

Eagle Plains Exploration Project
Executive Committee Screening

Revised Project Proposal

Prepared for:

Yukon Environmental and Socio-economic Assessment Board (YESAB)
Whitehorse, Yukon

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Executive Summary

Section 1 Details of the Project Description

The Project Proponent, Chance Oil and Gas Ltd. (Chance) proposes to conduct the Eagle Plains Exploration Project (the Project), an oil and gas exploration program, in north-central Yukon, Canada. This Project proposal is being submitted to the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee as a comprehensive Revised Project Proposal, to undergo an assessment as part of an Executive Committee Screening process. This is a Referred Project under paragraph 56(1)(d) of the *Yukon Environmental and Socio-economic Assessment Act*, S.C. 2003, c. 7. (Government of Yukon 2003c) (*YESAA*).

The Project is approximately 605 kilometres (km) north of Whitehorse along the Dempster Highway. Chance proposes to conduct exploratory activities over 10 years (2025 to 2034) to confirm the quality, quantity, and areal extent of hydrocarbons. Chance has completed Project-related baseline studies between 2019 and 2023 including surface and groundwater, permafrost, aquatics and fish, vegetation, wildlife, linear features, socio-economic, and heritage resources.

Project activities will focus on the following programs:

- a seismic exploration program;
- an exploratory drilling program; and,
- an extended flow testing (EFT) program at select wells.

The seismic program will require up to 1,500 square kilometres (km²) of 3D Low Impact Seismic (LIS) data acquisition (2.75 metres [m] wide source lines and 1.75 m wide receiver lines) and up to 2,000 km of 2D seismic (2.75 m wide). LIS will provide high-quality information about the geology of Eagle Plains while minimizing environmental effects compared to historic approaches to seismic testing. The seismic program will include seismic line construction, recording and data analyses to understand the area's complex geology. The line preparation (access road construction, line cutting and mulching, surveying, and drilling) and the establishment of temporary creek crossings will be conducted during the winter months under frozen ground conditions. Seismic recording would then follow in the summer months with a wireless system including helicopter use for deployment and recovery of recording equipment and data collection.

The exploratory drilling program consists of up to seven wells drilled sequentially (one to two wells at a time) per year, to a maximum of 30 wells over the 10-year term of the Project. The number and sequence in which wells are drilled depends on previous drilling success, extended flow test (EFT) results, data collected from the seismic exploration program, weather, and road conditions. The drilling program will require winter access roads, including a combination of new access roads (i.e., previously uncleared or used more than 10 years ago) and previously cleared access roads. Temporary drilling pads will only exist during winter and will be created from snow on areas cleared of trees and tall vegetation; the ground will remain mostly undisturbed.

If an exploration well is successful (i.e., the discovery of crude oil or natural gas in sufficient quantities), an EFT will be conducted at that well, to an estimated maximum of 30 wells. An EFT at an individual well could

last for several months up to the end of winter, depending on the well and whether the discovery is principally crude oil or natural gas. The EFT program will be staggered across the Project wells.

Progressive reclamation and closure activities are planned to be ongoing during the exploration program. This includes the reclamation of winter roads, abandoned well pads, seismic lines, and clearings due to accessory activities. As this Project primarily involves winter activities (except for seismic recording), reclamation will mostly rely on low impact seismic, stem bending, and natural regeneration, intended to minimize ground surface disturbance. All unsuccessful wells will be appropriately abandoned in accordance with regulatory requirements, reclaimed progressively, and monitored to assess the progress of revegetation and recovery following the completion of work in an area. At the end of the Project, the MBC sump area will be decommissioned and reclaimed, and all active wells that have successfully undergone EFT will be appropriately suspended pending potential future development approval.

The Project includes development of new infrastructure and will utilize existing infrastructure. Construction of a central processing facility (CPF) adjacent to the camp, will allow Chance to store, further treat/separate fluid produced during EFT and transfer it to trucks for disposal. An airstrip approximately 1,500 m long will be constructed at about km 4 along the Chance winter road from the Dempster Highway intersection. The airstrip will be used only during the winter throughout the Project life. The existing camp (Chance Camp), office, and storage yard were established in October 2011 during previous exploration activities in the Eagle Plains basin and are located at km 325 of the Dempster Highway. The existing 75-person camp will house workers and be a central location during all Project components. Due to the remoteness of seismic activities, a remote camp (fly-in) will be established near the proposed East Greaves and West Greaves Winter Roads, roughly 40 km from the Chance Camp, to accommodate approximately 25 personnel. In addition, a small mobile camp will be established at each active well for onsite accommodation for three personnel.

Sources of waste at the Project include domestic and sewage waste at the camps, and drilling waste at the well sites. The main waste discharge from the Project is anticipated to be drilling waste produced at the well sites. Waste management consists of an incinerator for burning non-toxic and food waste and a secure storage area for other forms of waste. Wastewater disposal at the Chance Camp consists of a wastewater treatment plant, a holding lagoon, and an exfiltration system. For other remote and mobile camps, wastewater and sewage will be collected in tanks approved by the CSA and transported off site for disposal at an approved facility. At each well site during drilling, there will be sewage storage, and a food waste incinerator related to the operation of the related camp accommodation. Drill cuttings will be disposed of into a series of mix-bury-and-cover (MBC) pods within a single MBC sump area. Formation water, saline fluids, drilling fluids and rig wash will be disposed of underground in approved deep-injection wells converted from existing suspended wells.

The Project may use of up to 300 m^3 of water per day (or per permitted limits) for camp use and for making ice as part of building winter roads, ice roads and temporary well sites, not exceeding 10% of the instantaneous flow from approved extraction points including Eagle River, Ogilvie River, Whitestone River and Glacier Creek. Water sources and volumes will follow issued water permits. Bottled water will be provided for human consumption.

Third-party activities and contractor/subcontractor support that are anticipated for the Project may include, contractors, subcontractors, supply services and vendors, as needed.

The Project is located within the North Yukon Planning Region and Peel Watershed Planning Region and is therefore subject to the approved *North Yukon Regional Land Use Plan* (NYRLUP) (Vuntut Gwitchin Government and Yukon Government 2009) and the *Peel Watershed Regional Land Use Plan* (PWRLUP) (Peel Watershed Planning Commission 2019). Within both plans, the Project is within a designated Zone IV integrated management area which allows for the highest development level to occur, in comparison to Zone I through Zone III integrated management areas which are classified as having higher sensitivity to landscape disturbance, ecological and cultural values, risk of significant adverse effects, and level of acceptable change.

Some proposed Project benefits related to employment, training and contracting for services and goods for Yukon First Nations, its citizens, residents of communities affected by the oil and gas activity, and other Yukon residents are possible. Should the exploration Project be successful, the benefits may expand to accommodate investment interest in infrastructure associated with a potential future development, if approved. Chance is committed to ongoing engagement with First Nations about the Project and ongoing consultation and discussions around potential Project benefits and associated Benefits Agreements, following Section 68 of the *Yukon Oil and Gas Act*, RSY 2002, C.162 (Government of Yukon 2002h) *(YOGA)* including training, employment, and contracting opportunities with potentially affected First Nations.

Section 2 Consultation and Engagement

As per the Y*ukon Environmental and Socio-economic Act, SC 2003, c 7 (YESAA*) requirements, Chance has undertaken consultation and engagement activities with potentially affected First Nations and residents of communities. **Section 2 Consultation and Engagement** describes Chance's First Nations Consultation and Engagement Program (the Program) including:

- information about potentially affected First Nations and residents of communities;
- consultation and engagement requirements for the Project;
- consultation and engagement principles and objectives;
- consultation and engagement with potentially affected First Nations and residents of communities during challenges to the Program, including COVID-19 and natural disasters; and,
- consultation and engagement activities with potentially affected First Nations and residents of communities from 2014 to December 20, 2023.

Potentially affected First Nations and residents of communities consulted and engaged about the Project include (alphabetically):

- First Nation of Na-Cho Nyäk Dun;
- Gwich'in Tribal Council, comprising:
  - Ehdiitat Gwich'in Council;
  - Gwichya Gwich'in Council (Tsiigehtchic);
  - Nihtat Gwich'in Council; and,
  - Tetl'it Gwich'in Council.
- Tr'ondëk Hwëch'in;
- Vuntut Gwitchin First Nation; and,
- Residents of Aklavik, Dawson City, Fort McPherson, Inuvik, Mayo, Old Crow, and Tsiigehtchic.

Chance's engagement with potentially affected First Nations and residents of communities has and continues to be focused on meeting the following *YESAA* requirements:

- providing opportunities to share Project information, including information on potential Project-related effects to support potentially affected First Nations and residents of communities to prepare and present views about the Project; and,
- considering, fully and fairly, views presented by potentially affected First Nations and residents of communities about the Project.

Chance has undertaken consultation and engagement activities with potentially affected First Nations and residents of communities since 2014. During this time, Chance sought to solicit views, concerns, input, and feedback about the Project; however, some events hindered active consultation and engagement activities between Chance, and potentially affected First Nations and residents of communities.

Chance recognizes that First Nation governments and communities have faced capacity challenges and time and resource constraints required to participate meaningfully in the Program. Chance acknowledges the importance of First Nations governments and communities having opportunities to provide feedback and be heard on their concerns related to the Project. Chance is committed to an engagement process that seeks to align with First Nation expectations, *YESAA* and related guidance, and best practices.

In January 2023, Chance reinitiated consultation and engagement activities with potentially affected First Nations. Chance sought to establish positive and collaborative relationships that would continue through the YESAB EC screening assessment process and into future Project phases, if approved. Consultation and engagement activities between 2014 and 2023 included ongoing Project communications and updates via email, phone call, and text message, community open house events, virtual and in-person meetings, and document sharing. Chance shared an updated Draft Project Description with potentially affected First Nations in July 2023. Consultation and engagement activities since July 2023 have focused on developing a shared understanding of the Project; specifically, how the Project design has changed in response to First Nation and resident of communities' feedback from 2014 to 2023. Chance provided opportunities to discuss and share information about the Project, Project-related effects, and mitigation measures with potentially affected First Nations and residents of communities. Chance also created opportunities for Chance, potentially affected First Nations, YESAB's EC, and Government of Yukon to meet collectively to develop a shared understanding of the screening process and discuss opportunities to support potentially affected First Nations' involvement in the Project's assessment process. Feedback shared by potentially affected First Nations and residents of communities, and how Chance has responded and adapted the Project to feedback shared, is outlined in this Project Proposal.

Chance recognizes that additional challenges may affect its ability to consult and engage in the most effective way with potentially affected First Nations and residents of communities. However, Chance is committed to continuing to work with, and to have open dialogue with, potentially affected First Nations and communities throughout all stages of the Project. This includes providing information, giving sufficient time for review and consideration, accepting feedback, and taking input into consideration. Additionally, Chance will follow consultation and engagement guidelines and protocols established by potentially affected First Nations, Government of Yukon, and the *YESAA*.

Section 3 Methodology

Section 3 Methods outlines the approach followed for assessing the effects of the Project on Environmental and Socio-Economic values. The Project effects assessment methods follow guidance provided by Yukon Environmental and Socio-economic Assessment Board (YESAB) in YESAB's Environmental and Socio-Economic Assessment Methodology (YESAB 2021a).

Eleven VESECs were identified for the Project assessment:

Environmental:

- Permafrost and Terrain;
- Water Resources;
- Fish and Fish Habitat;
- Vegetation;
- Wildlife and Wildlife Habitat; and,
- Caribou.

Socio-economic:

- Heritage Resources;
- Community Infrastructure and Services;
- Land and Resource Use;
- Community Health and Wellbeing; and,
- Employment and Economy.

To quantify or qualify the potential effects of the Project on each of the VESECs, one or more indicators and one or more assessment parameters were defined for each of these VESECs. Spatial boundaries, defined as the areas within which the effects of the Project are expected to interact with the VESECs and indicators, were defined for each VESEC. Project temporal boundaries looked at the 10-year life of the Project as a single Exploration phase, during which all Project activities are expected to occur somewhat concurrently (Project infrastructure/well development, drilling, extended flow testing).

Baseline studies were conducted on all VESECs to support characterizing existing conditions, against which potential effects of the Project were evaluated. Project potential effects were assessed using a combination of quantitative and qualitative information on Project design and activities.

Some Project footprints, including well sites, well access roads, and secondary camp locations were not spatially-defined because the locations of many of these sites depends on the early findings from the drilling and seismic programs. Given this uncertainty in some Project Footprints, and to assist with quantifying the effects of the Project, ten well site scenario models were developed to evaluate a range of potential Project effects on the environment.

Environmental constraints mapping, developed for the Project, was used as part of the scenario modeling, and was further integrated into VESEC-specific mitigations during the relevant effects assessments. This, along with a series of targeted mitigation measures, are proposed for mitigating the potential effects of the Project on the environment. These mitigations were taken into consideration when characterizing predicted

residual effects. Where the magnitude of residual effects was characterized as low or greater, an assessment of cumulative effects was also conducted.

Section 4 Permafrost and Terrain

Section 4 Permafrost and Terrain outlines the assessment of Project effects on this Valued Environmental and Socio-Economic Component (VESEC). The Project has the potential to interact with permafrost and terrain stability, and the indicators for assessing potential adverse effects were changes to the extent of ground ice and changes that results in ground settlement or mass movement. The assessment approach for permafrost was a quantitative approach to permafrost degradation, or aggradation. The assessment approach to terrain stability was a qualitative discussion on terrain instability.

A baseline study was undertaken which detailed the current permafrost and terrain stability conditions within the Regional Study Area (RSA); the Exploration Development Suitability (EDS) assessment outlined in **Appendix 4-A Terrain and Permafrost Baseline Report** is an important component of the environmental constraints map used for the Project.

Results of the assessment for permafrost and terrain state that with the implementation of proposed mitigation measures there should be a low magnitude change to permafrost and terrain stability over a localized area, although the results are generally considered irreversible. The residual effects of the Project on permafrost and terrain stability are rated as **not significant.**

Section 5 Water Resources

Section 5 Water Resources considers potential effects of the Project on surface water quality and hydrology due to the potential for these types of effects to further directly or indirectly affect aquatic ecosystems and the fish, aquatic organisms, wildlife, and humans that utilize and are supported by these aquatic ecosystems.

Existing surface water quality and hydrology conditions in the Regional Study Area (RSA) were characterized through baseline studies and analysis of data collected between 2013 and 2020. Baseline studies found that the RSA contains a high number of streams (approximately 1,467, which are mainly smaller headwater streams), and relatively few waterbodies (none of which are greater than 5 hectares [ha]). Watercourses in active permafrost regions, like that of the RSA, range from permanent flow to intermittent flow, which are seasonally timed. The lower order streams are more likely to be seasonally intermittent as inputs from precipitation decrease as rain transitions to snow, and baseflows are reduced as shallow permafrost re-freezes. In the case of the smaller streams, the channel may fully freeze in early winter. Additionally, ice build-up in watercourses alters flow behaviour through the formation of ice in the channel as well as changes to flow dynamics in flowing streams of all sizes, with this effect occurring naturally from the beginning of freeze-up until spring thaw is complete.

The direct and indirect pathways for potential effects of the Project on water resources are through sedimentation, contaminant and nutrient influxes, thermal changes and reduced flow and water levels. With the implementation of mitigation, residual effects due to sedimentation, contaminant and nutrient influxes,

and thermal changes are predicted to be negligible. Low magnitude effects are predicted for flows and water levels as a result of water withdrawals for Project activities, but these withdrawals will be managed within the limits set by approved water licences/permits, be supported by a proposed flow monitoring program, mainly occur during the winter when fish are typically absent from the RSA, and are reversible once water withdrawals cease. Residual effects on water resources are predicted to be **not significant.**

Section 6 Fish and Fish Habitat

The assessment in **Section 6 Fish and Fish Habitat** examined Project interactions with fish their habitats, focusing on two assessment indicators: fish mortality and fish habitat. Projects effects were evaluated against these two indicators through a qualitative evaluation of change to fish mortality risk, and a qualitative evaluation of changes in fish habitat quality and quantity, using data from baseline studies conducted for the Project.

The Regional Study Area (RSA) encompasses 1,467 mapped streams, most of which are smaller headwater streams. Few ponds and lakes occur in the RSA and none are greater than 5 hectares (ha) in size. During the winter, when the majority of Project activities will occur, fish are generally not present in the RSA. Smaller streams fully freeze or dewater, whereas larger streams have residual pools with no flow and associated low dissolved oxygen. Most fish are suspected to migrate out of the study area to larger rivers for overwintering.

With the implementation of all proposed mitigation measures, negligible residual effects are predicted for change in mortality risk, change in fish habitat quality, and change in fish habitat quantity.

Section 7 Vegetation

An assessment of Project effects on Vegetation (**Section 7**) was conducted, with a focus on two indicators: wet shrub tamarack-producing ecosystem units and ecosystem units of conservation concern. Ecosystem units of conservation concern were identified as the following: dry ecosystem units, riparian spruce sites and unique wetland sites. The assessment primarily consists of a quantitative assessment of the change in area for each of the two indicators.

Baseline studies were conducted to support the assessment and included ecosystem mapping and database development, field sampling and surveys within the Regional Study Area (RSA). Field surveys completed by EDI documented 125 different plant species, including trees, shrubs, and forbs, ferns and allies, graminoids, lichens, moss, and liverwort species throughout the RSA. In addition to these individual vegetation species, thirty-one distinct ecosystem units were mapped within the RSA. Most of the RSA is mapped in a shrub structural stage and is dominated by moist and mesic black and white spruce forests, with Labrador tea (Rhododendron groenlandicum), alder (Alnus spp.) and birch (Betula spp.) shrub cover.

For wet shrub Tamarack-producing ecosystem units, a low magnitude residual effect is predicted to last for the long-term, but be reversible, once trees and tall shrubs regenerate following cessation of Project activities. For ecosystems of conservation concern, a low magnitude residual effect is predicted to last for the long-term but be reversible once trees and tall shrubs regenerate. The predicted residual effects of the

Project on the vegetation Valued Environmental and Socio-Economic Component (VESEC) are not expected to result in a change in ecosystem units within the RSA to the point where they are no longer regionally viable or persistent. Therefore, with the implementation of all proposed mitigation measures, the residual effect on vegetation is predicted to be **not significant.**

Section 8 Wildlife and Wildlife Habitat

Section 8 Wildlife and Wildlife Habitat summarizes the assessment of Project effects on marten, moose and birds. The assessment primarily examined how changes in available habitat could affect marten, moose, and birds, and how changes in mortality risk could affect marten and moose using data from baseline studies.

Baseline studies were conducted to support the assessment. Baseline studies included field surveys, habitat modeling, and a desktop review of wildlife species that are of conservation or management concern which could occur in the RSA. The Project overlaps with boreal taiga and is characterized by open-canopy, spruce-dominated habitats where permafrost generally limits tree growth, with limited anthropogenic disturbance of wildlife habitat. Surveys confirmed the presence of five bird species of conservation concern and identified extensive low-suitability marten and moderate-suitability moose habitat.

The Project's footprints and activities may result in low magnitude, adverse residual effects that will not have a significant effect on wildlife. Changes in habitat for marten, moose, and birds and an increase in mortality risk for marten and moose are predicted to occur; however, mitigation measures are anticipated to be effective at minimizing adverse effects

Section 9 Caribou

The Project occurs exclusively within the Porcupine Caribou Herd (PCH) range. The PCH is a subpopulation of barren-ground caribou (Rangifer tarandus groenlandicus) known for its widespread distribution, large population aggregations, dramatic fluctuations in population size, and lengthy seasonal migrations (COSEWIC 2016). Within the North Yukon Regional Land Use Plan, the PCH is considered “the most significant and culturally important wildlife resource in the planning region” (Vuntut Gwitchin Government and Yukon Government 2009). Section 9 Caribou presents the assessment of Project effects on this VESEC, which was selected based on the cultural, ecological, and economic value of caribou to First Nations and the Yukon.

Although most barren-ground caribou subpopulations are in decline (COSEWIC 2016), the PCH has increased in size over the last two decades. After 50 years of PCH monitoring, the subpopulation has not exhibited fluctuations in size as large as other barren-ground caribou subpopulations (COSEWIC 2016). This may be due to the PCH’s large annual and seasonal ranges and the diversity of habitats across these ranges (Russell et al. 1993, Whitten 1996).

The Porcupine Caribou Technical Committee (1993) assessed the relative importance of seasonal ranges using six criteria: energy balance, reproductive contribution, tolerance to disturbance, escape requirements, intensity of use, and whether alternative habitats are available. Although all seasons are important to

meeting the annual life requisites of the PCH, the calving and post-calving seasons are considered of the highest importance, and fall and winter are considered of the lowest importance (Porcupine Caribou Technical Committee 1993).

The PCH has historically overlapped the Project Regional Study Area (RSA) in the rut/ late fall and winter periods. However, the RSA overlaps a small portion of those seasonal ranges—6.0 percent (%) during rut/ late fall and 6.5% during winter—and does not overlap with the most frequently used portions of those ranges. Baseline data suggests that Porcupine caribou typically make movements of several kilometres per day in both rut/ late fall and winter and rarely spend multiple days in the same location. Residency times are shorter during rut/ late fall than winter and shorter in the RSA compared to the broader seasonal ranges. The combination of faster daily movements and shorter residency times in the RSA to the broader seasonal ranges suggests the PCH's historical transient use of the RSA.

The Project's PCH baseline studies involved quantifying habitat selection during rut/ late fall and winter. Selected habitat, especially areas of High quality, were mostly dependent on the amount and distribution of light macrolichen cover. During winter lichens constitute the primary forage of most barren-ground caribou populations (COSEWIC 2016).

Based on the PCH's ecology and possible interaction with the Project RSA the Project has the potential to affect PCH habitat, movement, mortality, and energetics. Key factors considered when determining Project interactions and potential effects include temporal overlap, spatial extent, caribou movement rates, and land use planning context. Overlap between the Project and PCH will likely occur during the herd's rut/ late fall and winter seasons (October to April, annually) when the herd is present in Eagle Plains. However, rut/ late fall and winter are considered the seasons of lowest concern. During rut/ late fall and winter, caribou are typically in prime body condition, experience neutral to positive energy balances, do not experience stress from heat and insect harassment, and are least sensitive to human disturbances. Furthermore, the Project RSA (2,400 km²) is a relatively small portion of the PCH's rut/ late fall and winter ranges in Yukon.

During rut/ late fall and winter, the PCH is typically widely dispersed in small and medium-sized groups (Russell et al. 1993). In any given year, Project activities will be clustered to annual work areas so that disturbances are limited to approximately a third (32%) of the RSA, reducing the degree of overlap with the PCH rut/ late fall and winter ranges to about 2% of their total extent in Yukon. The 2% area of overlap could correspond to 2,180 caribou with the potential to interact with the Project. For caribou that might use the RSA, their residency would likely last only a small portion of the rut/ late fall and winter seasons. Overall, the relatively small spatial and temporal overlap between the Project and PCH would be expected to limit the exposure of individual caribou to Project-related disturbances.

The Project is expected to have direct habitat effects on caribou via vegetation clearing associated with the development of seismic lines, winter access roads, well sites, and secondary camps. Vegetation clearing is expected to reduce the amount of 'selected' (moderate and high quality) habitats by caribou. The extent of direct habitat effects on rut/late fall and winter habitat are 0.2% in Eagle Plains (Ecoregion) and up to 2% in the RSA (Region), translating to a negligible magnitude effect.

Indirect habitat effects refer to reduced use of 'selected' (moderate and high quality) habitats by caribou due to sensory disturbances from adjacent areas (also referred to as reduced habitat effectiveness). Several Project activities, including winter access road construction and operation, seismic exploration, well development and operation, and camp operations, can potentially cause indirect habitat effects. The

magnitude of indirect habitat effects on the PCH is predicted to be low to moderate depending on the scale at which they are assessed. The annual work areas are small relative to the rut/ late fall and winter season ranges, so a relatively small proportion of the population is likely to be affected. The residency time of caribou occurring in annual work areas is expected to be short (e.g., 1–2 weeks during winter), and caribou will have alternative habitat available to them outside annual work areas. The energetic cost for affected animals to use alternative habitat is expected to be relatively low because PCH caribou are typically in good body condition in fall and winter and usually travel several kilometres per day during these seasons.

The Project can potentially affect caribou movements by creating sensory disturbances (e.g., noise) that result in avoidance of those areas by caribou. The magnitude of residual effects on caribou movements depends on the scale of analysis, ranging from low to moderate magnitude. Most caribou travelling through the rut/ late fall and winter ranges will not be exposed to the Project; based on the relatively small size of annual work areas compared to PCH rut/ late fall and winter seasonal ranges (≤1% of the seasonal ranges by area), a relatively small proportion of the PCH population is likely to be exposed to Project activities that could affect movement. For caribou that do travel through or around the annual work area, the most likely effects are elevated energetic output or stress; any effects on movement that do occur are expected to be limited to local alterations to the location and timing/rate of movement within the RSA which, if they occur, could cause indirect effects on individual animals such as stress or increased energy expenditures, but are unlikely to impede broad movements among seasonal ranges.

The Project can potentially cause indirect mortality to caribou by creating linear features that can enhance access and hunting efficiency of humans and wolves (facilitated predation). If indirect mortality were to result from the Project, the magnitude and duration of effects would likely be limited to the annual work areas in the years they were active, specifically when Project activities result in snow packing along linear features. Depending on the scale at which effects are evaluated, and in consideration of the complexity of factors involved, the magnitude of effects due to indirect mortality is predicted to be negligible to moderate, and would translate to a minimal population-level effect.

The Project is not expected to substantially affect caribou habitat, movement, mortality, or energetics. The collective residual effects on caribou from all potential sources are assessed to be **not significant.**

Section 10 Heritage Resources

Section 10 Heritage Resources outlines the assessment of Project effects on this Valued Environmental and Socio-Economic Component (VESEC). Heritage Resources include archaeological, historic, and palaeontological resources, and were selected as a VESEC for the Project because of their cultural importance. Indicators related to Heritage Resources include known Heritage Resource sites, identified areas of potential for currently undocumented Heritage Resource sites within the Regional Study Area (RSA), and chance finds of Heritage Resources in areas not associated with known sites or identified areas of potential for currently undocumented archaeological and historic sites. These indicators were selected to support protection of known sites and areas of potential for undocumented sites from being adversely affected by Project activities, to comply with the cultural values of people who utilize the RSA, and to adhere to applicable legislation. The assessment parameter used to evaluate effects on Heritage Resources is

whether or not the Project will cause a qualitative change to the nature or condition of each of the three indicators.

A Heritage Resource Overview Assessment (HROA) covering the RSA was completed in 2022 to establish the initial baseline conditions with regard to Heritage Resources by identifying all known Heritage Resources within the RSA and developing a model mapping areas of high potential for currently unknown Heritage Resource sites. Heritage Resource Impact Assessments have also been completed in the Project area between 2000 and 2023 to ground truth areas of potential concern and, more recently, to test HROA model mapping predictions.

Results of this assessment state if the mitigation measures as described are followed, there should be negligible adverse residual effects resulting from the Project. In consideration of the mitigation that has been implemented to date, and the mitigation that will be implemented as the Project moves forward, the residual effects of the Project on Heritage Resources for all phases of the Project are rated not significant.

Section 11 Socio-Economics

Section 11 Socio-Economics describes and summarizes the assessment of potential effects of the Project on the human environment related to social, economic, health, and cultural conditions. Four Valued Environmental and Socio-Economic Components (VESECs) were identified as part of the Socio-Economic assessment:

- Community Infrastructure and Services: assesses the Project effects on community related infrastructure and services;
- Land and Resource Use: assesses the Project effects to commercial, recreation, and traditional land and resource use;
- Community Health and Wellbeing: assesses the Project effects on the health and wellbeing of the communities in the vicinity of the Project; and
- Employment and Economy: assesses the Project effects to labour, goods and services, employment and business opportunities, and the regional or local economy.

A desktop review was conducted to gather information on existing demographic and socio-economic conditions. Primary data collection through interviews with key informants was then undertaken to confirm the findings from secondary data collection and to address identified data gaps related to socio-economic conditions in the Local Study Area (LSA) and Regional Study Area (RSA). Where possible, collected data were disaggregated to capture information about the conditions of different sub-groups within the population of the LSA and RSA.

For community health and wellbeing, a report assessing the environmental determinants of health for the Project was completed in November 2023 that assessed the potential effects of Project activities on the environmental determinants of health for human receptors in the LSA. The assessment evaluated whether any Project activities present a complete risk pathway for exposure, consisting of an identified hazard, a pathway of exposure and a human that would be exposed. The evaluation considered the seasonality of Project activities as well as varying harvesting seasons that affect land users time on the land.

Project effects on community infrastructure and services were assessed by taking into consideration changes in the demand for housing and temporary accommodation, physical infrastructure, social services, and in the use of transportation infrastructure from existing conditions. No or negligible effects were predicted for most community infrastructure and services indicators. The Project is expected to result in a low magnitude effect on the use of transportation infrastructure from increased traffic. Project-related vehicles have the potential to result in a minor increase in traffic that would be potentially distinguished within the existing volume of traffic along the Dempster Highway and portions of the North Klondike Highway. This effect on community infrastructure and services is expected to be **not significant**.

Project effects on land and resource use were assessed by taking into consideration potential changes in commercial and recreational land and resource use, and First Nations culture and land and resource use. No or negligible effects were predicted for existing designated lands, availability, and abundance of resources for commercial use, land area and access for commercial and recreational use, and resource availability, abundance or quality for subsistence use. The Project is expected to result in low magnitude changes in environmental conditions for recreational use, low magnitude effects to land area and access for First Nations cultural use, and low magnitude effects to environmental conditions for First Nations cultural use. These effects on land and resource use are predicted to be **not significant.**

Project effects on community health and wellbeing were assessed by taking into consideration potential changes in environmental quality that may affect human health, and potential changes to social determinants of health. Negligible effects were predicted for human health associated with changes to drinking water quality, air quality, and traditional food quality. Negligible effects were also predicted for access to healthcare services and infectious disease rates. The Project is expected to result in a low to moderate magnitude change in substance use, and a low to moderate magnitude change in human health to a small proportion of First Nation land users. These effects on community health and wellbeing are predicted to be **significant**.

Project effects on employment and economy were assessed by taking into consideration the potential effects on local and regional employment opportunities, local and regional business opportunities, potential effects on economic diversity, and potential effects on territorial and local government finances. The Project is expected to result in a positive effect on both the employment opportunities and business opportunities at local and regional scales, and a positive effect on economic diversity. No effect was predicted on territorial and local government finances.

Section 12 Effects Management

Management and monitoring plans and associated subplans will be developed for the Project as required, and will include safety, prevention, mitigation, management, and monitoring measures where appropriate. Developed plans may include the following:

- Environmental Management Plan;
- Wildlife Management and Monitoring Plan;
- Conceptual Reclamation and Closure Plan;
- Safety Management and Emergency Response Plan; and,
- Consultation and Engagement Plan.

The plans are required as part of Project design and all Project activities, and will consider potential environmental and socio-economic effects, effectiveness of applied mitigation measures, and will include adaptive management measures and associated follow-up monitoring requirements.

Acknowledgements

Chance Oil and Gas Ltd. (Chance) would like to acknowledge that the Project falls mostly within the Traditional Territory of the Vuntut Gwitchin First Nation, overlaps small areas of the Traditional Territories of the First Nation of Na-Cho Nyäk Dun and Tetłʼit Gwichʼin Council, and is adjacent to the Tr'ondëk Hwëch'inʼs Traditional Territory.

During the preparation of this Revised Project Proposal, Chance sought to solicit views, concerns, input, and feedback about the Project from many individuals and communities. Chance would like to thank the following First Nations and their members for their contributions and feedback during consultation and engagement activities (listed alphabetically):

- First Nation of Na-Cho Nyäk Dun;
- Gwichʼin Tribal Council, comprising:
- Ehdiitat Gwichʼin Council;
- Gwichya Gwich'in Council (Tsiigehtchic);
- Nihtat Gwichʼin Council; and,
- Tetłʼit Gwichʼin Council.
- Tr'ondëk Hwëch'in; and,
- Vuntut Gwitchin First Nation.

Chance would also like to thank the residents of the following communities for their contributions and feedback during consultation and engagement activities for the Revised Project Proposal (listed alphabetically):

- Aklavik;
- Dawson City;
- Fort McPherson;
- Inuvik;
- Mayo;
- Old Crow; and,
- Tsiigehtchic.

Chance is submitting this Revised Project Proposal for review to the Yukon Environmental and Socio-economic Boardʼs (YESAB) Executive Committee (EC) for a screening. Chance thanks the members of YESAB and the EC for their support, feedback and guidance during the development and submission of the Revised Project Proposal.

Chance recognizes that a variety of other territorial and federal regulatory agencies and Decision Bodies are involved in the review of the Project and associated submissions for Project authorizations and wishes to thank representatives of the Yukon Government and Government of Canada for their input, and the members of the Yukon Land Use Planning Council for reviewing the Revised Project Proposal as part of the land use plan conformity check.

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Abbreviations and Acronyms

Acronym / Abbreviation	Definition
2D	two-dimensional
3D	three-dimensional
AAQS	Ambient Air Quality Standards
AER	Alberta Energy Regulator
ATV	all-terrain vehicle
BC	British Columbia
BMP	best management practice
CAPP	Canadian Association of Petroleum Producers
CCME-FAL	Canadian Council of Ministers of the Environment guidelines for protecting freshwater aquatic life
CCESA	Caribou Cumulative Effects Study Area
CEA	Cumulative Effects Assessment
CESA	Cumulative Effects Study Area
Chance	Chance Oil and Gas Ltd.
CI	Confidence Interval
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
CO_2	carbon dioxide
COPC	Contaminants of potential concern
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CPF	Central Processing Facility
CSA	Canadian Standards Association
CSA	Caribou Study Area
CWD	Coarse woody debris
DDT	dichlorodiphenyltrichloroethane
DFO	Fisheries and Oceans Canada
DO	Designated Office
DST	Drill Stem Test
e.g.,	for example [Latin: exempli gratia]
ECCC	Environment and Climate Change Canada
EDI	EDI Environmental Dynamics Inc.
EDS	exploration development suitability
EERP	Explosive Emergency Response Plan
EFT	Extended Flow Test
eLMS	Electronic License Management System

Acronym / Abbreviation	Definition
EMP	Environmental Management Plan
ESA	Environmental Site Assessment
et al.	and others [Latin: *et alia*]
GDP	Gross Domestic Product
GHGs	greenhouse gases
GPS	Global Positioning System
GSCI	Gwich'in Social and Cultural Institute
HADD	harmful alteration, disruption or destruction
H_2S	hydrogen sulphide
HRIA	Heritage Resource Impact Assessment
HROA	Heritage Resource Overview Assessment
HS/ERP	Health, Safety and Emergency Response Plan
HSE	Health, Safety and Environment
HSI	Habitat Suitability Index
i.e.,	that is [Latin: id est]
IAAC	Impact Assessment Agency of Canada
IMA	Integrated Management Area
IPCB	International Porcupine Caribou Board
LIS	Low-Impact Seismic
LMU	Land Management Unit
LSA	Local Study Area
LTS	Leaning Tree Stand
LUP	Land Use Plan
MBC	Mix Bury Cover
MBCA	*Migratory Birds Convention Act*
MVC	Moose vehicle collisions
MZ	Management Zone
n.d.	no date
NE	northeast
NRCAN	Natural Resources Canada
NWT	Northwest Territories
NYLUP	North Yukon Land Use Plan
NYRLUP	North Yukon Regional Land Use Plan
OGDPR	Yukon Oil and Gas Drilling and Production Regulations
PCH	Porcupine Caribou Herd
PCMB	Porcupine Caribou Management Board
PCTC	Porcupine Caribou Technical Committee

Acronym / Abbreviation	Definition
PPE	personal protective equipment
pers. comm.	personal communication
Project	Eagle Plains Exploration Project
PWRLUP	Peel Watershed Regional Land Use Plan
QEP	Qualified Environmental Professional
RCMP	Royal Canadian Mounted Police
RMA	Riparian Management Area
RRZ	Riparian Reserve Zone
RSA	Regional Study Area
RSC	Revised Statutes of Canada
RSF	Resource Selection Functions
RSY	Revised Statutes of Yukon
RV	Recreational Vehicle
RZ	Reserve Zone
S.C.	Statute of Canada
SARA	*Species at Risk Act*
SCVF	surface casing vent flow
TDG	Transportation of Dangerous Goods
TDR	Technical Data Report
TSS	Total Suspended Solids
UAV	Unmanned aerial vehicles
UFA	Umbrella Final Agreement
US	United States
USA	United States of America
VESEC	Valued Environmental and Socio-Economic Component
WHMIS	Workplace Hazardous Materials Information System
YESAA	*Yukon Environmental Socio-economic Assessment Act*
YESAB	Yukon Environmental and Socio-economic Assessment Board
YOGA	*Yukon Oil and Gas Act*
YT	Yukon
ZOI	Zone of Influence

Symbols and Units of Measure

Units	Definition
<	less than
>	greater than
≤	less than or equal to
≥	greater than or equal to

Units	Definition
±	plus or minus
%	percent
#	number
°C	degrees Celsius
$	dollars
”	inches
’	feet
CDN$	Canadian dollars
cm	centimetre
dB	decibels
dBA	A-weighted decibel
ha	hectare
kg	kilogram
km	kilometre
km^2	square kilometre
km/hr	kilometre per hour
km/km^2	kilometre per square kilometre
kPa	kilopascal
L	litre
mKB	metres Kelly Bushing (below the surface)
lbs	pounds
µPa	microPascal
m	metre
mm/s	millimetres per second

Gwich'in and English Spellings

Gwich'in spelling	English spelling
Teetł'it Gwinjik	Peel River
Teetł'it Zheh	Fort McPherson
Tsiigehtchic	Arctic Red River
Tth'an Dhidlii Njik	Dalglish Creek
Vadzaih	Caribou
Vuntut Gwitchin	Peoples of the Lakes

Note: Tetł'it Gwich'in Council refers to the Designated Gwich'in Council that is the local organization that receives funding from the Gwich'in Tribal Council to operate and deliver programs and services at the community level under the Gwich'in Comprehensive Land Claim Agreement. The correct way to write is Tetł'it in the Gwich'in language.

Note: Teetł'it Gwich'in Council refers to the Teetl'it Gwich'in Band Council that refers to the Band Council that receives funding from Indigenous and Northern Affairs Canada for and provides rights to Gwich'in relating to education and other benefits under Treaty 11 that was signed on July 28, 1921. The correct way to write Teetł'it Gwich'in Council in the Gwich'in language.

Hän and English Spellings

Hän spelling	English spelling
Hähkè	Chief

1 DETAILS OF THE PROPOSED PROJECT

1.1 INTRODUCTION

The Eagle Plains Exploration Project proposal is being submitted to the Yukon Environmental and Socio-economic Assessment Board (YESAB) as a comprehensive Revised Project Proposal to the Executive Committee, to undergo an assessment as part of an Executive Committee Screening process, as described in **Section 1.6.1 Requirement for an Executive Committee Screening**. As this is a Referred Project under paragraph 56(1)(d) of the *Yukon Environmental and Socio-economic Assessment Act*, S.C. 2003, c. 7. (Government of Yukon 2003c) (*YESAA*), the Pre-Submission Engagement process under YESAB does not occur, and therefore no separate Project Description was provided, and no Project Proposal Report will be issued by YESAB before Project Proposal submission. Based on this process, this Revised Project Proposal report (hereafter referred to as the Project Proposal) presents the anticipated required information for the Project including:

1. Details of the Proposed Project;
2. Consultation and Engagement;
3. Methods;
4. Permafrost and Terrain;
5. Water Resources;
6. Fish and Fish Habitat;
7. Vegetation;
8. Wildlife and Wildlife Habitat:
    - 8.1 Marten;
    - 8.2 Moose; and,
    - 8.3 Birds.
9. Caribou;
10. Historic Resources;
11. Socio-Economics:
    - 11.1 Community Infrastructure and Services;
    - 11.2 Land and Resource Use;
    - 11.3 Community Health and Well-being; and,
    - 11.4 Employment and Economy.
12. Effects Management:
    - 12.1 Management and Monitoring Plans; and,
    - 12.2 Follow Up Monitoring.

Relevant maps and appendices are attached as supporting documentation.

1.2 PROJECT PROPONENT

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The former proponent of the Project was Northern Cross (Yukon) Limited. In 2016, a subsidiary of CNOOC Ltd., which held majority ownership of Northern Cross (Yukon) Limited shares, sold all its holdings to existing and new company shareholders. This restored the company's status to that of a Canadian-controlled private company, though the legal entity did not change. The change in ownership resulted in the company's name to Chance Oil and Gas Limited (Chance) in 2017.

1.3 PROJECT IDENTIFICATION AND DESCRIPTION

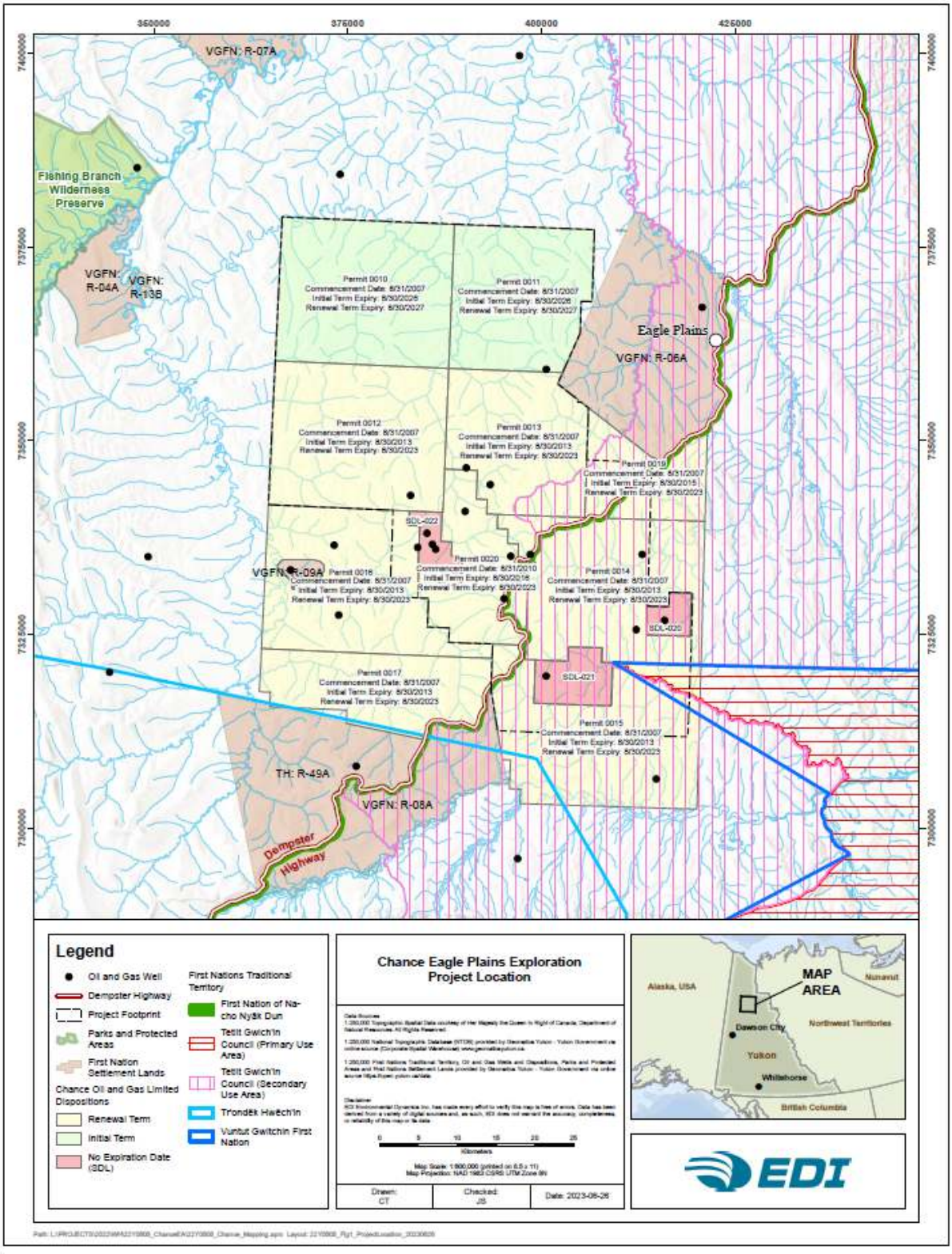
Chance proposes to conduct the Eagle Plains Exploration Project (the Project), an oil and gas exploration program, in north-central Yukon, Canada. The Project is approximately 605 kilometres (km) north of Whitehorse along the Dempster Highway (**Map 1-1**). Chance proposes to conduct exploratory activities over 10 years (2025 to 2034) to confirm the quality, quantity, and areal extent of hydrocarbons.

1.3.1 Exploration History

The Project occurs within the Eagle Plains sedimentary basin, north of the Ogilvie River and west of the Richardson Mountains. The basin contains existing natural gas and oil resources (Government of Yukon 2019), including 4.6 billion cubic metres (m^3) of gas and 3.2 million m^3 of oil (Hannigan 2014).

The basin has had intermittent periods of oil and gas exploration since the 1950s. Those activities established winter roads, seismic lines, and exploratory wells across the basin, including approximately 40 exploration wells. Eight wells are currently being maintained in suspended status, and the remaining wells have been plugged and abandoned. Seismic exploration within the basin has included approximately 10,000 km of two-dimensional (2D) lines (mostly before 1985), and about 325 km^2 of three-dimensional (3D) seismic was conducted in 2013/2014 (Northern Cross (Yukon) Ltd. 2014).

Chance has completed Project-related baseline studies between 2019 and 2023 including surface and groundwater, permafrost, aquatics and fish, vegetation, wildlife, socio-economic, and heritage resources.



Map 1-1. Chance Eagle Plains Exploration Project Location

1.4 PROJECT ACTIVITIES AND COMPONENTS

1.4.1 Project Activities

Project activities will focus on the following programs:

1. a seismic exploration program;
2. an exploratory drilling program, and,
3. an extended flow testing (EFT) program at select wells.

The seismic program will require up to 1,500 square kilometres (km²) of 3D seismic (2.75 metres [m] wide source lines and 1.75 m wide receiver lines) and up to 2,000 km of 2D seismic (2.75 m wide). The seismic program will include seismic line construction and recording.

Seismic line construction will include clearing of the lines, helipads, staging sites, and temporary creek crossings, and will be done during the winter. Seismic lines will be mulched down to 0.1 m and established approximately 200–300 m apart using a meandering line path. Helipads and staging areas will be cleared as needed, but rely on existing clearings (i.e., treeless areas) as much as possible. Temporary creek crossings will be established in the winter at regular intervals (generally every 5th source line) to facilitate movement of the mulcher and other seismic equipment across creeks and removed before the spring thaw.

Seismic recording will take place during the summer months. This phase of the seismic program will require a helicopter to deploy and retrieve personnel and equipment along the seismic source and receiver lines cleared in the previous winter.

The exploratory drilling program consists of up to seven wells drilled sequentially (one to two wells at a time) per year, to a maximum of 30 wells over the 10-year term of the Project. Each well site will be up to 1.44 hectares (ha). Drill cuttings will be disposed of into a series of mix-bury-and-cover (MBC) pods within a single MBC sump area. formation water, saline fluids, and the liquefaction of drilling fluids and rig wash will be disposed of underground in approved deep-injection wells converted from existing suspended wells.

The drilling program will require winter access roads, including a combination of new access roads (i.e., previously uncleared or used more than 10 years ago) and previously cleared access roads. Roads will be cleared to a minimum of 0.1 m in height (i.e., ground vegetation will be retained) and 8–10 m wide with wider pullouts of 16–20 m spaced every 5 km to allow two-way traffic to pass.

If a well is successful (i.e., the discovery of crude oil or natural gas in sufficient quantities), an extended flow test (EFT) will be conducted at that well, to an estimated maximum of 30 wells. An EFT at an individual well could last for several months up to the end of winter, depending on the well and whether the discovery is principally crude oil or natural gas. The EFT program will be staggered across the Project wells, but it is anticipated that there will likely be at least one EFT occurring somewhere in the Project at any given time during the winter months, with the first EFT potentially occurring in the winter following the year in which discovery is made.

All unsuccessful wells will be abandoned, reclaimed progressively and monitored to assess the progress of revegetation and recovery following the completion of work in an area. Progressive decommissioning and reclamation of access roads will be completed when they are no longer useful or necessary and

monitored to assess revegetation and recovery. At the end of the Project, the MBC sump area and airstrip will be decommissioned and reclaimed, and all active wells will be suspended.

Table 1-1 summarizes the activities that support the seismic, exploration drilling, and EFT programs.

Table 1-1. Summary of Key Activities

Project Activity	Summary of Activity
Engagement	• ongoing engagement with First Nations • ongoing engagement with community residents and other stakeholders
Access Roads	• construction of winter road access for exploratory well drilling, DST, EFT, and seismic program access and execution so will be the first activities of a winter program • clearing woody vegetation along the identified route to near ground level • minimum of 10 centimetres (cm) of packed snow, packing snow and, in some sections, spreading water to create ice on the ground surface • up to 8–10 m wide for two-lane with wider pullouts of 16–20 m spaced every 5 kms to allow for passing traffic • total length of winter access roads per season will vary based on locations identified for exploration drilling each winter; new well sites will be accessed using existing/previously used routes as much as possible to minimize new clearing and linear disturbance • each season, a maximum of 125 km of new (previously uncleared or used more than 10 years ago) winter access roads created • approximately 15% of the roads built on previously disturbed ground (e.g., old roads, cutlines) • maximum of 200 km of winter access roads (new winter access + previously cleared winter access) will be active each season • maintaining and snow-clearing of roads and leases

Seismic Exploration	• access road construction
	• seismic line construction, hazard identification, cutting, surveying:
	  ○ establishment of seismic line rough mulching areas in winter to include:
	  ▪ up to 1,500 km² of 3D seismic (up to 2.75 m wide source lines, 1.75 m wide receiver lines all mulched)
	  ▪ up to 2,000 km of 2D seismic (up to 2.75 m wide)
	  ○ select tree clearing and grubbing will include salvage during the winter, before the construction of the winter access roads; this activity is subject to avoidance by meandering lines across the land to mitigate significant clearing
	• Global Positioning System (GPS) Survey of receiver points and source points
	• Low Impact Seismic (LIS) tracked air drilling of seismic shot holes
	• explosive charge storage (magazines), transportation, and use (1 kilogram [kg] per source point)
	• data acquisition and recording with a wireless system including helicopter use for deployment and recovery of recording equipment and conducting data recording

Drilling Exploration	• winter establishment of up to 30 well sites, each approximately 1.44 ha (120 m x 120 m) within the Project area • tree clearing and grubbing including salvage during the winter, before the construction of the winter access roads • clearing woody vegetation on the well site to near ground level • well site pads will be constructed using packed snow, water to freeze the site, a protective liner and rig mats as required

Project Activity	Summary of Activity

	• up to 30 pads will be constructed and used for exploration drilling over the 10-year life of the Project
	• installation of surface infrastructure on drill sites including:
	  ○ drill rig
	  ○ drilling mud tanks, pumps, and mud mixing and separation systems
	  ○ power generators
	  ○ boilers
	  ○ flare tanks and flare stack
	  ○ blowout preventer accumulator system
	  ○ fuel storage
	  ○ well cement mixing and storage
	  ○ drill pipe and casing laydown area
	  ○ storage bins for rock cuttings removed from the drilling mud
	  ○ trailers for offices, first aid, rig manager sleeping quarters, water storage and treatment, sewage storage, and food waste incinerator
	• drilling wells up to 2,500 m deep:
	  ○ wells drilled sequentially, one to two wells at a time, up to seven wells per year
	  ○ use of low-toxicity, water-based mud system
	  ○ use of an average of 15 m³ and up to a maximum of 100 m³ of water per operating day for drilling and site preparation; higher volumes of water may be needed if snow making or site surface icing is required
	  ○ disposal of drill cuttings into a designated MBC sump
	  ○ disposal of approximately 300 m³ of centrifuged drilling mud and rock cuttings in MBC
	• Drill Stem Tests (DST): one or more on each well at depths where formations with the potential to produce crude oil or natural gas were encountered.
	  ○ potential acid stimulation using approximately 5-10 m³ of a weak concentration of hydrochloric acid (10-20 percent [%])
	  ○ production and separation of fluids recovered from the well during the DST(s)
	  ○ flaring natural gas, separation of crude oil and any produced formation water
	• MBC sump area access for drilling mud and rock cutting disposal
	• disposal of formation water, saline fluids, liquid faction of drilling fluids and rig wash underground in approved deep-injection wells converted from existing suspended wells or wells drilled as part of this Project
	• maintaining and snow-clearing of roads and leases

Extended Flow Testing (EFT)	• installation of surface and subsurface equipment and facilities to enable testing and extended well tests including:
	  ○ casing of entire well bore and perforation of the casing at zones of interest
	  ○ packer, tubing, and downhole measurement gauges
	  ○ wellhead valve assembly
	  ○ flare tank and flare stack gas is to be flared off, and oil is placed in storage tanks. recovered formation water (if any) will be disposed of in deep zone injection wells.
	  ○ separator vessel, treating vessel, and storage tanks
	  ○ appropriate artificial lift systems (e.g., pumps)
	  ○ heaters
	  ○ dehydrators
	  ○ flow lines
	  ○ metering equipment

Project Activity	Summary of Activity
	○ portable generators • conduct EFTs on up to 30 wells: ○ may be completed within a few weeks at a predominantly natural gas bearing zone or may require up to 2 winters for a predominantly crude oil-bearing zone ○ separation of natural gas, crude oil, and formation water ○ potential production of crude oil during EFT and temporary storage for future shipment ○ using natural gas on site for process heating of storage tanks and other vessels, fuelling artificial lifting to assist crude oil production, or compression of natural gas to be used in other areas of the Project such as fuel to heat the camp ○ flaring natural gas during EFT if unable to use on site • gas to be flared off, and oil is placed in storage tanks • disposal of recovered formation water (if any), saline fluids, water from centrifuged drilling mud, and rig wash underground in deep-injection wells will be converted from existing suspended wells or wells drilled as part of this Project. • routine maintenance of facilities, production equipment and well bores, as needed
Well Maintenance (Workovers)	• suspended wells inspected annually, and active wells are subject to servicing on an as-needed basis to address issues that interrupt the EFT, requiring mobilization and installation of a service rig and related equipment on the well site to remedy the problem • maintenance activities include: ○ wellhead inspection pressure test of surface wellhead valves ○ surface casing vent flow test ○ gas migration test ○ repair or replace pumping equipment ○ clear blockages to fluid flow that can develop during EFT ○ replace worn-out downhole equipment ○ set up EFT in other formations within the same well bore ○ suspend or abandon wells after EFT
Mix Bury Cover (MBC) Construction and Operation	• construction of an MBC sump approximately 6.4 ha total in area to dispose of drill cuttings and drilling byproducts • preferred MBC location is an adjacent, previously undisturbed area approximately 63,910 m² south of the Dempster Highway accessed by a winter road located at km 336 • sump will be excavated as disposal volume is required to minimize potential permafrost exposure (possibly in narrow compartments oriented east-west to maximize shading) • each MBC “pod” within the sump will be approximately 800 m² and contain the drill cuttings and spent mud from one well; only one pod at a time will be active/excavated • typical well produces up to 300 m³ of drill cuttings for disposal; development of the MBC would parallel the rate of exploration drilling (i.e., typically 1,500 m^3 of drill cuttings for disposal each year) • removal and stockpile of organic cover material and silts removed during MBC construction for use in reclamation
Central Processing Facility (CPF)	• construction of CPF adjacent to the camp, will allow Chance to store, further treat/separate fluid produced during EFT and transfer it to trucks for disposal. The additional processing enabled by the CPF will stabilize the crude oil, as required for future truck transport to an appropriate approved crude marketing point. The CPF would include: ○ multi-stage and multi-phase separators ○ heat treatment ○ vapour and gas collection system for flares or to provide fuel for camp use ○ processing of crude oil to stabilize and meet specifications for truck transport

Project Activity	Summary of Activity
	○ storage of up to approximately 3,180 m³ of crude oil ○ storage of approximately 119 m³ of formation water • fuel storage facility ○ 151,000 litre (L) diesel fuel ○ 24,000 L propane • storage and use of chemicals and reagents: ○ hydrochloric acid (10% to 20% concentration) ○ methanol ○ additives to prevent corrosion of oilfield processing and handling equipment ○ demulsifiers to be used in treating fluids to better separate oil from formation water • bulk explosive compound to store dynamite charges for seismic exploration.
Airstrip	• construction of an airstrip approximately 1,500 m long located at about km 4 along the Chance winter road from the Dempster Highway intersection • airstrip will be used only during the winter when the surface can be levelled using winter road construction techniques. if sufficient air traffic support is required, Chance may upgrade the airstrip to year-round usage. • airstrip will be used throughout the project life, approximately two flights per week. • Jet-A aviation fuel will be stored at the airstrip
Water Withdrawal	• use of up to 300 m³ of water per day (or per permitted limits) for camp use and for making ice as part of building winter roads, ice roads and temporary well sites, not exceeding 10% of the instantaneous flow from the following extraction points: ○ year-round extraction from the Eagle River, Ogilvie River, and Whitestone River ○ extraction from Glacier Creek for fly-in camp ○ use up to 20 m³ of water daily (for washing, showers, toilets, etc.); bottled drinking water will be supplied to the camp for human consumption ○ construction of a water reservoir at the camp for water storage and use during low water periods. This may be filled during the summer when surface water flow rates are high. Two insulated water tanks are available for water storage with a capacity of 400 and 700 US barrels (liquid)
Transportation	• use Dempster Highway, North Klondike Highway, and Alaska Highway to access Project site; alternate access could include Highway from Watson Lake to Carmacks • approximate offsite traffic on public roads between the site and supply points estimated at: ○ 7–10 water trucks per week ○ up to 3 fuel trucks per week ○ 10 lightweight service vehicles per week as needed • Onsite traffic on Project-controlled roads is estimated to be: ○ fuel and water deliveries at a rate of 5–8 trucks per week ○ lightweight service vehicles daily to transport personnel and gear from camp to well sites, and for use by monitors
Chance Camp	• opening the existing camp and mobilizing equipment and personnel including drilling and seismic crews • continued use of existing 75-person Chance Camp, located at km 325 of the Dempster Highway. ○ up to 75 people on-site during all Project components: ○ existing waste management and disposal facilities ○ existing wastewater treatment infrastructure

Project Activity	Summary of Activity
	• remote camp for up to 25 personnel will be established near the proposed East Greaves and West Greaves Winter Roads, roughly 40 km from the Chance Camp to improve safety and access to sites • mobile camp will be set up at each active well to house the crew as needed (typically three personnel) • up to three secondary camps will be established in remote parts of the Project area to support safety and staging of exploration • Eagle Plains Hotel will be used to accommodate personnel overflow for short periods, if required
Reclamation and Closure	• progressive abandonment and reclamation of unsuccessful wells • wells that have successfully undergone EFT will be suspended pending future development considerations • installation of cement plugs across all porous/permeable zones within the well bore, across the base of each casing section and including an overlapping portion below the surface casing with the base of the surface casing • cutting a surface portion of well casing(s) off at least 1 m below ground level and welding steel plates to cap the casing • MBC sump area will be reclaimed as per available legislation and industry best management practices, including YOGA and *Directive 050 Drilling Waste Management* (Alberta Energy Regulator [AER] 2023) • removal of equipment, matting, materials, and debris from well sites • natural revegetation of low impact seismic lines • progressive decommissioning and reclamation of access routes when they are no longer necessary • testing facilities are to be removed from each site • upon complete field decommissioning activities, the removal of the CPF will occur • airstrip will be decommissioned and reclaimed at the end of the Project

1.4.2 Project Phases

The Project will have only one phase; the exploration phase, spanning 10 years.

1.4.3 Project Stages and Schedule

Field activities for the Project are planned to begin in winter 2025/2026 following the completion of the YESAB Executive Committee Screening Process. Within the 10 years of the exploration phase, work may be broken up into work stages (3 work stages, for example), with activities in each stage lasting 1 to 3 years, in each of the presumed three work areas. Each area is expected to encompass approximately one-third of the total Project area. The extent (size, location, and boundaries) of work areas will be developed iteratively over the Project's life based on existing and future exploration results).

Up to seven wells may be drilled sequentially per year, to a maximum of 30 wells over the 10-year life of the Project. The sequence in which wells are drilled for the exploration program depends on previous drilling success, EFT results, data collected from the seismic exploration program, weather, and road conditions. The ongoing process of interpreting seismic data will allow Chance to better understand the geological setting and size/geometry of the potential prospect.

Most of the activities will occur in the winter (e.g., seismic line clearing and shot hole drilling). Work outside of the winter includes aerial-supported seismic recordings. Conducting the seismic grid and shot hole drilling programs in the winter is expected to minimize the Project's effects on terrain, terrestrial and aquatic resources. The seismic recording will take place in summer to minimize ground disturbance and reduce Health, Safety and Environment (HSE) risks.

1.4.3.1 Seismic Exploration Program

Seismic exploration will take place year-round. The line preparation (access road construction, line cutting, surveying, and drilling) and the establishment of temporary creek crossings will be conducted during the winter months (potentially starting in October but likely December through April) under frozen ground conditions. Before spring thaw, temporary creek crossings will be removed. Recording would then follow in the summer months (June through September). This involves using a helicopter to deploy and retrieve personnel and equipment to the exploration area where geophones will be placed on the receiver lines and a shooter will detonate the previously loaded charges in a prescribed sequence. A brief outline of the annual schedule is shown on **Figure 1-1**.

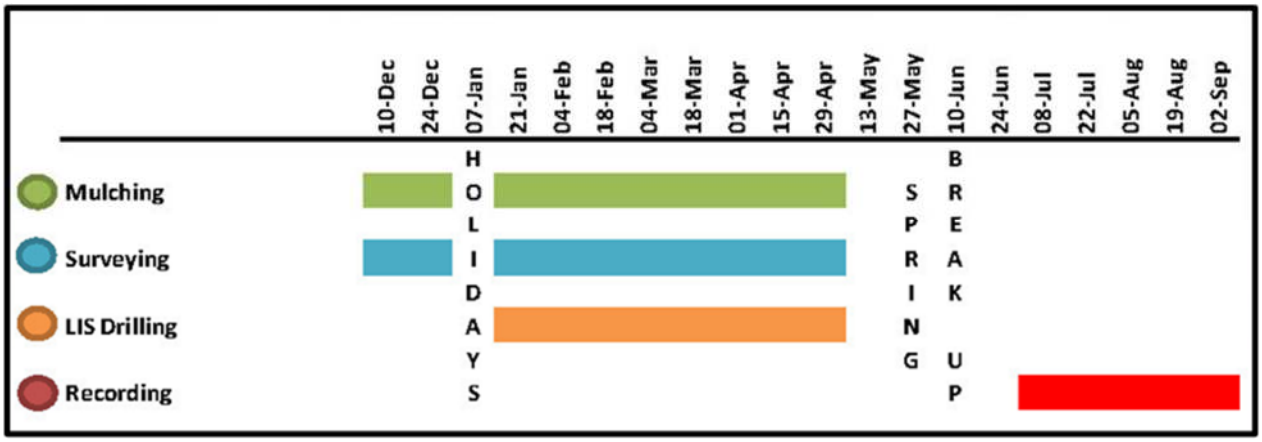


Figure 1-1. Proposed Year-round Schedule for Seismic Exploration in Eagle Plains

The seismic exploration program will consist of up to 1,500 km² of 3D Low Impact Seismic (LIS) data acquisition and up to 2,000 km of 2D LIS data acquisition. Seismic exploration relies on the geophones placed in a single line (2D) or along multiple, usually parallel, lines (3D). The 2D program may be undertaken as a single program or several smaller programs; the 3D program will be conducted as several programs of 400–700 km² areas. The winter seismic programs will minimize terrain, terrestrial and aquatic environmental effects. The seismic recording will take place in summer to minimize ground disturbance and reduce Health, Safety and Environment (HSE) concerns.

1.4.3.1.1 Seismic Recording and Drill Locations

Seismic exploration uses a compressional seismic p-wave (like an ultrasound) to remotely image rock layers beneath the surface. The technology measures the reflected energy waves (p-waves), akin to multiple echoes from each rock layer, to identify geological settings where oil and natural gas might be located. This imaging allows geophysicists and geologists to map the subsurface structure of rock

formations that could contain hydrocarbons and help pinpoint areas of the greatest potential for drilling a successful well.

Small dynamite charges in shallow holes, called shot holes, are used to create the p-waves that reflect off the various rock layers underground; the reflected p-waves are recorded by sensitive devices called geophones The small dynamite charges within each shot hole force the energy downward through the various rock layers. A seismic detonation of one kilogram (kg) is comparable to the sound of a passing diesel truck and is only 0.5 seconds in duration. Little reflected energy is perceptible at the surface by anything other than the sensitive geophones. The p-waves reflect off the various rock layers underground like and echo. As the energy bounces back to the surface, the geophones detect the seismic waves and record the data (**Figure 1-2**). The time it takes to receive the sound wave from the detonation tells geophysicists and geologists where the rock properties change, helping to find the oil and gas deposits.

Once all source points have been detonated in sequence, the data are processed and analyzed. The interpretation of the seismic data can give geophysicists detailed cross-sections (2D seismic lines) and multi-dimensional graphics (3D seismic programs) of the sub-surface area. This information is combined with previously known information about the rock types within the area and their properties, such as hardness, density and porosity, to support drilling locations for wells. The decision to drill wells or acquire additional seismic is determined by the amount and quality of the data available (**Figure 1-3**).

Decisions to drill wells or acquire additional seismic data is an ongoing process to define the resource potential in a particular geological formation or geographic region and is a combination of geological and geophysical efforts. The process includes ongoing seismic acquisition and geological evaluation as the wells are drilled and production capabilities are examined.

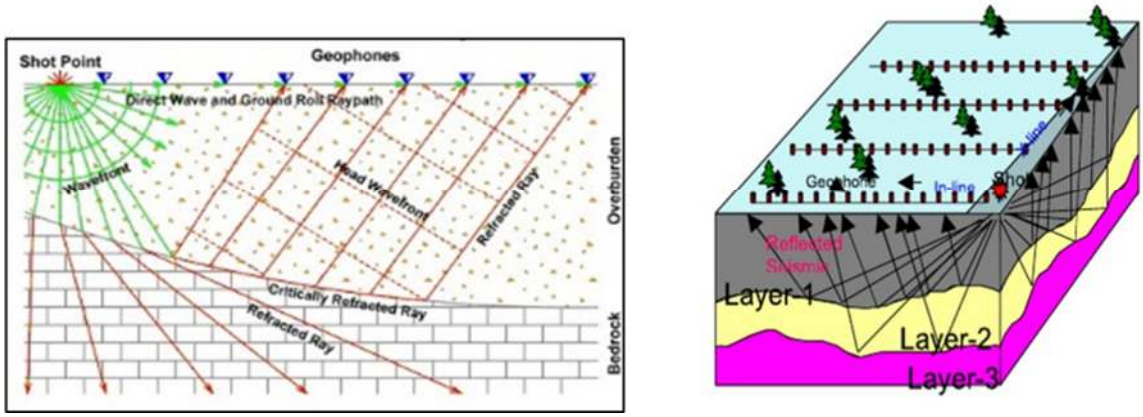


Figure 1-2: A Graphic Example of the Reflection Seismic Exploration Data Collection Process.

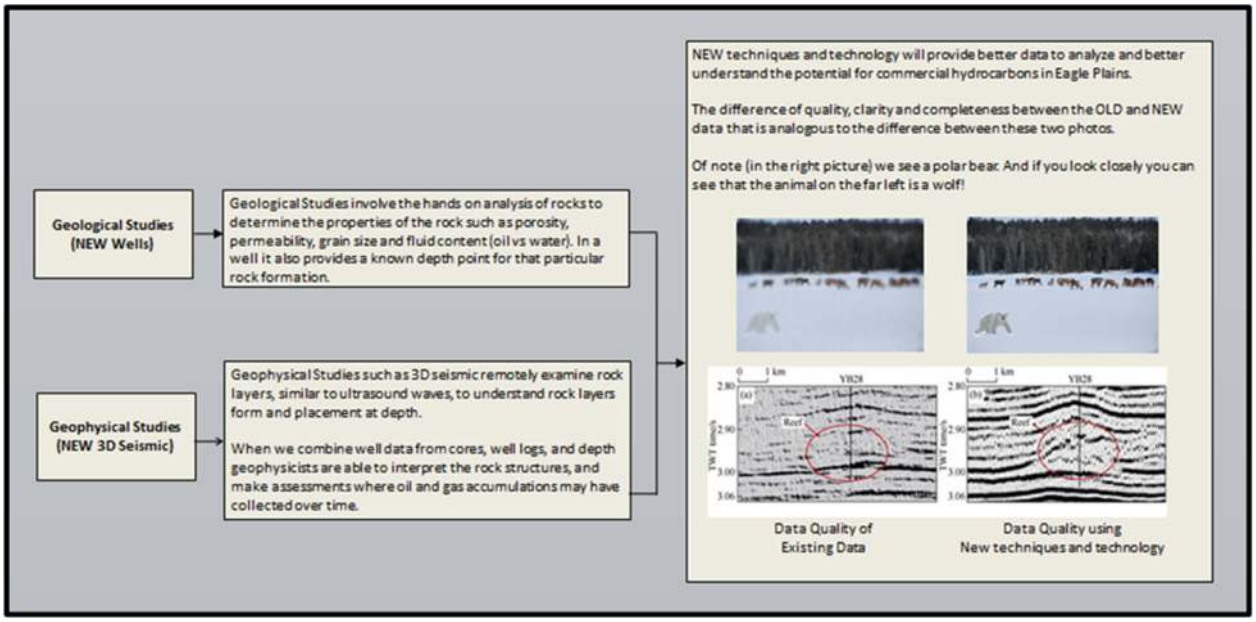


Figure 1-3: Example Geological and Geophysical Studies

1.4.3.1.2 Seismic Data

Seismic data is required in the Eagle Plains Basin to understand the area's complex geology. Modern seismic techniques will provide high-quality information about the geology of Eagle Plains while minimizing environmental effects. The proposed area for seismic exploration consists of about 1,500 km² of new 3D and 2,000 km of new 2D reflection seismic exploration within Chance's exploration permit area. **Map 1-2** illustrates the extent of the exploration area. However, the location of each annual seismic program, whether 2D or 3D, will be determined by analyzing the exploration drilling results and how seismic may help determine the knowledge of the basin. Low Impact Seismic 2D programs can be used to determine the extent or edge of a prospect, and LIS 3D will show more detail.

Depending on available accommodations, personnel, and equipment, the seismic data will likely be acquired in several discrete programs of approximately 400–700 km² areas. Year-round operations will enable resource allocation by completing line preparation during the winter and conducting the recording activities during the summer using heli-portable operations. Lines will be prepared in winter when snow is present, and the ground is frozen. Winter ground preparation will protect the active layer and underlying permafrost and preserve saplings and small shrubs. Year-round operations will enable larger portions of the seismic program to be completed with reduced disruption within the Project area.

For LIS 3D, a design is created by a professional 3D designer. For the Eagle Plains area, receiver lines will have an east/west orientation, and source lines will be oriented north/south. The spacing between points is determined by the level of data resolution required to image the shallowest rock formation of interest. It is estimated to vary between 40 and 50 m since the geology at Eagle Plains dips from the northeast (NE) to the southwest (SW). For a given layer of rock, it will be physically shallower in the NE part of the basin and deeper in the SW. The receiver lines will be mulched with the narrowest mulch head size (1.75 m wide), allowing for safe travel by foot, snowmobile or all-terrain vehicles (ATVs) and will run roughly parallel to other meandering receiver lines spaced approximately 200 m apart. The north-south source lines will be

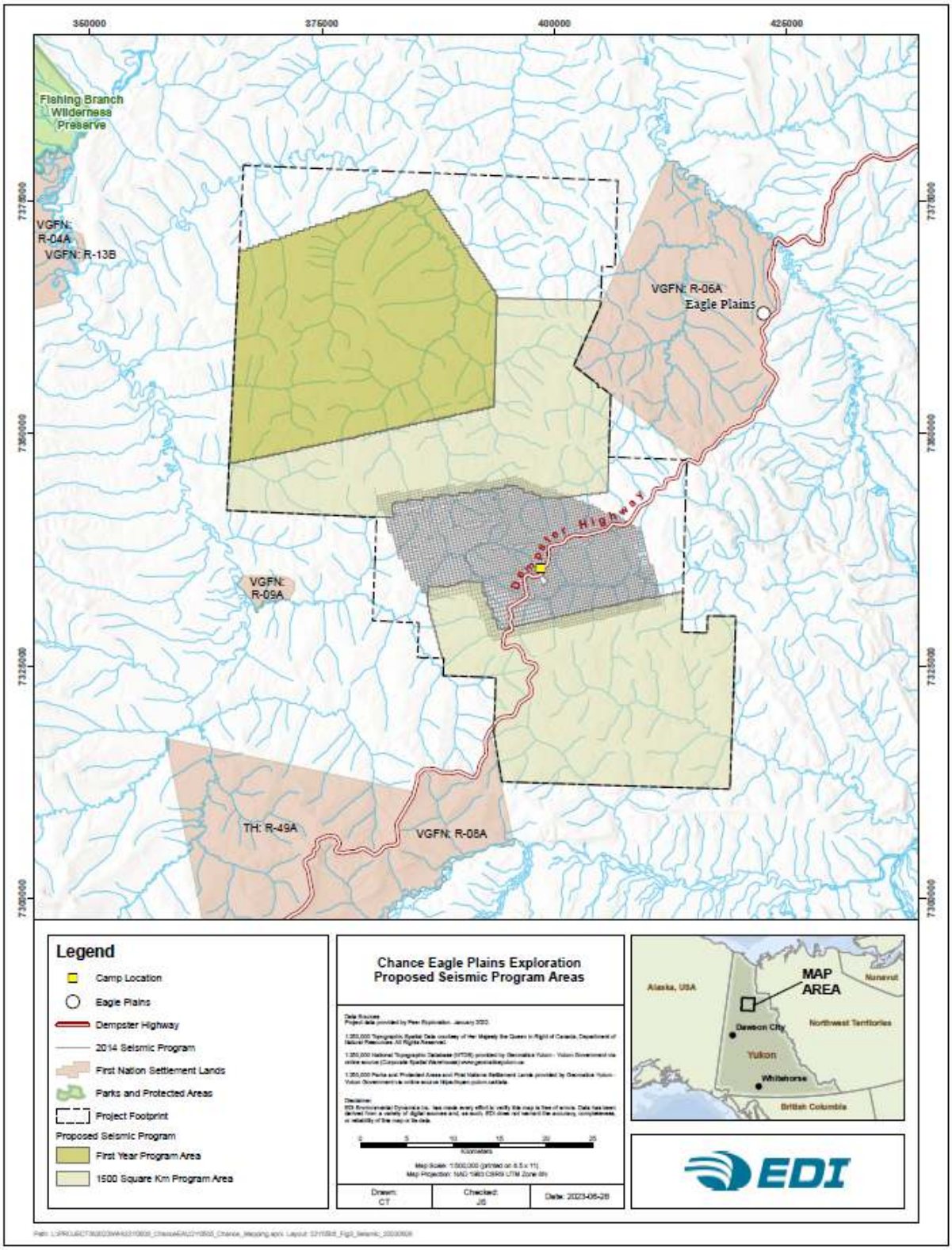
mulched (2.75 m wide) to allow access for the tracked drills that make the shot holes. The source lines run roughly parallel to other meandering source lines approximately 300 m apart. For LIS 2D, the geophones and sources are located within the same meandering, about 2.75 m wide, line.

During the recording process, each source point is detonated separately upon the initiation of a radio signal directed by the field operator called a “shooter”. The shooter is positioned at least 30 m from the active station and can survey the surrounding environment to observe detonation safety. The source point that will be detonated is in the source “swath” area and provides a centre point for the recording patch. A recording “patch” is the area of live (active) geophones that are closest to the source point swath area (within 3,000 m). Upon detonation of the source point within the swath, the geophones in the recording patch collect the data. For the Eagle Plains area, the patch size is comprised of 16 lines containing 140 geophones each (**Map 1-2**)**.** The patch ensures that far offset distances are greater than the depth of target formation; therefore, the data will encompass areas large enough to prevent gaps in the data. The patch is moved digitally and physically as the shooter travels from east to west and then north to south. Geophones are continually picked up from the recorded area and moved to the next area ahead of the recording patch.

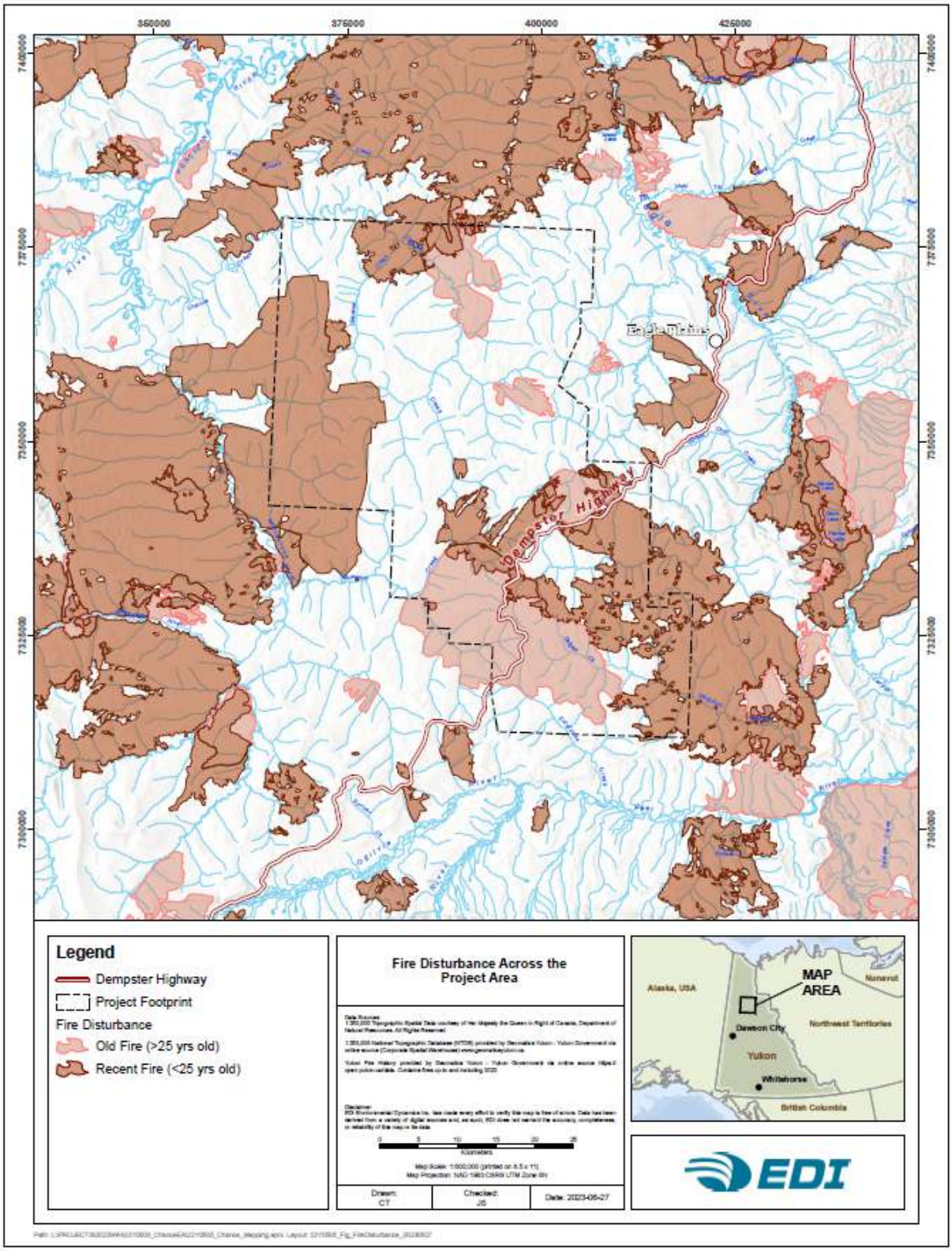
As seismic program data will be acquired over several years, naturally occurring fires are likely in the area. Several fires have occurred in the Eagle Plains basin, and approximately 60% of the Project area has been burned. The most recent wildfire occurred in 2017, burning 294 km² within Chance’s exploration permits 0010 and 0012 (**Map 1-3**).

Each year that a seismic program with be conducted, an analysis of mitigation strategies is undertaken, and appropriate strategies are implemented to reduce the environmental effects in the area. One example is using existing burn areas rather than clearing new vegetation where possible. The proposed first-year seismic program was designed considering the existing open meadow and burn areas. Lines traversing these areas will not disturb live vegetation and should not be regarded as a functional disturbance. Regrowth in these areas will also be monitored to gauge the natural regeneration conditions in the area. Previous LIS seismic line disturbances will continue to be analyzed to make sure that current methods of line preparation provide optimal conditions for regrowth in the Eagle Plains area. Ecological, permafrost and historical data have been extensively gathered and incorporated into the operations plan.

Seismic operations are planned for year-round operations in the year that they are to be conducted, based on length of time required to conduct each component of the program and the limited personnel, equipment, and accommodations available in the Eagle Plains area. The line preparation (access trail construction, line cutting, surveying, and drilling) will be conducted during the winter months (December through April) under frozen ground conditions and recording would then follow in the summer months (July through September) (**Figure 1-4**).



Map 1-2: Chance Eagle Plains Exploration Proposed Seismic Program Area



Map 1-3: Forest Disturbance Across the Project Area

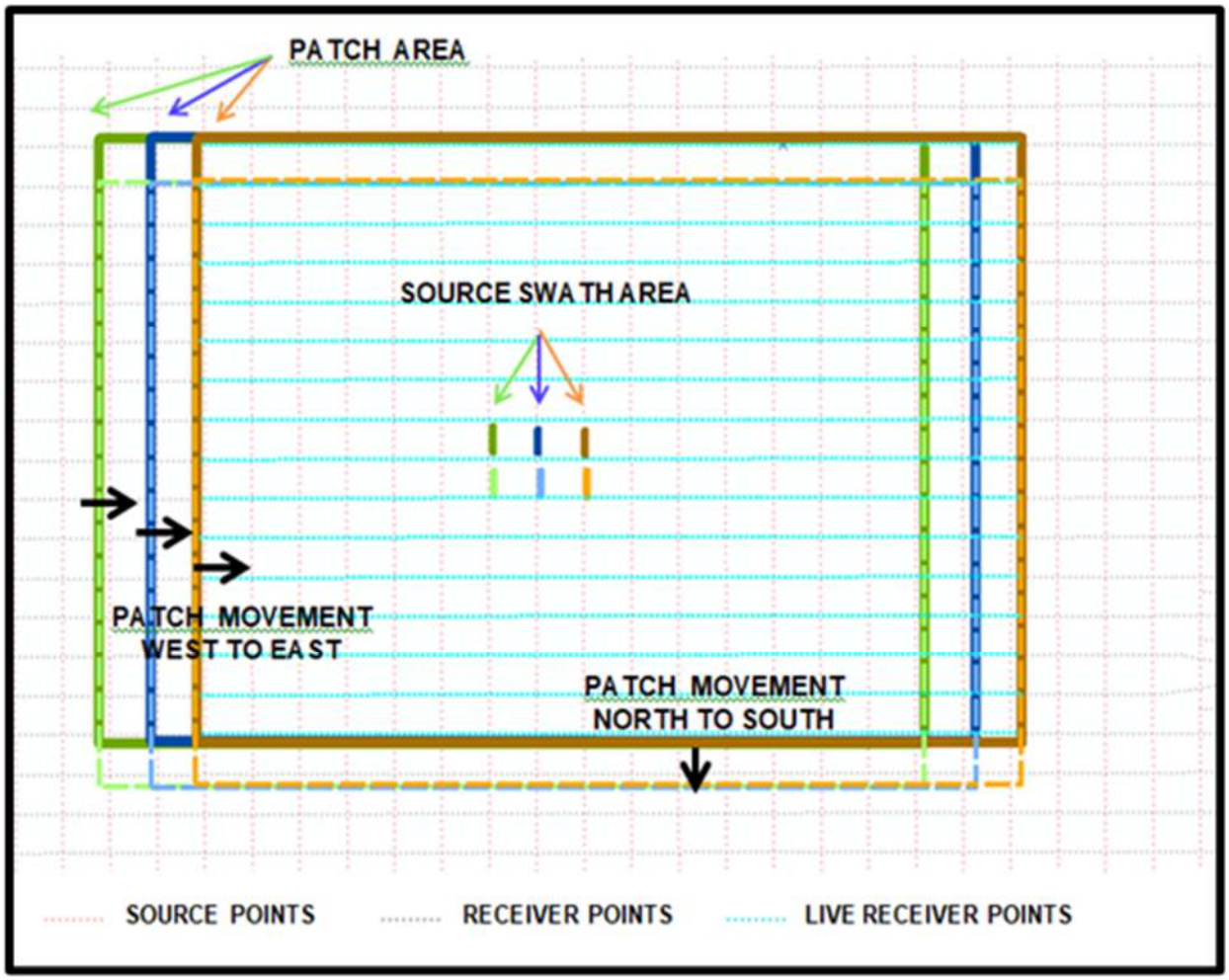


Figure 1-4: Proposed Seismic Patch Size and Movement Throughout the Program Area.

1.4.3.1.3 Seismic Line Construction

The historical seismic data in the Eagle Plains area consists of "Legacy" 2D seismic lines and the "Modern" LIS 3D seismic program conducted in 2013–2014. The methods used to construct the Legacy 2D lines included 6–10 m wide lines in straight (linear) patterns that cross the landscape. These lines are visible today mainly due to the past use of bulldozers to remove over/understory — these clearing methods and wider lines are not required in modern LIS practices. Modern LIS line construction methods use narrow line widths that meander and create non-linear line disturbances. Bulldozers are no longer used in seismic line construction; smaller and narrower mulchers are now used to support the preservation of the active layer and reduced vegetation removal.

Line preparation will use the LIS methods, reducing the landscape footprint. This technique creates meandering source and receiver lines that limit the line of sight to less than 70 m, which minimizes predator (e.g., wolf) line of sight for prey. The LIS method also ensures that the line can avoid removing larger timber that shelters under canopy vegetation by adjusting the meander of the line to avoid larger trees and mature vegetation.

1.4.3.1.4 Line Preparation — Cutting

A combination of mulchers and operators with chainsaws will prepare source and receiver lines that will be closely monitored and quality controlled. Mulchers (**Photo 1-1**) are equipped with GPS units with seismic line data to allow the operator to follow a pre-planned course. Mulcher operators have detailed information on the area's pre-identified hazards or constraints, culturally sensitive locations, flora and fauna setbacks, and course derivations, and the operator takes care when approaching these areas of concern. Lines will be doglegged (or bent) at locations crossing any major access trails and open clearings to reduce the visual identification of access points into the program area. Meandering line construction chooses the path of least resistance and avoids timber larger than 20 to 30 cm in diameter (**Photo 1-2** and **Photo 1-3**). This technique reduces the line of sight down line to less than 70 m.

Source lines will be mulched to 2.75 m wide (**Photo 1-4**) to accommodate tracked LIS drill vehicles, and receiver lines will be 1.75 m wide (**Photo 3-3**) to accommodate snowmobiles, ATVs and personnel. A minimum of 60 cm of packed snow will be left online to mitigate possible damage to vegetation or permafrost. Riparian areas and lines containing pokers or leaners will be hand cleared with chainsaws.

The seismic line preparation will be done using rough mulching: a technique that removes the branches but leaves the tree stems intact. This technique is useful in leaving evenly distributed coarse, woody debris allowing for more rapid decomposition of the fallen timber while enabling the new vegetation to propagate through the mulch (**Photo 1-4**). The mulcher heads are set to high blade, leaving the active layer undisturbed and soil or permafrost unaffected. The mulch also protects the root system of young timber from heat, cold, drought and erosion. Rough mulching makes lines narrower, creating more natural lines with weakly defined cut-width edges.

Since creeks in the program area freeze to the bottom in winter, no "major" watercourse crossings will be required. A major watercourse crossing is any stream or river that will not freeze to the bottom or the water flow is too great to sustain a snow fill crossing. Crossings are categorized as mechanical (equipment crossing) or foot crossing. The mechanical crossings (**Figure 1-5**) will be constructed using snow fills and may require a water truck to make snow and freeze in the crossing. Water crossings are first packed with clean snow pushed from the creek surface to the crossing location. This prevents woody debris from contaminating the creek during spring melt. The snow is then hardened using a water truck to form ice to strengthen crossing integrity with the weight of the equipment. Snow fills in both creeks and drainage areas will preserve the integrity of the banks for adequate water flow and run-off. All crossings will be removed before spring break-up to allow obstruction-free drainage. Given the Eagle Plains area has very low tree density, creeks often have natural areas to cross where vegetation removal is not required. Where vegetation clearing is required near a creek, the root system remains intact to maintain creek bank stability. All snow fills will be constructed following the Department of Fisheries and Oceans (DFO) Code of Practice: Ice Bridges and Snow Fills. (Fisheries and Oceans Canada 2023).

Riparian areas are also examined and added to the program map. Since riparian areas provide key resources for wildlife and bank stability, mechanical equipment is restricted to a 45 m setback from the bank edge. This setback protects vegetation disturbance in the area and makes sure source holes terminate at a safe distance to avoid flowing holes (**Figure 1-6**).



Photo 1-1. A 2.5 m Wide Mulcher



Photo 1-2. A 2014 3D Source 2.5 m Wide Line in the Project Area



Photo 1-3. A 2014 3D Receiver 1.75 m Wide Line



Photo 1-4. 2019 Photo Showing 2014 3D Source Line Construction and Deadfall from Wildfire. Note: Minimal Disturbance to the Active Layer and Minimal Mulch Produced

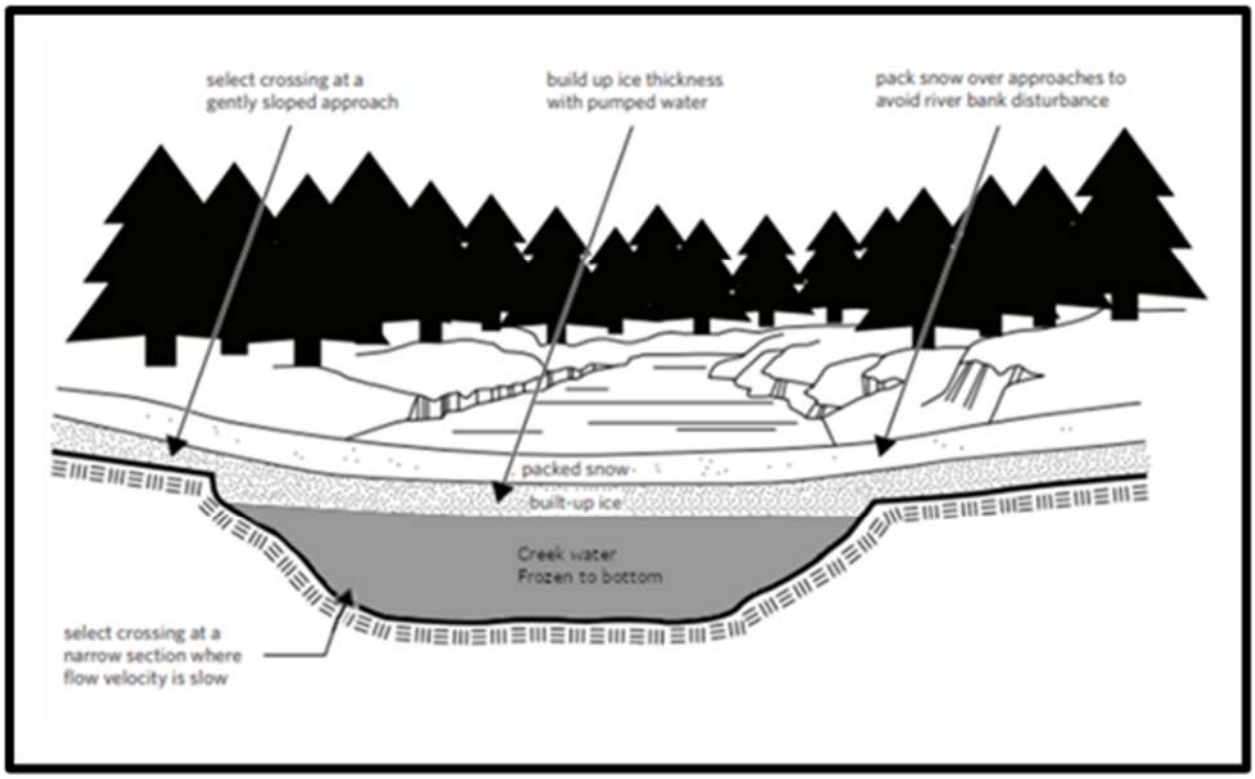


Figure 1-5. Typical Creek Crossing in Eagle Plains. Creeks are Crossed at a 90-degree Angle to Banks to Preserve Bank Stability

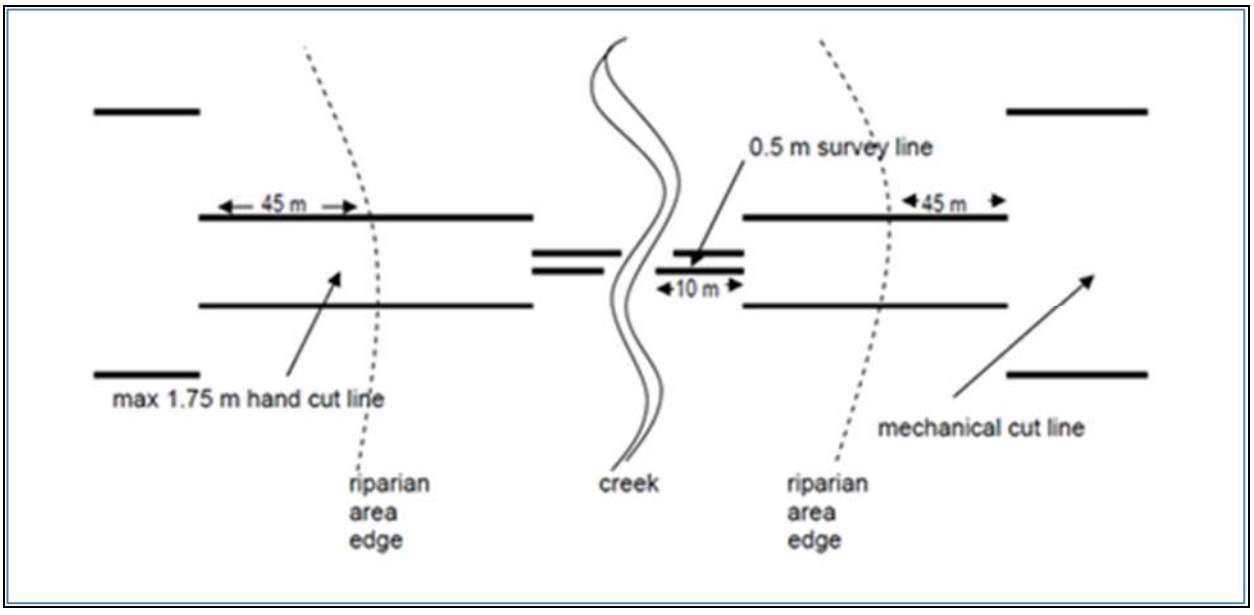


Figure 1-6. Riparian Area Diagram with Cutting and Mechanical Equipment Setbacks

1.4.3.2 Line Preparation — Surveying

Once there are a sufficient number of source and receiver lines cut to allow the next stage of the seismic program to occur, surveyors then travel the source lines using ATVs and snowmobiles to survey and mark each drill location of the source holes; on receiver lines they mark the receiver points where the recording crew will place the wireless geophones.

Surveyors also contribute to the hazard/sensitive site assessment map as they record their GPS data. These data include:

- riparian areas;
- difficult terrain;
- historical/archaeological areas;
- animal sites/features;
- facilities;
- hazard identification;
- proper line placement;
- movement around thick bush;
- refining cutting requirements; and,
- flag all hazards or constraints and riparian areas.

1.4.3.3 Line Preparation — Drilling

Once source points are surveyed, narrow-tracked LIS drills (**Photo 1-5**) are deployed to drill a 10 cm diameter, 6 m deep hole at each location. For the proposed seismic program in Eagle Plains, the source points will be spaced along the source lines at approximately a 50 m interval.



Photo 1-5. Narrow Low Impact Seismic (LIS) drills

No water was required to drill the source holes during the 2014 seismic program, and cuttings were easily reloaded into the hole chamber after the dynamite was placed at the bottom of the hole. Source holes are loaded with 1 kg of dynamite to be later detonated by the recording crew (this is called pre-loading). As provincial/territorial and federal legislation requires, each source point is plugged with drill cuttings (soil, rocks, etc.) brought up to the surface from the drill stem). An industry-approved plug is inserted into the hole at a minimum depth of 30 cm below the surface and then filled to the surface with more drill cuttings.

Chance and the industry's explosive providers are aware of the regulations under the federal *Transportation of Dangerous Goods Act*, S.C. 1992, c. 34 (Government of Canada 1992) and strictly adhere to those regulations. Explosives will only be transported in approved magazines and by individuals trained in transporting dangerous goods. Natural Resources Canada (NRCAN) regulates and controls all aspects of explosive possession and transportation through magazine licences which are renewed annually. The new Electronic License Management System (eLMS) allows up-to-date management of all explosive purchases, transport, and incidents to ensure explosives are tracked and safely stored. The two types of magazines that will be used to store explosives are as follows:

Maxam Type 9 Magazines (Photo 1-6):

- There are two compartments — dynamite and detonator.
- Type 9 magazines are lined with 7/8" Armortex (Bullet Proofing and Blast Resistant). Dimensions are 58" wide x 144" long x 66" high.
- Doors are high security and built as per NRCAN Regulations and issued a Federal Tag #.
- There will be two different sizes of skidded Type 9 magazines which will store up to 3,000 kg of explosives and 5,000 detonators, depending on packaging. There are also wheeled Type 9 magazines built to the same specifications but with reduced capacities.
- Construction from the outer skin to inside is:
    - ¼" steel plate;
    - 7/8" Armortex; and,
    - ¼" plywood interior.
    - Weight is 7,500 pounds (lbs).
    - These magazines are transported by either small custom-built tandem axle trailers, tandem axle recovery/tow truck with a flat bed or any truck trailer unit such as a low boy.

Maxam Type 4 Magazines:

- Single-compartment magazine;
- Various sizes — 8' wide x 12' long x 7' high with a capacity 7,500 kg;
- High-security door construction as per NRCAN Regulations and issued a Federal Tag #;
- Construction from the outer skin to inside is:
    - ¼" steel plate;
    - 3" gravel;
    - ¾" plywood interior.
    - Weigh 18,000 lbs; and,
    - These magazines are transported with either a tandem axle recovery/tow truck with a flat bed or any truck unit such as a low boy.



Photo 1-6. Explosives Magazine Storage (Maxam Type 9)

1.4.3.3.1 Data Acquisition — Recording

Recording the seismic program consists of two stages: laying out and picking up equipment on the receiver lines; and detonation at each source hole.

Geophone "Layout"/ "Pick-up" — Line crew members place the geophones (**Photo 1-7**) and associated equipment at each receiver point location. Using a long line and heli-bags, a helicopter will place and retrieve recording equipment along the receiver lines at predetermined intervals. Recording personnel will access the equipment in the heli-bags and place a series of geophones approximately every 40 m along the receiver lines. The recording crew will be using a cableless recording system. Cableless recording systems are ideal for gathering seismic data because they reduce the constraints on geophone placement, eliminate downtime for cable repair, and reduce the number of crew members required to deploy the equipment. Once in place, the geophones record the seismic waves created by the charges detonating on the source lines. Once the section of geophones is recorded, personnel and a helicopter return to retrieve the equipment and any debris used to mark the surveyed receiver locations. The geophones are returned to the staging site, downloaded, cleared and deployed back to the program to be laid out again to record the next section of line.



Photo 1-7. Example of a Geophone

Source Point Detonations — This stage begins after the first section of geophones has been laid out on the receiver lines. Specially trained personnel called “shooters” traverse the source lines on foot, via ATVs or snowmobiles, to each source point. The shooter examines the area around the source point for any possible hazards, constraints, or wildlife and inspects the condition of the leads. They connect the detonation device to the leads and signal to the Observer (located at the staging site) that the charge is safe to detonate. The shooter stands clear of the source hole (approximately 30 m) but remains within viewing distance to watch the area remains clear. A specific radio signal initiates the detonation, and the shooter returns to the hole to remove the detonation device, the leads, and any flagging or markers in the area. The shooter then proceeds to the next source point and repeats this procedure.

Once the program is complete, a crew may be deployed to clean up any remaining material used online for the seismic program. The garbage is returned to a staging point and discarded in an approved bin to be transported to a waste facility. The crew also reports issues that may require further reclamation to be immediately addressed.

During the recording stage, the equipment on the source and receiver lines is accessed by foot, ATV, snowmobile or by helicopter. The helicopter will be based out of the Chance Camp at km 325, and the use of the helicopter will be minimized. Where possible, the helicopters will be sourced from local operators familiar with the environment and the guidance document *Flying in Caribou Country* (Government of Yukon

2010); however, specialized long-lining operators will be required outside Yukon for the recording operation. The addition of helipads will also be required for safety and medevac reasons but will be selected in naturally open and sparsely treed areas.

Staging sites will store some or all of the following equipment throughout the seismic program. All equipment is moved to the next staging site as the equipment is required in the next area of the program:

- Trucks (1/2, 3/4, and 1 ton);
- ATV and snowmobiles;
- Trailers (flat decks and covered);
- Double-walled fuel tanks (diesel 145,228 L, Gas 83,825 L and Jet-A 35,000 L)
  - The fuel will be contained at the main camp in double-walled tanks and transported to the staging sites in a 2,000 L tank trailer for use during operational activities in each area.
- Helicopter & fuel tanker;
- Picker trucks (1-ton trucks with equipment);
- Recording bags;
- Garbage bins to temporarily store garbage before incineration;
- Magazine;
- Survey and drill supplies;
- Canvas tents;
- Medivac unit;
- LIS drill units;
- Seacan for storage and tools;
- Snow cats;
- Water truck;
- Battery truck; and,
- Mulchers.

1.4.3.4 Exploratory Drilling Program

Drilling will be conducted during winter, primarily from January through March. The sequence in which wells are drilled depends on previous drilling success, EFT results, data collected from the seismic exploration program, weather, and road conditions. The following is a brief chronology of the progression of a drilling program:

- Review seismic and other data to help guide prospect definition and well locations.
- Develop winter access road to well site.
- Clear vegetation as needed, and conduct site levelling (see below).
- Install surface infrastructure for drilling and testing the exploratory well on the well site.
- Drill the well.
- Transport and dispose of drill cuttings in the MBC sump via winter access road.
- Well logging and core sampling before conducting DSTs.
- Conduct DSTs to determine whether EFT should be conducted.
- Case and suspend the well or abandon and reclaim depending on results.
- Move the drill rig to the next well site area.

Temporary drilling pads will only exist during winter and will be created from snow on areas cleared of trees and tall vegetation; the ground will remain undisturbed. Levelling will be done by building a snow and ice base. Rig mats will then be positioned to help with levelling and distribute the load of equipment sitting on top. If the DSTs are unsuccessful (i.e., no commercial quantities of petroleum products were encountered in the well), well abandonment or suspension will be completed, followed by progressive reclamation. A

suspended well is a well that is not producing and has been safely secured, but production could be restarted later. An abandoned well is a well that has been permanently shut down, appropriately plugged, and the well head removed, as defined in the Yukon *Oil and Gas Drilling and Production Regulations*, YOIC 2004/158 (Government of Yukon 2004) (*OGDPR*); it can then be considered safe and secure by regulators.

Well abandonment or suspension includes:

- abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface); or,
- suspend well to become an alternative location for deep zone injection (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).

Progressive reclamation includes:

- remove all surface infrastructure;
- remediate well site area.
- Recontouring of the well site areas is not anticipated as well site contouring will be limited to levelling the area using packed snow and ice; therefore, there will be minimal disturbance to the underlying vegetative layer.
- An example of a typical rig at night, and as viewed during the day at the end of a constructed winter access road are shown on **Photos 1-8** and **1-9.**



Photo 1-8. Example of Typical Chance Rig at Night



Photo 1-9. Example of Typical Chance Rig at End of Constructed Winter Access Road

1.4.3.5 Extended Flow Testing

If the DST is successful (i.e., petroleum products in quantities deemed commercial were encountered in the well) an EFT would be conducted. Successful wells will be suspended as an intermediate step to cover timing differences between finishing the DST, finishing drilling the well, and undertaking an EFT. More than one DST could be done on a well if there are multiple geological formations with potential commercial quantities of hydrocarbons. An EFT at an individual well could last from several months to the end of winter, and up to two consecutive winters depending on whether the discovery is mainly crude oil or natural gas. An EFT generally includes the following activities:

- Install surface and sub-surface equipment required for the EFT.
- Complete the well with tubing and downhole gauges.
- Perforate casing at zones of interest to allow natural gas and natural gas liquids to flow into the well bore (hydraulic fracturing is neither proposed nor required to perform an EFT).
- Allow the well to flow, flare gas, and collect oil, natural gas liquids, and other fluids.

Well completion is the process of readying a well for production after drilling and may include the following tasks: perforating the casing, installing production flow control devices, and installing steel tubing and wellhead components. Further details on the EFT process, including pre- and post-EFT tasks are outlined in **Table 1-2**. **Figures 1-7** to **1-9** show typical schematic process diagram for a DST, a typical flare stack and gas/vapour recovery flowsheet, and typical flare stack unit on a portable rig.

Table 1-2: Process Following Successful Drill Stem Test for Discovery of Both Primarily Natural Gas and Crude Oil

Primarily Natural Gas Discovery	Primarily Crude Oil Discovery
Complete well (perforate the casing, and install production flow control devices, steel tubing, and wellhead components).	Complete well (perforate the casing, and install production flow control devices, steel tubing, pumps if needed, and wellhead components).
Install required surface facilities (separator vessel, heaters, dehydrators, stock tanks, flow lines, metering equipment, portable generators, and flare stack).	Install required surface facilities (separator vessel, heaters, treaters, stock tanks, flow lines, metering equipment, portable generators, and flare stack).
Conduct EFT of 1–2 months	Conduct EFT up to 2 winters
Measure natural gas and water from wells.	• Measure, store, and process crude oil, natural gas, and water from wells. • Transport crude oil from EFT to CPF, then to an acceptable market.
Conduct maintenance on well as required (work over).	Conduct maintenance on well as required (work over).
Once EFT is complete, either: • decommission and abandon well; or • suspend well pending future use (e.g., develop a project proposal to bring into production).	Once EFT is complete, either: • decommission and abandon well; or • suspend well pending future use (e.g., develop a project proposal to bring into production).
Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).	Abandon well (cement all perforated producing zones, install shallow cement plugs, cut and cap surface casing 1 m below normal ground surface).
Remove all surface infrastructure.	Remove all surface infrastructure.

Primarily Natural Gas Discovery	Primarily Crude Oil Discovery
Remediate well site area and allow disturbed vegetation to regenerate naturally	Remediate well site area and allow disturbed vegetation to regenerate naturally

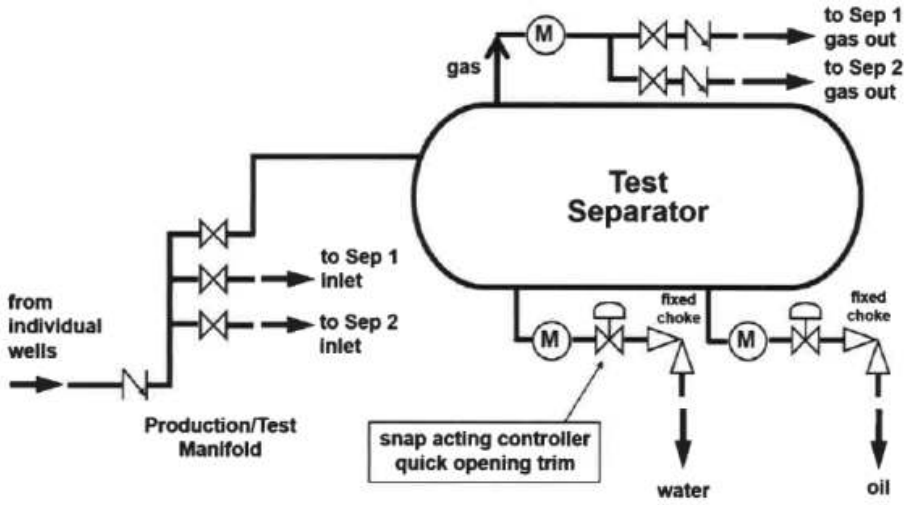


Figure 1-7. Drill Stem Test (DST) Process Diagram from Well Head Through the Test Separator

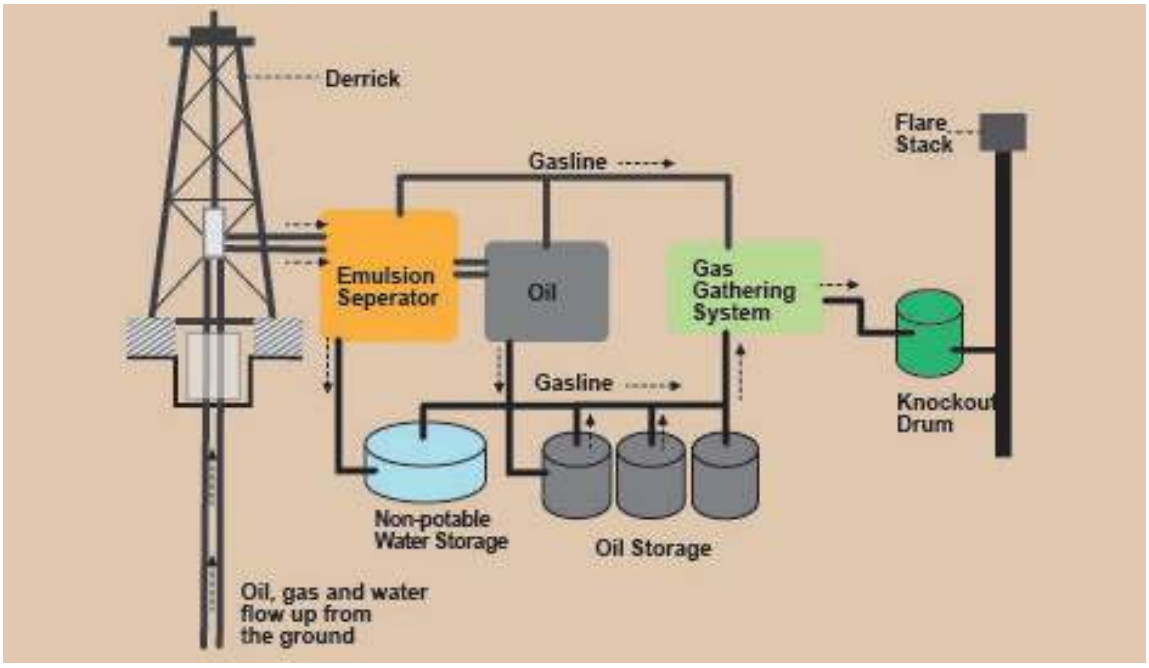


Figure 1-8. Typical Flare Stack and Gas/Vapour Recovery Flowsheet

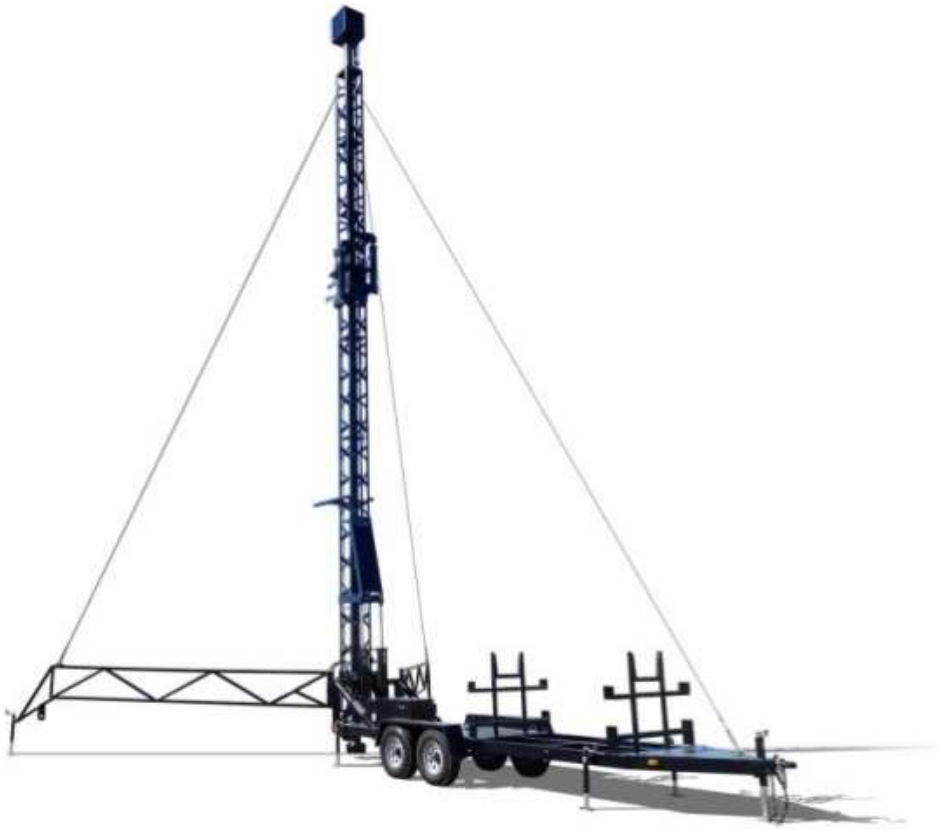


Figure 1-9. Typical Flare Stack Unit on a Portable Rig

1.4.3.5.1 Well Maintenance

Any well completed for and EFT, or not completed for an EFT and suspended, may require maintenance during the 10-year life of the Project. Well maintenance is required on any suspended well before abandonment, conversion to an active well, or annually if it remains suspended. Well-maintenance equipment may include a service rig, wireline truck, cement trucks, and associated support equipment. Under the *OGDPR*, a well is deemed suspended when it is safely secured, but is not producing oil or natural gas.

Well maintenance activities, also known as workovers, generally include:

- pressure testing to confirm the integrity of the casing and well head valves;
- removal of equipment in the wellbores such as tubing and plugs;
- wireline investigations to measure temperatures and cement integrity and convey any perforating equipment;
- remedial work such as cement squeezes or treatments to improve flow from the reservoir rocks into the well bore; and,
- well bore integrity assessment.

1.4.3.5.1.1 Pressure Test and Surface Casing Vent Flow Test and Gas Migration Test

A pressure test will be conducted at each well to evaluate the integrity of the wellhead and the existing well bore casing. The well (or Legacy well) will then be tested for surface casing vent flow (SCVF) and gas migration in the area immediately surrounding the well head. Chance reports that no SCVF has been detected in existing suspended wells during annual inspections.

If SCVF is identified, the well will be inspected, and test results will be logged using various tools (e.g., noise tool, temperature tool, bond log tool) to determine the source of the SCVF and/or gas migration. The logs will be analyzed, and a plan will be formulated to complete a downhole shut-off at the source of the SCVF or gas migration if required. This is only done for significant vent flow events or when abandoning a well. Non-significant vent flows are normally left until end-of-life for newly producing or suspended wells.

Depending on the status of the well (e.g., cased or completed with perforations) and the nature of the problem, the equipment needed to fix the problem will typically involve some combination of a service rig, wireline services and possibly cementing services.

1.4.3.5.1.2 Temperature Log and Cement Bond Log

Once SCVF and gas migration testing is complete, the service rig, support equipment, and wireline will be moved to the well site. A temperature log will be recorded from the surface to 300 m Kelly Bushing below the surface (mKB) to identify anomalies or departures from the reference gradient. Most anomalies are related to fluids entering the formation through the borehole or fluid exit. If there is no anomaly, this work will be a measure of the depth and thickness of permafrost.

A cement bond log will be run after the analysis of the temperature log. The cement log uses the variations in the amplitude of an acoustic signal travelling down the casing wall between a transmitter and receiver to determine the quality of a cement bond on the exterior casing wall. The acoustic signal will be more attenuated in the presence of cement than if the casings were uncemented. The cement log is used to identify sections of the well bore that will need intervention to isolate porous formations from adjacent formations through new cement squeezes.

1.4.4 Project Design Stage

The Project is currently designed to a conceptual level. Project facility locations combine known, fixed spatial locations (e.g., camp location) and undefined spatial locations that will be determined as the seismic and drilling programs gather data. Detailed Project design will be done iteratively throughout the life of the Project based on data gathered through Project progression. It will conform to the commitments made by Chance and the terms and conditions stated in the Decision Document(s) resulting from the YESAB Executive Committee screening process, and other issuances, once defined.

1.4.5 Proposed Concurrent Activities

It is anticipated that during each 1 to 3 year timeframe, seismic exploration will alternate with exploration drilling and EFT due to capacity constraints at the camp.

Ongoing Project planning and data analysis will be concurrent with field activities. Chance will engage potentially affected First Nations and residents of communities throughout the life of the Project.

Table 1-3 presents a high-level outline of the timing of main and accessory activities. **Table 1-4** outlines the sequence of well development activities including well pad development, drilling, DST and EFT, and what resources are needed based on the success of drilling and testing.

Table 1-3. Project Activity Timing

Component	Timing	Details (as needed)
Seismic Exploration Program	Except for seismic data recording, the seismic programs will occur during the winter and alternate with the drilling activities due to capacity constraints at the camp.	Subject to this limitation, seismic programs could occur during the 10-year exploration period.
Drilling Exploration Program	Alternating with seismic programs initially, starting during the winter months (October through April).	Drilling may be interspersed with accessory activities such as preparing/decommissioning access to well sites, mobilizing/demobilizing equipment, and reclamation activities.
EFT program	Timing will depend on the exploration drilling results, primarily the discovery of crude oil or natural gas, and the capacity of the 75-person camp to accommodate the necessary crews.	The EFT will be staggered across the Project area, but it is expected that one or more EFTs will occur in the Project area during the winter season, following initial discovery from drilling.
MBC sump pod construction	MBC sump pod construction will occur in every season that drilling is occurring, and pods will be built on an as-needed basis to dispose of drill cuttings.	
Airstrip and CPF construction	Airstrip and CPF construction will likely occur within the first or second winter season.	
Reclamation	Reclamation will be ongoing throughout the Project's life.	

Table 1-4. Sequence of Well Development Activities

Sequence of Well Development Activities	
1. Develop winter access road to well site.	
2. Develop well site (approximately 1.44 ha in area).	
3. Install surface infrastructure for drilling and testing exploratory well on well site.	
4. Drill well.	
5. Transport and dispose of drill cuttings in MBC sump via winter access road.	
6. Well logging and core sampling before conducting DSTs.	
7. Conduct DSTs to determine whether EFT should be conducted.*	
8. Move drill rig to the next well site area.	
If DST is not successful* (i.e., no petroleum products were encountered in the well)	**If DST is successful** (i.e., Natural Gas or Crude Oil is encountered)Successful wells will be suspended as an intermediate step to cover timing differences between finishing the DST and undertaking EFT.

Sequence of Well Development Activities		
	Primarily Natural Gas Discovery	**Primarily Crude Oil Discovery**
• Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface); or • Suspend well to become an alternative location for deep zone injection (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).	Complete well/well completion (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).	Complete well/well completion (finish casing, perforate the casing, and install production flow control devices, steel tubing, pumping equipment is needed, and wellhead components).
Remove all surface infrastructure.	Install required surface facilities (separator vessel, heaters, dehydrators, stock tanks, flow lines, metering equipment, portable generators, and flare stack).	Install required surface facilities (separator vessel, heaters, treaters, stock tanks, flow lines, metering equipment, portable generators, and flare stack).
Remediate well site area.	Conduct EFT for 1–2 months.	Conduct EFT for up to 2 years.
Natural revegetation of well site area	Measure natural gas and water from wells.	• Measure, store, and process crude oil, natural gas, and water from wells. • Transport crude oil from EFT to CPF, then to an acceptable market.
Natural revegetation of access roads	Conduct maintenance on well as required (work over).	Conduct maintenance on well as required (work over).
	Once EFT is, complete either: • decommission and abandon well; or, • suspend well pending future use (e.g., develop further project proposal to bring into production)	Once EFT is complete, either: • decommission and abandon well; or • suspend well pending future use (e.g., develop further project proposal to bring into production)
	Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).	Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).
	Remove all surface infrastructure.	Remove all surface infrastructure.
	Remediate well site area and allow to regenerate naturally.	Remediate well site area and allow to regenerate naturally.

Note: * DSTs can occur throughout the drilling process and are not delayed waiting for the entire well to be drilled. These tests are done following logging and any core sampling, but prior to casing the well. There may be multiple DSTs performed on a given well as the drilling proceeds, and success or failure of the well is determined based on results of all the DSTs completed.

1.4.6 Project Scale

Spatial boundaries, including local and regional, account for the scale and spatial extent of expected Project activities. The area in which Project activities will take place comprises approximately 2,400 km² of oil and gas exploration rights or permits on either side of the Dempster Highway south and west of the Eagle Plains Hotel. This includes the area of seismic work. This area has been defined as the Regional Study Area (RSA) for the Project Proposal and is further defined and described in **Section 3 Methods**.

Temporal scale accounts for the duration of time of the activity or the effect of the activity. Chance intends to conduct exploratory Project activities over 10 years, possibly beginning as early as 2025, conducting activities primarily during the winter.

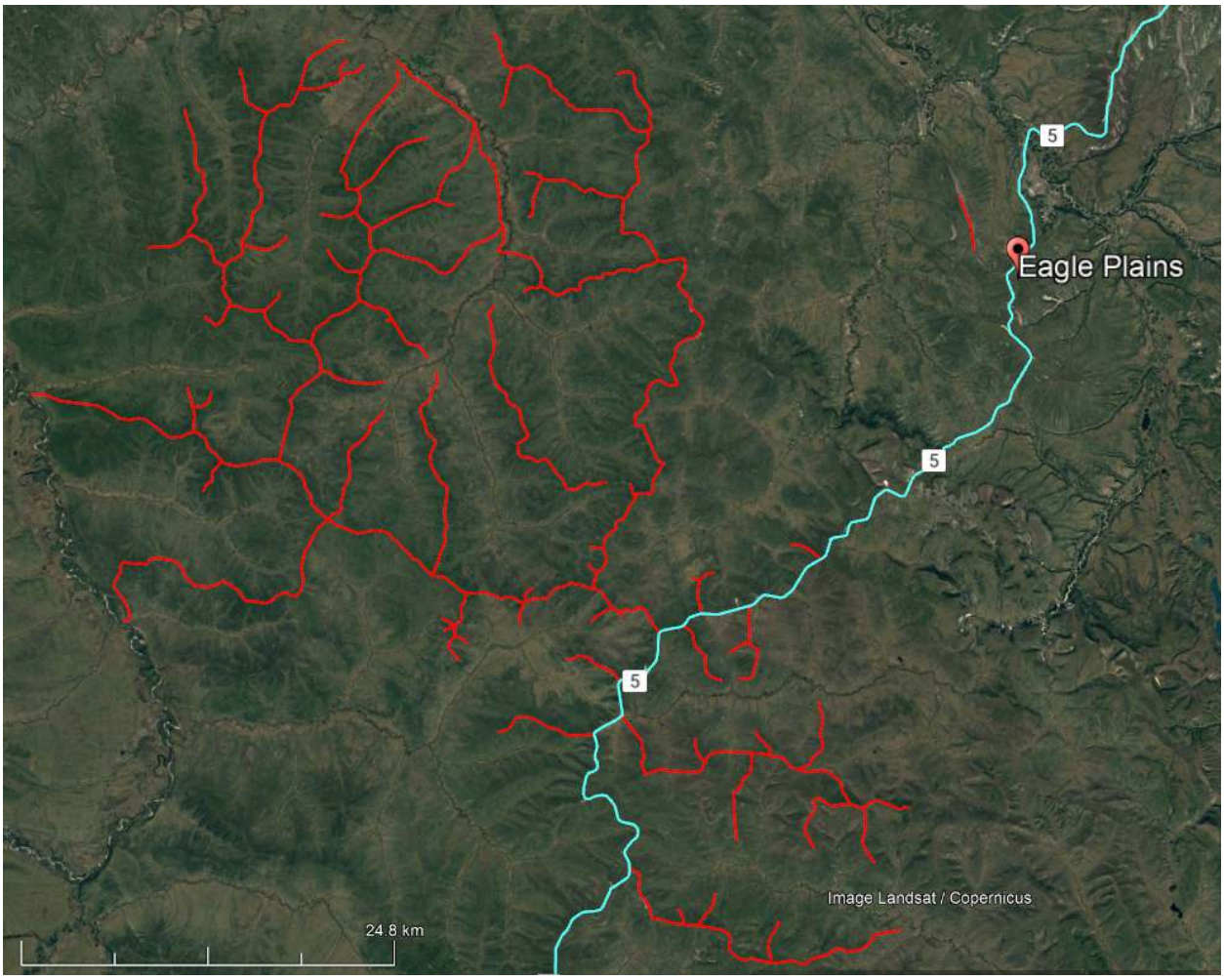
Further details about spatial and temporal boundaries are discussed in **Section 3.1.2.2**.

1.4.7 Access and Transportation

1.4.7.1 Access

Winter roads will be used for the exploration program. No new permanent roads are anticipated within the exploration stage of the Project. **Figure 1-10** shows the maximum potential winter road network to the exploration sites. Each winter road's number, location and length will be determined as the exploration program develops. As the program unfolds, the access road network's size will depend on drilling results (success). If drilling results are discouraging, the road network may be less than shown.

This Project's proposed winter road construction method will be a compaction of the natural snow cover. Water may be needed in some areas to reinforce the packed snow. Some snow may be hauled to low areas or areas that are wind-blown. The natural vegetation cover will be preserved and remain undisturbed as much as possible. Compacted snow roads are appropriate to serve low ground pressure geotechnical field programs or winter roads with low traffic volumes. This method will suit this exploration program, as the expected traffic on this road will include transportation of a drilling rig with anticipated one to two moves (this number could be up to five depending on the time needed to drill and evaluate a given well) per season, and a small number of support vehicles. Winter roads will be restricted from public access for safety reasons.



Note: Roads on this map only include primary winter road access network. Proposed spur roads to well sites are not shown.

Figure 1-10. Conceptual Winter Road Network

1.4.7.1.1 Routing Rationale for the Winter Roads

The routing of a winter road needs to consider the following criteria (discussed in detail below):

- road geometry, such as grades and curves to suit the intended vehicles;
- number and width of water crossings;
- avoidance of unfavorable terrain;
- avoidance of selected areas determined by historical resources, vegetation, and wildlife habitat; and,
- sensitivity of permafrost terrain.

Road geometry: Ideally, for vehicle safety, the maximum gradients on the road should be 6% or less, with only short sections up to 10%. The routing developed for this Project generally falls within this range, although route adjustments will likely be undertaken in the field if these desirable gradients are met.

Number and width of water crossings: Selecting routes that minimize the number and width of water crossings reduces the complexity of the winter road construction and the uncertainty or risk during operation. All crossings are expected to be completely frozen during the operating season.

Avoidance of unfavourable terrain: Chance has undertaken terrain mapping of the area. The route is located on bedrock, weathered bedrock and colluvial sediment where possible.

Sensitivity of permafrost terrain to constructing a winter road: Chance has undertaken permafrost mapping in combination with terrain mapping. The route, where possible, is generally located on ice poor to ice-moderate permafrost. Ice-rich permafrost is sensitive to the activities associated with the construction and use of winter roads and will be avoided to the extent possible. Specific mitigation to preserve permafrost will be undertaken when it must be crossed.

The development of the routing for the potential winter road network has considered these criteria. The potential routes have been selected to minimize the effect on unfavourable terrain and thaw sensitive permafrost terrain while balancing the need to access sites.

1.4.7.1.2 Construction Considerations and Operating Season

The winter road will not be constructed until the ground is sufficiently frozen and has adequate snow cover to limit disturbance to the ground and vegetation.

Winter road construction will commence when the depth of snow cover is sufficient to cover low-lying vegetation after compaction (estimated to be greater than 60 cm before packing), thereby minimizing effects on the ground. This can be supplemented by hauling snow from other areas such as the Chance Camp or by utilizing snow-making equipment. The winter road will be constructed with dozers supplemented with steel frame drags. Other equipment may be required to haul snow as necessary.

The winter road widths will be dependent on the size of vehicles to be used each season. Single-lane winter road for smaller lighter equipment and very low traffic volumes will be as narrow as 5 m. Wider two-lane winter roads, approximately 8 to 10 m in width, will be constructed for larger equipment and greater numbers of vehicles.

Closing a winter road is based on observed snow cover depletion and current and forecasted weather. Once the insulating snow softens and disappears and the daily air temperatures rise above 0 degrees Celsius (°C) for a few days, the winter road will be operated only at night, and eventually closed before the ground thaws. Diligent and ongoing observations of the conditions and forecasts will be undertaken so equipment is moved off site and the winter roads are closed appropriately.

The general operating season for a winter road in this area is estimated to be from the end of January to the end of March but could last longer depending on the opening and the end of winter.

1.4.7.1.3 Mix Bury Cover (MBC) Sump Access Road

Chance also proposes the construction of a 400 m long, 6 m wide winter road to the proposed MBC sump area. This road will be built as early in the operating season as possible (soon after mid-January as snow and weather permitting) and will take approximately two weeks to complete. It will be reopened each winter season that drilling occurs. The proposed route follows an existing access road; no major clearing will be

required. The proposed route includes no watercourse crossings and is 800 m from the nearest surface water body.

1.4.7.1.4 Access Road Maintenance

Maintenance of winter access routes may include low-ground-pressure vehicles, a road grader equipped with a wing snow plough, some water application, and use of matting where required. Grading may be required over certain stretches of the route, and depressions along the roads will be filled with snow to smooth the surface. If required, water will be withdrawn from approved water sources using adequately sized intakes and screened to prevent debris blockage and fish mortality; refer to *Interim Code of Practice: End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater* (Fisheries and Oceans Canada 2020).

1.4.7.2 Transportation

During the exploration program, Chance will attempt to limit traffic on the winter access roads to authorized personnel.

Transportation of workers, materials, and equipment to the Project will be accomplished using light-weight service trucks, service delivery trucks for fuel and water, and airplane. Personnel will be transported to camp from town using light-weight service trucks or buses or by airplane following the construction of a 1.5 km long winter airstrip at km 4 of the Chance winter road. Personnel and gear will be transported from the camp to well sites via the Dempster Highway and Project winter roads using light-weight service vehicles. Fuel and water will be delivered directly from their respective filling stations to each camp and to well sites as needed.

A typical description of road traffic during the prime operating periods (winter) is presented in **Table 1-5.**

Table 1-5: Typical Road Traffic During Operating Windows

	Activity Description	Peak Traffic	Normal Traffic
1	Early Season Mobilization (Winter)	High	Light /High
2	Rig Mobilization (Winter)	High	Light /High
3	Drilling (Winter)	Light/High	Light
4	Access Road Construction (Winter)	Light/High	Light
5	Extended Flow Testing (Winter)	Light/High	Light
6	Seismic Line Preparation (Winter)	High	Light/Medium
7	Seismic Recording (Summer)	High	Light

Notes:
1. High: 20–40 vehicles per 24-hour day
2. Light: less than 20 vehicles per 24-hour day

Chance expects vehicle volumes on the winter access roads during exploration drilling activities to range between medium and light traffic volumes but may be high temporarily during mobilization of equipment such as the drilling rig. Transportation of supplies, water and fuel trucks will be on demand, as needed. At

a minimum, if required, the essential traffic volume to maintain minimum and safe drilling operations is estimated to be as low as 10 vehicles per day using winter roads to support the drilling operation.

The traffic for the seismic program will primarily be travelling on the Chance and Blackie roads and other proposed winter access trails as well as a small section of the Dempster Highway. The traffic for the line preparation activities in the winter months is estimated to be up to 20 vehicles per day. Any use of the Dempster Highway is scheduled to occur during specific times of the day as crews will be transported to and from their work site at day break, and sundown. The number of vehicles that typically travel the Dempster Highway during winter is 40–50 per day. As this is a very low highway usage time the added traffic for the seismic program is not expected to interfere with regular highway users. The winter line preparation traffic will include mobilization/demobilization and crew transport to and from the main Chance Camp. Using a remote camp will reduce vehicular travel on all roads, including the Dempster Highway, as the proposed remote camp locations are 40 km closer to the seismic program area than the Chance Camp. The traffic of the recording crew is expected to be greatly reduced as helicopters will be used to transport personnel and equipment to the program area rather than vehicular traffic.

Weekly traffic on the Dempster Highway to/from town to the camp, or to/from town directly to the well site may include seven to ten water trucks, two to three fuel trucks, and 10 light-weight service vehicles, each way. Project factors influence transport rates, including weather (more fuel consumed during colder weather), drilling rate (faster penetration requires more water deliveries in a shorter time), winter road water requirements, and well site maintenance. The capacity of the fuel and water haulers, as well as the storage capacity on site is also expected to influence transport rates.

Daily, the Project anticipates using approximately 10 light-weight service trucks to transport supplies and personnel to and from camp to site. During the day, between two and five trucks will be used every 12 hours at shift change to transport personnel to and from camp and the well site. Environmental and wildlife monitors will use two or more additional trucks to conduct their activities.

There will also be occasional transport of drill cuttings from the well sites to the MBC sump area.

Traffic volume on winter access roads is relative to the phase of the drilling program, with highest volumes expected when during drill site mob/demob (e.g. demobilizing a drill site, then mobilizing the drill rig and constructing the site infrastructure) and when setting casing. Inventory management can reduce traffic volumes by sending casing loads in advance of casing activities. Mobilization and drill rig set up takes approximately five days and requires transport of up to 30 loads in 12–24 hours.

Air traffic is estimated at two flights in/out per week to transport workers, materials, and equipment to the Project.

Chance’s contractors will transport crews between the camp and the well site using company vehicles. Vehicles will be equipped with radio communication and, particularly during busy times (i.e., setup and demobilization), will be radio-controlled. For safety reasons, personnel accessing the areas (i.e., winter roads) must notify the appropriate staff (i.e., security personnel or managers/supervisors) when they leave the Dempster Highway and arrive at the well sites. Chance staff or contractors hired as environmental monitors and security personnel will monitor access to the winter roads.

Trucking a stabilized crude oil cargo in specially constructed transporting tanks presents the same risk as transporting the diesel fuel required and used in the Yukon. The process of loading and dispatching trucks

at regular intervals will be planned and handled by licenced professionals who will also maintain constant communication and GPS tracking of trucks travelling down the Dempster Highway and on other connecting routes to their destination.

Chance will employ Journey Management practices during Project activities as part of overall safety management procedures. Any unit transporting materials to Chance's Camp at km 325 will be called and tracked periodically by the dispatcher. This will support road safety for the truck driver and other road users and the safety of the cargo. It also provides critical planning information for receiving staff to plan for offloading its cargo and possibly loading backhauls.

Transportation journeys may include truck delivery to terminals in Fort Nelson and Fort St. John, British Columbia (BC), or Grand Prairie, Alberta. The driving times will vary depending on which of these options is used, but the management procedures will remain the same.

Chance and its trucking contractor(s) will include transportation safety in the Health, Safety and Emergency Response Plan (HS/ERP) to manage potential risks and provide a clear chain of communication and action in the event of an accident while in transit on Yukon roads and highways. The plan will address any other Provincial routes. All reputable trucking contractors versed with transporting flammable liquids and petroleum products generally are mandated to follow the *Transportation of Dangerous Goods Act, 1992, SC 1992, c 34* (Government of Canada 1992). Ensuring the truck is safety-checked and the drivers are qualified and adhere to their company's safety policies are the key to preventing an incident or accident. Tracking the drivers to check on transit speed on a real-time basis means the truck's progress is never neglected and the driver is on notice to observe all road traffic rules at all times.

All incidents affecting Chance's trucking contractor will be reported to Chance and form part of Chance's safety statistics. Each incident will be investigated, and the causes for each occurrence will be closely analyzed and discussed with the truck owner. Should any trucking contractor exhibit an undue number of close calls/near misses or a series of incidents with the same causes, they would be removed from the contract without delay and replaced with a more competent and safety-minded contractor.

1.4.8 Workforce and Accommodation

Workforce requirements will vary over the life of the Project and will ultimately be limited by the existing camp capacity. During past drilling and seismic exploration programs undertaken between 2012 and 2014, the camp had no more than 75 to 80 people on site at any time. During drilling, operations occurred 24 hours per day with a 20-day-on and 10-day-off crew rotation cycle, meaning that one-third of the crew was off duty at any point. The seismic exploration occurred on a 12-hour clock and cycled the various services as the program unfolded with limited crew changes, mostly connected with the camp catering activities.

Chance aims to offer training, employment and contracts to its First Nation/Yukon partners as required in accordance with Section 68 of the Yukon *Oil and Gas Act*, RSY 2002, C.162 (Government of Yukon 2002h) (*YOGA)*. During its last drilling/seismic program, Chance successfully hired a workforce from the communities of Old Crow, Fort McPherson, Dawson, Whitehorse, and Inuvik.

The camp (Chance Camp), office, and storage yard were established in October 2011 and are located at km 325 of the Dempster Highway. The existing 75-person camp will house many workers and be a central location for processing and storage.

The camp is accessible year-round unless the highway is closed due to weather or construction. For this Project, Chance plans to use the camp for storing and transporting equipment and supplies needed for service and personnel accommodations. The Chance Camp is the Project's main accommodation facility, and it can house up to 75 people in trailers alongside a kitchen, sanitary and potable water treating facilities. Camp waste management consists of an incinerator for burning non-toxic and food waste and a secure storage area for other forms of waste. Non-incinerated waste will be transported to an appropriate municipal waste facility for disposal.

Due to the remoteness of seismic activities, a remote camp (fly-in) will be established near the proposed East Greaves and West Greaves Winter Roads, roughly 40 km from the Chance Camp, to accommodate approximately 25 personnel. It would be used as an operations camp with full services, including food, fuel, sleeper trailers, bathrooms, water storage, project management, and HSE offices. The fly-in camp is necessary for activities planned in the winter months due to the cold temperatures approaching - 50°C, the nearly 24-hour darkness, and the potential for "white out" snow storms threatening crew member safety.

In addition, a mobile camp will be established at each active well for onsite accommodation for the rig manager, wellsite geologist and safety/first aid personnel. This will be a trailer accommodating sleeping and a small medical/first aid trailer equipped with heat, power, water, and sewer service that may be installed at the well site during well operations to provide essential first aid supplies and refuge for workers. All wastewater and sewage will be collected in tanks approved by the Canadian Standards Association (CSA) and transported off-site for disposal at an approved facility in Fort McPherson or treated at the Chance Camp.

For the 10-year lifespan of the Project, up to three secondary camps will be established in more remote parts of the area to further support safety and staging of operations. Additional personnel may also be accommodated at the Eagle Plains Hotel if needed.

1.4.9 Project Resource Requirements

1.4.9.1 Water Requirements

The Project proposes the use of up to 300 m³ of water per day (or per permitted limits) for making snow to build winter roads, ice roads and temporary well sites, not exceeding 10% of the instantaneous flow from the following extraction points:

- year-round extraction from the Eagle River, Ogilvie River, and Whitestone River; and,
- seasonal extraction from Glacier Creek.

Water use up to 20 m³ daily (for washing, showers, toilets) is anticipated and bottled drinking water will be supplied to the camp. The majority of water withdrawal is expected to occur in the winter. A water reservoir may be constructed at the camp for water storage and use during low water periods; two insulated water tanks are available for water storage with a capacity of 400 and 700 US barrels (liquid).

1.4.9.2 Chemicals

Chemicals required for the Project may include H_2S Scavenger, clay stabilizers, drilling mud (water- based), weak hydrochloric acid (10–20% concentration) for well acid stimulation, methanol, corrosion additives, demulsifiers, and cement. Specific quantities of chemical usage will depend on the number of wells drilled, as determined by seismic data analysis. Chemicals will be used and stored in compliance with territorial and federal requirements.

1.4.9.3 Explosives

Small dynamite charges for up to 1,500 km^2 of 3D seismic and up to 2,000 km of 2D seismic (using 1 kg per source point) will be required for seismic source points. The specific number of source points required is yet to be determined and will depend on the quantity and quality of the data available. A primary explosives magazine will be required at a staging site near the Chance Camp, and a smaller daily magazine will be required near the specific work area.

1.4.9.4 Fuel Supply and Storage

A fuel storage facility will be required to store diesel, gasoline, propane and Jet-A fuel. Chance Camp will require diesel and propane for on-site power generation, heating and cooking. Diesel will be stored on-site in 15,000 L and 50,000 L Enviro Tanks. There will be up to six tanks at the camp and up to two at the drilling rig site (where the drilling rig is drilling a well). The tanks are bulk fuel, double-walled storage tanks with built-in secondary containment. The drilling rig, boilers, and light towers at the drilling rig site will have built-in fuel storage tanks.

Propane will be used to fuel the furnaces, hot water tanks, and the kitchen at the camp and drilling rig sites and stored in 1,500 L propane bullet tanks. It is anticipated there will be up to six tanks at the camp and up to two at the drilling rig camp. Fuel for seismic activities will be contained at the main camp in double-walled tanks and transported to staging sites in a tank trailer for use. The seismic equipment is expected to use a combination of gasoline and diesel depending on the machine. Additional fuel including diesel, propane and gasoline will be required in smaller quantities for the remote camp and secondary camps.

1.4.9.5 Equipment and Machinery

The Project will require equipment and machinery for each Project component including seismic activities, drilling, EFT activities, well maintenance (workovers), construction of access roads, construction and operation of the MBC sump, construction and use of the CPF, construction and use of the airstrip, use of the camps, and reclamation and closure activities.

Trailers will be required for offices, First Aid, rig crew sleeping quarters, water storage and treatment, sewage storage, and the food waste incinerator.

Anticipated resources required for Project activities are also described in **Section 1.4** and the sequence of well development activities based on the success of DST, EFT and primary type of hydrocarbon discovery was presented in **Table 1-4** and includes a list of key Project components for each exploration activity scenario for further clarity. A more refined list of required resources for each Project component will be prepared after further Project development.

The list of required equipment and machinery for the Project components will likely include, but not be limited to:

- artificial lift systems;
- ATV and snowmobiles;
- battery truck;
- blowout preventor accumulator system;
- boilers;
- canvas tents;
- casing;
- Challenger Cats, D6 cats, snow cats and graders;
- dehydrators;
- double-walled storage tanks for drilling mud, cement, crude oil and formation water;
- drags;
- drilling mud tanks, pumps and mud mixing and separation systems;
- drilling pipe (e.g., conductor, casing, production, liner);
- drilling rig
- flare tank and flare stack;
- flatbed trailers;
- flow lines and valves;
- heaters;
- helicopter & fuel tanker;
- LIS tracked seismic air drilling units;
- explosive magazines;
- medivac units;
- metering equipment;
- mulchers and mulching equipment;
- multi-stage and multi-phase separators;
- packer, tubing and gauges;
- picker trucks (1-ton trucks with equipment);
- portable generators;
- power generators;
- rig matting;
- seacans and storage bins for storage and tools;
- seismic recording equipment;
- separator and treating vessels and storage tanks;
- snow-making equipment;
- vapour and gas collection system;
- vehicles/trucks (1/2, 3/4, and 1 ton);
- waste bins;
- wastewater and sewage tanks;
- water trucks; and,
- wellhead valve assembly.

1.4.10 Project Emissions, Discharge of Wastes, and Disturbances

1.4.10.1 Project Emissions

Please refer to **Section 1.9 Air and Greenhouse Gas (GHG) Emissions**.

1.4.10.2 Waste Discharge

Sources of waste at the Project include domestic and sewage waste at the camps, and drilling waste at the well sites. The main waste discharge from the Project is anticipated to be drilling waste produced at the well sites.

Discharge of wastes will be managed following applicable territorial and federal legislation. Where feasible, Project design will incorporate features to enhance efficiency, reduce waste, and minimize general effects on the surrounding environment.

1.4.10.2.1 Seismic

There is no waste discharge associated with the seismic program. Waste is limited to garbage generated on site. Once the program is complete, a crew may be deployed to clean up any remaining material used on the lines for the seismic program. The garbage is returned to a staging point and discarded in an approved bin to be transported to an approved waste facility.

1.4.10.2.2 Camp

At the Chance Camp, waste management consists of an incinerator for burning non-toxic and food waste and a secure storage area for other forms of waste. Incineration will generate discharges to air, which are discussed in **Section 1.9**. All non-incinerated waste will be transported to an appropriate municipal waste facility for disposal.

Bottled water will be provided for human consumption. Wastewater disposal at the Chance Camp consists of a wastewater treatment plant, a holding lagoon, and an exfiltration system.

For other remote and mobile camps, wastewater and sewage will be collected in tanks approved by the CSA and transported off site for disposal at an approved facility in Fort McPherson or Yukon Lagoon at km 4 on the Dempster Highway.

1.4.10.2.3 Well Sites

At each well site during drilling, there will be sewage storage, and a food waste incinerator related to the operation of the related camp accommodation. There is no discharge of wastewater or sewage as they will be collected in tanks.

Waste discharge at well sites during drilling will comprise drilling waste that includes rock chips and cuttings. The drilling fluid returned to the surface is sent through a shale shaker to separate rock cuttings, and the drilling mud is returned to the well to continue drilling. The recovered cuttings are put through a centrifuge, where the drill cuttings are further separated from any residual water before being disposed of in the MBC sump. At the end of drilling, the mud slurry is run through the centrifuge to separate the water for future use in the next well. Recovered mud is disposed of in the MBC sump.

Chance has selected well site dimensions to provide an appropriate perimeter for containing liquid or solid waste from the Project. The well site will be lined to contain potentially released fluids.

The Oil and Gas Branch of the Yukon Government has adopted *Directive 050: Drilling Waste Management* (AER 2023) procedures for the disposal of drilling wastes within the Yukon. Chance will follow the MBC requirements of the Directive for the remote sump locations.

1.4.10.2.3.1 Solid Drill Cuttings

Drill cuttings are a direct byproduct of the drill bit grinding through rock. Cuttings are brought to surface with the drilling mud and separated via shale shakers and centrifuges.

“Stripping” is running the drilling mud through centrifuges as it returns to the surface to separate the water from any solids suspended in the fluid stream. Cuttings are separated during stripping and stored separately on the well site until they can be disposed of. The fluid is then either recycled back into the mud system in the drilling operation or retained for use in future drilling locations.

Close attention to the dryness of the cuttings moving across the shale shakers and collected in the shale bins is required for the following reasons:

- Less total weight in the cuttings equals less cost associated with future handling of the drill cuttings.
- In the winter, handling and moving dry cuttings is easier as they do not freeze and create large blocks of material.
- Recycling more fluid separated from the cuttings reduces the need for additional make-up drilling fluid.

Drill cuttings will be removed from the well sites for disposal at the MBC sump.

1.4.10.2.3.2 Drilling Mud

Chance is proposing to use water-based drilling fluid systems. After drilling a few wells using recycled drilling fluids, the mud system may need to be partially or fully reconstituted (disposal of the current fluid and mixing fresh water and new drilling fluid products). This ensures the drilling fluid is fresh and capable of drilling through the different rock types found in the proposed wells and is performing to meet exploration needs. Chance has successfully re-used drilling fluid systems across multiple wells to reduce the overall need for make-up water and the total fluid volume for disposal.

The following conditions were established for the selection of the drilling mud system:

- low-toxicity mud system confirmed through laboratory analysis;
- meets program requirements (maintain formation stability, hole cleaning and well control); and,
- suitable for disposal at the MBC sump.

Any drill fluid selected must satisfy Section 32 "*Approved Drilling Fluid"* of YOGA's *OGDPR* (Government of Yukon 2004).

1.4.10.2.4 Mix Bury Cover (MBC) Sump

As described and detailed in *Directive 050 Drilling Waste Management* Section 13 (AER 2023), and accepted in the Yukon, MBC is a method of disposing of drilling waste (both drill cuttings and drilling mud) by which the byproducts and spent mud are mixed with a local receiving soil at a specific mix ratio, deposited into a sump area, and then covered with clean subsoil.

A typical MBC sump design consists of three distinct layers:

- A clean subsoil layer 1 to 1.5 m deep on top of the drill cuttings and soil mix acts as an insulator between the subsoil/drill cutting mix and the vegetative layer to support that, after final reclamation, the site is returned to its original state.
- The subsoil/drill cutting mix layer is where the receiving subsoil is mixed at a specified mix ratio with the disposed of material (e.g., drill cuttings, spent drilling mud).
- Clay-rich material exceeding 1 m depth below the drill cuttings and soil mix, or alternative impermeable liner, acts as a hydraulic isolator.

The identified MBC sump location will be investigated for suitability via drill cores to confirm the following conditions are present and at what depth:

- Sump soil has appropriate deposits of clay-rich soils.
- Appropriate clay-rich material of 1 m is beyond the horizontal and vertical dimensions of the sump for hydraulic containment.
- There is an absence of hydraulic defects or ways for fluid to leak out of the sump.
- A composite sample, made up of five subsamples, is required for every 3,000 m³ proposed to be used for MBC.

Before Project-related drilling activities begin, a test sample of the drilling fluid will be analyzed and compared against the receiving soils at the proposed MBC site to estimate the soil/waste mix ratio to determine if the final soil composition complies with *Directive 050 Drilling Waste Management* Section 3 (AER 2023). While the MBC sump is actively being used, Chance will monitor and inspect the site to evaluate sump integrity, the volumes of material involved, and if further work is needed to the sump location. Project drill cuttings will be transported to and disposed of at the MBC sump, while drill fluids will be reused until the end of the Project or the end of the season. Chance plans to construct a new MBC sump (see **Figure 1-4**). The preferred MBC location for this Project is an undisturbed area of approximately 63,910 m², adjacent to the historic Devon sump accessed at km 336 of the Dempster Highway.

Figure 1-11 shows the proposed MBC sump area with conceptual MBC pods. Each conceptual pod is 800 m², representing the estimated area required to dispose of 300 m³ of drill cuttings (approximately one well worth). The additional area between and around the MBC pods is to accommodate spacing between MBC pods for truck access and to stockpile excavated material. Chance will operate one MBC pod at a time to minimize potential permafrost exposure to ambient air temperature.

As per the AER directive, sampling drill waste will undergo the following sampling procedures:

- During drilling, the environmental monitor will be onsite to conduct sampling in compliance with *Directive 050 Drilling Waste Management* (AER 2023) to verify that the drilling waste is compliant and accurate records are being kept, and to respond to spills.
- The environmental monitor will take soil samples at the MBC site before use for MBC and after closure and reclamation.

If drilling byproducts do not meet *Directive 050 Drilling Waste Management* (AER 2023), the disposal materials will be transported to an appropriately permitted facility for disposal. Chance has previously used permitted facilities that can accept specified waste, located in Whitehorse and northeast BC.

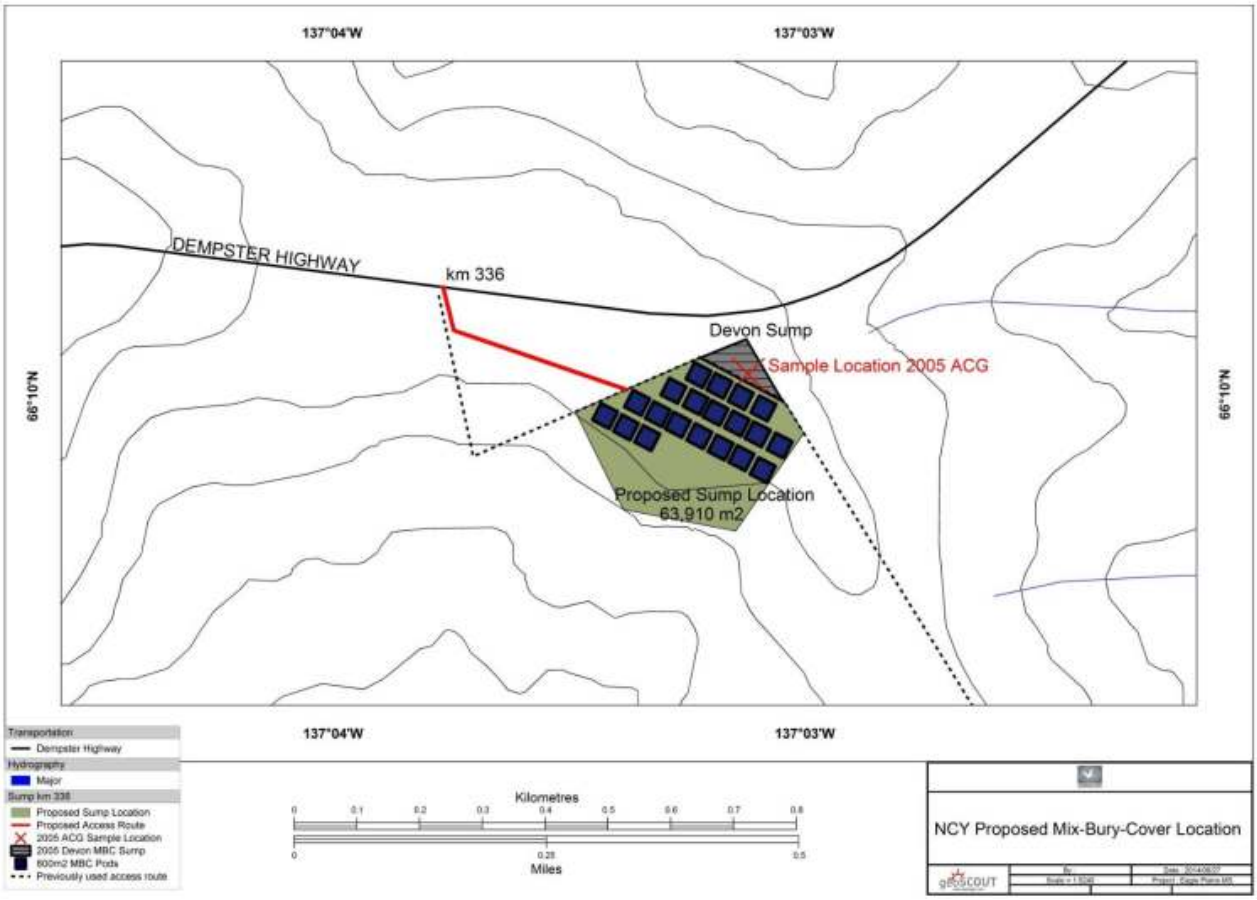


Figure 1-11. General Location and Plan of the Proposed Mix Bury Cover (MBC) Sump

1.4.10.2.5 Injection Well

An active injection well may be used for disposal of waste liquid at depths that are unlikely to affect groundwater and are isolated from surface access by impermeable layers of bedrock, permafrost or other geologic layers. Active injection wells can be converted back to suspended status but cannot be used as production wells without refitting; injection wells do not produce oil or gas products. Existing (historic), suspended wells, or wells drilled as part of the Project will be converted into injection wells for disposal of fluids including produced water, drilling fluids, and rig wash. Produced water refers to water (e.g., formation water) that returns to the surface as a wastewater byproduct when oil and natural gas are extracted. Chance has two wells already screened and are pending permitting for deep zone disposal; they are existing suspended wells A-25 and E-78. It is likely that one or both of these wells will be used for disposal/injection.

Directive 050 Drilling Waste Management (AER 2023) covers the disposal of drilling fluids. Drilling fluid will be stripped back to the clear portion and disposed of in an approved injection well. Disposal of production fluids will meet the environmental standards as well the oilfield waste disposal standards and limits per the relevant Sections in YOGA *OGDPR* (Government of Yukon 2004).

Injection wells require injectivity and suitability investigations before approval and use. This cannot occur until the wells are re-entered and ready for the investigation trials. As such, injection well locations were not confirmed at the time of Project proposal development. Injection well testing and suitability investigations will be in compliance with the applicable legislation including:

- the zone within which injection is proposed must have an impermeable barrier above it to prevent migration of the injected fluid;
- the zone within which injection is proposed must be greater than 750 m below the ground surface;
- within the proposed injection zone, the rock's permeability and porosity must permit fluid pumping at low surface pressure and well below formation breakdown pressure;
- testing must determine injection fluid compatibility between the rock and native reservoir before injection; and,
- testing must determine the porosity and permeability of the formation and reservoir by measuring the pressure and rate of injection.

Once their disposal suitability is confirmed, the following types of liquid materials (treated with bactericide) will be disposed of within injection wells following Project permits/licences:

- produced water per well;
- workover fluids;
- rig wash;
- saline fluids (completion brines); and,
- liquid fraction of drilling fluids.

To support best reservoir management practices, the re-injection of produced water back downhole may sometimes be required.

1.4.10.3 Disturbances

Seismic exploration will occur across an area of up to 1,500 km² (2.75 m wide source lines, 1.75 m wide receiver lines all mulched) for 3D seismic, and up to 2,000 km (2.75 m wide) for 2D seismic. To minimize surface disturbance, the line preparation (access road construction, line cutting, surveying, and drilling) will be conducted during the winter months (potentially starting in October but likely December through April) under frozen ground conditions, and recording would then follow in the summer months (July through September). Existing disturbances including previous cut lines, burn areas, and natural open areas will be used, where possible. The calculated disturbed area from seismic exploration over the life of the Project is estimated to be approximately 6,336 hectares (ha).

Each season, a maximum of 125 km of new winter access roads will be created. This will require clearing woody vegetation above the surface of the snow for the length of the route. The roads will be 8–10 m wide with 16–20 m pullouts every 5 km. Approximately 15% of the roads will be built on previously disturbed ground such as old roads and cutlines. A maximum of 200 km of winter access roads (new winter access + previously cleared winter access) will be active each season. To minimize disturbance, the winter road will not be constructed until the ground is sufficiently frozen and has adequate snow cover to limit ground and vegetation disruption. Existing shrub-stage vegetation will be pushed over or cut as high as possible. Access to winter roads will be restricted during and after exploration, allowing the road to fully melt in spring,

thus reducing the potential for additional disturbance caused by outside users. Over the life of the Project, approximately 563 ha of area will be disturbed for winter access roads.

Each well site is approximately 1.44 ha. Total disturbance due to Project well sites is anticipated to be a maximum of 43.2 ha if all 30 wells are drilled. To minimize disturbance, trees and shrubs are cleared but ground vegetation left intact. Where trees and large shrubs exist, they will be hand cut and piled to form brush piles for later use in the site's reclamation. The sites are levelled using a minimum of 10 cm packed snow or ice, and rig matting provides insulation and protection to the underlying snow and ground surface.

The MBC sump area is planned to be approximately 6.4 ha total. Each MBC "pod" will be 800 m² and contain the drill cuttings from one well; only one pod at a time will be active/excavated. The preferred MBC sump location for this Project is located adjacent to the historic Devon sump accessed at km 336 of the Dempster Highway.

The Chance Camp, including the CPF and all other proposed camp infrastructure, is located within an existing disturbed area, approximately 9 ha in size. No additional surface disturbance is expected in this area, beyond historically disturbed to construct the camp.

The airstrip will create a disturbance consisting of a 1,500 m long runway with associated aviation fuel storage. Approximately 6.8 ha will be disturbed as part of constructing the airstrip.

Surface disturbances will be mitigated using measures and best management practices (BMPs) recommended by the NYLUP and PWLUP. All disturbances will be subject to the Reclamation and Closure Plan measures, including progressive decommissioning and reclamation of areas when no longer required for the Project.

Noise and light disturbances are discussed in the context of potential disturbances to receptors, and as such are discussed in **Sections 4-11** of the Project Proposal as applicable.

1.4.11 Third-Party Project Activities

Third-party activities and contractor/subcontractor support that are anticipated for the Project may include, but not be limited to, the following contractors, subcontractors, supply services and vendors:

- drilling and engineering consultants;
- environmental and regulatory consultants;
- consultation and engagement consultants;
- environmental monitoring support (e.g., wildlife monitors);
- seismic exploration activities and data analysis support;
- construction contractors (e.g., road maintenance, equipment maintenance, vegetation clearing, well pad construction, reclamation and closure activities);
- safety contractors;
- camp contractors (e.g., camp catering, housing services, waste and sewage management);
- laboratory testing and analysis;
- logistics support (e.g., logistics services, equipment delivery, power, communications);
- transportation services (e.g., bus transport, hauling, flight operations); and,
- vendor support (e.g., material suppliers).

1.4.12 Project Alternatives

1.4.12.1 Seismic Alternatives Assessment

An alternatives assessment was conducted to determine the most appropriate methodology for collecting geological information for the Eagle Plains region. Many factors including the quality and quantity of existing data and the feasibility and accessibility of methods used to acquire new data were considered.

The initial phase was to analyze the existing 2D seismic data, well logs, and geological assessments currently available in the Eagle Plains basin. Although valuable, this information has been encouraging yet deemed insufficient to adequately develop a comprehensive exploration drilling program. The analysis of the 3D seismic data, conducted in 2014, offered greater detail and provided a comprehensive image of the geology within its footprint. The methodology used for the 3D design and program execution of the 2014 seismic exploration project revolved around minimizing surface disturbance while maximizing vegetation regeneration capabilities. The same process was used in developing the proposed seismic program for the Project.

The second phase of the alternatives assessment was to analyze the feasibility and accessibility considerations to execute an exploration program in Eagle Plains. The remoteness and terrain are key factors in assessing the feasibility of the different seismic acquisition methods. The difficult terrain eliminates some forms of exploration as the steep slopes and wooded areas adversely affect accessibility to most areas in Eagle Plains. In addition, the short daylight hours in the winter months limit the type of equipment that can be used for winter activities as visibility is limited and safety becomes a growing concern. The Permit Area is deep in Northern Yukon where the availability of equipment and qualified seismic personnel is limited or non-existent. This requires that all mobilization activities are carefully considered to verify that the plan is most appropriate for the Project. All equipment options were considered in developing this exploration plan and the analysis of alternative options are detailed below.

1.4.12.1.1 2D vs 3D Seismic Acquisition

Most exploration within the Eagle Plains Basin is the legacy 2D lines that exist from the 1960s to the early 2000s. The legacy lines within the Eagle Plains region used “cat cut” methods where a wide, straight line was stripped to provide accessibility for the seismic acquisition. 2D only refers to the line having a two-dimensional subsurface view and not the surface methods used to construct the line. The modern Low Impact Seismic (LIS) used today on both 2D and 3D programs has a greatly reduced footprint. It is less perceptible on the ground and from the air compared to the line construction method used on the legacy lines. The effect and regeneration review of the 2014 seismic program was a testament to using these LIS methods in Eagle Plains, as this was the first ever LIS 3D seismic program conducted in the region.

2D seismic acquisition is best for initial analysis of a formation to reduce the time and cost of acquiring the more detailed 3D seismic program. This type of exploration is better suited to image large structures as much of the geology between lines requires interpolation of the continuation of the stratigraphic features. This can help determine the closing of a stratigraphic feature. Both 2D and 3D methods will be used in the Eagle Plains area to image the basin’s complex geography and delineate the edges of the hydrocarbon resource.

1.4.12.1.2 Vibroseis

Vibroseis is an alternative to drilling shot points (i.e., the standard approach for seismic testing) and instead uses a “vibrator truck” to create the energy source. This is done by lowering a large plate onto the ground that vibrates at a specific frequency to produce strata penetrating sound waves. These sound waves are then recorded using geophones placed into the ground in the same fashion as a traditional shot point program.

The draw back to this technology is that the units are very large. Source lines need to be cleared to a much wider width of 6–8 m. In areas where the units would be required to turn around, such as at the intersection of the source line with a creek, there would be additional clearing requirements to provide enough room to maneuver. As Eagle Plains also has many 15–20 degree slopes, these units would require the additional support of a “tow cat” to aid the vibrator in ascending and descending the steep slopes. Another drawback of using the vibrators is that the seismic program must be conducted completely in the winter months. There is no flexibility to prepare the source point locations in winter and conduct the program recording in the summer.

1.4.12.1.3 Heli-Drilling

A heli-drill is a portable unit deployed by a helicopter from hole to hole that could be an alternative to the tracked air hammer drill rig for drilling of seismic shot holes. These units are long lined into position where a drilling crew waits at the surface. These drills require a helicopter pilot skilled in long lining as a helicopter is required to move each drill from hole to hole.

The size of the proposed seismic program would require multiple drilling units and several helicopters due to the volume of source holes. This poses several problems, primarily the availability of units and the safety of field personnel. The number of heli-portable drilling units available is limited as this technology is seldom used for seismic exploration and is time-intensive to deploy and cost-prohibitive.

Heli-portable exploration requires long hours of daylight, making winter work impractical due to the extended periods of darkness in the Northern Yukon. In addition to increased noise, safety is an additional concern with heli-portable use due to the increased number of helicopters in the area, the exposure of pilots to potential collision, and all ground crew to overhead hazards.

1.4.12.1.4 Hand Drilling

Hand drilling uses a short-stemmed auger drill that is typically manned by two crew members and could be an alternative to the tracked air hammer drill rig for drilling seismic shot holes. This type of drill in not mounted on a stabilization unit and is more challenging and dangerous to operate. Although this method is used in areas with access restrictions, it is limited in the number of holes that can be drilled, it poses more safety concerns, and the holes are shallower than any other forms of drilling.

As hand drilling requires the downward pressure of the two person operators, it is impossible to drill in areas with hard soils or permafrost. The operators are also closer to the exposed drill bit, increasing safety concerns. In addition, this technique is limited in the depth of the hole that can be drilled. This reduced depth would not be adequate to load a large enough charge with sufficient energy to obtain optimal records to image the subsurface layers at the targeted depth. When utilizing hand drilling, the shot point is drilled in

a muti-hole pattern with a reduced charge in each hole to compensate for the lack of charge that can be loaded at the shallow depth, resulting in triple the holes being drilled.

1.4.12.1.5 LIS Methodology

After review of the available seismic exploration methods and the effects assessment of the past seismic activity in the Eagle Plains area, it was deemed that the LIS methodology used to conduct the 2014 2D and 3D seismic programs is the preferred method for the Project. This method maximizes the quality of data collected while minimizing the effect on the environment by reducing the footprint and reducing the potential for safety incidents. Although this method is currently the best available option, new technologies will be reviewed as they become available and assessed for technological adequacy, environmental effects and safety of use.

1.4.12.2 Drilling and Extended Flow Testing Alternatives Assessment

Alternative technologies and methods for oil and gas exploration drilling and potential subsequent EFT for oil and gas extraction are not currently available. EFT will only be conducted on wells where petroleum products were encountered to gather information about the nature of the petroleum resource accumulation and its productive capability. Project activities follow current industry best practices and Government of Yukon standards. Conducting the drilling programs in the winter is expected to minimize terrain, terrestrial and aquatic environmental effects. Where appropriate, opportunities to eliminate or reduce flaring from any residual solution gas not consumed for process heating or engine power will be evaluated following the Yukon *Guidelines: Flaring, Venting Reduction, and Fugitive Emissions* (Government of Yukon 2019). Technologies and practices related to oil and gas flaring are evolving and will be reviewed by Chance as they become available.

1.4.12.3 Project Location Alternatives Assessment

Alternative locations for the proposed Project were considered. However, the proposed Project has been sited within the Eagle Plains sedimentary basin which contains proven natural gas and oil reserves (Government of Yukon 2019), including 4.6 billion cubic metres (m^3) of gas and 3.2 million m^3 of oil (Hannigan 2014). The Project area has had intermittent periods of oil and gas exploration since the 1950s. That activity has established winter roads, exploratory well sites, worker camp, and other infrastructure in the area that can be used during Project activities and produced available historical oil and gas data for evaluation to improve the success of a viable hydrocarbon discovery as a result of this Project.

The Project is located within the North Yukon Planning Region and Peel Watershed Planning Region and is therefore subject to the approved *North Yukon Regional Land Use Plan* (NYRLUP) (Vuntut Gwitchin Government and Yukon Government 2009) and the *Peel Watershed Regional Land Use Plan* (PWRLUP) (Peel Watershed Planning Commission 2019). Within both plans, the Project is within a designated Zone IV integrated management area which allows for the highest development level to occur, in comparison to Zone I through Zone III integrated management areas which are classified as having higher sensitivity to landscape disturbance, ecological and cultural values, risk of significant adverse effects, and level of acceptable change.

1.4.13 Proposed Project Benefits

Benefits for any oil and gas activity in the Yukon is a requirement under Section 68 of the *YOGA*. The *YOGA* generally prescribes opportunities to be offered for employment, training and contracting for services and goods for Yukon First Nations, its citizens, residents of communities affected by the oil and gas activity, and other Yukon residents. Potential Project benefits related to employment, economy, and community infrastructure and services have been identified in **Section 11 Socio-Economics** and summarized in a more generalized manner below for this section.

1.4.13.1 Energy Security

The Yukon has unique energy challenges including long distances from production centres, high demand for heat during cold winters, and an isolated electricity grid (Government of Yukon 2020). The Project proposes to explore a local/regional oil and gas source for the Yukon, ultimately providing longer term benefits by lowering the carbon footprint on fuel consumption and greenhouse gas emissions should the Project be successful.

1.4.13.2 Employment and Economy

There are potential beneficial effects on local/regional employment and contracting opportunities from Project demands on local/regional labour resources and third-party services. Given the exploratory nature of the Project, such opportunities are expected to be relatively small scale over the 10-year lifespan of the Project and be primarily related to winter Project activities. It is anticipated there may be employment opportunities hired from the northern Yukon region and Northwest Territories related to camp operations, logistics, winter road and well site construction and maintenance, wildlife and environmental monitoring, some services and labour opportunities for the drilling and testing activities, and some services and labour opportunities for seismic exploration.

The oilfield services required to undertake seismic, drilling, and extended flow testing activities are generally specialized and of limited availability in the Yukon. These services are generally imported from supply centres in Alberta and BC. Some limited employment opportunities for First Nation/Yukon partners may be available with these service providers.

Employment with supporting services such as camp catering, transport for crew changes, water (e.g., for camp use, drilling, snow making, road and well site construction) and waste hauling (e.g., produced water disposal, sewage transport from the remote camp back to the main camp), freight hauling, and rig transport may be available for First Nation/NWT/Yukon partners.

This Project may offer economic diversification and economic activity during a typically quiet period (winter months). The Project is small in scale and may foster conditions that allow local businesses to participate and develop expertise in new areas.

The capital spending of the Project may cause an indirect economic benefit in terms of income taxes paid by Yukon citizens and businesses participating in the Project. Depending on the activity, annual capital spending in Canadian dollars (CDN$) is estimated to range between CDN$15 and CDN$35 million per year for this Project.

1.4.13.3 Training Programs

There is potential for some beneficial effects for education services available within communities to offer specific training to First Nation/NWT/Yukon partners to support local residents meeting the requirements. The proposed Project is situated in a northern, remote area and personnel exposure to typical safety hazards associated with oil and gas industry operations are possible (e.g., high pressures, heavy machinery, hot fluids, flammable fluids, chemicals, explosive materials, extreme weather); therefore, training programs are planned to provide appropriate personnel with safety knowledge and a safe working environment. Examples of training will include Bear Aware, First Aid, H_2S Aware and H_2S Alive, Workplace Hazardous Materials Information System (WHMIS), Transportation of Dangerous Goods (TDG), Common Safety Orientation, Fall Protection, and other relevant workplace safety training as applicable. Training may be available for wildlife and environmental monitor positions.

1.4.13.4 Future Project Benefits

Should the exploration Project be successful, the benefits may expand to accommodate investment interest in infrastructure associated with a potential future development, if approved. The economic benefits of a potential longer-term oil and gas development (e.g., taxes and royalties, energy supply, employment and training) will be greater than can be offered during this early-stage exploration Project.

Chance is committed to ongoing consultation and discussions around potential Project benefits and associated Benefits Agreements, following Section 68 of the *YOGA*, including training, employment, and contracting opportunities with potentially affected First Nations.

1.5 RECLAMATION AND CLOSURE

Progressive reclamation and closure activities are planned to be ongoing during the exploration program. This includes the reclamation of winter roads, abandoned well pads, seismic lines, and clearings due to accessory activities. As this Project primarily involves winter activities (except for seismic recording), reclamation will mostly rely on low impact seismic, stem bending, and natural regeneration, intended to minimize ground surface disturbance. A Conceptual Reclamation and Closure Plan will detail reclamation, abandonment, and closure activities. A summary of reclamation and closure activities are outlined in **Table 1-6** with some of the key activities described in the following subsections.

Table 1-6. Summary of Key Reclamation and Closure Activities

Project Activity	Activity Description
Engagement	ongoing engagement with First Nations.
	ongoing engagement with community residents.
Seismic Lines	LIS, narrow construction, stem bending, natural regeneration
Well Suspension	Wells that have successfully undergone EFT will be suspended pending future development approval.
Well Abandonment	Unsuccessful wells and wells not used for disposal will be abandoned when testing or production phases are complete.
	Testing facilities are to be removed from each site.

Project Activity	Activity Description
Mix Bury Cover (MBC) Sump Site Reclamation	The site will be reclaimed as per *Directive 050 Drilling Waste Management* (AER 2023)
Central Processing Facility (CPF)	Upon completion of field decommissioning activities, the CPF will be removed.
Well Site Reclamation	Well site equipment will be removed.
	Area will be allowed to revegetate naturally.
Accessory Activities	Discussions with regulators (as necessary) before reclamation work to determine whether there should be changes to the plan
	Annual monitoring until vegetation regrowth is deemed satisfactory
	Conduct a Phase 1 Environmental Site Assessment (ESA) for each location.
	Obtain Regulatory Closure approval.

1.5.1 Seismic Lines

In addition to the low impact seismic method, with reduced line width and meandering paths, the remediation plan will include access deterrence. Although nominal, standing timber will be gently pushed across seismic lines to create a Leaning Tree Stand (LTS) using a “Stem Bending” method to decrease these sight lines. Although not expected to be required to a great extent in the Eagle Plains area, this technique is highly effective in reducing access and enabling sufficient cover for vegetation regeneration.

1.5.2 Mix Bury Cover (MBC) Sump Site Reclamation

The standard *Directive 050 Drilling Waste Management* (AER 2023) of action prescribes the following closure and reclamation actions for MBC sumps:

- Upon completion of the Project, remote disposal locations will be covered with a minimum of 1.0 m of capping material and contoured to meet background topography.
- A Phase 1 ESA will be completed for each well and corresponding remote MBC location to identify any potential areas of environmental concern.
- If the Phase 1 ESA triggers a Phase 2 ESA, soil samples will be collected and analyzed at an accredited laboratory.
- If contamination is identified, a Remediation Action Plan will be prepared and upon approval, the remedial program will be completed. Once all contamination is addressed in the Phase 1 ESA, Phase 2 ESA, or Remediation, a surface program will be conducted, including soil and vegetation.
- Once vegetation is established, a Detailed Site Assessment will be completed comparing soil lithology and vegetation on site to off site.

The stockpiled vegetative layer and soil will be re-applied to the MBC sump area on top of the capping materials and after completed contouring. Environmental monitors will follow the testing requirements following *Directive 050 Drilling Waste Management* (AER 2023).

1.5.3 Well Abandonment

As mentioned, the 30 proposed wells are part of an exploration program to help determine the region's oil and natural gas resource potential. Depending on the outcome of the results, some wells may be proposed for future production as part of a separate project, to be evaluated and assessed at that time based on relevant regulatory pathways. All other, unproductive wells will be decommissioned and abandoned. As the Operator, Chance is responsible for all wells deemed its property. This responsibility can never be delegated to any other party unless and until such time Chance relinquishes ownership according to *YOGA* and its regulations (Government of Yukon 2002, 2004).

Wells maintained for potential, future production or other operational uses will be suspended for future conversion to those uses. The *OGPDR* under *YOGA* (Government of Yukon 2004) have specific actions required from an operator to maintain a well in a suspended state; key among these actions is to periodically conduct inspections to verify that the integrity of the well is intact. While a well is in suspended status, the regulator requires a sum of money to be placed on deposit to cover the cost of abandonment and remediation of the site. Once abandoned, the status becomes permanent, and re-entering such a well would not be possible.

The normal stages before decommissioning/abandonment of a well are:

- The well is determined to be unusable.
- Perforations are cemented by placing a cement plug below and above them and squeezing cement into the formations to isolate them within the well bore permanently. A mechanical shut-off device called a bridge plug may also be wireline set above the cement plug to add protection or isolation.
- A second cement plug would be set higher in the production casing and below the estimated permafrost maximum depth. This plug is normally set on top of a bridge plug so that it does not leak down in the casing. The plug is also “felt” with a drill bit to confirm its existence and hardness.
- The casing at the surface is cut 1 m below the original ground and buried under the soil to remediate the location entirely. The soil will be left to achieve a frozen state naturally, and permafrost is expected to establish within it at the same depth as the surrounding area.
- The lease is remediated by removing all equipment and infrastructure to restore its original condition. The surface location will be left to revegetate naturally.

When appropriate, a decommissioning/abandonment plan for the well sites will be developed to comply with Part 7 of the *OGDPR* (Sections 95, 96, 97, 99) (Government of Yukon 2004). Wells would require final well abandonment according to the *YOGA OGPDR* (Government of Yukon 2004).

If the entire Project had to be suspended but not completed, the infrastructure would be preserved and maintained until the Project resumes. If it is decided to terminate the Project, the infrastructure will be decommissioned.

1.5.4 Winter Roads and Winter Well Sites

Reclamation activities will promote natural revegetation as quickly as possible throughout the life of the Project. Well site and winter road reclamation activities will be designed to meet the following objectives:

- Leave the site uncontaminated following the completion of Project activities.
- Remove all garbage, petroleum products, and equipment.
- Prevent long-term erosion or slumping and promote successful natural revegetation of disturbed areas.

Given the winter road construction methods that will be employed (i.e., packing snow to a minimum thickness of 10 cm), no additional reclamation is anticipated to be required for the winter roads. Proposed Project activities will take place during winter, and the winter access roads and well site pads will be constructed using snow and ice to minimize damage to the vegetative layer or compaction/scarification of the organic soil layer. The proposed measures to promote successful natural revegetation are:

- Complete removal of equipment, matting, materials and debris from well sites.
- Leaving the well sites and winter roads in such a condition that water ponding, slumping or soil erosion are unlikely outcomes – if (unplanned) soil disturbance takes place, the surface would be contoured to minimize erosion (depending on the area disturbed), roughened, and covered in a layer of mulch or cut vegetation.
- No stockpiles of snow or ice will be left at the well sites or along the winter roads, to minimize melt-related effects on vegetation.
- During winter road construction, trees and shrubs will be cleared but ground vegetation will be left intact and protected via minimum 10 cm packed snow or rig mats. Large trees and shrubs may be hand cut and piled adjacent to the road for later use during road reclamation when they will be used to form brush piles on the road would be expected to inhibit human travel and provide ongoing soil/non-woody vegetation protection post-melt.

Access to winter roads will be restricted during and after the Project. Restricting access will support spring melt, and reduce the potential for additional disturbance from outside users and reducing risk to Chance employees and the public.

1.6 REGULATORY CONTEXT

Permits, approvals, conditions, authorizations and licences that could be required for the Project include the following Decision Bodies, relevant Acts and associated regulations:

- Yukon Government:
  - *Boiler and Pressure Vessel Act, RSY 2002, c 16* (Government of Yukon 2002a);
  - *Dangerous Goods Transportation Act, RSY 2002, c 50* (Government of Yukon 2002b);
  - *Environment Act, RSY 2002, c 76* (Government of Yukon 2002c);
  - *Forest Protection Act, RSY 2002, c 94* (Government of Yukon 2002d);
  - *Forest Resources Act, SY 2008, c 15* (Government of Yukon 2008);
  - *Highways Act, RSY 2002, c 108* (Government of Yukon 2002e);

- *Historic Resources Act, RSY 2002, c 109* (Government of Yukon 2002f);
- *Lands Act, RSY 2002, c 132* (Government of Yukon 2002g);
- *Public Health and Safety Act, RSY 2002, c 176* (Government of Yukon 2002i);
- *Territorial Lands (Yukon) Act, SY 2003, c 17* (Government of Yukon 2003a);
- *Waters Act, SY 2003, c 19* (Government of Yukon 2003b);
- *Wildlife Act, RSY 2002, c 229* (Government of Yukon 2002j); and,
- *YOGA.*

- First Nations Decision Bodies;
- Federal agencies and Acts:
  - Natural Resources Canada;
  - *Canadian Environmental Protection Act, 1999, SC 1999, c 33* (Government of Canada 1999);
  - *Explosives Act, RSC 1985, c E-17* (*Government of Canada 1985);*
  - *Migratory Birds Convention Act, 1994, SC 1994, c 22* (Government of Canada 1994)
  - *Species at Risk Act, SC 2002, c 29* (Government of Canada 2002); and,
  - *Transportation of Dangerous Goods Act, 1992, SC 1992, c 34* (Government of Canada 1992).

A complete list of required permits, approvals, authorizations and licences will be verified as needed as the Project progresses through the approval process with the relevant Decision Bodies, as identified by YESAB. Permits and licences will be obtained from the appropriate regulators (e.g. territorial government, federal government, First Nations governments) specific to the Project activities and location before work starts.

1.6.1 Requirement for an Executive Committee Screening

In July 2014, Northern Cross (Yukon) Limited submitted a Project Proposal (YOR project # 2014-0112) to the Dawson Designated Office (DO) for an exploratory drilling program in the Eagle Plains region, consisting of up to 20 oil and gas wells, and supporting activities such as winter and all-season roads, disposal locations for drill cuttings and camp facilities for project personnel (Northern Cross (Yukon) Ltd. 2014). The proposal's adequacy review was completed on October 30, 2014, and the evaluation was completed in December 2015.

In February 2016, the Dawson DO referred the Project to the Yukon Environmental and Socio-Economic Assessment Board (YESAB) Executive Committee for screening under s. 56(1)(d) of the *Yukon Environmental and Socio-economic Assessment Act, S.C. 2003, c. 7* Government of Yukon. 2003c. (*YESAA*) The Project was referred for an Executive Committee screening as the DO was unable to determine the likelihood of significant adverse effects on the Porcupine Caribou Herd; the DO was unable to determine the probability or magnitude of changes to caribou migration and seasonal distribution in relation to project activities and the associated duration, reversibility, and extent of such effects. The report stated: "… *after taking into account any mitigative measures included in the project proposal, it cannot determine whether the project will have, or is likely to have, significant adverse environmental or socio-economic effects*". A copy of YESAB's Designated Office Evaluation Report is attached in **Appendix 1-A Designated Office Evaluation Report, YESAB, February 9, 2016.**

With ownership changes and a name change to Chance Oil and Gas Ltd., Chance reviewed its business plans and decided to proceed with a more ambitious exploration program over a larger area within the

Exploration Permits previously awarded to the company by the Yukon Government. Rather than undertake the project that YESAB Designated Office in Dawson referred to the Executive Committee in early 2016, the company proposed to launch an expanded exploratory drilling program as proposed in this submission.

Engagement with affected First Nations with their government officials and with the communities at large in respect to the expanded exploration project started in 2017 and continues to the present, but progress was adversely affected by restrictions imposed to address the COVID-19 pandemic from 2020 to 2022. Discussions also commenced with representatives of the Yukon Government in 2017 and have continued since then, subject to restrictions imposed by the COVID-19 outbreak.

Chance and their consultants have undertaken additional baseline data collection and analysis to support predictions of potential Project effects on the Eagle Plains environment, wildlife, and to better understand the potential socio-cultural interactions with the Project. In addition, Chance Oil and Gas Ltd. has developed and implemented a consultation and engagement plan with First Nations and residents of communities to meet the requirements of *YESAA* s.50(3). Environmental baseline data-gathering studies were undertaken in 2019, 2020, 2021, 2022, and 2023 to support the larger exploration project. Two Heritage Resource field studies were also done in the summers of 2022 and 2023.

Due to the Project changes and the implementation of YESAB's Pre-Submission Engagement process for Executive Committee screenings, a comparison of the original Project activities and the Project activities in their current iteration was prepared at the request of the Executive Committee. This comparison was intended to assist the members of the Executive Committee in determining whether the Project in its current form was sufficiently similar to Project YOR# 2014-0012 for them to be considered the same Project, or whether the Project as it is now should be considered a new project.

In July 2022, Chance submitted the comparison table of proposed Project information based on 2022 and 2014 details to the YESAB Executive Committee to verify the appropriate regulatory process (Aasman 2022). Upon review of that memorandum, YESAB (2022) stated, "*The Executive Committee has determined that while your 2022 project contains material changes, these changes are not fundamentally different than your 2014 project*." The 2022 project was defined as a referred project per s.4 of the Screening Rules. Further, Chance was directed to submit a revised proposal for evaluation to the Executive Committee under s.56(4) of the *Yukon Environmental and Socio-economic Assessment Act.* The letter went on to further describe the adequacy review process.

To continue the process and obtain clarity between Chance and YESAB, on August 23, 2023, Chance met with the YESAB Executive Committee, whereby the project and regulatory pathway were discussed and clarified. On September 5, 2023, YESAB followed up with a letter to Chance (YESAB 2023) defining the process for a referred project. The letter stated, "*As this is a referred project, the typical Pre-Submission Engagement process does not occur, and therefore no Project Description is expected, and no Project Proposal Report will be issued prior to Project Proposal submission*."

The letter also stated that a comprehensive revised Project Proposal was to be submitted to the Executive Committee, detailing the Project as proposed, the current conditions, associated data and Traditional Knowledge, and detailed effects assessments. In addition, the submission is to include a complete consultation and engagement record.

Therefore, the Project herein is subject to an Executive Screening by the Executive Screening Committee under the *Act* as a Referred Project.

1.7 CONSIDERATION OF REGIONAL LAND USE PLANS

The North Yukon (NYRLUP) and Peel Watershed (PWRLUP) Regional Land Use Plan boundaries (Vuntut Gwitchin Government and Yukon Government 2009, Peel Watershed Planning Commission 2019) encompass the Project RSA. The Project occurs in the area identified by both plans for higher levels of development, in part because of the expected oil and gas potential. Project mitigations address the RLUPs General Management Directions, and the Project is designed while considering the Recommended Best Management Practices. This section describes the key features of those plans relevant to the Project's environmental assessment.

Yukon RLUPs are developed to address Section 11 of the Umbrella Final Agreement (UFA, Council for Yukon Indians et al. 1993). The RLUPs are intended to help ensure that "…*social, cultural, economic and environmental policies are applied to the management, protection and use of land, water and resources in an integrated and coordinated manner so as to ensure Sustainable Development*" (Section 11.1.1.6 of UFA). Based on those intentions, the plans identify how and where land uses may or may not occur. Land Use Plans are developed and approved by the Yukon Government and affected First Nations as the areas apply to their land base (e.g., Traditional Territories).

The Project's RSA is encompassed within the approved North Yukon RLUP (NYRLUP; Vuntut Gwitchin Government and Yukon Government 2009) and approved Peel Watershed RLUP (PWRLUP; Peel Watershed Planning Commission 2019) (**Map 1-4, Table 1-7**). Most of the RSA is encompassed within the NYRLUP's Land Management Unit (LMU) #9. The southwest corner falls within the PWRLUP's LMU #7 (Dalglish Creek). Both LMUs recognized the high oil and gas development potential and are considered Integrated Management Area Zone IV — Highest Level of Development (Summarized in Table 3.1 in each plan).

The NYRLUP (Vuntut Gwitchin Government and Yukon Government 2009) divides the Planning Region into 23 land management units classified into three categories: protected area, integrated management area (IMA), and community area. IMAs are further classified into four zones: Zone 1 (lowest development), Zone II (low development), Zone III (moderate development), and Zone IV (highest development). IMA zones are classified based on the area's sensitivity to landscape disturbance, ecological and cultural values, risk of significant impacts, and level of acceptable change. The RSA is in a Zone IV IMA, with lower ecological and cultural values in a moderately sensitive biophysical setting. Subsequently, Zone IV IMAs allow for the highest development level to occur. Forty-nine (49) percent of the NYRLUP is categorized as some form of protection (**Table 1-7**).

Relevant to the Project, the NYRLUP acknowledges (pg. 5–29) that

> *"Standard oil and gas industry practices have a much smaller footprint and impact on ecological values than practices used in the 1960's [sic]. Current operating practices significantly reduce the potential for major long-term impacts. Given the current low levels of activity, existing site-specific best management practices, used in combination with the direction provided by this Plan, are considered adequate to mitigate potential impacts of oil and gas activity."*

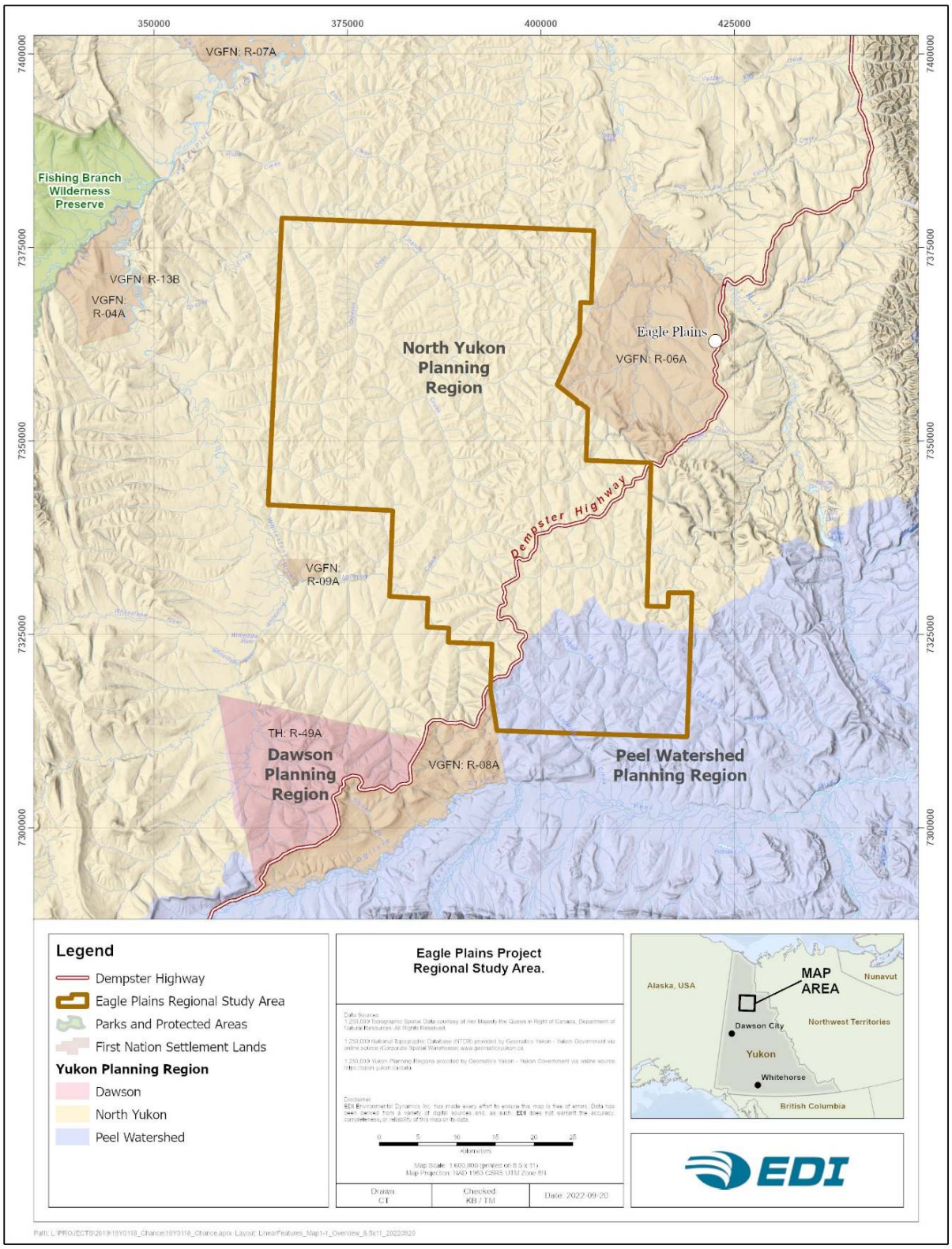
The southeastern corner of the RSA lies within the PWPRLUP (Peel Watershed Planning Commission 2019). Following a framework like the NYRLUP, the PWPR is divided into 16 LMUs, each with similar

ecological characteristics, planning issues, and management intent. Each LMU is categorized by a land-use designation system. Like the area designation in the NYRLUP, the RSA portion in the PWRLUP is in IMA Zone IV, LMU 7 (Dalglish Creek), allowing for the highest level of development. Eighty-three (83) percent of the PWPRLUP is categorized as some form of protection (**Table 1-7**).

Protected/Conservation areas[1] account for 61% of the combined planning areas (49% in the NYRLUP, 83% in the PWRLUP). The Project does not occur in any of those protected areas. The LMUs encompassing the RSA are 8,014 km² (6% of the combined NYRLUP and PWRLUP). The 2,386 km² RSA represents 2% of the combined area of the NYRLUP and PWRLUP (**Table 1-7**).

The NYRLUP identified some industry-specific disturbance issues, while the PRWLUP identified concerns as LMU Objectives. Those issues and how they cross-reference to how and where they are addressed in this Project Proposal are summarized in **Table 1-8**.

[1] Protected areas: removes an area from oil and gas and mineral disposition, and prohibits exploration activities (Peel Watershed Planning Commission 2019)



Map 1-4: Eagle Plains Project Regional Study Area

Table 1-7: Key Facts of the Regional Land Use Plans Relevant to the Eagle Plains Exploration Project

Spatial Features	NYRLUP		PWRLUP		Combined	
	LUP Area (km^2)	% of LUP Area	LUP Area (km^2)	% of LUP Area	LUP Area (km^2)	% of LUPs Area
The total area encompassed by the Planning Region	55,548	na	67,431	na	122,979	na
Conservation/Protected Area, Habitat Protection Area, and Land Withdrawal	27,145	49	55,858	83	75,497	61
LMU #9 (NYRLUP) and LMU #7 (PWRLUP)	6,415	11	1,599	2	8,014	6

Table 1-8: Environmental Issues Identified in the Land Use Plans with a Cross-Reference to How They Are Addressed in the Project Proposal

Identified Environmental Issue	How addressed in this Project Proposal	Relevant Section(s)
NYLUP (Vuntut Gwitchin Government and Yukon Government 2009, pg. 5–29)		
Oil and gas exploration and development activities and associated land uses (transportation, gravel extraction, and water withdrawal) can cause cumulative and adverse changes over large landscapes.	Acknowledged, and these issues are focus areas in the Project Proposal.	• Water withdrawal is addressed in **Section 5.** • Gravel extraction is not a part of the Project. • The Project Proposal addresses cumulative effects following methods outlined in **Section 3**.
Impacts could affect valued ecological resources, including Porcupine Caribou Herd (PCH), moose, marten, wetlands, lakes and rivers.	The potential Project-related effects on the PCH, moose, and marten are addressed explicitly in this Project Proposal. Wetlands, lakes and rivers are addressed as ecological landscape units of importance.	• PCH: Section 9 • Moose: Section 8 • Marten: Section 8 • Wetlands, Lakes and Rivers: **Section 7**
The construction and ongoing operations of large-scale oil and gas infrastructure would bring many new workers to the region.	The Project Proposal is for an oil and gas exploration project. It does not result in ongoing operations. There is no substantial infrastructure. Workers are temporarily housed in a remote camp. Largest work force no larger than 80 people	NA
Coordinated and effective management of the PCH habitat and population requires an integrated management approach in advance of increasing industrial land use.	Porcupine Caribou Herd management is integrated among the management authorities (territorial, state, federal, First Nation) and the Porcupine Caribou Management Board.	The Porcupine Caribou Herd management overview is provided in **Section 9**.
Land use conflicts might arise between: a) oil and gas and wilderness/cultural tourism;	Land use conflicts are possible, although no known or future tourism operators exist in the exploration area.	• Potential for land use conflicts are addressed in the **Section 11.** • The exploration project's potential effects on PCH use of

Identified Environmental Issue	How addressed in this Project Proposal	Relevant Section(s)
b) oil and gas and traditional economic activities and cultural pursuits; and, c) oil and gas and PCH use of winter range.		winter range are addressed in **Section 9**.
PWRLUP LMU #7 Objectives (Peel Watershed Planning Commission 2019, pg. 95)		
1. Ecological integrity is maintained.	The broad term "ecological integrity" is addressed by considering associated Valued Environmental and Socio-economic Components (VESECs) included within the water, fish, vegetation, and wildlife-focused assessments.	• Water: Section 8 • Fish: Section 6 • Vegetation: **Section 7** • Wildlife: **Section 8**
2. Some culturally and ecologically-aware resource exploration and extraction that supports the local economies.	This Project Proposal is intended to reflect that Chance's awareness of the area's ecology, values of interest, and protection plans that will be in place to support an exploration project in IMA IV-designated lands for the highest development level.	Project Proposal submission, effects assessment, and proposed protection plans.
3. All permitted land use activity does not significantly impact movement and habitats of caribou.	The Project's potential effect on caribou movement and habitat are addressed using all available information and best environmental assessment practices.	PCH: **Section 9**
4. Industrial activity does not result in any alteration to the Peel River's viewscape.	The Project is not visible to Peel River users and does not alter the Peel River's viewscape.	NA

1.7.1 Cumulative Effects Indicator Levels

The RLUPs encourage results-based management and use cumulative effects indicators to determine if goals and objectives are met. Direct surface disturbance and linear density are the two cumulative effects indicators included in the Plans. The Zone IV IMA guidelines (i.e., cumulative effects indicator levels) are 0.75–1.0% surface disturbance (of IMA – Zone IV) and 0.75–1.0 km/km² linear density (Table 3.2 in both RLUPs).

Activities considered exempt from functional disturbance restrictions are (1) new linear features less than 1.5 m wide; (2) land-use activities that occur on frozen water bodies; (3) winter work with no required clearing of trees; and (4) winter work that uses existing disturbances and linear features.

Although both plans suggest the indicator values noted above,

> *"The recommended indicator levels serve as a benchmark, and provide the Parties responsible for plan implementation an opportunity to review and consider the potential outcomes of resource management decisions. They will also assist in the YESAB process by providing an indication of potential cumulative effects within a LMU"* (NYRLUP, pg.3–6).

As surface disturbances and linear features reach a level of functional recovery and become part of the continuous landscape, they can be subtracted from the total amount of disturbed area (Vuntut Gwitchin Government and Yukon Government 2009). The RLUPs suggest using a height of 1.5 m for woody vegetation in forested areas, as vegetation above that height would likely inhibit travel or access by humans or wildlife and is, therefore, considered functionally recovered. In areas dominated by low-growing vegetation, a feature could be considered functionally recovered when covered by native species roughly the same height and composition as the surrounding vegetation. To be considered "functionally recovered", features must have similar sediment and run-off compared to background levels, roughly match original contours, and have no human-brought materials on the site.

1.7.1.1 Linear Features Study: Characteristics and Quantification

Intermittent exploration activities in the Eagle Plains area from the 1950s to 2014 have created a network of winter roads, 2D seismic lines and, most recently, 3D seismic lines within the RSA. Recognizing previous and planned activities and the concerns around the indicators presented in the RLUPs, Chance commissioned a study to determine the extent and characteristics of linear features in the Project footprint (**Appendix 1-B Linear Feature Study**). The study addressed three objectives: (1) comprehensive mapping and classification of existing linear feature footprints within the RSA; (2) quantification of structural aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and (3) quantification of regeneration pathways and structural stages of linear features. Key findings from that study relevant to this assessment and consideration as cumulative effects indicators include:

- Structural, vegetation, and functional characteristics differed substantially among linear feature types. 3D seismic accounts for the largest extent of linear features in the RSA and had the narrowest widths and limited functional effects (e.g., the proportion of features used by ungulates in the winter was less than a third of the rates of use on 2D and winter roads). Winter roads, except for the Dempster Highway, had the widest average widths and the greatest functional effects. However, a substantial portion (39%) had regenerated into or past the Tall Shrub stage (which this study suggests may be the best criterion for functional recovery). Most 2D lines had substantial vegetation regeneration, resulting in the shortest average sightlines and the slowest movement speeds. However, ungulates still appeared to select them to travel during winter.
- Four primary types of linear features occur in the RSA, totalling 4,269 km: 2D seismic (34%), 3D seismic (51%), winter roads (14%), and the Dempster Highway (1%). The unadjusted linear feature density for the RSA totalled 1.79 km/km². After accounting for burns, natural openings and regeneration, the adjusted linear feature density for the RSA totalled 0.52 km/km², below the cautionary (0.75 km/km²) and critical (1.0 km/km²) cumulative effects indicator levels in the NYRLUP and PWRLUP.
- Substantial vegetation regeneration has occurred on existing features in the RSA. Previous work by the Yukon Government identified the potential for atypical successional trajectories to occur on linear features in the region. Although atypical succession occurred to a limited extent, the study of the linear feature determined that 81% of the sites exhibited a normal succession (100% on 3D lines). Only 5% exhibited inhibited regeneration trajectories (mostly stagnated succession on winter roads). Regarding functional recovery, 53% of sites met the NYRLUP and PWRLUP criterion of vegetation reaching 1.5 m, and 38% met the criterion of attaining a

Tall Shrub structural stage. Using the Tall Shrub structural stage as a criterion of functional recovery may be a more ecologically appropriate criterion to meet LUP objectives.

- The extent of open habitats (e.g., burns, wetlands and shrublands) and the degree of regeneration on existing linear features (mostly the older 2D lines and winter roads) play an important role in calculating effective linear feature density in the RSA. Before accounting for open areas and regeneration, the total linear feature density was 1.79 km/km². After accounting for open areas and vegetation regeneration (to the Tall Shrub structural stage), the effective linear feature density was 0.52 km/km².

The results and their relationships to the cumulative effects indicators are discussed where relevant in the following sections of the Project Proposal.

1.7.2 Conformity with Land Use Plans

Chance has had preliminary written discussions with the Yukon Land Use Planning Council regarding the information requirements for a conformity check with the NYRLUP and the PWRLUP. A conformity check across the two plans will include several elements. New spatial disturbance and linear density calculations will be added to existing disturbances. Other components include a review of the baseline data. For the PWRLUP, the parties have attempted to clarify their expectations with the 2022 Standard Terms and Conditions (Peel Plan Implementation Committee 2022). Additionally, the conformity review will address the objectives for LMU # 9 and #7 of the relevant plans and any relevant "Special Management Considerations" set for each LMU. That information compilation and conformity discussions will be concurrent with this YESAB proposal review.

1.8 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Climate change, from the human-caused increase in greenhouse gases such as carbon dioxide, is reportedly increasing the frequency and intensity of extreme weather events including heavy precipitation, severe floods, prolonged droughts, and increased wildfires around the globe (National Aeronautics and Space Administration [NASA] 2023, Environment and Climate Change Canada [ECCC] 2019). Climate is changing in the Eagle Plains area, as it is throughout Yukon, more rapidly than at southern latitudes (BNQ 2023).

Given the remote, northern location of the Project, potential effects of the environment on the Project could result from climate change effects such as permafrost changes and terrain instability, extreme weather, increased wildfire frequency, and fluctuating water levels in lakes and rivers. Details related to mitigating associated risks to the Project are further discussed below.

1.8.1 Climate Change and Terrain Instability

The Project Area is underlain by continuous permafrost (Heginbottom et al. 1995), ground that remains below 0°C for more than two years. Permafrost is approximately 100 to 200 m thick, based on measurements and calculations from drill holes (See **Appendix 4-A** of **Section 4 Permafrost and Terrain**). The active layer, overlying permafrost and subject to seasonal freeze-thaw cycles, varies in thickness based on elevation, aspect, slope position, sediment texture, snowpack, and vegetation cover. It is commonly as

thin as 0.5 m and up to several metres thick in areas recently burned by wildfire. Active layer detachments are translational landslides that occur from thawing soil above permafrost in the summer. Although increasing since 1992, they are not prevalent but occur on some steeper slopes (Haseldine 2021). Thermokarst is very localized in some sections of valley bottom, and retrogressive thaw flows are rare.

Due to climate change, continued warming of air temperature and changes in precipitation patterns are already affecting near-surface permafrost and associated terrain stability. Gradual (mm/year) degradation (thawing) of permafrost is likely to increase thermokarst subsidence and the size and distribution of active layer detachments, which, in turn, may affect local hydrology, sediment delivery to watercourses, and rates of erosion. Additionally, more frequent and severe wildfires may exacerbate permafrost thaw by removing insulating vegetation and increasing summertime warming. Terrain stability is gradually decreasing, in certain areas, in association with climate change. Degrading permafrost, largely through its influence on terrain stability, has the potential to locally affect certain components of the Project.

Poorly routed or sited Project infrastructure could be subject to differential subsidence, driven by thermokarst subsidence, with potential effects on the integrity of the infrastructure and a heightened need for maintenance. It could also be unnecessarily exposed to mass movements such as rockfall, active layer detachments, retrogressive thaw flows or solifluction, all of which could damage surface infrastructure.

Exploration development suitability maps (See **Appendix 4-A** of **Section 4 Permafrost and Terrain**) highlight variability in observed and potential landscape response to climate change (and anthropogenic surface disturbance), and where the environment has the greatest potential to affect the Project, without mitigation. As discussed in Section 3 Methods, environmental constraints mapping, which outlines sensitive or high quality environmental and heritage values where Project work is to be avoided or minimized, was undertaken. The mapping of permafrost and terrain sensitive areas was included in constraints mapping for potential avoidance or minimization of Project work, where possible. Particular attention will be given to locating infrastructure, such as camps, staging areas and well pad sites, within appropriate areas of suitability. Winter roads are best established outside such areas, as well, although measures are readily available to mitigate risks where crossings of such areas are unavoidable (**see Section 4.3**). Further mitigation measures appropriate to address the potential effects on the Project due to permafrost related terrain instability are discussed in **Section 4 Permafrost and Terrain**.

1.8.2 Extreme Weather

The potential for extreme weather conditions will be discussed in the Chance comprehensive HS/ERP including appropriate mitigation measures related to extreme weather conditions that may affect field personnel and the undertaking of all Project components. For example, extreme weather events may include variable weather conditions including severely cold temperatures, intense winter storms (blizzard/white out conditions, heavy snow, freezing rain, high winds), which may cause delays in site mobilization and transportation of goods and services, increase personnel health and safety risks, and cause delays. Mitigation measures appropriate to address the potential effects on Project personnel and equipment due to extreme weather may include, but not limited to:

- Reduce the risk of hypothermia and frost bite by dressing in layers, carrying spare clothing, covering exposed skin, and utilizing available heated shelters.
- Provide adequate navigation and communication systems.

- Evaluate transportation conditions (road reports and closures, flight conditions, use of Journey Management processes).
- Provide First Aid training for personnel.
- Provide Common Safety Orientation (including extreme weather) for personnel.
- Design for and adjust exploration as appropriate for site conditions (e.g., cold-weather rated equipment, use of heaters for equipment, overhead hazard awareness during high winds, equipment tie downs, other activity considerations).

1.8.3 Wildfires

The potential for wildfires will be discussed in the Chance comprehensive HS/ERP and will include appropriate mitigation measures related to potential effects of increased wildfire frequency in the Project area which may affect field personnel and the undertaking of all Project components. For example, wildfires in the region could cause Project delays, increase personnel health and safety risks, and affect site mobilization and transportation of goods and services due to air quality concerns and road closures. In addition, as stated above, more frequent and severe wildfires may exacerbate permafrost thaw by removing insulating vegetation and increasing summertime warming. The interactions between wildfires and permafrost are detailed in various regional studies (French et al. 2016, Kokelj et al. 2017, Perrin and Jokowski 2022). Wildfire mitigation measures may include, but not limited to:

- Evaluate forest fire conditions/reports in the area.
- Work closely with representatives on Yukon Fire Management if fires in area
- Evaluate air quality conditions and forecasts from wildfire smoke in relation to relevant air quality health indices.
- Follow appropriate procedures for storage of flammable goods.
- Provide forest fire response procedures (personnel notification, evacuation).
- Provide forest fire reporting procedures.

1.8.4 Fluctuating Surface Water Levels

Water levels in Yukon lakes and rivers are affected by several processes that are influenced by climate change, including amount and timing of snowmelt, precipitation, permafrost thaw, groundwater flux and melting glaciers. Such processes may affect water levels in the proposed water extraction sources identified for the Project. Measures to mitigate the potential low water levels from Project-identified water sources are described in **Section 5 Water Resources** and will be a component to a Chance Environmental Management Plan (EMP). In winter exploration, it is more likely that the Project will be affected by low flow versus high flow water events due to water source and quantity requirements for various processes. Mitigation measures may include, but not limited to:

- All works with the highest water requirements will be planned to occur in November, December, and, to a lesser degree, January, increasing the confidence that adequate water is available for the proposed work and to manage access to available flow during the lowest flow periods (February and March).
- Collect weekly or bi-weekly flow measurements at the point(s) of withdrawal to determine 10% of the actual flow instantaneous discharge and monitor discharge.

- Develop and implement plans to reduce water withdrawals, should the instantaneous monitoring data indicate unacceptable direct hydrologic effects (e.g., flows below 10% instantaneous flows) or indirect effects (e.g. increased channel erosion.
- Bottled drinking water will be supplied to the camp.
- Construction of a heated water reservoir at the camp for water storage and use during low water periods will be completed.

Please refer to the list of management and monitoring plans anticipated for the Project included in **Section 12.** Each management and monitoring plan will be prepared for the Project's specific needs and will include a complete list of associated mitigation measures, when developed.

1.9 AIR AND GREENHOUSE GAS (GHG) EMISSIONS

According to Natural Resources Canada (2014), greenhouse gases (GHGs) include carbon dioxide, nitrous oxide and methane, where carbon dioxide is the principle GHG. Carbon dioxide is a colourless, odourless, non-flammable gas produced by the combustion of fossil fuels including gasoline and diesel. Carbon dioxide emissions contribute to climate change.

1.9.1 Direct Air Emissions

1.9.1.1 Flaring

Flaring is the principal source of air emissions related to EFT of natural gas discoveries and will be conducted in compliance with regulatory controls over a short time period, likely a week to one month in duration, as EFT activity at a predominantly natural gas bearing zone may be completed within several weeks in comparison to a predominantly crude oil-bearing zone where EFT activity may require up to 2 winters (but with minimal flaring of natural gas required). Natural gas is dissolved in crude oil in most instances so there will likely be some flaring at EFTs of oil discoveries. Natural gas may be flared but preferentially used as fuel for process heating, mechanical power, and onsite power generation for the Project. It is not anticipated that any oil produced during EFT will be burned during flaring, as it will be captured and trucked offsite.

Flaring consists of burning off natural gas at height. The resultant combustion products are water vapour, carbon dioxide and possibly small quantities of sulphur dioxide (if hydrogen sulphide is present in the natural gas). Hydrogen sulphide is not expected based on data obtained historically and during drilling activities conducted by Chance between June 2012 and June 2013. It is expected that exhaust gases will dissipate upwards into the atmosphere.

Flaring of residual solution gas that is not consumed for use of process heating or engine power (mechanical or electrical) will occur. Use of natural gas extracted from crude oil during EFT will displace use of propane or diesel for consumption and may result in emissions reduction by an estimated 50% compared to propane and diesel use.

Depending on surface conditions, the flare stack will be a minimum of 18 m high and a maximum of 30 m high to assist in air dispersal of combustion end products and mitigate effects on vegetation, trees and permafrost. Flaring of gases during the EFT will occur under regulatory controls. Gas will be control-burned through the flare stack following the flare permit issued by the Government of Yukon, Oil and Gas Branch.

The Yukon government regulates air quality under the *Environment Act,* RSY 2002, c.76 (Government of Canada 2002) and the *Air Emission Regulations*, YOIC 1998/207 (Government of Canada 1998), and by issuing Air Emissions Permits for specific activities which are required before proceeding. When an activity requires an Air Emissions Permit, it must comply with the published regulated air quality criteria in Yukon Ambient Air Quality Standards (AAQS) (Yukon Environment 2019 a). Flaring related to EFT requires an Air Emissions Permit from Yukon Environment. Data requirements for flaring are provided in the *Guidelines: Flaring, Venting Reduction, and Fugitive Emissions* (Yukon Environment 2019b). Following these guidelines, Chance will determine the sulphur dioxide content of the natural gas from each well where EFT is being conducted before flaring; if the content of sulphur dioxide exceeds 5 mol, air dispersion modelling will be prepared for submission to *OGDPR* (Government of Yukon 2004) for review and approval. The collection of sulphur dioxide data on specific wells must be determined in the field.

The proposed Project is an exploration project; therefore, outcomes of potential oil and gas discoveries and volumes are difficult to predict and depend on variables such as the actual presence, type and quality of hydrocarbon encountered (crude oil, natural gas) and production rates of the wells.

1.9.1.2 Other Combustion Sources

In addition to flaring, air quality effects may occur from Project activities that require the combustion of fossil fuels during seismic exploration, drilling, EFT, reclamation and closure activities, and are expected to be localized to areas in which equipment is being operated. These combustion sources may include:

- trucks and service vehicles (e.g., pickup trucks, water trucks, fuel trucks);
- ATVs and snowmobiles;
- heavy equipment (e.g. loaders, graders, snow cats, flatbeds);
- air transportation (airplane, helicopter);
- drilling rig;
- mulchers;
- LIS tracked air hammer drilling rig;
- camps (e.g., heating for Chance Camp, remote fly-in camp, wellsite); and,
- equipment (e.g., boilers, heaters, portable generators, mulchers).

The operation of an incinerator for domestic waste will occur and will be done following the *Air Emission Regulations* (Government of Yukon 1998) and permitting conditions, as required.

Fuel types for combustion for the above sources include diesel, propane, gasoline, and aviation fuel (Jet-A). Byproducts from the combustion of these fuel types may include carbon monoxide, carbon dioxide, nitrogen oxides, and particulate matter.

The Project is an exploration project and the number, location and sequence in which wells are drilled for the exploration program depends on seismic data, previous drilling success, EFT results and other conditions; therefore, quantification of air emissions from the combustion of the above fuel sources is not available at this time but will be reported following the relevant territorial and federal air emission regulations.

1.9.2 Fugitive Air Emissions

Fugitive emissions associated with the Project may include releases of fuels or production fluids related to accidents and malfunctions, equipment leaks (e.g., wellhead, well casing, valves, piping), and evaporation losses, including venting from fuel storage tanks and losses from fuel transfer activities.

Methane is the predominant type of greenhouse gas emitted as a fugitive emission in the oil and gas sector; however, carbon dioxide, and nitrous oxide emissions (to a lesser extent) may also occur (Picard 2000)

As outlined in **Section 1.4.9.4**, a fuel storage facility with double-walled fuel tanks for storage of diesel, gasoline, propane and Jet-A fuel will be required for fuel consumption. Operation of the Chance Camp will require diesel and propane consumption. Diesel will be stored on site in 15,000 to 50,000 L Enviro Tanks. It is anticipated there may be up to six tanks at the Chance Camp and up to two at the drilling rig site. The drilling rig, boilers, and light towers at the rig site will have built-in fuel storage tanks. Propane will be stored in propane bullet tanks (approximately 5700 L each): six at the camp and up to two at the rig camp. Fuel for seismic activities will be transported from the main camp area to staging sites in a tank trailer. The seismic equipment is expected to use a combination of gasoline and diesel depending on the machine. Fuel storage will also be required at the remote camp, mobile camps at each active well, and secondary camps required in remote parts of the Project area to support the safety and staging of activities.

Crude oil extracted during DST and, where applicable, subsequent EFT will be stored in up to five surface tanks at the CPF. Storage tanks for the Project will be in compliance with Yukon and Canadian standards and regulations.

Fugitive air emissions related to oil and gas activities are regulated by the YOGA and its regulations including the *OGDPR* (Government of Yukon 2004). Fugitive emissions management will follow the Guidelines: Flaring, Venting Reduction, and Fugitive Emissions (Government of Yukon 2019b) and other relevant legislation and will be included in the EMP.

Developing and implementing a program to detect and repair leaks will be undertaken. These programs will meet or exceed the CAPP BMPs for fugitive emissions management, as required in the Flaring, Venting Reduction, and Fugitive Emissions guidelines (Government of Yukon 2019b).

The Project is an exploration project and the number, location and sequence in which wells are drilled for the exploration program depends on seismic data, previous drilling success, EFT results and other conditions; therefore, quantification of air emissions from fugitive sources is not provided at this time but will be reported following the relevant territorial and federal air emission regulations.

1.9.2.1 Fugitive Dust

Airborne particulates in the form of fugitive dust are anticipated to result primarily from the use of vehicles and equipment on roads or seismic lines in the summer under dry conditions, helicopter take-offs and landings, clearing/mulching of woody vegetation for seismic line preparations, excavation of the MBC sump area, wind erosion on exposed soil, and seismic detonation activities. With the exceptions of seismic operations, Project activities occur mainly during the winter months when soils are frozen and site access can be accomplished via winter roads; therefore, fugitive dust produced by the Project is anticipated to be minimal.

1.10 ACCIDENTS AND MALFUNCTIONS

Accidents and malfunctions could potentially occur during any Project activity. Examples of potential incidents that could be anticipated are discussed in the following subsections. The Chance HS/ERP will further outline the potential accidents and malfunctions that are foreseeable and provide comprehensive management and mitigative measures.

1.10.1 Vehicular Accidents

Due to the remote location and limited availability of skilled personnel and equipment for the Project, people and equipment will likely be mobilized from Northeastern BC and Alberta. Some personnel and equipment may travel from as far as Calgary, Alberta (approximately 3,100 km). Risk of vehicular accidents during ground transportation of personnel and goods increases during adverse conditions (e.g., inclement weather). Chance will identify and mitigate the potential for vehicular accidents as part of the HS/ERP development. The following are examples of mitigative measures to limit the risk of vehicular accidents:

- Transportation of equipment to and from site will follow federal, territorial, and provincial regulations about service hours, dangerous goods transport, and equipment maintenance.
- Chance intends to use local personnel and equipment as much as possible for the Project.
- Posted speed limits must be adhered to and drivers must adjust to weather and road conditions as needed.
- Journey management practices will be used.

1.10.2 Helicopter Operations

During the recording phase of the seismic program helicopters will transport equipment and personnel to areas within the program. The use of helicopters greatly reduces the affects and potential risk to personnel and the environment; however, it does have the potential for crashes, noise, and contact with the propellers and downwash. The appropriate mitigative measures about using helicopters as transportation are:

- Daily flight schedule is to be reviewed along with weather conditions, helipad locations, and locations of all Program crews on the ground.
- Pre-flight checklists are to be complete.
- Pilot “fit for duty” forms and assessments are to be conducted daily.
- All helicopters are to be serviced daily, and a maintenance log and inspection form must be supplied prior to every flight.
- Post-flight inspections and operations debrief make sure that any unforeseen conditions that arise are communicated.
- In the case of a crash the Emergency Response Plan will be enacted.
- All personnel working around helicopters must be equipped with approved hearing protection so that no hearing loss is sustained.
- Wildlife monitors will be employed to scout for wildlife and contribute to operations plans to employ mitigation where wildlife is present.
- The pilot will give personnel general training on helicopter operations for the program as well as pre-flight briefings.

- Any incident involving propeller contact or downwash will be reported and investigated.
- Any disturbance or damage will be remediated to restore it to pre-disturbance condition.

1.10.3 Mulching Operations

During the line preparation activities small, tracked mulching units are used to open areas where timber impedes the ability to drill source holes or layout seismic receivers (geophones). The potential risks are potential contact with mulching debris and the potential to impact the active layer while mulching. The following are examples of mitigative measures of mulching operations:

- Personnel will be provided training regarding the operations and dangers associated with mulching.
- Daily route planning will improve awareness of where the mulchers will be present and determine successive activities outside of the area to be cleared.
- Wildlife surveys will provide feedback that will guide the field operations into an area of low wildlife activity.
- Mulching heads can be raised and lowered to control the distance to the ground. The mulcher head remains 10 cm above the active layer as it is unnecessary to mulch to the ground. Snow depths add buffer as the snow pack protects the ground.

1.10.4 Seismic Hole Drilling

Seismic holes must be drilled to varying depths for the seismic explosives to be loaded into and drill cuttings packed back in. The drill is a small (2.5 m) track mounted rig that will air drill up to 6 m. The hole is 10.2 cm (4”) in diameter. The drilling activity produces a mound of soil that will be packed back into the hole once the charge is loaded (see **Section 1.10.5 Handling, Loading and Detonating Seismic Explosives** for loading operations). The risks associated with drilling are the exposure to rough terrain and the potential for rollover and spills. Appropriate mitigative measures for the handling of explosives are:

- All personnel involved in seismic drilling are properly trained in safe operating and emergency shut down procedures. Drills are only to be operated with a minimum crew of 2 personnel so that a second person is available to assist in case of an emergency. All unnecessary personnel will be removed from the drilling area to limit exposure to the drill and the explosives.
- Routes are carefully selected so that extremely challenging terrain is avoided and lines are moved to less difficult and environmentally sensitive areas.
- Drilling units are top heavy and can pose a risk of tipping. This can lead to accidental spills from the drill unit and potential injury. Terrain must be assessed before drill commencement. As the source lines will have already been cut and surveyed the potential hazards for the drills will be well known and addressed at the pre-operative meeting. Spill kits will be made available and training on their use will be provided. Any spills will be quickly cleaned up, reported as needed, and inspected for appropriate reclamation.
- Drilling will cease in the event of a lightning or thunderstorm in the vicinity.

1.10.5 Handling, Loading, and Detonating Seismic Explosives

Seismic explosives are comprised of 1 kg dynamite charges and a detonator cap. These are transported in an approved truck designed for transporting the dynamite and detonator caps in separate compartments. The magazine will be stored at an approved and permitted staging site. Charges and caps are then moved to the drill hole locations in portable magazines mounted on the drilling rig. The risks associated with charges are the exposure to the explosives and detonator caps, potential for accidental detonation, potential for theft, potential for fire and the potential for a missed detonation. The risks associated with drilling are the exposure to rough terrain and the potential for rollover and spills. The following are examples of mitigative measures about shot-hole drilling:

- All personnel handling explosives and caps must have the appropriate PPE and the proper training and clearance for Ground Disturbance, Transportation of Dangerous Goods and Blasting as Yukon Territory requires.
- All sections of the Canada *Explosives Act*, RSC 1985, c E-17 (Government of Canada 1985) and Regulations shall be followed in purchasing, transporting, storing, and handling seismic explosives.
- Contractors must be covered under the Canadian Association of Geophysical Contractors Explosive Emergency Response Plan (EERP) or other approved plan by Natural Resources Canada (NRC).
- Unnecessary personnel will be removed from the areas where explosives are present.
- Explosives and detonators are to be transported provided that separate, enclosed and locked Type 6 magazines are used and separated by no less than 15 cm of solid lumber between the magazines.
- Magazines are to be kept locked except when opened for depositing or removing the contents. Contents are removed from the drill magazine and stored in the main magazine at the explosive staging site.
- A digital drill logging system will be used to record the date, time, depth and amount of explosives and detonators used at each drilling location (known as a source point). These digital drill logs are cross referenced to the coordinates of the source point as well as whether the detonation was successful. This produces a complete digital profile of all of the explosives used for the seismic acquisition.
- All materials are to be stored at staging sites approved by the Yukon Workers Compensation Health and Safety Board in NRC-approved explosives magazines that are locked, access-controlled and physically monitored daily. Magazine sites are carefully chosen for maximum security and fire control.
- Vegetation is cleared from the magazine site for a distance of 25 m.
- No smoking is permitted within the explosives magazine site.
- No use of cell phones or radios permitted in the vicinity.
- No storage of combustible materials or fuel on magazine site.
- Magazine will be frequently cleaned to remove grit, sand or abrasive materials, as these can compromise explosives.
- Vehicles must not be parked within the 25 m vegetation clearance zone.
- Fire extinguishers will be present.

- Fire procedures will be discussed with all employees and drills will be conducted so that the safe mitigation of the explosives and evacuation of personnel.
- Personnel are monitored as to their location in the field and proximity to explosives with the use of online tracking software and the use of geofencing around magazine sites.
- Small fires outside of the 8 m safety zone can be mitigated by making sure that the magazine is closed and locked and extinguished using the appropriate fire extinguishers.
- In the case of a lightning strike in the area of the magazine the door will be closed and locked and personnel evacuated from the area.
- In the case of a forest fire all authorities will be notified immediately of the magazine site so that they are aware of the danger in that location.
- All source holes are logged and during the seismic acquisition activities a team of seismic "shooters" are deployed to individually prime and set the charge off. Each hole is recorded as being successfully detonated or no detonation. In the result of a no detonation hole the leads are removed and the dynamite is left to disintegrate and become inert. No detonation holes are rare as all detonators are tested for working condition prior to loading the hole. Any unexploded charges are reported to the government with all of the information pertaining to the loaded hole including location and charge size.

1.10.6 Releases to the Environment

Although deemed unlikely, Chance will be prepared to deal with unanticipated releases to the environment including releases to the atmosphere, water and land surface, and these proven, appropriate mitigation measures will be included as part of the development of the Chance HS/ERP and EMP

Examples of atmospheric releases that may occur include methane and hydrogen sulphide (H_2S) releases (dependent on H_2S concentration in the reservoir). Appropriate mitigation measures pertaining to atmospheric releases may include:

- Onsite personnel will receive appropriate operational and safety training for each task undertaken and will use appropriate personal protective equipment (PPE).
- Onsite personnel will be trained in emergency procedures in the event of an atmospheric release.
- Best management practices and safe operating procedures will be adhered to, to minimize risk of releases.
- Well testing equipment with pressurized vessels and flare stacks will be used on site to mitigate atmospheric releases.
- Well heads and blowout preventers are designed with backup systems to support rapid containment in the unlikely event of a release.
- Neutralizing chemicals such as H_2S Scavenger will reduce the potential for H_2S release, where appropriate. However, the presence of H_2S at well locations for the Project is not expected based on historical data.
- Safety systems will prevent or minimize release at the source (e.g., automatic shut-offs, containment systems).
- Use of detection and monitoring systems to allow for early intervention and reduce the potential for accidental releases

- Scheduling of regular inspection and maintenance of equipment.

Examples of surface releases that may occur include hydrocarbons (e.g., diesel, gasoline), drilling mud, saline water, and chemicals including H_2S Scavenger, clay stabilizer, and methanol. Appropriate mitigation measures for surface releases may include:

- Onsite personnel will receive appropriate operational and safety training for each task undertaken and will use appropriate PPE.
- Best management practices and safe operating procedures will be adhered to, to minimize risk of releases.
- Onsite staff will be trained in the emergency procedures in the event of a surface release.
- Catchment trays will be used at fluid transfer points to prevent surface releases.
- Fuels and chemicals will be properly contained and stored in compliance with legislation.
- WHMIS documents will be on site to support the proper storage, handling, usage, and treatment requirements.
- TDG regulations will be followed.
- All personnel handling and transporting fuels and chemicals will be trained in the proper handling (WHMIS training) and transportation (TDG training) of such fuels and chemicals.
- Spill kits will be readily available on site and personnel will follow the procedures in the Spill Response Plan in the EMP.
- Use of safety systems are expected to prevent or minimize release at source (e.g., automatic shut offs, flow restrictors).
- If a surface release occurs, contaminated materials will be removed from the environment in accordance with the appropriate legislation.

1.10.7 Blowouts

Blowouts are uncontrolled gas or fluid releases to the atmosphere and/or surface. They are rare in the Canadian oil and gas industry but can result in severe injury to workers or possibly death. The Blowout Plan mitigation and response measures will be included within a comprehensive HS/ERP which would be enacted to mitigate personnel safety incidents and effects on the environment in the unlikely event of a blowout. The Blowout Plan may include the following examples of mitigation and response measures:

- Onsite personnel will receive appropriate operational and safety training for roles performed.
- Onsite personnel will use appropriate PPE.
- Best management practices and safe operating procedures serve to minimize risk of releases.
- Proper installation, testing and use of blowout prevention equipment will be undertaken.
- Emergency procedures will be followed in the event of a blowout, including roles and responsibilities of personnel, communication protocols (including emergency notifications to authorities, First Nations, and hunters' and trappers' associations);
- Identification of service providers for each circumstance (e.g., to bring a blowout under control),
- Preparation of medical emergency plans including locations of the nearest hospital, alternative hospital, and transportation protocols.

Once the blowout is controlled, clean up procedures will be followed in accordance with the appropriate legislation to remove released fluids and contaminants for disposal at an approved waste handling facility and will be in accordance with the EMP.

1.10.8 Perforating

During the well completions (e.g., installation of well casing) and at other specific times, the use of explosive perforating charges may be required to punch holes in the casing into geological formations containing crude oil and/or natural gas to allow the controlled flow of oil and/or gas into the well bore and up to surface at the commencement of EFT activities. This activity carries a risk of detonation of explosives at surface. Appropriate mitigative measures for well completion activities including perforating will be included in the development of the Chance HS/ERP. Some examples of mitigation measures related to perforating include:

- All personnel handling and transporting explosives will receive the appropriate training (e.g., TDG training).
- Unnecessary personnel will be removed from the area during the arming of the explosive equipment.
- Safety meetings will be held to inform personnel of their responsibilities during the well completion process; safety meetings will be held at the start of this procedure and at a shift change.

1.10.9 Cementing

During the drilling and completion operations, cementing will be required to cement the casing in place or isolate productive zones from each other. During these operations, there is a risk of spilling cementing materials. Appropriate mitigative measures for well completion activities including cementing will be considered in the development of the Chance HS/ERP and the EMP which will include a Spill Response Plan. Some examples of mitigation measures related to cementing include the following:

- Onsite personnel will use appropriate PPE.
- Best management practices and safe operating procedures serve to minimize risk of releases.
- Appropriate personnel will receive WHMIS training and WHMIS documents will be accessible to support the proper storage, handling, usage, and treatment requirements.
- If a spill occurs, the material will be removed from the environment in accordance with required legislation and the Chance Spill Response Plan in the EMP.

1.10.10 Radioactive Well Logging

During the drilling and completions operations, downhole “logging” tools on wireline delivery into the well bore may be used to measure the properties of the various rock formations and any fluids that have accumulated in these formations. Some of these tools contain radioactive materials in trace quantities. The use of these tools creates a risk of exposure to radioactive materials or release of small amounts of radioactive material from failed equipment. Measures used to mitigate the risk of radioactive well logging will be included in the development of the Chance HS/ERP; some examples may include:

- All personnel handling the materials will have the proper training as required by Canadian Nuclear Safety Commission.
- Unnecessary personnel will be removed from the areas where radioactive materials are present.
- All radioactive materials will be stored in locked and access-controlled containers and in compliance with appropriate legislation.

1.10.11 Human-Wildlife Conflicts

Human-wildlife conflict occurs when encounters between humans (e.g., site workers) and local wildlife lead to negative results such as loss or damage of property, bodily injury to a worker or animal, and direct wildlife mortalities associated with vehicular accidents and equipment strikes. The risk of human-wildlife conflicts or dangerous encounters is increased by the presence of wildlife attractants such as food, cooking grease, and garbage.

Chance will take measures to prevent human-wildlife conflicts associated with Project activities such as use of vehicles, camp/kitchen operations and operation of heavy equipment and will include relevant mitigation measures in the development of the Chance EMP and associated Wildlife Management and Monitoring Plan. Examples of mitigation measures pertaining to human-wildlife conflicts may include:

- All roads will have controlled access off the Dempster highway (some will have gates, controlled access, and/or security).
- Any use of winter roads is to be managed with radio communication for traffic control, safety management and notices of wildlife encounters.
- Winter road usage will abide by posted speed limits which must be reduced when wildlife is encountered.
- Notable wildlife observations (e.g., large mammals) will be reported to the Wildlife Monitors who will record and communicate observations, in compliance with the Wildlife Management and Monitoring Plan.
- A Caribou Interaction Response Plan will be used when caribou are observed during Project activities (**Section 9**).
- High visibility tape will be placed, and regularly replaced as needed, on guy wires of equipment such as the flare stack to promote visibility to birds and other wildlife.
- Best practices including appropriate management of attractants such as food and cooking oil will be undertaken to reduce opportunity for human-wildlife conflicts or dangerous encounters, in accordance with *Guidelines for Industrial Activity in Bear Country* (Government of Yukon and Mining and Petroleum Environmental Research Group 2008).
- Refuse containers will be bear proof to prevent wildlife access. Garbage collection will be undertaken regularly and either burned at the incinerator at the Chance Camp or removed to an approved landfill site to reduce presence of wildlife attractants and reduce opportunity for human-wildlife conflicts or dangerous encounters.

Potential wildlife encounters, direct wildlife mortality risks, human-wildlife conflict and associated mitigations have also been discussed in **Section 8 Wildlife**, **Section 9 Caribou**, and **Section 12 Effects Management** and will be incorporated into the Project EMP and Wildlife Management and Monitoring Plan where appropriate.

1.10.12 General Safety

Chance will develop a Project-specific, comprehensive HS/ERP to complete all Project components in the safest manner possible. General safety measures to mitigate and respond to potential accidents and malfunctions will be developed and included in the HS/ERP. Some examples of general safety mitigation measures may include:

- At each shift change, safety meetings will be held with the incoming crew.
- All personnel will be required to wear proper PPE including protection for potentially extremely cold weather.
- All personnel will have the required training necessary to perform their duties. Some examples of training requirements are:
    - First Line Blowout Prevention;
    - Second Line Blowout Prevention;
    - Well Service Blowout Prevention;
    - TDG training;
    - WHMIS training;
    - Detection and Control of Flammable Substances training;
    - First Aid training (Standard and Emergency); and,
    - Common Safety Orientation (including extreme weather and temperature exposure safety).

A nurse practitioner will be on site (at the Chance Camp) at all times during the Project to support the timely treatment of any and all injuries due to the remoteness of exploration activities.

2 CONSULTATION AND ENGAGEMENT

Chance Oil and Gas Ltd. (Chance) is submitting the Eagle Plains Exploration Project (the Project) for review to Yukon Environmental and Socio-economic Board's (YESAB) Executive Committee (EC) for a screening. As per the *Yukon Environmental and Socio-economic Act (YESAA*) requirements, Chance has undertaken consultation and engagement activities with potentially affected First Nations and residents of communities. This Consultation and Engagement Section describes Chance's First Nations Consultation and Engagement Program (the Program) since Project initiation in 2014, up to December 20, 2023. This section describes the Program, including:

- information about potentially affected First Nations and residents of communities;
- consultation and engagement requirements for the Project;
- consultation and engagement principles and objectives;
- consultation and engagement with potentially affected First Nations and residents of communities during challenges to the Program, including COVID-19 and natural disasters; and,
- consultation and engagement activities with potentially affected First Nations and residents of communities from 2014 to December 20, 2023.

2.1 POTENTIALLY AFFECTED FIRST NATIONS AND RESIDENTS OF COMMUNITIES

The Program encompasses consultation and engagement with First Nations and residents of communities potentially affected by the Project. Potentially affected First Nations and residents of communities were identified as being potentially affected based on meeting one or more of the following criteria under the *YESAA*:

- The Project footprint (**Map 2-1**) overlaps with First Nations whose Traditional Territory, as defined by the *Umbrella Final Agreement* (UFA) and including Settlement Land and/or Non-Settlement Land and includes Lands within the *First Nation of Na-Cho Nyäk Dun Final Agreement*, *Gwich'in Comprehensive Land Claim Agreement*, and *Vuntut Gwitchin First Nation Final Agreement*;
- residents of a community that overlaps with the Project; or,
- First Nations and/or residents of a community who may experience significant environmental or socio-economic effects from the Project (Yukon Environmental and Socio-economic Assessment Board [YESAB] 2022).

Potentially affected First Nations and residents of communities consulted and engaged about the Project are listed below (alphabetically):

- First Nation of Na-Cho Nyäk Dun;
- Gwich'in Tribal Council, comprising:
  - Ehdiitat Gwich'in Council;
  - Gwichya Gwich'in Council (Tsiigehtchic);
  - Nihtat Gwich'in Council; and,
  - Tetł'it Gwich'in Council.

- Tr'ondëk Hwëch'in;
- Vuntut Gwitchin First Nation; and,
- Residents of Aklavik, Dawson City, Fort McPherson, Inuvik, Mayo, Old Crow, and Tsiigehtchic.

The Program includes consultation and engagement with potentially affected First Nation Citizens that live outside of administrative centres and reserves.

The Project overlaps the Traditional Territories of

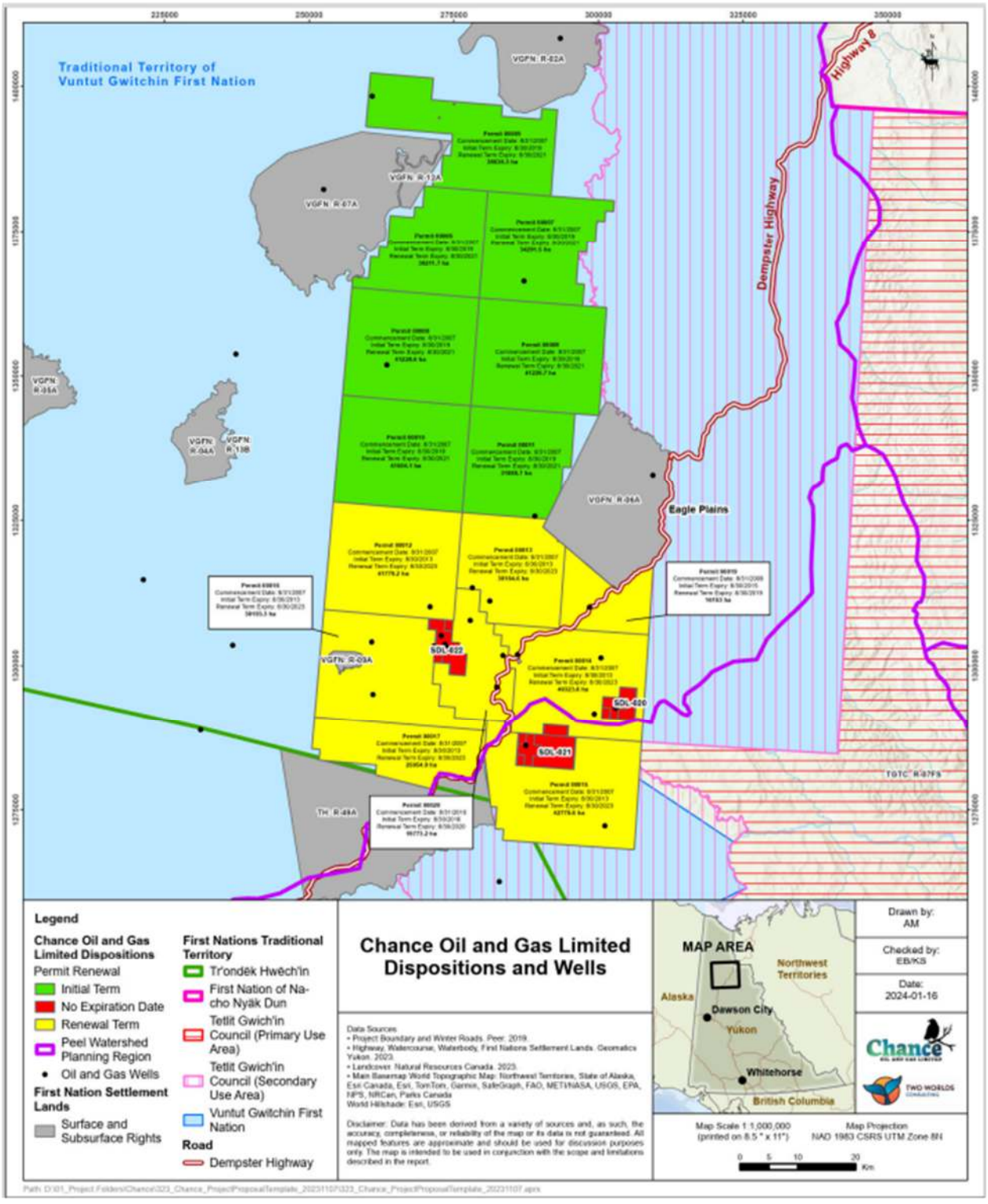
- First Nation of Na-Cho Nyäk Dun;
- Tetłʼit Gwichʼin Council; and,
- Vuntut Gwitchin First Nation.

Most of the Project is within the Traditional Territory of the Vuntut Gwitchin First Nation. The Project also overlaps small areas of the Traditional Territories of the First Nation of Na-Cho Nyäk Dun and Tetłʼit Gwichʼin Council. Tr'ondëk Hwëch'inʼs Traditional Territory does not overlap with the Project footprint but is adjacent to the southern edge of the Project.

The Project does not fall within any First Nation Settlement Lands but borders the east and southwest portions of the Vuntut Gwitchin First Nation Settlement Lands.

Since no residents of communities overlap with the Project footprint, residents of communities consulted and engaged on the Project were chosen based on the potential that they may experience significant environmental or socio-economic effects from the Project, and because the majority of potentially affected First Nation Citizens reside in these communities.

Map 2-1 shows the location of the Project within a larger permitted exploration area.



Map 2-1. Chance Oil and Gas Limited Dispositions and Wells

2.2 CONSULTATION AND ENGAGEMENT REQUIREMENTS

The Project is subject to a screening by the YESAB EC, as stated in the *Designated Office Evaluation Report*: *Eagle Plains Multi-Well Exploration Program* issued on February 9, 2016 (Project Number: 2014-0112). In addition to the YESAB EC screening, the Project also requires federal and territorial permits, licences, approvals, and assessments.

Proponent-led consultation is distinct from Crown requirements to consult First Nations (Government of Canada 2003a). The Crown has a duty to consult with affected First Nations about projects "and, where appropriate, to accommodate Indigenous groups [when] it considers conduct that might adversely affect potential or established Aboriginal or treaty rights" (Government of Canada 2023b). Chance is required to meet consultation requirements under Sections 3 and 50(3) of the *YESAA* (Government of Canada 2003). The *YESAA* requires Chance to consult with potentially affected First Nations and residents of communities prior to submitting its Project Proposal to the EC (Government of Canada 2003a).

Chance's engagement with potentially affected First Nations and residents of communities has and continues to be focused on meeting the following *YESAA* requirements:

- providing opportunities to share Project information, including information on potential Project-related effects to support potentially affected First Nations and residents of communities to prepare and present views about the Project; and,
- considering, fully and fairly, views presented by potentially affected First Nations and residents of communities about the Project.

This section describes Chance's activities through the Program to achieve these objectives. The Program was also developed to meet YESAB's consultation guidance outlined in the *Consultation Guidance for Proponents* and the *User Guide: Pre-Submission Engagement for Executive Committee Screenings* (Phase 6) (see **Figure 2-1**) (YESAB 2022).



Figure 2-1. Stages of 'Yukon Environmental and Socio-economic Assessment Board's Pre-Submission Engagement Process

2.3 CONSULTATION AND ENGAGEMENT PRINCIPLES AND OBJECTIVES

Chance strives to implement the following consultation and engagement principles during all Project-related consultation and engagement activities, based on YESAB guidance (Yukon Environmental and Socio-economic Board 2017):

- transparency and openness, which includes:

    - providing equal opportunity to access Project information; and,
    - making Project information to potentially affected First Nations and residents of communities available in a timely and digestible manner.
- adaptive management, which includes:
    - responding to First Nation and residents of communities' feedback; and,
    - mitigating, where possible, potential adverse Project-related effects on potentially affected First Nations and residents of communities.
- mutual respect, trust, and understanding which includes:
    - implementing consultation and engagement activities to support all potentially affected First Nations, residents of communities, and Chance working together; and,
    - creating opportunities for potentially affected First Nations and residents of communities to meaningfully understand and provide feedback about the Project.

Consultation and engagement objectives for the Project include:

- building collaborative relationships with potentially affected First Nations and residents of communities during all Project phases;
- developing a shared understanding of the Project with potentially affected First Nations and residents of communities;
- discussing potential Project-related effects, issues, and interests identified by potentially affected First Nations and residents of communities;
- potentially amending the Project design based on input and concerns from potentially affected First Nations and residents of communities; and,
- developing mitigation measures for potential Project-related adverse effects on potentially affected First Nations and residents of communities.

These objectives may evolve throughout the life of the Project in response to feedback from potentially affected First Nations and residents of communities.

2.4 OVERVIEW OF THE CONSULTATION AND ENGAGEMENT PROGRAM

Chance has undertaken consultation and engagement activities with potentially affected First Nations and residents of communities since 2014. Chance sought to solicit views, concerns, input, and feedback about the Project. However, various events and relationship constraints occurred between 2014 to 2023 that created barriers to the Program, such as:

- ability of potentially affected First Nations and residents of communities to participate in Project consultation and engagement activities; and,
- ability of potentially affected First Nations and residents of communities to share feedback about the Project.

This section provides an overview of the successes and challenges in the Program. Chance recognizes that First Nation governments and communities have faced capacity challenges and time and resource

constraints required to participate meaningfully in the Program. Chance acknowledges the importance of First Nations governments and communities having opportunities to provide feedback and be heard on their concerns related to the Project. Chance is committed to an engagement process that seeks to align with First Nation expectations, *YESAA* and related guidance, and best practices.

At a high level, the following timeline displayed in **Figure 2-2** shows important milestones in the Project and the Program up to submission of the Project Proposal in February 2024.

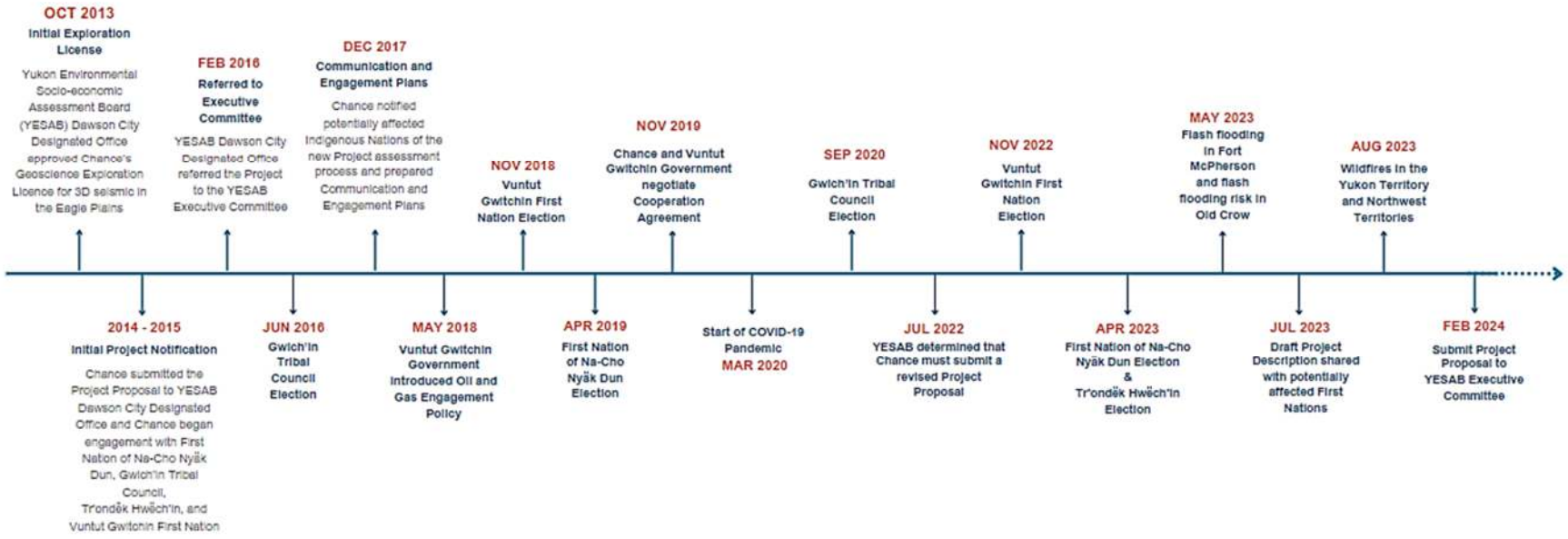


Figure 2-2. Milestones in Consultation and Engagement Related to the Eagle Plains Exploration Project

2.4.1 Yearly Summaries of Consultation and Engagement Activities and Events Shaping Involvement in the Program

This section summarizes consultation and engagement activities and events that shaped potentially affected First Nations and residents of communities' involvement in the Program.

2.4.1.1 2014

In July 2014, Northern Cross (Yukon) Limited, now named "Chance Oil and Gas Ltd", submitted a Project Proposal for the "Eagle Plains Multi-Well Exploration Program" for assessment by YESAB's Dawson City Designated Office (DO) (YOR# 2014-0112). The Project Proposal documents included a Project description, Project mapping and layout, a 2013 *Heritage Resource Impact Assessment* (*HRIA*), a 2013 *Heritage Resources Overview Assessment* (*HROA*), an *Emergency Spill and Response Plan*, an *Operational Plan*, an *Emergency Response Plan*, and a *First Nation Environmental Monitoring Plan*.

The Project assessment's first public comment period, which was extended by the Dawson City DO in response to extension requests from the Tetl'it Gwich'in Council, Vuntut Gwitchin First Nation, and First Nation of Na-Cho Nyäk Dun, was undertaken from October 30 to December 4, 2014 (inclusive of the extension) (YOR# 2014-0112-096-1). In 2014, the Dawson City DO put forward four Information Requests to Northern Cross Limited.

Chance-led consultation and engagement activities were paused during the public comment period.

2.4.1.2 2015

Throughout 2015, YESAB's Dawson City DO continued its assessment of Northern Cross (Yukon) Limited's "Eagle Plains Multi-Well Exploration Program" (YOR# 2014-0112). The Dawson City DO undertook an additional "Seeking Views and Information" stage, with a second public comment period from November 4 to December 9, 2015. The Dawson City DO held a public meeting in Dawson City during this time. On December 10, 2015, the Dawson City DO began preparing its recommendation, and extended the submission deadline five times between December 23, 2015, and February 9, 2016 (YOR# 2014-0112).

2.4.1.3 2016

In February 2016, YESAB's Dawson City DO released its evaluation report of the "Eagle Plains Multi-Well Exploration Program" (YOR# 2014-0112). As per s. 56(1)(d) the *YESAA,* the DO referred the Project to the EC for a screening, as it "could not determine whether the Project will have, or is likely to have, significant adverse socio-economic effects" (YOR# 2014-0112-274-1). This referral to a higher level of assessment requires Chance to submit more extensive information and involves additional and lengthier assessment steps.

In June 2016, the Gwich'in Tribal Council Election was held.

2.4.1.4 2017

In August 2017, Chance received renewal terms of exploration permits held by Chance (M.O. 2017/37). Yukon's *Oil and Gas Act*, section 14, requires consultation with Yukon First Nations to extend permits (Government of Yukon 2002).

In December 2017, Chance sent letters to Vuntut Gwitchin First Nation, Tetl'it Gwich'in Council, First Nation of Na-Cho Nyäk Dun, and Tr'ondëk Hwëch'in providing notification of the Project and requesting the development of a *Communication and Engagement Plan* in partnership with each First Nation.

2.4.1.5 2018

In January 2018, Vuntut Gwitchin First Nation transmitted its preliminary *Oil and Gas Engagement Policy* to Chance via email. This policy, officially disclosed to the public in May 2018, serves the purpose of "establishing a respectful, transparent, and meaningful framework" to govern consultation and engagement between the Vuntut Gwitchin First Nation and oil and gas proponents (Vuntut Gwitchin Government 2018). The document outlines the Vuntut Gwitchin First Nation's procedural approach for proponents to engage with its Citizens concerning oil and gas activities and dispositions.

In May 2018, Chance and First Nation of Na-Cho Nyäk Dun began developing the First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Limited Engagement and Consultation Plan.

In May 2018, Chance received extensions to renewal terms of exploration permits 0012-0017 held by Chance Oil and Gas Ltd. (M.O. 2018/42). Yukon's *Oil and Gas Act*, Section 14, requires consultation, including the development of communication and engagement plans, with Yukon First Nations to extend permits (Government of Yukon 2002).

In May 2018, the Vuntut Gwitchin First Nation publicly introduced its *Oil and Gas Engagement Policy*.

In August 2018, the Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan was finalized.

In November 2018, the Vuntut Gwitchin First Nation election was held.

2.4.1.6 2019

In April 2019, the First Nation of Na-Cho Nyäk Dun election was held.

In November 2019, Chance and Vuntut Gwitchin First Nation met with a facilitator to negotiate a Cooperation Agreement required under Stage II of the *Vuntut Gwitchin Government Oil and Gas Engagement Policy*. The objectives and content of the Cooperation Agreement were discussed.

In August 2019, Chance was granted an extension to the renewal terms of oil and gas permits 0008-11 and 0019 held by Chance Oil and Gas Ltd. (M.O. 2019/27). Yukon's *Oil and Gas Act*, Section 14, requires consultation with Yukon First Nations to extend permits (Government of Yukon 2002).

2.4.1.7 2020

In February 2020, Chance requested an exemption from Vuntut Gwitchin First Nation under the *Vuntut Gwitchin Government Oil and Gas Engagement Policy* and the *Benefits and Stewardship Agreement* to accelerate entry into the *YESAA* process, given the tenure of existing exploration permits. Specifically, Chance wished to enter the *YESAA* process while simultaneously engaging Vuntut Gwitchin First Nation regarding the *Vuntut Gwitchin Government Oil and Gas Engagement Policy*. Vuntut Gwitchin First Nation advised Chance that their request for a waiver of the requirement under the *Vuntut Gwitchin Government Oil and Gas Engagement Policy* had not been granted by the Vuntut Gwitchin First Nation Natural Resources Committee.

In March 2020, the Government of Yukon declared a state of emergency at the start of the COVID-19 pandemic (McPhee-Knowles, Hoffman, and Kanary 2022). Chance's Program changed in response to COVID-19 protocols, processes, and preferences established by potentially affected First Nations, Government of Yukon, and the Government of Canada. Changes included pausing and rescheduling in-person consultation and engagement activities and focusing on virtual consultation and engagement methods, respecting safe distance and mask-wearing protocols during in-person meetings, as well as adapting and responding to ongoing requests from potentially affected First Nations and communities. Chance also developed a *COVID-19 Community Engagement and Consultation Procedures* document. Additional information on the impact of COVID-19 on potentially affected Indigenous Nations and the Program is described in **Section 2.5.1**.

- In December 2020, Chance submitted the Eagle Plains Well Maintenance and Exploration application to the Dawson City DO (YOR# 2020-0197). This involved the maintenance of 8 suspended oil and gas wells, extended flow testing (EFT) on 3 wells, the conversion of 2 wells to deep-injection wells for disposal of waste borehole fluids, and the abandonment of up to 6 wells[2] as part of the Project.

In August 2020, Chance was granted an extension to the renewal terms of oil and gas permit 0020 (M.O. 2020/55). As per Section 14 of the Yukon's *Oil and Gas Act*, consultation is required with Yukon First Nations to extend permits (Government of Yukon 2002).

In September 2020, the Gwich'in Tribal Council Election was held.

2.4.1.8 2021

While the Yukon received its first shipment of vaccine doses in January 2021, the effects of the COVID-19 pandemic continued to affect communities and First Nations throughout 2021. For example, until the end of May 2021, outside of territory travel for vaccinated individuals required a 2-week self-isolation upon return (McPhee-Knowles, Hoffman, and Kanary 2022).

In March 2021, Vuntut Gwitchin First Nation sent a letter to Chance expressing concerns about perceived non-compliance with their *Oil and Gas Engagement Policy* and the *Communication and Engagement Plan*. Consequently, Vuntut Gwitchin First Nation decided to pause communications with Chance temporarily, pending an internal review of the Vuntut Gwitchin First Nation's *Oil and Gas Engagement Policy*'s alignment with Chance's *Communication and Engagement Plan*. Future consultations would be discretionary on the part of the First Nation and would be by invitation only.

In April and May of 2021, Chance hosted two open house events in Old Crow and provided a Project overview including information on wildlife studies, historical linear features in Eagle Plains, water quality and other ecological data, and drilling.

In October 2021, Chance hosted an open house in Old Crow to discuss permafrost, seismic, and wildlife baseline studies.

[2] "When a company no longer needs a well to support its oil and gas development, the well must be permanently sealed and taken out of service. This part of the closure process is known as abandonment" ("How Are Wells Abandoned?" 2020).

2.4.1.9 2022

In May 2022, Chance held two community open house events in Old Crow to share Project information including details on the drilling program, heritage resources, permafrost, seismic testing, and wildlife studies.

In July 2022, YESAB determined that Chance must submit a revised Project Proposal.

In August 2022, Chance was granted extensions to its renewal terms of oil and gas permits 0010 and 0011 by the Government of Yukon (M.O. 2022/47). The Yukon's *Oil and Gas Act,* Section 14, requires consultation with Yukon First Nations to extend permits (Government of Yukon 2002).

In September 2022, the Chiefs of Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in First Nation, and First Nation of Na-Cho Nyäk Dun released a joint statement opposing the approved extension of two of Chance's permits to 2027. The Chiefs noted that development within their Traditional Territories creates barriers to achieving climate change mitigation goals, sustainable development, and protecting the culturally significant Porcupine Caribou Herd (PCH) that lives throughout the Eagle Plains region. Chance did not formally respond to this joint statement, however, continued to be available to discuss Chance permits directly with potentially affected First Nations, if interested.

In November 2022, the Vuntut Gwitchin First Nation election was held, and leadership changed.

2.4.1.10 2023

In January 2023, Chance hosted an in-person meeting in Vancouver, British Columbia (BC) with the Chiefs, staff, and technical advisors of potentially affected First Nations to re-establish collaborative working relationships, discuss consultation and engagement preferences, and to provide a Project update. Chief Frost from Vuntut Gwitchin First Nation shared concerns about and the importance of being more confident in numbers and determinations in the YESAB consultation and engagement process. Chief Frost also expressed that the northern First Nations want to participate collaboratively in the Project to ensure it is well managed and not going to create long-term environmental degradation. Chief Frost said the northern First Nations will share their interests and concerns with Chance and stop the consultation and engagement process from advancing if it does not consider local Indigenous Knowledge.

In April 2023, both the First Nation of Na-Cho Nyäk Dun and Tr'ondëk Hwëch'in held council elections. Chance sent letters to both governments and requested to meet and discuss the Project.

In May 2023, Chance travelled to Old Crow to conduct a community open house event with Vuntut Gwitchin First Nation Citizens and residents of Old Crow. High streamflow advisories were issued by the Government of Yukon due to ice jams on both the Porcupine and nearby Old Crow rivers. This event was cancelled due to a flash flooding risk.

In May 2023, Chance held a Project overview community open house with Gwich'in Participants and residents of Inuvik at the Nihtat Gwich'in Council Board Room in Inuvik.

In May 2023, Chance met with Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), and the Gwich'in Development Corporation to discuss Project updates, consultation and engagement preferences, and an overview of the open house in Inuvik with Gwich'in Participants and residents of Inuvik.

In May 2023, there was a flash flooding event in Fort McPherson. The Peel River flooded the Dempster Highway and cut off access to the airport. Concurrently, there was a death in the community. Chance cancelled a community open house event in response to these circumstances.

In June 2023, Chance submitted the application for the *Eagle Plains Camp: For Well Inspection and Maintenance* project to YESAB's Dawson City DO (YOR# 2023-0099). Project activities for this application included operation of the existing Chance main camp for five consecutive years for a 4-week period between mid-June and mid-August, if approved. Well site inspections (3 by road and 5 by helicopter) would occur at 8 well site locations. Within that 5-year period, the camp would be opened for two winter seasons between the months of early November to mid-April to support well maintenance at the 8 well sites.

In July 2023, Chance shared the *Draft Project Description* with potentially affected First Nations.

In August 2023, Chance met with technical advisors on behalf of First Nation of Na-Cho Nyäk Dun, Tr'ondëk Hwëch'in, and Vuntut Gwitchin First Nation to discuss the *Draft Project Description* and proposed consultation and engagement activities with each First Nation.

In August 2023, multiple wildfires occurred across the Yukon and the Northwest Territories (NWT). The 2023 wildfire season was Canada's most severe on record. Effects from wildfires included an evacuation order, implementing emergency response plans, loss of power, infrastructure damage, and adverse effects on human health. Chance shifted its Program in response to natural disasters and emergency response measures implemented by each First Nation and community. For example, Chance rescheduled 2 community open house events planned for Fort McPherson and Old Crow from August to September 2023.

In August 2023, Chance met virtually with potentially affected First Nations and YESAB to discuss the Project's assessment process. YESAB confirmed the Project's assessment would begin at Stage 6 of the EC's Pre-Submission Engagement (PSE) Process (See **Figure 2-1**).

In August 2023, Chance was granted extensions to its renewal terms of oil and gas permits 0012-0017 and 0019-0020 (M.O. 2023/38). Yukon's *Oil and Gas Act*, Section 14, requires consultation with Yukon First Nations to extend permits (Government of Yukon 2002).

In August, September, and October 2023, Chance met virtually with Gwich'in Tribal Council staff to discuss the Project and proposed consultation and engagement activities.

In October 2023, Chance, potentially affected First Nations, Government of Canda, YESAB, and Government of Yukon met virtually to discuss the Project's assessment process, capacity funding, and possible efficiencies through a coordinated approach (e.g., sharing consultants to support potentially affected First Nations' review of the Project Proposal).

In December 2023, Chance held community open house events in Fort McPherson and Old Crow. Chance held a World Café event[3] in Old Crow to share information on potential Project-related effects and proposed mitigation measures to support Vuntut Gwitchin First Nation Citizens and residents of Old Crow to prepare views about the Project. This event provided an opportunity for Vuntut Gwitchin First Nation Citizens and residents of Old Crow to provide feedback on consultation and engagement, potential Project-related

[3] A World Café event is an engagement method that creates an informal method of discussion. Participants are separated into smaller groups to discuss different subjects.

effects, general Project-related concerns, and proposed mitigation measures. Chance held a hybrid online and in-person open house event in Fort McPherson to provide a Project overview to Gwich'in Participants and residents of Fort McPherson, Tsiigehtchic, and Aklavik. This event provided an opportunity for Gwich'in Participants and residents of Fort McPherson to prepare and share views about the Project.

In December 2023, Chance held a hybrid online and in-person technical working group meeting with a technical advisor for First Nation of Na-Cho Nyäk Dun and Tr'ondëk Hwëch'in, a technical advisor for Vuntut Gwitchin First Nation, the Porcupine Caribou Management Board, and the Government of Yukon to share information and receive feedback about the Project's wildlife studies (notably the PCH) including baseline conditions, potential Project-related effects, and proposed mitigation measures. Chance invited all potentially affected First Nations to a hybrid technical working group meeting on heritage resources and permafrost on January 16, 2024[4].

2.5 EFFECTS ON THE CONSULTATION AND ENGAGEMENT PROGRAM

From 2014 to 2023, numerous events hindered active consultation and engagement activities between Chance, and potentially affected First Nations and residents of communities. Chance also acknowledges that during this time, there were periods of strained relationships with potentially affected First Nations and residents of communities. The following sections describe key challenges and opportunities to the Program since Project initiation.

2.5.1 Navigating Collaboration: Consultation and Engagement During the COVID-19 Pandemic and Natural Disasters

Rural communities encounter unique obstacles when it comes to accessing health and social services, which are more easily accessible in larger urban centres (e.g., Whitehorse and Yellowknife). Consequently, these communities responded quickly and with abundance of caution to the start of the COVID-19 pandemic in March 2020. Potentially affected First Nations and residents of communities were affected by the pandemic, with many requiring the reprioritization of limited resources to protect individual and community health and well-being (Auditor General of Canada 2023). Actions to protect communities included cancelling events, restricting visitors, and redirecting resources to develop risk mitigation policies and monitor outbreaks (Vuntut Gwitchin Government 2021a; 2021b; MacIntyre 2020). In March 2020, the Chief of First Nation of Na-Cho Nyäk Dun called for mining activities to pause due to concerns that fly-in workers would pose an exposure risk to the community (Rudyk 2020).

Restrictions on gathering sizes constrained potentially affected First Nation governments' capacity to internally meet and review information shared by Chance (Auditor General of Canada 2023). Chance's Program changed in response to COVID-19 protocols, processes, and preferences established by potentially affected First Nations, Government of Yukon, and the Government of Canada. Changes included pausing and rescheduling in-person consultation and engagement activities and focusing on virtual

[4] Meeting summaries for the technical working groups in December 2023 and January 2024 were not available at the time this chapter was drafted.

consultation and engagement methods, respecting safe distance and mask-wearing protocols during in-person meetings, as well as adapting and responding to ongoing requests from potentially affected First Nations and communities as needed. Chance acknowledges and appreciates potentially affected First Nations' commitment to engagement and consultation despite the circumstances introduced by the COVID-19 pandemic.

During this time potentially affected First Nations and residents of the associated communities were also affected by natural disasters. Notably, in 2023, potentially affected First Nations and residents of communities were affected by potential and actual flooding events, as well as wildfires. Effects from natural disasters included an evacuation order, implementing emergency response plans, loss of power, infrastructure damage, and effects on human health. Chance shifted its Program in response to natural disasters and emergency response measures implemented by each First Nation and community. For example, Chance rescheduled 2 community open house events planned for Old Crow in May 2023 and August 2023 to September 2023.

Sections 2.7 to **2.10** summarize consultation and engagement activities with potentially affected First Nations and residents of communities. These sections are presented in alphabetical order.

2.5.2 Vuntut Gwitchin Government's *Oil and Gas Engagement Policy*

Vuntut Gwitchin First Nation's *Oil and Gas Engagement Policy* came into force in May 2018. The policy serves the purpose of "establishing a respectful, transparent, and meaningful framework" to govern consultation and engagement between the Vuntut Gwitchin First Nation and oil and gas Proponents (Vuntut Gwitchin Government 2018). The document outlines the Vuntut Gwitchin First Nation's procedural approach for Proponents to engage with its Citizens concerning oil and gas activities and dispositions.

In March 2021, Vuntut Gwitchin First Nation sent a letter to Chance expressing concerns about perceived non-compliance with their *Oil and Gas Engagement Policy* and the *Communication and Engagement Plan*. In the letter, Vuntut Gwitchin First Nation said they perceived that engagement activities fell short of constituting consultation. Vuntut Gwitchin First Nation stressed the importance of Chance adhering to the principles of free, prior, and informed consent in relation to the Project.

Vuntut Gwitchin First Nation then suspended communications with Chance, pending an internal review of the *Oil and Gas Engagement Policy*'s alignment with the *Communication and Engagement Plan*. Future consultations would be discretionary on the part of the First Nation and would be by invitation only.

In September 2022, the Chiefs of Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in First Nation, and First Nation of Na-Cho Nyäk Dun released a joint statement opposing the approved extension of two of Chance's permits to 2027. The Chiefs noted that development within their Traditional Territories creates barriers to achieving climate change mitigation goals, sustainable development, and protecting the culturally significant PCH that lives throughout the Eagle Plains region (see **Section 8** of the Project Proposal documents for more information). Chance did not formally respond to this joint statement, however, continued to be available to discuss its permits directly with potentially affected First Nations, if interested.

Chance followed up with Vuntut Gwitchin First Nation to request re-engagement. Since the election of Chief Frost in 2022, Chance and Vuntut Gwitchin First Nation have moved forward with consultation and engagement, resulting in more active consultation and engagement activities. Chance has met with elected

Vuntut Gwitchin Government representatives, met with Vuntut Gwitchin First Nation technical advisor and staff, and was invited to host two community events with Vuntut Gwitchin Fist Nation Citizens.

Moving forward, Chance is committed to following consultation and engagement guidelines and protocols established by Vuntut Gwitchin First Nation, and to follow consultation and engagement guidelines and protocols outlined by all potentially affected First Nations. Chance continues to refine the Program in response to feedback shared from potentially affected First Nations. Chance strives to provide information with sufficient time to review, create opportunities to receive and respond to questions, feedback, and concerns, and to carefully consider all feedback from potentially affected First Nations and residents of communities.

2.5.3 Relationship-Building

The process of change in government is a multifaceted undertaking that involves political, administrative, legislative, and societal dimensions. Complexity arises from the need to address numerous issues, engage with various stakeholders, and implement changes in a systematic and responsible manner. After elections, the dynamics between companies and governments undergo a transformation, marked by the need for building relationships and familiarizing new council members with the essential aspects of proposed projects. Cultivating these new relationships takes time, which requires additional consultation and engagement activities.

Potentially affected First Nations' elected governments have changed since the Project was initiated in 2014. Since February 2016, when the Project was referred to an EC screening by the Dawson City DO, there have been seven elections within the governments of potentially affected First Nations (see timeline in **Section 2.4**). With every election, Chance has responded by connecting with newly formed governments to reintroduce the Project and consultation and engagement activities.

Chance is committed to respectfully consulting and engaging with all current and future First Nation governments of potentially affected First Nations. Prior to moving forward with community-level consultation and engagement activities, Chance will request feedback from potentially affected First Nations' governments on the preferred level and methods of involvement in the Project's assessment process, the Project, and Project-related consultation and engagement activities.

Sections 2.7 - **2.10** summarize consultation and engagement activities with potentially affected First Nations and residents of communities. These sections are presented in alphabetical order.

2.5.4 Consultation and Engagement Record Management and Legislative Requirements

Consultation and engagement requirements and best practices have evolved since the Project was initiated in 2014 (e.g., tracking and reporting expectations). The Project was initially developed to comply with the DO level assessment's consultation and engagement tracking and reporting requirements. After the Dawson City DO referred the Project to an EC screening, Chance was required to complete additional work to fulfill EC consultation and engagement tracking and reporting requirements. The introduction of the new assessment process led to Project delays, including delays to Project-related consultation and engagement and the development of the Project Proposal, while Chance navigated unfamiliar requirements, provided

additional information requested by assessment authorities, and aligned their application with the revised assessment criteria.

In 2023, YESAB determined that the Project would be advanced to Phase 6 of the EC's new PSE Process (See **Figure 2-1**). This required Chance to amend and update its consultation and engagement record for the Project in accordance with YESAB's *Consultation Guidance for Proponents*.

The record of contact with potentially affected First Nations and residents of communities includes all available records as of December 20, 2023.

2.5.5 Moving Forward: Consultation and Engagement Next Steps

Chance recognizes that additional challenges may affect its ability to consult and engage in the most effective way with potentially affected First Nations and residents of communities. However, Chance is committed to continuing to work with, and to have open dialogue with, potentially affected First Nations and communities throughout all stages of the Project. This includes providing information, giving sufficient time for review and consideration, accepting feedback, and taking input into consideration. Additionally, Chance will follow consultation and engagement guidelines and protocols established by potentially affected First Nations, Government of Yukon, and the *YESAA.*

While Chance has submitted its Project to the EC, it will continue its efforts to consult and engage with potentially affected First Nations and residents of communities. At the same time, Chance will be following the EC screening closely, tracking and taking into consideration all comments received by the EC during the assessment process. Chance may consult and engage with potentially affected First Nations and residents of communities to further understand comments, concerns, and/or questions shared with or by the EC.

2.6 RESULTS OF CONSULTATION AND ENGAGEMENT

In January 2023, Chance reinitiated consultation and engagement activities with potentially affected First Nations. Chance sought to establish positive and collaborative relationships that would continue through the YESAB EC screening assessment process and into future Project phases, if approved. Consultation and engagement activities between 2014 and 2023 included ongoing Project communications and updates via email, phone call, and text message, community open house events, virtual and in-person meetings, and document sharing. Chance shared an updated *Draft Project Description* with potentially affected First Nations in July 2023. Consultation and engagement activities since July 2023 focused on developing a shared understanding of the Project; specifically, how the Project design has changed in response to First Nation and resident of communities' feedback from 2014 to 2023. Chance provided opportunities to discuss and share information about the Project, Project-related effects, and mitigation measures with potentially affected First Nations and residents of communities. Chance also created opportunities for Chance, potentially affected First Nations, YESAB's EC, and Government of Yukon to meet collectively to develop a shared understanding of the screening process and discuss opportunities to support potentially affected First Nations' involvement in the Project's assessment process.

Feedback shared by potentially affected First Nations and residents of communities, and how Chance has responded and adapted the Project to feedback shared, is outlined in **Table 2-1**.

Table 2-1. Key Feedback Shared from 2014 to the Present

First Nation and Residents of Communities' Feedback	Chance's Response to Feedback Shared
Importance of land, water, and resources to First Nation culture and way of life	Chance recognizes and values the culture and way of life of First Nations and appreciates the First Nations' connection to the land. Chance modified the Project design to reduce potential Project-related effects on land, water, and resources. This includes spreading Project activities over 10 years to reduce annual environmental effects, optimizing the location of Project activities to avoid sensitive features, and scheduling most work during the winter. Additionally, Chance will implement mitigation measures, management plans, and a monitoring program to further reduce potential Project-related effects.
Concern for potential Project-related effects on the PCH	Chance has modified the original Project design submitted to the Dawson City DO to reduce potential Project-related effects on the PCH. This includes the modifications identified in Chance's response to feedback shared on the importance of land, water, and resources to First Nation culture and way of life (above), focusing many activities on previously disturbed areas and access networks to the extent possible, and implementing horizontal and directional drilling techniques to allow Chance to locate drilling locations to avoid sensitive and land and resource use activities as needed.
Importance of the PCH for cultural continuity, food, and other traditional purposes	Chance recognizes the importance of the PCH for cultural continuity, food, and other traditional purposes. Chance is committed to minimizing negative effects on the communities and First Nations who rely on the PCH by reducing potential effects on the herd as described in Chance's response to feedback shared on the concern for potential Project-related effects on the PCH.
Concern for negative effects on watercourses and wetlands	Chance conducted additional baseline studies in 2018/19 to understand potential Project-related effects on waterbodies and wetlands and shared relevant studies with interested First Nations. Additionally, Chance will optimize the location of activities that have the potential to affect waterbodies by minimizing the placement of winter roads and well sites, avoiding riparian areas and implementing mitigation measures, management plans, and on-site environmental monitoring.
Concern for seismic line clearing effects on predator-prey relationships and visual effects on people driving on the Dempster Highway	Chance proposes using low-impact seismic techniques and primarily winter seasonal activities to reduce seismic lines' functional and visual effects. This includes using dog leg designs where seismic lines cross the Dempster Highway, narrow seismic lines, and line construction that meanders across the land instead of being straight.
Concern regarding effects on permafrost	Chance conducted additional baseline studies in 2018/19 and 2022/23 to understand potential Project-related effects on permafrost and shared relevant studies with interested First Nations.
The perception that the Project involved fracking	Chance confirmed that fracking is not part of Project activities. If sufficient oil and/or natural gas resources are discovered, Chance may propose to conduct a future extraction project. Any future extraction project would undergo an environmental assessment. There is currently no plan for a future extraction project.
Interest in contributing to Project heritage studies	Chance shared heritage studies with potentially affected First Nations and committed to notifying potentially affected First Nations immediately if heritage resources are discovered. Chance will invite potentially affected First Nations to involve Citizens in heritage fieldwork studies. These studies are

First Nation and Residents of Communities' Feedback	Chance's Response to Feedback Shared
	partly investigative, but also demonstrative of how heritage work is done and how it can influence the Project.
Interest in employment, training, and procurement opportunities	Chance proposes to spread Project activities across a period of up to 10 years to create longer/steadier employment opportunities and to host career fairs. During its last drilling/seismic program, Chance successfully hired workers from the communities of Old Crow, Fort McPherson, Dawson, Whitehorse, and Inuvik.
Concern about lack of involvement in Project planning and mitigation development	Chance confirmed its willingness to continue discussing expected Project activities, potential Project-related effects, and mitigation measures with potentially affected First Nations and residents of communities.
Concern about Project-related potential effects on climate change	Chance shared that the long-term intent of the Project is to define a local source of oil and gas and reduce the overall carbon footprint of fuel consumption in the Yukon and neighbouring jurisdictions. Chance shared that the Project is explorative in nature, so the only emissions are connected to fuel consumption for camp operations, transportation of goods and services, exploration activities which includes potential for flaring during flow testing, and seismic programs. An estimate of this is pending.
Concern regarding cumulative effects	Chance conducted a *Linear Features Study* of the functional effect of existing linear features in the Project footprint, focused on wildlife, which was shared with interested First Nations. The Project effects assessment includes an evaluation of the creation of new linear features, as well as an assessment of cumulative effects to which the Project may contribute. The Project is focused on newer, low-impact seismic technology.
Concern about temporary and permanent Project roads	Chance modified the Project design to change from using year-round permanent roads to winter ice roads. Chance will restrict public access to roads.
Concern about year-round drilling	Chance switched the Project design from year-round to winter-only drilling activities.
Concern regarding non-compliance with Vuntut Gwitchin First Nation's *Oil and Gas Engagement Policy*	Chance acknowledges that there were challenges with its early engagement activities and aligning them with the Vuntut Gwitchin First Nation's *Oil and Gas Engagement Policy*. Chance confirmed its willingness to continue discussing Project activities, potential Project-related effects, and mitigation measures with potentially affected First Nations and residents of communities.

2.7 CONSULTATION AND ENGAGEMENT WITH FIRST NATION OF NA-CHO NYÄK DUN AND RESIDENTS OF MAYO

Section 2.7 outlines consultation and engagement activities with First Nation of Na-Cho Nyäk Dun and residents of Mayo. Information on Project notification, consultation and engagement planning, methods, activities, and agreements, issues, interests, and feedback shared through consultation and engagement activities are described in **Sections 2.7.1 – 2.7.9**.

2.7.1 Community Profiles

The following subsections describe First Nation of Na-Cho Nyäk Dun and the community of Mayo.

2.7.1.1 First Nation of Na-Cho Nyäk Dun

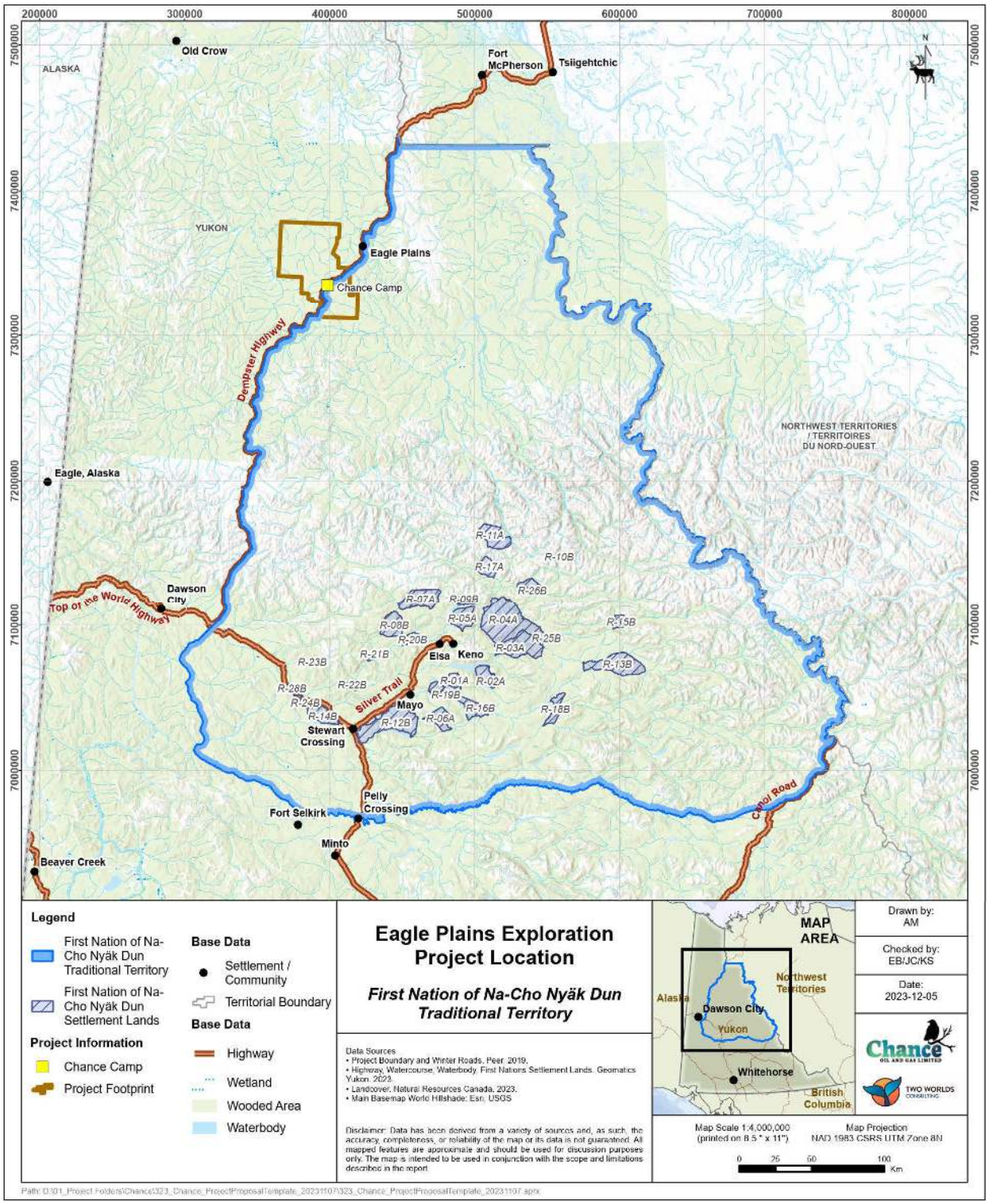
> "First Nations people have lived in our Traditional Territory since time began. Historically our ancestors lived on the land, maintaining a balance between the environment, the animals and our people." (Peter, Hogan and the First Nation of Na-Cho Nyäk Dun Lands Department 2006)

Na-Cho Nyäk Dun, means the Big River People in Northern Tutchone (Fred 2010). Na-Cho Nyäk Dun people are culturally affiliated with Northern Tutchone people of Selkirk First Nation and Little Salmon Carmacks First Nation (McClellan 2015).

The First Nation of Na-Cho Nyäk Dun has promoted the use of their traditional language and created initiatives including online Northern Tutchone language training for names of places, household items, and emotions to revitalize the use of the language within their community (First Nation of Na-Cho Nyäk Dun Elders et al. 2019).

> "Language can permeate every part of life in the community… There is no doubt the language we use is influential in who we are and how we think. Currently, our Northern Tutchone language has fallen into disuse. We don't use it because we don't know it, and we don't know it because there are no apparent benefits. To re-awaken the language, we have to teach it and make it a viable option, and then we have to follow that with the motivation to learn and use the language." (First Nation of Na-Cho Nyäk Dun 2023).

The First Nation of Na-Cho Nyäk Dun's Traditional Territory spans 162,456 kilometres square (km^2) in the Yukon and the NWT and overlaps with the Village of Mayo (326 kilometres (km) north of Whitehorse). First Nation of Na-Cho Nyäk Dun's Traditional Territory extends east to west from the NWT border to the Dempster Highway in the Yukon, and south to north from the Macmillan River to the Teetł'it Gwinjik (Peel River) watershed (**Map 2-2**). Additionally, the First Nation has an unsettled claim, which is currently being negotiated after the signing of a Framework Agreement in 2015, with the Government of Northwest Territories regarding potential transboundary territory (Government of Northwest Territories n.d.).



Map 2-2: First Nation of Na-Cho Nyäk Dun Traditional Territory

First Nation of Na-Cho Nyäk Dun's total registered population[5] as of November 2023 was 551 Citizens, (Government of Canada 2021). The First Nation is part of the *Umbrella Final Agreement* and signed its Self-Government Agreement in 1993 (Government of Canada 1993). First Nation of Na-Cho Nyäk Dun owns or manages 2,408.69 km^2 of Category A Lands and 4,748.95 km^2 of Category B Lands (Government of Canada 1993).

First Nation of Na-Cho Nyäk Dun's governance structure includes the Assembly and Council (Na-Cho Nyäk Dun 2009). The Assembly comprises all First Nation of Na-Cho Nyäk Dun Citizens who are 16 years of age or older (Na-Cho Nyäk Dun 2009). The Council is composed of a Chief, Deputy Chief, four councillors, 1 Elder Councillor, and one Youth Councillor. **Figure 2-3** outlines the Council's governance structure.

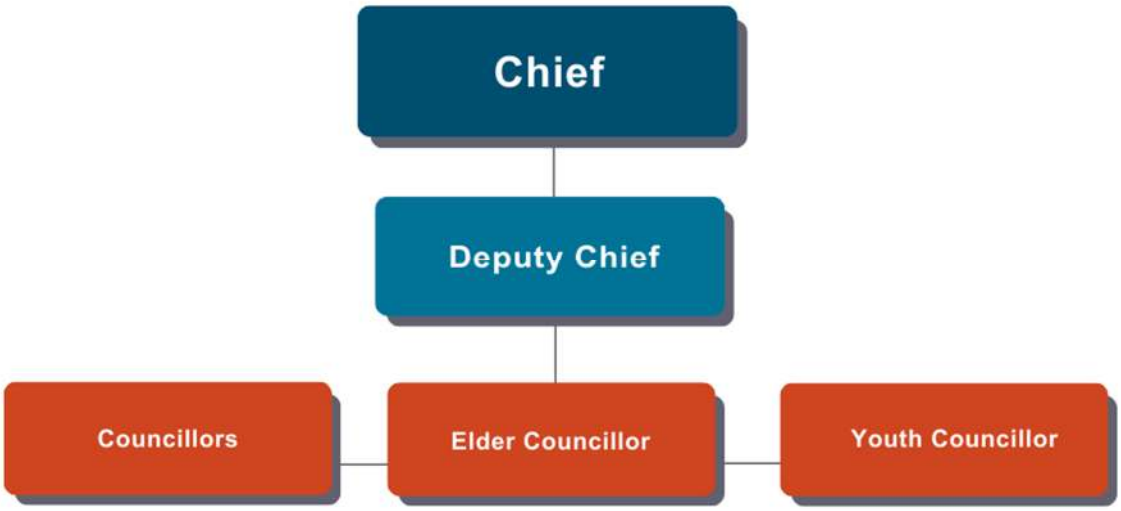


Figure 2-3. First Nation of Na-Cho Nyäk Dun Governance Structure

The Council has an overall responsibility to provide direction and guidance for the management, operation, and administration of First Nation of Na-Cho Nyäk Dun in a manner consistent with direction provided by the General Assembly (Na-Cho Nyäk Dun 2009). These terms are outlined in the *First Nation of Na-Cho Nyäk Dun Constitution* (Na-Cho Nyäk Dun 2009). The 2023 to 2027 First Nation of Na-Cho Nyäk Dun leadership is Chief Dawna Hope, Deputy Chief Roberta Hager, and councillors Edward Brown, Helaina Moses, Geri-Lee Buyck, and Paul Profeit.

2.7.1.2 Mayo

The Village of Mayo (Mayo) is located approximately 400 km north of Whitehorse at the confluence of the Mayo and Stewart rivers within the Traditional Territory of First Nation of Na-Cho Nyäk Dun. Mayo was founded in 1903 by Alfred Mayo, an early prospector and trader. By 1920, Mayo became one of the main

[5] Registered population refers to population data gathered by Statistics Canada through censuses. Chance recognizes First Nation citizenship data may differ from registered population data gathered by Statistics Canada. Registered population data available through Statistics Canada is limited to censuses completed.

points for shipping silver ore from Keno Hill to Whitehorse (Village of Mayo n.d.). In 1950, an all-weather road was built connecting Mayo to the Klondike Highway. In 2021, Mayo's total population was 188 people (Government of Canada 2022).

The Mayo municipal government is composed of one mayor and four councillors, each of whom are elected for a 4-year term (Village of Mayo, n.d.). In 2021, the industries with the largest proportion of the workforce were public administration, construction, and educational services (Government of Canada 2022).

Mayo is served by the Mayo Health Centre, an ambulatory healthcare facility for primary care that offers immunization clinics, prenatal classes, postnatal care, school health clinics, 24/7 emergency services, and ambulance services that respond to highway accidents (Government of Yukon 2018). Emergency response services, specifically ambulance and firefighting services, are run by local community volunteers (Village of Mayo, n.d.).

The local J.V. Clark School runs from Kindergarten to Grade 12. Mayo also has a Yukon University campus that offers in-person and distance learning certificates, diplomas, degrees, vocational and upgrading programs and courses (Government of Yukon 2022).

2.7.2 Project Notification

Chance initiated consultation and engagement with First Nation of Na-Cho Nyäk Dun on December 1, 2017. Chance sent a letter (**Appendix 2-A First Nation of Na-Cho Nyäk Dun and Residents of Mayo Consultation and Engagement Records**) that proposed the development of an engagement and consultation plan and next steps to develop a partnership with First Nation of Na-Cho Nyäk Dun.

2.7.3 Consultation and Engagement Planning

Chance developed a *First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Limited Engagement and Consultation Plan* (**Appendix 2-A**) outlining a proposed consultation and engagement approach with First Nation of Na-Cho Nyäk Dun. This plan included information on communication pathways, meeting processes, engagement documentation, and adaptive management. Chance shared the plan with First Nation of Na-Cho Nyäk Dun on May 16, 2018 for review and comment.

Implementation of consultation and engagement activities remains ongoing.

2.7.4 Consultation and Engagement Methods

Consultation and engagement methods with First Nation of Na-Cho Nyäk Dun up to December 20, 2023 included:

- meetings (virtual and in-person);
- letters;
- correspondence via phone call, text message, and email;
- Projects handouts; and,
- Information sharing (e.g., sharing Project documents for review and comment).
- Chance will adjust consultation and engagement methods in response to feedback from First Nation of Na-Cho Nyäk Dun throughout the life of the Project.

2.7.5 Consultation and Engagement Activities

Table 2-2 outlines an overview[6] of consultation and engagement activities undertaken with First Nation of Na-Cho Nyäk Dun up to December 20, 2023.

Engagement materials such as presentations and handouts shared with First Nation of Na-Cho Nyäk Dun and residents of Mayo have been compiled in **Appendix 2-A** of this Project Proposal. Where appendices were unavailable for compilation, **Table 2-2** indicates as such with an asterisk.

[6] The overview of consultation and engagement activities include meetings and events between, as well as letters and documents shared between, Chance and First Nations.

Table 2-2. Key Consultation and Engagement Activities with First Nation of Na-Cho Nyäk Dun

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
First Nation of Na-Cho Nyäk Dun	Correspondence via phone call, text message, meeting, and email	Ongoing	Coordinating engagement activities and sharing Project information.
First Nation of Na-Cho Nyäk Dun Residents of Mayo	Community Open House Event	17-Jun-2014	Held an open house in Mayo at First Nation of Na-Cho Nyäk Dun's Multi-Purpose Room in their government building (**Appendix 2-A**)*.
First Nation of Na-Cho Nyäk Dun	Document sharing for records	13-Sep-2016	Provided a 2-page document outlining key elements of the Project (**Appendix 2-A**).
First Nation of Na-Cho Nyäk Dun	Letter	15-Sep-2016	Provided a draft of their Yukon First Nation Engagement and Consultation Strategy (**Appendix 2-A**)*.
First Nation of Na-Cho Nyäk Dun	Letter	01-Dec-2017	Requested to co-develop a communications and engagement plan (**Appendix 2-A**).
Chance First Nation of Na-Cho Nyäk Dun	Meeting	22-Jan-2018	Requested an update of engagement planning mandates (**Appendix 2-A**)*[7].
Chance First Nation of Na-Cho Nyäk Dun	Meeting	09-Apr-2018	Discussed relationship building and opportunities to share views on the relationship and the proposed communications and engagement plan (**Appendix 2-A**)*.
First Nation of Na-Cho Nyäk Dun	Phone Call	01-May-2018	Provided the Chief an update on the progress made to the communications and engagement plan being developed with all potentially affected First Nations (**Appendix 2-A**)*.
First Nation of Na-Cho Nyäk Dun	Meeting	05-May-2018	Discussed the Project (**Appendix 2-A**)*.
First Nation of Na-Cho Nyäk Dun	Letter	07-May-2018	Notified that Chance would be submitting a tenure extension request of the Exploration Permits 0012-117 (**Appendix 2-A**)*.
First Nation of Na-Cho Nyäk Dun	Document sharing for review and comment	16-May-2018	Shared the First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Limited Engagement and Communication Plan (Draft Version 1) (**Appendix 2-A**).

[7] Engagement records between December 20, 2023 to February 2024 were not available at the time this chapter was written.

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Chance First Nation of Na-Cho Nyäk Dun	Meeting	03-Aug-2018	Discussed the First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Limited Engagement and Communication Plan (Version 1) (**Appendix 2-A**)*.
First Nation of Na-Cho Nyäk Dun	Document sharing for review and comment	05-Aug-2018	Shared the First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Limited Engagement and Communication Plan (Version 2) (**Appendix 2-A**)*.
Chance First Nation of Na-Cho Nyäk Dun	Meeting	06-Nov-2018	Discussed the implementation of the First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Limited Engagement and Communication Plan (Version 2) (**Appendix 2-A**).
Chance First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Government of Yukon	Meeting	01-Feb-2019	Discussed the First Nation engagement plans, the *Vuntut Gwitchin First Nation Oil and Gas Engagement Policy*, and the *Draft Project Description* (Version 1) (**Appendix 2-A**).
Chance First Nation of Na-Cho Nyäk Dun	Meeting	10-Jun-2019	Discussed the Draft *Project Description* (Version 1) and annual reporting requirements for the Government of Yukon (**Appendix 2-A**).
First Nation of Na-Cho Nyäk Dun	Document sharing for records	14-Jun-2019	Provided information on summer field work participation opportunities (**Appendix 2-A**).
First Nation of Na-Cho Nyäk Dun	Document sharing for records	14-Jun-2019	Shared a notice letter with First Nation of Na-Cho Nyäk Dun stating Environmental Dynamics Inc. (EDI) will be conducting fish and environmental studies scheduled from July 1 to July 10, 2019 pending authorization from the Fisheries and Oceans Canada (DFO) license (**Appendix 2-A**).
First Nation of Na-Cho Nyäk Dun	Document sharing for records	24-Jul-2020	Shared the Project Proposal (Version 1) (**Appendix 2-A**).
First Nation of Na-Cho Nyäk Dun	Document sharing for records	24-Jul-2020	Shared the Emergency Spill Response Plan (**Appendix 2-A**).
Chance First Nation of Na-Cho Nyäk Dun	Meeting	05-May-2021	Presented the *Draft Project Description* (Version 1). Provided information on baseline studies. Discussed consultation and engagement next steps (**Appendix 2-A**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
First Nation of Na-Cho Nyäk Dun	Document sharing for review and comment	18-May-2021	Shared the Chance Eagle Plains Exploration Project: Baseline Information on Terrain Permafrost and Suitability Maps (**Appendix 2-A**).
First Nation of Na-Cho Nyäk Dun	Document sharing for review and comment	02-Aug-2021	Shared the Draft 2021 Annual Report on the Implementation First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Engagement and Communication Plan (**Appendix 2-A**).
Chance First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Government of Yukon	Document sharing for review and comment	20-Jan-2022	Provided the updated Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2022 Interim Report (22-22ASR) (**Appendix 2-A**).
Chance First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Government of Yukon	Document sharing for review and comment	29-Nov-2022	Provided the updated Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2022 Interim Report (22-22ASR) (**Appendix 2-A**).
Chance Leadership and technical advisors from: Gwich'in Tribal Council First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation	Meeting	26-Jan-2023	Hosted an in-person meeting in Vancouver, BC to re-establish collaborative working relationships, discuss consultation and engagement preferences, and to provide a Project update (**Appendix 2-A**).
Chance First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Government of Yukon	Document sharing for review and comment	15-Mar-2023	Provided the updated Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2022 Interim Report (22-22ASR) (**Appendix 2-A**).
First Nation of Na-Cho Nyäk Dun	Document sharing for review and comment	13-Jul-2023	Shared the *Draft Project Description* (Version 1) (**Appendix 2-A**).
Chance Advisor acting on behalf of:	Meeting	03-Aug-2023	Discussed the *Draft Project Description* (Version 2) (**Appendix 2-A**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
First Nation of Na-Cho Nyäk Dun and Tr'ondëk Hwëch'in			Proposed consultation and engagement activities with First Nation of Na-Cho Nyäk Dun.
First Nation of Na-Cho Nyäk Dun	Document sharing for records	05-Sep-2023	Shared the Wildlife Baseline Studies (**Appendix 2-A**).
First Nation of Na-Cho Nyäk Dun	Document sharing for records	05-Sep-2023	Shared the *Linear Feature Study* (**Appendix 2-A**).
First Nation of Na-Cho Nyäk Dun	Document sharing for records	05-Sep-2023	Shared the 2D and 3D Seismic Plain Language Summary (**Appendix 2-A**).
First Nation of Na-Cho Nyäk Dun	Document sharing for records	05-Sep-2023	Shared the Draft Project Overview Video (**Appendix 2-A**).
Chance Gwich'in Tribal Council Advisor acting on behalf of: First Nation of Na-Cho Nyäk Dun and Tr'ondëk Hwëch'in Vuntut Gwitchin First Nation YESAB Government of Yukon	Meeting	13-Oct-2023	Discussed the Project's assessment process, capacity funding, and possible efficiencies through a coordinated approach (e.g., sharing consultants to support potentially affected First Nations' review of the Project Proposal) (**Appendix 2-A**).
Chance First Nation of Na-Cho Nyäk Dun Technical Advisor	Email	14-Nov-2023	Informed Chance that First Nation of Na-Cho Nyäk Dun is not interested in being consulted about the Project, but that they would like to receive Project-related information (**Appendix 2-A**).
Chance First Nation of Na-Cho Nyäk Dun	Letter	17-Nov-2023	Sent a letter to Chief and Council requesting confirmation that First Nation of Na-Cho Nyäk Dun are not interested in being consulted about the Project in response to email received on November 14, 2023 (**Appendix 2-A**).
First Nation of Na-Cho Nyäk Dun Gwich'in Tribal Council Porcupine Caribou Management Board Tr'ondëk Hwëch'in Vuntut Gwitchin First Nation Government of Yukon	Meeting	20-Dec-2023	Discussed completed environmental baseline studies; potential effects on fish and wildlife and potential mitigation measures for fish and wildlife; potential PCH effects and potential mitigations; and the *Linear Features Study* and North Yukon Land Use Planning conformity (**Appendix 2-A**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Chance EDI TWC			
* = Appendix was not available at the time this section was drafted.			

2.7.6 Agreements

Chance and First Nation of Na-Cho Nyäk Dun signed a Benefits Agreement to support First Nation of Na-Cho Nyäk Dun's involvement in Chance's drilling and seismic programs and activities in Eagle Plains between 2011 and 2014. The agreement ended upon completion of the well maintenance activities in 2014.

Chance and First Nation of Na-Cho Nyäk Dun have not discussed any formal agreement for the Project to date. Though outside the scope of this Project, First Nation of Na-Cho Nyäk Dun, Vuntut Gwitchin First Nation, Government of Yukon, and Chance signed a Benefits Agreement on October 25, 2023 for their Well Maintenance Project.

2.7.7 Records Management

Appendix 2-A includes a record of contact documenting all consultation and engagement activities including emails, phone calls, text messages, letters, meetings, and events between Chance and First Nation of Na-Cho Nyäk Dun up to December 20, 2023.

2.7.8 Consultation and Engagement Feedback (Effects, Issues, and Interests)

Chance sought to obtain feedback from potentially affected First Nations and residents of communities through Project engagement activities. **Table 2-3** presents effects, issues, and interests shared by First Nation of Na-Cho Nyäk Dun with Chance up to December 20, 2023.

Table 2-3. First Nation of Na-Cho Nyäk Dun Key Issues and Consultation and Engagement Feedback

Interaction Type	Participant / Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Project Design					
Meeting	First Nation of Na-Cho Nyäk Dun	09-Apr-2018	Requested information regarding resource extraction planning and timelines.	No response was provided at the time.	The purpose of the Eagle Plains Exploration Project is to determine the quantity and quality of oil and natural gas resources in Eagle Plains. Chance will then compare that data with existing data from other locations to assess the viability of future development activity. If sufficient oil and/or natural gas resources are discovered, Chance may propose to conduct a future extraction project. Any future extraction project would undergo an environmental assessment. There is currently no extraction plan.
Meeting	First Nation of Na-Cho Nyäk Dun	09-Apr-2018	Asked if the Project included a refinery.	No response was provided at the time.	The Project does not include a refinery.
Meeting	First Nation of Na-Cho Nyäk Dun	09-Apr-2018	Expressed concerns about oil spills.	Chance acknowledged and recorded the comment.	Chance will develop and implement procedures to prevent the inadvertent release of oil to the ground or waterways. Additionally, Chance will develop an Emergency Spill and Response Plan and implement an Environmental Protection Plan which will include details about environmental monitoring and internal compliance with the spill prevention and response measures.
Meeting	First Nation of Na-Cho Nyäk Dun	09-Apr- 2018	Requested information regarding the quantity of oil and natural gas resources in Eagle Plains in comparison to quantities in other known oil and gas regions.	Chance acknowledged and recorded the comment.	The purpose of the Eagle Plains Exploration Project is to determine the quantity and quality of oil and natural gas resources in Eagle Plains. Chance will then compare that data with existing data from other locations to assess the viability of future development activity. If sufficient oil and/or natural gas resources are discovered, Chance may propose to conduct a future extraction project. Any future extraction project would

Interaction Type	Participant / Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
					undergo an environmental assessment. There is currently no extraction plan.
Consultation and Engagement					
Community Open House Event	First Nation of Na-Cho Nyäk Dun	16-Jun-2014	Stated they were not pleased there was no question-and-answer period after the event and expressed disapproval for the Project.	Chance acknowledged and recorded the comment.	Chance is committed to providing question-and-answer periods at future Project-related community events with First Nation of Na-Cho Nyäk Dun Citizens.
Meeting	First Nation of Na-Cho Nyäk Dun	26-Jan-2023	Commented that the Project development process has been lengthy.	Chance acknowledged and recorded the comment. Chance responded that consultation and engagement is a priority, which requires time, and expressed the desire for open dialogue and feedback. Chance is committed to addressing potentially affected First Nations' concerns.	Chance is committed to building positive and open relationships with all potentially affected First Nations. Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements.
Meeting	First Nation of Na-Cho Nyäk Dun	26-Jan-2023	Expressed a desire for positive relationships between northern Indigenous communities and Chance. Noted the importance of moving forward and for northern First Nations to work together and support one another.	Chance acknowledged and recorded the comment. Chance committed to understanding how each potentially affected First Nation wishes to be engaged and the best ways to share information.	Chance is committed to building positive and open relationships with all potentially affected First Nations. Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements. Chance created and supported opportunities for all potentially affected First Nations to meet with YESAB, Government of Yukon, and Government of Canada to discuss the Project's assessment process and related capacity funding

Interaction Type	Participant / Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
					opportunities for potentially affected First Nations.
Wildlife and Wildlife Habitat					
Meeting	First Nation of Na-Cho Nyäk Dun	03-Aug-2023	Raised concerns on seismic-program related effects on predator-prey relationships.	Chance acknowledged and recorded the comment.	Chance undertook a study on linear features to evaluate potential Project-related effects on the movement of people and animals, as well as the dispersal of plants within a given landscape. Historical linear features are largely naturally revegetated, and more recent linear features are showing good signs of naturally recovering to their original state. Usage of these disturbed areas does not seem to indicate any predatory advantage nor human presence. Two localized conditions limit greater ease of travel. Vegetation is fairly open and has limited effect on impeding movement. Ground cover, thick peat, and graminoid tussocks limit movement (see **Section 9**). Chance utilizes design components, such as using meandering seismic lines, which aim to minimize visual disturbance and make it more difficult for predators and hunters to travel along the lines. Chance is open to further dialogue to best address this issue. Chance shared the *Linear Features Study* for review and records (See **Appendix 8-B**).
Heritage Resources					
Meeting	First Nation of Na-Cho Nyäk Dun	05-May-2021	Stated the importance of receiving contributions from First Nation of Na-Cho Nyäk Dun on heritage resources. Requested to review the heritage studies.	Chance acknowledged and recorded the comment. Chance responded that First Nation of Na-Cho Nyäk Dun's feedback and input on heritage studies is critical. Chance shared 4 heritage studies with First Nation of	Chance continues to be committed to sharing future heritage studies with the First Nation of Na-Cho Nyäk Dun for their review and comment. Chance will work with potentially affected First Nations to support their involvement in future heritage resources studies.

Interaction Type	Participant / Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
				Na-Cho Nyäk Dun in May 2021, January 2022, December 2022, and March 2023 for their review and records.	See **Section 10** for information on Project-related effects to and mitigation measures for heritage resources.

2.7.9 Ongoing Consultation and Engagement

While a consultant for First Nation of Na-Cho Nyäk Dun has indicated that the First Nation does not currently wish to be consulted about the Project prior to proposal submission, Chance will continue to share Project information and updates. However, at any time, if the First Nation of Na-Cho Nyäk Dun wishes to be actively consulted and engaged with, Chance will adapt the Program to reflect such changes. Planned and possible ongoing consultation and engagement activities include (and are not limited to):

- Project communications (e.g., updates regarding schedule, permitting, monitoring activities, incorporation of Indigenous Knowledge to Project plans, capacity funding);
- meetings to discuss Project-related effects, issues, input, and interests;
- opportunities to review and provide comment on Project plans and materials; and,
- opportunities to develop Project-related mitigation measures.

2.8 CONSULTATION AND ENGAGEMENT WITH GWICH'IN TRIBAL COUNCIL, AND RESIDENTS OF INUVIK, FORT MCPHERSON, TSIIGEHTCHIC, AND AKLAVIK

Section 2.8 outlines consultation and engagement activities with Gwich'in Tribal Council and residents of Inuvik, Fort McPherson, Tsiigehtchic, and Aklavik. Information on Project notification, consultation and engagement planning, methods, activities, and agreements, issues, interests, input, and feedback shared through consultation and engagement activities are described in **Sections 2.8.1- 2.8.10**.

2.8.1 Community Profiles

The following subsections describe Gwich'in Tribal Council and the communities of Inuvik, Fort McPherson, Tsiigehtchic, and Aklavik.

2.8.1.1 Gwich'in Tribal Council

> "Ek'italtsi' means Image, or Identity, and sets the tone of who we are as a people, who we see ourselves as, and how we conduct ourselves outwardly. It is a celebration and pride in our history, traditions, and culture." (Gwich'in Tribal Council 2021)

Gwich'in peoples have lived in Alaska, NWT, and the Yukon since time immemorial (Gwich'in Tribal Council, n.d.-a). There are more than 9,000 Gwich'in peoples who live in Alaska, NWT, and the Yukon today (Gwich'in Council International, n.d.). There are 3,500 Gwich'in Participants located in the communities of Aklavik, Inuvik, Teetł'it Zheh (Fort McPherson), and Tsiigehtchic (Gwich'in Tribal Council, n.d.-e).

The Gwich'in Tribal Council represents the interests of Gwich'in peoples in Aklavik, Inuvik, Teetł'it Zheh, and Tsiigehtchic (Gwich'in Tribal Council, n.d.-a; n.d.-h). Its government is comprised of a Grand Chief, the Tetł'it Gwich'in Council, the Ehdiitat Gwich'in Council, and the Nihtat Gwich'in Council.

The current government is composed of: Grand Chief Ken Kyikavichik, Director Grace Martin of the Tetł'it Gwich'in Council, Director Danny Green of the Ehdiitat Gwich'in Council, Director Michael Greenland of the

Ehdiitat Gwich'in Council, Vice President Chris Smith of the Nihtat Gwich'in Council, and Director Kelly McLeod of the Nihtat Gwich'in Council (Gwich'in Tribal Council, n.d.-c).

The Gwich'in Tribal Council owns the Gwich'in Settlement Corporation and the Gwich'in Development Corporation (Gwich'in Tribal Council, n.d.-a). The Gwich'in Settlement Corporation manages capital transfers that Gwich'in Tribal Council receives from the Government of Canada (Gwich'in Tribal Council, n.d.-b). The Gwich'in Development Corporation creates economic opportunities for the Gwich'in Tribal Council by acquiring investments and business partnerships (Gwich'in Development Corporation, n.d.).

Figure 2-4 outlines the governance structure of Gwich'in Tribal Council.

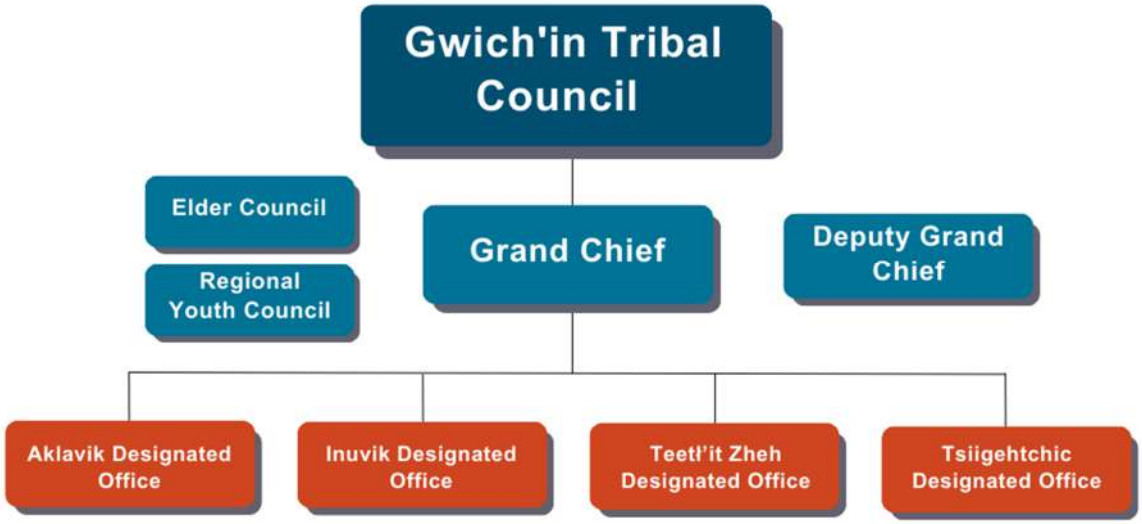


Figure 2-4. Gwich'in Governance Structure

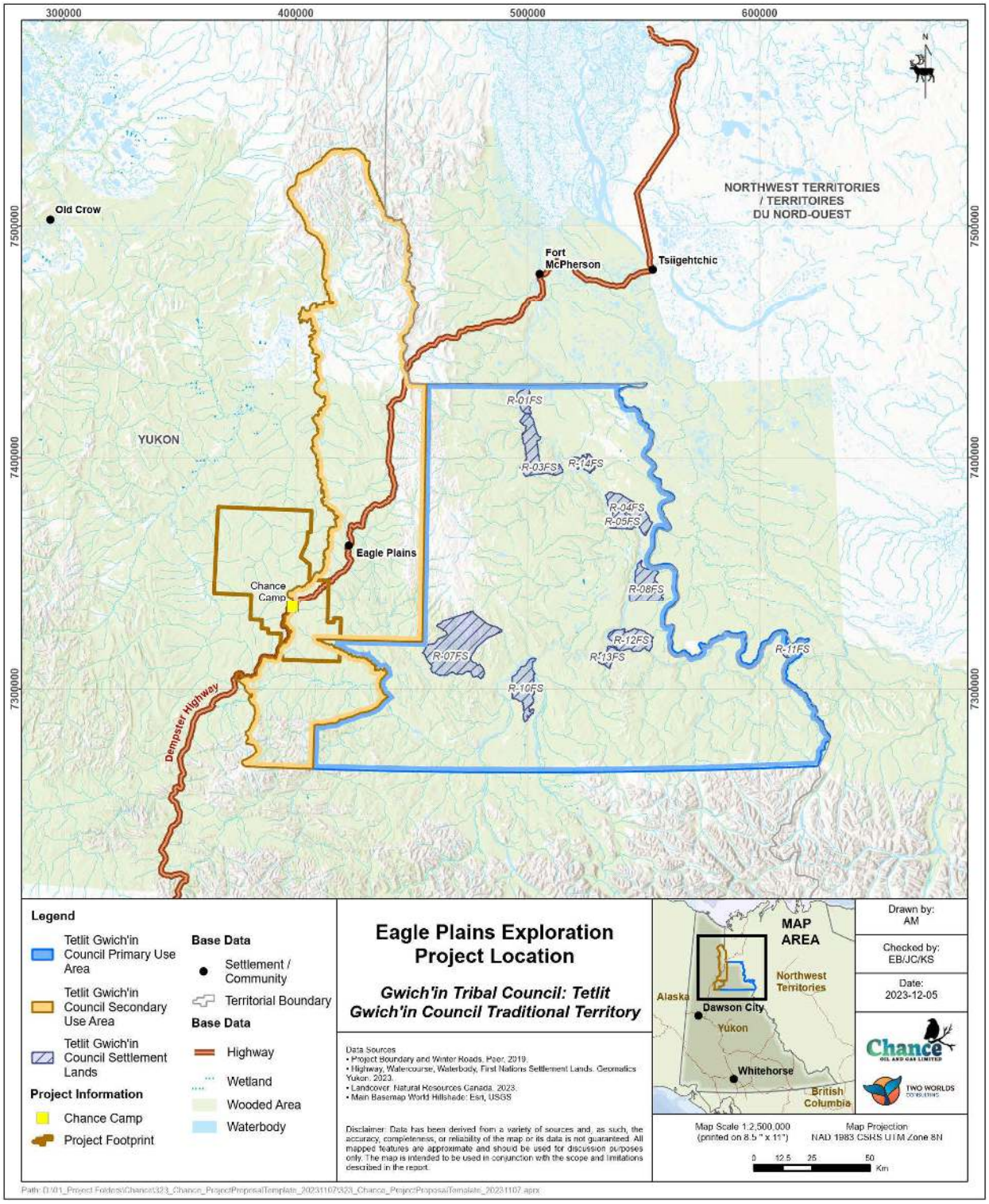
Grand Chief Ken Kyikavichik serves as the Lead Negotiator of the Regional Gwich'in Collaborative, responsible for negotiating the Gwich'in Collaborative Government on behalf of the communities of Aklavik, Teetł'it Zheh (Fort McPherson), and Tsiigehtchic (Gwich'in Tribal Council, n.d.-d).

Gwich'in Tribal Council's main office is in Inuvik, NWT (Gwich'in Tribal Council, n.d.-a). Other Gwich'in Tribal Council offices are in Yellowknife and Edmonton (Gwich'in Tribal Council, n.d.-a).

Gwich'in Tribal Council's Department of Cultural Heritage notes that the Gwich'in language Dinjii Zhu' Ginjik is one of the most endangered Indigenous languages in Canada (Gwich'in Tribal Council Department of Cultural Heritage, n.d.). There are approximately 270 Dinjii Zhu' Ginjik first language speakers as of 2016 (Clark 2020).

The Gwich'in Traditional Territory stretches from Alaska, through the Yukon, to the Mackenzie Valley in the NWT (Gwich'in Tribal Council, n.d.-e). Treaty 11 was signed in July 1921 by the Gwich'in of Tsiigehtchic (previously Arctic Red River) and Teetł'it Zheh (Gwich'in Tribal Council, n.d.-a). **Map 2-3** illustrates current Gwich'in land management and use areas (Gwich'in Tribal Council, n.d.-g). These also include their secondary and primary use areas to the west and south.

In 1992, the Government of Canada, the Government of the Northwest Territories, and Gwich'in Tribal Council signed the *Gwich'in Comprehensive Land Claim Agreement*—also referred to as the Gwich'in Agreement (Government of Canada and Gwich'in Tribal Council 1992; Gwich'in Tribal Council, n.d.-f). This modern treaty agreement includes information on ownership of land, economic benefits, land and environmental management, hunting and fishing, and self-governance.



Map 2-3: Gwich'in Tribal Council: Tetlit Gwitch'in Council Traditional Territory

2.8.2 Inuvik

The Town of Inuvik (Inuvik) is located 200 km north of the Arctic Circle, on the traditional lands of the Inuvialuit, Gwich'in, and Métis people (Town of Inuvik 2021a). It was established in the 1950s to support the federal government's relocation of the community of Aklavik, which was experiencing severe flooding damage. Today, Aklavik remains in its original location (Government of the Northwest Territories n.d.). Inuvik achieved municipal incorporation in 1979 and is currently the third largest community in the NWT (Municipal and Community Affairs n.d.b). It is the administrative centre for the Beaufort Delta (Town of Inuvik 2021b), and currently has a population of 3,137 residents (Statistics Canada 2023c).

Inuvik is governed by a council composed of one mayor and eight councillors. The current town council, in office from 2021 to 2024, is comprised of: Mayor Clarence Wood, Deputy Mayor Natasha Kulikowski, and Councillors Whitney Alexis, Ned Day, Tony Devlin, Grant Gowans, Jesse Harder, Alana Mero, and Kurt Wainman (Town of Inuvik 2021d).

Key economic sectors in Inuvik include transportation, construction, petroleum exploration, and public administration. Additionally, there is growth potential in the tourism industry (Town of Inuvik 2021b). Most residents are employed in territorial and local governments and Indigenous government offices (Town of Inuvik 2021a). Residents continue to engage in traditional economies through hunting, trapping, and fishing, which are an integral part of the community's culture and economy.

Inuvik has the only hospital facility in the Beaufort Delta region, offering diverse medical services, including emergency care, acute treatment, diagnostic imaging, laboratory testing, long-term care, rehabilitation, health education and promotion, obstetrical care, operating room services, and an on-site pharmacy. Specialists from Yellowknife and Edmonton offer services on a rotational basis, such as dermatology, ear, nose and throat care, gynecology, internal medicine, neurology, ophthalmology, orthopaedics, pediatrics, psychiatry, and surgery as needed (Town of Inuvik 2021e). The Inuvik hospital serves Fort McPherson, Aklavik, Tsiigehtchic, Tuktoyaktuk, Paulatuk, Sach's Harbour, and Ulukhaktok (Practice NWT n.d.).

There is one elementary school (Kindergarten to Grade 7), the East Three Elementary School, and one secondary school (Grade 7-12), the East Three Secondary School (Beaufort Delta Divisional Education Council 2021). Aurora College, a post-secondary institution, provides services including academic upgrading, diploma and degree options, technical training, apprenticeships, and continuing education opportunities (Town of Inuvik 2021c).

Please refer to **Section 11** for more socio-economic information regarding Inuvik.

2.8.2.1 Fort McPherson

The traditional name of the Hamlet of Fort McPherson (the Hamlet) is Teet'lit Zheh, which means "place at the head waters". The name's origin lies in its location on the east bank of Teetł'it Gwinjik in the Beaufort Delta (Spectacular Northwest Territories 2019). Incorporated as a municipality in 1986, the Hamlet was established in 1849 when a Hudson's Bay Company trading post was set up 4 miles from the current community (Hamlet of Fort McPherson 2010a). As of 2021, the Hamlet had a population of 647 (Statistics Canada 2023a).

The Hamlet's municipal government is composed of one mayor and eight councillors, each elected for a 3-year term. The most recent election was held in December 2023 (GNWT 2023), which resulted in the election of: Mayor Rebecca Blake and Councillors Stanley Snowshoe, George Nerysoo, Joyce Blake, Sierra

Daley, Kyla Ross, Ruby McDonald, Priscilla Itsi, and Lawrence Firth (Municipal and Community Affairs n.d.a).

Fort McPherson's economy is highly dependent on employment and economic opportunities from the Government of Northwest Territories. The Hamlet, the Designated Gwich'in Organization, and the school are the main employers (Hamlet of Fort McPherson 2010b). The Hamlet also relies on the construction and transportation industries, along with local businesses such as the Fort McPherson Tent and Canvas Factory (Hamlet of Fort McPherson 2010a; 2010b).

The William Firth Sriigwindaih Zheh Health Centre provides general healthcare services via nursing staff and visiting practitioners that provide primary care to Fort McPherson residents (Health and Social Services Authority n.d.b; Practice NWT n.d.). The nearest hospital is in Inuvik, 186 km away and accessible by road (Town of Inuvik 2021e).

Fort McPherson has one school (Kindergarten to Grade 12), the Chief Julius School, operated by the Beaufort Delta Education Council (Beaufort Delta District Education Council 2021).

Please refer to **Section 11** for more socio-economic information regarding Fort McPherson.

2.8.2.2 Tsiigehtchic

Tsiigehtchic, formerly known as Arctic Red River, is a charter community in the Beaufort Delta, which overlooks the confluence of the Mackenzie River and Arctic Red River (Ecology North 2010). Tsiigehtchic translates to "at the mouth of the iron river" in the Gwich'in language, which may be in reference to an iron mineral deposit found in the soil further up the Arctic Red River (Gwich'in Tribal Council, n.d.-a). In 2021, the population of Tsiigehtchic was 138 (Statistics Canada 2023d).

The municipal government is composed of the Gwichya Gwich'in Council's elected Chief and Council, one Chief and three councillors elected by the First Nation's election code, and two additional councillors elected through the NWT's *Local Election Act* (Ingrid Kritsch 2012).

The economy of Tsiigehtchic is primarily comprised of public administration, education services, utilities, administrative support, waste management and remediation services (Statistics Canada 2023d).

The Tsiighehtchic Health Centre provides general primary care services via nursing staff and visiting practitioners (Health and Social Services Authority n.d.c; Practice NWT n.d.). The nearest hospital is in Inuvik, 129 km away by road (Town of Inuvik 2021e).

Tsiigehtchic has one school (Kindergarten to Grade 12), the Chief Paul Nidtichis School, operated by the Beaufort Delta Education Council (Beaufort Delta District Education Council 2023a).

Please refer to **Section 11** for more socio-economic information regarding Tsiigehtchic.

2.8.2.3 Aklavik

Aklavik translates to "barren ground grizzly place" (Spectacular Northwest Territories 2023) and is located on the Peel channel of the Mackenzie River Delta (Gwich'in Tribal Council 2016). According to the 2021 Census, Aklavik's population is 536 (Statistics Canada 2023b).

Aklavik's economy is primarily supported by public administration, educational services, construction, retail, and health care and social assistance (Statistics Canada 2023b).

The Susie Husky Health and Social Services Centre, Aklavik's health centre, provides general health services via nursing staff and visiting practitioners that provide primary care to residents ((Health and Social Services Authority n.d.a; Practice NWT n.d.). The nearest hospital is in Inuvik, only accessible by plane (Town of Inuvik 2021e).

Aklavik has one school (Kindergarten to Grade 12), the Moose Kerr School, operated by the Beaufort Delta Education Council (Beaufort Delta District Education Council 2023b).

Please refer to **Section 11** for more socio-economic information regarding Aklavik.

2.8.3 Project Notification

Chance initiated engagement with Gwich'in Tribal Council on December 1, 2017. Chance sent a letter (**Appendix 2-B Gwich'in Tribal Council and Residents of Inuvik, Fort McPherson, Tsiigehtchic, and Aklavik Consultation and Engagement Records**) to Gwich'in Tribal Council about the *Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan* and next steps to develop a partnership with Gwich'in Tribal Council.

Chance initiated consultation and engagement with residents of Aklavik, Inuvik, Tsiigehtchic, and Fort McPherson at community open house events in August 2019.

2.8.4 Consultation and Engagement Planning

Chance developed the *Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan* (**Appendix 2-B**) outlining a proposed engagement approach with Gwich'in Tribal Council. The plan included information on communication pathways, meeting process, engagement documentation, and adaptive management.

Chance shared the *Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan* with Gwich'in Tribal Council for review and comment and received a signed copy from Gwich'in Tribal Council on January 9, 2019. The implementation of this proposed engagement approach remains ongoing.

2.8.5 Consultation and Engagement Methods

Engagement methods with Gwich'in Tribal Council up to December 20, 2023, included

- meetings (virtual and in-person);
- teleconference;
- letters;
- handouts;
- correspondence via phone call, text message, and email;
- community open house event; and,
- information sharing (e.g., sharing Project documents for review and comment).
- Chance will adjust consultation and engagement methods in response to feedback from Gwich'in Tribal Council throughout the life of the Project.

Consultation and engagement methods with residents of Inuvik, Fort McPherson, Tsiigehtchic, and Aklavik up to December 20, 2023 included community open house events and handouts.

2.8.6 Consultation and Engagement Activities

Table 2-4 outlines engagement activities undertaken with Gwich'in Tribal Council and residents of Inuvik, Fort McPherson, Tsiigehtchic, and Aklavik up to December 20, 2023.

Engagement materials such as presentations and handouts shared with Gwich'in Tribal Council and residents of Inuvik, Fort McPherson, Tsiigehtchic, and Aklavik have been compiled in **Appendix 2-B** of this Project Proposal. Where appendices were unavailable for compilation, **Table 2-4** indicates as such with an asterisk.

Table 2-4. Consultation and Engagement Activities with Gwich'in Tribal Council and Residents of Inuvik, Fort McPherson, Tsiigehtchic, and Aklavik

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Gwich'in Tribal Council	Correspondence via phone call, text message, meeting, and email	Ongoing	Coordinating engagement activities and sharing Project information.
Gwich'in Tribal Council	Letter	22-Jan-2015	Received a letter stating that Gwich'in Tribal Council reviewed Chance's Project application against their heritage databases and listed their concerns. These concerns are listed in Table 4: Consultation and Engagement Feedback from Gwich'in Tribal Council and Residents of Inuvik, Fort McPherson, Tsiigehtchic, and Aklavik (**Appendix 2-B**).
Gwich'in Tribal Council	Letter	26-Sep-2016	Sent a letter to Gwich'in Tribal Council discussing the Project, future meetings, partnership opportunities for First Nations, information regarding the Judicial Review, and the protection of the PCH (**Appendix 2-B**).
Gwich'in Tribal Council Tetł'it Gwich'in Council	Letter	01-Dec-2017	Provided Tetł'it Gwich'in Council with information on the Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan that Chance wished to develop in partnership with Tetł'it Gwich'in Council (**Appendix 2-B**).
Chance Gwich'in Tribal Council	Meeting	22-Jan-2018	Discussed relationship-building, future Project consultation engagement activities, and the communications and engagement plan Chance hoped to develop (**Appendix 2-B**)*.
Chance Gwich'in Tribal Council Tetł'it Gwich'in Council	Meeting	24-Apr-2018	Discussed Project information, roles and responsibilities, relationship building, and the communications and engagement plan that Chance hoped to develop (**Appendix 2-B**).
Gwich'in Tribal Council	Document sharing for review and comment	07-May-2018	Shared the Draft Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan (**Appendix 2-B**).
Chance Tetł'it Gwich'in Council	Document sharing for records	08-May-2018	Shared a map related to the extension of their exploration permits (**Appendix 2-B**). An updated map showing exploration permit areas is in **Section 1** of the Project Proposal.
Gwich'in Tribal Council Tetł'it Gwich'in Council	Letter	08-May-2018	Notified Gwich'in Tribal Council and Tetł'it Gwich'in Council about extending exploration tenure permits (**Appendix 2-B**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Gwich'in Tribal Council	Meeting	29-May-2018	Discussed the Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan and draft meeting minutes from April 24, 2018 (**Appendix 2-B**)*.
Gwich'in Tribal Council	Meeting	27-Jul-2018	Discussed and reviewed the Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan (**Appendix 2-B**)*.
Gwich'in Tribal Council	Meeting	31-Jul-2018	Discussed and reviewed the Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan (**Appendix 2-B**)*.
Gwich'in Tribal Council	Meeting	01-Aug-2018	Discussed final revisions to the *Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan* and agreed that the plan did not need to be signed (**Appendix 2-B**)*.
Gwich'in Tribal Council	Document sharing for records	01-Aug-2018	Final Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan (**Appendix 2-B**)*.
Gwich'in Tribal Council	Document sharing for review and comment	15-Oct-2018	Shared the Draft *Terms of Reference (TOR)* (Version 1) (**Appendix 2-B**)*.
Chance Gwich'in Tribal Council	Meeting	17-Oct-2018	Discussed implementation of the Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan. Identified the members of the Communications and Consultation Management Committee (**Appendix 2-B**)*.
Gwich'in Tribal Council	Document sharing for review and comment	24-Oct-2018	Shared the Draft *Confidentiality Agreement* (**Appendix 2-B**).
Gwich'in Tribal Council	Document sharing for records	13-Nov-2018	Shared a map of Chance's permitted Project footprint (**Appendix 2-B**)*.
Gwich'in Tribal Council	Document sharing for records	13-Nov-2018	Shared the Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan (**Appendix 2-B**)*.
Gwich'in Tribal Council	Document sharing for records	13-Nov-2018	Shared the Draft *TOR* (**Appendix 2-B**)*.
Gwich'in Tribal Council	Meeting	15-Nov-2018	Discussed implementation of the *Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan* and next steps between Gwich'in Tribal Council and Chance (**Appendix 2-B**)*.

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Gwich'in Tribal Council	Document sharing for records	21-Nov-2018	Shared the Draft *TOR* (Version 2) (**Appendix 2-B**)*.
Chance Gwich'in Tribal Council	Meeting	14-Dec-2018	Discussed the Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan, draft Cooperation Agreement, TOR, and Confidentiality Agreement. (**Appendix 2-B**)*.
Chance	Document sharing for records	09-Jan-2019	Shared a signed Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan with Chance for their records (**Appendix 2-B**).
Chance First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Government of Yukon	Meeting	01-Feb-2019	Discussed the First Nation Consultation Plans, the *Vuntut Gwitchin First Nation Oil and Gas Engagement Policy*, and the *Draft Project Description* (Version 1) (**Appendix 2-B**).
Gwich'in Tribal Council	Letter	26-Mar-2019	Notified Gwich'in Tribal Council of Chance's tenure extension request (**Appendix 2-B**).
Gwich'in Tribal Council	Fieldwork (Email)	21-May-2019	Provided Tetł'it Gwich'in Council a formal notification regarding fieldwork to extract rock samples out of Eagle Plains Basin planned between July 10 and 24, 2019. (**Appendix 2-B**).
Gwich'in Tribal Council	Document sharing for records	05-Jun-2019	Shared the Draft *Project Description* (**Appendix 2-B**).
Gwich'in Tribal Council	Meeting	07-Jun-2019	Met with Gwich'in Tribal Council leadership to discuss the Project, land tenure extension requests to the Government of Yukon, and consultation and engagement (**Appendix 2-B**).
Nihtat Gwich'in Council	Document sharing for records	10-Jun-2019	Shared a Draft *Project Description* with Nihtat Gwich'in Council (**Appendix 2-B**).
Gwich'in Tribal Council	Document sharing for records	14-Jun-2019	Shared the Eagle Plains Environmental Studies 2018 (**Appendix 2-B**).
Gwich'in Tribal Council	Letter	14-Jun-2019	Shared a notice letter with Gwich'in Tribal Council stating EDI will be conducting fish and environmental studies scheduled from July 1 to July 10, 2019, pending authorization from the Fisheries and Oceans Canada (DFO) license (**Appendix 2-B**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Gwich'in Tribal Council	Fieldwork (Email)	17-Jun-2019	Invited Gwich'in Tribal Council to send 2 Gwich'in Participants to join the planned environmental monitoring programs for the summer (**Appendix 2-B**).
Chance Gwich'in Tribal Council Residents of Tsiigehtchic	Community Open House Event	19-Aug-2019	Chance met with Gwich'in Participants and residents of Tsiigehtchic to provide a Project update. The open house included a presentation and catered dinner. In total, 14 Gwich'in Participants and residents of Tsiigehtchic attended the open house (**Appendix 2-B**)*.
Chance Gwich'in Tribal Council Residents of Inuvik	Community Open House Event	20-Aug-2019	Met with Gwich'in Participants and residents of Inuvik to provide a Project update. The open house included a presentation and catered dinner. In total, 8 Gwich'in Participants and residents of Aklavik attended the open house (**Appendix 2-B**)*.
Chance Gwich'in Tribal Council Residents of Aklavik	Community Open House Event	21-Aug-2019	Met with Gwich'in Participants and residents of Aklavik to provide a Project update. The open house included a presentation and catered dinner. In total, 10 Gwich'in Participants and residents of Aklavik attended the open house (**Appendix 2-B**)*.
Chance Gwich'in Tribal Council Residents of Fort McPherson	Community Open House Event	22-Aug-2019	Met with Gwich'in Participants and residents of Fort McPherson to provide a Project update. The open house included a presentation and catered dinner (**Appendix 2-B**)*.
Chance	Letter	18-Sep-2019	Shared a letter with Chance that Gwich'in Social and Cultural Institute drafted for YESAB (**Appendix 2-B**).
Gwich'in Tribal Council	Meeting	22-Nov-2019	Met with Gwich'in Tribal Council about the Project (**Appendix 2-B**)*.
Gwich'in Tribal Council	Document sharing for records	22-Nov-2019	Shared the Project Summary (**Appendix 2-B**).
Gwich'in Tribal Council	Letter	22-May-2020	Shared a letter titled Initiation of Engagement for Eagle Plain Well Maintenance Project (**Appendix 2-B**).
Gwich'in Tribal Council	Document sharing for records	18-Jun-2020	Shared the Draft *Project Description* (Version 1) (**Appendix 2-B**).
Chance	Document sharing for records	08-Jul-2020	Shared the memo titled *Response to Gwich'in Tribal Council Comments* on the Eagle Plain Well Maintenance Project. These comments from Gwich'in Tribal Council were originally received by Chance on June 18, 2020 (**Appendix 2-B**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Gwich'in Tribal Council	Document sharing for review and comment	13-Jul-2020	Draft 2020 Annual Report on the Implementation of Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan (**Appendix 2-B**).
Chance Gwich'in Tribal Council	Meeting	22-Jul-2020	Discussed Project design changes resulting from consultation and engagement feedback and refinement of the *Draft Project Description* (Version 1) (**Appendix 2-B**).
Chance	Document sharing for review and comment	30-Jul-2020	Provided comments on the Draft 2020 Annual Report on the Implementation of Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan (**Appendix 2-B**).
Chance	Document sharing for review and comment	02-Sep-2020	Provided comments on the Draft *Project Description* (Version 1) with Chance (**Appendix 2-B**)*.
Chance Gwich'in Tribal Council	Virtual meeting	16-Nov-2020	Met with recently elected Gwich'in Tribal Council leadership to introduce the company and Project (**Appendix 2-B**).
Chance Gwich'in Tribal Council	Meeting	03-Jun-2021	Presented on the Draft *Project Description* (Version 1) and provided updates regarding baseline information gathered by its consultants. Chance and Gwich'in Tribal Council discussed consultation and engagement next steps. Gwich'in Tribal Council brought up concerns regarding the Mix Bury Cover (MBC) sumps, water usage, depths of disposal wells, and the presence of aquifers in those areas (**Appendix 2-B**).
Gwich'in Tribal Council	Document sharing for review and comment	17-Jun-2021	Shared the Draft *Project Description* (Version 1) (**Appendix 2-B**).
Gwich'in Tribal Council	Document sharing for records	30-Jun-2021	Shared the *Suitability Map and Surficial Geology* document from Palmer (**Appendix 2-B**).
Gwich'in Tribal Council	Document sharing for review and revisions	16-Jul-2021	Shared the Draft 2021 Annual Report: Implementation of the Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan (**Appendix 2-B**).
Gwich'in Tribal Council	Document sharing for records	23-Jul-2021	Shared the ground photos of Devon Sump (**Appendix 2-B**).
Chance	Letter	30-Aug-2021	Shared feedback on the *2021 Annual Engagement Plan* (**Appendix 2-B**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Gwich'in Tribal Council	Document sharing for review and signature	10-Sep-2021	Shared the updated draft *2021 Annual Engagement Plan* and outlined changes made based on Gwich'in Tribal Council's feedback. Gwich'in Tribal Council requested a change to the Gwich'in Tribal Council signatory name. Chance provided an updated copy for signing (**Appendix 2-B**).
First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Tr'ondëk Hwëch'in	Document sharing for records	17-Dec-2021	Shared the letter to the Government of Yukon, Land Tenure Extension Request for Exploration (Permits 0008-0017, 0019 and 0020 ("Permits") (**Appendix 2-B**).
Chance First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Government of Yukon	Document sharing for review and comment	20-Jan-2022	Provided an updated Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2022 Interim Report (22-22ASR) (**Appendix 2-B**).
Gwich'in Tribal Council	Letter	07-Jun-2022	Stated Chance would like to propose initial terms of reference for ongoing engagement and for the collaborative process necessary to conclude a *Cooperation Agreement* (**Appendix 2-B**).
Chance First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Government of Yukon	Document sharing for review and comment	29-Nov-2022	Provided an updated Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2022 Interim Report (22-22ASR) (**Appendix 2-B**).
Chance Gwich'in Tribal Council First Nation of Na-Cho Nyäk Dun Tr'ondëk Hwëch'in Vuntut Gwitchin First Nation	Meeting	26-Jan-2023	Hosted an in-person meeting in Vancouver, BC to re-establish collaborative working relationships, discuss consultation and engagement preferences going forward, and provide a Project update (**Appendix 2-B**).
Gwich'in Tribal Council	Letter	07-Mar-2023	Sent Gwich'in Tribal Council a letter regarding a land tenure extension for Exploration Permits 0012-0017, and 0020 (**Appendix 2-B**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Chance First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Government of Yukon	Document sharing for review and comment	15-Mar-2023	Provided an updated Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2022 Interim Report (22-22ASR) (**Appendix 2-B**).
Gwich'in Tribal Council	Letter	05-Apr-2023	Notified Gwich'in Tribal Council of potential future socio-economic data collection starting June 11, 2023. Requested a meeting in Old Crow on May 15, 2023. Included a summary of the Project and a proposed schedule for engagement (**Appendix 2-B**).
Gwich'in Tribal Council	Meeting	16-May-2023	Provided a Project update (**Appendix 2-B**)*.
Gwich'in Tribal Council Residents of Inuvik	Community Open House Event	16-May-2023	Held a community open house in Inuvik at the Nihtat Gwich'in Council Board Room. Six community members attended this event and provided feedback. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to open house attendees. (**Appendix 2-B**).
Gwich'in Tribal Council	Meeting	17-May-2023	Hosted an in-person meeting with Grand Chief Ken Kyikavichik staff from the Gwich'in Development Corporation, and Chance and the Project team to discuss Project updates, Gwich'in Tribal Council and Gwich'in Development Corporation's consultation and engagement preferences, and to give an overview of the May 16, 2023, Open House in Inuvik (**Appendix 2-B**).
Gwich'in Tribal Council	Document sharing for review and comment	13-Jul-2023	Shared the Draft *Project Description* (Version 2) (**Appendix 2-B**).
Tetłʼit Gwich'in Council	Document sharing for review and comment	14-Jul-2023	Shared the Draft *Project Description* (Version 2) (**Appendix 2-B**).
Gwich'in Tribal Council	Virtual meeting	29-Aug-2023	Shared the re-introduced the Draft *Project Description* (Version 2) and discussed engagement (**Appendix 2-B**).
Gwich'in Tribal Council	Virtual meeting	27-Sep-2023	Re-introduced the Draft *Project Description* (Version 2) and discussed engagement. Discussed topics included: information on exploration, design changes, baseline studies, and the assessment process (**Appendix 2-B**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Chance Potentially affected First Nations Gwich'in Tribal Council Government of Canda YESAB Government of Yukon	Meeting	13-Oct-2023	Discussed the Project's assessment process including capacity funding and possible efficiencies through a coordinated approach (e.g., sharing consultants to support potentially affected First Nations' review of the Draft *Project Description* (Version 2) (**Appendix 2-B**).
Chance EDI TWC Gwich'in Tribal Council	Meeting	01-Nov-2023	Discussed Project Proposal updates and schedule, as well as upcoming Consultation and engagement activities. Discussed how the Gwich'in Tribal Council is experiencing ongoing capacity challenges. Gwich'in Tribal Council shared concerns about cumulative effects in the Peel Watershed and cumulative effects of greenhouse gas emissions (**Appendix 2-B**).
Chance EDI TWC Gwich'in Tribal Council	Meeting	04-Dec-2023	Discussed upcoming consultation and engagement activities. Gwich'in Tribal Council expressed concerns about lack of cultural or heritage baseline data. See **Section 2.8.9** for more information on how Chance responded to this feedback (**Appendix 2-B**).
Chance Gwich'in Tribal Council Staff Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	Community Open House Event	07-Dec-2023	Held a hybrid online and in-person community open house in Fort McPherson at the Tetlit' Zheh Fort McPherson Hamlet Chamber. Twenty-Six Gwich'in Participants attended this event. Chance shared Project information through a PowerPoint presentation, a Project Overview Video, posterboards, and a 1-page handout. Chance provided a catered dinner, door prizes, and responded to questions and presented Project information to open house attendees. (**Appendix 2-B**).
First Nation of Na-Cho Nyäk Dun Gwich'in Tribal Council Porcupine Caribou Management Board Tr'ondëk Hwëch'in Vuntut Gwitchin First Nation Government of Yukon Chance EDI	Meeting	20-Dec-2023	Discussed completed environmental baseline studies; potential effects on fish and wildlife and potential mitigation measures for fish and wildlife; potential PCH effects and potential mitigations; and the *Linear Features Study* and North Yukon Land Use Planning conformity (**Appendix 2-B**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
TWC			
* = Appendix was not available at the time this section was drafted.			

2.8.7 Agreements

Chance and Gwich'in Tribal Council have not discussed any formal agreement for the Project to date.

2.8.8 Records Management

Appendix 2-B includes a record of contact documenting all consultation and engagement activities including emails, phone calls, text messages, letters, meetings, and events between Chance and Gwich'in Tribal Council up to December 20, 2023 and a record of contact documenting all consultation and engagement activities with residents of Inuvik, Fort McPherson, Tsiigehtchic, and Aklavik up to December 20, 2023 (**Appendix 2-B**).

2.8.9 Consultation and Engagement Feedback (Effects, Issues, and Interests)

Chance sought to obtain feedback from potentially affected First Nations and residents of communities through Project engagement activities. **Table 2-5** presents effects, issues, and interests shared by Gwich'in Tribal Council and residents of Inuvik, Fort McPherson, Tsiigehtchic, and Aklavik with Chance up to December 20, 2023.

Table 2-5. Gwich'in Tribal Council Consultation and Engagement Key Issues and Feedback

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Aquatic Resources					
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked if the Project considered potential effects to frogs.	Project activities are primarily in winter when frogs will be dispersed and hibernating below the soil surface. Due to primary winter activities and minimal soil disturbance, Project interactions with frogs are expected to be negligible and were not evaluated further.	Comment was addressed at the time it was shared. See **Section 8** for more information on Project-related effects on and protection measures for wildlife and wildlife habitat.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked if the Project considered potential effects to invertebrates including water insects.	Due to primary winter activities and minimal soil disturbance, Project interactions with invertebrates are expected to be negligible and were not evaluated further.	Comment was addressed at the time it was shared. See **Section 8** for more information on Project-related effects on and protection measures for wildlife and wildlife habitat.
Project Design					
Letter	Gwich'in Tribal Council	22-Jan-2015	Expressed concern for the size of the Project, the number of wells, and establishment of new all-season roads.	Chance acknowledged and recorded the comment.	Chance modified the Project design to eliminate all-season roads from the Project. Instead, Chance will utilize winter ice roads. Chance acknowledges Gwich'in Tribal Council's concerns about the number of well sites. **Section 1** describes how the well sites and design will incorporate key features to enhance efficiency, reduce waste, and minimize general effects on the surrounding environment (see **Section 1**). Chance will limit traffic on the winter access to authorized personnel. Traffic will include approximately 8 to 9 light-weight service trucks daily (for supplies

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
					and personnel), 1 to 2 water trucks, and 1 fuel truck as frequently as exploration activities dictate (see **Section 1**).
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked about mercury and fire effects on well heads.	The Chance Project Team said no mercury or fire effects are expected.	Comment was addressed at the time it was shared. See **Section 1** for more information on Project design.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked Chance to clarify what dog legged means.	The Chance Project Team clarified that the term "dog legged" referred to crocked or bent. This term was used in reference to the proposed seismic activities for the Project versus more traditional grid seismic lines from the 1990s.	Chance utilizes design components, such as using meandering seismic lines, which aim to minimize visual disturbance and make it more difficult for predators and hunters to travel along the lines. Chance is open to further dialogue to best address this issue. See **Section 1** for more information on Project design.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked where Project sewage will go (e.g., river, lake, or land).	The Chance Project Team said all wastewater and sewage will be collected in tanks approved by the Canadian Standards Association and transported offsite for disposal at an approved facility in Fort McPherson.	Comment was addressed at the time it was shared. See **Section 1** for more information on Project design.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked about the end users of oil and gas products from the Project.	The Chance Project Team confirmed end users of a potential future extraction project are expected to be folks and businesses from Yukon and NWT. Confirmed any future extraction Project would undergo an environmental assessment.	If sufficient oil and/or natural gas resources are discovered, Chance may propose to conduct a future extraction project. Any future extraction project would undergo an environmental assessment. There is currently no extraction plan. Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
				Confirmed this Project has no end-use product and focuses on exploration.	See **Section 1** for more information on Project design.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked how Chance collects seismic data.	The Chance Project Team confirmed seismic data are collected by technology called geophones. Added that geophones are placed in the ground and then picked up by helicopter and taken to a lab for data analysis.	Comment was addressed at the time it was shared. See **Section 1** for more information on Project design.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked if Chance is only drilling in the winter.	The Chance Project Team confirmed that Project drilling activities will occur only in the winter.	Comment was addressed at the time it was shared. See **Section 1** for more information on Project design.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked how many wells there are so far.	The Chance Project Team confirmed there are 6 existing wells in the Eagle Plains area. Added that Chance is proposing to drill up to 30 wells over a 10-year period.	Comment was addressed at the time it was shared. See **Section 1** for more information on Project design.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked how Chance reclaims well sites.	The Chance Project Team said progressive reclamation will be ongoing throughout the Project. Added that wells will be plugged and covered to support natural revegetation.	Comment was addressed at the time it was shared. See **Section 1** for more information on Project design.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson	07-Dec-2023	Asked how many roads the Project will have, how deep the drilling will be, what type of drill will be used, how many wells are anticipated, if there will be fracking,	Chance acknowledged and recorded the comment. Chance responded that there will be 2 roads, the drilling will be up to 2.5 km deep, that there will be no fracking, there will be up to 30 wells, and	Comment was addressed at the time it was shared. See **Section 1** for more information on Project design.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
	Residents of Tsiigehtchic Residents of Aklavik		and what methods will be used to extract oil and gas.	explained that the Project strives to confirm the quality and quantity of oil and gas in the Project footprint.	
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Inquired about what the Project is going to do to get the oil from the ground.	The Chance Project Team shared that the Project only includes exploration activities. Extraction activities are not part of the Project.	Any future extraction project would undergo an environmental assessment. There is currently no extraction plan. See **Section 1** for more information on Project design.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Asked how many wells will be drilled.	The Chance Project Team confirmed up to 30 wells will be drilled over a 10-year period.	Comment was addressed at the time it was shared. See **Section 1** for more information on Project design.
Consultation and Engagement					
Meeting	Gwich'in Tribal Council	16-Nov-2020 26-Jan-2023	Expressed interest in further understanding Project timelines and a collaborative approach with proponents, requesting Chance to provide additional time for reviewing Project documents, with the aim to communicate effectively to Citizens.	Chance acknowledged and recorded the comment.	Chance is committed to building positive and open relationships with all potentially affected First Nations. Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Meeting	Gwich'in Tribal Council	26-Jan-2023	Expressed interest in advancing discussions around historic and current use of the land in the Project footprint and associated effects on Treaty rights and access.	Chance acknowledged and recorded the comment.	Chance is committed to building positive and open relationships with all potentially affected First Nations. Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Suggested Chance advertise future community engagement events in Inuvik at the post office, churches, and the grocery store. Asked if Chance is talking to Elders. Added that it is important to listen and follow what Elders say as they have wisdom and know what they are talking about. Noted Elders are not on Facebook. Mentioned the importance of knowing both sides of the story to the best decision is made.	Chance acknowledged and recorded the comment.	Comment was addressed at the time it was shared.
Meeting	Gwich'in Tribal Council	17-May-2023	Asked Chance to use language depicting the Project's effects on the area instead of characterizing its significance. Acknowledged the importance of providing	Chance acknowledged and recorded the comment.	Chance is committed to building positive and open relationships with all potentially affected First Nations. Chance acknowledges Gwich'in Tribal Council's comment and will focus on accurately assessing and describing

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
			the community with the appropriate context for discussing potential effects and illustrated how specific language can be misleading.		effects and communicating those to potentially affected First Nations. Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements.
Meeting	Gwich'in Tribal Council	27-Sep-2023	Emphasized the need for pre-approval prior to initiating consultation and engagement activities.	Chance acknowledged and recorded the comment. Chance seeks guidance from the Gwich'in Tribal Council for leadership-specific consultation and engagement activities.	Chance is committed to building positive and open relationships with all potentially affected First Nations. Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Rated the Open House "OK to Very Satisfied". Stated that the Open House had a lot of good information. Stated that the event helped them learn more about Chance and the Project. Stated that the Open House had good information on Chance and the Project.	Chance acknowledged and recorded the comment.	Comment was addressed at the time it was shared.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson	07-Dec-2023	Noted they were not able to share their thoughts, ideas, and knowledge during the event in a comfortable manner.	Chance acknowledged the comment and will look at finding additional opportunities for Gwich'in Participants to comfortably share their thoughts, ideas, and knowledge during future	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
	Residents of Tsiigehtchic Residents of Aklavik			community events for the Project.	
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Tsiigehtchic Residents of Aklavik Residents of Fort McPherson	07-Dec-2023	Noted that the Open House felt rushed.	Chance acknowledged the comment and shared that the Chance Project Team was informed by the venue that the room had accidentally been double booked. The planned four-hour event was compressed into two hours. Future Project-related events will be longer to avoid attendees from feeling rushed.	Comment was addressed at the time it was shared.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Stated that when seeing data, it is good to see real time photos of a site, such as ground drill holes to understand the information.	Chance acknowledged the comment and will make photos of the drill holes available to Gwich'in Participants, if the Project is approved.	Comment was addressed at the time it was shared.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Suggested having a "coffee house" platform at the end of the event to enable one-on-one discussions.	Chance acknowledged the comment and will implement opportunities for more one-on-one discussions at the end of future community events for the Project.	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Community Health and Well-being					
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked about potential Project-related effects to Inuvik and mentioned increased community investments could influence their decision-making around extending their existing work contract in Inuvik.	The Chance Project Team confirmed they hired Two Worlds Consulting to assess potential Project-related effects to communities. Added that this assessment is still underway and will be described in the Project Proposal.	Comment was addressed at the time it was shared. See **Section 11** for more information on Project-related effects on and mitigation measures for community health and well-being.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Noted Inuvik needs more community amenities such as Tim Hortons.	Chance acknowledged and recorded the comment.	Comment was addressed at the time it was shared. See **Section 11** for more information on Project-related effects on and mitigation measures for community health and well-being.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Shared difficulty access fresh produce in the spring after the ice road closes.	Chance acknowledged and recorded the comment.	Comment was addressed at the time it was shared. See **Section 11** for more information on Project-related effects on and mitigation measures for community health and well-being.
Birds					
Document Sharing: Memorandum in Response to Gwich'in Tribal Council Comments	Gwich'in Tribal Council	08-Jul-2020	Requested Chance minimize disturbance to soils and vegetation to protect bird and riparian habitat.	Chance acknowledged and recorded the comment. Chance shared that winter exploration will reduce negative effects on riparian areas. The construction and use of winter roads will minimize effects on surface vegetation.	Project-related effects on birds are described in **Section 8** of the Project Proposal. Mitigation measures are expected to address potential effects on water resources and fish. Residual effects on these values are expected to be negligible. See **Sections 5** and **6** of the Project Proposal for more details.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
				Chance shared that winter roads follow the height of land avoiding riparian areas and water bodies. All activities occur away from riparian areas and there are no stream crossings associated with the winter roads.	See **Section 11** for more information on Project-related effects on and mitigation measures for community health and well-being.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Noted Project activities are not when birds are there, but chickadees may be there.	Chance acknowledged and recorded the comment and that there may be some overwintering birds in the Regional Study Area.	Comment was addressed at the time it was shared. See **Section 11** for more information on Project-related effects on and mitigation measures for community health and well-being.
Vegetation					
Document Sharing: Memorandum in Response to Gwich'in Tribal Council Comments	Gwich'in Tribal Council	08-Jul-2020	Requested Chance to avoid unnecessary degradation of the soil and destruction of wildlife habitat.	Chance acknowledged and recorded the comment. Chance shared the Project design (e.g., re-establishing winter roads and work during winter) was intended to minimize and/or eliminate potential effects on values such as soil, permafrost, vegetation, riparian areas, and wildlife habitat.	Chance acknowledges Gwich'in Tribal Council's concerns about soil and wildlife habitat protection. Chance intends to minimize and/or eliminate potential effects on values such as soil, permafrost, vegetation, riparian areas, and wildlife habitat. Chance stated that the construction and use of winter roads will minimize effects on surface vegetation and permafrost. It anticipates no negative effects on vegetation or permafrost. The winter road construction is not anticipated to affect terrain stability. It will follow the height of land and does not require grading or clearing of surface soils. Snow build up (10 cm) will be utilized to support equipment. Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
					Project work should be avoided or minimized. See **Section 7** for more information on Project-related effects on and mitigation measures for vegetation.
Document Sharing: Memorandum in Response to Gwich'in Tribal Council Comments	Gwich'in Tribal Council	08-Jul-2020	Expressed concern about the winter road and its effect on water bodies, wetlands, permafrost/terrain stability and the local ecology. Recommended Chance explore other access methods.	Chance acknowledged and recorded the comment. Chance shared that winter exploration will reduce negative effects on riparian areas. The construction and use of winter roads will minimize effects on surface vegetation and permafrost. It anticipates no negative effects on vegetation or permafrost. The winter road construction is not anticipated to affect terrain stability. It will follow the height of land and does not require grading or clearing of surface soils. Snow build up (10 cm) will be utilized to support equipment.	This issue is addressed in **Section 7** of the Project Proposal. Chance acknowledges this issue as a concern and will limit traffic on the winter access to authorized personnel. Traffic will include approximately 8 to 9 light-weight service trucks daily (for supplies and personnel), 1 to 2 water trucks, and 1 fuel truck as frequently as exploration activities dictate. See **Section 1** for more information. Chanced shared that winter roads follow the height of land avoiding riparian areas and water bodies. All activities occur away from riparian areas and there are no stream crossings associated with the winter roads.
Meeting	Gwich'in Tribal Council	22-Jul-2020	Requested additional information on Project clearing activities and reclamation plans.	Chance acknowledged and recorded the request for additional information. Chance provided an explanation of mitigation practices used to reduce effects on wildlife habitat such as the use of narrow (10 metres (m) wide) winter roads. Chance also indicated that it will maintain vegetation aside to preserve the root mass.	Chance recognizes the concern surrounding closure activities and reclamation. Chance is committed to following all applicable legislation and policies, including undertaking reclamation activities after Project exploration activities have been completed. Monitoring programs and follow-up monitoring will be in place. Follow-up meetings will occur to demonstrate work completed. Chance is required to set money aside for reclamation.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
				Winter road access will be restricted to prevent additional degradation. Each well site will be roughly 1 hectare.	For more information on clearing activities and reclamation plans, see **Section 1** of the Project Proposal.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked if there are any berries in the Project footprint.	The Chance Project Team acknowledged there are berries in the Project footprint.	Comment was addressed at the time it was shared. See **Section 7** for more information on Project-related effects on and mitigation measures for community vegetation.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked what is the difference between old growth forests and new forests.	The Chance Project Team confirmed that old growth forests are considered areas with trees over 100 years old and newer forests have trees less than 100 years old.	Comment was addressed at the time it was shared. See **Section 7** for more information on Project-related effects on and mitigation measures for community vegetation.
Water Resources					
Letter Document Sharing: Memorandum in Response to Gwich'in Tribal Council Comments	Gwich'in Tribal Council	22-Jan-2015 08-Jul-2020 03-Jun-2021 26-Jan-2023	Concerns over contamination of water resources Expressed concern about temporary and permanent Project roads, and how these roads may affect water and fish in the area. Expressed concerns over water usage, depths of disposal wells, MBC sumps, and the presence of aquifers in those areas.	Chance acknowledged and recorded the comment. Chance shared the *Surface Water Quality and Hydrology Baseline* report with Gwich'in Tribal Council for their records. Chance stated that all well sites are located at least 100 m from any water bodies. Chance will use existing access and withdrawal sites to minimize the risk of erosion and sedimentation.	Chance shared the *Fish and Fish Habitat Studies* baseline report with Gwich'in Tribal Council. Chance shared the Project design (e.g., re-establishing winter roads and work during winter) was intended to minimize and/or eliminate potential effects on values such as soil, permafrost, vegetation, riparian areas, and wildlife habitat. Chance shared that winter exploration will reduce negative effects on riparian areas. Chance shared that winter roads follow the height of land avoiding riparian areas and water bodies. All activities occur away from riparian areas and there are no stream crossings associated with the winter roads. Mitigation measures are expected to address potential effects on

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					water resources and fish. Residual effects on these values are expected to be negligible. See **Sections 5** and **6** of the Project Proposal for more details. Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See **Section 3** for more information.
Document Sharing: Memorandum in Response to Gwich'in Tribal Council Comments	Gwich'in Tribal Council	08-Jul-2020	Inquired about the specifics of fluids for pressure and wellbore tests, raising concerns about spills and groundwater effects. Asked for risk assessments for each well based on fluid type and urged the provision of a spill response plan. Emphasized the need for personnel training in spill response and reporting, with an insistence on immediate reporting to the Government of Yukon and potentially affected First Nations for any spills.	Chance to list the fluids and materials necessary. Chance committed to developing plans to mitigate potential effects. Personnel trained in spill response will be onsite for the duration of the Project. In addition to spill response and cleanup, the spill response plan will include details on reporting requirements.	More information about the type of materials used for the flow tests is available in **Section 2.3.2** of the Project Proposal. Chance will establish and enforce procedures to prevent unintended fluid release into the environment. Furthermore, an Emergency Spill and Response Plan and an Environmental Protection Plan will be devised, encompassing specifics on environmental monitoring and internal adherence to spill prevention and response measures. Chance will develop and implement procedures to prevent the inadvertent release of oil to the ground or waterways.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked if water is monitored for residue.	The Chance Project Team said that water quality will be characterized for the effects assessment.	Comment was addressed at the time it was shared. See **Section 5** for more information on Project-related effects on and mitigation measures for water resources.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Meeting	Gwich'in Tribal Council	17-May-2023	Asked for additional information on the water source, its use for camp operations, and its role in drilling activities.	Chance acknowledged and recorded the comment.	This issue is addressed in **Sections 1 and 5** of the Project Proposal documents. Water for the drill rig, winter road construction, and camp operation will primarily be obtained from existing withdrawal points on the Eagle River, with alternative sources located on the Ogilvie River and Whitestone River (see **Section 5**). The allocation of water usage will be determined by licensed allowances.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Asked if any water quality studies had been conducted in the Project footprint. Asked if there had been any water quality studies conducted in the Peel River.	Chance acknowledged and recorded the comment. Chance provided an overview of the water studies conducted. It explained that heavy metals (hydrocarbons) had been identified. Chance confirmed that there have been water quality studies in the upper reaches of the Peel River.	Chance shared baseline studies with Gwich'in Tribal Council. Chance had a surface water quality and hydrology baseline report developed to inform background characteristics of surface water within the Regional Study Area. This report will guide any anticipated or intended water resource requirements. See the **Section 5** for mapping of riparian constraints within the Project footprint. See **Section 5** for more information on water quality studies in the Peel River. See **Section 5** for more information on Project-related effects on and mitigation measures for water resources.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic	07-Dec-2023	Asked how far back water baselines studies go.	The Chance Project Team conducted water fieldwork studies in 2019, 2020, and 2022. Added that additional publicly available data comes from the 1980s and 2000s.	Comment was addressed at the time it was shared..

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
	Residents of Aklavik				
Wildlife and Wildlife Habitat					
Letter Document Sharing: Memorandum in Response to Gwich'in Tribal Council Comments	Gwich'in Tribal Council	22-Jan-2015 08-Jul-2020 16-Nov-2020 22-Jul-2020	Expressed concern for Project effects on wolverines, fur-bearing animals, bald eagles, and wildlife habitat.	Chance acknowledged and recorded the comment. Chance invited the Gwich'in Tribal Council to send a wildlife monitor on-site during construction and operation activities	Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See **Section 8** for more information. See **Section 8** for more information on Project-related effects on and mitigation measures for wildlife and wildlife habitat.
Document Sharing: Memorandum in Response to Gwich'in Tribal Council Comments	Gwich'in Tribal Council	08-Jul-2020	Expressed concern about the land use-related disturbances such as noise, smell, and light and requested Chance identify mitigation measures to reduce/avoid these disturbances. Expressed concern about human wildlife conflicts. Recommended Chance train Project personnel in best practices.	Chance acknowledged and recorded the comment. Chance to reduce disturbances such as noise, smell, and light. Winter conditions help to minimize risk to wildlife and the camp is constructed to minimize attractants. Food waste to be stored in secure areas not accessible to wildlife. Chance stated that incinerators would be present at the camp to burn organic material and reduce wildlife attractants	See **Section 8** for more information regarding Project design mitigation measures to reduce human land use related disturbances and effects on wildlife and wildlife.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked if the Project researched how to avoid high-quality moose habitat.	The Chance Project Team confirmed that moose habitat had been studied. Added that potential Project-related effects to moose habitat, and mitigation measures to address those effects, would	Comment was addressed at the time it was shared. See **Section 8** for more information on Project-related effects on and mitigation measures for wildlife and wildlife habitat.

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				be described in the Project Proposal.	
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Suggested Chance monitor wildlife after any damages to permafrost.	The Chance Project Team acknowledged the comment and confirmed there would be ongoing wildlife monitoring throughout the Project.	Comment was addressed at the time it was shared. See **Section 8** for more information on Project-related effects on and mitigation measures for wildlife and wildlife habitat.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Noted that the Project footprint is not good for grizzlies and asked about protection measures for black bears.	Due to primary winter activities and minimal soil disturbance, Project interactions with black bears are expected to be negligible. The Chance Project Team said the Project will avoid active den sites if any are identified.	Comment was addressed at the time it was shared. See **Section 8** for more information on Project-related effects on and mitigation measures for wildlife and wildlife habitat.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Stated that most Elders oppose industrial development within the Traditional Territory because of effects to caribou. Noted that the caribou travel through the Project footprint. Explained that there is a big concern from the PCMB around development effects to caribou. Added that Elders always say that "you can't eat money". Stated that Elders may be against the Project because they know when development starts in an area the caribou leave and don't	The Chance Project Team confirmed a lot of information had been received from the PCMB to inform Porcupine Caribou Herd studies for the Project. Added that the PCMB provided Chance/EDI with collared data and that Chance shared Project information and wildlife studies with the PCMB technical committee per the PCMB's direction. The Chance Project Team shared that Chance met with the PCMB on December 1st to discuss the Project and conducted a technical working group meeting with the (Porcupine Caribou Management Board PCMB) on the Porcupine Caribou Herd on	Comment was addressed at the time it was shared. See **Section 8** for more information on Project-related effects on and mitigation measures for wildlife and wildlife habitat.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
			go back to that area. Added that caribou previously migrated through that area, which makes it a big concern for the users of the PCH Suggested that Chance have a meeting with caribou user groups.	December 20th. Chance acknowledged that industrial development could affect the environment, wildlife, and people. Chance noted that they are responsible to mitigate potential Project-related adverse effects on the environment, wildlife, and people.	
Porcupine Caribou Herd					
Letter Document Sharing: Memorandum in Response to Gwich'in Tribal Council Comments Meeting	Gwich'in Tribal Council	22-Jan-2015 08-Jul-2020 22-Jul-2020 26-Jan-2023	Expressed concerns regarding effects on caribou and the PCH specifically. Stated that caribou is a key issue. Suggested employing a wildlife monitor during Project activities to safeguard uninterrupted PCH migration. Requested more information on wildlife deterrents and techniques. Recommended that the Tetłʼit Gwichʼin Renewable Resources Council be consulted.	Chance acknowledged and recorded the comment. Chance to invite Gwich'in Tribal Council to send a wildlife monitor during construction and operation phases of the Project.	Chance conducted additional wildlife baseline studies, including studying the PCH, in 2018/19 and updated these studies in 2022/23. Chance shared the Wildlife Baseline Studies report with Gwich'in Tribal Council for their records. Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See **Section 9** for more information. Chance acknowledges and considers concerns regarding the PCH. See **Section 9** for more information on Project-related effects on and mitigation measures for the PCH and land and resource use.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants	16-May-2023	Suggested Chance monitor where caribou are standing, as they are always moving.	The Chance Project Team shared they have been working with PCH collar data from the Porcupine Caribou Technical Committee to better	Comment was addressed at the time it was shared.

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	Residents of Inuvik		Noted that PCH will stick around for a two-week period.	understand potential Project-related effects to the PCH.	See **Section 9** for more information on Project-related effects on and mitigation measures for the PCH.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked if Chance is planning to put collars on moose.	The Chance Project Team confirmed they are not planning to put collars on moose.	Comment was addressed at the time it was shared. See **Section 8** for more information on Project-related effects on and mitigation measures for the PCH.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Expressed Elders' and the PCMB's concern that industrial development will negatively affect caribou. Described that caribou avoid development and then do not return. Explained that caribou travel through the Project footprint. Added that caribou used to migrate through that area, which makes it a big concern for the users of the PCH. Suggested that Chance have a meeting with caribou user groups.	Chance has scheduled with potentially affected First Nations and the PCMB. Chance stated that it is important to keep in mind that industrial development can have some negative effects on the environment, wildlife, and people. Chance explained that it is responsible for making recommendations to mitigate potential effects.	On December 20, 2023, a meeting was held to discuss effects on PCH and potential mitigations. Chance, PCMB, potentially affected First Nations, and wildlife consultants attended. See **Section 9** for more information on Project-related effects on and mitigation measures for the PCH.
Land and Resource Use					
Letter Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson	22-Jan-2015 07-Dec-2023	Expressed concern for Project-related effects on climate change and associated changes to the land, weather, and	Chance acknowledged and recorded the comment. Chance stated the Project has put in place various measures to address the potential effects resulting from climate change.	In addition, for accounting for the effects of climate change regarding the Project, the Project also strives to establish a local oil and gas source for Yukon and neighbouring projects, ultimately lowering the carbon footprint on fuel consumption and greenhouse gas emissions. As an

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	Residents of Tsiigehtchic Residents of Aklavik		wildlife on which the Gwich'in depend.	Additionally, the Project has prepared contingency plans to account for any slumps related to climate change.	exploratory initiative, emissions are primarily linked to camp operations, transportation, drilling, and seismic programs, with an estimate pending.
Meeting	Gwich'in Tribal Council	22-Jul-2020	Questioned whether there was an increased risk of ski-doo traffic, and how it would be monitored.	Chance acknowledged and recorded the comment. Chance created a traffic/access plan, restricting site access for safety. Chance will restrict access to authorized personnel. Chance is utilizing existing access. Chance conducted a study to observe human use in the area (e.g., monitoring snow tracks) and did not find evidence of people accessing the area at that time.	Comment was addressed at the time it was shared. See **Section 11** for more information on Project-related effects on and mitigation measures for land and resource use.
Meeting Document Sharing: Memorandum in Response to Gwich'in Tribal Council Comments	Gwich'in Tribal Council	16-Nov-2020 08-Jul-2020	Expressed concerns about trapping. Gwich'in Tribal Council identified that the Project footprint overlaps with Tetl'it Gwich'in traplines.	Chance acknowledged and recorded the comment. Chance invited the Gwich'in Tribal Council to send a wildlife monitor on-site during construction and operation activities.	Chance acknowledges concerns regarding effects on wildlife, wildlife habitat, trapping, and traditional activities. For more information on Project-related effects on wildlife and wildlife habitat and mitigation measures see **Section 8** of the Project Proposal.
Meeting	Gwich'in Tribal Council	03-Jun-2021	Requested information regarding MBC. Gwich'in Tribal Council identified quite a few relic sumps, outside of the Yukon, which have	Chance acknowledged and recorded the comment. Chance stated that the Eagle Plains region does not have enough water to create those erosional experiences/issues.	Chance is committed to providing technical information regarding soil composition.

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			been exposed by water erosion.		
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Stated that the maps that Gwich'in Tribal Council has are outdated and do not show the current uses of Gwich'in Participants. Noted that this does not mean that Gwich'in Participants are not using the Project footprint for traditional land use and resource uses.	The Chance Project Team acknowledged the comment and indicated that further engagement with Gwich'in Tribal Council will continue as the Project proceeds through the YESAB Executive Committee process.	Comment was addressed at the time it was shared.
Linear Features					
Meeting	Gwich'in Tribal Council	24-Apr-2018	Expressed concern about landscape level effects. The 325 km of seismic lines will affect people as they drive by Project on the Dempster Highway. Community members have expressed concern with the alteration to the landscape.	Chance acknowledged and recorded the concern regarding effects of seismic lines. Chance conducted a linear features study to understand potential Project-related linear disturbances including effects on predator and prey interactions. Chance utilizes design components, such as using meandering seismic lines, which aim to minimize visual disturbance and make it more difficult for predators and hunters to travel along the lines. Chance is open to further dialogue to best address this issue.	Chance acknowledges the concern and wants to continue discussions to minimize effects on potentially affected First Nations. The comment is addressed in **Section 11.3** of the Project Proposal documents.

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Meeting	Gwich'in Tribal Council	24-Apr-2018 17-May-2023	Expressed concern with linear disturbance on predator and prey interactions. Recognized that this is a key concern for communities. Requested Chance consider how predators use linear disturbance.	Chance conducted a linear features study to understand potential Project-related linear disturbances including effects on predator and prey interactions. Chance shared the Linear Features Study with Gwich'in Tribal Council for their records.	Chance staff hired as wildlife monitors and security personnel will monitor access to the winter roads. See **Sections 11.3** and **9** of the Project Proposal for more information.
Document Sharing: Memorandum in Response to Gwich'in Tribal Council Comments	Gwich'in Tribal Council	08-Jul-2020	Requested Chance to avoid unnecessary degradation of the soil and destruction of wildlife habitat.	Chance acknowledged and recorded the comment. No further action was required. Chance shared the Project design (e.g., re-establishing winter roads and work during winter) was intended to minimize and/or eliminate potential effects on value such as soil, permafrost, vegetation, riparian areas, and wildlife habitat.	Comment was addressed at the time it was shared.
Permafrost and Terrain					
Meeting	Gwich'in Tribal Council	17-May-2023	Inquired whether buffers would be used to protect permafrost areas.	Chance acknowledged and recorded the comment. Chance responded that Project activities will not be adjacent to high sensitivity areas.	Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See **Section 4** for more information.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Asked how much closer the drill got in areas where permafrost was burned from fire.	The Chance Project Team responded that vegetation affected by wildfire will grow back in 100 to 200 years. Shared that drilling will likely	Comment was addressed at the time it was shared.

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				take place in areas where bedrock is near the surface to minimize thickening of the active layer (which could result in permafrost thawing). Confirmed areas sensitive to permafrost degradation will be avoided.	
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Asked if there are slumps and/or erosion in the Project footprint.	The Chance Project Team shared that in general, there are areas of existing erosion and slumps, however they were classified in the exploration suitability as areas not ideal for development and to either avoid or engineer around. The Chance Project Team stated that they prepared the exploration activities to limit slumping. Chance added that normally, it maps the drilling location (100 m x 100m) and that it will put 6" mats on the whole operation.	A "Constraints Map" exercise was conducted to identify especially sensitive or high-quality environmental values where project work should be avoided. Constraints included permafrost/terrain sensitive areas to avoid. See **Section 4** for more information.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Asked what a "Mix Cover Zone" is.	Chance acknowledged and recorded the comment. Chance stated this will be the area where the sumps resulting from the exploration activities will be buried to protect the environment.	Comment was addressed at the time it was shared.

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Heritage Resources					
Letter	Gwich'in Tribal Council	22-Jan-2015	Expressed concerns about the absence of Traditional Use/Knowledge studies and requested additional time to review the Project Proposal for supporting planning and mitigation development. Recognized worries about potential Project-related effects on traditional Tetł'it Gwich'in trails and the headwaters of Tth'an Dhidlii Njik ("Bone-they are scattered around-creek," also known as Dalglish Creek).	Chance acknowledged and recorded the comment.	Chance identified secondary sources of Traditional Knowledge for Gwich'in Tribal Council's review, comment, and permission to use in the Project Proposal. Chance assessed in Heritage Resources in **Section 10** of the Project Proposal.
Document Sharing: Memorandum in Response to Gwich'in Tribal Council Comments	Gwich'in Tribal Council	08-Jul-2020	Requested that the wildlife monitor be trained to identify archaeological materials and paleontological materials.	Chance acknowledged and recorded the comment. No response was provided at the time.	Chance will provide additional training in identification of both typical archaeological and paleontological materials to field technicians/environ. The Chance Project Team confirmed a *Chance Find Procedure* for the Project is being developed and stated potentially affected First Nations will be notified when the *Chance Find Procedure* is implemented.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Mentioned the importance of protecting archaeological,	The Chance Project Team responded that any archaeological and heritage resource discoveries in the Project footprint will be	Comment was addressed at the time it was shared. The Chance Project Team confirmed a *Chance Find Procedure* for the Project is being developed and stated potentially

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
			historical, and paleontological sites	protected from Project-related effects.	affected First Nations will be notified when the *Chance Find Procedure* is implemented.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Inuvik	16-May-2023	Someone said the Borden number is a coordinate and known archaeological site that is not to be disturbed.	The Chance Project Team acknowledged and recorded the comment. Confirmed potentially affected First Nations would be contacted if archaeological and heritage resources are discovered to follow appropriate protection protocols.	Chance will work with potentially affected First Nations to support their involvement in future heritage resources studies. See **Section 10** for information on Project-related effects to and mitigation measures for heritage resources.
Meeting	Gwich'in Tribal Council	17-May-2023	Requested to be contacted if a burial site is discovered. Recommended that Chance engage Elders in development of the site.	Chance acknowledged and recorded the comment. Chance confirmed archaeology and heritage mitigation plans would be included in Chance's *Project Proposal* (Version 2, p. 30).	If human remains are encountered within the Project footprint, all work in the vicinity will stop immediately and First Nations, the Government of Yukon Heritage Resource Unit, and the RCMP will be contacted for guidance on how to proceed. This consultation will be guided by the principles laid out in the *Guidelines Respecting the Discovery of Human Remains and First Nation Burial Sites in the Yukon* document published by the Government of Yukon's Heritage Resource Unit. Chance will prepare a *Chance Find Procedure* which will apply during all Project activities.
Meeting	Gwich'in Tribal Council	17-May-2023	Asked if the *Project Proposal* (Version 2) will include a contact list if any archaeological or paleontological items were found.	Chance acknowledged and recorded the comment. Contact list will be provided later.	Comment was addressed at the time it was shared. The Chance Project Team confirmed a *Chance Find Procedure* for the Project is being developed and stated potentially affected First Nations will be notified when the *Chance Find Procedure* is

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					implemented. The *Chance Find Procedure* will include a contact list.
Meeting	Gwich'in Tribal Council	04-Dec-2023	Expressed concern about the lack of cultural or heritage baseline data.	Chance to resend the heritage baseline studies to Gwich'in Tribal Council.	Comment was addressed at the time it was shared.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Asked if any grave sites have been discovered in the Project footprint.	The Chance Project Team confirmed no burial sites had been discovered in the Project footprint. Shared that remnants of tools were discovered. The Chance Project Team said the soil in the Project footprint is not ideal for preserving organic material. Confirmed protocols will be in place to protect cultural and heritage resources, including a *Chance Find Procedure*. The Chance Project Team said applicable heritage and conservation permits were required to complete archaeological and heritage resources studies for the Project. The permits ensure that consultants such as Ecofor follow archaeological and heritage resource study guidelines set by Government of Yukon Heritage. Added that any archaeological and heritage resource discoveries in the Project footprint will be protected from Project-related impacts.	If human remains are encountered within the Project footprint, all work in the vicinity will stop immediately and First Nations, the Government of Yukon Heritage Resource Unit, and the RCMP will be contacted for guidance on how to proceed. This consultation will be guided by the principles laid out in the *Guidelines Respecting the Discovery of Human Remains and First Nation Burial Sites in the Yukon* document published by the Government of Yukon's Heritage Resource Unit. Chance will prepare a Chance Find Procedure which will apply during all Project activities. Chance will work with potentially affected First Nations to support their involvement in future heritage resources studies. See **Section 10** for information on Project-related effects to and mitigation measures for heritage resources.

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				Chance acknowledged and recorded the comment. Chance responded that no burials have been discovered. Studies have only uncovered tools. Chance explained that soil in the Project footprint is not ideal for preserving organic material. If any heritage resources, archaeological, or paleontological items are discovered, Chance will follow all legislation.	
Employment and Economy					
Letter Meeting Community Open House Events	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Inuvik Residents of Tsiigehtchic Residents of Aklavik	24-Apr-2018 15-Nov-2018 16-May-2023 07-Dec-2023	Indicated interest in training and capacity building opportunities for their communities. Expressed interest in Project-related employment and training, scholarship, and capacity funding opportunities. Asked if the Project will be good for young people looking for work. Suggested Chance discuss job opportunities at the high school. Stated it would be preferential to hire more First Nations.	Chance strives to offer training, employment, and contracts to its First Nations partners. During its last drilling/seismic program, Chance successfully hired a workforce from the communities from Old Crow, Fort McPherson, Dawson, Whitehorse, and Inuvik (*Draft Project Description* (Version 2), p. 72). The Chance Project Team acknowledged the comment and expressed interest to share potential Project-related employment and training opportunities with youth, when available. Chance is committed to ongoing consultation and	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
				discussions around training, employment, and contracting opportunities with potentially affected First Nations.	
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Asked if there are any monitors from Fort McPherson expected to work on the Project.	Chance acknowledged and recorded the comment. Chance stated that in 2014, the Project hired 30% of its seismic program labour from the greater Yukon Area. Chance added that there are other sectors that will benefit from the Project (e.g., transportation, food, monitors).	Chance strives to offer training, employment, and contracts to its First Nations partners. Chance is committed to ongoing consultation and discussions around training, employment, and contracting opportunities with potentially affected First Nations.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Asked how people can apply to potential job opportunities.	The Chance Project Team stated to contact Cindy Dickson or Greg Charlie for more information on how to apply for Project-related job opportunities. Cindy Dickson and Greg Charlie's contact information was provided on the Project handout distributed at the Open House.	Comment was addressed at the time it was shared.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Asked how many Gwich'in Participants have been involved in field studies. Stated economic opportunities are a topic of interest and should be shared with the community. Shared that the community needs to understand the opportunities	The Chance Project Team mentioned that Vuntut Gwitchin First Nation Citizens and Gwich'in Participants had been involved in pervious field studies and Chance exploration activities. Chance added that they had already received resumes from Gwich'in Participants and residents of Fort McPherson for the Project and will	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
			available before reviewing Project documentation and providing feedback.	continue to share information on Project-related employment opportunities with Gwich'in Tribal Council and Gwich'in Participants.	
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Asked what Chance's procurement and hiring policies are. Stated that Gwich'in Participants want to see them sooner rather than later to understand what needs to be done to access potential employment and training opportunities.	Chance committed to sharing Project-related employment information with Gwich'in Participants and noted procurement and hiring policies had not yet been developed.	Comment was addressed at the time it was shared.
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Stated it would be nice to have more First Nations involved in the Project. Added that a video showcasing "real work" on the ground makes more sense than graphs alone. Noted that the graphs and video of work should be combined.	Chance acknowledged and recorded the comment and will consider developing a new Project video that involves photo stills, video clips, and graphs, if the Project is approved.	Comment was addressed at the time it was shared.
Socio-Economics					
Document Sharing: Gwich'in Tribal Memorandum in Response to Gwich'in Tribal Council Comments	Gwich'in Tribal Council	08-Jul-2020	Indicated concern regarding increased traffic on the Dempster Highway.	Chance acknowledged and recorded the comment. Chance stated that Project design shows minimized traffic to the Project and on the Project site to avoid effects on wildlife (e.g., restricted access and speed limits).	Anticipated Project-related traffic and efforts to manage and limit traffic are described in **Sections 1 and 11**. Chance will limit traffic on the winter access roads to authorized personnel. Traffic will include approximately 8 to 9 light-weight service trucks daily (for supplies and personnel), 1 to 2 water

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
					trucks, and 1 fuel truck as frequently as exploration activities dictate (see **Sections 1 and 11**).
Mitigations and Monitoring					
Meeting	Gwich'in Tribal Council	22-Jul-2020	Requested bi-weekly updates on the findings of the wildlife monitor.	Chance acknowledged and recorded the comment. Chance committed to sending bi-weekly wildlife monitoring reports to Gwich'in Tribal Council.	Comment was addressed at the time it was shared.
Cumulative Effects					
Meeting	Gwich'in Tribal Council	01-Nov-2023	Expressed concern about cumulative effects in the Peel Watershed and cumulative effects of greenhouse gas emissions.	Chance acknowledged and recorded the comment.	See **Section 1, 10.6 and 11** of the Project Proposal for more information regarding cumulative effects.
Climate Change					
Community Open House Event	Gwich'in Tribal Council Gwich'in Participants Residents of Fort McPherson Residents of Tsiigehtchic Residents of Aklavik	07-Dec-2023	Asked what the Project will do to address potential effects resulting from climate change.	Chance stated the Project has put in place measures to address potential Project-related effects resulting from climate change. Added the Project has prepared contingency plans to account for any climate change-related effects to the Project such as slumps/erosion.	Comment was addressed at the time it was shared.

2.8.10 Ongoing Consultation and Engagement

Chance will continue to consult and engage Gwich'in Tribal Council and residents of Inuvik, Fort McPherson, Tsiigehtchic, and Aklavik following submission of the Project. Chance will refine the Program in response to feedback from Gwich'in Tribal during future Project phases, as needed. Planned ongoing consultation and engagement activities include (but are not limited to):

- Project communications (e.g., updates regarding schedule, permitting, monitoring activities, incorporation of Indigenous Knowledge to Project plans, and capacity funding);
- meetings to discuss Project-related effects, issues, and interests;
- opportunities to review and provide comment on Project plans and materials; and,
- opportunities to develop Project-related mitigation measures.

2.9 CONSULTATION AND ENGAGEMENT WITH VUNTUT GWITCHIN FIRST NATION AND RESIDENTS OF OLD CROW

Section 2.9 outlines consultation and engagement activities with Vuntut Gwitchin First Nation and residents of Old Crow. Information on Project notification, consultation and engagement planning, methods, activities, and agreements, issues, interests, input, and feedback shared through consultation and engagement activities are described in **Sections 2.9.1- 2.9.9.**

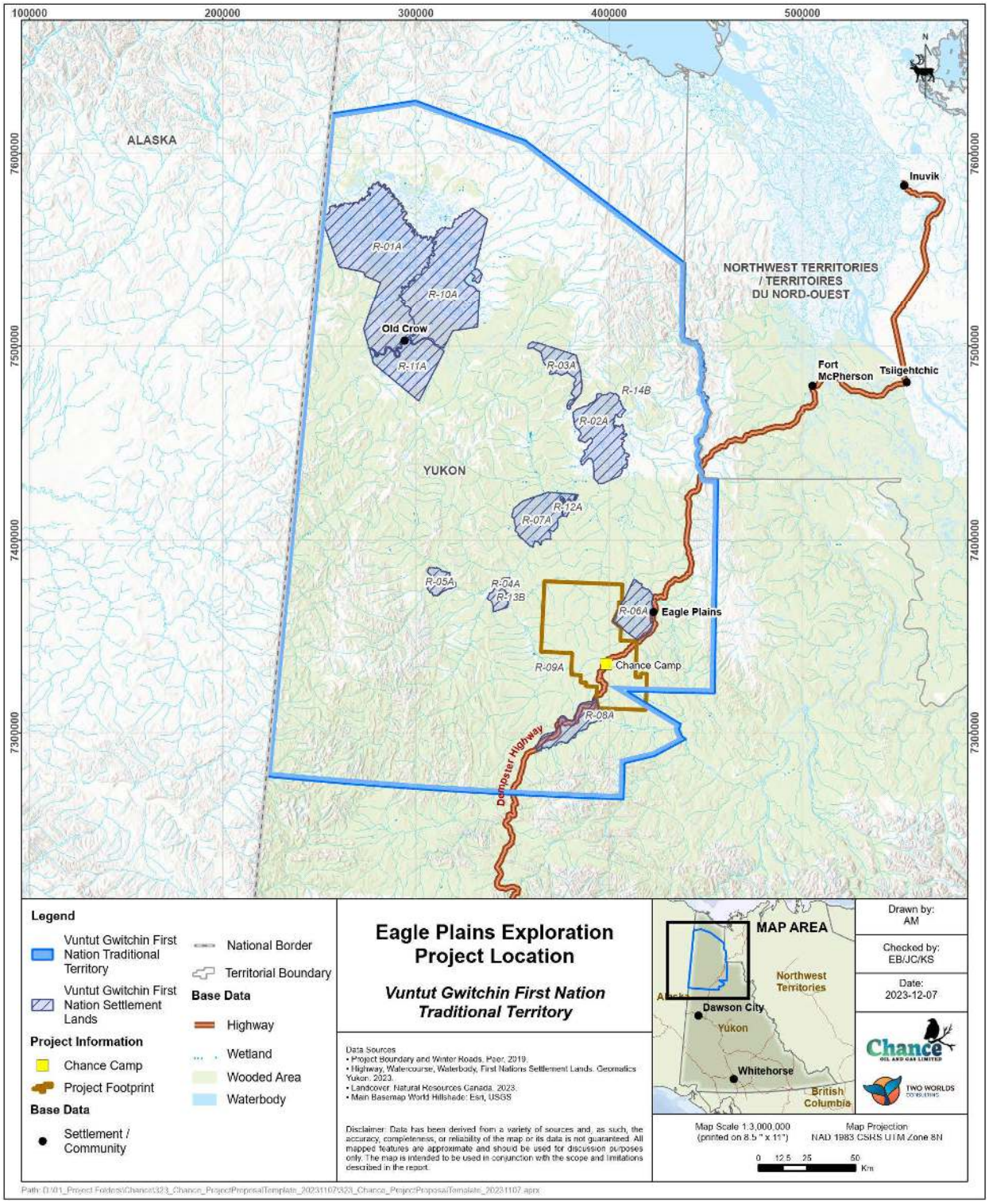
2.9.1 Community Profiles

2.9.1.1 Vuntut Gwitchin First Nation

> Old Crow derives its name from an Indian Chief, "Deetru` K`avihdik", which means "Crow May I Walk". Following his death in the 1870's, his people named the river, mountain, and area in his honor, thus being the community of Old Crow."
>
> (Vuntut Gwitchin First Nation n.d.)

Vuntut Gwitchin First Nation is located north of the Arctic Circle, in Old Crow, Yukon (Government of the Vuntut Gwitchin First Nation, n.d.-a). The community of Old Crow is 1 of 19 Gwitchin communities located in northern Alaska and Canada (Council of Yukon First Nations, n.d.). The Gwitchin Nation has a population of 7,500 people (Government of the Vuntut Gwitchin First Nation, n.d.-a) with more than 200 Citizens living in Old Crow as of 2021 (Government of Canada 2022).

Due to the seasonal migration routes of the PCH, Gwitchin Elders chose this area to call their home (Government of the Vuntut Gwitchin First Nation, n.d.-a). Vuntut Gwitchin First Nation Citizens frequently travel across their Traditional Territory to hunt, trap, gather, and fish (Vuntut Gwitchin First Nation, n.d.-a). The Vuntut Gwitchin First Nation Traditional Territory, presented in **Map 2-4**, is around 67,960 km² (Council of Yukon First Nations, n.d.).



Map 2-4: Vuntut Gwitchin First Nation Traditional Territory

The Vuntut Gwitchin is composed of one Chief and four councillors, in office for terms of 4 years (Government of the Vuntut Gwitchin First Nation, n.d.-b). The current Vuntut Gwitchin First Nation government was elected in November 2022 and sworn in on January 11, 2023, and is made up of: Chief Pauline Frost, Deputy Chief Debra-Leigh Reti, and Councillor Jeneen Njootli (Government of the Vuntut Gwitchin First Nation, n.d.-b). There is currently one Councillor vacancy. **Figure 2-5** visually represents the Vuntut Gwitchin First Nation governance structure.

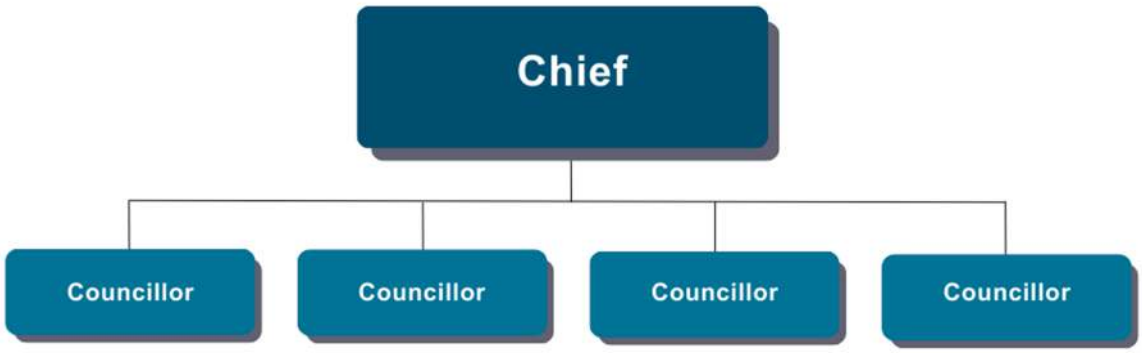


Figure 2-5. Vuntut Gwitchin First Nation Governance Structure (Government of the Vuntut Gwitchin First Nation n.d.)

Vuntut Gwitchin is the traditional name for Vuntut Gwitchin First Nation and can be translated as “People of the Lakes” and land of the PCH (Government of the Vuntut Gwitchin First Nation, n.d.-a). The name Vuntut Gwitchin is also derived from the muskrat trapping season (Vuntut Gwitchin First Nation, n.d.-a).

Vuntut Gwitchin First Nation Citizens are dependent on the PCH for their survival, cultural and spiritual well-being, and livelihood. The PCH are referred to as the centre of Gwitchin culture (Government of the Vuntut Gwitchin First Nation, n.d.-a; Vuntut Gwitchin First Nation, n.d.-a). All parts of the caribou are used for food, clothing, cultural objects, crafts, and other items (Government of the Vuntut Gwitchin First Nation, n.d.-a). The PCH passes through Old Crow in April, May, August, and September (Government of the Vuntut Gwitchin First Nation, n.d.-a). The caribou meat can be prepared in several ways (e.g., smoked, dried, boiled, and fried) and may be used in soups, roasts, jerky, chizi (pemmican), stews, and delicacies such as head soup (Government of the Vuntut Gwitchin First Nation, n.d.-a). The rest of the animal may be used to make clothing such as moccasins, gloves, boots, handbags, and many other items (Government of the Vuntut Gwitchin First Nation, n.d.-a). The PCH is vital to Vuntut Gwitchin First Nation Citizens and their culture.

2.9.1.2 Old Crow

Old Crow is the sole community found in northern Yukon, north of Dawson City (Vuntut Gwitchin First Nation, n.d.-a). Located on the Porcupine River, Old Crow has no road access and is only accessible by airplane, boat, or snowmobile (Government of the Vuntut Gwitchin First Nation, n.d.-a; Vuntut Gwitchin First Nation, n.d.-a). The community was founded in 1898, following the Klondike Gold Rush (Vuntut Gwitch’in 1996). In 2021, it had a population of approximately 235 people (Government of Canada 2022).

Old Crow is the home and administrative centre of the Vuntut Gwitchin Government. The community is governed by the Vuntut Gwitchin Government (Government of the Vuntut Gwitchin First Nation, n.d.-b). In

2021, industries with the largest proportion of the workforce were public administration, construction, and healthcare and social assistance (Government of Canada 2022).

The Old Crow Health Centre is the community's sole healthcare facility, offering general health services staffed by a full-time registered nurse and a Whitehorse physician on a monthly rotational basis (Vuntut Gwitchin First Nation 2023). For urgent emergency care and more complex health needs, residents are flown by medical evacuation (Medevac) to Whitehorse (Vuntut Gwitchin First Nation 2023). The current facility was built in 1960 and upgraded in the mid-1980s. A new health centre is currently being constructed, as well as housing, to replace the existing centre. The new centre will offer social services, home care services, mental wellness and substance use services, and community nursing health services. The construction project was anticipated to be completed in 2023 (Vuntut Gwitchin First Nation, n.d.-b; Government of Yukon 2019a).

Old Crow has one school (Kindergarten to Grade 12), Chief Zzeh Gittlit School. After Grade 9, students may choose to attend high school in Whitehorse and live in the Gadzoosdaa Student Residence (Vuntut Gwitchin First Nation, n.d.-b; Government of Yukon 2019b). There is a Yukon University campus that offers various certificates, diplomas, degrees, vocational, and upgrading programs and courses. The campus also provides public access to computers and Internet. Its staff offer employment skills assistance, academic advising, and counselling to residents (Yukon University, n.d.).

2.9.2 Project Notification

Chance initiated engagement with Vuntut Gwitchin First Nation on December 1, 2017. Chance sent Vuntut Gwitchin First Nation a letter (**Appendix 2-C Vuntut Gwitchin First Nation and Residents of Old Crow Consultation and Engagement Records**) about the *Communications and Engagement Plan* and developing a partnership with Vuntut Gwitchin First Nation.

Chance initiated consultation and engagement with residents of Old Crow at a community open house event on February 1, 2019.

2.9.3 Consultation and Engagement Planning

Chance developed a *Communication and Engagement Plan* (**Appendix 2-C**) outlining a proposed engagement approach with Vuntut Gwitchin First Nation. The *Communication and Engagement Plan* included information on communication pathways, meeting process, engagement documentation, and adaptive management.

Chance shared the *Communication and Engagement Plan* with Vuntut Gwitchin First Nation on March 28, 2018, for review and comment. The implementation of the proposed engagement approach remains ongoing.

2.9.4 Consultation and Engagement Methods

Consultation and engagement methods with Vuntut Gwitchin First Nation up to December 20, 2023 included

- meetings (virtual and in-person);

- letters;
- flyers and handouts;
- correspondence via phone call, text message, and email;
- community open house events;
- community leadership swearing-in event; and,
- information sharing (e.g., sharing Project documents for review and comment).

Chance will adjust consultation and engagement methods in response to feedback from Vuntut Gwitchin First Nation throughout the life of the Project.

Consultation and engagement methods with residents of Old Crow up to December 20, 2023 included community open house events as well as flyers and handouts.

2.9.5 Consultation and Engagement Activities

Table 2-6 outlines engagement activities undertaken with Vuntut Gwitchin First Nation and residents of Old Crow up to December 20, 2023.

Engagement materials such as presentations and handouts shared with Vuntut Gwitchin First Nation and residents of Old Crow have been compiled in **Appendix 2-C** of this Project Proposal. Where appendices were unavailable for compilation, **Table 2-6** indicates as such with an asterisk.

Table 2-6. Key Consultation and Engagement Activities with Vuntut Gwitchin First Nation and Residents of Old Crow

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Vuntut Gwitchin First Nation	Correspondence via phone call, text message, and email	Ongoing	Coordinating engagement activities and sharing Project information.
Chance Vuntut Gwitchin First Nation Residents of Old Crow	Community Open House Event	15-Jun-2014	Held an open house at Chief Zzeh Gitlitt School Gym in Old Crow (**Appendix 2-C)***.
Chance Vuntut Gwitchin First Nation	Community Open House Event	16-Jun-2014	Held an open house at Vuntut Gwitchin First Nation's Whitehorse office for Vuntut Gwitchin First Nation Citizens to discuss a smaller-scale exploration project that was being submitting to the YESAB DO in Dawson (**Appendix 2-C**).
Chance Vuntut Gwitchin First Nation	Community Open House Event	16-Jun-2014	Held an open house at the Yukon Inn in Whitehorse with Vuntut Gwitchin First Nation Citizens to discuss the Project (**Appendix 2-C**).
Chance Vuntut Gwitchin First Nation Residents of Old Crow	Community Open House Event	17-Jun-2014	Held an open house at the Old Crow Community Hall. Chance provided Project information including a description of the targeted drilling program (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Document sharing for records	26-Sep-2016	Provided a draft Engagement and Communication Strategy (**Appendix 2-C**).
Chance Vuntut Gwitchin First Nation	Letter	08-Sep-2017	Sent a letter stating their interests in achieving an *Engagement and Communication Plan* with Vuntut Gwitchin First Nation (**Appendix 2-C**).
Chance	Letter	12-Sep-2017	Sent a letter to Chance replying to their September 8, 2017 letter regarding the *Engagement and Communication Plan* (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Letter	01-Dec-2017	Sent a letter regarding the *Communication and Engagement Plan* that Chance wishes to develop in partnership with Vuntut Gwitchin First Nation (**Appendix 2-C**)*.
Chance	Letter	11-Jan-2018	Received an email from Vuntut Gwitchin First Nation with a letter and the *Vuntut Gwitchin Government Oil and Gas Engagement Policy* (**Appendix 2-C**).
Chance Vuntut Gwitchin First Nation	Meeting	24-Jan-2018	Introduced the Vuntut Gwitchin First Nation Chief to the chair of Chance's Board of Directors. Discussed the draft *Vuntut Gwitchin Government Oil and Gas Engagement Policy,* and arrangements to develop a communications and engagement plan (**Appendix 2-C**)*.

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Chance Vuntut Gwitchin First Nation	Meeting	22-Feb-2018	Discussed relationship building, the oil and gas industry, the Chance Community Relations Committee, the draft *Vuntut Gwitchin Government Oil and Gas Engagement Policy*, and community engagement for the Project (**Appendix 2-C**).
Chance Vuntut Gwitchin First Nation	Meeting	22-Mar-2018	Discussed the draft Schedule of Engagement, Chance Community Relations Committee Terms of Reference, and Chance Engagement and Communication Plan (**Appendix 2-C**)*.
Vuntut Gwitchin First Nation	Document sharing for review and comment	27-Mar-2018	Shared the Community Relations Terms of Reference (**Appendix 2-C**)*.
Vuntut Gwitchin First Nation	Document sharing for review and comment	28-Mar-2018	Shared the Draft Communication and Engagement Plan and the draft Schedule of Engagement (**Appendix 2-C**)*.
Vuntut Gwitchin First Nation	Document sharing for review and comment	27-Apr-2018	Shared the Vuntut Gwitchin and Chance Communication and Engagement Plan (**Appendix C-7**).
Chance Vuntut Gwitchin First Nation	Meeting	03-May-2018	Discussed revisions to the draft Vuntut Gwitchin and Chance Communication and Engagement Plan (**Appendix 2-C**)*.
Chance	Document sharing for records	15-May-2018	Received a revised copy of the *Vuntut Gwitchin and Chance Communication and Engagement Plan,* dated May 7, 2018, from Vuntut Gwitchin First Nation (**Appendix 2-C**)*.
Chance Vuntut Gwitchin First Nation	Meeting	19-Jun-2018	Discussed engagement activities in Old Crow during the week of July 9–13, 2018 (**Appendix 2-C**)*.
Chance Vuntut Gwitchin First Nation	Meeting	10-Jul-2018	Discussed Chance's land tenure status, Project plans, community pathways for oil and gas related matters, and collaborative consultation and engagement (**Appendix 2-C**)*.
Vuntut Gwitchin First Nation	Document sharing for review and comment	26-Jul-2018	Shared the 1-page draft *Community Event* document (**Appendix 2-C**)*.
Chance Vuntut Gwitchin First Nation	Meeting	11-Sep-2018	Met with Vuntut Gwitchin First Nation to develop a *Cooperation Agreement* (**Appendix 2-C**).
Chance Vuntut Gwitchin First Nation	Meeting	12-Sep-2018	Met with Vuntut Gwitchin First Nation to develop a *Cooperation Agreement* (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Document sharing for review and comment	20-Sep-2018	Draft Cooperation Agreement and the Exploration Scenario's document (**Appendix 2-C**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Vuntut Gwitchin First Nation	Letter	03-Oct-2018	Sent a letter to Vuntut Gwitchin First Nation to advise that Chance intended to relinquish its exploration rights to the entire Exploration Permit 0005 (EP). Chance noted the importance of protected areas and expressed interest in supporting Vuntut Gwitchin First Nation by surrendering this EP to facilitate the creation of the Habitat Protection Area (HPA) with no encumbrance of outside oil and gas rights. Chance added that they were giving Vuntut Gwitchin First Nation notice prior to informing the Government of Yukon of the relinquishment (**Appendix 2-C**)*.
Chance Vuntut Gwitchin First Nation	Meeting	04-Oct-2018	Reviewed the *Cooperation Agreement* (**Appendix 2-C**).
Chance	Letter	31-Oct-2018	Sent a letter to Chance thanking Chance for surrendering their oil and gas Exploration Rights to their permit #0005 ("EP5"). Vuntut Gwitchin First Nation stated this was viewed as a 'goodwill gesture' of cooperation and respect (**Appendix 2-C**).
Chance Vuntut Gwitchin First Nation	Meeting	12-Dec-2018	Discussed the Vuntut Gwitchin Government Oil and Gas Engagement Policy (**Appendix 2-C**).
Vuntut Gwitchin First Nation Chief and Council Natural Resources Committee	Meeting	29-Jan-2019	Discussed Chance's land tenure permits and exploration intentions and provided the opportunity for Vuntut Gwitchin First Nation to share feedback on and ask questions about the Project (**Appendix 2-C**).
Chance First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Government of Yukon	Meeting	01-Feb-2019	Discussed the First Nation engagement plans, the *Vuntut Gwitchin First Nation Oil and Gas Engagement Policy*, and the *Draft Project Description* (Version 1) (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Letter	15-Mar-2019	Introduced Chance, provided a description of the *Oil and Gas Dispositions and Application*, *Confidentiality Agreement*, compliance records, and dispositions and wells (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Document sharing for records	05-Jun-2019	Draft Project Description (Version 1) (**Appendix 2-C**).
Vuntut Gwitchin First Nation Residents of Old Crow	Community Dinner Event	06-Jun-2019	Gave a presentation and provided dinner to Vuntut Gwitchin First Nation and Old Crow Citizens.

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
			Discussed the draft *Project Description* (Version 1) and the annual reporting of the *Vuntut Gwitchin Government Oil and Gas Engagement Policy* (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Document sharing for records	15-Jun-2019	Provided Vuntut Gwitchin First Nation with information on summer field work participation (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Fieldwork (Email)	17-Jun-2019	Invited Vuntut Gwitchin First Nation to send 2 participants to join the planned environmental monitoring programs for the summer (**Appendix 2-C**).
Chance	Letter	10-Jul-2019	Sent a letter to Chance responding to notices submitted by Chance regarding the *Vuntut Gwitchin Government Oil and Gas Policy*, extension of oil and gas permits 0006-0011 and 0019, and Chance's proposed oil and gas activities in the Eagle Plains basin (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Letter	15-Jul-2019	Expressed interest to meet with Vuntut Gwitchin First Nation in August 2019 to discuss capacity funding as well as consultation and engagement (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Document sharing for review and comment	25-Jul-2019	Shared the Draft Implementation of the Vuntut Gwitchin Government and Chance Oil and Gas Communication and Engagement Plan Annual Report (**Appendix 2-C**).
Chance	Document sharing for records	30-Jul-2019	Sent Chance the signed Implementation of the Vuntut Gwitchin Government and Chance Oil and Gas Communication and Engagement Plan Annual Report (**Appendix 2-C**)*.
Chance	Letter	26-Aug-2019	Sent a letter to Chance to confirm the following notices were complete and sufficient, in accordance with Section 24 and 25 of the *Vuntut Gwitchin Government Oil and Gas Engagement Policy*: Chance's application to extend the term of oil and gas permits 0006-0011 and 0019 and notice of Chance's proposed oil and gas activities in Eagle Plains basin. Vuntut Gwitchin First Nation stated the *Vuntut Gwitchin Government Oil and Gas Engagement Policy* now would require the negotiation of a *Cooperation Agreement* between Vuntut Gwitchin Government and Chance (**Appendix 2-C**).
Chance Vuntut Gwitchin First Nation	Meeting	17-Oct-2019	Discussed a Project update, cooperation and collaboration, and the *Cooperation Agreement* (**Appendix 2-C**).
Chance Vuntut Gwitchin First Nation	Meeting	26–27-Nov-2019	Retained a third-party facilitator to mediate negotiation of the *Cooperation Agreement* required under Stage II of the *Vuntut Gwitchin Government Oil and Gas Engagement Policy*. Both parties met for 2 days (November 26 and

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
			November 27, 2019) to discuss objectives and content of the *Cooperation Agreement* (**Appendix 2-C**)*.
Vuntut Gwitchin First Nation	Document sharing for review and comment	04-Dec-2019	Provided Chance with a revised *Cooperation Agreement* (**Appendix 2-C**).
Chance	Document sharing for records	10-Dec-2019	Provided Chance with a *Work Plan* (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Document sharing for records	12-Feb-2020	Provided the *Gap Analysis* to Vuntut Gwitchin First Nation (**Appendix 2-C**).
Chance	Letter	27-Feb-2020	Received a letter about Chance's request for a waiver of the requirement under the V*untut Gwitchin Government Oil and Gas Engagement Policy* and a *Benefits and Stewardship Agreement* with Chance. Vuntut Gwitchin First Nation advised Chance that their request for a waive of the requirement under the *Vuntut Gwitchin Government Oil and Gas Engagement Policy* had not been granted by the Vuntut Gwitchin First Nation Natural Resources Committee (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Letter	10-Mar-2020	Stated that Chance is disappointed that the Vuntut Gwitchin First Nation Natural Resources Committee was not able to provide the waiver to accommodate the undertaking of the YESAB process. Details around the *Benefits and Stewardship Agreement* were disclosed. Expressed interest in a meeting or series of meetings between April 1 and 8, 2020 in Old Crow to discuss capacity funding and host a community open house event including dinner to provide a Project update (**Appendix 2-C**).
Chance	Letter	18-Mar-2020	Requested a meeting for further clarity on Chance's request of proposed topics of discussion outlined in the March 10, 2020 letter (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Letter	09-Apr-2020	Advised Vuntut Gwitchin First Nation that Chance will comply with the *Vuntut Gwitchin Government Oil and Gas Engagement Policy*. Details around capacity funding were included. Chance stated virtual communications will be necessary due to the COVID-19 pandemic (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Letter	20-Apr-2020	Advised Vuntut Gwitchin First Nation that Chance applied to extend tenure of a permit by 5 years that would expire on August 30, 2020 (**Appendix 2-C**).
Chance	Letter	04-May-2020	Expressed that communications and response time may be prolonged or delayed due to the COVID-19 pandemic (**Appendix 2-C**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Vuntut Gwitchin First Nation	Letter	27-May-2020	Sent a letter to Vuntut Gwitchin First Nation confirming the completion of Section 24 requirements of the *Vuntut Gwitchin Government Oil and Gas Engagement Policy* (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Letter	10-Jun-2020	Followed up on the notice of the Project for Eagle Plains Well Maintenance of Section 24 requirements of the *Vuntut Gwitchin Government Oil and Gas Engagement Policy* (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Virtual meeting	09-Jul-2020	Provided a Project overview and answered questions from Vuntut Gwitchin First Nation (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Document sharing for records	10-Jul-2020	Provided Vuntut Gwitchin First Nation the *COVID-19 Community Engagement and Consultation Procedures* document (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Document sharing for review and comment	13-Jul-2020	Shared the Draft Implementation of the Vuntut Gwitchin Government and Chance Oil and Gas Communication and Engagement Plan Annual Report (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Virtual meeting	21-Aug-2020	Discussed the *Cooperation Agreement* (**Appendix X**).
Vuntut Gwitchin First Nation	Meeting	03-Sep-2020	Held a hybrid meeting and discussed revisions to the proposed Eagle Plains Well Maintenance and Winter Activities and answered questions (**Appendix 2-C**).
Vuntut Gwitchin First Nation and Residents of Old Crow	Community Open House Event	03-Sep-2020	Hosted an open house in Old Crow and documented 11 Vuntut Gwitchin First Nation Citizens and residents of Old Crow attendees (**Appendix 2-C**)*.
Vuntut Gwitchin First Nation and Residents of Old Crow	Document sharing for records	03-Sep-2020	Provided a handout at the open house on September 3, 2020 in Old Crow. This handout outlined the mitigation measures and potential effects on the PCH (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Document sharing for records	05-Sep-2020	Provided the draft Project Proposal for the Well Maintenance Program (**Appendix 2-C**).
Vuntut Gwitchin First Nation and Residents of Old Crow	Document sharing for records	07-Sep-2020	Summarized Vuntut Gwitchin issues and concerns regarding wildlife and Project effects from a meeting in Old Crow (**Appendix 2-C**)*.
Vuntut Gwitchin First Nation	Document sharing for records	16-Sep-2020	Shared the Yukon Oil and Gas Act Benefits Agreement (**Appendix 2-C**).
Vuntut Gwitchin First Nation Natural Resources Committee	Virtual meeting	31-Oct-2020	Provided a Project update and discussed workplans, the *Vuntut Gwitchin Government Oil and Engagement Policy* process, the Project Proposal, Project feedback, third-party support, YESAB pre-submission and submission

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
			consultation and engagement activities, and next steps. Details around capacity funding were also discussed (**Appendix 2-C**)*.
Vuntut Gwitchin First Nation Natural Resources Committee	Virtual meeting	03-Nov-2020	Explained the withdrawal of the Project Proposal from the Dawson City YESAB DO (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Letter	17-Dec-2020	Shared a letter regarding the *Cooperation Agreement* (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Virtual meeting	17-Dec-2020	Discussed the Project including well maintenance and winter activities and previous questions raised by Vuntut Gwitchin First Nation (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Meeting	17-Feb-2021	Discussed capacity funding and the Project (**Appendix 2-C**).
Chance	Letter	31-Mar-2021	Received from Vuntut Gwitchin First Nation to discuss communication pathways, consultation and engagement including measures implemented by Vuntut Gwitchin First Nation before continuing engagement with Chance under stage 2 of the *Vuntut Gwitchin Government Oil and Gas Engagement Policy*, and non-compliance with the *Vuntut Gwitchin Government Oil and Gas Engagement Policy* (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Letter	12-Apr-2021	Provided a letter to Chief Tizya-Tramm regarding the letter Chance received on March 31, 2021. Chance re-stated their intentions to engage respectfully and transparently with the Vuntut Gwitchin Government (**Appendix 2-C**).
Vuntut Gwitchin First Nation and Residents of Old Crow	Community Open House Event	20-Apr-2021	Hosted an open house at Chief Zzeh Gitlitt School in Old Crow. In total, 10 Vuntut Gwitchin First Nation Citizens and residents of Old Crow attended the open house (**Appendix 2-C**)*.
Vuntut Gwitchin First Nation and Residents of Old Crow	Community Open House Event	21-Apr-2021	Hosted an open house at Chief Zzeh Gitlitt School in Old Crow. In total, 7 Vuntut Gwitchin First Nation Citizens and residents of Old Crow attended the open house (**Appendix 2-C**)*.
Vuntut Gwitchin First Nation and Residents of Old Crow	Community Open House Event	18-May-2021	Hosted an open house in Old Crow. In total, 14 Vuntut Gwitchin First Nation Citizens and residents of Old Crow attended the event. Environmental Dynamics Inc. (EDI), Vertex, and Chance provided respective presentations on linear features, water quality, wildlife, birds, and fish studies, drilling, and the Project (**Appendix 2-C**)*.
Vuntut Gwitchin First Nation and Residents of Old Crow	Document sharing for records	09-Jun-2021	Shared handouts for open house events from April 20, 2021, April 21, 2021, and May 18, 2021. Chance also shared the presentation that was shared at these events (**Appendix 2-C**)*.
Vuntut Gwitchin First Nation	Document sharing for records	13-Jul-2021	Shared the *Vuntut Gwitchin Heritage Act* with Chance for documentation (**Appendix 2-C**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Vuntut Gwitchin First Nation	Document for review and comment	19-Jul-2021	Shared the Draft *Implementation of the Vuntut Gwitchin Government and Chance Oil and Gas Communication and Engagement Plan Annual Report* (**Appendix 2-C**).
Vuntut Gwitchin First Nation and Residents of Old Crow	Community Open House Event	13-Oct-2021	Hosted an open house at Chief Zzeh Gitlitt School Gym in Old Crow. Attendees included approximately 43 Vuntut Gwitchin First Nation Citizens and residents of Old Crow. Chance presented on permafrost, seismic, and wildlife baseline studies (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Letter	27-Oct-2021	Discussed capacity funding and repairing the relationship with Vuntut Gwitchin First Nation (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Letter	01-Dec-2021	Requested a meeting with the Chief of Vuntut Gwitchin First Nation (**Appendix 2-C**).
First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Tr'ondëk Hwëch'in	Document sharing for records	17-Dec-2021	Shared a letter to the Government of Yukon, Land Tenure Extension Request for Exploration Permits 0008-0017, 0019 and 0020 ("Permits") (Appendix C-41) (**Appendix 2-C**).
Chance First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Government of Yukon	Document sharing for review and comment	20-Jan-2022	Provided an updated version of the Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2022 Interim Report (22-22ASR) (**Appendix 2-C**).
Chance Vuntut Gwitchin First Nation Residents of Old Crow	Community Open House Event	05-May-2022	Held a community open house event in Old Crow to share Project information including heritage resources, permafrost, seismic testing, about wildlife studies. Attendees included approximately 29 Vuntut Gwitchin First Nation Citizens and residents of Old Crow (**Appendix 2-C**).
Chance Vuntut Gwitchin First Nation Residents of Old Crow	Community Open House Event	26-May-2022	Held a community open house event in Old Crow to share Project information. Attendees included approximately 13 Vuntut Gwitchin First Nation Citizens and residents of Old Crow. Chance presented on the details on the drilling program and wildlife baseline studies (**Appendix 2-C**).
Chance	Letter	05-Aug-2022	Sent Chance a letter on communication and engagement about the Project (**Appendix 2-C**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Chance First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Government of Yukon	Document sharing for review and comment	29-Nov-2022	Provided an updated version of the Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2022 Interim Report (22-22ASR) (**Appendix 2-C**).
Chance Leadership and technical advisors from: Gwich'in Tribal Council First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation	Meeting	26-Jan-2023	Hosted an in-person meeting in Vancouver, BC to re-establish collaborative working relationships, discuss engagement preferences going forward, and provide a Project update (**Appendix 2-C**).
Chance First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Government of Yukon	Document sharing for review and comment	15-Mar-2023	Provided an updated version of the Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2022 Interim Report (22-22ASR) (**Appendix 2-C**).
Vuntut Gwitchin First Nation	Letter	05-Apr-2023	Provided Project information, including an update on the *Draft Project Description* (Version 2) (**Appendix 2-C**).
Chance Vuntut Gwitchin First Nation Residents of Old Crow	Community Open House Event	15-May-2023	Travelled to Old Crow for an in-person community open house event. This event was cancelled due to the potential for a flash flood. Chance, with approval from Chief Frost, provided a catered dinner for leadership and community members at the Old Crow Community Centre. No summary was prepared because the event did not occur.
Chance Vuntut Gwitchin First Nation	Meeting	04-Aug-2023	Discussed a Project overview, design changes, baseline studies, and schedule, and engagement (**Appendix 2-C**).
Chance Vuntut Gwitchin First Nation	Meeting	25-Aug-2023	Discussed Chance's land tenure extensions and resources to support Vuntut Gwitchin First Nation's participation in the EC assessment process (**Appendix 2-C**)*.
Chance Vuntut Gwitchin First Nation	Meeting	13-Sep-2023	Discussed a Project update, baseline studies, and schedule and engagement (**Appendix 2-C**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Chance Potentially affected First Nations Government of Canada YESAB Vuntut Gwitchin First Nation	Meeting	13-Oct-2023	Discussed the Project's assessment process including capacity funding and possible efficiencies through a coordinated approach (e.g., sharing consultants to support potentially affected First Nations' review of the Project Proposal) (**Appendix 2-C**).
Vuntut Gwitchin First Nation and Residents of Old Crow	Community Open House Event	06-Dec-2023	Held a focus group event in Old Crow to share Project information with presentations by technical experts from EDI, Ecofor, and Palmer. This included wildlife, fish and fish habitat, heritage resources, and permafrost presentations (**Appendix 2-C**).
First Nation of Na-Cho Nyäk Dun Gwich'in Tribal Council Porcupine Caribou Management Board Tr'ondëk Hwëch'in Vuntut Gwitchin First Nation Government of Yukon Chance EDI TWC	Meeting	20-Dec-2023	Discussed completed environmental baseline studies; potential effects on fish and wildlife and potential mitigation measures for fish and wildlife; potential PCH effects and potential mitigations; and the linear features study and North Yukon Land Use Planning conformity (**Appendix 2-C**).
* = Appendices not available at the time this section was drafted.			

2.9.6 Agreements

Chance and Vuntut Gwitchin First Nation signed a Benefits Agreement to support Vuntut Gwitchin First Nation's involvement in Chance well maintenance activities in Eagle Plains between 2011 and 2014. The agreement ended upon completion of the well maintenance activities in 2014.

Chance and Vuntut Gwitchin First Nation have not discussed any formal agreement for the Project to date. Though outside the scope of this Project, First Nation of Na-Cho Nyäk Dun, Vuntut Gwitchin First Nation, Government of Yukon, and Chance signed a Benefits Agreement on October 25, 2023 for their Well Maintenance Project.

2.9.7 Records Management

Appendix 2-C includes a record of contact documenting all consultation and engagement activities including emails, phone calls, text messages, letters, meetings, and events between Chance and Vuntut Gwitchin First Nation to up to December 20, 2023, and a record of contact documents all consultation and engagement activities with residents of Old Crow up to December 20, 2023 (**Appendix 2-C**).

2.9.8 Engagement Feedback (Effects, Issues, and Interests)

Chance sought to obtain feedback from potentially affected First Nations and residents of communities through Project engagement activities.

Table 2-7 presents effects, issues, and interests shared by Vuntut Gwitchin First Nation and residents of Old Crow with Chance up to December 20, 2023.

Table 2-7. Vuntut Gwitchin First Nation and Residents of Old Crow Key Issues and Consultation and Engagement Feedback

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Project Design					
Email	Vuntut Gwitchin First Nation	20-Oct-2020	Requested information regarding Project costs, well permit areas, number of wells, and their locations.	Chance acknowledged and recorded the comment.	Chance modified the Project design to eliminate all-season roads from the Project. Instead, Chance will utilize winter ice roads. Chance acknowledges Vuntut Gwitchin First Nation's concerns about the number of well sites. **Section 1** describes how the well sites and design will incorporate key features to enhance efficiency, reduce waste, and minimize general effects on the surrounding environment. Chance will limit traffic on the winter access to authorized personnel. Traffic will include approximately 8 to 9 light-weight service trucks daily (for supplies and personnel), 1 to 2 water trucks, and 1 fuel truck as frequently as exploration activities dictate (see **Section 1**).
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	05-May-2022	Expressed concern about drilling locations.	Chance acknowledged and recorded the comment.	Chance is committed to sharing well locations as locations become known. Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See **Sections 1 and 3** for more information.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Inquired about previous drilling activity in the Eagle Plains Area. Asked if Chance has mapped out camps in the area.	Drilling occurred in 2012 and 2013. Drill holes were to up 3.4 km deep. The Project will utilize shallow drilling, involving drilling between 1,500 and 2,400 m. Fracking	Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See Table 1-1: Summary of Key

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
				will not be utilized for this exploration Project. Chance is utilizing the Doors Yukon camp. No other specific work camps in the area will be used.	Activities for more information on the Chance camp.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked who granted Chance the authority to drill in the Project footprint.	The Chance Project Team said the Project is located off First Nation settlement land, and the Government of Yukon is the regulator that grants authority to drill.	Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements. Comment was addressed at the time it was shared.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked why information around who has the authority to drill in the Project footprint is not known to the public.	The Chance Project Team responded that they want this information to get out. The Chance Project Team said there was a 7-year process to develop the *North Yukon Land Use Plan* including public meetings. The *North Yukon Land Use Plan* outlines designated high development areas. Chance shared that the *North Yukon Land Use Plan* was approved by Vuntut Gwitchin Government. The Chance Project Team also said that the YESAB process will dictate what the Project will be and stated YESAB is required to review all Project information and feedback from First Nations.	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked if the Project is going to be conducted throughout the year.	The Chance Project Team confirmed exploration activities are planned for the winter months over a 10-year period.	Comment was addressed at the time it was shared.
Consultation and Engagement Process					
Meeting	Vuntut Gwitchin First Nation	22-Feb-2018 04-Oct-2018	Vuntut Gwitchin First Nation suggested extending the timeline for discussing the Agreement to allow for more community engagement, considering that the First Nation is new to the oil and gas industry and expressed a need for additional time to comprehend the Project.	Chance acknowledged and recorded the comment. Chance responded that they accept a longer timeline, with February 2019 remaining the target end date. No further action required at this time.	Chance is committed to building positive and open relationships with all potentially affected First Nations. Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements.
Letter Letter Letter Email Letter Letter	Vuntut Gwitchin First Nation	10-Jul-2019 27-Feb-2020 18-Mar-2020 31-Mar-2020 31-Mar-2021 05-Aug-2022	Vuntut Gwitchin First Nation unable to proceed with consultation and engagement activities, until concerns around Chance's application to extend the term of oil and gas permits were discussed and addressed. Requested a meeting. Commented that Chance was in non-compliance with the Vuntut Gwitchin Government's *Oil and Gas Engagement Policy*. Stated that Chance is required to undertake consultation and engagement activities in a manner that complies with this policy.	Chance acknowledged and recorded the comment. Chance met with Vuntut Gwitchin First Nation Natural Resources Committee in August 2019 to discuss matters related to consultation and engagement. Chance advised Vuntut Gwitchin First Nation that it will comply with the Vuntut Gwitchin Government *Oil and Gas Engagement Policy* (April 9, 2020 letter).	Chance is committed to following the Vuntut Gwitchin Government's Oil and Gas Engagement Policy. Chance is committed to building positive and open relationships with all potentially affected First Nations. Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	26-May-2022	Vuntut Gwitchin First Nation requested additional consultation and engagement with community members.	Chance acknowledged and recorded the comment.	Chance is committed to building positive and open relationships with all potentially affected First Nations. Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements. Chance conducted 8 socio-economic interviews with Vuntut Gwitchin First Nation staff and organizations and businesses in Old Crow. Of the 8 interviews, 5 interviews were conducted with Vuntut Gwitchin Government staff (3 in-person and 2 virtually) and 3 interviews were conducted with previous or current organization/business representatives.
Meeting	Vuntut Gwitchin First Nation	26-Jan-2023 04-Aug-2023	Requested a tripartite meeting between Vuntut Gwitchin First Nation, Chance, and the Government of Yukon.	Chance acknowledged and recorded the comment. Chance confirmed interest in understanding YESAB and Government of Yukon consultation's next steps. Chance will continue to attempt to meet with YESAB and Government of Yukon to confirm the common understanding of next consultation steps.	Chance is open to meeting with potentially affected First Nations and other parties throughout the Project's phases. Potentially affected First Nations, YESAB, Government of Yukon, Government of Canada, and Chance met on October 13, 2023, to discuss the Project's assessment process including consultation requirements and capacity funding opportunities for First Nations.
Meeting	Vuntut Gwitchin First Nation	03-Sep-2020	Commented that engagement is important to identify the valued ecological and socio-economic components and assess the Project in a detailed and meaningful way.	Chance acknowledged and recorded the comment. Chance confirmed that it wants to work with Vuntut Gwitchin First Nation.	Chance acknowledges the importance of consulting with potentially affected First Nations and values their input in the assessment process. Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
					First Nation protocols and preferences, and *YESAA* requirements. Potentially affected First Nations, YESAB, Government of Yukon, Government of Canada, and Chance met on October 13, 2023, to discuss the Project's assessment process including consultation requirements and capacity funding opportunities for First Nations
Letter Meeting	Vuntut Gwitchin First Nation	05-Aug-2022 13-Oct-2023	Stated that the Project Proposal should consider effects on the Gwich'in Nation as a whole, including Gwich'in in Alaska. Inquired about existing or potential consultation activities with Alaska and Alaskan First Nations regarding international transboundary lands.	Chance acknowledged and recorded the comment. Chance stated it is following *YESAA* consultation requirements and identified that *YESAA* does not include international transboundary consultation requirements.	Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements.
Meeting	Vuntut Gwitchin First Nation	26-Jan-2023	Expressed concerns for Treaty and Aboriginal Rights, extent of engagement, permits with First Nation of Na-Cho Nyäk Dun, removal of 5 northern permits.	Chance acknowledged and recorded the comment. Chance responded that it is looking to understand how each Indigenous Nation would like to engage and share information. Chance stated that they are open to economic and environmental stewardship partnerships. Chance stated that they have hired consultants to assess potential Project-related effects on the Eagle Plains basin.	Chance shared the Draft *Collaboration Plan* outlining proposed consultation and engagement activities with Vuntut Gwitchin First Nation between October 2023 and February 2024 with Vuntut Gwitchin First Nation for review and comment. Chance is committed to refining future consultation and engagement in response to feedback from Vuntut Gwitchin First Nation.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Meeting	Vuntut Gwitchin First Nation	26-Jan-2023	Commented that there are important engagement protocols that requires building integrity and trust with Elders and communities.	Chance acknowledged and recorded the comment.	Chance is committed to building positive and open relationships with all potentially affected First Nations. Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements.
Meeting	Vuntut Gwitchin First Nation	26-Jan-2023	Recognized the importance of re-establishing relationships with all northern Indigenous Nations.	Chance acknowledged and recorded the comment.	Chance is committed to building positive and open relationships with all potentially affected First Nations. Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Expressed a need for engagement and consultation with local communities. Shared individuals are seeking proper and informed engagement but are not for or against the Project.	Chance committed to continue engaging Vuntut Gwitchin First Nation on the Project. Chance planned another community event in Old Crow in December 2023 to discuss potential Project-related effects and proposed mitigation measures with Vuntut Gwitchin First Nation Citizens and residents of Old Crow.	Comment was addressed at the time it was shared.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Requested that Chance clarify where they have been, where they are now, and where they are headed.	The Chance Project Team shared information on the YESAB process for the Project. The Chance Project Team also prepared a 2-page handout to share Project information, a description of the YESAB	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
				assessment process, studies completed by Chance, the Project assessment process timeline, and key First Nation Project feedback and Chance's responses to shared feedback. This handout was also shared at community event in Old Crow in December 2023.	
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Shared that quieter individuals are interested in questions asked. Suggested finding opportunities for local people to meet on behalf of the community.	Chance shared that they are available to discuss Project information with interested Vuntut Gwitchin First Nation Citizens and residents of Old Crow via phone or email. Chance made their contact information available in the Project handout that was distributed at the Open House.	Comment was addressed at the time it was shared.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Noted the importance of those with expertise presenting on permafrost, habitat, and water.	The Chance Project Team includes experts on permafrost, habitat, and water from EDI and Palmer. These experts were at the Open House to share information on and support discussions about their respective areas of expertise with Open House attendees.	Comment was addressed at the time it was shared.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Suggested more involvement in the Project from Vuntut Gwitchin First Nation leadership.	Chance acknowledged and shared this feedback with Vuntut Gwitchin First Nation leadership.	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Appreciated the opportunity to learn more about the Project. Noted the Project Overview Video was very informative.	Chance acknowledged the comments.	Comment was addressed at the time it was shared.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Expressed interest in learning more about Chance and the Project.	Chance committed to continue engaging Vuntut Gwitchin First Nation on the Project. Chance planned another community event in Old Crow in December 2023 to discuss potential Project-related effects and proposed mitigation measures with Vuntut Gwitchin First Nation Citizens and residents of Old Crow.	Comment was addressed at the time it was shared.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Suggested Chance use a microphone during their next presentation to help all attendees hear the questions and comments from the crowd.	Chance designed a community event in December 2023 to support smaller, more focused group discussions about the Project. These discussions also supported better hearing conditions for attendees.	Comment was addressed at the time it was shared.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Shared the Open House was a great information session. Noted Chance provided good information on Project operations at the Open House.	Chance acknowledged the comments.	Comment was addressed at the time it was shared.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Suggested Chance discuss the Project with young people.	Chance acknowledged the comment and shared that all community-level events hosted by Chance are open to all ages. Chance also	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
				shared openness to connecting with interested young people about the Project via phone or email at any time. Chance made their contact information available in the Project handout that was distributed at the Open House.	
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Shared the Open House was their first meeting about oil and gas and that there was lots of information. Expressed they do not understand but are getting there. Suggested Chance conduct additional consultation and engagement activities in Old Crow or send out Project information via paper.	Chance committed to continue engaging Vuntut Gwitchin First Nation on the Project. Chance planned another community event in Old Crow in December 2023 to discuss potential Project-related effects and proposed mitigation measures with Vuntut Gwitchin First Nation Citizens and residents of Old Crow. Chance also prepared and distributed a 2-page handout at this event to share Project information, a description of the YESAB assessment process, studies completed by Chance, the Project assessment process timeline, and key First Nation Project feedback and Chance's responses to shared feedback.	Comment was addressed at the time it was shared.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Inquired as to why other First Nations are being consulted about the Project.	Chance mentioned that the Project is consulting with other First Nations because the Eagle Plains Area is within their Traditional	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
				Territories. Chance is required to consult with others because of the Project location and potential effects.	
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Expressed that Chance has provided clear and valuable information at the event. Added that the Project will be a significant project for Vuntut Gwitchin Government. Expressed that having two focus groups made it conducive for open communication. Expressed Chance explained the topics well. Shared that they were satisfied or very satisfied with the World Café.	Chance appreciated the feedback.	Comment was addressed at the time it was shared.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked if other governments are involved in studies completed for the Project. Inquired about Environmental Dynamic Inc.'s (EDI's) involvement with other governments.	The Chance Project Team said Chance is responsible for conducting the studies and uses available government data to support their studies. Added that Chance is required to conduct specific studies to meet requirements under the *Yukon Environmental Socio-economic Assessment Act*. The Chance Project Team shared that EDI supports the sonar project on the Porcupine River and works with the Vuntut Gwitchin First	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
				Nation on the winter road which involves DFO.	
Fish and Fish Habitat					
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked if the Chance Project Team has a best practice for protecting fish and fish habitat or where the answers go from their studies.	Chance is required to follow fish guidelines set by DFO. Other guidelines for fish and fish habitat protection could come from YESAB or suggestions made by Vuntut Gwitchin First Nation and other potentially affected First Nations. Shared that there will be a public comment period once Chance submits the Project Proposal to YESAB in 2024. Added that anyone can download and submit comments on the Project Proposal directly to YESAB and/or Chance. The Chance Project Team noted that suggestions to protect fish and fish habitat shared today are helpful and could change the Project design. The Chance Project Team confirmed suggestions shared would be reflected in the Project Proposal. The Chance Project Team reminded attendees that the World Café event is one of multiple opportunities to ask questions about and shared feedback on the Project.	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Traditional Knowledge					
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked if Traditional Knowledge was considered in the Project design.	The Chance Project Team shared that Traditional Knowledge has been considered throughout the process and was provided information by Citizens of Old Crow on the winter range of the PCH. The Chance Project Team noted that PCH baseline studies captured both Traditional Knowledge and western science. The Chance Project Team engaged Vuntut Gwitchin First Nation Heritage on Traditional Knowledge confidentiality and use protocols. The Chance Project Team also shared existing secondary sources of Traditional Knowledge for Vuntut Gwitchin First Nation Heritage's review, comment, and permission for use. The Chance Project Team added that Traditional Knowledge is reflected in the Land and Resources section of the Project Proposal and has influenced the Project design (e.g., focusing on winter access roads versus all-season access roads). The Chance Project Team added that a request was brought in for the Project Team to halt	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
				building an all-season road until resources have been identified. It was requested that hunters were not allowed on the access road.	
Land and Resource Use					
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Expressed concerns about the Project affecting Vuntut Gwitchin lands and the PCH. Added that Vuntut Gwitchin First Nation relies heavily on traditional food because of their remote location.	The Chance Project Team acknowledged the significance of PCH to Vuntut Gwitchin people. Added that Project-related effects to the PCH and land and resource use are described in the Project Proposal. Proposed mitigation measures for Project-related effects will also be described in the Project Proposal.	See **Section 11** for more information on potential Project-related effects on and mitigation measures for land and resource use.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Expressed concerns regarding subsistence hunting.	Chance confirmed that the land use will change and will affect subsistence hunting. Chance anticipates that there will be no long-term effects, but there will be an effect on caribou movement and subsistence harvesting in the short term.	See **Section 11** for more information on potential Project-related effects on and mitigation measures for land and resource use.
Water Resources					
Community Open House Events Meeting	Vuntut Gwitchin First Nation Residents of Old Crow	13-Oct-2021 05-May-2022 26-May-2022	Expressed concern for surface water effects and environmental protection. Expressed concern about water quality.	Chance acknowledged and recorded the comment.	Chance hosted a World Café event to share Project effects information with and obtain feedback on proposed mitigation measures from Vuntut Gwitchin First Nation Citizens and residents of Old Crow on December 6, 2023.

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	Vuntut Gwitchin First Nation	04-Aug-2023	Stated that water is a key issue.		Chance shared baseline studies with Vuntut Gwitchin First Nation. Chance had a surface water quality and hydrology baseline report developed to inform background characteristics of surface water within the Regional Study Area. This report will guide any anticipated or intended water resource requirements. See the **Section 5** for mapping of riparian constraints within the Project footprint. Personnel trained in spill response will be onsite for the duration of the Project. In addition to spill response and cleanup, the spill response plan will include details on reporting requirements. More information about the type of materials used for the flow tests is available in **Section 1** of the Project Proposal. Chance will establish and enforce procedures to prevent unintended fluid release into the environment. Furthermore, an Emergency Spill and Response Plan and an Environmental Protection Plan will be devised, encompassing specifics on environmental monitoring and internal adherence to spill prevention and response measures. Chance will develop and implement procedures to prevent the inadvertent release of oil to the ground or waterways. See **Section 5** of the Project Proposal for more information.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Recommended Vuntut Gwitchin First Nation conduct research and information on	Chance acknowledged the importance for water quality/quantity data and community-led monitoring.	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
			water impacts (upstream and downstream water quality).	Chance committed to sharing water and fish studies completed for the Project with Vuntut Gwitchin First Nation leadership[8]. Chanced shared this feedback with Vuntut Gwitchin First Nation leadership.	
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked how spills in rivers will be cleaned up. Asked how the Project will avoid creek crossings and erosion. Encouraged Chance to conduct drilling away from water resources. Asked what measures the Project is taking to protect creeks.	The Chance Project Team said studies completed for the Project have helped to identify potential low-impact drilling locations away from creeks and other water bodies. Added that the Project will avoid works near creeks as much as possible and that mitigation measures will be in place in case working near creeks becomes unavoidable. The Chance Project Team shared that Chance has spill plans and an emergency response plan, which is required by law for all oil and gas companies in Canada. Added that as part of the regulations, the well location needs to be a minimum of 100 m away from any water source. Added that the	Chance to list the fluids and materials necessary. Chance committed to developing plans to mitigate potential effects. Personnel trained in spill response will be onsite for the duration of the Project. In addition to spill response and cleanup, the spill response plan will include details on reporting requirements. More information about the type of materials used for the flow tests is available in **Section 1** of the Project Proposal. Chance will establish and enforce procedures to prevent unintended fluid release into the environment. Furthermore, an Emergency Spill and Response Plan and an Environmental Protection Plan will be devised, encompassing specifics on environmental monitoring and internal adherence to spill prevention and response measures.

[8] Two Worlds Consulting, on behalf of Chance, shared the Project's Fish and Fish Habitat and Surface Water Quality and Hydrology report with Vuntut Gwitchin First Nation's technical advisor and Executive Director on November 27, 2023 and offered to meet and discuss these studies, if interested.

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				Chance Project Team must be aware of all spill incidents. Added that releases to the environment are expected to be highly unlikely.	Chance will develop and implement procedures to prevent the inadvertent release of oil to the ground or waterways.
Wildlife and Wildlife Habitat					
Meeting	Vuntut Gwitchin First Nation	03-Sep-2020	Expressed concern for effects to caribou and moose.	Chance acknowledged and recorded the comment. Chance stated a desire to work with lands technical staff to gather information on interests in the Project footprint.	Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See **Sections 8 and 9** for more information. Chance's Wildlife Baseline Study summarizes existing baseline information for moose and developed a habitat model for the species within the Eagle Plains Regional Study Area (RSA). The habitat model quantifies the suitability, amount, and distribution of potential habitat for moose in the RSA. This information will be used to assess the Project's potential effects on moose and develop measures to mitigate effects if required (EDI, 2022, p. 87). EDI reviewed telemetry data and analysis outputs from the Porcupine Caribou Technical Committee to quantify the degree of seasonal range overlap by the PCH with the Project RSA during late fall and winter, when seasonal range use overlaps the RSA (EDI, 2022, p. 112). See **Sections 8** and **9** of the Project Proposal for more information on potential Project effects on moose and caribou.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Meeting	Vuntut Gwitchin First Nation	03-Sep-2020	Expressed concern for wolves.	Chance acknowledged and recorded the comment. Chance stated that wolves are not near the road as there is 24-hour road use. There will also be wildlife monitors present and ready to report sightings.	Chance conducted a *Linear Features Study* to understand the functional effect of existing linear features in the Project footprint, focused on wildlife, which was shared with Vuntut Gwitchin First Nation. The Project effects assessment includes an evaluation of the creation of new linear features, as well as an assessment of cumulative effects on which the Project may contribute. The Project is focused on newer, low-impact seismic technology. See **Sections 8** and **9** of the Project Proposal for more information on the potential effects of the Project on wolf prey species, including moose and caribou.
Letter	Vuntut Gwitchin First Nation	05-Aug-2022	Expressed concern that the Project will create human access and commented that the ecosystem has been protected by its inaccessibility.	Chance acknowledged and recorded the comment.	Chance is committed to controlling and restricting public use of its access roads. Chance recognizes this is a concern and will engage potentially affected First Nations further on this issue. Chance will limit traffic on the winter access to authorized personnel. Traffic will include approximately 8 to 9 light-weight service trucks daily (for supplies and personnel), 1 to 2 water trucks, and 1 fuel truck as frequently as exploration activities dictate (see **Section 1**).
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Inquired about Chance's fish guidelines for the Project and expressed interest in seeing clear guidelines to protect fish..	The Chance Project Team confirmed fish guidelines for the Project will follow guidelines set by the Department of Fisheries and Oceans (DFO) Canada. Measures will be outlined in the Project Proposal.	Comment was addressed at the time it was shared.

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Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Inquired about differences in monitoring outcomes between lake fish and river fish. Identified that different species are found in each.	Monitoring efforts did identify arctic grayling but did not detect any salmon species. Chance is only monitoring river systems and not lakes.	Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See **Section 3 and 6** for more information.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Inquired about the Project's strategies for safeguarding riparian areas within the Project footprint.	Chance has identified high value riparian areas; these areas will be avoided as much as possible.	Chance shared that winter exploration will reduce negative effects on riparian areas. The construction and use of winter roads will minimize effects on surface vegetation. Chance shared that winter roads follow the height of land avoiding riparian areas and water bodies. All activities occur away from riparian areas and there are no stream crossings associated with the winter roads. Mitigation measures are expected to address potential effects on water resources and fish. Residual effects on these values are expected to be negligible. See **Sections 5** and **6** of the Project Proposal for more details. Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See **Section 3** for more information.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Inquired about a wildlife monitoring program	The Chance Project Team said there will be a wildlife monitoring program throughout the Project that prioritizes hiring First Nation Citizens.	Comment was addressed at the time it was shared.

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Porcupine Caribou Herd					
Meeting Community Open House Events Letter	Vuntut Gwitchin First Nation Residents of Old Crow	03-Sep-2020 13-Oct-2021 05-May-2022 04-Aug-2023 05-Aug-2022	Expressed concerns regarding effects on caribou and specifically for the PCH.	Chance acknowledged and recorded the comment. Chance stated a desire to work with lands technical staff to gather information on interests in the Project footprint. Chance stated the topics would be included in the draft Project Proposal and Chance is open to discussing these topics with Vuntut Gwitchin First Nation.	Chance acknowledges the important cultural value of the PCH to the Gwich'in. Chance is committed to reducing potential negative effects on the PCH and other wildlife. Chance hosted a World Café event to share Project effects information with and obtain feedback on proposed mitigation measures from Vuntut Gwitchin First Nation Citizens and residents of Old Crow on December 6, 2023.Chance shared baseline studies with Vuntut Gwitchin First Nation on the PCH. Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See **Sections 3 and 9** for more information. See **Section 9** of the Project Proposal for more information on potential Project effects on the PCH.
Meeting	Vuntut Gwitchin First Nation	03-Sep-2020	Expressed concern for wolves using seismic cut lines and winter trails to hunt caribou.	Chance acknowledged and recorded the comment. Chance stated that wolves are not near the road as there is 24-hour road use. There will also be wildlife monitors present and ready to report sightings.	Chance assessed the potential effects of the Project on caribou mortality, including facilitated predation by wolves. See **Section 9** of the Project Proposal for more information.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Expressed concern for a lack of engagement and consultation with the PCMB. Shared concern for caribou showing signs of impacts,	The Chance Project Team discussed the data received from the PCMB and stated the Caribou Effects Assessment in the Project	See **Section 9** for more information on potential Project-related effects on and mitigation measures for the PCH.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
			including changes to hunting practices due to development in the region. It was mentioned that Project analysis should be discussed with PCMB. Expressed concerns for caribou and stated that 30 wells over 10 years is concerning. Added that wildfires are destroying habitat range (including reduced blueberry harvests), which is further impacting caribou. Noted the importance of consultation with PCMB.	Proposal will be shared with the PCMB before it is submitted to YESAB in February 2024. Chance scheduled a Project overview meeting with PCMB on December 1, 2023 and a workshop on December 20, 2023 with technical advisors from the potentially affected First Nations and the PCMB to discuss PCH studies completed for the Project as well as potential Project-related effects to the PCH and proposed mitigation measures to protect the PCH.	
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Expressed concern for caribou and declines in northern caribou species.	Chance responded that this will be addressed in the Project Proposal.	See **Section 9** for more information on potential Project-related effects on and mitigation measures for the PCH.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked what information the Chance Project Team had received from the PCMB.	The Chance Project Team confirmed that a lot of information had been received from the PCMB. Added that the PCMB provided Chance/EDI with collared data and that Chance shared Project information and wildlife studies with the PCMB technical committee per the PCMB's direction. The Chance Project Team shared that Chance met with	Comment was addressed at the time it was shared.

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				the PCMB on December 1st to discuss the Project and conducted a technical working group meeting with the PCBM on the Porcupine Caribou Herd on December 20th.	
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Inquired about the decline of the northern caribou species.	The Chance Team acknowledge the concern about reported declines in caribou numbers, and that several herds are showing signs of recovery, and noted that the Porcupine Caribou Herd is at the largest numbers ever recorded.	Comment was addressed at the time it was shared.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Requested that meat from a caribou killed by a predator be brought to Vuntut Gwitchin First Nation.	The Chance Project Team said typically the Government of Yukon and Environment and Climate Change Canada want to inspect the carcass. The Chance Project Team confirmed looking into the viability of sharing caribou meat with Vuntut Gwitchin First Nation. Added that while drilling, employees are to let the caribou move through the Project site unimpeded. The Chance Project Team explained that caribou are expected to adapt to the drills if they are not seen as predators.	Comment was addressed at the time it was shared. See **Section 9** for more information on potential Project-related effects on and mitigation measures for the PCH.

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Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Noted that a lot of caribou like to stay along the winter roads.	The Chance Project Team agreed based on observations from the 2013/2014 seismic work, and noted this behaviour.	Comment was addressed at the time it was shared. See **Section 9** for more information on potential Project-related effects on and mitigation measures for the PCH.
Permafrost and Terrain					
Community Open House Event Community Open House Event Meeting	Vuntut Gwitchin First Nation Residents of Old Crow Vuntut Gwitchin First Nation	13-Oct-2021 05-May-2022 04-Aug-2023 06-Dec-2023	Expressed concern about permafrost effects. Stated that permafrost is a key issue.	Chance acknowledged and recorded the comment.	Chance hosted topic-specific focus group discussions to share potential Project effects information with and obtain feedback on mitigation measures from Vuntut Gwitchin First Nation and residents of Old Crow on December 6, 2023. Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See **Section 3** for more information. See **Section 4** of the Project Proposal for more information on potential Project-related effects on and mitigation measures for permafrost.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked if the Surficial Geology Mapping and Road and Wellpad Suitability for Exploration maps shared on the permafrost posterboard were accurate.	Chance clarified that the maps been field verified to a level consistent with professional standards, and adjusted using data collected in field (i.e., temperature sensors and surface drilling. had been ground tested using sensors).	Comment was addressed at the time it was shared. See **Section 4** of the Project Proposal for more information on potential Project-related effects on and mitigation measures to for permafrost.
Community Open House Event	Vuntut Gwitchin First Nation	06-Dec-2023	Asked if Palmer was a private company or a government office.	Chance confirmed that Palmer is a privately owned company. Shared that Palmer hires registered	Comment was addressed at the time it was shared. See **Section 4** of the Project Proposal for more information on potential Project-

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
	Residents of Old Crow			professional geologists and geo-scientists who are bound by ethical standards to present accurate terrain and permafrost information.	related effects on and mitigation measures for permafrost.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked if permafrost is under the whole Project footprint.	The Chance Project Team stated that they are trying to avoid areas that are ice-rich. Added that areas containing silts and clays will thaw the permafrost more quickly than areas without silts and clays. The Chance Project Team noted that Chance will utilize the suitability map prepared by Palmer to design winter access road and drilling locations.	Comment was addressed at the time it was shared. See **Section 4** of the Project Proposal for more information on potential Project-related effects on and mitigation measures for permafrost.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked if the temperature of the ground has been warmer due to climate change.	The Chance Project Team confirmed data had only been collected over the past few years; changes in climate are measured on a longer time scale.	Comment was addressed at the time it was shared. See **Section 4** of the Project Proposal for more information on potential Project-related effects on and mitigation measures for permafrost.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked if the Project footprint has been hit by wildfires.	The Chance Project Team responded that wildfires have hit the Project footprint which can cause permafrost to reduce and increase the active layer. Added that wildfires damage permafrost, but vegetation helps to insulate the permafrost in areas not damaged by wildfire.	Comment was addressed at the time it was shared. See **Section 4** of the Project Proposal for more information on potential Project-related effects on and mitigation measures for permafrost.

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Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked what was identified in the permafrost study.	The Chance Project Team said the studies identified areas and thickness of permafrost. Added that this data will help create a baseline to understand potential future impacts to permafrost in the area.	Comment was addressed at the time it was shared. See **Section 4** of the Project Proposal for more information on potential Project-related effects on and mitigation measures for permafrost.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked about the depth of the permafrost.	The Chance Project Team said the depth of permafrost varies across the Project footprint. Palmer's drilling work shows that the active layer is 0.45 to 0.9 m thick in fine-grained soils, below wetlands, and in valley bottoms. In coarse-grained soils, it is more than 0.9 m thick. Areas recently burned by wildfire have active layers that are more than 1 m thick, possibly much more.	Comment was addressed at the time it was shared. See **Section 4** of the Project Proposal for more information on potential Project-related effects on and mitigation measures for permafrost.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked what the Project will do to avoid drilling in discontinuous permafrost areas.	The Chance Project Team noted that the Project will take action to prevent drilling in discontinuous permafrost areas.	Comment was addressed at the time it was shared. See **Section 4** of the Project Proposal for more information on potential Project-related effects on and mitigation measures for permafrost.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Noted that some people in Old Crow have noticed changes in soil/permafrost conditions.	The Chance Project Team said that happens when the permafrost starts to unfreeze.	Comment was addressed at the time it was shared. See **Section 4** of the Project Proposal for more information on potential Project-related effects on and mitigation measures for permafrost.

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Employment and Economy					
Email Community Open House Event	Vuntut Gwitchin First Nation Vuntut Gwitchin First Nation Residents of Old Crow	20-Jan-2020 20-Oct-2020 05-May-2022 06-Dec-2023	Requested information about potential job opportunities and training needs. Stated employment opportunities are important for Old Crow. Requested that Chance provide a deeper understanding of potential employment, and training and contracting opportunities. Inquired whether Vuntut Gwitchin First Nation employees had been involved in recent studies. Recommended wildlife monitors should be from Old Crow.	Chance acknowledged and recorded the comment. The Chance Project Team said wildlife monitoring opportunities will be prioritized for Vuntut Gwitchin First Nation Citizens.	Chance will offer training, employment, and contracts to its First Nations partners. Most employment opportunities will be connected to camp operations, construction of roads and seismic lines, and environmental monitoring. During its last drilling/seismic program, Chance hired a workforce from the communities of Old Crow, Fort McPherson, Dawson, Whitehorse, and Inuvik (See **Section 11**). Chance is committed to ongoing consultation and discussions around training, employment, and contracting opportunities with potentially affected First Nations.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Suggested that there would be more demand for Project-related job opportunities if a worker could keep job-related equipment as part of their compensation (e.g., chainsaw).	Chance acknowledged the comment and would investigate opportunities for employees to keep job-related equipment as part of their compensation.	Comment was addressed at the time it was shared. See **Section 11** of the Project Proposal for more information on potential Project-related effects on and mitigation measures for employment and economy.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Expressed hope for Project-related job opportunities, including opportunities for youth.	Chance responded that potentially affected First Nations including youth would be prioritized for Project-related job opportunities.	Comment was addressed at the time it was shared. See **Section 11** of the Project Proposal for more information on potential Project-related effects on and mitigation measures for employment and economy.

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Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Shared the community of Old Crow would need job training with financial support.	Chance responded that job-related training would be provided for Project employees.	Comment was addressed at the time it was shared. See **Section 11** of the Project Proposal for more information on potential Project-related effects on and mitigation measures for employment and economy.
Socio-Economics					
Meeting	Vuntut Gwitchin First Nation	03-Sep-2020	Asked what process Chance will use to protect oral history. Asked what the timeline is for collecting data on wildlife, oral history, and interviewing people in the area. Stated they would like to see a review of oral history.	Chance acknowledged and recorded the comment. Chance stated they are relying on existing information and any data collected to date.	Comment was addressed at the time it was shared. Chance sent Vuntut Gwitchin First Nation a Draft Collaboration Plan in November 2023 outlining proposed consultation and engagement activities to support the Project Proposal assessment process for the Eagle Plains Exploration Project up to February 2024 for Vuntut Gwitchin First Nation's review and comment. This document included information on socio-economic interview timeline. Chance sent Vuntut Gwitchin First Nation a list of identified secondary sources of Traditional Knowledge for Vuntut Gwitchin First Nation's review, comment, and permission for use. The secondary sources were selected based on Chance's understanding that they included Traditional Knowledge relevant to the Project. Chance invited Vuntut Gwitchin First Nation to share any additional Traditional Knowledge sources that may not be listed to help inform the development of the socio-economic assessment and Project Proposal. Chance requested Vuntut Gwitchin First Nation's feedback on any protocols or guidance for the use of Traditional

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					Knowledge to inform the socio-economic assessment. Chance hosted topic-specific focus group discussions to share potential Project effects information with and obtain feedback on mitigation measures from Vuntut Gwitchin First Nation and residents of Old Crow on December 6, 2023.
Letter	Vuntut Gwitchin First Nation	05-Aug-2022	Commented previous negative effects of oil and gas exploration to Vuntut Gwitchin First Nation's livelihood.	Chance acknowledged and recorded the comment.	Chance acknowledges the negative effects on Vuntut Gwitchin First Nations's livelihood by previous exploration activities. Chance is committed to reducing and/or eliminating any similar potential negative effects resulting from its Project. It will follow all relevant legislation and policies to reduce the potential for negative effects.
Meeting	Vuntut Gwitchin First Nation	03-Sep-2020	Identified a gap with regards to the assessment of potential Project effects on Vuntut Gwitchin First Nation harvesting rights.	Chance acknowledged and recorded the comment.	Chance is committed to reducing, eliminating, and/or mitigating any potentially negative effects on affected First Nations' harvesting rights. It has undergone a rigorous effects assessment, as seen within the Project Proposal submitted to YESAB's EC. Chance is open to future discussions with potentially affected First Nations regarding concerns surrounding harvesting rights and other topics.
Cumulative Effects					
Meeting	Vuntut Gwitchin First Nation	04-Aug-2023	Requested information about the Project's approach to cumulative effects.	Chance acknowledged and recorded the comment. Chance stated that it had conducted a linear features assessment to assess regrowth of linear features.	See **Section 3** of the Project Proposal for more information regarding cumulative effects methods.

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				Chance identified that this and other such information will feed into the cumulative effects for the Project.	
Mitigations and Monitoring					
Meeting	Vuntut Gwitchin First Nation	03-Sep-2020	Requested access to Chance's monitoring protocols. Inquired about possible mitigation measures.	Chance acknowledged and recorded the comment. Chance stated that there will be very limited traffic and most of the traffic will be wildlife monitors. Chance stated there will be a team above the monitors that they will report to (e.g., wildlife biologists, Vuntut Gwitchin First Nation staff). The team will be used to discuss and provide advice to put together an effective site-specific mitigation measure.	Chance is committed to controlling and restricting public use of its access roads. Chance recognizes this is a concern and will engage potentially affected First Nations further on this issue. Chance will limit traffic on the winter access to authorized personnel. Traffic will include approximately 8 to 9 light-weight service trucks daily (for supplies and personnel), 1 to 2 water trucks, and 1 fuel truck as frequently as exploration activities dictate (see **Section 11**).
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	26-May-2022	Vuntut Gwitchin First Nation expressed concern about spill monitoring, reporting, and mediation.	Chance acknowledged and recorded the comment.	Chance to list the fluids and materials necessary. Personnel trained in spill response will be onsite for the duration of the Project. In addition to spill response and cleanup, the spill response plan will include details on reporting requirements. More information about the type of materials used for the flow tests is available in **Section 1** of the Project Proposal. Chance will establish and enforce procedures to prevent unintended fluid release into the environment. Furthermore, an Emergency Spill and Response Plan and

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
					an Environmental Protection Plan will be devised, encompassing specifics on environmental monitoring and internal adherence to spill prevention and response measures. Chance will develop and implement procedures to prevent the inadvertent release of oil to the ground or waterways. See **Section 1 and 12** of the Project Proposal for more information.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2022	Recommended the role of monitoring, research, and academic involvement in the area.	Chance shared monitoring would be conducted throughout the Project and offered to share Project-related studies with interested parties to support research and academic studies in the area.	Comment was addressed at the time it was shared. See **Sections 11 and 12** of the Project Proposal for more information regarding monitoring.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Participants observed that no progressive reclamation had occurred in the last 3 years. Vuntut Gwitchin First Nation thought an environmental firm typically completes this work. Perhaps there is an economic opportunity here for Vuntut Gwitchin Government.	Monitoring programs and follow-up monitoring will be in place. Follow-up meetings will occur to demonstrate work completed. Chance is required to set money aside for reclamation.	Chance recognizes the concern surrounding closure activities and reclamation. Chance is committed to following all applicable legislation and policies, including undertaking reclamation activities after Project exploration activities have been completed. Monitoring programs and follow-up monitoring will be in place. Follow-up meetings will occur to demonstrate work completed. Chance is required to set money aside for reclamation. For more information on clearing activities and reclamation plans, see **Sections 1 and 12** of the Project Proposal.
Community Open	Vuntut Gwitchin First Nation	O6-Dec-2023	Expressed interest in a wildlife monitoring program.	There will be a wildlife monitoring program that employs locals. Chance	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
House Event	Residents of Old Crow			acknowledged and recorded the comment.	See **Section 8, 11 and 12** of the Project Proposal for more information regarding monitoring.
YESAB Process					
Community Open House Event Meeting	Vuntut Gwitchin First Nation Residents of Old Crow Vuntut Gwitchin First Nation	26-May-2022 26-Jan-2023 06-Dec-2023	Requested clarification about the YESAB process, the EC, and status of engagement. Expressed concern about the YESAB process. Inquired about the assessment Process.	Chance acknowledged and recorded the comment and concern.	Chance presented an overview of the YESAB EC Screening Process on October 13, 2023 during a meeting with Vuntut Gwitchin First Nation Deputy Councillor, technical advisors and staff. The same information was shared at a community open house event with Vuntut Gwitchin First Nation Citizens and residents of Old Crow on September 13, 2023.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Requested more information on the YESAB environmental assessment process for the Project.	Chance prepared and distributed a 2-page handout at a December 2023 community event in Old Crow to share Project information, a description of the YESAB assessment process, studies completed by Chance, the Project assessment process timeline, and key First Nation Project feedback and Chance's responses to shared feedback.	Comment was addressed at the time it was shared.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Noted the north is presently predominately reliable on oil and gas and believe its time for Vuntut Gwitchin First Nation to get involved in the Project and make recommendations to YESAB.	Chance shared that the Project Proposal submitted to YESAB will be available for public review and comment. YESAB is required to review recommendations made about the Project through the public review and comment period.	Comment was addressed at the time it was shared.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	13-Sep-2023	Stated Chance had done what they can to give information on the Project and that Vuntut Gwitchin First Nation had the ability to make recommendations to YESAB and the Government of Yukon.	Chance acknowledged the comment.	Comment was addressed at the time it was shared.
Reclamation and Remediation					
Meeting	Vuntut Gwitchin First Nation	03-Nov-2020	Questioned whether successful flow testing of subsequent resource development can be seen as reasonable in the foreseeable future.	Chance acknowledged and recorded the comment. Chance stated that it will be difficult to consider what would be there in the future.	Comment was addressed at the time it was shared.
Letter	Vuntut Gwitchin First Nation	05-Aug-2022	Recognized the feasibility of oil and gas production is diminished with a high probability of infrastructure becoming stranded assets.	Chance acknowledged and recorded the comment.	Chance recognizes the concern surrounding closure activities and reclamation. Chance is committed to following all applicable legislation and policies, including undertaking reclamation activities after Project exploration activities have been completed. Monitoring programs and follow-up monitoring will be in place. Follow-up meetings will occur to demonstrate work completed. Chance is required to set money aside for reclamation. For more information on clearing activities and reclamation plans, see **Sections 1 and 12** of the Project Proposal.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Inquired about who would lead the reclamation.	Chance is doing the reclamation. The Project should not need extensive reclamation. Natural regeneration will occur. If any spills occurred Chance	Chance recognizes the concern surrounding closure activities and reclamation. Chance is committed to following all applicable legislation and policies, including undertaking reclamation

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
				would be responsible for reclamation. The main effort would be dismantling the camp.	activities after Project exploration activities have been completed. Monitoring programs and follow-up monitoring will be in place. Follow-up meetings will occur to demonstrate work completed. Chance is required to set money aside for reclamation. For more information on clearing activities and reclamation plans, see **Section 1 and 12** of the Project Proposal.
Heritage Resources					
Community Open House Event	Vuntut Gwitchin First Nation	06-Dec-23	Inquired about whether a heritage site is the same as an unmarked burial site.	Archaeological finds are turned over to the Government of Yukon Heritage Resource Unit. Chance responded that no burials have been discovered. Studies have only uncovered tools. Chance explained that soil in the Project footprint is not ideal for preserving organic material. If any heritage resources, archaeological, or paleontological items are discovered, Chance will follow all legislation.	If heritage resources including human remains are encountered within the Project footprint, all work in the vicinity will stop immediately and First Nations, the Government of Yukon Heritage Resource Unit will be contacted for guidance on how to proceed. The RCMP would also be contacted if human remains were encountered. This consultation will be guided by the principles laid out in the *Guidelines Respecting the Discovery of Human Remains and First Nation Burial Sites* in the Yukon document published by the Government of Yukon's Heritage Resource Unit. Chance will prepare a *Chance Find Procedure* which will apply during all Project activities. Chance is committed to discussing and working with potentially affected First Nations to support their involvement in future heritage resources studies. See **Section 10** for information on Project-related effects to and mitigation measures for heritage resources.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
Community Open House Event	Vuntut Gwitchin First Nation	06-Dec-2023	Participants wanted to know what Chance has found at the site thus far and what is done with the artifacts. Inquired about how Chance employees would approach an archaeological find. Participants wanted to see a copy of the Chance "Find Procedure".	Archaeological finds are turned over to the Government of Yukon Heritage Resource Unit. Chance responded that no burials have been discovered. Studies have only uncovered tools. Chance explained that soil in the Project footprint is not ideal for preserving organic material. If any heritage resources, archaeological, or paleontological items are discovered, Chance will follow all legislation.	Employees would create a 30 m buffer area around archaeological and heritage sites to protect and avoid the areas. If a drill site overlaps with an archaeological site, the Project will implement measures to remove all the artifacts on site. This will be conducted in compliance with Federal, Provincial, First Nation, and industry best practices and standards. The *Chance Find Procedure* is being developed by the Project once it is implemented the First Nations will be notified. Chance is committed to discussing and working with potentially affected First Nations to support their involvement in future heritage resources studies. See **Section 10** for information on Project-related effects to and mitigation measures for heritage resources.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Citizens encouraged Chance to work with the Vuntut Gwitchin Government Natural Resource department. Vuntut Gwitchin First Nation noted that they have a lot of information that can inform Chance's work.	Chance thanked the attendee for their comment and noted they would continue to engage Vuntut Gwitchin Government on the Project including sharing heritage resources information. Chance planned a technical working group with government and technical advisor representatives from all potentially affected First Nations and Government of Yukon to discuss the Project's archaeological and	Chance will work with potentially affected First Nations to support their involvement in future heritage resources studies. See **Section 10** for information on Project-related effects to and mitigation measures for heritage resources.

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
				heritage resource studies on January 16, 2024.	
Vegetation					
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Asked if Chance could give examples of lichen protection.	The Chance Project Team shared that conducting Project activities in the winter will reduce potential Project-related effects to lichen. The Chance Project Team added that lichen is also protected because newer seismic technology will not require that vegetation be cut all the way to the ground. Added that lichen is also protected when winter access roads are reused.	Comment was addressed at the time it was shared. See **Section 7** for information on Project-related effects to and mitigation measures for vegetation.
Other					
Meeting	Vuntut Gwitchin First Nation	26-Jan-2023	Stated that it is critical that Chance consider Indigenous Knowledge within its Project Proposal to YESAB.	Chance acknowledged and recorded the comment.	Chance will consult and engage with potentially affected First Nations in a respectful and appropriate manner, in accordance with First Nation protocols and preferences, and *YESAA* requirements. Chance sent Vuntut Gwitchin First Nation a list of identified secondary sources of Traditional Knowledge for Vuntut Gwitchin First Nation's review, comment, and permission for use. The secondary sources were selected based on Chance's understanding that they included Traditional Knowledge relevant to the Project footprint. Chance invited Vuntut Gwitchin First Nation to share any additional Traditional Knowledge sources that may not be listed to help inform the development of the socio-

Interaction Type	Respondent	Date	Comment / Issue	Chance Response at the Time of Engagement	Chance Response at Project Proposal Submission
					economic assessment and Project Proposal. Chance requested Vuntut Gwitchin First Nation's feedback on any protocols or guidance for the use of Traditional Knowledge to inform the socio-economic assessment. Chance hosted topic-specific focus group discissions to share potential Project effects information with and obtain feedback on mitigation measures from Vuntut Gwitchin First Nation Citizens and residents of Old Crow on December 6, 2023.
Community Open House Event	Vuntut Gwitchin First Nation Residents of Old Crow	06-Dec-2023	Inquired about Old Crow transitioning to cleaner energy sources.	The Chance Project Team said royalties from a future extraction project could be used by Vuntut Gwitchin Government to support the transition to more sustainable energy sources.	Comment was addressed at the time it was shared.

2.9.9 Ongoing Consultation and Engagement

Chance will continue to consult and engage Vuntut Gwitchin First Nation and residents of Old Crow following submission of the Project. Chance will refine the Program in response to feedback from Vuntut Gwitchin First Nation during future Project phases, as needed. Planned ongoing consultation and engagement activities include (but are not limited to):

- Project communications (e.g., updates regarding schedule, permitting, monitoring activities, incorporation of Indigenous Knowledge to Project plans, and capacity funding);
- meetings to discuss Project-related effects, issues, and interests;
- opportunities to review and provide comment on Project plans and materials; and,
- opportunities to develop Project-related mitigation measures.

2.10 CONSULTATION AND ENGAGEMENT WITH TR'ONDËK HWËCH'IN AND RESIDENTS OF DAWSON CITY

Section 2.10 outlines consultation and engagement activities with Tr'ondëk Hwëch'in. Information on Project notification, consultation and engagement planning, methods, and activities, agreements, issues, interests, and feedback shared through consultation and engagement activities are described in **Sections 2.10.1** - **2.10.9**.

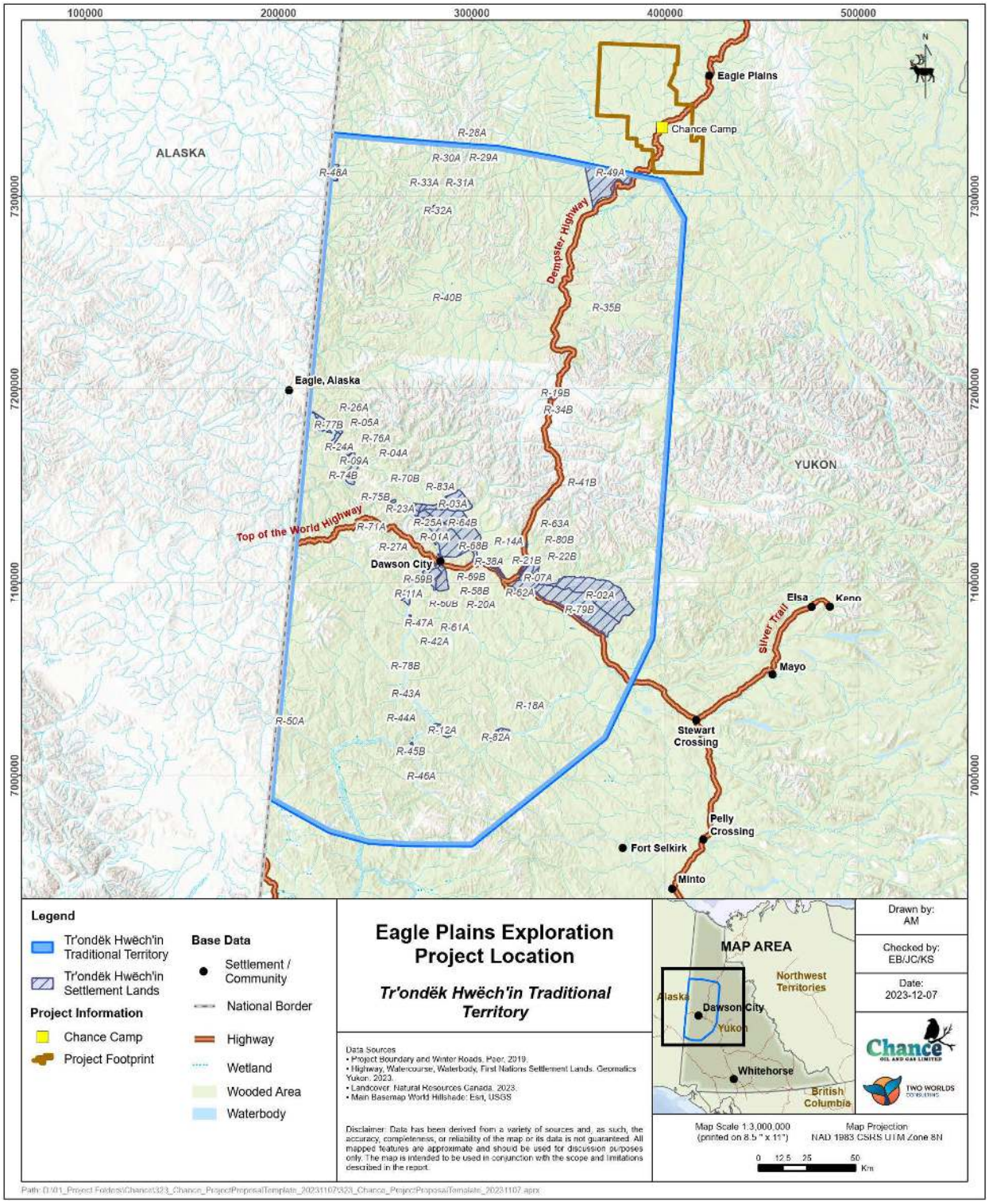
2.10.1 Community Profile

2.10.1.1 Tr'ondëk Hwëch'in

> "The name, Tr'ondëk Hwëch'in, tells the story of our ancestral occupation of the ancient site located at the mouth of present day Klondike on the left limit. Tr'o means hammer rock used to drive the salmon weir stakes into the mouth of the river, ndëk is the "river" part and Hwëch'in means the "people". Liberally translated, it means: the people who lived at the mouth of the Klondike. (Gerald Isaac, February 1999)" (Tr'ondëk Hwëch'in n.d.)

Tr'ondëk Hwëch'in have traced lineage to the area now known as Dawson City, Yukon dating back 11,000 years (Tr'ondëk Hwëch'in, n.d.-a). Since then, Tr'ondëk Hwëch'in Peoples worked to strike a balance between their traditional lifestyle and the ways of the newcomers (Tr'ondëk Hwëch'in, n.d.-b).

As of September 2023, Tr'ondëk Hwëch'in have a registered population of 961 Citizens (Government of Canada 2023a). Tr'ondëk Hwëch'in holds a total of 2,598.51 km^2 of land, with 1,553.99 km^2 of Category A Lands, 1,036 km^2 of Category B Lands, and 8.52 km^2 is other allocated land (Fred 2006). **Map 2-5** shows Tr'ondëk Hwëch'in's Traditional Territory as well as the settlement land agreed to under the *Tr'ondëk Hwëch'in Final Agreement*.



Map 2-5: Tr'ondëk Hwëch'in Traditional Territory

The *Tr'ondëk Hwëch'in Final Agreement* was signed in 1998 and today Tr'ondëk Hwëch'in exercise self-governance (Council of Yukon First Nations 1993). The *Tr'ondëk Hwëch'in Final Agreement* builds off the UFA and lists specific provisions pertaining to consultation, land and resource use, settlement land, self-governance, and taxation. The *Tr'ondëk Hwëch'in Final Agreement* ensured that the Tr'ondëk Hwëch'in people could govern themselves and protect their land and rights (Tr'ondëk Hwëch'in, n.d.-b). The Tr'ondëk Hwëch'in governance structure includes he Hähkè, Deputy Chief, and three councillors. The current Tr'ondëk Hwëch'in leadership is composed of: Hähkè Darren Taylor, Deputy Chief Erin McQuaig, and Councillors Kylie Van Every, Kyrie Nagano, and Ryan Peterson. The Tr'ondëk Hwëch'in governance structure is shown in **Figure 2-6**.

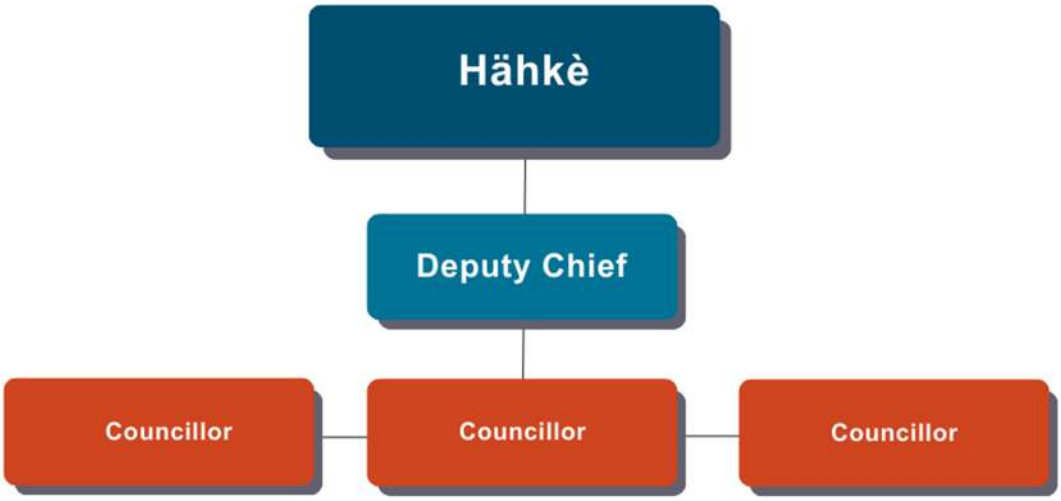


Figure 2-6. Tr'ondëk Hwëch'in Governance Structure

> To preserve our heritage and ensure a strong future, the Tr'ondëk Hwëch'in invest in promoting our Hän language, learning traditional skills from Elders, and engaging youth. Initiatives like the Moosehide Gatherings, Dänojà Zho Cultural Centre, Tr'ochëk National Historic site, and the return of our entrusted songs
>
> demonstrate our commitment to cultural preservation and pride in our ancestry (Tr'ondëk Hwëch'in n.d.).

The Tr'ondëk Hwëch'in's First Nation language is Hän, which is an important part of the community's heritage and culture:

2.10.1.2 Dawson City

Dawson City is located approximately 530 km north of Whitehorse, on the east bank of the Yukon River, at the confluence of the Klondike River at the heart of the Tr'ondëk Hwëch'in Traditional Territory. Dawson City was founded in 1896 by Joseph Ladue and named in January 1897 after Canadian geologist George M. Dawson. Dawson City was Yukon's capital from 1898 until 1952, after which it was moved to Whitehorse (Klondike Visitors Association, n.d.; Greener Pasture, n.d.; City of Dawson, n.d.). As of 2021, Dawson's

registered population was 1,577 people, making it the second-largest community in the Yukon (Government of Canada 2022).

Dawson City Municipal Government is comprised of one mayor and four councillors, each elected for a 4-year term with the most recent election held in October 2021 (City of Dawson, n.d.).

Dawson City has a thriving economy based in the mining, tourism, and culture sectors. As of 2021, the industries with the largest proportion of the workforce were public administration, construction, and educational services (City of Dawson, n.d.; Government of Canada 2022).

Dawson City has two healthcare facilities: a hospital and a health centre. Dawson City Community Hospital is the second-largest hospital in the Yukon, and offers 24/7 emergency care, inpatient and ambulatory care, X-ray, laboratory services, and general ultrasound. Dawson City Health Centre offers treatment programs and activities, including visiting doctor clinics, referrals, immunization clinics, prenatal classes, postnatal care, nursing and residential care, and school health clinics (Government of Yukon 2018). The Dawson City Health Centre is attached to the Dawson City Community Hospital.

Dawson's only school is the Robert Service School, which offers enrolment from Kindergarten to Grade 12. Dawson also has a Yukon University campus that offers a variety of certificates, diplomas, degrees, vocational, and upgrading programs and courses targeted to meet the employment needs of the mining, culture, and tourism sectors (Government of Yukon 2022; Yukon University, n.d.).

Please refer to **Section 11** for more socio-economic information on Dawson City.

2.10.2 Project Notification

Chance initiated engagement with Tr'ondëk Hwëch'in on September 26, 2018. Chance sent a letter (**Appendix 2-D Tr'ondëk Hwëch'in and Residents of Dawson City Consultation and Engagement Records**) to Tr'ondëk Hwëch'in about the *Tr'ondëk Hwëch'in and Chance Oil and Gas Communications and Engagement Plan* (**Appendix 2-D**) and next steps to develop a partnership with Tr'ondëk Hwëch'in.

Chance initiated consultation and engagement with residents of Dawson City at a community open house event on June 18, 2014.

2.10.3 Consultation and Engagement Planning

Chance has and will continue to consult Tr'ondëk Hwëch'in and residents of Dawson City who may be potentially affected by the Project to better understand potential Project-related effects on their First Nation, Citizens, and community. Chance recognizes Tr'ondëk Hwëch'in sits on the North Yukon Oil and Gas International Forum and Porcupine Caribou Management Board, both entities Chance has engaged about the Project.

Chance developed an Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan (**Appendix 2-D**) outlining a proposed engagement approach with Tr'ondëk Hwëch'in. The Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan included information on communication pathways, meeting process, engagement documentation, and adaptive management. Tr'ondëk Hwëch'in sent the Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan to the Government of Yukon on August 28, 2018.

2.10.4 Consultation and Engagement Methods

Engagement methods with Tr'ondëk Hwëch'in up to December 20, 2023 have included

- meetings (virtual and in-person);
- letters;
- correspondence via phone call, text message, and email; and,
- information sharing (e.g., sharing Project documents for review and comment).
- Chance will adjust consultation and engagement methods in response to feedback from Tr'ondëk Hwëch'in throughout the life of the Project.

2.10.5 Consultation and Engagement Activities

Table 2-8 outlines engagement activities undertaken with Tr'ondëk Hwëch'in and residents of Dawson City up to December 20, 2023.

Engagement materials such as presentations and handouts shared with Tr'ondëk Hwëch'in and residents of Dawson City have been compiled in **Appendix 2-D** of this Project Proposal. Where appendices were unavailable for compilation, **Table 2-8** indicates as such with an asterisk.

Table 2-8. Key Consultation and Engagement Activities with Tr'ondëk Hwëch'in

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Tr'ondëk Hwëch'in	Correspondence via phone call, text message, and email	Ongoing	Coordinating engagement activities and sharing Project information.
Chance Tr'ondëk Hwëch'in Residents of Dawson City	Community Open House Event	18-Jun-2014	Held an open house in Dawson City at the Yukon Order of Pioneers Hall. The open house included a formal presentation by Chance followed by a question-and-answer period (**Appendix 2-D**)*.
Tr'ondëk Hwëch'in	Letter	01-Dec-2017	Provided information on the communication and engagement plan that Chance wished to develop in partnership with Tr'ondëk Hwëch'in (**Appendix 2-D**)*.
Tr'ondëk Hwëch'in	Letter	27-Feb-2018	Followed up to request a meeting with Tr'ondëk Hwëch'in on developing a communication and engagement plan (**Appendix 2-D**)*.
Chance Tr'ondëk Hwëch'in	Phone Call	15-Mar-2018	Had a conversation with the Chief of Tr'ondëk Hwëch'in regarding letters and follow-up. Chance suggested a meeting in April (**Appendix 2-D**)*.
Chance Tr'ondëk Hwëch'in	Meeting	10-Apr-2018	Discussed relationship-building with Tr'ondëk Hwëch'in and collaboration on a *Communications and Engagement Plan* per Government of Yukon's Order in Council 2017/037 (**Appendix 2-D**)*.
Tr'ondëk Hwëch'in	Letter	08-May-2018	Notified Tr'ondëk Hwëch'in about Chance's upcoming submission of a request to extend the tenure of the exploration permits (#0012-117) (**Appendix 2-D**)*.
Tr'ondëk Hwëch'in	Document sharing for review and comment	17-May-2018	Shared the Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan (Draft) (**Appendix 2-D**)*.
Tr'ondëk Hwëch'in	Document sharing for records	23-Jul-2018	Shared the Tr'ondëk Hwëch'in Traditional Territory shapefiles (**Appendix 2-D**)*.
Tr'ondëk Hwëch'in	Meeting	23-Jul-2018	Discussed revisions to the Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan (**Appendix 2-D**)*.
Tr'ondëk Hwëch'in	Letter	26-Jul-2018	Updated Chief and Council on the Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Document sharing for review and comment	17-Oct-2018	Shared the Draft *Confidentiality Agreement* (**Appendix 2-D**)*.

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Chance Tr'ondëk Hwëch'in	Meeting	23-Oct-2018	Discussed implementation of the *Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan* that was submitted to Government of Yukon on August 28, 2018 (**Appendix 2-D**).
Chance Tr'ondëk Hwëch'in	Meeting	23-Nov-2018	Discussed capacity funding and a meeting with Government of Yukon, YESAB, and potentially affected First Nations (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Document sharing for signature	04-Dec-2018	Provided the *Capacity Funding* letter (Final Version) for signing (**Appendix 2-D**)*.
Tr'ondëk Hwëch'in	Document sharing for records	24-Jan-2019	Sent the *Confidentiality Agreement* dated January 22, 2019 (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Letter	27-Mar-2019	Notified Tr'ondëk Hwëch'in of a request to extend tenure on Exploration Permits (#0006-0011 and #0019) (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Document sharing for records	07-Jun-2019	Shared the *Draft Project Description* (Version 1) (**Appendix 2-D**).
Chance Tr'ondëk Hwëch'in	Meeting	11-Jun-2019	Presented the *Draft Project Description* (Version 1) Discussed next steps in the YESAB EC process, annual reporting requirements, and capacity funding (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Letter	14-Jun-2019	Shared a notice letter with Tr'ondëk Hwëch'in stating EDI would be conducting fish and environmental studies scheduled from July 1 to July 10, 2019 pending authorization from the Fisheries and Oceans Canada (DFO) license (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Document sharing for records	25-Jun-2019	Shared the *Draft Project Description* (Version 1) (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Document sharing for records	25-Jun-2019	Shared the Community Consultation Program (Proposed Activity Alignment) (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Document sharing for records	31-Jul-2019	Shared the Annual 2019 Report on the Implementation of Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan (Draft) (**Appendix 2-D**).
Chance Tr'ondëk Hwëch'in	Meeting	12-Aug-2019	Met with Tr'ondëk Hwëch'in to provide Project updates, capacity funding, and a Cooperation Agreement (**Appendix 2-D**).
Chance Tr'ondëk Hwëch'in	Virtual meeting	17-Jun-2020	Provided an overview of the proposed Eagle Plain Well Maintenance Project and provided an opportunity for Tr'ondëk Hwëch'in to ask questions and/or provide feedback (**Appendix 2-D**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Tr'ondëk Hwëch'in	Document sharing for review and comment	13-Jul-2020	Shared the Annual 2020 Report on the Implementation of Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan (Draft) (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Document sharing for records	24-Jul-2020	Shared the *Project Proposal* (Version 1) (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Document sharing for records	24-Jul-2020	Shared the Emergency Spill Response Plan (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Document sharing for records	28-Mar-2021	Shared the Methods of Hydraulic Fracturing (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Meeting	27-Apr-2021	Presented a draft *Project Description* (Version 1). Chance provided information and updates regarding baseline studies and discussed consultation and engagement next steps (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Document sharing for review and comment	12-May-2021	Shared Chance's 2021 Engagement Schedule (**Appendix 2-D**).
First Nation of Na-Cho Nyäk Dun Tr'ondëk Hwëch'in	Document sharing for records	18-May-2021	Shared the Chance Eagle Plains Exploration Project: Baseline Information on Terrain Permafrost and Suitability Maps (**Appendix 2-D**).
Chance Tr'ondëk Hwëch'in	Virtual meeting	08-Jun-2021	Discussed permafrost baseline information, consultation and engagement preferences, planning, and upcoming reports (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Document sharing for review and comment	16-Jul-2021	Shared the Draft Annual 2021 Report on the Implementation of Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan (**Appendix 2-D**).
First Nation of Na-Cho Nyäk Dun Vuntut Gwitchin First Nation Gwich'in Tribal Council Tr'ondëk Hwëch'in	Document sharing for records	17-Dec-2021	Shared a letter to the Government of Yukon, Land Tenure Extension Request for Exploration Permits 0008-0017, 0019 and 0020 ("Permits") (**Appendix 2-D**).
Chance	Document sharing for review and comment	29-Jul-2022	Sent Chance a signed copy of the 2022 Annual Report on the Implementation of Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Letter	27-Jun-2023	Updated the newly elected Chief about the Project (**Appendix 2-D**).

Recipient or Participant	Engagement Activity	Date	Description of Chance Consultation and Engagement
Chance Technical advisor on behalf of Tr'ondëk Hwëch'in and First Nation of Na-Cho Nyäk Dun	Meeting	03-Aug-2023	Discussed the Project, consultation and engagement activities, socio-economic secondary and primary data collection, and well abandonment (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Document sharing for records	05-Sep-2023	Shared the Draft Project Overview Video (**Appendix 2-D**).
Chance Potentially affected First Nations Government of Canada YESAB Government of Yukon Tr'ondëk Hwëch'in	Meeting	13-Oct-2023	Discussed the Project's assessment process including capacity funding and possible efficiencies through a coordinated approach (e.g., sharing consultants to support potentially affected First Nations' review of the Project Proposal) (**Appendix 2-D**).
Tr'ondëk Hwëch'in	Letter	22-Nov-2023	Requested feedback from Tr'ondëk Hwëch'in First Nation regarding interest in being consulted about the draft Project Proposal (**Appendix 2-D**).
* = Appendices not available at the time this section was drafted.			

2.10.6 Agreements

Chance and Tr'ondëk Hwëch'in have not discussed any formal agreement for the Project to date.

2.10.7 Records Management

Appendix 2-D includes a record of contact documenting all consultation and engagement activities including emails, phone calls, text messages, letters, meetings, and events between Chance and Tr'ondëk Hwëch'in to up to December 20, 2023, and a record of contact documents all consultation and engagement activities with residents of Dawson City up to December 20, 2023.

2.10.8 Engagement Feedback (Effects, Issues, and Interests)

Chance sought to obtain feedback from potentially affected First Nations and residents of communities through Project engagement activities. **Table 2-9** presents effects, issues, and interests shared by Tr'ondëk Hwëch'in with Chance up to December 20, 2023.

Table 2-9. Tr'ondëk Hwëch'in Key Issues and Consultation and Engagement Feedback

Interaction Type	Respondent	Date	Comment / Issue	Chance's Response at the Time of Engagement	Chance's Response at Project Proposal Submission
Project Design					
Meeting	Tr'ondëk Hwëch'in	12-Aug-2019	Expressed concern for the *Resource Access Roads Framework's* timeline to completion (Government of Yukon, n.d.). Concerned about the negative effects of increased road access.	Chance acknowledged and recorded the comment. Chance expressed a desire for access regulations to be completed by Government of Yukon. It recognized that such legislation would address public access issues to the Project footprint.	Chance is committed to controlling and restricting public use of its winter access roads. Chance recognizes this is a concern and will engage potentially affected First Nations further on this issue. Chance will limit traffic on the winter access to authorized personnel. Chance staff hired as wildlife monitors and security personnel will monitor access to the winter access roads. Traffic will include approximately 8 to 9 light-weight service trucks daily (for supplies and personnel), 1 to 2 water trucks, and 1 fuel truck as frequently as exploration activities dictate (see **Section 1**). Traffic is expected to be higher during rig moves, delivery of casing, and other operational events. These types of events will be periodic rather than steady.
Consultation and Engagement Process					
Meeting	Tr'ondëk Hwëch'in	10-Oct-2018	Expressed interest in both parties developing a capacity funding agreement.	Chance acknowledged and recorded the comment.	Chance to address details and follow-up to this capacity funding agreement.
Meeting	Tr'ondëk Hwëch'in	08-Jun-2021	Expressed a desire for a positive relationship between the parties and opening communication channels. Discussed the importance of Tr'ondëk Hwëch'in, Vuntut Gwitchin First Nation, First Nation of Na-	Chance acknowledged and recorded the comment. Chance responded that it wishes to foster a good working relationship with all potentially affected First Nations and will continue to actively work on this.	Chance is committed to building positive and open relationships with all potentially affected First Nations. Chance will consult and engage with potentially affected First Nations in a respectful manner and in accordance with First Nation protocols and preferences, and *YESAA* requirements.

Interaction Type	Respondent	Date	Comment / Issue	Chance's Response at the Time of Engagement	Chance's Response at Project Proposal Submission
			Cho Nyäk Dun working together.		
Wildlife and Wildlife Habitat					
Meeting	Tr'ondëk Hwëch'in	03-Aug-2023	Expressed concerns for seismic effects on predator-prey relationships.	Chance acknowledged and recorded the comment. Chance described and shared the *Linear Features Study* conducted to assess and support mitigation decisions related to this concern.	Chance undertook a study on linear features to evaluate potential Project-related effects on the movement of people and animals, as well as the dispersal of plants within a given landscape. Historical linear features are largely naturally revegetated, and more recent linear features are showing good signs of naturally recovering to their original state. Usage of these disturbed areas does not seem to indicate any predatory advantage nor human presence. Two localized conditions limit greater ease of travel. Vegetation is fairly open and has limited effect on impeding movement. Ground cover, thick peat, and graminoid tussocks limit movement (see **Section 9**). Chance shared the *Linear Features Study* (**Appendix 8-B**) Chance recognizes this is a concern and will engage potentially affected First Nations further on this issue.
Porcupine Caribou Herd					
Meeting	Tr'ondëk Hwëch'in	10-Oct-2018	Requested that Chance engage with the PCMB and Tr'ondëk Hwëch'in about the PCH migration through the area.	Chance acknowledged and recorded the comment.	Chance conducted additional wildlife baseline studies, including studying the PCH, in 2018/19 and updated these studies in 2022/23. Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See **Sections 3 and 9** for more information.

Interaction Type	Respondent	Date	Comment / Issue	Chance's Response at the Time of Engagement	Chance's Response at Project Proposal Submission
					Chance acknowledges and considers concerns regarding the PCH. Potential effects and mitigation measures to the PCH and Traditional Land Use are discussed in **Sections 9** and **11** of the Project Proposal documents. Chance met with the PCMB on December 1, 2023 and December 20, 2023. Chance will continue to engage with the PCMB.
Meeting	Tr'ondëk Hwëch'in	17-Jun-2020	Suggested that Chance considers potential effects on 40 Mile Caribou Herd and Hart River Caribou Herd in addition to the PCH.	Chance acknowledged and recorded the comment. Chance indicated these suggestions will be considered.	Chance reviewed the Project in relation to the Forty Mile and Hart River caribou herds. The Project is not expected to interact with these herds, and thus were not considered further in the assessment.
Meeting	Tr'ondëk Hwëch'in	08-Jun-2021	Expressed concern for potential Project-related effects on the PCH.	Chance acknowledged and recorded the comment.	Chance conducted additional wildlife baseline studies, including studying the PCH, in 2018/19 and updated these studies in 2022/23. Chance shared the Wildlife Baseline Studies report with Tr'ondëk Hwëch'in for their records. Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized, including caribou habitat. See **Section 9** for more information. Chance acknowledges and considers concerns regarding the PCH. Potential effects and mitigation measures to the PCH and Traditional Land Use are discussed in **Sections 9** and **11** of the Project Proposal.

Interaction Type	Respondent	Date	Comment / Issue	Chance's Response at the Time of Engagement	Chance's Response at Project Proposal Submission
Permafrost and Terrain					
Meeting	Tr'ondëk Hwëch'in	08-Jun-2021	Expressed concern for potential Project-related effects on permafrost.	Chance acknowledged and recorded the comment.	The concerns we heard during this meeting, and others that followed, have been addressed in subsequent meeting presentations as well as within the Project Proposal. Generally, the winter timing and access routing will minimize ground disturbance and potential effects on permafrost and vegetation (See **Sections 4** and **7**).
Community Health and Well-being					
Meeting	Tr'ondëk Hwëch'in	08-Jun-2021	Recognized the PCH have high value as traditional food and for cultural and spiritual well-being.	Chance acknowledged and recorded the comment.	Chance acknowledges the important cultural value, food security, and spiritual importance of the PCH. Chance is committed to reducing potential negative effects on the PCH and other wildlife (see **Sections 9 and 11**).
Employment and Economy					
Meeting	Tr'ondëk Hwëch'in	10-Oct-2018	Expressed interest in Chance sharing job postings throughout the Project for Tr'ondëk Hwëch'in to share with Citizens.	Chance acknowledged and recorded the comment. Chance committed to prioritizing jobs for potentially affected First Nations with Traditional Territories that overlap with the Project footprint first before expanding opportunities to others.	Chance strives to offer training, employment, and contracts to its First Nations partners. During its last drilling/seismic program, Chance successfully hired a workforce from the communities from Old Crow, Fort McPherson, Dawson, Whitehorse, and Inuvik (see **Section 11**). Chance is committed to ongoing consultation and discussions around training, employment, and contracting opportunities with potentially affected First Nations.

Interaction Type	Respondent	Date	Comment / Issue	Chance's Response at the Time of Engagement	Chance's Response at Project Proposal Submission
Mitigations and Monitoring					
Meeting	Tr'ondëk Hwëch'in	12-Aug-2019	Recommended the development of a monitoring program for air quality and emissions.	Chance acknowledged and recorded the comment. Chance recognized that monitoring emissions is costly and that it is not required by legislation at this time.	Chance is committed to conducting monitoring after Project exploration activities are complete (see **Sections 1 and 12**). Chance will not be monitoring emissions as it does not anticipate any significant adverse effects on air quality from the Project.
Email	Tr'ondëk Hwëch'in	24-Jul-2020	Inquired about a Wildlife Management Plan.	Chance acknowledged and recorded the comment.	Chance will develop a Wildlife Management and Monitoring Plan. See **Section 12** of the Project Proposal for more information.
Other					
Meeting	Tr'ondëk Hwëch'in	27-Apr-2021	Suggested that Chance create a specific visual of the Project footprint.	Chance acknowledged and recorded the comment. Chance agreed and stated a desire to create a constraints map for the for the Project Proposal.	Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See **Section 3** for more information. Peer Solutions, on behalf of Chance, prepared a Project video showcasing still photos and videos clips of the Project footprint. This video was shared with Tr'ondëk Hwëch'in's technical advisor in August 2023 (**Appendix 2-D**) and made available for download on a secure file sharing site for Tr'ondëk Hwëch'in.
Meeting	Tr'ondëk Hwëch'in	27-Apr-2021	Suggested that Chance create a decision tree to help define the methodology on the categorizations of exploration outcomes.	Chance acknowledged and recorded the comment.	Chance created a constraints map to identify sensitive or high-quality environmental and heritage values where Project work should be avoided or minimized. See **Section 3** for more information.

2.10.9 Ongoing Consultation and Engagement

Chance will continue to consult and engage Tr'ondëk Hwëch'in and residents of Dawson City following submission of the Project. Chance will refine the Program in response to feedback from Gwich'in Tribal during future Project phases, as needed. Planned ongoing consultation and engagement activities include (but are not limited to):

- Project communications (e.g., updates regarding schedule, permitting, monitoring activities, incorporation of Indigenous Knowledge to Project plans, and capacity funding);
- meetings to discuss Project-related effects, issues, and interests;
- opportunities to review and provide comment on Project plans and materials; and,
- opportunities to develop Project-related mitigation measures.

3 METHODOLOGY

3.1 EFFECTS ASSESSMENT

The Eagle Plains Exploration Project (the Project) effects assessment methods described in this section follow guidance provided by Yukon Environmental and Socio-economic Assessment Board (YESAB) in YESAB's Environmental and Socio-Economic Assessment Methodology (YESAB 2021a). The effects assessment follows these basic steps:

- select the Valued Environmental and Socio-Economic Components (VESECs) and related indicators and assessment parameters on which the assessment focuses;
- define spatial and temporal boundaries for the assessment;
- gather data on baseline conditions within the assessment boundaries;
- identify potential effects associated with the Project through an evaluation of potential interactions of the Project with each VESEC;
- define appropriate mitigation to address identified potential effects;
- describe, analyze, and characterize potential residual effects of the Project after incorporating mitigation;
- determine the significance of the residual effects of the Project; and,
- conduct a Cumulative Effects Assessment (CEA) by describing whether the residual effects of the Project for a given environmental or socio-economic component have the potential to interact with other past, present, or reasonably foreseeable future projects or activities to create an adverse cumulative effect.

3.1.1 Assessment Scope

The scope of the assessment is defined by the issues, VESECs, indicators and assessment parameters that will be used to assess the effects of the Project, in combination with the spatial and temporal boundaries of the assessment. The following subsections define these topics in more detail.

3.1.1.1 Issues

Issues scoping involved compiling and analyzing available information to identify environmental, economic, social, heritage, and health issues that could occur as a result of the Project. Information compiled and reviewed included legislation and regulations, approved regional land use plans, community engagement inputs, public comments from open houses, and an evaluation of identified concerns on similar projects in the region and elsewhere. The following key issues and concerns were identified:

- degradation of permafrost;
- terrain instability;
- reductions in water quantity and quality;
- degradation or loss of watercourses and wetlands;
- fish habitat loss and degradation;
- creation of barriers to fish passage;
- in-stream water withdrawals affecting over-wintering fish habitat;
- facilitated human access resulting in increased harvesting of fish;
- concern about Project access roads and effects to water and fish;

- loss of tamarack;
- direct wildlife habitat effects, including habitat loss, alteration and fragmentation;
- indirect wildlife effects including reduced use or avoidance of habitats;
- facilitated human and predator access, and resultant effects on predator-prey relationships, due to seismic line clearing;
- effects on migratory birds;
- effects on American marten;
- effects on moose;
- effects on the Porcupine Caribou Herd (PCH) and concern about their decline;
- degradation of air quality;
- Project-related effects on climate change;
- damage or loss of heritage resources;
- effects on First Nations culture, way of life, and land use;
- employment, training, and procurement opportunities;
- concern about effects to traditional trails and traditional sites related to cultural use areas for trapping and hunting (i.e., moose and caribou);
- increased access to traditional territories and resulting damage to the livelihood of First Nations Citizens;
- impacts to the potential visual impacts to the landscape;
- concern about the human land use-related disturbances such as noise, smell, and light and potential mitigations;
- concern related to increased traffic on the Dempster Highway; and,
- concern over increased risk of increased ski-doo traffic and access management.

3.1.1.2 Valued Environmental and Socio-economic Components

VESECs were identified based on the results of key issues scoping noted above. The issues were grouped into two broad categories: Environmental and Socio-economic. These issues were then further grouped to help focus the assessment and minimize the degree of duplication and redundancy.

The following VESECs were selected for the Project Proposal:

Environmental:

- Permafrost and Terrain;
- Water Resources;
- Fish and Fish Habitat;
- Vegetation;
- Wildlife and Wildlife Habitat; and,
- Caribou.

Socio-economic:

- Heritage Resources;
- Community Infrastructure and Services;
- Land and Resource Use;
- Community Health and Wellbeing; and,
- Employment and Economy.

The rationale for their selection is summarized in **Table 3-1.**

3.1.1.3 Indicators and Assessment Parameters

For an effect to occur, there must be a measurable change in the condition of the VESEC and a corresponding effect on at least one indicator for a VESEC. Each VESEC has at least one indicator (e.g., habitat), and each indicator has at least one assessment parameter, which is defined as a quantitative or qualitative measures of the Project's effects on the indicator (e.g., quantitative change in habitat). **Table 3-2** lists the indicator(s) and assessment parameter(s) for each VESEC. Details, as necessary, are provided in the individual VESEC sections.

Table 3-1. Valued Environmental and Socio-Economic Components and Rationale for Selection for the Eagle Plains Exploration Project

VESECs	Rationale for Selection
Environmental	
Permafrost and Terrain	Changes in permafrost and terrain stability can result in ecosystem changes, slumping, sedimentation in waterways, and other effects
Water Resources	• Potential effects on surface water quality from Project activities • Important to human use and health (drinking water) • Traditional use and related legislation • Strong link to fish and fish habitat • Key attribute of healthy and functioning aquatic and terrestrial ecosystems
Fish and Fish Habitat	• Potential habitat loss from water withdrawal in higher-order streams in winter • Traditional and current food source • Social and cultural importance • Fish that may be exposed to chemical changes in surface water, dietary items or sediment because of the Project • Potential need for authorization under the *Fisheries Act*
Vegetation (including tamarack and ecological communities of conservation concern)	• Tamarack identified as culturally important during Indigenous community meetings • Ecological communities of conservation concern may have limited availability on the landscape
Wildlife and Wildlife Habitat (including Marten, Moose, and Birds).	• Marten: Importance as a furbearer (trapping resource) and indicator of mature and old-growth forest • Moose: Cultural importance and traditional harvest • Birds: Potential presence of eight species of federal conservation concern
Caribou	• Caribou hold Indigenous, regulatory, stakeholder and conservation importance • Caribou can be susceptible to activities that remove or degrade habitat, or facilitate increased access by wolves and hunters • The North Yukon Regional Land Use Plan identifies the PCH as a key concern
Socio-economic	
Heritage Resources	Social/cultural importance
Community Infrastructure and Services	Social importance of community-related infrastructure and services in the vicinity of the Project

VESECs	Rationale for Selection
Land and Resource Use	Social/cultural importance of current land and resource Social/cultural importance of traditional land and resource
Community Health and Wellbeing	• Social/cultural importance of health and well-being of nearby communities • Potential for changes to food and drinking water access and availability and human health
Employment and Economy	• Potential demands for labour, goods and services that could affect local employment and business opportunities, and the regional or local economy

Table 3-2. Valued Environmental and Socio-Economic Components, Indicators and Assessment Parameters Considered in the Environmental Assessment of the Eagle Plains Exploration Project

VESECs	Indicator	Assessment Parameters	Notes
ENVIRONMENTAL			
Permafrost and Terrain	Permafrost	• Changes to ground temperature • Changes to active layer thickness • Changes to ice content	Project activities could locally degrade (thaw) ice-rich permafrost and/or destabilize slopes
	Terrain stability	• Changes to ground settlement and/or mass movement • Changes to surface drainage • Changes to slope morphology	
Water Resources	Surface water quality	• Change in sedimentation and total suspended solids • Change in contaminant and nutrient influxes • Changes in thermal regimes	Water quality could be affected by Project activities
	Hydrology	Change in flows, water levels	Water quantity could be affected by Project activities
Fish and Fish Habitat	Mortality risk	Change in mortality risk	Project activities, including seismic activities and water withdrawal, could increase mortality risk for fish
	Habitat quality	Change in habitat quality	Project activities could result in alteration of habitat quality from water withdrawal,

VESECs		Indicator	Assessment Parameters	Notes
				sedimentation, and removal of riparian vegetation
		Habitat quantity	Change in habitat quantity	Water withdrawal may decrease the quantity of available fish habitat
Vegetation		Tamarack-producing ecosystem units	Change in area (ha) of tamarack producing ecosystem units.	Project activities could result in alteration and/or loss of tamarack
		Ecosystem units of conservation concern	Change in area (ha) of ecosystem units of conservation concern	Project activities could result in alteration and/or loss of ecosystem units of conservation concern
Wildlife and Wildlife Habitat	**Marten**	Habitat	Change in habitat	Project activities could result in habitat alteration and/or loss
		Mortality risk	Change in mortality risk	Increased access from Project activities may affect marten harvesting
	Moose	Habitat	Change in habitat	Project activities could result in habitat alteration and/or loss
		Mortality risk	Change in mortality risk	Project activities could directly and indirectly increase mortality risk for moose
	Bird Species at Risk	Habitat	Change in habitat	Project activities could result in habitat alteration and/or loss
Caribou		Direct habitat effects	Change in suitable habitat within the Project Footprint	Project activities could result in direct habitat alteration and/or loss
		Indirect habitat effects	Change in suitable habitat within a Zone of Influence (ZOI)	Project activities could result in avoidance of habitat due to sensory disturbance
		Movement	Change in movements based on a ZOI	Project activities could result in changes in caribou movements due to sensory disturbance
		Mortality risk	Change in mortality risk	Mortality risk could be affected directly and indirectly by Project activities
SOCIO-ECONOMIC				
Heritage Resources		Known Heritage Resource sites	Disturbance of a Heritage Resource sites	Project activities could disturb known or undocumented Heritage Resources

VESECs	Indicator	Assessment Parameters	Notes
	Areas of potential for undocumented Heritage Resource sites		
	Chance finds of Heritage Resources		
Community Infrastructure and Services	Housing and Accommodation	Changes in demand for housing and temporary accommodation	Community-related infrastructure and services near the Project could be affected directly or indirectly through incremental demand on local infrastructure and services.
	Physical Infrastructure	Changes in demand on physical infrastructure (water, waste, energy infrastructure)	
	Community Services	Changes in demand on community and social services (emergency and health, education, and other social services)	
	Transportation	Changes in pattern of use for transportation infrastructure (traffic volumes, road conditions)	
		Changes in safe use of transportation infrastructure	
Land and Resource Use	Commercial and Recreational Land and Resource Use	Change in area available for and access to current land uses	Commercial and recreational land and resource use refers to the designated and undesignated use of lands and resources for commercial and recreational purposes. Commercial and recreational land and resource use in the vicinity of the Project could be affected directly or indirectly through Project components and activities that alter access, area use, or environmental conditions for current land and resource use.
		Changes in resource availability or abundance	
		Change in environmental conditions (e.g., air quality, noise and vibration, visual quality) that influence user's experience on the land	
	First Nations Culture and Land and Resource Use	Changes to cultural use areas and access	Current First Nations culture and land and resource use are important values of potentially affected First Nations. Traditional land and resource use activities support the socio-economic wellbeing of First Nations and their respective citizens and contributes to their cultural identity and practices.
		Changes in resource availability, abundance, or quality for subsistence activities	
		Changes in cultural identity and transfer of traditional knowledge	

VESECs	Indicator	Assessment Parameters	Notes
Community Health and Wellbeing	Environmental Quality	Human health risk factors from exposure to affected environmental media (surface water, groundwater, soil, air quality, sediments, sensory conditions)	Community health and well-being could be affected directly or indirectly through Project components and activities that contribute to changes in environmental quality, posing a possible risk to human health. Community health and wellbeing may also be directly or indirectly affected by Project components and activities that change social determinants of health and well-being.
		Changes in traditional food quality	
		Changes in public or occupational safety risk (emergency preparedness plan, malfunctions, and accident risk)	
	Social Determinants of Health and Perceived Effects on Health	Changes to community health-related to infectious and chronic disease	
		Changes to community mental health and wellness (stress, substances use, sense of community)	
		Changes in food security status (traditional food quality, quantity, availability, access and perceived effects)	
		Changes in community safety or security (crime, injury, accidents)	
		Changes in personal or relational safety (in camp, in community)	
		Changes in healthcare services demand (e.g., access, capacity for non-emergency services)	
		Changes in Indigenous cultural health (e.g., perceived access to land and impact on health, access to traditional cultural use activities and impact on health)	
Employment and Economy	Employment and Labour	Changes in employment and income	• Employment and economy could be affected directly or indirectly through project demands for labour, goods and services that would affect local employment and business opportunities, and the regional or local economy. • Economic growth and diversification could be affected directly or indirectly from incremental Project demands for local/regional labour, resources, and third-party services. Furthermore, Project demands for community infrastructure and services has the potential to influence local/regional government finances.
		Changes to traditional (non-wage) economic activities	
		Changes in contracting opportunities	
	Economic growth and diversification	Changes in economic diversity and dependency	
		Changes to local-regional governments expenditures and revenues	

3.1.1.4 Assessment Boundaries

Assessment boundaries focus the extent of the assessment. Assessment boundaries for the Project fall under four categories:

- spatial boundaries;
- temporal boundaries;
- technical boundaries; and,
- administrative boundaries.

Each of these four assessment boundaries are defined and described below.

3.1.1.4.1 Spatial Boundaries

Spatial boundaries encompass the areas within which the effects of the Project are expected to interact with the VESECs and indicators. The Project was assessed using five types of spatial boundaries, though not all were used for all VESECs. **Table 3-3** describes each of these spatial boundaries. VESEC-specific definitions are provided where appropriate within the relevant sections of the Project assessment.

Table 3-3. Spatial Boundaries Used for the Project Effects Assessment of the Eagle Plains Exploration Project

Spatial Boundary	Description of Area
Project Footprint	The area where ground will be disturbed, and Project activities will occur.
Zone of Influence (ZOI)	Characterized as an area defined by a distance buffer from the Project Footprint to assess the indirect effects on the Wildlife and Wildlife Habitat, and the Caribou VESECs. The ZOIs are intended to represent areas where sensory disturbance from Project effects could reduce habitat effectiveness and are specific to each wildlife species to which they are applied. ZOIs are based on the best available information and further described as applicable within **Section 8** and **Section 9** of the Project Proposal.
Local Study Area (LSA)	Encompasses the area within which the Project is expected to interact with and potentially result in changes to the VESECs through both direct and indirect effects. Due to the uncertainty in the Project Footprint, LSAs were not defined for all VESECs; in these cases, the Regional Study Area (RSA) was the primary area of consideration for Project effects. Where applicable, LSAs are further defined within the VESEC-specific assessments.
Regional Study Area (RSA)	Potential effects for all VESECs were considered within the context of the RSA. For most biophysical VESECs and for Heritage Resources, the RSA was delineated to encompass the Project's related exploration claim areas. For the Socio-economic VESECs, individual RSAs were defined for each and are further described in **Section 11** of the Project Proposal.
Caribou Study Areas (CSAs)	Potential effects for caribou were considered within the context of multiple spatial scales that are specific to caribou: (1) the RSA, (2) the Eagle Plains ecoregion, and (3) the extent of the rut/ late fall and winter seasonal ranges for the PCH. These scales of analysis correspond to the CSAs, and are further described in **Section 9** of the Project Proposal.

3.1.1.4.2 Temporal Boundaries

Temporal boundaries encompass the time the Project is expected to interact with the VESECs and indicators. The Project will be conducted in one phase: Exploration. This Exploration phase will occur over

approximately 10 years, with all Project activities occurring somewhat concurrently during this phase (Project infrastructure/well development, drilling, extended flow testing).

3.1.1.4.3 Technical Boundaries

Technical boundaries represent limitations on the predictability of Project effects. These boundaries are often specific to individual VESECs, though not always. Where technical boundaries apply to specific VESECs, they are described in detail within the relevant VESEC assessments. The following technical boundaries apply to the Project Proposal assessment:

- The specific locations of some Project footprints (well sites, well access roads, secondary camps) are not defined in the Project Proposal. The nature of the Project activities means that some Project footprint components will be determined after earlier Project activity results (e.g., results from drilling and seismic activities will help to define future drilling locations).
- The assessment of First Nations Culture and Land and Resource Use, and the linkages of individual VESECs to this assessment, is constrained by the availability of Traditional Knowledge used to support an understanding of the use of lands and resources by First Nations for cultural activities.

3.1.1.4.4 Administrative Boundaries

Administrative boundaries represent any constraints that may be placed on the effects assessment due to political, social, and economic realities. Often, these administrative boundaries result in constraints on some data inputs for an assessment (e.g., census subdivisions). Where administrative boundaries apply to specific VESECs, they are described in detail within the relevant VESEC assessments. The following administrative boundaries apply to the entire Project assessment:

- The effects assessment is limited to within the Yukon, Canada; and,
- The effects are considered in the context of the land use designations in the North Yukon Land Use Plan and Peel Region Land Use Plan.

3.1.2 Baseline Conditions

YESAB defines baseline condition as a reference point to analyze the predicted change in the condition of a VESEC as a result of the proposed project activities and associated effects (YESAB 2021a). For each selected VESEC, baseline conditions in the Project study areas are appropriately and adequately described based on a review of existing desktop information and results of field studies. The description of these baseline conditions supports and informs the identification of potential Project interactions with VESECs, and the evaluation and characterization of those interactions. Summaries of baseline conditions are included within relevant sections of the assessment for each VESEC, with additional detail provided within appended baseline reports.

3.1.3 Exploration Project Planning Context

As mentioned in **Section 3.1.1.4.3** the specific locations of exploration wells and well access roads linking the wells to the mainline road network cannot be pre-defined at the Project Proposal stage; many other Project Footprint details (e.g., main road network, camp location, airstrip, seismic lines) are, however, defined. The location of wells depends on the results of the seismic exploration and the information collected from any preceding wells. In addition, some secondary Project feature locations (e.g., secondary

camp locations) are also not confirmed. Therefore, a series of plausible well site location scenarios were developed to assess the potential effects of wells, well access roads, and secondary camp locations on spatially-explicit values for applicable VESECs. Multiple scenarios were developed to estimate a range of possible effects on the environment.

Ten scenarios were developed. Exploration personnel manually mapped one scenario, and nine scenarios were modelled in GIS. Each scenario consisted of 30 discreet well sites and 30 well access roads, with one access road for each well site linking it to the mainline road network. The locations of wells were selected to avoid or minimize overlap with environmental constraints (see **Section 3.1.3.1**), consistent with mitigation measures that are planned for well site development. For the manually mapped scenario, potential resource targets were considered in well site selection based on historical exploration information. However, these targets are preliminary and could change substantially as new seismic data are obtained and analyzed. For the modelled scenarios, potential resource targets were not considered.

In the manual mapping scenario, the exploration personnel located well sites and spur roads using their best judgement to avoid or minimize overlap with the environmental constraints. In the modelled scenarios, well sites were randomly selected using a weighted-random selection approach, where the probability of selected sites was reduced by 'costs' assigned to each environmental constraint.

For the effects assessments that quantified changes in spatially-explicit indicators (e.g., vegetation), the potential effects of each scenario are quantified, and the range of potential effects across the 10 scenarios are summarized and considered for relevant VESECs.

3.1.3.1 Environmental Constraints Mapping

A constraints map outlines sensitive or high quality environmental and heritage values where Project work is to be avoided or minimized. Developing and applying a constraints map for VESECs is especially useful when certain Project features cannot be preplanned (i.e., mapped), which is the case for the exploration well sites and well access roads for the Project.

Within the constraints mapping and associated well site scenario modeling, a hierarchy for avoidance was assigned to individual environmental or heritage values, aligning with mitigation measures identified for individual VESECs within their mitigation and effects assessment sections. Exploratory wells and spur roads were prohibited (i.e., avoidance) from occurring within heritage sites or in Riparian Reserve Zones (RRZs). Other values including sensitive permafrost areas, Riparian Management Areas (RMAs), ecosystems of conservation concern, high value caribou habitats, and high value moose habitats were avoided where practical, but not entirely (i.e., minimized).

In some cases multiple constraints occurred adjacent to each other, or overlapped, and it was not possible to avoid all constraints. Where that occurred, a priority ranking for avoidance was developed based on a subjective evaluation of the rarity, sensitivity, and importance of the constraints. The priority for avoidance was:

1. Heritage sites;
2. RRZs;
3. Permafrost/terrain sensitive areas;
4. RMAs;
5. Ecosystems of conservation concern;

6. High-value caribou habitat; and
7. High-value moose habitat.

For details on the individual values, and associated mitigation measures for those values (including how they were defined and incorporated into the constraints mapping) refer to the individual assessments for those VESECs.

3.1.3.2 Work Areas

Due to the geographic extent of the Project, work will be broken up into multiple work areas, with operations in each work area anticipated to be for 1–3 years. Conducting the work across different areas in different years is a logistical requirement, given the size of the Project Area. For most footprint-related effects (e.g., direct habitat effects associated with vegetation clearing, erosion risk associated with stream crossings), effects were assessed for the entire 10–year Project period. However, for effects associated with sensory disturbance (e.g., indirect habitat loss and wildlife movement), effects were assessed at the work area level (and associated timescale of 1–3 years per work area) because effects of sensory disturbance are expected to be limited to a single work area at any given stage.

This approach to characterizing effects is required to account for key differences in the duration and persistence of the effects from footprint-related disturbance and sensory disturbances. Footprint-related effects will be assessed cumulatively across the entire RSA. The first footprint disturbances created at the start of the Project will likely still exist when the last footprint disturbance is made at the end of the Project (i.e., the effects of the first footprints will likely not have been reversed before the completion of the last footprints). However, sensory disturbance-related effects are expected to cease immediately or return to pre-disturbance levels quickly once the work activity is completed in a given area.

Successive work areas cannot be planned in advance. The extent (size, location, and boundaries) of work areas are expected to develop iteratively over the Project's life based on existing and future exploration results and logistical constraints (e.g., equipment and personnel availability). Instead of assessing effects for defined portions of the RSA, effects were estimated aspatially as a proportion of the effects for the entire RSA, based on the maximum extent over which exploration activities could occur in any given year. The activity that is expected to have the largest work extent each year is seismic exploration, and the maximum extent over which seismic could occur is 500 square kilometres (km²), or about 21 percent (%) of the RSA. In most years, the extent of seismic explorations will be less than 500 km².

Although most disturbances will be associated with exploration activities within the annual work areas, some Project disturbances are expected to occur each year outside the annual work areas. These activities include the operation of the main camp, the airstrip and access road, and water hauling. One or more winter roads outside the annual work areas may be required to provide access to the work areas from camp. The combined length of access roads off the Dempster Highway for a given work area could vary from zero kilometres for work areas adjacent to the Dempster Highway to 60 kilometres (km) for work areas in the northern portion of the RSA.

Based on the factors discussed, associated with maximum work area size, access roads outside the work areas, and fixed annual Project infrastructure, the maximum annual proportion of the RSA subject to sensory disturbance was estimated to be one third (i.e., 33%) of the RSA. Thus, the maximum extent of sensory disturbance-related effects (e.g., temporary reduced habitat effectiveness for some wildlife VESECs) was calculated for each VESEC by applying the applicable ZOI buffers to each disturbance type across the RSA and then multiplying that total extent by 0.33.

3.1.4 Effects Characterization

3.1.4.1 Project Interactions and Potential Effects

A project effect is a change in the condition of a VESEC caused directly or indirectly by a project. Project components and activities that may interact with a VESEC and potentially cause changes to indicators are identified for each VESEC in an interactions matrix (**Table 3-4)**.

The assessment of the potential effects of project components and activities is based on comparing baseline and predicted future conditions with and without the Project. The interaction matrix provides 1) a tool to assist with understanding the Project components and their high-level interactions with VESECs, and 2) a visual confirmation to reviewers that all Project components and activities have been included in the assessment of each VESEC.

Activities within the matrix have been characterized as having no interaction (0), a minor interaction (1) where an effect is possible but is not expected to be measurable or meaningful (e.g., possible behavioural response for wildlife, but no measurable effect on individual survival or reproduction), or an interaction that may result in a measurable effect (2). Interactions characterized as (2) were carried forward to the residual effects characterization.

The interactions are identified in **Table 3-4**. Details about the Project Components and Activities are presented in **Section 1.3.7**. A more detailed description of the likely interactions are provided in the individual VESEC selections.

Table 3-4. Eagle Plains Exploration Project Interaction Matrix with Valued Environmental and Socio-Economic Components

Project Component / Activity	Environmental VESECs						Socio-economic (VESECs)				
	Permafrost and Terrain	Water Resources	Fish and Fish Habitat	Vegetation	Wildlife and Wildlife Habitat	Caribou	Historic Resources	Community Infrastructure and Services	Land and Resource Use	Community Health and Wellbeing	Employment and Economy
Engagement	0	0	0	0	0	0	0	0	0	0	0
Seismic Exploration	2	2	2	2	2	2	2	1	2	2	+
Drilling Exploration	2	2	2	2	2	2	2	1	2	2	+
Extended Flow Testing (EFT)	0	0	0	0	2	2	1	0	1	1	+
Well Maintenance (Workovers)	0	0	0	0	2	2	1	1	1	1	+
Winter Access Creation and Maintenance	2	2	2	2	2	2	1	0	2	2	0
Mix Bury Cover (MBC) Construction and Operation	2	0	0	0	2	2	2	0	1	1	+
Central Processing Facility (CPF)	2	0	0	2	2	2	2	0	1	1	+
Airstrip Operations	0	2	0	2	2	2	0	0	1	1	+
Water Withdrawal	1	2	2	0	2	2	0	0	1	1	0
Transportation	1	0	0	0	2	2	1	2	1	1	0
Chance Camp Operations	1	2	0	2	2	2	1	1	1	2	+
Reclamation and Closure	2	0	0	0	2	2	2	0	1	1	0

Notes:
+ = beneficial effect
0 = no interaction
1 = minor interaction with VESEC possible, but small immeasurable effect (e.g., possible slight behavioural response, no vegetation effects, no measurable effect on water quality). Designates a summary of effects that are addressed in the effects assessment as a discussion. This rating does not lead into residual effects characterization.
2 = substantial interaction with VESEC, designates a more detailed assessment of potential effects. Carry forward into residual effects characterization.

3.1.4.2 Mitigation Measures

Mitigation measures are actions and measures that Chance Oil and Gas Ltd. (Chance) will use to address potential Project-related adverse effects. Mitigation measures are identified following the mitigation hierarchy approach:

- avoid potential adverse effects;
- minimize effects to the extent possible, if not avoidable, through measures including but not limited to modification of project design or use of abatement technologies; and,
- employ restoration or rehabilitation techniques to treat remaining adverse effects on site.

Chance has made substantial effort to incorporate avoidance and minimization into Project design and operational decisions, in the form of spatial avoidance (e.g., **Section 3.1.3.1 Environmental Constraints Mapping**) and temporal avoidance (i.e., majority of Project activities occurring during winter months, when many VESECs are less sensitive to potential effects). Within each VESEC-specific assessment of the Project Proposal are descriptions of technically and economically feasible measures that Chance proposes to incorporate to mitigate the Project's potential effects. Appropriate mitigation measures have been identified based on a combined evaluation of site-specific conditions, best practices, available and effective technologies, technical and economic feasibility, and professional experience.

Chance identifies several Project-specific Environmental Management Plans (EMPs) that will collate relevant mitigation measures and provide operational implementation guidance during exploration. These EMPs are further described in **Section 12**.

3.1.4.3 Residual Effects Characterization

Residual effects are effects that remain after mitigation. All Project-related adverse residual effects are described and assessed within the residual effects characterization for individual VESECs.

The residual effects characterization uses magnitude, likelihood, geographic extent, duration, frequency, timing, and reversibility. The general residual effect criteria used for the Project are defined in **Table 3-5**, following guidance provided by YESAB (YESAB 2021b). **Table 3-6** provides standardized Project ratings for each criterion; VESEC-specific ratings have been defined within individual VESEC sections where necessary.

Table 3-5. YESAB's Effect Characterization Criteria

Project Activity	Effects Pathway(a)
Magnitude	• Definition: The extent of a Project-related change from baseline conditions — a narrative or quantification. • Explanation: Depending on the effect, magnitude may be measured with familiar units; for example, in describing habitat loss, the change from baseline conditions may be measured in hectares. More abstract measures may be required for other effects, such as effects on heritage resources.
Likelihood	• Definition: The probability that an effect will occur. • Explanation: Some effects may be certain, while others will be unlikely.
Geographic Extent	• Definition: The spatial area(s) in which an effect is predicted to be detectable. • Explanation: The geographic extent of effects can be local or regional; in some cases, the geographic extent may be outside the RSA. For example, some effects may only occur in communities rather than the project location.

Project Activity	Effects Pathway(a)
Duration, Frequency and Timing	• Definition: Duration: The length of time an effect is predicted to last. • Explanation: Certain effects may persist beyond the life of the Project.
	• Definition: Frequency: How often an effect is predicted to occur. • Explanation: Certain effects occur more frequently than others.
	• Definition: Timing: When an effect is predicted to occur. • Explanation: Certain effects depend on the time they occur (e.g. time of year).
Reversibility	• Definition: The degree to which a valued environmental or socio-economic component can be returned to baseline conditions or other established reference point after proposed activities have ceased. • Explanation: Effects can be reversible or permanent. Reversible effects may have lower impacts than irreversible or permanent effects.

Adapted from YESAB 2021a.

Table 3-6. Definitions of Effects Criteria Classifications for the Assessment of VESECs in the Project

Criterion		Rating	Definition
Magnitude		Negligible	There will be no measurable change from existing conditions
		Low	The residual effect will be a slight, but measurable change from existing conditions
		Moderate	The residual effect will be a measurable change from existing conditions but will not affect the VESECs viability, role or function
		High	The residual effect will be a substantial, measurable change from existing conditions that may affect the VESECs viability, role or function
Likelihood		Unlikely	No residual effect is expected, but a residual effect is not impossible
		Possible	A residual effect may occur but is not likely
		Probable	A residual effect is likely to occur, but it is not certain
		Certain	A residual effect will occur
Geographic Extent		Maximum disturbance footprint	The residual effect will be confined to the maximum disturbance footprint
		Local	The residual effect will be confined to the LSA
		Regional	The residual effect will extend beyond the LSA but be confined to within the RSA
		Beyond regional	The residual effect will extend beyond the RSA
Duration, Frequency and Timing	Duration	Short-term	The residual effect will occur for less than one year
		Medium-term	The residual effect will occur for greater than one year and up to the life of the Project
		Long-term	The residual effect will extend beyond the life of the Project

Criterion		Rating	Definition
		Permanent	The residual effect is predicted to be permanent and thus unlikely to recover to existing conditions
	Frequency	Occasional	The residual effect will occur rarely (once or a few times over the life of the Project)
		Periodic	The residual effect will be occur consistently at regular intervals or associated with temporal events (e.g., during spring freshet, low flows, growing season)
		Continuous	The residual effect will occur continuously
	Timing	Year-round	The residual effect will occur year-round
		Seasonal	The residual effect will be confined to a portion of the year
Reversibility		Reversible	The residual effect is predicted to be reversible within a clearly defined period
		Irreversible	The residual effect is predicted to be irreversible

3.1.4.3.1 Context and Confidence

A project's context has a bearing on determining the significance of likely adverse effects and is considered an important input under the *Yukon Environmental and Socio-economic Assessment Act* S.C. 2003, c. 7 (*YESAA*). The following contextual factors are used to support determining the significance of likely adverse project effects: environmental and/or socio-economic context within which the Project occurs (e.g., land use plans); legislation; Indigenous and treaty rights; cumulative effects of other past, present, and likely future projects or activities; standards, plans and policies; ecological or social limits and thresholds; vulnerability and resiliency of social and/or ecological systems and components; political and cultural setting (YESAB 2021b). Context is evaluated separately for the residual effects on each individual VESEC.

Limitations of existing data and uncertainty associated with the assessment were also characterized by assigning a level of confidence for each residual effect. level of confidence is considered concerning:

- scientific certainty relative to the quantification of the effect, including the quality and or quantity of data and the understanding of effect mechanisms;
- scientific certainty relative to the effectiveness of the proposed mitigation; and,
- professional judgment based on prior experience in predicting effects and the known effectiveness of proven mitigation measures.

Confidence estimates are intended to support YESAB and regulator evaluation of risk associated with the Project's residual effects. In the determination of confidence for each residual effect characterization, the following categories are used:

- Low Confidence: is assigned when the VESEC, subcomponent or Project interaction is not well understood, or the mitigation has not been proven effective;
- Moderate Confidence: is assigned where the VESEC is understood in similar ecosystems and effects have been documented in the larger regional area or the literature, and/or the mitigation has been proven effective elsewhere; and,
- High Confidence: is assigned when the VESEC, subcomponent, and Project interactions are well understood, and the mitigation has been proven effective.

3.1.5 Significance Determination

In characterizing the likely or predicted residual effects of the Project, the assessment has included an evaluation of whether those residual effects are likely to be significant or not significant. Magnitude, geographic extent, and duration are typically the primary characteristics affecting significance, with other characteristics acting as modifiers. For example, if an adverse effect of the Project has a sufficiently high magnitude, affects a reasonably large area, and lasts for a sufficient duration, then a significant adverse effect may be identified.

Definitions of significant versus not significant have been provided for each VESEC within the relevant effects characterizations, alongside an evaluation of the significance of residual effects on those VESECs. Defining significance generally incorporates the principles of sustainability and other relevant concepts and considerations, as appropriate. In general, within the Project Proposal, significant environmental effects are those adverse effects that are predicted to cause a change in the VESEC that is likely to alter its status or integrity beyond an acceptable level (e.g., where it is not sustainable or is unavailable to contribute to ecological function or future generations). An effect that does not approach those criteria is considered not significant.

3.1.6 Cumulative Effects

Cumulative effects are changes to environmental, social or economic values caused by the Project's activities when combined with effects of other past, present and reasonably foreseeable future projects or activities (YESAB 2021c). Cumulative effects occur when the Project interacts (spatially and temporally) with residual effects of other projects or activities and creates an effect greater than the Project's residual effect. For the Project, the CEA was completed for all VESECs with potential predicted residual effects with magnitude of low or greater. This process included defining assessment boundaries, identifying cumulative effects within those boundaries, and evaluating the significance of those cumulative effects. The subsections below describe the approach used, and the results of the CEA for each VESEC are presented in the VESEC-specific assessment sections.

3.1.6.1 Cumulative Effects Assessment Boundaries

3.1.6.1.1 Spatial Boundaries

The CEA was completed within spatial boundaries relevant to each individual VESEC. The majority of VESECs assessed cumulative effects at the scale of (**Table 3-7**):

1. the general Cumulative Effects Study Area (CESA); and
2. the Caribou Cumulative Effects Study Area (CCESA).

Cumulative effects for many VESECs were assessed within the Land Management Units (LMU) of the North Yukon Land Use Planning and the Peel Watershed Planning regions that overlap with the Project. In the North Yukon Planning Region, this is LMU #9 (Eagle Plains); in the Peel Watershed Planning Region, this is LMU #7 (Daglish Creek). These boundaries were selected for assessing cumulative effects for many VESECs because cumulative effects indicators have been adopted for each LMU in these planning regions and provide the context within which the results of the CEA can be interpreted (**Section 1.6** of **Section1 Details of the Project Description** of the Project Proposal). Cumulative effects on caribou were assessed within the Canadian portion of the PCH range. Cumulative effects for socio-economic VESECs were

assessed at scales relevant to each of those four individual VESECs, as listed below and further defined within **Section 11 Socio-Economics** of the Project Proposal.

Table 3-7. Spatial Boundaries Used for the Cumulative Effects Assessment of the Eagle Plains Exploration Project

VESEC	CEA Spatial Boundary	Description of Area
• Permafrost and Terrain • Water Resources • Fish and Fish Habitat • Vegetation • Wildlife and Wildlife Habitat • Heritage Resources	Cumulative Effects Study Area (CESA)	The extent of the combined areas of LMU #9 in the North Yukon Planning Region and LMU #7 in the Peel Watershed Planning Region.
Caribou	Caribou Cumulative Effects Study Area (CCESA)	The Canadian portion of the PCH range.
Land and Resource Use	Land and Resource Use RSA	Game Management Subzones overlapping the Project Footprint where the Project could affect regional management of wildlife and harvesting
Employment and Economy	Employment and Economy RSA	The boundaries of the regional government and municipalities from which the Project could potentially source business services and labour.
Community Infrastructure and Services	Community Infrastructure and Services RSA	The boundaries of the regional government and municipalities from which the Project may potentially source municipal services and infrastructure and related regional public transportation networks.
Community Health and Well-being	Community Health and Well-being RSA	For the Community Health and Well-being - Environmental Determinants of Health subcomponent: the Game Management subzones overlapping the Project Footprint where the Project could affect regional management and harvesting of wildlife in its relation to environmental determinants to human health outcomes. For the Community Health and Well-being - Social Determinants of Health subcomponents: the boundaries of the regional government and municipalities from which the Project may potentially source community health and social services related to well-being.

3.1.6.1.2 Temporal Boundaries

For the CEA, temporal boundaries were defined as follows:

- Past: includes projects and activities that were completed before 2024. For projects and activities within the RSA, the spatial effects of these projects are generally considered to be contained within baseline spatial data (e.g., existing roads, seismic lines, etc.).
- Present: includes projects and activities initiated before 2024 and currently operating in 2024.
- Future: includes projects and activities proposed to start at some point between the time the CEA was completed (early 2024) and the end of Project activities (2035, 10 years after the

start of the Project, assuming 2025 start date). The effects of the Project can be expected to last beyond 2035 while disturbed land goes through reclamation and restoration. However, 2035 represents the peak of potential future cumulative effects to which the Project contributes.

3.1.6.2 Cumulative Effects Analysis

3.1.6.2.1 Projects and Activities

A list of past, present, and reasonably foreseeable future projects and activities with potential to interact spatially and temporally with the Project was compiled (**Table 3-8**). This list of projects and activities that can contribute to cumulative effects on the VESECs was collated from multiple sources including:

- the YESAB Project Registry;
- the final Land Use Plans for the North Yukon and Peel Watershed Planning Regions (North Yukon Planning Commission 2009, Peel Watershed Planning Commission 2019);
- geospatial data from the Yukon Government;
- other publicly available data; and,
- input from individuals working in these regions.

Each project was assigned a complete, ongoing, or proposed status based on its temporal status and activity status, as described in the YESAB Project Registry and other best available information. In many cases, information on the temporal status of a project was not readily available, including projects in the YESAB Project Registry where the approval was listed as “vary”, which indicated the project was approved with changes to the proposal. In those cases, the Registry did not further indicate the project's temporal status. To take a conservative approach, we assumed any project with a “vary” approval proceeded and was either complete, operating or ongoing based on other available data (e.g., review of satellite imagery, proposed project start and end times, etc.).

Many disturbances (gravel quarries, oil and gas projects, or mining projects) were in the Geo Yukon Areal Surface Disturbance layer (most recently updated in 2021 (Powell 2023), but were not in the YESAB Project Registry. These disturbances had no information associated with them other than the type of industry, type of disturbances, and area. Given their continued, visible presence on the landscape, these projects were assumed to have remaining residual effects that could interact with Project residual effects and were included in the CEA.

Besides expeditions on the Firth River, many tourism activities in the YESAB Project Registry only occurred for one season. In the case of these short-term activities, it was typically assumed that no remaining residual effects were interacting with Project residual effects, and these projects were not carried forward.

Table 3-8. List of Other Past, Present, and Reasonably Foreseeable Future Projects and Activities Included in the Cumulative Effects Assessment

Industry	Project Name/ Activity	Activity Status	Location	Proponent
Transportation	Dempster Highway	Ongoing	LU Planning Regions	Government of Yukon
	Ogilvie Grader Station Solar, km 195 Dempster Highway	Ongoing	PCH Range	Government of Yukon
	Old Crow Winter Road	Ongoing	LU Planning Regions, PCH Range	Government of Yukon and Vuntut Gwitchin Government
	Old Crow all-season road/	Proposed	LU Planning Regions, PCH Range	Government of Yukon and Vuntut Gwitchin Government
	Wind River Trail and Hart River Winter Road	Ongoing	LU Planning Regions	Unknown, historic exploration or seismic lines
	Various Transportation Infrastructure	Ongoing	LU Planning Regions	Various
Communities and community infrastructure	Communities of Old Crow and Eagle Plains, Homesteads, and Camps	Ongoing	LU Planning Regions, PCH Range	Vuntut Gwitchin Government, Yukon Government
	Eagle Plains Solid Waste Disposal	Ongoing	LU Planning Regions	Yukon Government
Gravel Quarry	Gravel quarries – Unnamed	Ongoing	LU Planning Regions	Unknown
	Sheep Creek Gravel Pit, km 433 Dempster Highway	Ongoing	PCH Range	Yukon Government
	Gravel Extraction and Crushing North and South Cornwall Rivers	Complete	PCH Range	Yukon Government
	Porcupine River Gravel Development	Complete	PCH Range	Yukon Government
	Granular Pit Exploration + Development – km 158	Ongoing	PCH Range	Yukon Government
	Granular Pit Development km 226 Dempster Highway	Ongoing	PCH Range	Yukon Government
	Dempster Highway Granular Pit Development: km 188, 208, and 232	Proposed	PCH Range	Government of Yukon

Industry	Project Name/ Activity	Activity Status	Location	Proponent
Oil and Gas	Oil and Gas Exploration Drilling	Complete	LU Planning Regions, PCH Range	Chance Oil and Gas Limited (then Northern Cross Limited)
	Flow Tests at Three Existing Hydrocarbon Wellsites	Complete	LU Planning Regions, PCH Range	Chance Oil and Gas Limited (then Northern Cross Limited)
	Quarry Pit Development for Wellsite Access Road, Eagle Plains-Northern Cross	Complete	LU Planning Regions, PCH Range	Chance Oil and Gas Limited (then Northern Cross Limited)
	Northern Cross – 2008 Winter Drilling Program	Complete	LU Planning Regions, PCH Range	Chance Oil and Gas Limited (then Northern Cross Limited)
	Northern Cross Yukon Limited – 2008 Summer Drilling Program	Complete	LU Planning Regions, PCH Range	Chance Oil and Gas Limited (then Northern Cross Limited)
	Northern Cross Yukon Limited – Eagle Plains Resource Assessment Programs (Construction of Camp)	Ongoing	LU Planning Regions, PCH Range	Chance Oil and Gas Limited (then Northern Cross Limited)
	Blackie M-59 Re-Evaluation Program (Oil and Gas exploration)	Complete	LU Planning Regions, PCH Range	Chance Oil and Gas Limited (then Northern Cross Limited)
	Eagle Plains 3D Seismic Survey	Complete	LU Planning Regions, PCH Range	Chance Oil and Gas Limited (then Northern Cross Limited)
	Eagle Plains Well Maintenance and Exploration	Ongoing	LU Planning Regions, PCH Range	Chance Oil and Gas Limited
	Re-Abandonment of Petroleum Exploration Well B-62	Ongoing	PCH Range	Yukon Government
	Oil and Gas	Ongoing/ Complete	LU Planning Regions	Various (Geo Yukon Surface Disturbance Layer)
Communications	Yukon Fiber Optic Network	Ongoing	LU Planning Regions, PCH Range	Government of Yukon
	ROHL Camp	Ongoing	LU Planning Regions, PCH Range	ROHL (Dempster Fiber Line)
Tourism	Tourism	Ongoing/ Complete	LU Planning Regions	Various

Industry	Project Name/ Activity	Activity Status	Location	Proponent
	Firth River Rafting/Expeditions	Ongoing/ Complete	PCH Range	Various: Nahanni River Adventure Ltd., Canadian River Expeditions, The Explorers League, ROAM Adventures
Recreation	Recreation Use	Ongoing	LU Planning Regions	Various
Resource Harvesting	Non-commercial Fishing	Ongoing	LU Planning Regions	Residents
	Non-commercial Hunting	Ongoing	LU Planning Regions	Residents
	Trapping	Ongoing	LU Planning Regions	Various
	Big game outfitting	Ongoing	LU Planning Regions	Various
	Forest harvesting	Ongoing	LU Planning Regions, PCH Range	Various
Mineral Exploration	Mineral Exploration	Ongoing/ Complete	Regional	Various (Geo Yukon Surface Disturbance Layer)
	Kit Property	Complete	PCH Range	Strategic Metals Ltd.
	Michelle Property Exploration	Complete	PCH Range	Archer Cathro and Associates
	Quartz Mining – Shell Creek Property	Complete	PCH Range	Logan Resources
	OG Property	Complete	PCH Range	Full Metal Mineral Ltd.
	Quartz Exploration – Victoria Mountain	Complete	PCH Range	Aurchem Exploration Ltd.
	Quartz Exploration – Coal Creek (Monster)	Ongoing	PCH Range	Go Metals Corp.
Military	Bar-2 Shingle Point Long Range Radar Military Facility	Ongoing	PCH Range	Department of National Defense
	BAR-2 (Shingle Point, Yukon) Fuel Tank W22 B Upgrade	Ongoing	PCH Range	Department of National Defense
	Crush Gravel, Stockpile and Resurface Runway at BAR-2 (NWS radar Site 8 km SE of Shingle Point	Complete	PCH Range	Department of National Defense

Industry	Project Name/ Activity	Activity Status	Location	Proponent
	Bar-2 Shingle Point – HV Power Distribution Overhaul	Complete	PCH Range	Department of National Defense
Ivvavik National Park Operations	Sheep Creek Base Camp, Ivvavik National Park	Ongoing	PCH Range	Parks Canada
Other	Contaminated sites	Ongoing	Regional	Various
	IBC Camp on US/CA Border	Complete	PCH Range	International Boundary Commission

3.1.6.2.2 Cumulative Effects Characterization

Cumulative effects on a VESEC were considered if potential residual effects from the Project might interact with the effects from past, present, or reasonably foreseeable future projects and activities. Potential residual effects of projects and activities listed in **Table 3-8** were considered if they might interact with a given VESEC. Effects from other projects and activities were determined through a review of reports on the YESAB registry or other sources.

For each VESEC, a description of existing and predicted future conditions was provided using information and context as was relevant for that particular VESEC. Potential cumulative effects were determined by comparing existing conditions to future conditions. Future conditions combined existing conditions with predicted effects of all reasonably foreseeable future projects, including the Project.

All quantitative, spatially relevant effects (e.g., area of disturbed land) were assumed to be additive where they did not spatially overlap with another project or activity with the same type of effect. If a project or activity spatially overlapped with another project or activity, the more recent project or activity (temporally) was typically assumed to take precedence. The exception was if a project or activity was intended to remediate a historic disturbance (e.g., remediate a contaminated site).

Additional Project-specific mitigation measures might be proposed if an adverse cumulative effect was identified for a VESEC. After the incorporation of mitigation, all residual cumulative effects are characterized following the same methods as potential residual effects, as outlined in **Section 3.1.4**.

3.2 CONSIDERATION OF TRADITIONAL/INDIGENOUS KNOWLEDGE

Chance contacted potentially affected First Nations to inform them that an environmental and socio-economic assessment was being conducted for the Project Proposal, and that they planned to identify and apply existing Traditional Knowledge sources, including publicly available studies or reports, related to the Project area. Chance advised that they intended to use only Traditional Knowledge information that was relevant to understanding potential effects to First Nations. Chance also requested each potentially affected First Nation to identify and describe Traditional Knowledge confidentiality and protocols that may be applicable.

Chance acknowledged that Traditional Knowledge sources may include studies prepared for other regulatory processes, First Nation published documents, and other sources of publicly available information including books, articles, and reports. Chance confirmed that including Traditional Knowledge into the environmental and socio-economic assessment would support the understanding of existing environmental and socio-economic conditions and potential Project-related effects, and possibly inform mitigations or enhancement measures. Two Worlds Consulting, on behalf of Chance, identified existing secondary sources of Traditional Knowledge for each potentially affected First Nation to review, and requested their permission to use the sources in preparing the socio-economic assessment. First Nation-specific sources were outlined in a table and shared with each potentially affected First Nation by email. Additional information provided for each source included the document title, author, summary of the source, and URL (if available). Two Worlds Consulting offered to provide PDF copies of sources shared, if requested. **Table 3-9** identifies all secondary Traditional Knowledge sources shared with potentially affected First Nations for review and permission.

Table 3-9. Secondary Traditional Knowledge Sources Identified for Review by Potentially Affected First Nations

Document Title	Source	Summary	URL (if available)
First Nation Na-Cho Nyäk Dun			
YESAB # 2022-0090 Dempster Highway Shoreline Stabilization	YESAB	Traditional Territory is heavily altered from First Nation Na-Cho Nyäk Dun's pre-contact baseline, which has impacted cultural and traditional practices. Historical and ongoing impacts, impacts to heritage resources, and impacts to traditional use locations. First Nation Na-Cho Nyäk Dun stated they hold traditional knowledge information on moose, caribou, arctic grayling, and traditional camp/fish locations.	PDF copy available upon request
YESAB # 2022-0172, Quartz Exploration - Clear Creek	YESAB	First Nation Na-Cho Nyäk Dun outlined the important importance of traditional knowledge as speaking to the harvesters' and other observers' experiences of population declines and how the declines impact Indigenous Nations' constitutionally protected treaty rights.	PDF copy available upon request
First Nation of Na-Cho Nyäk Dun Traditional Knowledge Policy	EthicsHub	First Nation Na-Cho Nyäk Dun define and describe traditional knowledge, guidelines for disclosure of traditional knowledge, and outlines sensitivity level categories for traditional knowledge.	PDF copy available upon request
DÄN HÙNÀY Our People's Story: First Nation of Na-Cho Nyäk Dun Elders' Memories and Opinions on Mining	First Nation of Na-Cho Nyäk Dun	Collection of oral history from 2015 and 2019 on First Nation Na-Cho Nyäk Dun Citizens' experiences with the mining industry since 1915.	PDF copy available upon request
Gwich'in Tribal Council / Tetł'it Gwich'in Council			
Nan Geenjit Gwitr'it T'agwàa'in: Working for the Land (Gwich'in Land Use Plan)	Gwich'in Land Use Planning Board	Land Use Planning Board specify special management zones and conservation zones throughout Tetł'it Traditional Territory, traditional/cultural activities, and heritage resources.	PDF copy available upon request
Ways We Respect Caribou: Teetł'it Gwich'in Rules	University of Calgary	Discusses key traditional locations for Tetł'it Gwich'in when seeking caribou, and key harvesting times which were in fall and winter. Caribou harvesting today takes place throughout the Dempster Highway corridor. Number	PDF copy available upon request

Document Title	Source	Summary	URL (if available)
		of caribou harvested varies significantly by season, reflecting ecological and socio-economic factors.	
Gwich'in Harvest Study	Gwich'in Renewable Resources Board	Study includes a full species list for the study, and data on total harvests per species per year. Harvesting locations were kept confidential.	PDF copy available upon request
Gwich'in Tribal Council Website	Gwich'in Tribal Council	Outline legends regarding animals and early humans. Timeline of events post-contact at bottom of the History page.	HISTORY – GWICH'IN TRIBAL COUNCIL (gwichintribal.ca)
Gwich'in Renewable Resources Workshop	Gwich'in Language Teaching & Learning Centre	Legends and stories of wildlife and human interactions.	PDF copy available upon request
Gwich'in Traditional Knowledge: Nèhtrùh (Wolverine)	Gwich'in Renewable Resources Board	Traditional knowledge, legends, and stories about Wolverine.	PDF copy available upon request
Gwich'in Knowledge of Grizzly Bears	Gwich'in Social and Cultural Institute/Gwich'in Renewable Resources Board	Traditional knowledge and legends of Grizzly Bear.	PDF copy available upon request
Gwich'in Traditional Knowledge: Woodland Caribou, Boreal Population	Gwich'in Social and Cultural Institute	Traditional knowledge, legends, and significance of Woodland Caribou (Boreal population).	PDF copy available upon request
Gwich'in Knowledge of Bluenose Caribou	Gwich'in Social and Cultural Institute/Gwich'in Renewable Resources Board	Traditional knowledge and legends of Bluenose West Caribou.	PDF copy available upon request
TS'IIDĘ́Ų GWÌNOO GWINÌN: Animals from Long Ago	Gwich'in Social and Cultural Institute	Gwich'in stories and information about animals and legends of mythical creatures including bison, mammoths, giant caribou, legend of Raven, giant creatures, and more. Maps included for place names.	PDF copy available upon request
Fonds 426 – Gwich'in Tribal Council – Gwich'in Social and Cultural Institute Fonds	Government of Northwest Territories	Includes the fonds of historic sites, traditional knowledge work, and more.	Gwich'in Tribal Council – Gwich'in Social and Cultural Institute fonds – NWT Archives (accesstomemory.org)

Document Title	Source	Summary	URL (if available)
Gwich'in Place Names Atlas	gwichin.ca	An interactive online Atlas that explores the culture, history, traditional knowledge and land use of the Gwich'in through Gwich'in place names.	Atlas (gwichin.ca)
Tr'ondëk Hwëch'in			
Re: Quartz Exploration – Michelle Creek (2021-0176)	YESAB	Tr'ondëk Hwëch'in submitted comments stating the Michelle Creek Quartz Exploration is in their Cultural Integrity Area, cultural resources, and Settlement Land parcels near Cache Creek.	PDF copy available upon request
Tr'ondëk Hwëch'in Comments	YESAB	Tr'ondëk Hwëch'in noted the Dempster Highway Shoreline Stabilization project was in the boundaries of the Tr'ondëk Hwëch'in Cultural Integrity Area and a key goal of the Tr'ondëk Hwëch'in Final Agreement was to recognize and protect the economic and spiritual relationship between Tr'ondëk Hwëch'in and the land.	PDF copy available upon request
Tr'ondëk Hwëch'in Comments	YESAB	Tr'ondëk Hwëch'in outlined concerns for Dempster Highway Shoreline Stabilization development infringing on treaty rights, use of heritage resources, access to natural vegetation and foods, and impacts to wildlife and habitat. Heritage resource examples included harvesting, migration routes, traplines, medicines, place names/stories, camps/trails/burial sites).	PDF copy available upon request
Weathering Changes: Cultivating Local and Traditional Knowledge of Environmental Change in Tr'ondëk Hwëch'in Traditional Territory	YESAB	Tr'ondëk Hwëch'in discuss approaches and uses of traditional knowledge in environmental assessments. This article includes a Traditional Territory map (p. 441).	PDF copy available upon request
Tr'ondëk Hwëch'in Review of the Dawson Regional Draft Plan	Jstor	Tr'ondëk Hwëch'in noted Eagle Plains includes an important caribou harvesting area and potential for undiscovered archaeological sites/infrastructure related to harvest activities.	PDF copy available upon request
Tr'ondëk Hwëch'in Land Use: Dawson Planning Region	EMR Library	Map of Tr'ondëk Hwëch'in land use area.	PDF copy available upon request

Document Title	Source	Summary	URL (if available)
Vuntut Gwitchin First Nation			
Nanh Kak Ejuk Gweedhaa	Vuntut Gwitchin First Nation	Report of the changes in Vuntut Gwitchin First Nation Traditional Territory informed by traditional knowledge and Vuntut Gwitchin First Nation way of life. Includes trends related to community, weather, human health, insects, heritage, water, plants, animals, birds, and salmon.	PDF copy available upon request
YESAB Request for Information Chance Oil and Gas Eagle Plains Proposal	The Narwhal	Comments from Vuntut Gwitchin First Nation regarding impacts to traditional land use, consideration of culturally significant resources, and inclusion of traditional knowledge regarding wildlife.	PDF copy available upon request
Natural Resource Maps	Government of the Vuntut Gwitchin First Nation	Index of maps showing traditional knowledge of fish and wildlife data.	Vuntut Gwitchin First Nation Government Website (vgfn.ca)
Reconciling Traditional Knowledge, Food Security, and Climate Change	Project Muse	Discusses food security challenges related to traditional harvests of caribou and chinook salmon, and decline in practicing traditional food culture.	PDF copy available upon request
Vah Srigwehdli': The One Who Survived	Gwaandak Theatre and Vuntut Gwitchin Government	Story that exemplifies Gwich'in survival skills, resilience, community, and generosity. Serves as a reminder that climate change is harsh, fish and game are not always plentiful, and there is a growing concern about food security.	PDF copy available upon request

In addition to sharing secondary sources of Traditional Knowledge, Chance invited each potentially affected First Nation to share additional Traditional Knowledge sources to help inform the development of the assessment and Project Proposal. Chance offered to meet and discuss alternative submission options for certain Traditional Knowledge sources, if interested.

Vuntut Gwitchin First Nation provided consent for the use of identified secondary Traditional Knowledge sources and provided additional sources. Interviews with representatives of Vuntut Gwitchin First Nation also provided confirmation of available information about cultural use within their Traditional Territory, including the LSA.

Gwich'in Tribal Council provided consent for the use of identified secondary Traditional Knowledge sources and provided additional sources. Interviews with representatives of Gwich'in Tribal Council also provided confirmation of available information about cultural use within their Traditional Territory, including the LSA.

The First Nation of Na-cho Nyäk Dun did not consent to the inclusion of available Traditional Knowledge and did not participate in the socio-economic interview program. As a result, limited information is available about cultural use for First Nation of Na-cho Nyäk Dun within the LSA.

Tr'ondëk Hwëch'in did not consent to the inclusion of available Traditional Knowledge and did not participate in the socio-economic interview program. As a result, limited information is available about cultural use for Tr'ondëk Hwëch'in within the LSA.

Approved Traditional Knowledge secondary sources were used to inform the understanding of existing socio-economic conditions, the scoping of the socio-economic VESECs, the definition of socio-economic study area boundaries, and the identification of socio-economic Project interactions and effects. The assessment of First Nations Culture and Land and Resource Use in Section 11 of the Project Proposal is constrained by the availability of Traditional Knowledge used to support an understanding of the use of lands and resources by First Nations in the LSA.

Where Traditional Knowledge has not been provided by the First Nations, information about cultural use of the LSA was compiled from publicly available sources such as regional land use plans and other project proposals related to the LSA. Chance recognizes that the absence of Traditional Knowledge relevant to each potentially affected First Nation does not imply that this knowledge and information does not exist, or that the potentially affected First Nations have no cultural land and resource use interests or values associated within the LSA or RSA.

Chance will continue to consult and engage potentially affected First Nations to better understand their preferences around Traditional Knowledge and how it can be applied to the environmental and socio-economic assessment of the Project.

3.3 CONSIDERATION OF ABORIGINAL AND TREATY RIGHTS

Proponent-led consultation is distinct from Crown requirements to consult First Nations (Government of Canada 2003). The Crown has a duty to consult with affected First Nations about projects "and, where appropriate, to accommodate Indigenous groups [when] it considers conduct that might adversely affect potential or established Aboriginal or treaty rights" (Crown-Indigenous Relations and Northern Affairs Canada 2023).

Chance's consultation and engagement activities with potentially affected First Nations and residents of communities designed to meet consultation requirements under sections 3 and 50(3) of the YESAA (Government of Canada 2003) is described in **Section 2** of the Project Proposal. Issues and interests identified through consultation and engagement activities and how that input has informed Project scoping is described in **Table 2-1: Key Feedback Shared from 2014 to the Present** of **Section 2 Consultation and Engagement**.

Issues and interests related to environmental and socio-economic conditions identified through consultation and engagement activities have informed the scoping of VESECs, the definition of study area boundaries, and the identification of Project interactions and effects. Key issues and interests raised include:

- cultural value of the PCH and concern about their decline;
- impacts to wildlife behaviour and habitat that are valued as traditional food and for cultural and spiritual well-being;
- concern about effects to traditional trails and traditional sites related to cultural use areas for trapping and hunting (i.e., moose and caribou);
- increased access to traditional territories and resulting damage to the livelihood of First Nations citizens;
- interest in employment and contract opportunities;
- concern over the capacity of local communities to meet the demand for employment opportunities without further training and funding;
- impacts to the potential visual impacts to the landscape;
- concern about the human land use-related disturbances such as noise, smell, and light and potential mitigations;
- concern related to increased traffic on the Dempster Highway;
- opportunities for involvement in monitoring;
- concerns about Project-related effects to climate change and related impacts to the land and the wildlife on which First Nations depend for food, and ability of to travel and use the land for traditional purposes;
- concern about potential for water contamination (used by land users while on the land);
- concern for potential Project-related effects to water bodies and wetlands from new winter road and permafrost/terrain stability;
- identifying that the landscape is a key cultural value for the First Nations;
- concern about Project access roads and effects to water and fish;
- concern over increased risk of increased ski-doo traffic and access management;
- comment highlighting the importance of upholding objectives from the North Yukon Regional Land Use Plan;
- comment requesting clarification on process for protecting oral history;
- comment highlighting the issue of oil and gas exploration's effect on the quality of Traditional Territory and impact to the livelihood of First Nations; and,
- Further detail on consultation and engagement input is provided in **Section 2 Consultation and Engagement, and Section 11 Socio-Economics**.

4 PERMAFROST AND TERRAIN

Permafrost is ground that remains at or below 0 degrees Celsius (°C) for at least two consecutive years. At a local scale, the presence and thickness of permafrost depend on factors such as air temperature, snow cover, vegetation, and the ground's thermal properties. Above the permafrost is the active layer, a layer of ground that freezes in winter and thaws in summer, playing a crucial role in the movement of water from rainfall and snowmelt. Permafrost is primarily a concern if it contains large quantities of ice; bedrock and coarse gravel may be frozen but tend to have little to no ice, whereas finer sediments, like silt and sand, contain more ice. When these frozen sediments thaw, sediment and water become more mobile. Terrain stability considers geology and soils, inactive and active geomorphological processes, and landform assemblages. Terrain stability plays an important role in terrestrial and aquatic ecosystems, water quantity and quality, land use planning, and natural hazards. The baseline report (**Appendix 4-A Terrain and Permafrost Baseline Report**) describes the current permafrost and terrain stability conditions within the Regional Study Area (RSA); the Exploration Development Suitability (EDS) assessment outlined the baseline report is an important component of the environmental constraints map for the Eagle Plains Exploration Project (Project).

4.1 ASSESSMENT INDICATORS AND ASSESSMENT PARAMETERS

The Project has the potential to interact with permafrost and terrain stability, and the assessment indicators of potential adverse effects are changes to the extent of ground ice (through either changes in ground temperature, active layer thickness, or ice content), and changes that results in ground settlement or mass movement (typically associated with changes to surface drainage or slope morphology). The assessment approach for permafrost is a quantitative approach to permafrost degradation, or aggradation. The assessment approach to terrain stability is a qualitative discussion on terrain instability.

4.2 PROJECT INTERACTIONS AND POTENTIAL EFFECTS

The potential for the Project to interact with and adversely affect permafrost and terrain stability was assessed by systematically reviewing each of the components listed in the Project description (**Table 4-1**). The Project includes several components that have the potential to interact with and adversely permafrost and terrain stability. Each of these components received scores (0 = no interaction; 1 = minor interaction; 2 = substantial interaction) based on the expected magnitude of a potential adverse effect. Only component-effect interactions with a score of 2 are considered in residual adverse effects characterization, whereas lower scores are associated with adverse effects that are small (immeasurable) or negligible.

In general, Project-related activities could degrade (thaw) ice-rich permafrost or destabilize slopes, as well as adversely affect other Valued Environmental and Socio-Economic Components (VESECs). The following is a non-exhaustive list of potential effects pathways:

- Thaw of permafrost, irrespective of its ice content, can alter local water quantity (hydrology) through changes in the availability and capacity of soils (active layer) to store moisture.
- Changes in micro-topography and drainage conditions, through regrading or thermokarst activity, can alter vegetation health, rare plant survival and associated wildlife habitats.

- Unnaturally high rates of delivery of fine-grained sediments into creeks and rivers, in response to accelerated erosion on disturbed slopes, can be detrimental to water quality and fish and aquatic resources.
- Slope instability and/or thermokarst could disturb, or increase the risk of disturbance to, heritage resources or access corridors for hunting, trapping or other land uses.
- Thaw of organic-rich permafrost could accelerate the release of greenhouse gases into the atmosphere beyond rates already naturally occurring due to climate change.

4.2.1 Interactions Table

Eleven of the 14 Project components may interact with permafrost and terrain stability causing potential adverse effects by changes in changes to the extent of ground ice, and changes that results in ground settlement or mass movement. The direct and indirect pathways for potential adverse effects because of the Project components are described in the following sections.

Table 4-1. Expected Interactions Between the Permafrost and Terrain Stability Valued Environmental and Socio-Economic Components and Project Activities, by Type of Potential Effect

Project Component / Activity Subcomponent		Degradation of Permafrost	Aggradation of Permafrost	Terrain Instability
Seismic Exploration	Seismic line construction	2	0	1
	Helipads and staging sites	2	2	2
	Temporary creek crossings	2	0	2
	Seismic recording	0	0	0
Winter Well sites	Pad construction	2	2	2
	Drilling	2	2	0
Mix Bury and Cover Sites		2	2	2
Quarry Sites/ Borrow Pits		2	2	2
Winter Roads/ Trails (Seismic)		2	0	1
Winter Roads (Well Sites)		2	1	1
Main Camp		1	0	0
Secondary Camp		2	2	2
Dempster Highway Use		0	0	0
Airstrip		0	0	0

Notes:
0 = no interaction

1 = minor interaction with VESEC possible, but small immeasurable effect (e.g., possible slight behavioural response, no vegetation effects, no measurable effect on water quality). Designates a summary of effects that are addressed in the effects assessment as a discussion. This rating does not lead into residual effects characterization.

2 = substantial interaction with VESEC, designates a more detailed assessment of potential effects. Carry forward into residual effects characterization.

4.2.2 Degradation of Permafrost

Degradation (or warming) of permafrost through surface disturbances can occur due to flaring, compaction/stripping of organics, snow plowing/piling, or alteration of surface drainage patterns. Permafrost can warm and eventually degrade beneath such surface disturbances (**Figure 4-1**), initiating or exacerbating thermokarst activity in ice-rich terrain. The concentration of surface runoff may increase heat transfer from flowing or pooled water into the comparatively cool ground, thereby slowing annual freeze-back of the active layer. It may also warm and ultimately degrade (thaw) ice-rich permafrost, initiating or exacerbating thermokarst activity.

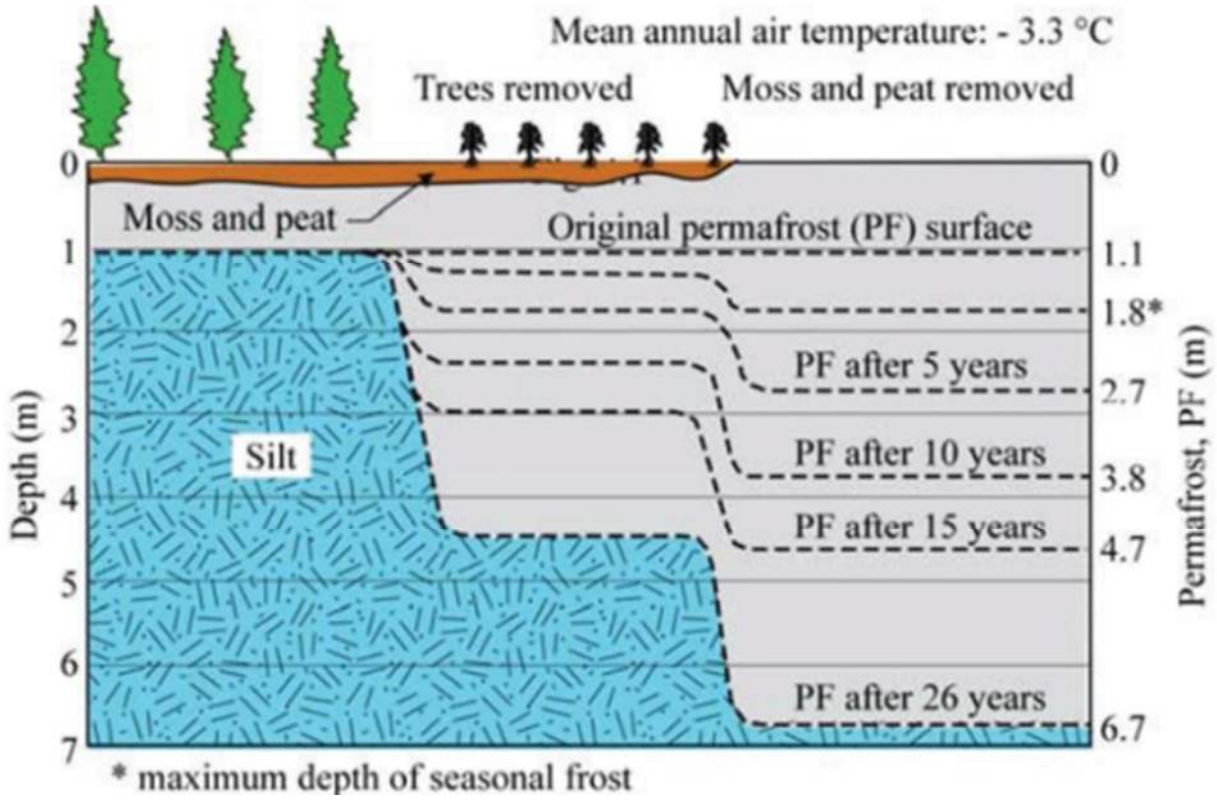


Figure 4-1. Permafrost Degradation (thaw) in Response to Different Surface Conditions: Undisturbed (left), Trees Removed (middle), and Moss and Peat Removed (right) (from Linell (1973), cited by Doré and Zubeck (2008)

4.2.3 Aggradation of Permafrost

Aggradation of permafrost can through placement of thick material in shaded areas with shallow permafrost. Fine-grained material retains moisture and, in the right setting, can gradually draw permafrost upward into it. If on a slope, the mounded permafrost may disrupt natural patterns of water flow through the active layer.

4.2.4 Terrain Instability

Project activities could initiate or exacerbate terrain stability by alteration of slope morphology or surface drainage. The alteration to slope morphology may be a result of oversteepening (cut) or excess weight (fill) on slopes. Reducing the likelihood or magnitude of slope failures may or may not be possible in areas where the hazard cannot be avoided.

In addition, changes in surface runoff patterns, especially where water becomes concentrated (e.g., in ditches and culverts), can increase the potential for slope instability by increasing soil saturation levels and, in turn, reducing associated shear strength. Mass movement may result. The management of surface runoff will be critical on slopes underlain by permafrost; unnatural concentrations can quickly saturate the active layer and reduce its effective shear strength, resulting in active layer detachments, or cause subsidence in ice-moderate or ice-rich settings.

4.3 MITIGATION MEASURES

The Project has a comprehensive set of measures designed to mitigate potential effects on permafrost and terrain stability. Standard mitigation measures to minimize residual effects of the Project on permafrost and terrain stability are described in this section and presented in **Table 4-2**.

Proactive risk mitigation is always preferred, especially in association with thermokarst-related hazards within a changing climate. Once thermokarst is initiated, whether naturally or through anthropogenic disturbance, it is extremely challenging to arrest. In areas where hazard avoidance is not possible or practicable, hazard mitigation measures can accommodate and manage permafrost and terrain stability hazards through design and operating procedures, reducing or eliminating drivers. **Table 4-2** summarizes the mitigation measures proposed to address one or more of the potential adverse effects.

Table 4-2. Mitigation Measures

Mitigation Measure	Potential Adverse Effect
Restrict equipment movement to designated corridors and well sites.	• Degradation (or warming) of permafrost through surface disturbances • Terrain instability due to alteration to slope morphology or surface drainage
Minimizing fire risk through limitation of activities outside of winter season and clearing vegetation in work areas to reduce fuel.	• Degradation (or warming) of permafrost through surface disturbances
Site preparation through careful site selection, which can include site specific assessments or use of buffers around elements at risk.	• Degradation of permafrost through alteration of surface drainage patterns and surface disturbances • Aggradation of permafrost through placement of thick material in shaded area with shallow permafrost

Mitigation Measure	Potential Adverse Effect
	• Terrain instability due to alteration to slope morphology or surface drainage
Limit or modify slope geometry through avoidance of piling or grading within areas designated as sensitive in the EDS.	• Terrain instability due to alteration to slope morphology or surface drainage • Degradation of permafrost through alteration of surface drainage patterns
Minimize and/or avoid excavations in sensitive areas in the EDS.	• Degradation (or warming) of permafrost through surface disturbances • Aggradation of permafrost through placement of thick material in shaded area with shallow permafrost
Management of surface runoff, avoiding ponding and concentrated flow down slopes.	• Degradation of permafrost through alteration of surface drainage patterns • Terrain instability due to alteration to slope morphology or surface drainage
Monitor ground temperature within/near construction areas	• Degradation of permafrost through alteration of surface drainage patterns and surface disturbances • Aggradation of permafrost through placement of thick material in shaded area with shallow permafrost
Preparation for installation of thermoshyphons	• Degradation (or warming) of permafrost through surface disturbances

4.3.1 Avoidance of Hazards

The EDS map from the baseline report (**Appendix 4-A**) provide a means of proactively locating Project infrastructure outside areas of LOW or VERY LOW suitability, to the greatest extent possible. This is expected to avoid potential hazards associated with mass movements, thermokarst, or fluvial processes. Only in localized crossings of such areas, or in cases of more minor disturbance such as that associated with winter seismic survey lines, will Chance use other mitigation means through eliminating, reducing, or managing hazards (**Sections 5.3.2** and **5.3.3**).

4.3.2 Elimination or Reduction of Hazards

Where hazards cannot be reasonably avoided through relocation of Project infrastructure, their drivers will be addressed directly to reduce or eliminate the hazard. Strategies to eliminate or reduce hazards related to permafrost and/or terrain stability include, but are not limited to:

- careful management of surface runoff to avoid unnatural concentration of water (flowing or standing) or saturation of surficial materials, especially in areas of potential instability;
- modification of slope geometry where identified, thereby reducing shear stress and reducing the potential for initiation or unimpeded runout of mass movement;
- implementation of measures to prevent starting wildfires, such as restricting smoking to designated areas and keeping machinery free of vegetation, while being prepared to re-insulate burned areas underlain by permafrost with additional organic material; and,
- implementation of erosion and sediment control measures (i.e., silt fencing or hay bailing) to reduce mobilization of fine-grained sediments and their delivery into sensitive receptors (e.g.,

fish-bearing streams) during Project activities that involve excavation of material (i.e., burrow pits, stockpiles, well pad construction).

4.3.3 Accommodation and Management of Hazards

In many cases, elimination or reduction of hazards through direct manipulation of their drivers is cost-prohibitive and unnecessary. Accommodating some degree of permafrost degradation in the design of Project infrastructure, especially considering the rapidity of responses to climate change, is likely necessary. Specific design, construction and maintenance techniques aimed at maintaining or minimizing change to the ground thermal regime are available for areas where ice-moderate or ice-rich permafrost cannot reasonably be avoided (i.e., installation of thermosphyons). The risks associated with most of the slope- and permafrost-related hazards within the Project area can be successfully mitigated through a variety of strategies of accommodation and management, such as:

- avoiding cuts and ditches wherever possible to limit disturbance to the active layer;
- restricting the movement of equipment used to minimize disturbance to surface organics;
- where possible, avoiding cut-slopes and high fills to limit mass movement potential;
- avoiding concentration and ponding of water to avoid degrading permafrost;
- monitoring ground temperatures within and near construction areas before, during and after construction, as a means of detecting early and addressing any unfavourable trends; and,
- Opportunities to limit and manage the runout of potential slope failures will be considered by Chance where the hazard is likely and unavoidable. Measures exist for controlling the trajectory of the mass movement, such as deflection berms. To help control the runout limits, passive or active measures will be considered individually or in combination during well site selection stage – this is a site-specific assessment.

4.4 EFFECTS CHARACTERIZATION

4.4.1 Approach

Modified from **Table 3-6** in **Section 3 Methods**, **Table 4-3** defines the criteria for the permafrost and terrain stability VESEC. Characterizing the residual adverse effects on permafrost and terrain stability considers the Project's potential effects and the mitigation measures used to minimize those potential effects. Residual effects on the VESEC have each been characterized in terms of magnitude, likelihood, geographic extent, duration, timing, frequency, and reversibility (**Table 4-3**). The significance of all residual effects (after mitigation measures are applied) is assessed collectively to determine the overall residual effect of the Project permafrost and terrain stability. (see **Section 5.5 Significance**).

Table 4-3. Permafrost and Terrain Stability Criteria for Characterizing Residual Effects

Criterion		Rating	Definition
Magnitude		Negligible	No qualitative change from existing conditions, as defined within the exploration development suitability classification in the Permafrost and Terrain baseline report (**Appendix 4-A**).
		Low	The residual effect will be a slight, but measurable change from existing conditions.
		Moderate	The residual effect will be a measurable change from existing conditions but will not affect the sustainability of fish and fish habitat.
		High	The residual effect will be a substantial, measurable change from existing conditions that may affect the sustainability of fish and fish habitat.
Likelihood		Unlikely	A residual effect is not expected, but a residual effect is not impossible.
		Possible	A residual effect may occur but is not likely.
		Probable	A residual effect is likely to occur, but it is not certain.
		Certain	A residual effect will occur.
Geographic Extent		Maximum disturbance footprint	The residual effect is confined to the maximum disturbance footprint.
		Local	The residual effect is confined to the Local Study Area.
		Regional	The residual effect is confined to the Regional Study Area.
		Beyond regional	The residual effect extends beyond the Regional Study Area.
Duration, Frequency and Timing	Duration	Short-term	The residual effect duration is less than a year (e.g., days, months)
		Medium-term	The residual effect duration is more than a year and up to the life of the Project (e.g., 10 years).
		Long-term	The residual effect duration is beyond the life of the Project (e.g., decades).
		Permanent	The residual effect is predicted to be permanent and thus unlikely to recover to existing conditions.
	Frequency	Occasional	The residual effect may occur rarely (e.g., once or a few times over the life of the Project).
		Periodic	The residual effect may occur consistently at regular intervals or associated with temporal events (e.g., during spring freshet, low flows, growing season).
		Continuous	The residual effect may occur all the time.
	Timing	Year-round	The residual effect may occur year-round.
		Seasonal	The residual effect may be confined to a portion of the year.

Criterion	Rating	Definition
Reversibility	Reversible	The residual effect is predicted to be reversible within a clearly defined period.
	Irreversible	The residual effect is predicted to influence the assessment indicator indefinitely.

4.4.2 Residual Effect

Residual effects are those effects remaining after the implementation of all mitigation measures, and therefore are the expected consequences. **Table 4-4** and **Table 4-5** outline the residual effects on permafrost and **Table 4-6** the residual effects on terrain instability.

Table 4-4. Characterization of Residual Effects on Permafrost Degradation

Criterion	Rating	Rationale
Magnitude	Low	Site selection for Project-related activities and infrastructure take into consideration EDS, prioritizing areas where bedrock is at or near surface.
Likelihood	Possible	While mitigation measures can decrease the effects of degradation, they cannot wholly eliminate the likelihood.
Geographic Extent	Maximum disturbance footprint	Permafrost degradation will be limited to the disturbance footprint as it is directly tied to the disturbance activity.
Duration	Medium-term	Field review of previous exploration activities show long-term effects of development on permafrost degradation within the disturbance footprint of these past activities without mitigation measures in place. However, with the implementation of mitigation, it is predicted that Project effects will only last up to the life of the Project before returning to baseline conditions.
Frequency	Periodic	Permafrost is expected to respond non-linearly (non-continuously) to surface disturbance, because maximum degradation is likely in summer with minimal degradation continuing in winter.
Timing	Year-round	Measurable response of permafrost to Project disturbance/activities may not be immediate but would be expected within the first few years, and would be present year-round until returning to baseline after cessation of Project activities
Reversibility	Irreversible	Degraded (thawed) permafrost is unlikely to naturally reform under current climate conditions, especially in recently burned areas, except potentially in shaded valley bottoms.

Table 4-5. Characterization of Residual Effects on Permafrost Aggradation

Criterion	Rating	Rationale
Magnitude	Low	Site selection for Project-related activities and infrastructure will take into consideration the exploration suitability mapping, prioritizing areas where bedrock is at or near surface and those away from streams and rivers for any disturbances beyond winter.
Likelihood	Unlikely	While mitigation measures can significantly decrease the likelihood of change, they cannot wholly eliminate the likelihood.
Geographic Extent	Maximum disturbance footprint	Permafrost degradation is expected to be limited to the disturbance footprint as it is directly tied to the disturbance activity.
Duration	Short-term	Minimal duration for permafrost aggradation is expected, as mitigation measures are easily achievable.
Frequency	Occasional	Minimal frequency for permafrost aggradation is expected, as mitigation measures are easily achievable.
Timing	Seasonal	Changes to active layer thickness through permafrost aggradation are seasonal in nature.
Reversibility	Reversible	Aggraded (expanded) permafrost could, however, return to pre-existing conditions once source of aggradation is removed, as climate continues to warm.

Table 4-6. Characterization of Residual Effects on Terrain Instability

Criterion	Rating	Rationale
Magnitude	Low	Project-related disturbances are surficial, unlikely to initiate or exacerbate any deep-seated instabilities in permafrost, with potential displacements largely limited to the active layer.
Likelihood	Unlikely	As part of Project baseline studies (**Appendix 4-A**), Chance will avoid locations with low EDS for Project-related activity, and thus this residual effect is not expected, though not impossible.
Geographic Extent	Local	In the event of instability, the affected area may extend beyond the disturbance footprint, typically downslope (e.g., active layer detachment) but potentially upslope (e.g., retrogressive thaw flow).
Duration	Medium-term	The greatest impact to slope stability is during an activity and immediately following the activity, before the site re-approaches equilibrium conditions. However, the possibility of thermokarst expansion to continue over a longer period, until ice supplies are exhausted, warrant acknowledgement.
Frequency	Occasional	Following initial mass movement and/or thermokarst subsidence, instability may continue in a discontinuous manner until equilibrium conditions are restored (e.g., failed slopes smooth scarps and revegetate, retrogressive thaw flows exhaust ice supplies).

Criterion	Rating	Rationale
Timing	Year-round	Once instability occurs, it will remain year-round until the conditions that prompted instability are removed or until the residual effect is abated.
Reversibility	Irreversible	Once material has been displaced from a location, whether by mass movement or thermokarst, it cannot be returned to baseline conditions. The area may be filled or regraded but the ecological value (e.g., texture, soil chemistry) will not be the same.

4.5 SIGNIFICANCE

A qualitative aggregation approach was applied to determining the significance of residual effects on permafrost and terrain stability. The magnitude, geographic extent, and reversibility criteria have the most influence on significance. Technical concepts and considerations to inform the determination of significance included:

- Available information on permafrost, terrain stability, and proposed Project activities:
  - Baseline reporting on permafrost and terrain stability was carried out by the Chance Project team (**Appendix 4-A**), based on field investigations (frost probing, shallow drilling, ground temperature monitoring, hand-dug test pitting, visual examination) and detailed surficial geology and exploration development suitability mapping.
  - Relevant research conducted in the Project area or similar settings (see **Section 1**).
- Benchmarks:
  - Baseline ground temperature data since 2021, in a variety of terrain/permafrost settings, will be used as a benchmark for comparison during monitoring during Project lifespan.
  - There are currently no industry-wide benchmarks to define the significance of a residual effect related to permafrost or terrain stability on the environment.
  - Qualitatively, professional accountability recommends minimizing residual effects on the environment where possible (EGBC, 2021, APEGA, 2022, and NAPEG, 2019).
  - Wildfires are historically known to have adverse effects on permafrost and terrain stability; the study area already has a history of wildfire occurrence with likely associated effects.
- Uncertainty:
  - Considered qualitatively, as spatial extent of some proposed Project activities is not defined (i.e., confirmed well site locations), relative to geographic location.

Table 4-7. Definition of Significance

Characterization	Definition
Not Significant	• Absence or minimal change to the environment, • Where any observed changes, if any, fall within the expected range of responsible practices, and • The effect does not worsen existing stressors to a degree that exceeds established benchmarks or acceptable limits.
Significant	• A measurable amount of change, beyond management standards or mitigation measures required to minimize the likelihood and severity of residual effects, and beyond what is reasonably expected by responsible practices of Professional Geologist or Professional Engineer related to activities that are known to affect the natural environment. • The effect exacerbates existing stressors on the environment to levels that exceed expected changes due to climate change.

The location of Project activities relative to the EDS assessment has considerable weight on the anticipated residual effects; the rational for the significance rating expands on this.

Table 4-8. Determination of Significance of Residual Effects on the Valued Environmental and Socio-Economic Components

VESEC	Residual Effect	Significance	Rationale
Permafrost	Low magnitude of change when Project activities align with HIGH or VERY HIGH exploration suitability mapping, over a relatively small footprint, but the result is generally irreversible.	Not Significant	Changes to permafrost are occurring independent of proposed Project activities (i.e., in association with climate change and wildfires). Analysis of active layer thickness (depth to permafrost) and ice content within a 1950s exploration footprint is consistent with minimal degradation when site selection aligns with HIGH or VERY HIGH suitability sites.
Terrain Stability	Low magnitude of instability when Project activities align with HIGH or VERY HIGH exploration development suitability mapping, which is likely to affect a localized area outside of activity footprint and be irreversible.	Not Significant	Less material is available for mobility in HIGH or VERY HIGH suitability areas (i.e., bedrock generally at or near surface). When there is less material available for displacement, the geographical extent that may be affected is limited.

In general, seismic surveys, when done during winter under frozen ground conditions, are not likely to have residual effects on permafrost or terrain stability. Areas classified as low to very low EDS (i.e., ice-rich areas, associated with valley bottoms) may result in larger magnitudes of permafrost degradation and/or terrain instability, potentially affecting a larger geographic extent; however, activities that are currently are not sited (i.e., well site and staging areas) will have site specific assessments conducted prior to development and are planned to occur within moderate to high EDS areas (i.e., wide, rounded ridge tops, shallow bedrock, ice-poor).

4.6 CUMULATIVE EFFECTS ASSESSMENT

4.6.1 Approach

Project-related residual effects on permafrost and terrain stability with the potential to interact with residual cumulative effects of past, present and reasonably foreseeable projects and activities within or extending into the Cumulative Effects Study Area (CESA) are:

- changes to ground ice; and,
- mass movement.

The spatial boundaries of the Cumulative Effects Assessment (CEA) on permafrost and terrain stability are delineated by the CESA as described in **Section 3.1.6.1.1**. Temporal boundaries for assessing cumulative effects encompass past, present, and reasonably foreseeable future activities spanning the Project's lifespan (**Section 1.3.1**).

4.6.2 Cumulative Effects

Cumulative effects to permafrost and terrain stability are expected to generally be limited to the direct area of surface disturbance from anthropogenic footprints (e.g., mineral exploration, oil and gas). The total surface disturbance (area [km²] and percent [%]) for the Project and all other projects and activities within the CESA are presented in **Table 4-9**. In the event of a terrain instability, mass movement may extend beyond the footprints of the various projects and activities, but it would be localized to the immediate area around these footprints.

Present conditions for total surface disturbance include a total area of 62.5 km² (0.6%) disturbed by past and present projects and activities; this is predicted to increase in the future by 1.2 km² (0.0%) following the inclusion of reasonably foreseeable projects and activities. The Project is expected to increase the amount of disturbed area over the existing conditions by a maximum of 69.5 km² (0.6%) within the CESA, resulting in a maximum disturbed area of 133.2 km² (1.2%) when combined with past, present, and reasonably foreseeable projects and activities. These total areas include complete disturbance (i.e., where that disturbance includes maximum ground disturbance inclusive of complete vegetation removal and grubbing) as well as alteration of surface conditions (e.g., removal of taller vegetation, but maintenance of shorter vegetation and ground cover during Low Impact Seismic [LIS]).

Table 4-9. Cumulative Change from Existing and Project-Related Disturbances on Permafrost and Terrain Stability

Cumulative Effect Indicator	Scenario	Cumulative Effects Study Area
Total Surface Disturbance (Footprints)	Present	62.5 km² (0.6%)
	Project	69.1–69.5 km² (0.6)
	Future	1.2 km² (0.0%)
	Total Cumulative Effect	132.8–133.2 km² (1.2%)

The Project area is underlain by continuous permafrost; effects to the above-mentioned indicators can be estimated with changes to active layer thickness (average annual thaw depth to permafrost). Based on previous activities in the area (**Appendix 4-A**), the residual effects of these other past activities have had the effect of reducing the active permafrost layer thickness by approximately 50 centimetres (cm) in areas of direct, complete disturbance. In disturbed areas where vegetation removal is not complete (e.g., LIS) it is expected that the reduction of the active permafrost layer thickness is less. These observed characteristics of developmental effects on permafrost in the RSA were taken into consideration when characterizing the cumulative effects summarized in **Table 4-10**.

Table 4-10. Characterization of Cumulative Effects on Permafrost and Terrain Stability

Criterion		Rating	Rationale
Magnitude		Negligible	The magnitude of cumulative change in permafrost and terrain stability is negligible because it is a <1% change in area at an estimated average difference of 50 cm in active layer thickness when no mitigations effects are in place from existing conditions.
Likelihood		Possible	While mitigation measures can decrease the effects, they cannot wholly eliminate the likelihood. The spacing of activities throughout the CESA decreases the likelihood of cumulative effects.
Geographic Extent		Maximum disturbance footprint	The cumulative effect is expected to remain within the footprint of the relevant projects and activities within the CESA.
Duration, Frequency and Timing	Duration	Permanent	The cumulative effect of changes to ground ice and mass movement is expected to be permanent, extending beyond the life of the Project.
	Frequency	Occasional	Permafrost is expected to respond non-linearly (non-continuously) to surface disturbance, however, following initial mass movement and/or thermokarst subsidence, instability may continue in a discontinuous manner until equilibrium conditions are restored.
	Timing	Year-Round	The effect is expected to occur year-round due to activity within the footprint until Project completion.

Criterion	Rating	Rationale
Reversibility	Irreversible	Changes to active layer thickness are expected to permanent with considered cumulative with climate change effects.

Potential climate change effects could cumulatively interact with residual Project effects and anticipated ongoing and proposed projects and activities effects resulting in changes to permafrost and terrain stability over the 10-year life of the Project. Climate change effects such as increased wildfires, warmer winters, and hotter summers, could increase ground temperature to a point where active layer thickness increases, changing ground ice content and increases susceptibility to mass movement.

4.6.3 Context and Confidence

The Project's environmental context and potential limitations of data and uncertainty associated with the assessment were considered for the assessment of cumulative effects. The ratings and rationale for the context and confidence in accurately quantifying and predicting cumulative effects are described in **Table 4-11**.

Table 4-11. Characterization of Context and Confidence in the Assessment of Cumulative Effects on Permafrost and Terrain Stability

Criterion	Rating	Rationale
Context	Moderate	The assessment of cumulative effects is qualitative at this time, and utilizes reasonable estimates based on current understanding in permafrost science. The Project area is underlain by continuous permafrost, that varies in ground ice content relative to factors, including underlaying material and climate history. To quantify change relative to baseline conditions, a quantitative understanding of climate change effects need to be considered. At this time, climate change models are done at regional scales, decreasing the confidence of models on a Project-specific scale.
Confidence	Moderate	There is moderate confidence in the characterization of the cumulative effect and its persistence. Changes to climate have a significant effect on the assessment indicators, and changes to permafrost and terrain stability can only be quantified through long-term monitoring of a site.

5 WATER RESOURCES

The Water Resources Valued Environmental and Socio-Economic Component (VESEC) assessment considers potential effects from the Eagle Plains Exploration Project (Project) on surface water quality and hydrology in the Regional Study Area (RSA), which represents the spatial extent of water resources potentially affected by the Project. Changes in water quality and hydrology could directly and indirectly affect the aquatic ecosystem, subsequently resulting in effects on fish, aquatic organisms and wildlife that utilize and are supported by these aquatic habitats.

5.1 EXISTING SURFACE WATER QUALITY AND HYDROLOGY

Existing surface water quality and hydrology conditions in the RSA were characterized through baseline studies and analysis of data collected between 2013 and 2020. Baseline studies found that the RSA contains a high number of streams (approximately 1,467, mainly smaller headwater streams), and relatively few waterbodies, none of which are greater than 5 hectare (ha). The major drainages in the RSA include the Porcupine and Peel River watersheds, with the subdrainages of the Eagle and Whitestone rivers entering the Porcupine drainage and the Ogilvie River entering the Peel drainage (**Appendix 5-A Surface Water Quality and Hydrology Baseline**).

Water quality baseline surveys found circumneutral to slightly acidic pH, brown stained water within the RSA. Nutrient concentrations are generally low to moderate, while total phosphorus concentrations indicate that streams are oligotrophic to mesotrophic (**Appendix 5-A**). Melting permafrost results in slumping banks that deposit material into the water column creating variable turbidity and total suspended sediment concentrations. Total metals including aluminum, cadmium, copper, iron, and manganese are present throughout the RSA at concentrations that exceed the Canadian Council of Ministers of the Environment guidelines for protection of freshwater aquatic life (CCME-FAL, CCME 2007).

Other metals were present at concentrations above the CCME-FAL in samples from each watershed area, including arsenic from Chance and Dalglish Creek sites, and selenium from McParlon, Eagle and Dalglish creek sites. Volatile organic carbons were not measured at or above laboratory detection limits at any of the sample locations in the baseline assessment (**Appendix 5-A**). Some Polycyclic Aromatic Hydrocarbons (PAHs) associated with naturally occurring oil and gas deposits and by-products of forest fires were measured in water samples from within the RSA, including naphthalene, biphenyl, phenanthrene, and retene.

Annual discharge in streams in the RSA watersheds is snowmelt driven, with peak flows during the spring and low flows during the winter (**Appendix 5-A**). Watercourses in active permafrost regions, like that of the RSA, range from permanent flow to intermittent flow, which are seasonally timed. The lower order streams are more likely to be seasonally intermittent as inputs from precipitation decrease as rain transitions to snow, and baseflows are reduced as shallow permafrost re-freezes. In the case of the smaller streams, the channel may fully freeze in early winter. Additionally, ice build-up in watercourses alters flow behaviour through the formation of ice in the channel as well as changes in flow dynamics in flowing streams of all sizes, and this effect occurs naturally from the beginning of freeze-up until spring thaw is complete.

5.2 ASSESSMENT INDICATORS AND ASSESSMENT PARAMETERS

The Water VESEC assessment indicators are surface water quality and hydrology. The approach for assessing the Project's effects on the surface water quality and hydrology indicators was to qualitatively evaluate the potential changes on sedimentation and total suspended solids (TSS), changes in contaminant and nutrient influxes, changes in thermal regimes and changes in flows and water levels.

5.3 PROJECT INTERACTIONS AND POTENTIAL EFFECTS

5.3.1 Project Interactions

Project-related activities identified as having the potential to interact with water resources include: seismic and drilling exploration, extended flow test (EFT), well maintenance, winter access roads, construction and operation of Mix Bury Cover (MBC) sump, Central Processing Facility (CPF), airstrip, water withdrawals, transportation and camp (**Table 5-1**).

The direct and indirect pathways for potential effects (sedimentation, contaminant and nutrient influxes, thermal changes and reduced flow and water levels) on surface water quality and hydrology indicators are discussed qualitatively in the sections below.

Table 5-1. Expected Interactions Between the Water Valued Environmental and Socio-Economic Component and Project Activities, by Type of Potential Effect

Project Component / Activity	Sedimentation	Contaminant and Nutrient Influxes	Thermal Changes	Reduced Flow and Water Levels
Engagement	0	0	0	0
Seismic Exploration	2	2	2	2
Drilling Exploration	2	2	2	2
Extended Flow Test (EFT)	2	2	2	2
Well Maintenance (Workovers)	0	0	0	0
Winter Access Roads	2	2	2	2
Mix Bury Cover (MBC) Construction and Operation	0	2	0	2
Central Processing Facility (CPF)	2	2	2	2
Airstrip	0	2	0	0
Water Withdrawal	2	2	2	2
Transportation	0	0	0	0
Camp	0	2	2	2
Reclamation and Closure	0	2	0	0

Notes:
0 = no interaction

1 = minor interaction with surface water quality and hydrology is possible, but small immeasurable effect. Designates a summary of effects addressed in the effects assessment as a discussion. This rating does not lead into residual effects characterization.
2 = substantial interaction with surface water quality and hydrology, designates a more detailed assessment of potential effects. Carried forward into residual effects characterization.

5.3.2 Increased Sedimentation

The Eagle Plains Basin has few watercourses of any substantial size. Most watercourse freeze to bottom in winter, and no major watercourses (i.e., those streams or rivers that either freeze to the bottom or the flow of water is too great to sustain a snow fill crossing) will require watercourse crossings to support Project activities. Project activities that may occur adjacent to watercourses, or require crossings of minor watercourses, have the potential to, if unmitigated, increase sediment concentrations, as TSS, through the potential erosion of unstable banks from works (e.g., removal of riparian trees to accommodate temporary stream crossings, seismic lines, seismic recording, and use of mobile equipment). Increased TSS may, in turn, result in an increase in concentrations of total metals bound to the particulate matter. As a result of increased TSS and contaminants, aquatic organisms can be adversely affected chronically (e.g., growth inhibition, reproductive disorders) or acutely (e.g., mortality).

5.3.3 Contaminant and Nutrient Influxes

Contaminant concentrations may directly increase in the RSA (e.g., accidental spills or leaks, seismic recording or indirectly (e.g., leaching of nitrogen from seismic recording, increased metal concentrations due to increased runoff). During seismic recording, by-products from the detonation of explosives may include compounds that can be toxic to fish and other aquatic biota. The specific processes leading to the release of nitrogen and the distribution of water-soluble nitrogen species to the environment are difficult to quantify and predict, but they are not expected to be substantial contributions to Project effects.

Wastewater resulting from camp activities could result in increased contaminants of concern and thermal changes in surface waters if it were to be discharged into a local stream. However, all wastewater and sewage will be collected and treated on-site before being released, with appropriate authorization, as clean water back into the environmentand is therefore not considered a potential effect pathway in this assessment.

5.3.4 Thermal Changes

Reduced water levels and reduction in baseflow at the water withdrawal location, as well as removal of riparian vegetation for the construction of seismic lines and temporary creek crossings can indirectly affect water temperatures. Lower water volume and the loss of shade make the streams (particularly smaller, low flowing streams), more susceptible to diurnal temperature fluctuations as well as seasonal climate variations resulting in potential warming effects during spring through early fall, when air temperatures tend to be greater than water temperatures, and a cooling effect during winter, when air temperatures tend to be colder than water temperatures. Thermal changes can result in a wide range of effects on the aquatic ecosystem by influencing oxygen levels, bacterial activity, chemical reactions, algae growth, fish physiology and species composition.

5.3.5 Reduced Flow and Water Levels

The Project will require fresh water for several activities, including the camp, winter road construction, well pad construction, well drilling, and well completion. Water withdrawals are proposed to occur year-round from the Eagle River, Ogilvie River, and Whitestone River, and seasonal extraction from Glacier Creek. The majority of water withdrawal is expected to occur in the winter.

Water withdrawals for Project works can result in changes in both surface water quality and hydrology. At the withdrawal point, water levels and flow are expected to be directly affected (reduced). The removal of source water can alter the natural processes of the channel (such as cleansing or flushing) as well as the natural recharge rates. Ice bridge construction for temporary stream crossings could contribute to the impediment of flows which are already naturally altered by ice build up in the RSA from the beginning of freeze-up until spring thaw is complete, though the majority of creeks and waterbodies in the Project area are completely frozen in the winter. A reduction in depth and baseflow can contribute to loss of available habitat (further discussed in the Fish VESEC, Project Interactions and Potential Effects) and overall degradation of water quality, lead to increased water temperature, increase in sediment oxygen demand (thus lowering dissolved oxygen levels) and alter the general chemistry of the water (as discussed above).

5.4 MITIGATION MEASURES

The Project will implement mitigation measures that are specific, measurable, verifiable and achievable in nature to avoid and minimize the potential for adverse effects on water in the RSA. The Project's design to conduct activities in stages, focusing on one area of the RSA at a time and completing most of the work during winter (November to April) will reduce the magnitude, duration, and extent of the Project's potential effects on the overall environment.

As a key mitigation measure, Project design is being done in consideration of the locations of waterbodies and their surrounding riparian areas through the environmental constraints mapping. The Yukon Energy, Mines and Resources's Forest Management Branch has established management guidelines for forest operations near streams, lakes, and wetlands. Although these guidelines were developed specifically for forestry, they are commonly applied to other resource developments in the territory as the best available information. The objectives of the guidelines are to conserve the integrity of water quality for fish, riparian habitat for wildlife, and hydrology.

The primary tool used to meet the management objectives is designation of a Riparian Management Area (RMA) around each water feature. Project features will, wherever practicable and with the exception of seismic features, be located outside the RMA. The RMA includes two components, a Reserve Zone (RZ) and a Management Zone (MZ). The size of the RZ and MZ vary depending on the size of the stream and the presence of fish, and both zones have acceptable size ranges. The RMA sizes applied to the Project's environmental constraints map are outlined in **Table 5-2** and **Table 5-3** for streams and lakes, respectively. Since widths are not known for all streams in the RSA, the RMA widths were attributed based on stream order, considering the average stream widths for each order that were measured in the field.

Table 5-2. Riparian Management Area Buffers for Streams in Eagle Plains Regional Study Area

Stream Order	Width (m; ± SE*)	Reserve Zone (m)	Management Zone (m)	Total Riparian Management Area (m)
1	1.91 ± 0.25	40	40	80
2	3.36 ± 0.30	40	60	100
3	4.26 ± 0.42	40	60	100
4	10.09 ± 0.31	50	70	120
5	13.23 ± 1.63	50	70	120

Note: *m=metre; SE-Standard Error

Source: After Yukon Forest Management Branch (FMB) riparian management guidelines. The buffer widths that are listed are mid to upper values of the ranges provided in the FMB guidelines. (Yukon Energy, Mines and Resources 2011)

Table 5-3. Riparian Management Area Buffers for Lakes in the Eagle Plains Regional Study Area

Lake Size (ha)	Reserve Zone (m)	Management Zone (m)	Total Riparian Management Area (m)
1 – 5	50	100	150
5 – 50	50	70	120
>50	40	40	80

Source: After Yukon Forest Management Branch riparian management guidelines. The buffer widths that are listed are mid to upper values of the ranges provided in the FMB guidelines. (Yukon Energy, Mines and Resources 2011)

Table 5-4 outlines mitigation that will be incorporated into the Project to address potential adverse effects to Water Resources.

Table 5-4. Mitigation Measures Relevant to Water and the Eagle Plains Exploration Project

Mitigation Measure	Potential Effect Addressed by Mitigation
Winter road construction, which will have the greatest water requirements, will primarily occur in November, December, and, to a lesser degree, January to reduce water withdrawal needs during the lowest flow periods (February and March)	• Reduced flow and water levels • Thermal changes
All wastewater and sewage will be collected in tanks approved by the Canadian Standards Association, treated on-site, then released as clean water back into the environment	• Contaminant and nutrient influxes • Thermal changes
Minimize Project activities in and near aquatic areas	• Sedimentation • Contaminant and nutrient influxes • Thermal changes
With the exception of seismic lines, Project features will be located outside the RMA (and particularly the RMZ), to the extent practicable. Overlap with a small extent of the RMZ is permissible where operations cannot completely avoid them.	• Sedimentation • Contaminant and nutrient influxes • Thermal changes

Mitigation Measure	Potential Effect Addressed by Mitigation
For seismic activities, with the exception of mechanical watercourse crossings, restrict all mechanical equipment 55 m away from the bank edge	• Sedimentation • Contaminant and nutrient influxes • Thermal changes
For mechanical seismic watercourse crossings, employ the following crossing site selection criteria: • areas with natural clearings, where available; • shallow banks • good bank stability; • areas with shallow water (e.g., not on bends in the river); • areas with 90 degrees access to the river; and • creek location that freezes to bottom.	• Sedimentation • Contaminant and nutrient influxes • Thermal changes
Minimize the number of stream crossings, especially on 3rd order and higher streams.	• Sedimentation • Contaminant and nutrient influxes • Thermal changes
Where stream crossings occur, align the road to minimize the extent of the RMA that is affected	• Sedimentation • Contaminant and nutrient influxes • Thermal changes
Concentrate Project activities in the winter	• Sedimentation • Contaminant and nutrient influxes • Thermal changes
If concrete works are required near streams, avoid concrete works when precipitation events are anticipated within 72 hours and the work cannot be contained	• Contaminant and nutrient influxes
Avoid concrete spillage	• Contaminant and nutrient influxes
Isolate concrete and concrete wash from the aquatic and riparian environment	• Contaminant and nutrient influxes
Construct all concrete forms so that they are properly sealed (e.g., proper sealed and locked chutes, hose, and hose connections)	• Contaminant and nutrient influxes
Maintain a carbon dioxide (CO_2) tank with a regulator, hose and gas diffuser on site to neutralize pH levels if a concrete spill to water occurs	• Contaminant and nutrient influxes
Isolate and hold any water that contacts uncured or partly cured concrete until the pH is less than 9.0 (BC freshwater quality guideline for pH is 6.5 to 9.0) (British Columbia Ministry of Environment and Climate Change Strategy [BC MECCS])	• Contaminant and nutrient influxes

Mitigation Measure	Potential Effect Addressed by Mitigation
All mobile equipment brought on site will be clean, free of leaks, excess oil and grease, and in good working order	• Sedimentation • Contaminant and nutrient influxes
All mobile equipment will be checked every morning for leaks and good working order	• Contaminant and nutrient influxes
Hydraulic machinery, if required, will use environmentally sensitive hydraulic fluids that are non-toxic to aquatic life and are readily or inherently biodegradable	• Contaminant and nutrient influxes
Refuelling, fuel stockpiling, and maintenance of mobile equipment will be limited to designated areas on level, impermeable surface areas at least 30 m away from water	• Contaminant and nutrient influxes
All refuelling will occur using funnels, pads, and drip pans in place	• Contaminant and nutrient influxes
Fuels, lubricants, and chemicals will be stored appropriately on site, with proper controls to prevent the release of deleterious substances, in a designated area at least 30 m away from water	• Contaminant and nutrient influxes
Properly sized oil drip pans will be placed under all equipment and vehicles left on site	• Contaminant and nutrient influxes
Develop a Spill Response Plan as part of the Environmental Management Plan	• Contaminant and nutrient influxes
The Spill Response Plan will (1) include a list of spill response equipment that will be present on site, (2) assign implementation and monitoring roles, and (3) require site personnel to have reviewed the plan, understand their roles and responsibilities, and are properly trained and equipped to conduct spill response activities	• Contaminant and nutrient influxes
Identify high-risk locations where spills are probable and maintain spill kits, capable of handling the largest potential spill through the duration of the Project, at these locations	• Contaminant and nutrient influxes
Locate Personal Protective Equipment (PPE) at the top of the spill kit to ensure easy access for the spill responder	• Contaminant and nutrient influxes
Keep spill kits closed with a safety seal affixed to indicate if the kit has been used or tampered with	• Contaminant and nutrient influxes
Respond immediately to all spills in accordance with plan	• Contaminant and nutrient influxes

Mitigation Measure	Potential Effect Addressed by Mitigation
If any accidental spills occur, they shall be immediately contained, cleaned up and reported (if reportable amount or type).	• Contaminant and nutrient influxes
Winter access road construction will follow the DFO Code of practice: Ice bridges and snow fills (Fisheries and Oceans Canada 2023)	• Sedimentation • Contaminant and nutrient influxes • Thermal changes
Locate a temporary crossing site where the watercourse is straight, banks are stable and where approaches have low slopes	• Sedimentation • Thermal changes
Operate vehicles and machinery in a manner that minimizes disturbance to the watercourse bed and banks	• Sedimentation
Do not leave logs or woody debris within the watercourse or on the banks where they can wash back into the watercourse	• Sedimentation
If logs are used for watercourse crossing construction, ensure that the logs are clean and securely bound together, and are removed before the spring freshet	• Sedimentation
Place a v-notch in centre of the ice bridge when crossing season is over (and it is safe to do so) to prevent blocking water flow and thus minimize channel erosion and flooding	• Sedimentation
Use only clean materials (i.e., water, ice, snow) to construct ice bridge	• Sedimentation
Remove compacted snow from the snow fills prior to the spring freshet	• Reduced flow and water levels • Contaminant and nutrient influxes
Water withdraw will not exceed 10% of the actual (instantaneous) flow	• Reduced flow and water levels • Thermal changes
Develop an Erosion and Sediment Control Plan as part of the Environmental Management Plan	• Sedimentation
Activities in the riparian zone will follow the DFO *Code of Practice: Ice bridges and snow fills*. (Fisheries and Oceans Canada 2023)	• Sedimentation • Contaminant and nutrient influxes • Thermal changes
Use existing trails, roads, access points or cut lines wherever possible	• Sedimentation • Thermal changes
Limit vegetation removal, pruning and grubbing to the area required for accessing the site of the works, undertakings and activities	• Sedimentation • Thermal changes

Mitigation Measure	Potential Effect Addressed by Mitigation
Construct roads, access points and approaches perpendicular to the watercourse if a new access point is required to reach the watercourse	• Sedimentation • Thermal changes
Construct approaches using clean compacted snow and ice to a sufficient depth to protect the banks of the watercourse	• Sedimentation
Restore the banks and riparian vegetation affected by the works, undertakings, and activities to their natural state	• Sedimentation • Thermal changes
Do not use ammonium nitrate-fuel oil mixtures	• Contaminant and nutrient influxes

5.5 EFFECTS CHARACTERIZATION

5.5.1 Approach

The residual effects characterization for the Water VESEC considers the Project's potential effects on surface water quality and hydrology indicators and the mitigation measures used to minimize those effects. The spatial boundary of effects characterization for Water was the RSA. Residual effects on surface water quality and hydrology have each been characterized in terms of magnitude, likelihood, geographic extent, duration, timing, frequency, and reversibility (**Table 5-5**). Determining residual effects on surface water quality and hydrology considered the context of the highest development (conforms to Regional Land Use Plans) and the confidence in accurately quantifying and predicting those residual effects. The significance of all residual effects (after mitigation measures are applied) is assessed collectively to determine the overall residual effect of the Project on the Water VESEC.

Table 5-5. Definitions of Effects Criteria Classification for the Assessment of Surface Water Quality and Hydrology in the Eagle Plains Exploration Project

Criterion	Rating	Definition
Magnitude	Negligible	No measurable change from existing conditions. **This corresponds to a less than (<)1% change in an assessment indicator.**
	Low	The residual effect will be a slight, but measurable change from existing conditions. **This corresponds to a 1–10 percent (%) change in an assessment indicator.**
	Moderate	The residual effect will be a measurable change from existing conditions but will not affect the sustainability of surface water and hydrology. **This corresponds to a 11–35% change in an assessment indicator.**
	High	The residual effect will be a substantial, measurable change from existing conditions that may affect the sustainability of surface water quality and hydrology. **This corresponds to a greater than (>)35% change in an assessment indicator.**

Criterion		Rating	Definition
Likelihood		Unlikely	A residual effect is not expected, but a residual effect is not impossible.
		Possible	A residual effect may occur but is not likely.
		Probable	A residual effect is likely to occur, but it is not certain.
		Certain	A residual effect will occur.
Geographic Extent		Maximum disturbance footprint	The residual effect is confined to the maximum disturbance footprint.
		Local	The residual effect is confined to the Local Study Area (LSA).
		Regional	The residual effect is confined to the RSA.
		Beyond regional	The residual effect extends beyond the RSA.
Duration, Frequency and Timing	Duration	Short-term	The residual effect duration is less than a year (e.g., days, months)
		Medium-term	The residual effect duration is more than a year and up to the life of the Project (e.g., years).
		Long-term	The residual effect duration is beyond the life of the Project (e.g., decades).
		Permanent	The residual effect is predicted to be permanent and thus unlikely to recover to existing conditions.
	Frequency	Occasional	The residual effect may occur rarely (e.g., once or a few times over the life of the Project).
		Periodic	The residual effect may occur consistently at regular intervals or associated with temporal events (e.g., during spring freshet, low flows, growing season).
		Continuous	The residual effect may occur all the time.
	Timing	Year-round	The residual effect may occur year-round.
		Seasonal	The residual effect may be confined to a portion of the year.
Reversibility		Reversible	The residual effect is predicted to be reversible within a clearly defined period.
		Irreversible	The residual effect is predicted to influence the assessment indicator indefinitely.

5.5.2 Increased Sedimentation

Table 5-6 presents the characterization of residual adverse effects for sedimentation and TSS. Provided the implementation of all mitigation measures in the previous section is successful, the residual adverse effect (as an increase in sedimentation and TSS) is expected to be of negligible. Any changes in sedimentation and TSS would be confined to the RSA. The duration of the effect is expected to be long term, with re-establishment of any riparian (after riparian vegetation and streambank stabilization is re-established). Sedimentation and increased TSS could occur periodically depending on the Project activities

and/or the season (e.g., increased streambank disturbances during exploration, increased runoff during spring freshet). Changes to sedimentation and TSS are expected to be reversible in the long term (particularly once riparian vegetation re-establishes).

Table 5-6. Characterization of Residual Effects on Sedimentation and Total Suspended Solids

Criterion		Rating	Rationale
Magnitude		Negligible	With the implementation of mitigation, changes in sedimentation and TSS are expected to be negligible, as mitigation is expected to minimize potential changes to water resources due to increased sedimentation.
Likelihood		Possible	Changes in sedimentation and TSS are possible but not likely.
Geographic Extent		Regional	Given stream connectivity and plans to explore throughout the RSA, any change in sedimentation and TSS would occur to the extent of the RSA.
Duration, Frequency and Timing	Duration	Medium-term to long-term	Riparian vegetation re-establishment, and therefore streambank stabilization will take years, during which there could be continued potential for increased sedimentation and TSS (long-term).
	Frequency	Periodic	Sedimentation and TSS would be associated with temporal events, such as during spring freshet.
	Timing	Seasonal	Sedimentation and TSS will be associated with periods of high flows (e.g., spring freshet).
Reversibility		Reversible	Changes in sedimentation and TSS are expected to be reversible in the long term (particularly once riparian vegetation fully re-establishes).

5.5.2.1 Context and Confidence

Determining residual sedimentation and TSS effects on Water Resources considered the context of Regional Land Use Planning and the confidence in accurately quantifying and predicting those effects (**Table 5-7**). Any residual sedimentation and TSS effects would be restricted to periodic events, are considered reversible and low in magnitude. With the implementation of all mitigation measures and protection plans listed in **Section 5.3** and **Table 5-4.** The confidence rating is high. (**Table 5-7**).

Table 5-7. Rating and Rationale for Context and Confidence

Criterion	Rating	Rationale
Context	Highest Development	The RSA is within Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans, which are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	High confidence (low uncertainty) in the ability to characterize any change in sedimentation and TSS, i.e., few knowledge gaps, understanding of mitigation efficacy.

5.5.3 Contaminant and Nutrient Influxes

Table 5-8 presents the characterization of residual adverse effects for contaminant and nutrient influxes. Provided the implementation of all mitigation measures in the previous section, a negligible residual adverse effect is predicted for the Project. Any residual effect would be confined to the RSA. Any residual effect would be of for the medium-term (full exploration period of the Project). The frequency and timing of any residual effect is expected to be occasional and year-round. If a residual effect were to occur, changes to contaminant and nutrient influxes should be reversible in the long term.

Table 5-8. Characterization of Residual Effects on Contaminant and Nutrient Influxes

Criterion		Rating	Rationale
Magnitude		Negligible	With the incorporation of mitigation, changes to contaminant and nutrient influxes are expected to be negligible. Mitigation measures are expected to minimize changes in contaminant and nutrient influxes. Design features and management practices will mitigate for the risk of spills and mitigate the risk of any spills from reaching waterbodies, watercourses, or groundwater.
Likelihood		Possible	Mitigation measures are expected to minimize the likelihood of changes from contaminant and nutrient influxes.
Geographic Extent		Regional	Any change from contaminant and nutrient influxes would be limited to the RSA.
Duration, Frequency and Timing	Duration	Medium-term	The risk of a change from contaminant and nutrient influxes are predicted to remain throughout the full exploration period of the Project (medium-term).
	Frequency	Occasional	Contaminant and nutrient influxes are expected to be rare.
	Timing	Year-round	Contaminant and nutrient influxes, though of low likelihood, may occur year-round, associated with run-off from exploration activities or leaching from seismic activities.
Reversibility		Reversible	Changes to contaminant and nutrient influxes are expected to be reversible in the long term.

5.5.3.1 Context and Confidence

With the implementation of mitigation measures and protection plans listed in **Section 5.3** and **Table 5-4**, the confidence in the predicted residual effect is high (**Table 5-9**).

Table 5-9. Rating and Rationale for Context and Confidence

Criterion	Rating	Rationale
Context	Highest Development	The RSA is within Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans, which are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	High confidence (low uncertainty) in the ability to characterize any change in contaminant and nutrient influxes, i.e., few knowledge gaps, understanding of mitigation efficacy.

5.5.4 Thermal Changes

Table 5-10 presents the characterization of residual adverse effects for thermal changes. Provided the implementation of all mitigation measures in the previous section, a negligible residual adverse effect (as changes to thermal regimes) is predicted for the Project, as very small portions of streams are predicted to be affected. Any residual effect resulting from low water volume and loss of shade would be confined to the RSA. Any residual effect as changes in thermal regimes may be long-term (until riparian vegetation is re-established) in duration. The frequency will be periodic and seasonal (e.g., small streams with reduced flows are more susceptible to diurnal and seasonal temperature fluctuations). If a residual effect were to occur, changes to thermal regimes should be reversible in the long term (particularly once water withdrawals cease and riparian vegetation re-establishes).

Table 5-10. Characterization of Residual Effects on Thermal Changes

Criterion		Rating	Rationale
Magnitude		Negligible	Changes to thermal regimes are expected to be negligible (i.e., very small portion of streams would be affected). Mitigation measures are expected to minimize thermal changes to water.
Likelihood		Possible	Mitigation measures are expected to minimize the likelihood of thermal regime changes.
Geographic Extent		Regional	Any thermal regime changes would be limited to the RSA.
Duration, Frequency and Timing	Duration	Long-term	Changes to thermal regimes may be long-term (recover to baseline), as it will take time for riparian cover to re-establish.
	Frequency	Periodic	Thermal regime changes would mostly be associated with temporal events (e.g., low flows, seasonal temperature extremes).
	Timing	Seasonal	Thermal regime changes will be associated with seasonal variations.
Reversibility		Reversible	Thermal regime changes are expected to be reversible in the long term (particularly once water withdrawals cease and riparian vegetation re-establishes).

5.5.4.1 Context and Confidence

Any residual effect for thermal regime changes would be periodic, are considered reversible and low in magnitude. With the implementation of all mitigation measures and protection plans listed in **Section 5.4**, the confidence rating is high (**Table 5-11**).

Table 5-11. Rating and Rationale for Context and Confidence

Criterion	Rating	Rationale
Context	Highest Development	The RSA is within Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans, which are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	High confidence (low uncertainty) in the ability to characterize changes to thermal regimes, i.e., few knowledge gaps, understanding of mitigation efficacy.

5.5.5 Reduced Flows and Water Levels

Table 5-12 presents the characterization of residual adverse effects for flows and water levels. Accounting for uncertainty related to the quantitative data available, taking into account the precautionary principle, and provided the implementation of all mitigation measures in the previous section, a low magnitude residual adverse effect (as changes to flows and water levels) is predicted. Any residual effect (e.g., altered natural channel processes) would be confined to the RSA, and will be medium-term (full exploration period of the Project) in duration. Any residual effect to flows and water levels will be periodic (primarily during water withdrawal) and year-round, though the majority of water withdrawal will occur in the winter. Changes to flows and water levels should be reversible in the long term (once water withdrawals cease).

Table 5-12. Characterization of Residual Effects on Flows and Water Levels

Criterion		Rating	Rationale
Magnitude		Low	Changes to flows and water levels will be low magnitude (i.e., withdrawals will not exceed 10% of instantaneous flow).
Likelihood		Probable	The residual effect is likely to occur due to periodic water withdrawals to support Project activities.
Geographic Extent		Regional	Any change in flows and water levels would be limited to the RSA.
Duration, Frequency and Timing	Duration	Medium-term	The duration of effects on flows and water levels will be medium-term (i.e., expected to remain for the duration of the Project).
	Frequency	Periodic	Changes to flows and water levels would be associated with periodic withdrawal of water for winter road development, well pad development, and camp operations.

Criterion		Rating	Rationale
	Timing	Year-round	Changes to flows and water levels are expected to be year-round, with the majority of water withdrawals occurring in the winter.
Reversibility		Reversible	Changes to flows and water levels are reversible once water withdrawals cease.

5.5.5.1 Context and Confidence

Due to the uncertainty associated with data limitations and related limitations in quantitatively assessing Project effects, the confidence in the assessment of residual effects on flows and water levels is moderate (**Table 5-13**).

Table 5-13. Rating and Rationale for Context and Confidence

Criterion	Rating	Rationale
Context	Highest Development	The RSA is within Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans, which are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	Moderate	Some limitations exist with availability of data to characterize and understand existing flow regimes in the RSA, and how those will be affected by the Project. However, based on data available and the anticipated effectiveness of Project mitigation there is moderate confidence in the prediction of residual effects to flows and water levels.

5.6 SIGNIFICANCE

The Water VESEC assessment considered the magnitude, likelihood, geographic extent, frequency, duration, and reversibility to determine if the Project could result in residual effects on surface water quality and hydrology. A weight of evidence approach and professional judgement were used to provide a qualitative classification for determining the significance of residual effects from the Project on surface water quality and hydrology, as defined in **Table 5-14**.

Table 5-14. Determination of Significance

Characterization	Definition
Not Significant	Residual effects do not meet the threshold of significant, defined below.
Significant	Residual effects have high magnitude; regional or beyond regional geographic extent; duration is long-term or permanent; and occur at all frequencies. Residual effects on Water Resources under this definition are considered consequential and potentially irreversible. It's anticipated that, as a result of these effects, the ability to meet land and resource management plan objectives is impaired.

The Project is not expected to substantially affect surface water quality and hydrology. Confidence is moderate to high in the efficacy of management standards and mitigation measures to minimize the likelihood of any residual effects. Changes in sedimentation and TSS, contaminant and nutrient influxes,

thermal regimes and flow and water levels are possible but expected to be negligible to low magnitude, confined to the RSA and in many cases be associated with seasonal events (i.e., increased runoff during spring freshet). The potential for a residual effect to occur to the Water VESEC will be medium-term (throughout the exploration period of the Project) to long-term. Once water withdrawals end, normal flow regimes would immediately re-establish (medium-term), however riparian vegetation re-establishment, and therefore streambank stabilization will take years, during which there could be small but continued (long-term) effects to water quality (e.g., sediment and nutrient inputs, effects to water temperature, etc.). All residual effects are predicted to be reversible and are not likely to persist once Project activities are completed. Therefore, the collective residual effects on Water Resources from all potential sources (sedimentation/TSS, contaminants and nutrient influxes, thermal changes and flows and water levels) are **not significant.**

5.7 FOLLOW-UP MONITORING

To address any uncertainty in residual effects predictions for flow and water levels, and to support and assess the effectiveness of the mitigation measures outlined above, the following monitoring programs will be completed by Chance as part of the Project:

- implement water quality monitoring as part of the Environmental Management/Monitoring Plan (EMP) and Erosion and Sediment Control Plan (ESC) plans;
- develop a flow monitoring program to collect flow measurements at the point(s) of withdraw to monitor discharge and support a determination of the 10% actual (instantaneous) flow. The flow measurements will be collected at intervals appropriate for characterizing baseflow recession during low flow periods, and are expected to be collected more frequently during the first couple of years of the Project; and,
- develop a trigger-response plan to reduce water withdrawals should the instantaneous monitoring data indicate unacceptable direct hydrologic effects (e.g., flows below 10% instantaneous flows) or indirect effects (e.g. increased channel erosion).

5.8 CUMULATIVE EFFECTS ASSESSMENT

Project-related residual effect with the potential to interact cumulatively with the residual effects of projects and activities identified within or extending into the cumulative effects study area (CESA) included changes to water quantity (flow reductions).

The spatial boundaries of the CEA for water were described in **Section 3** and activities outside the CESA but with potential effects within this area were also included in this assessment. Temporal boundaries for assessing cumulative effects encompass past, present, and reasonably foreseeable future activities spanning the Project's lifespan (**Section 1**).

5.8.1 Cumulative Effects

Cumulative effects to surface water flows are expected to generally be limited to water bodies with multiple sources of water withdrawals (e.g. municipal and industrial licenced water diversion points, in-stream alternations of flow). Activities with potential to reduce flows can only be qualitatively assessed for cumulative effects because data on volumes and durations of water use are not available for all water use,

and volumes of withdrawal for the project will be determined based on 10% of the instantaneous flows which will be determined at the time of withdrawal. Cumulative effects are expected to be limited to periods of low flow (i.e. cumulative effects are unlikely during peak flow periods). See **Table 5-15.**

Cumulative effects may occur during periods where water users are simultaneously withdrawing water either upstream or downstream on the same streams as the Project withdrawals. This could include the following:

- domestic water withdrawal for communities of old crow and eagle plains, homesteads, camps, and eagle river hotel;
- road construction and maintenance;
- gravel quarry activity (e.g. water withdrawal for gravel washing, or in-stream alterations of flow);
- pumping authorizations for industrial uses including drilling, winter road construction and maintenance, camp use, and construction use;
- oil and gas exploration water use (e.g. drilling, road and pad construction water use, camp water use); and,
- mineral exploration (e.g. drilling, road and pad construction water use, camp water use.

Table 5-15. Characterization of Cumulative Effects on Water Resources

Criterion		Rating	Rationale
Magnitude		Negligible	The magnitude of cumulative change in water quantity is predicted to be negligible as water withdrawal locations are well-dispersed through the CESA and the distance between withdrawal locations will ameliorate much of the potential cumulative effect. In addition, withdrawals for the Project are limited to 10% of instantaneous flows, and trigger monitoring will be utilized to reduce or stop withdrawals at such a time the water reduction reaches the threshold.
Likelihood		Probable	Other water withdrawals outside of the Project will operate independently and is dependent on factors that are not certain.
Geographic Extent		Beyond regional	Any cumulative effect will extend beyond the RSA, as most other projects and activities that may contribute to cumulative effects are outside this area.
Duration, Frequency & Timing	Duration	Short-term	The cumulative effect of changes to water flow will only occur during the duration of multiple concurrent water withdrawal activities and is not expected to extend beyond the duration of pumping (e.g. days or weeks)
	Frequency	Periodic	The effect will be limited to periods of concurrent water withdrawals for multiple sources which is likely to be periodic, and result in a cumulative effect during periods of low flow.
	Timing	Year-Round	The effect is expected to occur primarily during the period of planned water withdrawal (winter) but may occur during other periods of concurrent water use year-round.

Criterion	Rating	Rationale
Reversibility	Reversible	Changes to water quantity are expected to be reversible with reductions or cessation of water withdrawals.

6 FISH AND FISH HABITAT

Fish were selected as a key Valued Environmental and Socio-Economic Component (VESEC) for the Project because of their cultural, ecological, and economic value, including fishing. Prior to the baseline report (**Appendix 6-A Fish and Fish Habitat Studies**), limited information was available on fish and fish habitat within the Regional Study Area (RSA).

The baseline report described that the RSA encompasses 1,467 mapped streams[9], most of which are smaller headwater streams: 1,142 first-order, 239 second-order, 68 third-order, 16 fourth-order, and 2 fifth-order streams. Few ponds and lakes occur in the RSA and none are greater than 5 hectares (ha) in size.

During the winter (March 2020), no fish were observed in the RSA (**Appendix 6-A**). Smaller streams (first, second, and third-order) fully freeze or dewater, whereas larger streams (fourth and fifth-order) have residual pools with no flow and associated low dissolved oxygen.

Most fish are suspected to migrate out of the study area to larger rivers for overwintering. During the summer, Arctic grayling (*Thymallus arcticus*), round whitefish (*Prosopium cylindraceum*), burbot (*Lota lota*), slimy sculpin (*Cottus cognatus*), and longnose sucker (*Catostomus catostomus*) were captured in the RSA (**Appendix 6-A**); no salmon (*Oncorhynchus* spp.) were captured.

No aquatic Species at Risk nor critical habitat have been identified or mapped in the RSA (Fisheries and Oceans Canada 2023a).

6.1 ASSESSMENT INDICATORS AND ASSESSMENT PARAMETERS

The Project has the potential to interact with fish and fish habitat, and the assessment indicators of potential adverse effects are changes in fish mortality and fish habitat. The assessment approach for fish mortality is a qualitative discussion of the changes in fish mortality risk. The assessment approach for fish habitat is a qualitative discussion of the changes in fish habitat quality, and quantity.

6.2 PROJECT INTERACTIONS AND POTENTIAL EFFECTS

The potential for the Project to interact with and adversely affect fish and fish habitat was assessed by systematically reviewing each of the components listed in the Project description (**Table 6-1**). The Project includes several components that have the potential to interact with and adversely affect fish and fish habitat. Each of these components received scores (0 = no interaction; 1 = minor interaction; 2 = substantial interaction) based on the expected magnitude of a potential adverse effect, in the absence of mitigation measures being applied. Only component-effect interactions with a score of 2 are considered in residual adverse effects characterization, whereas lower scores are associated with adverse effects that are small (immeasurable) or negligible.

[9] These numbers refer to mapped streams or drainages. Note many of the smaller 'streams' may not meet the definition of a stream (i.e., could be seepages, wet areas, or wetlands).

6.2.1 Interactions

Ten of the 12 Project components may interact with fish and fish habitat causing potential adverse effects by changes in fish mortality risk and fish habitat quality or quantity. The direct and indirect pathways for potential adverse effects because of the Project components are described in the following sections. See **Table 6.1**.

Table 6-1. Expected Interactions Between Fish and Fish Habitat and the Eagle Plains Exploration Project and Resulting Potential Effects

Project Component / Activity	Fish Mortality Risk	Fish Habitat Quality	Fish Habitat Quantity
Engagement	0	0	0
Seismic Exploration	2	2	2
Drilling Exploration	2	2	2
Extended Flow Testing (EFT)	2	2	0
Well Maintenance (Workovers)	0	0	0
Winter Access Roads	2	2	2
Mix Bury Cover (MBC)	2	2	0
Central Processing Facility (CPF)	2	2	0
Airstrip	2	2	0
Water Withdrawal	2	2	2
Transportation	0	0	0
Camp	2	2	0
Reclamation and Closure	2	2	0

Notes:
0 = no interaction
1 = minor interaction with fish and fish habitat is possible, but small immeasurable effect (e.g., possible slight behavioural response). Designates a summary of effects addressed in the effects assessment as a discussion. This rating does not lead into residual effects characterization.
2 = substantial interaction with fish and fish habitat, designates a more detailed assessment of potential effects. Carry forward into residual effects characterization.

6.2.2 Fish Mortality Risk

Fish mortality risk may directly increase because of seismic exploration (detonation of charges). The source points of the seismic lines will be buried at typically 6 metre (m) depth with charges of up to 1 kilogram (kg) that may produce shock waves and increase noise in fish habitat; shot point noise is 1 second in duration and is not a continuous noise. A shock wave greater than 30 kiloPascals (kPa) can cause damage to fish swim bladders, internal organs, eggs, and larvae, translating to fish mortality or a range of sub-lethal effects. Fisheries and Oceans Canada (DFO) recommends that noise should not exceed 206 decibels (dB) re: 1 microPascal (µPa) (equivalent to 30 kPa) at the edge of fish exclusion zones (Wright and Hopky 1998).

Fish mortality risk may directly and indirectly increase because of water withdrawal. Withdrawing water too quickly can strand fish in dewatered areas that may result in direct fish mortality. Improperly sized intake screens may impinge or entrain fish translating to direct fish mortality or body damage. Water withdrawal during the winter may indirectly increase icing via increasing the frequency of icing and in-stream ice formation. Water withdrawal can cause fish mortality when the degree of icing is high (e.g., fish mortality due to scouring, dewatering, smothering, or freezing of the channel bed).

Fish mortality risk may directly and indirectly increase because of the Project by the mechanism of the introduction of contaminants. The charges used for seismic exploration or chemicals/fluids associated with drilling exploration (e.g., hydrochloric acid), extended flow testing (e.g., crude oil), mixed bury cover (e.g., drill cuttings), central processing facility (e.g., chemical storage), airstrip (e.g., aviation fuel), and camp (e.g., wastewater) may introduce contaminants into the water directly or indirectly via runoff if the component is adjacent to streams. Similarly, inadvertent leaks or accidental spills from mobile equipment (e.g., winter access roads) may introduce contaminants into water directly or indirectly via runoff if the mobile equipment is adjacent to streams. Any uncured concrete used for drilling exploration and reclamation and closure is particularly harmful to fish because of its alkaline properties (high pH) and elevated heavy metal concentrations. Uncured concrete may introduce contaminants into water directly or indirectly via runoff if the concrete works are adjacent to streams. Contaminant introductions can induce toxic effects, including fish mortality and sub-lethal effects such as tumours, organ damage, physical deformities, growth, and reproductive disorders.

6.2.3 Fish Habitat Quality

Fish habitat quality may indirectly decrease because of water withdrawal. Water withdrawal during the winter may indirectly increase icing via increasing the frequency of icing and in-stream ice formation. Water withdrawal can cause decreases in fish habitat quality when the degree of icing is low, e.g., fish displacement or dispersal from lower quality habitat.

Fish habitat quality may directly and indirectly decrease because of the Project via an increase in sediment concentrations, as Total Suspended Solids (TSS). TSS may directly increase during seismic exploration (detonation of charges) because of the re-suspension of fine sediment from the stream bed. TSS may increase during drilling exploration and reclamation and closure if uncured concrete enters water directly or indirectly via runoff. TSS may indirectly increase via erosion related to winter access roads near streams. TSS increases can cause decreases in fish habitat quality because fish and benthic invertebrates have reduced ability to seek and capture prey, fish can get coated gill structures (causing irritation and asphyxiation), and these species are exposed to lower dissolved oxygen concentrations. The settlement of TSS can also cause the mortality of benthic invertebrates by smothering.

Fish habitat quality may indirectly decrease because of seismic exploration (lines), drill exploration (wells), and winter road access. The removal of riparian vegetation for these activities may indirectly increase water temperature via the loss of shade, and indirectly decrease nutrient input via the loss of leaf litter and insect drop. Water temperature increases and nutrient input decreases can cause decreases in fish habitat quality. That is, water temperature increases may translate to accelerated development and thermal stress for fish. Nutrient input decreases may translate to decreased food production for fish.

6.2.4 Fish Habitat Quantity

Fish habitat quantity may directly decrease because of winter access roads, drilling exploration, and seismic exploration activities. Stream crossings for winter access roads may place structures into aquatic areas, translating to decreases in the aquatic habitat available to fish, as well as the potential to decrease fish passage to favourable habitat. Wells for drilling exploration and lines for seismic exploration may remove vegetation such as trees, translating to decreases in the riparian habitat available to fish.

Fish habitat quantity may directly decrease because of water withdrawal. Water withdrawal decreases the wetted area and water depth, translating to decreases in the aquatic habitat available to fish. The decreases in water depth may impede fish movement, translating to decreases in fish passage to favourable habitat. Water withdrawal can isolate habitat because of the dewatering of shallow sections or other features passable at higher flows, also translating to decreased fish passage to favorable habitat.

6.3 MITIGATION MEASURES

The Project has a comprehensive set of measures designed to mitigate potential effects on fish and fish habitat. Standard mitigation measures to minimize residual effects of the Project on fish and fish habitat are described in this section and presented in **Table 6-2**.

To avoid causing the death of fish and/or the harmful alteration, disruption or destruction (HADD) of fish habitat, DFO recommends that projects should be conducted in accordance with DFO's "*Measures to Protect Fish and Fish Habitat*:" (Fisheries and Oceans Canada 2023b) , which includes mitigation measures related to avoiding aquatic areas, avoiding riparian areas, least risk timing, maintaining riparian vegetation, erosion and sediment control, and deleterious substance control. Mitigation measures are also provided within the DFO Codes of Practice (Fisheries and Oceans Canada 2020, 2023c). To use a Code of Practice, a notification form will be submitted to the regional DFO office 10 working days before starting work. Mitigation measures are also provided in DFO *Guidelines for Use of Explosives In or Near Canadian Fisheries Waters* (Wright and Hopky 1998).

The Project has maximized the avoidance of aquatic areas. First, the number of temporary stream crossings for winter access roads will be minimized on first and second-order streams (19 crossings across all 10 scenarios) and on third-order and higher order streams (average 4.2 crossings, range 4 to 5 crossings, across the 10 scenarios). This mitigation translates to crossings on 1% of first and second-order streams (19 out of 1,706) and up to 6% of third-order and higher order streams (5 out of 86). These crossings will also be temporary, as they will be removed in the spring, limiting temporal interactions with aquatic areas. Second, siting of exploration drilling, extended flow testing (EFT), reclamation and closure, mix, bury, cover (MBC), airstrip, camp, and Central Processing Facility (CPF) will minimize the proximity near streams by avoiding the riparian reserve zone (40 or 50 m width) and will minimize overlap with the riparian management zone (40, 60, or 70 m width) behind the reserve zone. Thus, introduction of contaminants because of accidental releases and spills near streams has been minimized for these components.

The Project has maximized the avoidance of riparian areas by minimizing activities in the riparian zone as described in the simulations. Specifically, existing roads will be used, and wells and spur roads will be limited in riparian reserve zones (40 or 50 m width) closest to the streams (average 4.89 ha, range 4.85 to 4.99 ha, across the 10 scenarios), as well as in riparian management zones (40, 60, or 70 m width) behind

the reserve zone (average 6.53 ha, range 6.15 to 47.26 ha). This translates to average riparian reserve zone impacts of 0.03% in the RSA (out of 19,043.14 ha) and average riparian management zone impacts of 0.03% in the RSA (out of 21,095.33 ha). Some seismic lines will be in the riparian areas (reserve 499.35 ha and management 577.33 ha across the 10 scenarios) with a potential footprint amounting to 2.7% of the riparian zone within the RSA. Furthermore, temporary stream crossings for the winter roads will select for shallow banks and riparian areas with less vegetation to minimize vegetation removal. To minimize bank erosion, roots will not be removed. Seismic exploration (lines) where crossings are not present will use hand cutting within a 10-m-width zone to minimize vegetation removal, and roots will not be removed to minimize bank erosion.

Project component interactions with fish and fish habitat will be limited during the winter because fish are generally not in the RSA based on the findings of the baseline studies (**Appendix 6-A**). Project component interactions with fish and fish habitat will also be limited spatially and temporally because the Project will also likely focus on one of the multiple work areas every few years (1 to 3) within the RSA.

Most of the Project components occur during the winter (November to April) under frozen conditions, except for seismic exploration activities during the summer. Drilling exploration, and reclamation and closure activities contain concrete works. Project components in or near water, including the use of mobile equipment, have the potential for accidental releases of contaminants. Thus, the Project will follow standard mitigation for concrete works, as well as spill prevention and response (**Table 6-2**). Winter access road construction, water withdrawal, and activities in the riparian zone will follow the DFO *Code of Practice:* Ice bridges and snow fills (Fisheries and Oceans Canada 2023c; **Table 6-2**).

Seismic exploration may occur during the summer (June to October). The DFO least risk timing windows for the Porcupine and Peel drainages are July 15 to May 1 (Arctic grayling) and May 1 to September 1 (whitefish species). Given the small overlap in the two windows (July 15 to September 1) and that grayling dominated the catches (85%) during baseline studies, the grayling window takes precedence. This approach is supported by the data that display only two round whitefish were captured within the RSA, as well as no fry nor juveniles were captured. Arctic grayling fry, indicative of spawning, were captured in second to fifth-order streams during baseline studies. As such, detonation of seismic charges should not be completed near (i.e., riparian zone) second to fifth-order streams from May 1 to July 15. Detonation will also follow the DFO *Guidelines for Use of Explosives in or Near Canadian Fisheries Waters* (Wright and Hopky 1998) (**Table 6-2**).

Detonation charges will be 1 kg or less for the seismic lines. For example, the minimum setback distances for a 1 kg charge are 11 m considering the 30 kiloPascal (kPa) threshold for shock waves and 16 m considering the incubation period of May 1 to July 15 for second to fifth-order streams (Wright and Hopky 1998). However, the Project will provide a setback distance of 45 m, providing a conservative mitigation approach for seismic exploration.

Detonation charges will typically be buried at 6 m depth in a hole. A charge at 6 m depth is below the permafrost (typically greater than 2 m) and above the deep groundwater (greater than 100 to 200 m), such that potential contaminants in the charges should not be mobilized by water. However, charges that are buried in the suprapermafrost (typically less than 2 m, surface groundwater) may mobilize potential contaminants by water to the streams; thus, for mitigation, all charges are to be buried below the suprapermafrost, which may be up to 3 to 4 m locally in some areas (e.g., due to recent wildfire). Although

suprapermafrost (surface groundwater) will drain into the hole with the charge, any water that overtops the hole after detonation will refreeze because of the permafrost conditions including during the summer so potential contaminants should not be mobilized by water. Surface runoff will also be limited during the summer to mobilize potential contaminants because of (1) few heavy rainfall events to fully saturate the surface and, (2) the mossy organic layer at the surface mimics a water absorbing sponge. Therefore, the mobilization of potential contaminants in the charges by water to the streams will be minimized.

Table 6-2. Mitigation Measures Relevant to Fish and Fish Habitat and the Project

Mitigation Measure	Potential Effect Addressed by Mitigation
Winter road construction, which will have the greatest water requirements, will primarily occur in November, December, and, to a lesser degree, January to reduce water withdrawal needs during the lowest flow periods (February and March)	Fish Habitat Quality, Fish Habitat Quantity
All wastewater and sewage will be collected in tanks approved by the Canadian Standards Association , treated on-site, then released as clean water back into the environment	Fish Mortality Risk; Fish Habitat Quality
Minimize Project activities in and near the aquatic areas	Fish Mortality Risk; Fish Habitat Quality; Fish Habitat Quantity
With the exception of seismic lines, Project features will be located outside the RMA (and particularly the RMZ), to the extent practicable. Overlap with a small extent of the RMZ is permissible where operations cannot completely avoid them.	Fish Mortality Risk; Fish Habitat Quality
For seismic activities, with the exception of mechanical watercourse crossings, restrict all mechanical equipment 55 m away from the bank edge	Fish Mortality Risk; Fish Habitat Quality
For mechanical seismic watercourse crossings, employ the following crossing site selection criteria: • areas with natural clearings, where available; • shallow banks • good bank stability; • areas with shallow water (e.g., not on bends in the river); • areas with 90 degrees access to the river; and • creek location that freezes to bottom.	Fish Mortality Risk; Fish Habitat Quality
Minimize the number of stream crossings, especially on 3rd order and higher streams.	Fish Mortality Risk; Fish Habitat Quality
Where stream crossings occur, align the road to minimize the extent of the RMA that is affected	Fish Mortality Risk; Fish Habitat Quality
Concentrate Project activities in the winter	Fish Mortality Risk; Fish Habitat Quality
If concrete works are required near streams, avoid concrete works when precipitation events are anticipated within 72 hours and the work cannot be contained	Fish Mortality Risk; Fish Habitat Quality

Mitigation Measure	Potential Effect Addressed by Mitigation
Avoid concrete spillage	Fish Mortality Risk; Fish Habitat Quality
Isolate concrete and concrete wash from the aquatic and riparian environment	Fish Mortality Risk; Fish Habitat Quality
Construct all concrete forms so that they are properly sealed (e.g., properly sealed and locked chutes, hose, and hose connections)	Fish Mortality Risk; Fish Habitat Quality
Maintain a carbon dioxide (CO_2) tank with a regulator, hose and gas diffuser on site to neutralize pH levels if a concrete spill to water occurs	Fish Mortality Risk; Fish Habitat Quality
Isolate and hold any water that contacts uncured or partly cured concrete until the pH is less than 9.0 (BC freshwater quality guideline for pH is 6.5 to 9.0) (British Columbia Ministry of Environment and Climate Change Strategy 2023)	Fish Mortality Risk; Fish Habitat Quality
All mobile equipment brought on site will be clean, free of leaks, excess oil and grease, and in good working order	Fish Mortality Risk
All mobile equipment will be checked every morning for leaks and good working order	Fish Mortality Risk
Hydraulic machinery, if required, will use environmentally sensitive hydraulic fluids that are non-toxic to aquatic life and are readily or inherently biodegradable	Fish Mortality Risk
Refuelling, fuel stockpiling, and maintenance of mobile equipment will be limited to designated areas on level, impermeable surface areas at least 30 m away from water	Fish Mortality Risk
All refuelling will occur using funnels, pads, and drip pans in place	Fish Mortality Risk
Fuels, lubricants, and chemicals will be stored appropriately on site, with proper controls to prevent the release of deleterious substances, in a designated area at least 30 m away from water	Fish Mortality Risk
Properly sized oil drip pans will be placed under all equipment and vehicles left on site	Fish Mortality Risk
Develop and implement a Spill Response Plan	Fish Mortality Risk
The Spill Response Plan will (1) include a list of spill response equipment that will be present on site; (2) assign implementation and monitoring roles; and, (3) require site personnel to have reviewed the plan, understand their roles and responsibilities, and are properly trained and equipped to conduct spill response activities	Fish Mortality Risk
Identify high-risk locations where spills are probable and maintain spill kits, capable of handling the largest potential spill through the duration of the Project, at these locations	Fish Mortality Risk
Locate Personal Protective Equipment (PPE) at the top of the spill kit to ensure easy access for the spill responder	Fish Mortality Risk
Keep spill kits closed with a safety seal affixed to indicate if the kit has been used or tampered with	Fish Mortality Risk
Respond immediately to all spills in accordance with plan	Fish Mortality Risk
If any accidental spills occur, they shall be immediately contained, cleaned up and reported (if reportable amount or type).	Fish Mortality Risk

Mitigation Measure	Potential Effect Addressed by Mitigation
Winter access road construction will follow the DFO *Code of Practice: Ice bridges and snow fills* (Fisheries and Oceans Canada 2023c)	Fish Mortality Risk; Fish Habitat Quality
Locate a temporary crossing site where the watercourse is straight, banks are stable and where approaches have low slopes	Fish Habitat Quality
Operate vehicles and machinery in a manner that minimizes disturbance to the watercourse bed and banks	Fish Habitat Quality
Do not leave logs or woody debris within the watercourse or on the banks where they can wash back into the watercourse	Fish Habitat Quality
If logs are used for watercourse crossing construction, ensure that the logs are clean and securely bound together, and are removed before the spring freshet	Fish Habitat Quality
Place a v-notch in centre of the ice bridge when crossing season is over (and it is safe to do so) to prevent blocking fish passage, channel erosion, and flooding	Fish Habitat Quality
Use only clean materials (i.e., water, ice, snow) to construct ice bridge	Fish Mortality Risk; Fish Habitat Quality
Remove compacted snow from the snow fills prior to the spring freshet	Fish Habitat Quality
Water withdrawal will follow the DFO *Code of Practice: Ice bridges and snow fills* (Fisheries and Oceans Canada 2023c)	Fish Mortality Risk; Fish Habitat Quantity; Fish Habitat Quality
Screen intake pipes when pumping (DFO Code for fish protection screens) (Fisheries and Oceans Canada 2020)	Fish Mortality Risk
Water withdraw will not exceed 10% of the actual (instantaneous) flow	Fish Mortality Risk; Fish Habitat Quantity; Fish Habitat Quality
Activities in the riparian zone will follow the DFO *Code of Practice: Ice bridges and snow fills* (Fisheries and Oceans Canada 2023c)	Fish Mortality Risk; Fish Habitat Quality; Fish Habitat Quantity
Use existing trails, roads, access points or cut lines wherever possible	Fish Habitat Quantity; Fish Habitat Quality
Use methods to reduce soil compaction (e.g., swamp mats, pads)	Fish Habitat Quality
Limit vegetation removal, pruning, and grubbing to the area required for accessing the site of the works, undertakings, and activities	Fish Habitat Quantity; Fish Habitat Quality
Construct roads, access points, and approaches perpendicular to the watercourse if a new access point is required to reach the watercourse	Fish Habitat Quality
Construct approaches using clean compacted snow and ice to a sufficient depth to protect the banks of the watercourse	Fish Mortality Risk; Fish Habitat Quality
Restore the banks and riparian vegetation affected by the works, undertakings, and activities to their natural state	Fish Habitat Quantity; Fish Habitat Quality
Do not use ammonium nitrate-fuel oil mixtures	Fish Mortality Risk
Charges will be buried at a depth below the suprapermafrost (surface groundwater) layer	Fish Mortality Risk
Do not place charge shot holes in obvious drainage wells	Fish Mortality Risk
After loading a charge in a hole, the hole is to be back-filled or collapsed to confine the force of the detonation	Fish Mortality Risk

Mitigation Measure	Potential Effect Addressed by Mitigation
All "shock-tubes" and detonation wires are to be recovered and removed after each detonation	Fish Habitat Quality
Follow the setback distance of 45 m. For cases where this is not possible, the minimum setback distance is 11 m from any stream for 1 kg explosive to avoid risk of producing an instantaneous pressure change (i.e., overpressure) greater than 30 kPa (**Table 6-3**)	Fish Mortality Risk
Seismic exploration should not be completed near second to fifth-order streams May 1 to July 15. Charge detonation will also follow the DFO *Guidelines for Use of Explosives in or Near Canadian Fisheries Waters* (Wright and Hopky 1998).	Fish Mortality Risk; Fish Habitat Quality
If seismic exploration must occur May 1 to July 15 near second to fifth-order streams, follow the setback distance of 45 m. For cases where this is not possible, the minimum setback distance is 16 m from the stream for 1 kg of explosive to a peak particle velocity greater than 13 mm/s in a spawning bed (**Table 6-4**).	Fish Mortality Risk

Table 6-3. Setback Distance (m) from Centre for Detonation of a Confined Explosive to Fish Habitat to Achieve 30 kPa for Various Substrates

Substrate Type	Weight of Explosive Charge (kg)							
	0.5	**1**	**2**	**5**	**10**	**25**	**50**	**100**
Rock	7.6	10.7	15.1	23.9	33.8	53.4	75.5	106.8
Frozen Soil	7.0	9.9	14.0	22.1	31.2	49.4	69.8	98.7
Ice	6.3	8.9	12.5	19.8	28.0	44.3	62.7	88.7
Saturated Soil	6.3	8.9	12.6	19.9	28.1	44.4	62.8	88.9
Unsaturated Soil	4.3	6.1	8.7	13.7	19.4	30.7	43.5	61.5
Frozen Soil	7.0	9.9	14.0	22.1	31.2	49.4	69.8	98.7

Source: Wright and Hopky 1998, modified 100 kPa to 30 kPa

Table 6-4. Setback Distance (m) from Centre for Detonation of a Confined Explosive to Spawning Habitat to Achieve 13 mm/s for all Types of Substrates

Substrate Type	Weight of Explosive Charge (kg)							
	0.5	**1**	**2**	**5**	**10**	**25**	**50**	**100**
All	10.7	15.1	33.7	47.8	75.5	106.7	150.9	10.7

Source: Wright and Hopky 1998

6.4 EFFECTS CHARACTERIZATION

6.4.1 Approach

Characterizing the residual adverse effects on fish and fish habitat considers the Project's potential effects and the mitigation measures used to minimize those potential effects. The spatial boundary of effects characterization was the RSA. Residual effects on fish and fish habitat have each been characterized in terms of magnitude, likelihood, geographic extent, duration, timing, frequency, and reversibility (**Table 6-5**). Determining residual effects on fish and fish habitat considered the context of the highest development (conforms to Regional Land Use Plans) and the confidence in accurately quantifying and predicting those residual effects. The significance of all residual effects (after mitigation measures are applied) is assessed collectively to determine the overall residual effect of the Project on fish and fish habitat (see **Section 6.5 Significance**).

Table 6-5. Definitions of Effects Criteria Classifications for the Assessment of Fish and Fish Habitat in the Eagle Plains Exploration Project

Criterion		Rating	Definition
Magnitude		Negligible	No measurable change from existing conditions. **This corresponds to a <1% change in an assessment indicator.**
		Low	The residual effect will be a slight, but measurable change from existing conditions. **This corresponds to a 1–10% change in an assessment indicator.**
		Moderate	The residual effect will be a measurable change from existing conditions but will not affect the sustainability of fish and fish habitat. **This corresponds to a 11–35% change in an assessment indicator.**
		High	The residual effect will be a substantial, measurable change from existing conditions that may affect the sustainability of fish and fish habitat. **This corresponds to a >35% change in an assessment indicator.**
Likelihood		Unlikely	A residual effect is not expected, but a residual effect is not impossible.
		Possible	A residual effect may occur but is not likely.
		Probable	A residual effect is likely to occur, but it is not certain.
		Certain	A residual effect will occur.
Geographic Extent		Maximum disturbance footprint	The residual effect is confined to the maximum disturbance footprint.
		Local	The residual effect is confined to the Local Study Area.
		Regional	The residual effect is confined to the Regional Study Area.
		Beyond regional	The residual effect extends beyond the Regional Study Area.
	Duration	Short-term	The residual effect duration is less than a year (e.g., days, months)

Criterion		Rating	Definition
Duration, Frequency and Timing		Medium-term	The residual effect duration is more than a year and up to the life of the Project (e.g., years).
		Long-term	The residual effect duration is beyond the life of the Project (e.g., decades).
		Permanent	The residual effect is predicted to be permanent and thus unlikely to recover to existing conditions.
	Frequency	Occasional	The residual effect may occur rarely (e.g., once or a few times over the life of the Project).
		Periodic	The residual effect may occur consistently at regular intervals or associated with temporal events (e.g., during spring freshet, low flows, growing season).
		Continuous	The residual effect may occur all the time.
	Timing	Year-round	The residual effect may occur year-round.
		Seasonal	The residual effect may be confined to a portion of the year.
Reversibility		Reversible	The residual effect is predicted to be reversible within a clearly defined period.
		Irreversible	The residual effect is predicted to influence the assessment indicator indefinitely.

6.4.2 Fish Mortality Risk

Table 6-6 presents the characterization of residual adverse effects for fish mortality risk. Provided the implementation of all mitigation measures in the previous section, a residual adverse effect (as an increase in fish mortality risk) is not anticipated for the Project. Any residual effect (e.g., accidental spill) may be in the RSA geographic extent and of unlikely likelihood. Any residual effect may be medium-term duration (life of the Project), occasional frequency, and seasonal (summer). Although the loss of an individual to mortality is irreversible, it is anticipated to have a negligible magnitude at the population level.

Table 6-6. Characterization of Residual Effects on Fish Mortality Risk

Criterion	Rating	Rationale
Magnitude	Negligible	Mitigation measures are expected to minimize changes in fish mortality risk. For example, 1% of first and second-order streams will have temporary crossings and up to 6% of third and higher order streams will be crossed. Riparian reserve zone and management zone impacts of 0.03% outside of seismic lines and 2.7% for seismic lines. If a residual effect were to occur, fish mortality may be negligible at the population level (i.e., a very small number of fish would be affected rather than population effects).
Likelihood	Unlikely	Mitigation measures are expected to minimize the likelihood of changes in fish mortality risk.

Criterion		Rating	Rationale
Geographic Extent		Regional	Any change in fish mortality risk will be limited to the RSA.
Duration, Frequency and Timing	Duration	Medium-term	If a residual effect were to occur, fish mortality may be for the Project (medium-term).
	Frequency	Occasional	If a residual effect were to occur, fish mortality may be limited to occasional events.
	Timing	Seasonal	If a residual effect were to occur, fish mortality will be limited to the summer, when fish are in the RSA. Interactions with fish will be limited during the winter, when most Project components occur, because fish are generally not in the RSA.
Reversibility		Irreversible	If a residual effect were to occur, fish mortality may be irreversible at the individual level.

6.4.2.1.1 Context and Confidence

The confidence of no residual adverse effect anticipated is high for fish mortality risk within the context of Regional Land Use Planning (**Table 6-7**). For example, the mitigation is effective for confined explosive setbacks.

Table 6-7. Context and Confidence of Residual Effects on Fish Mortality Risk

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	The RSA is within Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans (LUPs), which are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	High confidence (low uncertainty) in the ability to characterize Project interactions for fish mortality risk, i.e., few knowledge gaps, and the mitigation is effective.

6.4.3 Fish Habitat Quality

Table 6-8 presents the characterization of residual adverse effects for fish habitat quality. Provided the implementation of all mitigation measures in the previous section, a residual adverse effect (as a decrease in fish habitat quality) is not anticipated for the Project. Any residual effect (e.g., loss of a few riparian trees) may be in the RSA geographic extent and of unlikely likelihood. Any residual effect may be long-term duration (time for riparian trees to return), occasional frequency, reversible, and negligible magnitude.

Table 6-8. Characterization of Residual Effects on Fish Habitat Quality

Criterion		Rating	Rationale
Magnitude		Negligible	Mitigation measures are expected to minimize changes in fish habitat quality. For example, 1% of first and second-order streams will have temporary crossings and up to 6% of third and higher order streams will be crossed. Riparian reserve zone and management zone impacts of 0.03% outside of seismic lines and 2.7% for seismic lines. If a residual effect were to occur, decreases in fish habitat quality may be negligible (very small portion of streams would be affected).
Likelihood		Unlikely	Mitigation measures are expected to minimize the likelihood of changes in fish habitat quality.
Geographic Extent		Regional	Any change in fish habitat quality will be limited to the RSA.
Duration, Frequency and Timing	Duration	Long-term	If a residual effect were to occur, decreases in fish habitat quality may be long-term (recover to baseline), as it will take time for banks to re-stabilize and riparian trees to return, i.e., sediment, temperature, and nutrients.
	Frequency	Occasional	If a residual effect were to occur, decreases in fish habitat quality may be limited to occasion events.
	Timing	Seasonal	If a residual effect were to occur, decreases in fish habitat quality may be limited to the summer, when fish are in the RSA. Fish habitat quality interactions will be limited during the winter, when most Project components occur, because fish are generally not in the RSA.
Reversibility		Reversible	If a residual effect were to occur, decreases in fish habitat quality are reversible in the long term.

6.4.3.1.1 Context and Confidence

The confidence of no residual adverse effect anticipated is high for fish habitat quality within the context of Regional Land Use Planning for the Project (**Table 6-9**). For example, the mitigation is effective for temporary stream crossings, sediment and erosion control, concrete works, and spill management and response.

Table 6-9. Context and Confidence of Residual Effects on Fish Habitat Quality

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	The RSA is within Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans, which are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	High confidence (low uncertainty) in the ability to characterize Project interactions for fish habitat quality, i.e., few knowledge gaps, and the mitigation is effective.

6.4.4 Fish Habitat Quantity

Table 6-10 presents the characterization of residual adverse effects for fish habitat quantity. Provided the implementation of all mitigation measures in the previous section, a residual adverse effect (as a decrease in fish habitat quantity) is not anticipated for the Project. Any residual effect (e.g., accidental water withdrawal exceedance) may be in the RSA geographic extent and of unlikely likelihood. Any residual effect may be short-term duration (time for water withdrawal activity), occasional frequency, reversible, and negligible magnitude.

Table 6-10. Characterization of Residual Effects on Fish Habitat Quantity

Criterion		Rating	Rationale
Magnitude		Negligible	Mitigation measures are expected to minimize changes in fish habitat quantity. For example, 1% of first and second-order streams will have temporary crossings and up to 6% of third and higher order streams will be crossed. Riparian reserve zone and management zone impacts of 0.03% outside of seismic lines and 2.7% for seismic lines. If a residual effect were to occur, decreases in fish quantity may be negligible (very small portion of streams would be affected).
Likelihood		Unlikely	Mitigation measures are expected to minimize the likelihood of changes in fish habitat quantity.
Geographic Extent		Regional	Any change in fish habitat quantity will be limited to the RSA.
Duration, Frequency and Timing	Duration	Short-term	If a residual effect were to occur, decreases in fish habitat quantity may be short-term (time for water withdrawal activity).
	Frequency	Occasional	If a residual effect were to occur, decreases in fish habitat quantity may be limited to occasional events.
	Timing	Seasonal	If a residual effect were to occur, decreases in fish habitat quantity may be limited to the summer, when fish are in the RSA. Interactions to fish habitat quantity will be limited during the winter, when most Project components occur, because fish are generally not in the RSA.
Reversibility		Reversible	If a residual effect were to occur, decreases in fish habitat quantity are reversible in the short term.

6.4.4.1.1 Context and Confidence

The confidence of no residual adverse effect anticipated is high for fish habitat quantity within the context of Regional Land Use Planning (**Table 6-11**). For example, the mitigation is effective for avoiding aquatic and riparian areas, and water withdrawal, e.g., do not exceed 10% of the actual (instantaneous) flow.

Table 6-11. Context and Confidence of Residual Effects on Fish Habitat Quantity

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	The RSA is within Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans, which are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	High confidence (low uncertainty) in the ability to characterize Project interactions for fish habitat quantity, i.e., few knowledge gaps, and the mitigation is effective.

6.5 SIGNIFICANCE

Significance was evaluated as part of the residual effects characterization for fish and fish habitat. **Table 6-12** provides the definition of significant versus not significant that were used.

Table 6-12. Determination of Significance for Residual Effects on Fish and Fish Habitat

Characterization	Definition
Not Significant	Management standards or mitigation measures are designed to minimize the likelihood and severity of residual effects.
Significant	Management standards or mitigation measures are not adequate to minimize the likelihood and severity of residual effects.

The Project is not anticipated to substantially affect fish and fish habitat. The Project was designed to limit interactions with fish and fish habitat by minimizing stream crossings and riparian area footprints to the extent practical, as well as most of the activities have been scheduled during the winter when fish are generally not in the RSA. Standard mitigation measures have been applied to the Project, and these measures are known to be effective at minimizing residual adverse effects. The confidence is high for no residual effects for fish mortality risk, fish habitat quality, and fish habitat quantity. Any residual effect for fish and fish habitat (e.g., loss of a small number of trees within riparian areas), is anticipated to be of negligible magnitude for fish mortality risk, fish habitat quality, and fish habitat quantity. Therefore, residual effects of the Project on fish and fish habitat from the three potential sources collectively are anticipated to be **negligible**.

6.6 CUMULATIVE EFFECTS ASSESSMENT

Given that residual effects of the Project on fish and fish habitat were predicted to be **negligible**, an assessment of cumulative effects on Fish and Fish Habitat was not conducted.

7 VEGETATION

Ecological communities play an important role in the maintenance of biodiversity, carbon sequestration, nutrient cycling, productivity and wildlife habitat. Ecological communities provide habitat for culturally important and harvestable plants and at-risk components of regional, territorial and federal biodiversity.

Field surveys completed by EDI Environmental Dynamics Inc. (EDI) have documented 125 different plant species, including 6 tree species, 29 shrub species, 48 forb species, 7 ferns and allies, 12 graminoid species, 11 lichen species, 10 moss species, and 2 liverwort species throughout the Regional Study Area (RSA) (**Appendix 7-A Ecological and Landscape Classification Mapping**). None of the vegetation species observed were listed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), under the federal *Species at Risk Act*, or on the Yukon track and watch species list.

In addition to these individual vegetation species, thirty-one distinct ecosystem units have been mapped within the RSA. Most of the RSA is mapped in a shrub structural stage with only 1 percent (%) of the RSA mapped in an old forest structural stage.

The RSA is dominated by moist and mesic black and white spruce forests, with Labrador tea (*Rhododendron groenlandicum*), alder (*Alnus* spp.) and birch (*Betula* spp.) shrub cover. The least common ecological units are found on dry sites or have been influenced by disturbances and are dominated by birch and willow (*Salix* spp.). Bogs were the most common wetland ecosystem unit mapped across the RSA, with some fens and marshes also mapped. No swamps were identified during the field program nor mapped within the RSA (**Appendix 7-A**).

The ecosystem units identified in the Ecological and Landscape Classification mapping were assessed for cultural value, rarity, conservation status, habitat values, and sensitivity to disturbance. Four groups of ecosystem units were identified for inclusion in the constraints mapping (dry sites, riparian spruce sites, tamarack sites, and unique wetland sites). In addition, all sites mapped as old forest were included in the constraints maps.

7.1 ASSESSMENT INDICATORS AND ASSESSMENT PARAMETERS

Methods used in the vegetation assessment align with established guidance for an environmental assessment process in the Yukon and Canada. The vegetation assessment methods follow the general methods noted in **Section 3**, with additional Valued Environmental and Socio-Economic Component (VESEC) specific methods provided in this section as needed.

The assessment of the potential effects of the Eagle Plains Exploration Project (the Project) on the Vegetation VESEC focuses on two indicators: tamarack-producing ecosystem units and ecosystem units of conservation concern. The assessment of these indicators consists of a quantitative assessment of the change in area for each of the two indicators. These indicators were identified based on Indigenous input and/or potential sensitivity, rarity, or value to wildlife.

The assessment focuses on changes to tamarack-producing ecosystem units and to changes to ecosystem units of conservation concern. Ecosystem units of conservation concern were identified as the following: dry ecosystem units, riparian spruce sites and unique wetland sites. The assessment of units of conservation concern included changes in old growth forest.

The change (alteration or loss) of selected indicators were quantified by calculating the area of each indicator that could potentially be affected by Project activities. Calculated disturbance areas were then compared to baseline areas to determine the area of alteration or loss. Project effects focused on the calculated maximum Project Footprint from the ten well site scenarios (see **Section 3.1.3**), but also discuss the minimum, and average Project footprints from those scenarios.

7.2 PROJECT INTERACTIONS AND POTENTIAL EFFECTS

7.2.1 Interactions Table

Certain Project works may interact with vegetation and result in potential effects. Specifically seismic exploration, drilling exploration, and construction of the winter access, Central Processing Facility (CPF), airstrip and camp are expected to interact with the vegetation VESEC (**Table 7-1**).

Table 7-1. Expected Interactions Between the Vegetation VESEC and Project Activities, By Type of Potential Effect

Project Component / Activity	Loss or Alteration of Wet Shrub Tamarack Ecosystem	Loss or Alteration of Ecosytem Units of Conservation Concern
Engagement	0	0
Seismic Exploration	2	2
Drilling Exploration	2	2
Extended Flow Testing (EFT)	1	1
Well Maintenance (Workovers)	2	2
Access Roads	2	2
Mix Bury Cover (MBC) Construction and Operation	2	2
Central Processing Facility (CPF)	1	1
Airstrip	2	2
Water Withdrawal	1	1
Transportation	2	2
Camp	2	2
Reclamation and Closure	1	1

Notes:
0 = no interaction
1 = minor interaction with vegetation is possible, but small immeasurable effect (e.g., possible slight behavioural response, no vegetation effects, no measurable effect on water quality). Designates a summary of effects addressed in the effects assessment as a discussion. This rating does not lead to the characterization of residual effects.
2 = substantial interaction with vegetation, designates a more detailed assessment of potential effects. Carry forward into residual effects characterization.

7.2.2 Loss or Alteration of Wet Shrub Tamarack Ecosystem

Tamarack sites are described as areas with greater than 5% tamarack cover, low presence of *Cladonia* species (caribou forage species) and a high presence of S*phagnum* or glow moss. Scrub birch and Labrador tea are present in the shrub layer. These sites are often present in thin strips between bog and riparian areas. The soil moisture regime ranges from hygric to subhydric and the soil nutrient regime ranges from poor to medium. Distinct to prominent mottles can be observed, seepage is present, and the permafrost layer is near the surface. A layer of ice is typically present within or above the frozen soil or frozen organic layer. The RSA contains approximately 177 ha of the Wet Shrub Tamarack ecosystem unit (**Table 7-2**) which is the only identified tamarack ecosystem unit in the RSA.

Table 7-2. Availability of Tamarack Ecosystems and Ecosystems of Conservation Concern in the Eagle Plains RSA

Ecosystem Group	Name	Baseline	
		Total RSA Area (hectares [ha])	% of RSA
Tamarack Sites	Wet Shrub – Tamarack	177.3	0.1
Dry Ecosystem Sites	Dry Spruce-Lichen (Conifer)	1,826.5	0.8
Dry Ecosystem Sites	Dry Aspen-Lichen (Deciduous)	280.8	0.1
Dry Ecosystem Sites	Dry Spruce-Birch-Lichen (Mixedwood)	2,103.6	0.9
Dry Ecosystem Sites	Dry Aspen (Deciduous)	80.1	<0.1
Riparian Spruce Sites	Riparian White Spruce – Prickly Rose	192.1	0.1
Riparian Spruce Sites	Riparian Spruce – Birch - Willow	674.4	0.3
Unique Wetland Sites	Fen	42.5	<0.1
Unique Wetland Sites	Marsh	59.5	<0.1
Old forest	Structural stage 8	2,302.7	1.0

The development of Project components necessitates alteration and, in some small cases, complete removal of vegetation within Wet Shrub Tamarack ecosystems. The vast majority of Project Footprint features (winter roads, well pads, seismic lines) will require removal of trees and tall shrubs, but low shrubs and groundcover will remain. In these areas, Wet Shrub Tamarack ecosystems will be altered but not completely removed. Select Project Footprint features will require complete removal of all vegetation.

7.2.3 Loss or Alteration of Ecosystem Units of Conservation Concern

All four ecosystem units of conservation concern (dry ecosystem units, riparian spruce sites, unique wetland sites, and old growth forest) are present within the RSA (**Appendix 7-A**). The following sections summarize their availability within the RSA and potential effects of the Project on each.

7.2.3.1 Dry Ecosystem Units

This dry ecosystem unit grouping is composed of four forested ecosystem units: Dry Spruce – Lichen, Dry Aspen – Lichen, Dry Spruce – Birch – Lichen and Dry Aspen. The RSA is comprised of approximately 1.8% of this dry ecosystem unit grouping. The most common of this grouping is the Dry Spruce – Birch – Lichen

(Mixedwood) (2,104 ha) and the least common is the Dry Aspen (80 ha) (**Table 7-2**). These areas typically provide caribou forage and are not commonly found across the RSA, as they are typically associated with steep south-facing slopes.

The Dry Spruce – Lichen ecosystem unit is a spruce (*Picea* species) dominated conifer stand with an understory composed of shrubs such as scrub/shrub birch *(Betula glandulosa*), prickly rose (*Rosa acicularis*), lowbush cranberry (*Vaccinium vitis-idaea*), alpine blueberry (*Vaccinium uliginosum*) and crowberry (*Empetrum nigrum*) and a small component of Alaska paper birch (*Betula neoalaskana*) in the canopy. This ecosystem unit typically has less than 2% forb cover, has no graminoid cover, and less than 5% moss cover, but greater than 50% lichen cover (caribou forage).

The Dry Aspen – Lichen ecosystem unit is an aspen dominated deciduous stand on south-facing slopes with an understory composed of lowbush cranberry, crowberry, and bearberry. This ecosystem unit may have greater than 5% forb cover, less than 1% graminoid cover and less than 5% moss cover. The lichen cover (caribou forage) is high.

The Dry Spruce – Birch – Lichen ecosystem unit is a mixedwood dominated stand supporting spruce and Alaska paper birch, with an understory of prickly rose, lowbush cranberry, bearberry (*Arctostaphylos uva-ursi*), less than 2% forb cover and less than 10% moss cover. This ecosystem unit has greater than 30% lichen cover (caribou forage).

The Dry Aspen ecosystem unit is a pure aspen dominated deciduous stand composed of very dry to dry soil nutrient regimes on moderate to steep slopes. This unit is very low in *Cladonia* species (caribou forage species) cover (less than 5%). These areas typically have poor soil nutrient regimes.

The development of Project components necessitates alteration and, in some small cases, complete removal of vegetation within dry ecosystem units that overlap Project Footprints. The vast majority of Project Footprint features (winter roads, well pads, seismic lines) that overlap these ecosystems will require removal of trees and tall shrubs, but low shrubs and groundcover will remain. In these areas, dry ecosystem units will be altered but not completely removed. Some of the low shrub and ground vegetation may be compacted during development of these sites, which may slow down the growth and spread of plants but is not expected to affect the survival of the plants. Select Project Footprint features will require complete removal of all vegetation where it overlaps with these ecosystems.

7.2.3.2 Riparian Spruce Sites

The RSA supports approximately 0.4% of the Riparian Spruce unit grouping. This grouping is comprised of the Riparian White Spruce – Prickly Rose ecosystem unit and the Riparian Spruce – Birch – Willow ecosystem unit.

Riparian White Spruce – Prickly Rose units are dominated by white spruce (*Picea glauca*) with a mixture of shrub species, but rose is present in the understory. These units are usually a thin strip of trees along streams and rivers. Typically, these units are considered to be mesic but some can be described as being subhygric. Most of these units have a medium to rich soil nutrient regime. Approximately 192 ha of this ecosystem unit was mapped within the RSA (**Table 7-2**).

Riparian Spruce – Birch – Willow areas are dominated by white and black spruce (*Picea mariana*); some Alaska paper birch may also be present, with a mixture of shrub species such as scrub birch and willow (*Salix* species) in the understory. This ecosystem unit is typically moister (subhygric to hygric) than the

White Spruce – Prickly Rose units and usually form a wider strip of trees along streams and rivers. Faint to distinct mottles can be observed in the soil, slight seepage can be present, and permafrost may also be present but at variable depths. Signs of flooding may be observed. Within the RSA, approximately 674 ha of the Riparian Spruce – Birch – Willow ecosystem unit was mapped (**Table 7-2**).

The development of Project components necessitates alteration and, in some small cases, complete removal of vegetation within riparian spruce sites that overlap Project Footprints. The vast majority of Project Footprint features (winter roads, well pads, seismic lines) that overlap these ecosystems will require removal of trees and tall shrubs, but low shrubs and groundcover will remain. In these areas, riparian spruce ecosystem units will be altered but not completely removed. Some of the low shrub and ground vegetation may be compacted during development of these sites, which may slow down the growth and spread of plants but is not expected to affect the survival of the plants. Select Project Footprint features will require complete removal of all vegetation where it overlaps with these ecosystems.

7.2.3.3 Unique Wetland Sites

The RSA supports approximately 2,828 ha of sites classified as wetlands, including bogs, fens and marshes. Fens and marshes are considered unique wetland sites within the RSA, as only 103 ha of these wetland types were mapped within the RSA.

Fens are a shrubby or graminoid peatland ecosystem unit where groundwater inflow maintains relatively high mineral content within the rooting zone. Graminoid fens have greater than 20% Sphagnum or moss cover. This ecosystem has a hydric moisture regime and a nutrient regime that can range from poor to rich. These sites generally have a thick fibric organic layer and there is the presence of permafrost. Seepage is often present. The RSA contains approximately 43 ha of fen wetland habitat (**Table 7-2**).

A marsh is a shallowly flooded mineral wetland ecosystem dominated by emergent vegetation. The area is usually dominated by graminoids and has less than 10% *Sphagnum* or moss cover. Seepage, permafrost and gleying are often observed in the soils within these areas. Approximately 60 ha of marsh habitat was mapped within the RSA (**Table 7-2**).

The development of Project components necessitates alteration and, in some small cases, complete removal of vegetation within unique wetland sites that overlap Project Footprints. The vast majority of Project Footprint features (winter roads, well pads, seismic lines) that overlap these ecosystems will require removal of trees and tall shrubs, but low shrubs and groundcover will remain. In these areas, unique wetland sites may be altered but not completely removed. Some of the low shrub and ground vegetation may be compacted during development of these sites, which may slow down the growth and spread of plants but is not expected to affect the survival of the plants. Select Project Footprint features may require complete removal of all vegetation where it overlaps with these ecosystems.

7.2.3.4 Old Forest

Old forest structural stage is defined as forested stands having complex structure with abundant large-sized trees, snags and coarse woody debris and comprised entirely of shade-tolerant overstory species with well-established canopy gaps (Yukon Government Department of Environment 2017). About 1% of the RSA is in an old forest structural stage. The majority of the old forest was mapped within the moist and mesic ecological units. Old forest was only mapped within two Dry Ecosystem units (Dry Spruce-Lichen (101 ha)

and Dry Spruce-Birch-Lichen Mixedwood (64.6 ha)) and one Riparian Spruce ecosystem unit (243 ha) (**Table 7-2**).

The development of Project components necessitates alteration and, in some small cases, complete removal of vegetation within old forest sites that overlap Project Footprints. The vast majority of Project Footprint features (winter roads, well pads, seismic lines) that overlap these ecosystems will require removal of trees and tall shrubs, but low shrubs and groundcover will remain. In these areas, the loss of trees will result in a change in structural stage and loss of old forest characteristics; the ecosystems may remain but will now be an early seral (shrub-dominated) ecosystem. Some of the low shrub and ground vegetation may be compacted during development of these sites, which may slow down the growth and spread of plants but is not expected to affect the survival of the plants. Select Project Footprint features may require complete removal of all vegetation where it overlaps with these ecosystems.

7.3 MITIGATION MEASURES

The Project will implement mitigation measures that are specific, measurable, verifiable and achievable in nature to avoid and minimize the effects on Vegetation. Several mitigation measures proposed within the constraints mapping phase of the Project have been incorporated into the Project's design to reduce the magnitude, duration, and extent of the Project's effects. **Table 7-3** identifies mitigation measures that will be implemented to minimize the effects of the Project on Vegetation

Table 7-3. Mitigation Measures

Mitigation Measure	Potential Adverse Effect
Avoid or minimize the overlap of Project components within tamarack-producing units and ecosystem units of conservation concern by applying the constraints map during the Project design phase.	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Minimize the spatial extent of new components by using existing infrastructure (e.g. roads, winter trails, seismic lines) wherever feasible.	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Delineate the Project Footprint boundaries and restrict equipment use to within the defined areas.	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Minimize vegetation and soil compaction within tamarack-producing units, fens and marshes with the use of mats or other anti-compaction approved methods and materials.	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Develop a plan to prevent deleterious substances from entering a water body	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Maintain all machinery on site in a clean condition and free of fluid leaks	• Loss or alteration of Wet Shrub Tamarack ecosystem

Mitigation Measure	Potential Adverse Effect
	• Loss or alteration of ecosystem units of conservation concern
Wash, refuel and service machinery in upland areas in such a way as to prevent any deleterious substances from entering a water body	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering a water body	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Establish a spill response plan with the following key mitigation measures: • report all spills as soon as possible when a deleterious substance enters a water body; • install containment measures around the spill; and, • collect and dispose of contaminated water or soil substrates using an emergency spill kit and other necessary spill response measures. Disposal will be at approved disposal facilities.	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Allow for the regeneration of natural vegetation following the cessation of exploration in a work area	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Limit grubbing activities (i.e., removal of groundcover) to the drill hole location and the MBC sumps	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Limit clearing of vegetation to the height of 0.1 m high wherever practicable	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Develop and implement an erosion and sediment control plan to prevent the introduction of sediment into any water body during all phases of the Project, undertakings and activities	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Install erosion and sediment control measures, where appropriate, before beginning works, undertakings and activities	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Maintain and inspect erosion and sediment control measures and structures regularly during all phases of the works, undertakings and activities	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Keep the erosion and sediment control measures in place until all disturbed ground has been stabilized, then remove all erosion and sediment control materials (unless biodegradable)	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern

Mitigation Measure	Potential Adverse Effect
Keep organic layers intact (i.e., limit grubbing and vegetation removal) wherever possible	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Operate machinery on land in stable, dry areas	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Monitor waterbodies regularly for signs of sediment entry during all phases of the works, undertakings and activities and take corrective action	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Use biodegradable erosion and sediment control materials whenever possible	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Minimize source line widths to 2.75 m and receiver line widths to 1.75 m and the total length of lines as much as possible (i.e., use as wide a spacing distance between lines as possible)	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern
Wash and inspect all equipment prior to arrival on site to minimize the potential for invasive plant introduction and spread	• Loss or alteration of Wet Shrub Tamarack ecosystem • Loss or alteration of ecosystem units of conservation concern

7.4 EFFECTS CHARACTERIZATION

7.4.1 Approach

The assessment of alteration of ecosystems of conversation concern considers the alteration or loss of these units across the range of the 10 Project footprint scenarios. The direct alteration is quantified by calculating the area predicted to be affected within the RSA and compared to baseline values. The data are presented as minimum, maximum and average values for the potential Project footprint areas that could be altered within the RSA by various Project components and subcomponents.

Based on the scenario modelling, a maximum Project footprint of 7,188 ha could potentially be affected by Project related activities (**Table 7-4**). Of this maximum Project footprint, approximately 151 ha overlaps with areas already devoid of vegetation (i.e., the existing camp and the Dempster Highway). The majority (88%) of the Project footprint is the areas to be affected by seismic line clearing, where low shrub and ground cover vegetation will be retained. A further 7.8% of the Project Footprint will be winter roads and trails, where low shrub and ground cover vegetation will also be retained to the maximum extent possible, within the limitations of safe construction of winter roads and trails (e.g., cutting large stumps down to ground level may sometimes be required).

An average of approximately 7,015 ha of new "disturbances" is expected to affect vegetation and ecosystems, with the majority constituting an alteration; only a small fraction of the area is predicted to be lost completely (i.e., all vegetation completely removed and grubbed).

Table 7-4. The Minimum, Maximum and Average Areas of Effect Footprint Features on the Vegetation and Ecosystems Within the Project Footprint

Footprint Feature	Minimum Footprint Area (ha)	Maximum Footprint Area (ha)	Average Footprint Area (ha)
Seismic component	6,335.2	6,337.7	6,336.3
Winter Roads and Trails	561.8	563.1	562.6
Well features	71.5	117.7	97.3
Proposed camp	12.0	12.0	12.0
Airstrip	6.8	6.8	6.8
Existing camp	8.8	8.8	8.8
Dempster Highway	142	142	142
Total Area (ha)	7,138.1	7,188.1	7,165.8

Based on the scenario modeling, the greatest range between the potential minimum Project Footprint and maximum Project footprint is associated with well features (**Table 7-4**), which include both well sites and associated well access (i.e., spur access to individual well sites). Project-related ecosystem alterations associated with well features have the potential to range from 71 ha to 118 ha (**Table 7-4**). Most of the other proposed Project Footprint features have range differences that are less than 2 ha or have a fixed Footprint.

Most of the Project footprint will be associated with seismic components (**Table 7-4**), which encompass three-dimensional (3D) combination, 3D receiver, and 3D source lines, as well as seismic access. Within the seismic Project Footprints, trees and tall shrubs will be cut down and some ground vegetation could be compacted/crushed. An average area of approximately 6,336 ha is expected to be altered in association with seismic features activities. It is assumed that these activities will cause minimal soil disturbance and the cutting of trees and tall shrubs within all seismic areas across the RSA will not be completed within the same winter but rather will be progressively conducted across the RSA over the life of the Project. Seismic components will be spread throughout the RSA and not be concentrated in one area or within one ecosystem unit. Once the proposed tree and shrub removal on seismic components is completed, natural regeneration of the line is expected occur.

Characterizing the residual adverse effects on vegetation considers the Project's potential effects and the mitigation measures used to minimize those potential effects. The spatial boundary of effects characterization was the RSA. Residual effects on vegetation have each been characterized in terms of magnitude, likelihood, geographic extent, duration, timing, frequency, and reversibility (**Table 7-5**). Determining residual effects on vegetation considered the context of the Regional Land Use Plans and the confidence in accurately quantifying and predicting those residual effects. The significance of all residual

effects (after mitigation measures are applied) is assessed collectively to determine the overall residual effect of the Project on vegetation.

Table 7-5. Definitions of Effects Criteria Classifications for the Assessment of Vegetation in the Eagle Plains Exploration Project

Criterion		Rating	Definition
Magnitude		Negligible	No measurable change from existing conditions. This corresponds to a <1% change in an assessment indicator.
		Low	The residual effect will be a slight, but measurable change from existing conditions. This corresponds to a 1–5% change in an assessment indicator.
		Moderate	The residual effect will be a measurable change from existing conditions but will not affect the sustainability of wildlife and wildlife habitat. This corresponds to a 5–15% change in an assessment indicator.
		High	The residual effect will be a substantial, measurable change from existing conditions that may affect the sustainability of wildlfie and wildlife habitat. This corresponds to a >15% change in an assessment indicator.
Likelihood		Unlikely	A residual effect is not expected, but a residual effect is not impossible.
		Possible	A residual effect may occur but is not likely.
		Probable	A residual effect is likely to occur, but it is not certain.
		Certain	A residual effect will occur.
Geographic Extent		Maximum disturbance footprint	The residual effect is confined to the maximum disturbance footprint.
		Local	The residual effect is confined to the Local Study Area.
		Regional	The residual effect is confined to the RSA.
		Beyond regional	The residual effect extends beyond the RSA.
Duration, Frequency and Timing	Duration	Short-term	The residual effect duration is less than a year (e.g., days, months)
		Medium-term	The residual effect duration is more than a year and up to the life of the Project (e.g., years).
		Long-term	The residual effect duration is beyond the life of the Project (e.g., decades).
		Permanent	The residual effect is predicted to be permanent and thus unlikely to recover to existing conditions.
	Frequency	Occasional	The residual effect may occur rarely (e.g., once or a few times over the life of the Project).
		Periodic	The residual effect may occur consistently at regular intervals or associated with temporal events (e.g., during spring freshet, low flows, growing season).
		Continuous	The residual effect may occur all the time.

Criterion		Rating	Definition
	Timing	Year-round	The residual effect may occur year-round.
		Seasonal	The residual effect may be confined to a portion of the year.
Reversibility		Reversible	The residual effect is predicted to be reversible within a clearly defined period.
		Irreversible	The residual effect is predicted to influence the assessment indicator indefinitely.

7.4.2 Vegetation Data Limitations

The following technical limitations apply to the vegetation baseline data used to support predicting Project residual effects:

- Vegetation baseline ecosystem mapping accuracy and resolution were limited by the availability of imagery quality, and challenges with attributing fire-disturbed polygons.
- No primary traditional knowledge information was collected for the vegetation assessment. Sources of traditional knowledge were limited to publicly available secondary sources cited in the baseline reports and assessment where appropriate.

7.4.3 Residual Loss or Alteration of Wet Shrub Tamarack Ecosystem

The Project may alter Wet Shrub Tamarack ecosystem units within the RSA across all 10 Project Footprint scenarios. It is estimated that up to 5.5 ha will be disturbed by Project-related activities (**Table 7-6**), which constitutes approximately 3% of the total available Wet Shrub - Tamarack ecosystem unit across the RSA. This low magnitude residual effect is predicted to last for the long-term, but be reversible, once trees and tall shrubs regenerate following cessation of Project activities (**Table 7-7**).

Table 7-6. Area of Wet Shrub Tamarack Ecosystem Predicted to be Lost or Altered Due to the Project, Based on an Assessment of the 10 Project Footprint Scenarios

Ecosystem Group	Name	Footprint Disturbance Scenarios			
		Min Area (ha)	Max Area (ha)	Avg Area (ha)	Avg % Change from Baseline
Tamarack Sites	Wet Shrub – Tamarack	5.5	5.5	5.5	3.1

Table 7-7. Residual Effects Characterization for Loss or Alteration of Wet Shrub Tamarack Ecosystems

Criterion		Rating	Rationale
Magnitude		Low	The change in the relative availability of Wet Shrub Tamarack ecosystems from baseline is 3%
Likelihood		Certain	Mitigation measures are expected to minimize but not eliminate the potential alteration or loss of Wet Shrub Tamarack ecosystems.
Geographic Extent		Maximum disturbance footprint	Direct habitat loss is predicted to be limited to the Project footprint.
Duration, Frequency & Timing	Duration	Long-term	Tamarack and other trees can take many years to regenerate, and thus it's predicted that regeneration of Wet Shrub Tamarack ecosystems could extend beyond the completion of exploration and associated reclamation, but is likely to recover to baseline over time.
	Frequency	Periodic	Vegetation clearing will be required for most Project related activities but will occur in phases.
	Timing	Year-round	Once vegetations is altered or lost, the residual effect from this alteration or loss will remain year-round until regeneration is complete.
Reversibility		Reversible	The regeneration of vegetation is expected to reverse the alteration/loss in Wet Shrub Tamarack ecosystems.

In a study completed by EDI (**Appendix 7-B Linear Feature Study**) on linear feature regeneration within the RSA, a key finding was that normal succession was the dominant trajectory observed for all linear features except the Dempster Highway. The majority of 3D seismic lines followed a normal succession trajectory. It was theorized that it was due to low impact methods used in 3D line creation that minimized ground and vegetation disturbance, creating conditions conducive to a normal successional trajectory (Yukon Energy Mines and Resources 2006, Golder Associates 2016). Thus, it's predicted that recovery of most affected Wet Shrub Tamarack ecosystems (especially those along Project Low Impact Seismic [LIS] lines) could be much faster than on historical two-dimensional (2D) lines and other clearing disturbances.

Tree growth rates in the Eagle Plains area are not known; similar species that occur in Eagle Plains were observed to grow 5–10 centimetres (cm) per year on 3D lines in the boreal forest in northeast BC (Golder Associates 2016). If similar growth rates occur in Eagle Plains, regeneration on the 3D lines could be 2 metres (m) over the next 5 to 20 years.

7.4.3.1.1 Context and Confidence

The Project is within a Zone IV Integrated Management Area (IMA) in both the North Yukon and Peel Watershed Planning Regions. In these areas with diminished ecological and cultural values in a moderately sensitive biophysical setting, Zone IV IMAs allows for the highest level of development. Cumulative effect indicators are used in both plans to determine if the current management and development is meeting the set goals and objectives. Two cumulative effects indicators included in the Plans are direct surface disturbance and linear density, with guidelines setting cautionary (0.75 kilometres [km] / square kilometres [km²]) and critical (1.0 km/km²) indicator levels in both plans.

Chance Oil and Gas Ltd. (Chance) commissioned a study to determine the extent and characteristics of liner features in the RSA (**Appendix 7-B**). The study supports assessing the Project's potential effects of linear features and refinement of mitigation measures for linear features to minimize the potential for adverse effects. After accounting for natural features and regeneration, the adjusted linear feature density for the RSA was below the cautionary indicator level, at 0.52 km/km², in both RLUPs.

With minimal ground disturbance, the maintenance of moss, herb, and low shrub layers is expected to support natural vegetation regeneration. Longer regenerating times are often caused or exacerbated by human use after the initial disturbance; however, extensive (non-Project) human use does not appear to be a factor in the RSA, as no sign of human use was observed outside of the Dempster Highway corridor during the EDI linear feature study (EDI Environmental Dynamics Inc 2023).

The uncertainty of the final Project Footprint results in a moderate confidence rating of the characterization of the predicted residual effects on Wet Shrub Tamarack ecosystems (**Table 7-8**).

Table 7-8. Rating and Rationale for Context and Confidence

Criterion	Rating	Rationale
Context	Highest Development	The RSA is within a Zone IV IMA — Highest Level of Development is allowed.
Confidence	Moderate	Mitigation measures are predicted to be effective at minimizing a change in vegetation, however, the uncertainty of the Project Footprint results in a Moderate Confidence of the characterization of the residual effect prediction to specific ecological units.

7.4.4 Residual Loss or Alteration of Ecosystems of Conservation Concern

Depending on the ecosystem of conservation concern, the Project may affect up to 3.7% of the available quantity of these ecosystems in the RSA across all 10 Project Footprint scenarios (**Table 7-9**). This low magnitude residual effect is predicted to last for the long-term, but be reversible, once trees and tall shrubs regenerate following cessation of Project activities (**Table 7-10**).

Table 7-9. Area of Wet Shrub Tamarack Ecosystem Predicted to be Lost or Altered Due to the Project, Based on an Assessment of the 10 Project Footprint Scenarios

Ecosystem Group	Name	Footprint Disturbance Scenarios			
		Min Area (ha)	Max Area (ha)	Avg Area (ha)	Avg % Change from Baseline
Dry Ecosystem Sites	Dry Spruce-Lichen (Conifer)	57.1	59.5	58.1	3.2
Dry Ecosystem Sites	Dry Aspen-Lichen (Deciduous)	8.9	8.9	8.9	3.2
Dry Ecosystem Sites	Dry Spruce-Birch-Lichen (Mixedwood)	65.4	67.6	65.9	3.1
Dry Ecosystem Sites	Dry Aspen (Deciduous)	2.8	2.9	2.9	3.6

Ecosystem Group	Name	Footprint Disturbance Scenarios			
		Min Area (ha)	Max Area (ha)	Avg Area (ha)	Avg % Change from Baseline
Riparian Spruce Sites	Riparian White Spruce – Prickly Rose	4.7	4.7	4.7	2.5
Riparian Spruce Sites	Riparian Spruce – Birch - Willow	16.9	16.9	16.9	2.5
Unique Wetland Sites	Fen	1.3	1.3	1.3	3.1
Unique Wetland Sites	Marsh	2.2	2.2	2.2	3.7
Old Forest	Structural stage 8	70.6	71.0	70.7	0.03

Table 7-10. Residual Effects Characterization for Loss or Alteration of Ecosystems of Conservation Concern

Criterion		Rating	Rationale
Magnitude		Low	The change in the relative availability of selected ecological units from baseline will be less than 5%
Likelihood		Certain	Mitigation measures are expected to minimize but not eliminate the potential alteration or loss of Wet Shrub Tamarack ecosystems.
Geographic Extent		Maximum disturbance footprint	Direct habitat loss is predicted to be limited to the Project footprint.
Duration, Frequency & Timing	Duration	Long-term	Old forest can take many years to regenerate post-clearing and regeneration of certain ecological communities could extend beyond the completion of exploration and associated reclamation, but is likely to recover to baseline over time.
	Frequency	Periodic	Vegetation clearing will be required for most Project related activities but will occur in phases.
	Timing	Year-round	Once vegetations is altered or lost, the residual effect from this alteration or loss will remain year-round until regeneration is complete.
Reversibility		Reversible	The regeneration of vegetation is expected to reverse the alteration/loss of ecosystems of conservation concern..

7.4.4.1.1 Context and Confidence

The Project is within a Zone IV IMA in both the North Yukon and Peel Watershed Planning Regions. In these areas with diminished ecological and cultural values in a moderately sensitive biophysical setting, Zone IV IMAs allows for the highest level of development. Cumulative effect indicators are used in both plans to determine if the current management and development is meeting the set goals and objectives. Two cumulative effects indicators included in the Plans are direct surface disturbance and linear density, with guidelines setting cautionary (0.75 km/km²) and critical (1.0 km/km²) indicator levels in both plans.

Chance commissioned a study to determine the extent and characteristics of liner features in the RSA (**Appendix 7-B**). The study supports assessing the Project's potential effects of linear features and refinement of mitigation measures for linear features to minimize the potential for adverse effects. After accounting for natural features and regeneration, the adjusted linear feature density for the RSA was below the cautionary indicator level, at 0.52 km/km², in both RLUPs.

With minimal ground disturbance, the maintenance of moss, herb, and low shrub layers is expected to support natural vegetation regeneration. Longer regenerating times are often caused or exacerbated by human use after the initial disturbance; however, extensive (non-Project) human use does not appear to be a factor in the RSA, as no sign of human use was observed outside of the Dempster Highway corridor during the EDI linear feature study (EDI Environmental Dynamics Inc 2023). The uncertainty of the final Project Footprint results in a moderate confidence rating of the characterization of the predicted residual effects on selected ecosystem units and old forests (**Table 7-11**).

Table 7-11. Rating and Rationale for Context and Confidence

Criterion	Rating	Rationale
Context	Highest Development	The RSA is within a Zone IV IMA — Highest Level of Development is allowed.
Confidence	Moderate	Mitigation measures are predicted to be effective at minimizing a change in vegetation, however, the uncertainty of the Project Footprint results in a Moderate Confidence of the characterization of the residual effect prediction to specific ecological units.

7.5 SIGNIFICANCE

7.5.1 Significance Criteria

The significance of potential effects is discussed at the Vegetation VESEC level and not for each indicator selected. The magnitude of total vegetation area effects is a key consideration for all the vegetation effects assessments and significance determinations —how much vegetation will be lost due to Project activities. No published thresholds exist to define a significant versus not significant effect on vegetation or ecosystems in the Yukon. The Project assessment used a qualitative definition of significance, based on available data and professional judgement (**Table 7-12**).

Table 7-12. Determination of Significance

Characterization	Definition
Not Significant	The residual effect is not expected to result in a change to ecosystems that could alter the viability or persistence of those ecosystems within the RSA.
Significant	The residual effect may result in a change to ecosystems that could alter the viability or persistence of those ecosystems within the RSA. (i.e., where it is not sustainable or is unavailable to contribute to biodiversity and ecosystem function).

With a low magnitude effect, less than 4% of any given assessed ecosystem predicted to be affected, the majority of the Project effects constituting alteration (through removal of trees and tall shrubs) rather than complete removal (clearing and grubbing of all vegetation), and the prediction that LIS Project Footprints

(the vast majority of the Project Footprint) will experience natural succession, the predicted residual effects of the Project on the vegetation VESEC are not expected to result in a change in ecosystem units within the RSA to the point where they are no longer regionally viable or persistent. Therefore, the residual effect is on vegetation is **not significant**.

7.6 CUMULATIVE EFFECTS ASSESSMENT

7.6.1 Approach

Project-related residual effects with the potential to interact cumulatively with the residual effects of reasonably foreseeable projects and activities identified within or extending into the Cumulative Effects Study Area (CESA) are:

- loss or alteration of Wet Shrub Tamarack ecosystems; and,
- loss or alteration of ecosystems of conservation concern.

The spatial boundaries of the cumulative effects assessment for the vegetation VESEC are delineated by the CESA as described in **Section 3.1.6.1.1**. Projects and activities outside the CESA, with potential effects within this area, were also included in this assessment. Temporal boundaries for assessing cumulative effects encompass past, present, and reasonably foreseeable future activities spanning the Project's lifespan.

7.6.2 Cumulative Loss or Alteration of Wet Shrub Tamarack Ecosystems

The assessment of the cumulative effect on Wet Shrub Tamarack ecosystems used the indicator of total surface disturbance (area [km²] and %) from anthropogenic footprints (e.g., mineral exploration, oil and gas) disturbed by the footprints for its characterization. Present conditions include a total area of 31.3 km² (0.3%) disturbed by past and present projects and activities within the CESA (**Table 7-13**). This is predicted to increase in the future by 0.2 km² (0.0%) following the inclusion of reasonably foreseeable projects and activities. The Project is expected to increase the amount of disturbed area over the existing conditions by a maximum of 47.9 km² (0.4%) within the CESA, resulting in a maximum disturbed area of 79.4 km² (0.7%) when combined with past, present, and reasonably foreseeable projects and activities.

Table 7-13. Cumulative Loss or Alteration of Wet Shrub Tamarack Ecosystems

Cumulative Effect Indicator	Condition	Cumulative Effects Study Area
Total Surface Disturbance (Footprints)	Present	31.3 km² (0.3%)
	Project	47.4–47.9 km² (0.4%)
	Future	0.2 km² (0.0%)
	Total Cumulative Effect	78.9–79.4 km² (0.7%)

A summary of the characterization of cumulative effect of the loss or alteration of Wet Shrub Tamarack ecosystems is provided in **Table 7-14**. It is predicted that <1% of the Wet Shrub Tamarack ecosystems present within the CESA may be affected by the Project and other projects and activities, and therefore the cumulative effect is negligible. The likelihood of the effect is probable due to the spatial uncertainty in the location of the Project and other projects and activities relative to Wet Shrub Tamarack ecosystems. The

geographic extent of this cumulative effect is expected to be beyond regional as the alteration of Wet Shrub Tamarack ecosystems is expected to occur throughout the CESA (beyond the RSA). The duration of the effect is expected to occur over the long-term due to the length of time required for Wet Shrub Tamarack ecosystems to regenerate following disturbance and reclamation. The frequency of the alteration of Wet Shrub Tamarack ecosystems is expected to be regular and, therefore, periodic. The timing of the effect is expected to occur year-round as the Project, in combination with other projects and activities, is anticipated to occur throughout the year. Regeneration of Wet Shrub Tamarack ecosystems is predicted to occur over time once many activities cease, and therefore is assessed as reversible.

Table 7-14. Characterization of Cumulative Loss or Alteration of Wet Shrub Tamarack Ecosystems

Criterion		Rating	Rationale
Magnitude		Negligible	The change in the relative availability of Wet Shrub Tamarack ecosystems across the CESA is < 1%.
Likelihood		Probable	Mitigation measures are expected to minimize but not eliminate the potential for the cumulative effect (i.e., anticipated vegetation clearing). Due to the uncertainty in the spatial location of the Project and other projects and activities, there is potential to avoid adverse effects on the vegetation indicators during detailed layout.
Geographic Extent		Regional	The effect is expected to occur throughout the CESA.
Duration, Frequency & Timing	Duration	Long-term	Wet Shrub Tamarack ecosystems can take many years to regenerate post-disturbance and could extend beyond the lifespan of the Project, but it is likely to recover to baseline over time.
	Frequency	Periodic	Vegetation alteration is expected to occur for the Project and other projects and activities as part of the assessment. The effect is anticipated to occur at regular intervals.
	Timing	Year-round	The effect may occur year-round due to the anticipated varying temporal nature of the Project and other projects and activities.
Reversibility		Reversible	The regeneration of Wet Shrub Tamarack ecosystems is expected to reverse any alteration that occurs.

7.6.2.1 Context and Confidence

The CESA is a Zone IV IMA in the North Yukon and Peel Watershed Planning Regions with which it overlaps. In these areas with diminished ecological and cultural values in a moderately sensitive biophysical setting, Zone IV IMAs allow for the highest level of development. The effects characterization is consistent with the objectives of existing Land Use Plans, and there is relatively high confidence that effects were accurately captured in the assessment.

The Level of Confidence in this prediction is High (**Table 7-15**). The effect of the alteration of Wet Shrub Tamarack ecosystems on vegetation is known, and the efficacy of mitigation measures has been supported through application on previous projects.

Table 7-15. Context and Confidence for Cumulative Effects of Loss or Alteration of Wet Shrub Tamarack Ecosystems

Criterion	Rating	Rationale
Context	Highest Development	The Project occurs within the IMA Zone IV Management Unit, designated as the highest level of disturbance.
Confidence	High	Mitigation measures are predicted to effectively minimize or eliminate the alteration of Wet Shrub Tamarack ecosystems. Therefore, there is high confidence in the characterization of cumulative effects and its persistence.

7.6.3 Cumulative Loss or Alteration of Ecosystems of Conservation Concern

The assessment of the cumulative loss or alteration of ecosystems of conservation concern used the indicator of total surface disturbance (area [km²] and %) from anthropogenic footprints (e.g., mineral exploration, oil and gas) disturbed by the footprints for its characterization. Present conditions include a total area of 82.5 km² (0.7%) disturbed by past and present projects and activities within the CESA (**Table 7-16**). This is predicted to increase in the future by 1.9 km² (0.0%) following the inclusion of reasonably foreseeable projects and activities. The Project is expected to increase the amount of disturbed area over the existing conditions by a maximum of 99.3 km² (0.9%) within the CESA, resulting in a maximum disturbed area of 183.8 km² (1.6%) when combined with past, present, and reasonably foreseeable projects and activities.

Table 7-16. Cumulative Loss or Alteration of Ecosystems of Conservation Concern

Cumulative Effect Indicator	Condition	Cumulative Effects Study Area
Total Surface Disturbance (Footprints)	Present	82.5 km² (0.7%)
	Project	98.2–99.3 km² (0.9%)
	Future	1.9 km² (0.0%)
	Total Cumulative Effect	182.6–183.8 km² (1.6%)

A summary of the characteristics of the cumulative effects on the loss of habitat is provided in **Table 7-17**. For all ecosystems of conservation concern, there is expected to be a change of <2% of their total availability across the CESA, resulting in a low magnitude effect. The likelihood of the cumulative effect is probable due to the spatial uncertainty in the location of the Project and other projects and activities relative to the assessed ecosystems. The cumulative effect is predicted to extend beyond the the RSA, with the effect occurring throughout the CESA. The duration of the effect is expected to occur over the long-term due to the length of time required for some of the assessed ecosystems to regenerate following disturbance. The frequency of the loss of habitat is expected to be periodic, with habitat loss occurring regularly. The timing of the effect is expected to occur year-round as projects and activities within the CESA are expected to result in the loss of habitat throughout the year. Regeneration of ecosystems of conservation concern is predicted to occur over time once many activities cease, and therefore is assessed as reversible.

Table 7-17. Characterization of Cumulative Loss or Alteration of Ecosystems of Conservation Concern

Criterion		Rating	Rationale
Magnitude		Low	The loss in the ecological communities across the CESA is < 2%.
Likelihood		Probable	Mitigation measures are expected to minimize but not eliminate the potential for a loss of habitat. Due to the uncertainty in the spatial location of the Project and other projects and activities, the effect is not certain, resulting in a probable rating.
Geographic Extent		Regional	Change in habitat quality is expected to occur across the CESA due to the location of the projects and activities.
Duration, Frequency & Timing	Duration	Long-term	Old forest and other ecological communities can take many years to regenerate following disturbance and extend beyond the Project's lifespan but are likely to recover to baseline over time.
	Frequency	Periodic	Vegetation clearing is expected to be required for the Project and other projects and activities. Clearing is expected to occur regularly.
	Timing	Year-round	Habitat loss is expected to occur year-round as a result of the projects and activities considered in this assessment.
Reversibility		Reversible	The regeneration of vegetation is expected to be reversible over time.

7.6.3.1 Context and Confidence

The CESA is a Zone IV IMA in the North Yukon and Peel Watershed Planning Regions with which it overlaps. In these areas with diminished ecological and cultural values in a moderately sensitive biophysical setting, Zone IV IMAs allow for the highest level of development. The effects characterization is consistent with the objectives of existing Land Use Plans, and there is relatively high confidence that effects were accurately captured in the assessment.

The Level of Confidence in this prediction is High (**Table 7-18**). The effect of loss or alteration of ecosystems of conservation concern is known, and the efficacy of mitigation measures has been supported through application on previous projects.

Table 7-18. Context and Confidence for Cumulative Effects of Loss or Alteration of Ecosystems of Conservation Concern

Criterion	Rating	Rationale
Context	Highest Development	The Project occurs within the IMA Zone IV Management Unit, designated as the highest level of disturbance.
Confidence	High	Mitigation measures are predicted to be effective at minimizing or eliminating habitat loss of ecosystems of conservation concern. Therefore, there is high confidence in the characterization of cumulative effects and its persistence.

8 WILDLIFE AND WILDLIFE HABITAT

This section assesses the Project's effects on wildlife, following the general methods approach and concepts described in Section 3 Methods. The assessment includes identifying Project interactions and effects, proposed mitigation to reduce and manage potential effects, characterization of residual Project and cumulative effects, and significance determination. Monitoring and follow-up programs to assess the effectiveness of mitigation measures and the accuracy of the predicitions in the assessment, and unforeseen Project-related effects are also described where appropriate.

The Wildlife and Wildlife Habitat Valued Environmental and Socio-Economic Components (VESECs) and the rationale for their selection are provided in Table 3-1 in Section 3. Wildlife and Wildlife Habitat VESECs include:

- American marten (marten);
- moose; and,
- birds.

The indicators and parameters used for determining a Project-related change on the Wildlife and Wildlife Habitat VESECs are presented in **Table 3-2** of **Section 3** and include habitat change and mortality risk for marten, moose, and birds.

8.1 WILDLIFE ASSESSMENT METHODS

Methods used in the wildlife assessment align with established guidance for an environmental assessment process in the Yukon and Canada. The wildlife assessment methods follow the general methods noted in **Section 3**. Characteristics that require more specification for the wildlife assessment are stated below.

The Regional Study Area (RSA, described in **Section 3, Table 3-3)** is also the Regional Assessment Area for marten, moose, and birds.

The indicators and assessment parameters for marten, moose, and birds are those identified in **Table 3-2** of **Section 3**: change in habitat and mortality risk. For each marten, moose, and birds, the assessment indicators and parameters and reasons for using them are described in detail in those species' sections.

The potential Project interactions and effects are described, and justification provided for each of the wildlife VESECs.

A table summary of mitigation measures specific to each of the wildlife VESECs is provided in each of the species sections. Similar mitigation measures are used for moose and marten for Project activities but different measures may be used for birds as Project activities occur primarily while birds are outside of the RSA (i.e., have migrated south out of the RSA).

8.1.1 Approach

Characterizing the residual adverse effects on wildlife and wildlife habitat considers the Project's potential effects and the mitigation measures used to minimize those potential effects. The spatial boundary of effects characterization was the RSA. Residual effects on wildlife and wildlife habitat have each been characterized

in terms of magnitude, likelihood, geographic extent, duration, timing, frequency, and reversibility (**Table 8-1**). Determining residual effects on wildlife and wildlife habitat considered the context of the highest development (conforms to Regional Land Use Plans) and the confidence in accurately quantifying and predicting those residual effects. The significance of all residual effects (after mitigation measures are applied) is assessed collectively to determine the overall residual effect of the Project on wildlife and wildlife habitat (**Sections 8.2.5, 8.3.5, 8.4.5**).

Table 8-1. Definitions of Effects Criteria Classifications for the Assessment of Wildlife and Wildlife Habitat in the Eagle Plains Exploration Project

Criterion		Rating	Definition
Magnitude		Negligible	No measurable change from existing conditions. This corresponds to a <1% change in an assessment indicator.
		Low	The residual effect will be a slight, but measurable change from existing conditions. This corresponds to a 1–10% change in an assessment indicator.
		Moderate	The residual effect will be a measurable change from existing conditions but will not affect the sustainability of wildlife and wildlife habitat. This corresponds to a 11–35% change in an assessment indicator.
		High	The residual effect will be a substantial, measurable change from existing conditions that may affect the sustainability of wildlfie and wildlife habitat. This corresponds to a >35% change in an assessment indicator.
Likelihood		Unlikely	A residual effect is not expected, but a residual effect is not impossible.
		Possible	A residual effect may occur but is not likely.
		Probable	A residual effect is likely to occur, but it is not certain.
		Certain	A residual effect will occur.
Geographic Extent		Maximum disturbance footprint	The residual effect is confined to the maximum disturbance footprint.
		Local	The residual effect is confined to the Local Study Area.
		Regional	The residual effect is confined to the Regional Study Area.
		Beyond regional	The residual effect extends beyond the Regional Study Area.
Duration, Frequency and Timing	Duration	Short-term	The residual effect duration is less than a year (e.g., days, months)
		Medium-term	The residual effect duration is more than a year and up to the life of the Project (e.g., years).
		Long-term	The residual effect duration is beyond the life of the Project (e.g., decades).
		Permanent	The residual effect is predicted to be permanent and thus unlikely to recover to existing conditions.
	Frequency	Occasional	The residual effect may occur rarely (e.g., once or a few times over the life of the Project).

Criterion		Rating	Definition
		Periodic	The residual effect may occur consistently at regular intervals or associated with temporal events (e.g., during spring freshet, low flows, growing season).
		Continuous	The residual effect may occur all the time.
	Timing	Year-round	The residual effect may occur year-round.
		Seasonal	The residual effect may be confined to a portion of the year.
Reversibility		Reversible	The residual effect is predicted to be reversible within a clearly defined period.
		Irreversible	The residual effect is predicted to influence the assessment indicator indefinitely.

A broader discussion and review of literature on the topic of the magnitude of habitat disturbance thresholds for wildlife in the context of environmental assessment was part of the review of the Jay Pipe Expansion Project in the Northwest Territories (Dominion Diamond 2014). That assessment provided a review of the scientific literature and showed that the literature does suggest a tolerance of a relatively high levels of disturbance by wildlife before a response to habitat effects. The citations below elaborate on some of those citations and provide relevant updated citations.

Swift and Hannon (2010) provide a meta-analysis of simulation and empirical small-scale (e.g., fungus and some insect habitat) and large-scale (e.g., birds and some mammals) studies on habitat pattern and habitat loss factors that lead to potential population-level effects. Their findings on habitat disturbance ranged broadly before a population-level effect was noted:

- **Simulation Studies** — **"**The threshold levels range across nearly the entire continuum of habitat proportion, from about 1 to 99% (though most fall between 10 and 50%)" [habitat remaining].
- **Empirical Small-Scale** — 20–40%, range from 20–100% habitat remaining.
- **Empirical Large-Scale** — 20%, 10–30% habitat remaining (e.g., effects noted at 70–90% habitat loss).

Regardless of the discussion above, Chance will consider disturbance >35% on high and moderate-suitability habitat (suitable habitat) within the RSA as a high magnitude effect. However, a >35% magnitude effect alone does not suggest a "significant" effect (i.e., measurable effect on population), as noted in the discussion above.

8.1.2 Wildlife Data Limitations

- There have been no site-specific marten or moose studies conducted in the RSA. Their occurrence, abundance, and distribution are inferred from nearby studies or similar habitat conditions. Bird information was limited to data collected on-site during one breeding season and information inferred from relevant studies on the same or similar species in similar habitats.

- No primary traditional knowledge information was collected for the wildlife assessment. Sources of traditional knowledge were limited to publicly available secondary sources cited in the baseline reports and assessment where appropriate.
- There are few studies on marten, moose, and birds in response to the proposed activities in the context of Eagle Plains' environmental conditions.

8.1.3 Input from Engagement on the Wildlife Assessment

- Marten was included as a VESEC because the Project overlaps with two trapping concessions, and the importance of the RSA to trappers (as it is associated with traditional lifestyle) was raised as an issue during community engagement (**Section 2.98**).
- Moose was included as a VESEC because the Project overlaps with moose habitat, and moose harvest (as it is associated with subsistence harvest) was raised as an issue during community engagement (**Section 2.98**).
- The Project's potential effects on birds were not explicitly raised as a concern during community engagement.
- Grizzly Bear was noted as another species that could occur in the RSA. While Chance acknowledges that Grizzly Bear were noted as important, as noted in **Section 3**, Grizzly Bear was not brought forward as a VESEC as there is little to no expected interaction with the proposed winter activities, and limited, intermittent interaction with individuals during seismic recording in the summer.

8.2 MARTEN

Marten was selected as a VESEC for the assessment of the Project due to their value as a furbearer to the Vuntut Gwitchin First Nation and to assess the potential Project effects on trapping resources (**Section 2.9.8**). The RSA occurs in the boreal taiga, at the northern limit of marten range (Buskirk and Ruggiero 1994, Yukon Ecoregions Working Group 2004). While marten occur over a contiguous range across northern North America from Labrador to Alaska (Snyder and Bissonette 1987, Buskirk and Ruggiero 1994, Drew 1995, Paragi et al. 1996), less is known about their basic ecology in northern boreal forest and taiga ecosystems than elsewhere (Latour et al. 1994). In more productive forests to the south, marten are often associated with mature forest structures, such as large trees, snags, and coarse woody debris (CWD; Buskirk and Ruggiero 1994, Thompson et al. 2012). Marten have not been assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) for Federal listing.

The primary threat to marten populations is the fragmentation of mature and old-growth coniferous forests and the removal of large snags and coarse woody debris (Moriarty et al. 2011, Delheimer et al. 2019). However, there is some evidence that in northern boreal forests, marten exploit structural stages with short, stunted trees that are sparsely distributed (Latour et al. 1994, Paragi et al. 1996). Therefore, habitat selection patterns for marten in northern boreal and taiga ecosystems can differ from those described elsewhere in North America (Pretzlaw 2006), and this assessment was conducted in the relative context of this northern setting. The Project's baseline studies involved quantifying living habitat within the RSA using a habitat suitability index model (**Appendix 8-A**). Habitat values were assigned a suitability ranking of high, moderate, low, or very low/nil, relative to the range of habitat quality across the RSA. The majority of the RSA is comprised of Low-quality habitat (59.7%), followed by Moderate-quality habitat (23.1%), and a

limited amount of High-suitability habitat (15.9%) with Nil areas only accounting for approximately 1.3% (**Table 8-2**). The model indicated a mosaic of High, Moderate, and Low-quality marten habitat across the RSA, but with Moderate-quality habitat being widespread across the RSA.

Concentrations of High-suitability habitat were within the Enterprise and Dalglish creek watersheds in the south, a band running east-west north of the Dempster Highway, and the western part of the northern half of the RSA. High and Moderate-quality habitat is also concentrated in narrow strips of mature/old riparian forests along some of the major watercourses in the RSA, including Chance and Greaves creeks in the northwest and McParlon Creek west of the Dempster Highway.

8.2.1 Assessment Indicators and Parameters

The potential effects on marten include a change in habitat and mortality risk that may result from interactions with the Project. Marten movements are not anticipated to be affected by the Project's narrow seismic and infrequent encounters with well pads on a measurable scale. The effect of change in habitat was assessed quantitatively using a habitat suitability model, and mortality risk was evaluated qualitatively.

8.2.2 Project Interactions and Potential Effects

This subsection characterizes interactions between the Project and marten and describes the potential adverse effects.

8.2.2.1 Interactions

Interactions between marten and Project-related activities and components may result in a change in habitat (i.e., the direct loss of habitat and the indirect alteration of adjacent habitat) and mortality risk. Consequently, the potential effects of the interactions are carried forward into the assessment of the summary evaluation in this section. **Table 8-2** summarizes the potential interactions, and those interactions and effects are discussed in more detail below.

Table 8-2. Expected Interactions Between Marten and Project and the Resulting Potential Effects

Project Component / Activity	Change in Habitat	Mortality Risk
Engagement	0	0
Seismic Exploration	2	0
Drilling Exploration	2	0
Extended Flow Testing (EFT)	2	0
Well Maintenance (Workovers)	2	0
Access Roads	2	2
Mix Bury Cover (MBC) Construction and Operation	2	0
Central Processing Facility (CPF)	2	0
Airstrip Use	2	0
Water Withdrawal	2	0

Project Component / Activity	Change in Habitat	Mortality Risk
Transportation	2	2
Camp Use	2	1
Reclamation and Closure	2	1

Notes:
0 = no interaction
1 = minor interaction with marten is possible, but small immeasurable effect (e.g., possible slight behavioural response, no vegetation effects, no measurable effect on water quality). Designates a summary of effects addressed in the effects assessment as a discussion. This rating does not lead to the characterization of residual effects.
2 = substantial interaction with marten, designates a more detailed assessment of potential effects. Carry forward into residual effects characterization.

8.2.2.2 Change in Habitat

The construction of Project components (e.g., seismic lines, well pads, camp, and winter access roads) necessitates vegetation clearing within the Project footprint, potentially leading to direct habitat loss. Each work area is anticipated to require vegetation clearing once at the start of activity within the specific work area. The assessment of the effect, change in habitat, encompasses the entire operational period of the Project (i.e., 10 years).

Marten appear to respond to moderate habitat loss and fragmentation levels and can become absent from the landscape if the non-forest cover is >25% (Chapin et al. 1998, Hargis et al. 1999). Sensory disturbances associated with human activity, construction activity, and anthropogenic features (e.g., seismic lines) can also affect marten behaviour and habitat use (Zielinski et al. 2008, Siren 2013, Tigner et al. 2015, Slauson et al. 2017).

Vehicles and resource roads may result in sensory disturbances up to 50 m, and marten may avoid crossing active linear features over 13 m wide (Katnik 1992, Zielinski et al. 2008, Slauson et al. 2017). Additionally, marten avoid using seismic lines ≥3 m wide, increasingly avoid areas corresponding with increasing seismic line density, and completely avoid areas with a seismic line density of 20.8 km/km² (Tigner et al. 2015). Marten will use seismic lines ≤2 m wide and seismic lines ≥6 m, supporting at least some regeneration (Tigner et al. 2015).

Marten may decrease their use of suitable habitat in response to increasing human activity, up to complete avoidance in areas with high activity, with females more sensitive to human activity than males (Slauson et al. 2017). Marten may reoccupy suitable habitat within several months of the ending of human activity (Siren 2013, Slauson et al. 2017). Similarly, marten may gradually increase their use of suitable habitat following the end of a project's construction activity and the start of operations, although at lower levels than pre-construction (Siren 2013).

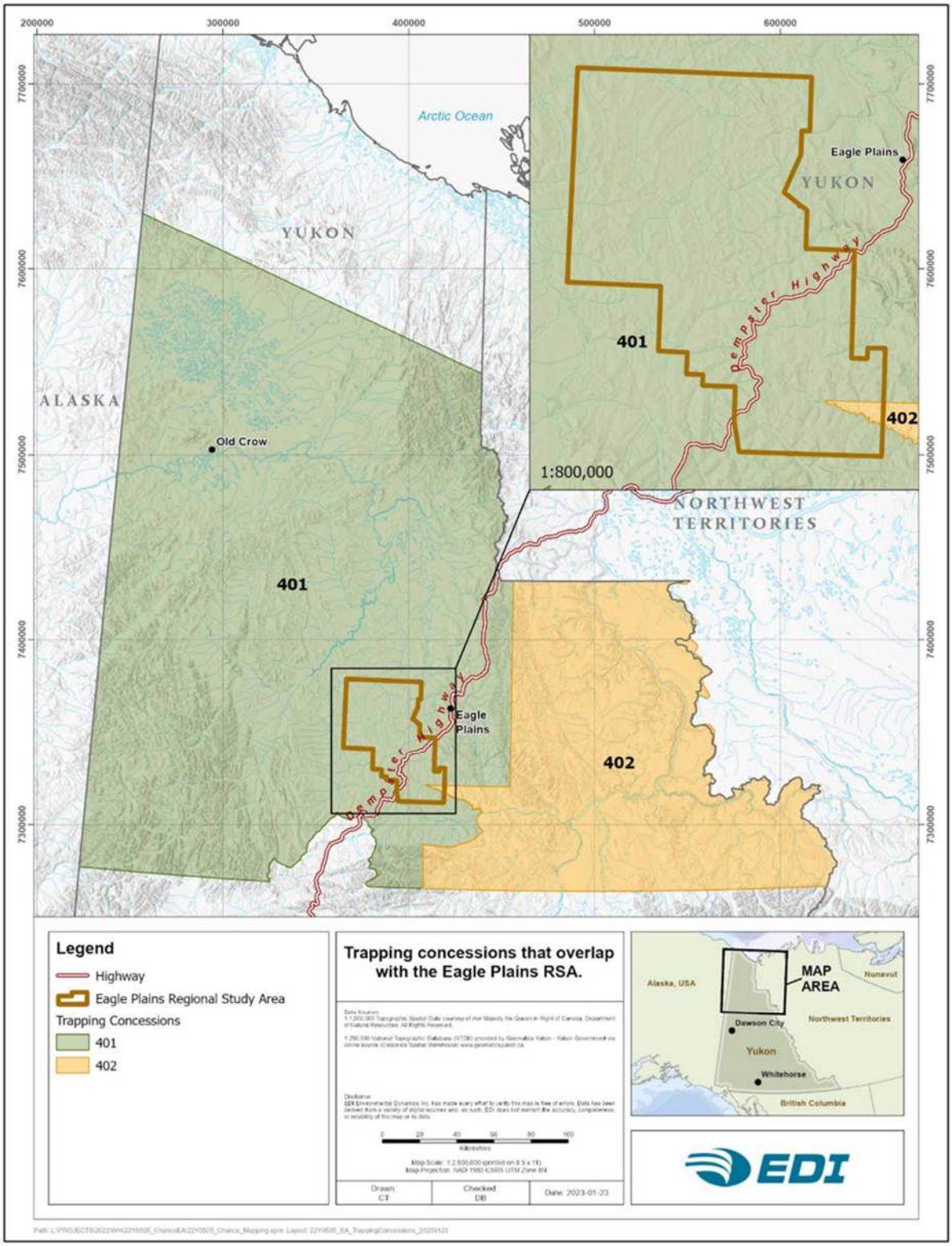
8.2.2.3 Change in Mortality Risk

Facilitating improved access for trapping and vehicle collision mortality are expected to be the primary sources of mortality risk from Project-related activities. Trapping can account for up to 90% of mortality in heavily trapped areas, whereas natural predation is the primary source of mortality in untrapped areas (Hodgman et al. 1994, 1997). Anthropogenic mortality can be compensatory with natural mortality in areas with sustainable marten harvest (Hodgman et al. 1994, Belant 2007).

Low reproductive rates and ease of trapping can make marten vulnerable to overharvesting in areas with easy road access (Hodgman et al. 1994). Increasing the number and density of roads can improve trappers' access, potentially increasing trapping effort and associated mortality risk for marten (Hodgman et al. 1994, Wiebe et al. 2013). Populations may decline if female survival, reproductive output, or immigration cannot compensate for high mortality rates (Hodgman et al. 1994).

In the Yukon, marten harvest is monitored via self-reporting by trappers within a concession. It is not directly monitored at the population level except in the Marten Conservation Area in the southern Yukon (Yukon Department of Environment 2022). Trapping quotas are used to build sustainable populations of marten in areas where overharvesting has been a concern (i.e., in the Marten Conservation Area) but not elsewhere, where trapping mortality is presumed to be sustainable (Slough and Smits 1985).

Marten were the most heavily trapped species (i.e., 715 reported harvested between 2012 – 2018) in the two group trapping concessions (401, 402) that overlap the RSA (**Map 8-1**). However, the annual marten harvest can vary considerably (i.e., 240 marten were harvested in 2015 compared to 0 harvested the following year), and the average annual harvest equals approximately one marten for every 847 km² of the combined concessions (**Figure 8-1**). A Yukon population density estimate of 0.6 marten/km² suggests that the number of harvested marten within the concessions is minimal compared to the overall population (Archibald and Jessup 1984).



Map 8-1. Trapping Concessions that Overlap with the Eagle Plains Regional Study Area

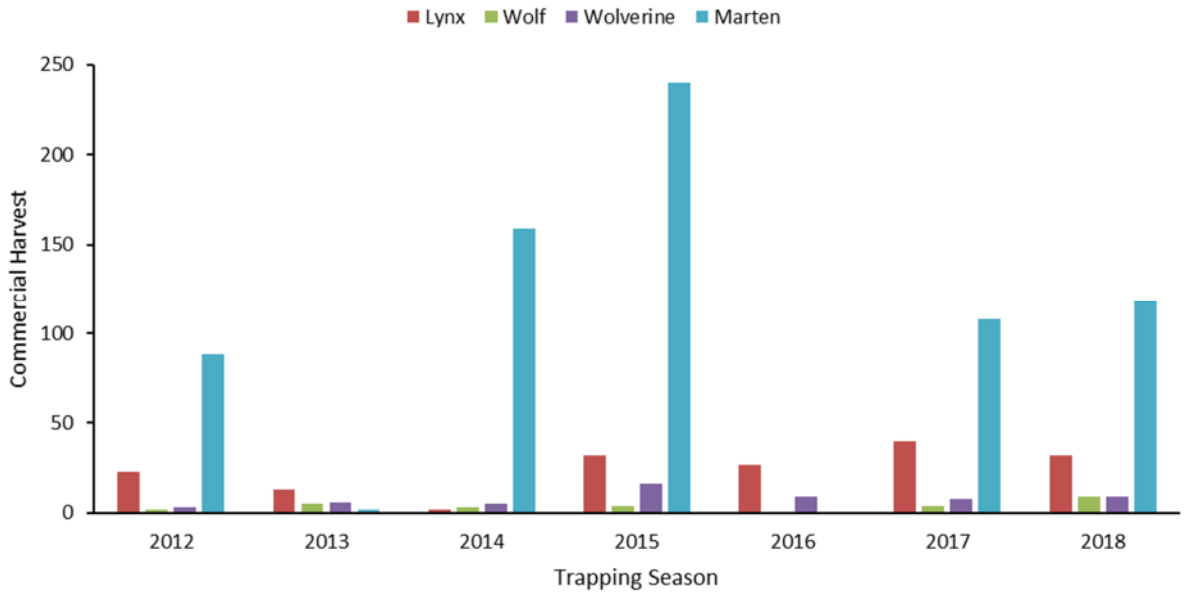


Figure 8-1. Commercial Harvest Returns for Group Trapping Concessions Overlapping the Regional Study Area for which Records were Available (Wall and Pinard 2023)

8.2.3 Mitigation Measures

Mitigation measures to avoid and minimize changes to marten habitat and mortality risk will be implemented as part of the Project design and during Project operations. Some mitigation measures may broadly apply to other wildlife species and other VESECs.

Mitigation measures to address both potential effects encompass several strategies, including:

- Minimizing the spatial extent of the Project and keeping activities (e.g., equipment use) within the Project footprint boundaries;
- Restrict most work activities to the winter aims to avoid when marten are denning with young;
- Increase the awareness of environmental and wildlife concerns through the development of a mandatory environmental orientation and policies for on-site personnel (e.g., use of wildlife reporting card, prohibition on pets); and
- Develop comprehensive plans addressing harmful substances, waste management, and traffic.

To the greatest extent possible, the environmental constraints mapping (**Section 3.3.2**) was used to avoid placing Project components (e.g., seismic lines, access roads) in suitable marten habitat. However, overlap with a small extent of suitable marten habitat is expected. To minimize and avoid changes in marten habitat and potential marten mortality, the Project will:

- retain potential denning trees (i.e., trees >30 cm in diameter at breast height with existing cavities or signs of decay) and coarse woody debris during vegetation clearing in suitable marten habitat where possible; and,
- to minimize changes to marten habitat and facilitate natural regeneration limit the clearing of vegetation to a height of 0.1 m high, except at the drill hole location and MBC sumps where

grubbing will occur, and to larger stumps along winter access roads to improve snow packing and subsequent safe driving conditions.

Snowbanks along road edges resulting from snow removal operations can create conditions that may hinder marten escape from access roads and increase mortality risk from vehicle collisions. Maintaining appropriately sized gaps in roadside snowbanks is expected to facilitate wildlife crossing, escape, and minimize mortality risk. Seismic lines are expected to decrease suitable marten habitat and the potential for increased facilitated trapping pressure. To reduce and avoid changes in marten habitat, the Project will:

- minimize line widths using Low Impact Seismic (LIS);
- use LIS in winter with snowpack that is expected to promote natural regeneration when Project activities are complete in a work area; and,
- maintain coarse woody debris along seismic lines, where possible.

Table 8-3 summarizes mitigation measures relevant to marten, organized by potential effect.

Table 8-3. Mitigation Measures Relevant to Marten and the Eagle Plains Exploration Project

Mitigation Measure	Potential Adverse Effect
Avoid or minimize the overlap of Project components with suitable marten habitat	Change in Habitat, Mortality Risk
Minimize the spatial extent of new components by using existing infrastructure (e.g., access roads, winter trails, seismic lines) wherever feasible	Change in Habitat, Mortality Risk
Delineate the Project footprint boundaries and restrict equipment use to within the defined areas	Change in Habitat, Mortality Risk
Conduct pre-clearance wildlife feature sweeps in suitable marten denning habitat before vegetation clearing and grubbing	Change in Habitat, Mortality Risk
Create and maintain species-specific no-work buffers around sensitive wildlife habitat features	Change in Habitat, Mortality Risk
Use winter access roads for Project-related activities to the extent practicable	Change in Habitat, Mortality Risk
Use buses or vans for transporting employees, visitors, and contractors as much as practical to reduce Project-related traffic	Change in Habitat, Mortality Risk
Prohibit workers from having domestic pets within the RSA	Mortality Risk
Prohibit workers, visitors, or contractors from feeding or harassing wildlife within the maximum disturbance footprint	Mortality Risk
Implement a wildlife orientation for all site personnel. The orientation will include information about potential Project effects on water, fish, vegetation and wildlife, potential wildlife crossings, wildlife mitigation measures, and waste management policies that limit human-wildlife interactions	Change in Habitat, Mortality Risk
Require workers to report all marten observations through a logbook or information directly passed to the on-site environmental lead	Change in Habitat, Mortality Risk
Develop a plan to prevent deleterious substances from entering a water body	Mortality Risk
Maintain all machinery on site in a clean condition and free of fluid leaks	Mortality Risk
Wash, refuel and service machinery in upland areas in such a way as to prevent any deleterious substances from entering a water body	Mortality Risk

Mitigation Measure	Potential Adverse Effect
Store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering a water body	Mortality Risk
Establish a spill response plan with the following key mitigation measures: • report all spills as soon as possible when a deleterious substance enters a water body; • install containment measures around the spill; and, • collect and dispose of contaminated water or soil substrates using an emergency spill kit and other necessary spill response measures. Disposal will be at approved disposal facilities.	Change in Habitat, Mortality Risk
Directed lighting or light shielding at well sites and camps, rather than broad lighting, to focus lighting toward the ground in work areas	Change in Habitat
Allow for the regeneration of natural vegetation following the cessation of exploration in a work area	Change in Habitat
Clear vegetation for winter access roads down to the shrub level only (0.1 m in height)	Change in Habitat
Limit grubbing activities (i.e., removal of groundcover) to the drill hole location and the MBC sumps	Change in Habitat
Develop and implement an erosion and sediment control plan to prevent the introduction of sediment into any water body during all phases of the Project, undertakings and activities	Change in Habitat
Install erosion and sediment control measures, where appropriate, before beginning works, undertakings and activities	Change in Habitat
Maintain and inspect erosion and sediment control measures and structures regularly during all phases of the works, undertakings and activities	Change in Habitat
Keep the erosion and sediment control measures in place until all disturbed ground has been stabilized, then remove all erosion and sediment control materials (unless biodegradable)	Change in Habitat
Keep organic layers intact (i.e., limit grubbing and vegetation removal) wherever possible	Change in Habitat
Operate machinery on land in stable, dry areas	Change in Habitat
Monitor waterbodies regularly for signs of sediment entry during all phases of the works, undertakings and activities and take corrective action	Change in Habitat
Use biodegradable erosion and sediment control materials whenever possible	Change in Habitat
Minimize source line widths to 2.75 m and receiver line widths to 1.75 m and the total length of lines as much as possible (i.e., use as wide a spacing distance between lines as possible)	Change in Habitat
Maintain coarse woody debris along linear features where possible	Change in Habitat
Post and enforce a speed limit of 50 km/hr on Project-related access roads	Mortality Risk
Implement a policy to minimize disturbance of wildlife on access roads, including providing wildlife with the right-of-way on roads, not using vehicles to entice wildlife to move off the road, and slowing or stopping until wildlife have cleared the road	Mortality Risk

Mitigation Measure	Potential Adverse Effect
Maintain appropriately sized gaps of 300 m in roadside snowbanks to facilitate wildlife crossing and escape	Mortality Risk
Implement an on-site policy prohibiting workers from shooting, trapping, hunting, and fishing within the RSA	Mortality Risk
Prohibit workers from having personal firearms within the RSA	Mortality Risk
Investigate all Project-related wildlife mortality and correct the root cause(s) through adaptive management where possible.	Mortality Risk

8.2.4 Effects Characterization

8.2.4.1 Approach

Residual effects on marten are characterized following those described in the Methods Section (**Table 8-1**), including consideration of magnitude, likelihood, geographical extent, duration, frequency, timing, reversibility, context, and confidence of the effect. The ratings and definitions for each residual effect characteristic are in **Table 8-1** and discussed explicitly in the relevant sections below.

8.2.4.2 Residual Change in Habitat Effects

The Project may affect the amount of suitable marten habitat in the RSA, resulting in a change in habitat abundance. The assessment of change in habitat considers the quantitative direct loss of marten habitat across the range of the 10 footprint scenarios and a qualitative assessment of the indirect alteration (e.g., sensory disturbances, edge effects, perceived barriers). Direct habitat loss was quantified by calculating the area of suitable marten habitat potentially lost to seismic, well pad and access road clearing within the RSA. The change in suitable habitat under each scenario was then compared with the amount of baseline suitable habitat for each rating category, resulting in a range of estimated changes in habitat for each rating (i.e., footprint scenarios − baseline).

Indirect effects from sensory disturbance can affect marten habitat use and may extend up to 50 m from areas of human presence and vehicle use. As a result, it is expected that marten may show short-term avoidance of areas with higher traffic levels and human presence. It is anticipated that this will be limited to small areas of the Project footprint due to the dispersed spatial and temporal activities of the Project and the limited amount of work outside of the winter. In addition, it is expected that marten will resume use of these areas following the ending of Project activities in an area, and the duration of the effect is predicted to be short-term.

After assessing the different footprint scenarios, it is expected that the Project will likely reduce the suitable marten habitat within the RSA (**Table 8-4**). High-quality habitat might decrease by up to 1.75%, and Moderate-quality habitat might decrease by 0.07%, with little to no difference among the well site scenarios.

Table 8-4. Change in Marten Habitat in the Eagle Plains Regional Study Area Based on Assessing the 10 Footprint Scenarios

Habitat Rating	Habitat Suitability Index Scores	**Baseline**		Footprint Scenarios (n = 10)		**Potential Change (n = 10)**	
		Area (ha)	Area (%)	Range (ha)	Range (%)	Range (ha)	Range (%)
High	>0.75 to 1.0	38,050	15.9	33,865to 33,886	14.2 to 14.2	−4,164 to −4,185	−1.7 to −1.8
Moderate	>0.50 to 0.75	55,202	23.1	55,037 to 55,064	23.1 to 23.1	−138 to −165	−0.1 to −0.1
Low	>0.25 to 0.50	142,485	59.7	137,243 to 137,271	57.5 to 57.5	−5,213 to −5,242	−2.2 to −2.2
Nil/Very Low	>0.0 to 0.25	3,016	1.3	12,563 to 12,586	5.3 to 5.3	9,548 to 9,570	4.0 to 4.0
Total		238,752	100.0				

Table 8-5 summarizes the residual effects characteristics and ratings, with rationale, for the predicted effects on habitat. High and moderate-rated marten habitat (i.e., suitable habitat) might decrease by up to 1.75% and 0.07%, respectively. Therefore, the magnitude of habitat change is low due to a <11% change in habitat from baseline conditions.

The Duration is expected to be long-term, as suitable habitat is anticipated to require 30–90 years to regenerate. However, sensory disturbances that may result in habitat alteration are expected to occur continuously throughout the life of the Project. Habitat loss is expected to occur as multiple irregular events as work areas change annually and clearing occurs in different areas of the seismic program.

Habitat alteration is expected to end following the completion of exploration and associated reclamation, and the regeneration of natural vegetation is expected to reverse the loss of habitat. Therefore, the potential residual effect on habitat and mortality risk is reversible.

Table 8-5. Characterization of Potential Project Effects on Marten Habitat

Criterion		**Rating**	**Rationale**
Magnitude		Low	The potential change in the amount of suitable habitat across the RSA is <11%. Vegetation clearing, including trees, is expected to be required for access roads and seismic lines.
Likelihood		Probable	Mitigation measures are expected to minimize but not eliminate the potential for change in habitat.
Geographic Extent		Local	Changes in habitat alteration due to Project-related sensory disturbances are predicted to be limited to the zone of influence (ZOI). Direct habitat loss is predicted to be limited to the maximum disturbance area.
Duration, Frequency and Timing	Duration	Long-term	A change in habitat is predicted to occur throughout the entire exploration period of the Project. However, affected habitat is expected to require 30 – 90 years to regenerate.

Criterion		Rating	Rationale
	Frequency	Continuous	Habitat loss will likely occur once in each work stage; however, habitat alteration through sensory disturbances is expected to occur continuously during the winter Project activities.
	Timing	Year-round	The residual effect of that vegetation clearing is predicted to remain year-round until vegetation has regenerated.
Reversibility		Reversible	The alteration of habitat is expected to end following the completion of exploration and associated reclamation. The regeneration of natural vegetation is expected to reverse habitat loss.

8.2.4.2.1 Context and Confidence

The RSA overlaps with the Zone IV Integrated Management Area (IMA) in the North Yukon and Peel Watershed Planning Regions. This zone is an area of diminished ecological and cultural values in a moderately sensitive biophysical setting and allows for the highest level of development. Cumulative effect indicators are used in both plans to determine if the current management and development are meeting the set goals and objectives. Two cumulative effects indicators included in the Plans are direct surface disturbance and linear density, with guidelines setting cautionary (0.75 km/km²) and critical (1.0 km/km²) indicator levels in both plans.

A network of linear features was previously created in parts of the RSA resulting from intermittent historical exploration activities. The Linear Feature Study (**Appendix 8-B**) determined the extent and characteristics of liner features in the RSA and addressed three objectives:

3. comprehensive mapping and classification of existing linear feature footprints within the RSA;
4. quantification of structural aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and,
5. quantification of regeneration pathways and structural stages of linear features.

This combined information supports assessing the Project's potential effects of linear features and refinement of mitigation measures for linear features to minimize possible effects. After accounting for natural features and regeneration, the adjusted linear feature density for the RSA was below the cautionary and critical indicator levels, at 0.52 km/km², in both regional land use plans.

The level of confidence in this prediction is Moderate (**Table 8-6**). The direct effects on marten habitat loss and alteration are documented in various studies, and the efficacy of mitigation measures has been supported through application on other and similar projects. However, there is some uncertainty in the specific context of those studies and the habitat conditions at Eagle Plains.

Table 8-6. Characterization of Context and Confidence in the Residual Project Effects on Marten Habitat

Criterion	Rating	Rationale
Context	Highest Development	The Project occurs within the IMA Zone IV Management Unit, designated as the highest level of disturbance.
Confidence	Moderate	Mitigation measures are expected to effectively avoid and minimize the changes in habitat; however, the uncertainty of the Project footprint results in Moderate Confidence in the residual effect prediction.

8.2.4.3 Residual Mortality Risk Effects

The Project may affect the risk of mortality for marten in the RSA and the assessment of this residual effect considers a qualitative assessment of the change in mortality risk. **Table 8-7** summarizes the residual effects characteristics and ratings, with rationale, for the predicted effects on mortality risk. Changes in mortality risk are expected to remain within baseline conditions given traffic controls and likely unrealized increased trapper access. Therefore, the magnitude of mortality risk is low due to likely unmeasurable changes from natural and pre-existing mortality risk conditions. Project-related access roads and seismic lines may facilitate trapping access within the RSA, therefore the geographic extent is Regional. The duration is expected to be medium-term, as changes to mortality risk are expected to occur continuously throughout the life of the Project.

Any changes in mortality risk are expected to end following the completion of exploration and associated reclamation. Therefore, the potential residual effect on mortality risk is reversible.

Table 8-7. Characterization of Potential Project Effects on Marten Mortality Risk

Criterion		Rating	Rationale
Magnitude		Low	The change in mortality risk is predicted to remain within natural variation.
Likelihood		Probable	Mitigation measures are expected to minimize but not eliminate the potential for mortality risk.
Geographic Extent		Regional	Changes in mortality risk are predicted to be associated with facilitated access to the RSA.
Duration, Frequency and Timing	Duration	Medium-term	A change in mortality risk is predicted to occur throughout the entire exploration period of the Project.
	Frequency	Continuous	Changes in mortality risk are expected to occur continuously during the winter Project activities.
	Timing	Winter	Project activities and disturbance is predicted to primarily occur in winter.
Reversibility		Reversible	Change in mortality risk is expected to end following the completion of exploration and associated reclamation.

8.2.4.3.1 Context and Confidence

The RSA overlaps with the Zone IV IMA in the North Yukon and Peel Watershed Planning Regions. This zone is an area of diminished ecological and cultural values in a moderately sensitive biophysical setting

and allows for the highest level of development. The level of confidence in this prediction is High (**Table 8-8**). The effect on marten mortality risk is documented and the efficacy of mitigation measures has been supported through application on other and similar projects.

Table 8-8. Characterization of Context and Confidence in the Residual Project Effects on Marten Mortality Risk

Criterion	Rating	Rationale
Context	Highest Development	The Project occurs within the IMA Zone IV Management Unit, designated as the highest level of disturbance.
Confidence	High	Mitigation measures are expected to effectively avoid and minimize mortality risk

8.2.5 Significance

- The potential change in high and moderate-quality marten habitat (<2%) is not expected to affect the long-term viability of the marten population within the RSA due to:
- The amount of anticipated habitat loss is below the level where marten populations become absent from a region (i.e., <25%);
- The timeframe until vegetation regeneration is predicted to occur and can become habitat; and,
- The amount of time Project activities may occur within an area and the length of time until marten usually reoccupy habitat.

As a result, the Project has been assessed as unlikely to change marten habitat or mortality risk to the point of altering their integrity within the RSA to the point where the regional marten population is unsustainable.. Therefore, the residual effects are **not significant**.

8.2.6 Cumulative Effects Assessment

8.2.6.1 Approach

Project-related residual effects on marten with the potential to interact with residual cumulative effects of past, present and reasonably foreseeable projects and activities within or extending into the Cumulative Effects Study Area (CESA) are:

- change in habitat; and,
- mortality risk.

The spatial boundaries of the Cumulative Effect Assessment (CEA) on marten are delineated by the CESA as described in **Section 3.1.6.1.1**. Projects and activities outside the CESA but with potential effects within this area were also included in this assessment. Temporal boundaries for assessing cumulative effects encompass past, present, and reasonably foreseeable future activities spanning the Project's lifespan (**Section 1.3.1**).

8.2.6.2 Cumulative Change in Habitat Effect

The assessment of the cumulative effect on marten used the indicator of total surface disturbance (area [km²] and percent [%]) from anthropogenic footprints (e.g., mineral exploration, oil and gas) disturbed by

the footprints for its characterization. Present conditions include a total area of 62.5 km² (0.6%) disturbed by past and present projects and activities within the CESA (**Table 8-9**). This is predicted to increase in the future by 1.2 km² (0.0%) following the inclusion of reasonably foreseeable projects and activities. The Project is expected to increase the amount of disturbed area over the existing conditions by a maximum of 69.5 km² (0.6%) within the CESA, resulting in a maximum disturbed area of 133.2 km² (1.2%) when combined with past, present, and reasonably foreseeable projects and activities.

The magnitude of cumulative change in habitat effects is low, as the total surface disturbance is <1% over existing conditions. The likelihood of the cumulative effect is probable due to mitigation measures minimizing but not eliminating the potential of the effect. The cumulative effect is expected to be regional in geographic extent, with changes in habitat occurring throughout the CESA as a result of projects and activities part of the assessment. The duration of the effect is expected to occur over the medium-term, as the effect is predicted to end following the completion of projects and activities in an area. The frequency of a change in habitat is expected to be continuous, as vegetation clearing is anticipated to occur occasionally, but its effects on habitat are predicted to continue until vegetation regenerates. The Timing of the effect is predicted to occur year-round as projects and activities within the CESA are expected to result in a change in habitat throughout the year. Over time, it is predicted that the regeneration of the affected habitat will likely occur following the completion of projects and activities, and it is anticipated to reverse the cumulative effect. A summary of the characteristics of the cumulative effects of change in habitat is provided in **Table 8-10**.

Table 8-9. Cumulative Change in Habitat Effects from Existing and Project-Related Disturbances on Marten

Cumulative Effect Indicator	Scenario	Cumulative Effects Study Area
Total Surface Disturbance (Footprints)	Present	62.5 km² (0.6%)
	Project	69.1–69.5 km² (0.6%)
	Future	1.2 km² (0.0%)
	Total Cumulative Effect	132.8–133.2 km² (1.2%)

Table 8-10. Characterization of Cumulative Change in Habitat Effects on Marten

Criterion		Rating	Rationale
Magnitude		Low	The change in habitat across the CESA is predicted to be <1% over existing conditions.
Likelihood		Probable	Mitigation measures are expected to minimize but not eliminate the potential for a change in habitat.
Geographic Extent		Regional	Change in habitat quality is expected to occur across the CESA due to the location of the projects and activities.
Duration, Frequency and Timing	Duration	Medium-term	The effect is expected to end following the completion of projects and activities in an area.
	Frequency	Continuous	Vegetation clearing required for projects and activities will likely occur occasionally, but the cumulative effect on marten is predicted to be continuous until vegetation regenerates.
	Timing	Year-round	The effect is expected to occur year-round due to changes in habitat remaining until vegetation regeneration.
Reversibility		Reversible	The regeneration of affected habitat is expected to be reversible over time.

8.2.6.2.1 Context and Confidence

The assessment of the cumulative change in habitat effects on marten considered the context of Regional Land Use Planning and the confidence in accurately quantifying and predicting those effects (**Table 8-11**). The characterization of effects is consistent with the Land Use Plans' objectives, and there is relatively high confidence that effects were accurately captured in the assessment. Some anthropogenic features may not have entirely been accounted for in the total disturbance calculation; however, there is a high degree of confidence that most disturbances were included. Therefore, the confidence in this CEA is high.

Table 8-11. Characterization of Context and Confidence in the Assessment of Cumulative Change in Habitat Effects on Marten

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	There is high confidence in characterizing the cumulative effect and its persistence. A precautionary approach was taken to quantify the change in habitat effect.

8.2.6.3 Cumulative Mortality Risk Effect

Cumulative mortality risk effects result from linear features across the landscape, with higher linear feature densities (km/km²) that can support facilitated predation of marten by human trappers. Therefore, linear feature density was used to assess cumulative mortality risk effects. Linear feature density was calculated as the total length of linear features divided by the size of the CESA.

Due to the Project, linear feature density is expected to increase by 2.2 km/km² in the CESA and between 0.0–2.3 km/km² in the trapping concessions overlapping the CESA relative to existing conditions. The maximum increase in linear feature density occurs due to the Project is approximately 25,090 km of additional linear features. A summary of the cumulative effect indicator for mortality risk effects is provided in **Table 8-12.**

The magnitude of the cumulative effect is predicted to be high due to the expected increase of >35% over existing conditions in the overall linear feature density. The cumulative effect is probable due to mitigation measures minimizing but not eliminating the Likelihood of the effect. The effect is anticipated to be regional in geographic extent, as it may occur throughout the CESA due to the projects and activities that were part of the assessment. The duration of the effect is expected to occur over the medium-term as risk is expected to end following the completion of projects and activities in an area. The frequency of mortality risk is anticipated to be continuous as conditions could exist within a given year that would facilitate trapping access along linear features. The timing of the effect is expected to occur year-round as projects and activities within the CESA are expected to result in mortality risk throughout the year. Over time, it is predicted that mortality risk will likely end following the completion of projects and activities in an area and will likely reverse the cumulative effect. A summary of the characteristics of the cumulative mortality risk effect is provided in **Table 8-13**.

Table 8-12. Cumulative Mortality Risk Effects from Existing and Project-Related Disturbances on Marten

Cumulative Effect Indicator	Condition	Cumulative Effects Study Area	Trapping Concession 387	Trapping Concession 401	Trapping Concession 402
Linear Feature Density	Present	0.8 km/km² (8,716.3 km)	0.4 km/km² (34.6 km)	0.8 km/km² (8,616.6 km)	0.2 km/km² (65.1 km)
	Project	2.2 km/km² (25,030.7–25,090.6 km)	0.0 km/km² (0.0 km)	2.3 km/km² (24,772.3–24,832.2 km)	0.6 km/km² (258.4 km)
	Future	0.0 km/km² (83.6 km)	0.0 km/km² (0.0 km)	0.0 km/km² (83.6 km)	0.0 km/km² (0.0 km)
	Total Cumulative Effect	3.0 km/km² (33,830.6–33,890.5 km)	0.4 km/km² (34.6 km)	3.1 km/km² (33,472.5–33,532.4 km)	0.8 km/km² (323.5–323.5 km)

Table 8-13. Characterization of Cumulative Mortality Risk Effects on Marten

Criterion		Rating	Rationale
Magnitude		High	The increase in linear feature density due to the Project is expected to be >35%.
Likelihood		Probable	Mitigation measures are expected to minimize but not eliminate mortality risk.
Geographic Extent		Regional	Changes in mortality risk are expected to occur across the CESA due to the location of the projects and activities.
Duration, Frequency and Timing	Duration	Medium-term	A change in mortality risk is predicted to end following the completion of projects and activities in an area.
	Frequency	Continuous	Conditions may exist that could lead to mortality risk occurring continuously along snow-packed linear features.
	Timing	Year-round	Mortality risk is expected to occur year-round.
Reversibility		Reversible	The mortality risk is expected to be reversible following the cessation of projects and activities.

8.2.6.3.1 Context and Confidence

The assessment of the cumulative mortality risk effects on marten considered the context of Regional Land Use Planning and the confidence in accurately quantifying and predicting those effects (**Table 8-14**). The characterization of effects is consistent with the Land Use Plans' objectives, and there is relatively high confidence that effects were accurately captured in the assessment. It is possible that some anthropogenic features were not included in the linear feature density calculation; however, there is a high degree of confidence that most disturbances were included. Therefore, the confidence in this CEA is high.

Table 8-14. Characterization of Context and Confidence in the Assessment of Cumulative Mortality Risk Effects on Marten

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans (LUPs) are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	There is high confidence in the characterization of the cumulative effect and its persistence. A precautionary approach was taken to quantify the change in habitat effect.

8.3 MOOSE

Moose are a large ungulate with conservation, cultural, and economic importance in the Yukon. They occur across the Northern Hemisphere and the Yukon, except where absent in the far southwest (Geist et al. 1999, Government of Yukon 2019, 2022a). The overall Yukon population is estimated to be 70,000, and an

average density of 100 to 250 moose per 1,000 km² of suitable moose habitat (Government of Yukon 2019, O'Donoghue 2020).

Moose use seasonal home ranges, moving between them typically in response to environmental conditions and reproductive status (Clarke et al. 2017, Government of Yukon 2022b). Winter is the most limiting season for moose in the Yukon. A moose winter forage habitat suitability model was developed for the RSA (**Appendix 8-A**). High-suitability moose winter habitat is limited across the RSA, most commonly associated with riparian areas, but Moderate-suitability habitat is extensive. Although moose are likely to select the High-suitability areas preferentially, a substantial amount of total winter forage appears to occur within large areas with relatively low willow cover (i.e., the Moderate-suitability areas).

Due to the scattered occurrence of High-suitability habitats across the RSA, some moose are expected to occur across the RSA in winter. However, local densities of moose are likely to vary within the portions of Low and Moderate-suitability habitats that form the habitat matrix at a larger scale.

A habitat suitability model was developed to quantify winter foraging habitat for moose within the RSA (**Appendix 8-A**). The model used a 4-class system categorical rating scheme (High, Moderate, Low, Nil), reflecting knowledge of the species' ecology and habitat use (Resources Inventory Committee 1999).

High-suitability winter moose habitat (7.1%) is limited, and Moderate-suitability habitat makes up the majority of the RSA (60.9%), followed by Low-suitability habitat (31.2%), and with Nil areas only accounting for approximately 0.8% of the RSA (**Table 8-15**). The distribution of winter moose habitat shows clear spatial patterns across the RSA. High-suitability habitat is found scattered across the RSA, generally in much smaller patches than areas of Moderate and Low. High-suitability areas are often in narrow riparian strips along streams, non-confined drainage areas, and some areas of upland deciduous and mixed-wood forest. Areas of Moderate habitat are concentrated in the southern half of the RSA and along the western and northern boundary in the northern portion of the RSA.

The pattern of having a relatively large portion of the landscape in Moderate-suitability winter habitat is different than in other parts of the Yukon, especially in more mountainous areas, where High and Moderate-suitability winter habitats are often constrained by elevation, snow depths and greater distribution of diverse vegetation communities (McCulley et al. 2017). Moderate and Low rated habitats likely provide a substantial proportion of total winter forage for moose in the RSA due to the large extent that Moderate and Low-suitability habitats cover. In Eagle Plains, the overall distribution of winter foraging habitat for moose appears to be distributed in relatively low levels across large portions of the RSA versus concentrated in relatively small portions of the landscape, typical in more mountainous parts of Yukon.

8.3.1 Assessment Indicators and Parameters

The potential effects on moose include a change in habitat and mortality risk that may result from interactions with the Project. The Project can affect moose habitat by clearing vegetation, causing sensory disturbance, and posing mortality risks by providing human and predator access to moose habitat during winter. A habitat suitability model quantified Project-related effects of a change in habitat. The predicted residual effect of change in mortality risk was assessed qualitatively.

8.3.2 Project Interactions and Potential Effects

This subsection characterizes interactions between the Project and moose and describes the potential adverse effects.

8.3.2.1 Interactions

Interactions between moose and Project-related activities and components may result in a change in habitat (i.e., the direct loss of habitat and the indirect alteration of adjacent habitat) and mortality risk. Consequently, the potential effects of the interactions are carried forward into the assessment of the summary evaluation in this section **Table 8-15** summarizes the potential interactions, and those interactions and effects are discussed in more detail below.

Table 8-15. Expected Interactions Between Moose and the Eagle Plains Exploration Project and the Resulting Potential Effects

Project Component / Activity	Change in Habitat	Mortality Risk
Engagement	0	0
Seismic Exploration	2	0
Drilling Exploration	2	0
Extended Flow Testing (EFT)	2	0
Well Maintenance (Workovers)	2	0
Access Roads	2	0
Mix Bury Cover (MBC) Construction and Operation	2	0
Central Processing Facility (CPF)	2	0
Airstrip	2	0
Water Withdrawal	2	1
Transportation	2	2
Camp	2	0
Reclamation and Closure	2	2

Notes:
0 = no interaction
1 = minor interaction with moose possible, but small immeasurable effect (e.g., possible slight behavioural response, no vegetation effects, no measurable effect on water quality). Designates a summary of effects that are addressed in the effects assessment as a discussion. This rating does not lead to the characterization of residual effects.
2 = substantial interaction with moose, designates a more detailed assessment of potential effects. Carry forward into residual effects characterization.

8.3.2.2 Change in Habitat

Vegetation clearing required to construct Project components (e.g., winter access roads, seismic lines, and staging areas) may result in direct habitat loss within the maximum disturbance footprint. Moose may exhibit reduced habitat use in response to diminishing habitat patch size, heightened spatial separation between patches, and alterations in patch configuration (Stewart and Komers 2012).

Habitat alteration due to sensory disturbances will likely be limited to the annual work area during vegetation clearing and seismic activity. Sensory disturbances associated with Project components and activities (e.g., anthropogenic noise, vehicle traffic, human presence) may alter moose use of habitat within a 250 m zone of influence (ZOI) of Project components (Dussault et al. 2006, Lykkja et al. 2009, Neilson and Boutin 2017).

Sensory disturbances associated with Project components and activities (e.g., vehicle traffic, human presence) may alter moose use of adjacent habitat. Vehicle traffic can negatively influence moose habitat selection with increasing traffic volumes, although roads with less than 10 vehicles/day typically do not affect moose habitat use (Laurian et al. 2008, Wattles et al. 2018). Road presence can affect moose habitat selection in the surrounding areas up to 1,000 m, although most effects occur within 250 m of a road (Colescott and Gillingham 1998, Yost and Wright 2001, Laurian et al. 2008, Shanley and Pyare 2011).

Moose may avoid areas of high human activity, although females with calves may also avoid areas of low human activity (Lykkja et al. 2009). Moose cows, particularly those with calves, strongly avoid areas with a high intensity of grey wolf (*Canis lupus*) use, which may include linear features associated with developing surrounding natural resources (Neilson and Boutin 2017). Habitat alteration from sensory disturbance will likely result in the downgrading of habitat up to 250 m away from Project components and activities and reduce the overall amount of Moderate and High rated habitat.

8.3.2.3 Change in Mortality Risk

Primary sources of mortality risk for moose from Project-related activities may include vehicle collisions and increased or easier hunter and predator access. It is expected that if any changes in Project-related moose mortality risk occur, they would likely be limited to active work areas. However, mitigation measures are expected to limit interactions between Moose and potential sources of direct mortality, thereby minimizing the potential effect of change in mortality risk. The annual harvest is lower within Yukon game management zone 1, where the Project is located, than in other management zones. It ranged from 0 to 10 individuals annually from 1980 – 2014, and 43% of the years, no harvest was recorded (Milligan 2018). It is expected that any changes in moose mortality risk from easier hunting access is expected to be minimal due to the low annual harvest. Linear features can facilitate movement by predators and increase mortality risk (Serrouya et al. 2016, Dickie et al. 2017b). The Project is minimizing the development of new linear features by reactivating historical winter access roads and using three-dimensional (3D) seismic lines. These linear features are selected less frequently by predators (e.g., grey wolf) and have decreased movement rates compared to two-deimensional (2D) seismic lines (Dickie et al. 2017a). As a result, any changes in mortality risk due to ease of predator access are expected to be minimal.

The increased mortality risk is possible through vehicle collisions and the potential for improved harvester access. Estimates for moose vehicle collisions (MVCs) are typically only available for highways and primary roads. An unknown number of mortalities may occur along resource roads (Child et al. 1991, Sielecki 2010). MVCs are typically most common during winter (i.e., December to February) and most frequently just after sunset and before sunrise, but typically only in areas where the surrounding snowpack depth is less than 100 cm (Sielecki 2010, Cunningham et al. 2022).

Moose may also avoid deeper snow depths and select roads cleared of snow to facilitate travel, increasing the likelihood of MVC (Cunningham et al. 2022). Other factors such as areas with higher moose use that overlap with roads (i.e., valley bottoms), poor light conditions, traffic speed exceeding 80 kilometres per hour (km/hr) and amount of vehicle traffic, and tall or extended snowbanks along road edges may influence

the risk of MVC (Stuart 1984, Child et al. 1991, Joyce and Mahoney 2001, Dussault et al. 2006, Danks 2007, O'Keefe and Rea 2012). Anthropogenic features (e.g., roads, seismic lines) can facilitate the ease of hunter and predator travel, increasing the accessibility into areas and resulting in indirect sources of mortality (Beazley et al. 2004, Ewacha 2016, Mumma and Gilligham 2019).

8.3.3 Mitigation Measures

Mitigation measures will be implemented as part of the design of the Project and during Project activities to avoid and minimize changes in moose habitat and mortality risk. Some mitigation measures may broadly apply to other VESECs, whereas others may be only to moose. Measures may also be applicable to both potential effects or each individually.

Mitigation measures to address both potential effects involve several strategies. Minimizing the spatial extent of the Project, delineating and limiting equipment use and directed lighting to within Project footprint boundaries, and using existing winter access roads. Restricting most work activities during winter is intended to avoid the moose calving season. For on-site personnel, mandatory environmental orientation, the use of wildlife reporting cards, and prohibitions on pets, firearms, hunting, and harassment will be enforced. Additionally, comprehensive plans addressing harmful substances, waste management, and traffic are expected to minimize further and avoid changes to moose habitat and mortality risk.

The environmental constraints mapping (**Section 3.3.2**) incorporates avoidance of high-value moose forage habitat in Project design to minimize and avoid changes in moose habitat. The Project will avoid locating mix bury and cover sites, and borrow pits in high-value winter moose forage habitats to the extent possible. However, overlap with a small extent of high-value winter moose habitat is expected. To minimize changes to moose habitat and facilitate natural regeneration, vegetation clearing will be limited to a height of 0.1 m high, except at the drill hole location and MBC sumps where grubbing will occur, and to larger stumps along winter access roads to improve snow packing and subsequent safe driving conditions. A plan to address potential erosion and sediment control concerns will be developed that is anticipated to avoid and minimize changes in moose habitat.

Snow banks along road edges resulting from snow removal operations can create conditions that may hinder moose escape from roads and increase mortality risk from vehicle collisions. Maintaining appropriately sized gaps, approximately every 300 m, in roadside snowbanks is expected to facilitate wildlife crossing, escape, and minimize mortality risk. Seismic lines are expected to result in a small increase in moose foraging habitat; however, there is the potential for increased facilitated predation by natural predators and humans. To minimize and avoid mortality risk, the Project will:

- increase the tortuosity of curves along seismic lines (to reduce sightlines and ease of travel);
- minimize the total length of lines as much as possible (i.e., use as wide a spacing distance between lines as possible);
- minimize line widths to ≤5 m; and,
- create vegetation barriers (e.g., sharp-angle 'dogleg' bends, vegetation piling) along lines where they enter the high-value habitat, and at least every 300 m within the habitat areas, to impede predator and human travel.

All mitigation measures applicable to moose, organized by potential effect is summarized in **Table 8-16**.

Table 8-16. Mitigation Measures Relevant to Moose and the Eagle Plains Exploration Project

Mitigation Measure	Potential Adverse Effect
Avoid or minimize the overlap of Project components with suitable moose habitat	Change in Habitat, Mortality Risk
Minimize the spatial extent of new components by using existing infrastructure (e.g., access roads, winter trails, seismic lines) wherever feasible	Change in Habitat, Mortality Risk
Delineate the Project footprint boundaries and restrict equipment use to within the defined areas	Change in Habitat, Mortality Risk
Use winter access roads for Project-related activities to the extent practicable	Change in Habitat, Mortality Risk
Use buses or vans for transporting employees, visitors, and contractors as much as practical to reduce Project-related traffic	Change in Habitat, Mortality Risk
Directed lighting or light shielding at well sites and camps, rather than broad lighting, to focus lighting toward the ground in work areas	Change in Habitat, Mortality Risk
Prohibit workers from having domestic pets within the RSA	Change in Habitat, Mortality Risk
Prohibit workers, visitors, or contractors from feeding or harassing wildlife within the maximum disturbance footprint	Change in Habitat, Mortality Risk
Implement a wildlife orientation for all site personnel. The orientation will include information about potential Project effects on water, fish, vegetation and wildlife, potential wildlife crossings, wildlife mitigation measures, and waste management policies that limit human-wildlife interactions	Change in Habitat, Mortality Risk
Require workers to report all moose observations through a logbook or information directly passed to the on-site environmental lead	Change in Habitat, Mortality Risk
Develop a plan to prevent deleterious substances from entering a water body	Change in Habitat, Mortality Risk
Maintain all machinery on site in a clean condition and free of fluid leaks	Change in Habitat, Mortality Risk
Wash, refuel and service machinery in upland areas in such a way as to prevent any deleterious substances from entering a water body	Change in Habitat, Mortality Risk
Store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering a water body	Change in Habitat, Mortality Risk
Establish a spill response plan with the following key mitigation measures: • report all spills as soon as possible when a deleterious substance enters a water body; • install containment measures around the spill; and, • collect and dispose of contaminated water or soil substrates using an emergency spill kit and other necessary spill response measures. Disposal will be at approved disposal facilities.	Change in Habitat, Mortality Risk
Allow for the regeneration of natural vegetation following the cessation of exploration in a work area	Change in Habitat
Clear vegetation for winter access roads down to the shrub level only (0.1 m in height)	Change in Habitat

Mitigation Measure	Potential Adverse Effect
Limit grubbing activities (i.e., removal of groundcover) to the drill hole location and the MBC sumps, and to larger stumps along winter access roads to improve snow packing and subsequent safe driving conditions	Change in Habitat
Develop and implement an erosion and sediment control plan to prevent the introduction of sediment into any water body during all work, undertakings and activities	Change in Habitat
Install erosion and sediment control measures, where appropriate, before beginning works, undertakings and activities	Change in Habitat
Maintain and inspect erosion and sediment control measures and structures regularly during all work, undertakings and activities	Change in Habitat
Keep the erosion and sediment control measures in place until all disturbed ground has been stabilized, then remove all erosion and sediment control materials (unless biodegradable)	Change in Habitat
Keep organic layers intact (i.e., limit grubbing and vegetation removal) wherever possible	Change in Habitat
Operate machinery on land in stable, dry areas	Change in Habitat
Monitor waterbodies regularly for signs of sediment entry during all phases of the works, undertakings and activities and take corrective action	Change in Habitat
Use biodegradable erosion and sediment control materials whenever possible	Change in Habitat
Post and enforce a speed limit of 50 km/hr on Project-related access roads	Mortality Risk
Implement a policy to minimize disturbance of wildlife on access roads, including providing wildlife with the right-of-way on roads, not using vehicles to entice wildlife to move off the road, and slowing or stopping until wildlife have cleared the road	Mortality Risk
Maintain appropriately sized gaps in roadside snowbanks to facilitate wildlife crossing and escape	Mortality Risk
Implement an on-site policy prohibiting workers from shooting, hunting, and fishing within the RSA	Mortality Risk
Prohibit workers from having personal firearms within the RSA	Mortality Risk
Investigate all Project-related wildlife mortality and correct the root cause(s) through adaptive management where possible	Mortality Risk
Increase the tortuosity of curves along seismic lines (to reduce sightlines and ease of travel)	Mortality Risk
Minimize seismic line widths and the total length of lines as much as possible (i.e., use as wide a spacing distance between lines as possible)	Mortality Risk
Create vegetation barriers along lines where they enter the high-value habitat, at least every 300 m within the habitat areas, to impede predator and human travel.	Mortality Risk

8.3.4 Effects Characterization

8.3.4.1 Approach

Residual effects on moose are characterized following those described in the Methods section (**Table 8-1**), including consideration of magnitude, likelihood, geographical extent, duration, frequency, timing,

reversibility, context, and confidence of the effect. The ratings and definitions for each residual effect characteristic are in **Table 8-1**and discussed explicitly in the relevant sections below.

8.3.4.2 Residual Change in Habitat Effects

The Project may affect the amount of suitable moose habitat in the RSA, resulting in a change in habitat. The assessment considers the direct loss of habitat and the indirect alteration (e.g., sensory disturbances, edge effects, perceived barriers) of habitat for moose across the range of the 10 footprint scenarios. Direct habitat loss was quantified by calculating the area of suitable moose habitat lost to clearing within the RSA. The alteration of suitable moose habitat is quantified by buffering Project components by 250 m and downgrading suitable habitat by one class within the buffer, where appropriate.

The Project may reduce the amount of suitable moose habitat within the RSA across the 10 footprint scenarios (**Table 8-17**). The change in suitable habitat under each scenario was compared with the amount of baseline suitable habitat for each rating category, resulting in a range of estimated changes in habitat for each rating (i.e., footprint scenarios – baseline). High-quality and Moderate-quality moose habitat may decrease by up to 0.9% and 7.5%, respectively, or up to 8.4% combined.

Table 8-17. Change in Moose Habitat in the Eagle Plains Regional Study Area Based on Assessing the 10 Footprint Scenarios

Baseline			Footprint Scenarios (n = 10)		Potential Change (n = 10)	
Habitat Rating	Area (ha)	Area (%)	Range (ha)	Range (%)	Range (ha)	Range (%)
High	16,944.4	7.1%	14,796 to 14,993	6.2 to 6.3	−1,951 to −2,148	−0.8 to −0.9
Moderate	145,394.1	60.9%	127,563 to 129,124	53.5 to 54.1	−16,270 to −17,832	−6.8 to −7.5
Low	74,514.5	31.2%	63,475 to 64,308	26.6 to 27.0	−10,207 to −11,040	−4.3 to −4.6
Nil	1,810.46	0.8%	30,278 to 32,492	12.7 to 13.6	28,468 to 30,682	11.9 to 12.9
Total	238,663.5	100.0	238,663.5	100.0		

A summary of the characterization of residual direct habitat effects on moose is provided in **Table 8-18.** The magnitude is expected to be low due to a <11% change in habitat from baseline conditions. The likelihood of a residual effect is deemed low as mitigation measures are expected to minimize, but not eliminate, any change in habitat. The geographic extent of changes in direct habitat loss is expected to occur only within the maximum disturbance area; however, habitat alteration may occur throughout the ZOI. The duration is expected to be medium-term, as the change in habitat will likely end in each work area following the completion of exploration and associated natural regeneration of each stage.

Sensory disturbances that may result in habitat alteration are expected to occur continuously throughout the life of the Project. Habitat loss will likely occur continuously as work areas change annually and clearing occurs in different areas of the seismic program. Habitat alteration is expected to end following the completion of exploration and associated reclamation, and the regeneration of natural vegetation is expected to reverse the loss of habitat. Therefore, the potential residual effect is reversible.

Table 8-18. Characterization of Potential Project Effects on Moose Habitat

Criterion		Rating	Rationale
Magnitude		Low	Vegetation clearing, including trees, is expected be required for access roads and seismic lines. As a result, Project-related activities are expected to result in a <11% change in habitat.
Likelihood		Certain	The probability of vegetation clearing causing direct habitat effects is certain.
Geographic Extent		Local	Changes in habitat alteration due to Project-related sensory disturbances are predicted to be limited to the ZOI. Direct habitat loss is predicted to be limited to the maximum disturbance area.
Duration, Frequency and Timing	Duration	Medium-term	A change in habitat is predicted to occur throughout the life of the Project.
	Frequency	Continuous	Habitat loss will likely occur once in each work stage; however, habitat alteration through sensory disturbances is expected to occur continuously.
	Timing	Year-round	The residual effect of that vegetation clearing is predicted to remain year-round until vegetation has regenerated.
Reversibility		Reversible	The alteration of habitat is expected to end following the completion of exploration and associated reclamation. The regeneration of natural vegetation is expected to reverse habitat loss.

8.3.4.2.1 Context and Confidence

The RSA is a Zone IV IMA in the North Yukon and Peel Watershed Planning Regions with which it overlaps. In these areas with diminished ecological and cultural values in a moderately sensitive biophysical setting, Zone IV IMAs allow for the highest level of development. Cumulative effect indicators are used in both plans if the current management and development are meeting the set goals and objectives. Two cumulative effects indicators included in the Plans are direct surface disturbance and linear density, with guidelines setting cautionary (0.75 km/km²) and critical (1.0 km/km²) indicator levels in both plans.

A network of linear features was previously created in parts of the RSA due to intermittent historical exploration activities. The Linear Feature Study (**Appendix 8-B**) determined the extent and characteristics of liner features in the RSA and addressed three objectives: (1) comprehensive mapping and classification of existing linear feature footprints within the RSA; (2) quantification of structural aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and (3) quantification of regeneration pathways and structural stages of linear features. That combined information supports assessing the Project's potential effects of linear features and refinement of mitigation measures for linear features to minimize possible effects. After accounting for natural features and regeneration, the adjusted linear feature density for the RSA was below the cautionary and critical indicator levels, at 0.52 km/km², in both regional land use plans.

The level of confidence in this prediction is Moderate (**Table 8-19**). The effects of habitat loss and alteration on moose are well-documented, and the efficacy of mitigation measures has been supported through

application on previous projects. However, there is some uncertainty in the specific context of those studies and the habitat conditions and harvest patterns at Eagle Plains.

Table 8-19. Characterization of Context and Confidence in the Residual Project Effects on Moose Habitat

Criterion	Rating	Rationale
Context	Highest Development	The Project occurs within the IMA Zone IV Management Unit, designated as the highest level of disturbance.
Confidence	Moderate	Mitigation measures are predicted to be effective at minimizing or eliminating the change in habitat; however, the uncertainty of the maximum disturbance footprint results in a Moderate Confidence of the residual effect prediction.

8.3.4.3 Residual Mortality Risk Effects

A summary of the characterization of residual indirect mortality effects on moose is provided in **Table 8-20.** The Magnitude is predicted to be low as mitigation measures are expected to minimize moose mortality risk to within natural variation. However, there is a possible likelihood of a change in mortality risk as while mitigation measures are expected to minimize, any change in mortality risk, they may not eliminate it. Project-related access roads and seismic lines may facilitate hunting access within the RSA, therefore the geographic extent is regional. The duration is expected to be medium-term, as the Frequency of the change in mortality risk is expected to occur continuously, but it will likely end following the completion of the Project. The timing of most work is planned to occur during the winter. Any changes in mortality risk are expected to end following the completion of exploration and associated reclamation, therefore, the potential residual effect is reversible.

Table 8-20. Characterization of Potential Project Effects on Moose Mortality Risk

Criterion		Rating	Rationale
Magnitude		Low	Project-related activities are expected to result in any change in mortality risk to remain within natural variation.
Likelihood		Possible	Mitigation measures are expected to minimize but not eliminate the potential for a change in mortality risk.
Geographic Extent		Regional	Changes in mortality risk are predicted to occur across the RSA due to potential of increased access.
Duration, Frequency and Timing	Duration	Medium-term	A change in mortality risk is predicted to occur throughout the entire exploration period of the Project.
	Frequency	Continuous	Changes to mortality risk are expected to occur continuously throughout the life of the Project.
	Timing	Year-round	Changes in mortality risk may occur year-round as Project access roads and seismic lines may be accessed year-round.
Reversibility		Reversible	Any change in mortality risk is expected to end following the completion of exploration and associated reclamation.

8.3.4.3.1 Context and Confidence

The RSA is a Zone IV IMA in the North Yukon and Peel Watershed Planning Regions with which it overlaps. In these areas with diminished ecological and cultural values in a moderately sensitive biophysical setting, Zone IV IMAs allow for the highest level of development.

The level of confidence in this prediction is High (**Table 8-21**). The effect of mortality risk on moose is known and the efficacy of mitigation measures has been supported through application on previous projects.

Table 8-21. Characterization of Context and Confidence in the Residual Project Effects on Moose Mortality Risk

Criterion	Rating	Rationale
Context	Highest Development	The Project occurs within the IMA Zone IV Management Unit, designated as the highest level of disturbance.
Confidence	High	Mitigation measures are predicted to be effective at minimizing or eliminating the change in mortality risk.

8.3.5 Significance

The Project is not expected to result in a change in moose habitat or a change in mortality risk that will alter the integrity of the moose population within the RSA to the point where it cannot sustain a regional population. The Project was designed to limit interactions with moose and moose habitat by avoiding suitable habitat to the extent practical. Standard mitigation measures have been applied to the Project, and these measures are known to be effective at minimizing residual adverse effects. Therefore, the residual effects are collectively predicted to be **not significan**t.

8.3.6 Cumulative Effects Assessment

8.3.6.1 Approach

Project-related residual effects with the potential to interact cumulatively with the residual effects of reasonably foreseeable projects and activities identified within or extending into the CESA on moose are:

- change in habitat; and,
- mortality risk.

The CESA delineates the spatial boundaries of the CEA for moose as described in **Section 3.1.6.1.1**. Projects and activities outside the CESA but with potential effects within this area, were also included in this assessment. Temporal boundaries for assessing cumulative effects encompass past, present, and reasonably foreseeable future activities spanning the Project's lifespan (**Section 1.3.1**).

8.3.6.2 Cumulative Change in Habitat Effect

The indicator used to characterize the change in habitat cumulative effect on moose was the total surface disturbance (area [km²] and percent [%]) from anthropogenic footprints (e.g., mineral exploration, oil and gas) disturbed by the footprints. Present conditions include a total area of 62.5 km² (0.6%) disturbed by past and present projects and activities within the CESA (**Table 8-22**). This is predicted to increase in the future by 1.2 km² (0.0%) following the inclusion of reasonably foreseeable projects and activities. The Project is expected to increase the amount of disturbed area over the existing conditions by a maximum of

69.5 km² (0.6%) within the CESA, resulting in a maximum disturbed area of 133.2 km² (1.2%) when combined with past, present, and reasonably foreseeable projects and activities.

The magnitude of cumulative change in habitat effects is expected to be low, as it is expected to be <1% increase over existing conditions. The likelihood of the cumulative effect is Probable due to mitigation measures minimizing but not eliminating the potential of the effect. Changes in habitat are expected to occur throughout the CESA due to projects and activities as part of the assessment; therefore, the cumulative effect is regional in geographic extent. The effect is predicted to end following the completion of projects and activities in an area, and as a result, it is medium-term in duration. The frequency of a change in habitat is expected to be continuous, as vegetation clearing will likely occur occasionally, but its effects on habitat are predicted to be continuous until vegetation regenerates. The effect of a change in habitat due to projects and activities within the CESA is predicted to have year-round timing. Over time, it is predicted that the regeneration of the affected habitat will likely occur after the end of the projects and activities considered in the assessment and will likely reverse the cumulative effect. A summary of the characteristics of the cumulative effects of change in habitat is provided in **Table 8-23**.

Table 8-22. Cumulative Change in Habitat Effects from Existing and Project-Related Disturbances on Moose

Cumulative Effect Indicator	Scenario	Cumulative Effects Study Area
Total Surface Disturbance (Footprints)	Present	62.5 km² (0.6%)
	Project	69.1–69.5 km² (0.6%)
	Future	1.2 km² (0.0%)
	Total Cumulative Effect	132.8–133.2 km² (1.2%)

Table 8-23. Characterization of Cumulative Change in Habitat Effects on Moose

Criterion		Rating	Rationale
Magnitude		Low	The change in habitat across the CESA is predicted to be <1% over existing conditions.
Likelihood		Probable	Mitigation measures are expected to minimize but not eliminate the potential for a change in habitat.
Geographic Extent		Regional	Change in habitat quality is expected to occur across the CESA due to the location of the projects and activities.
Duration, Frequency and Timing	Duration	Medium-term	The effect is expected to end following the ending of projects and activities in an area.
	Frequency	Continuous	Vegetation clearing required for projects and activities may occur occasionally, but the cumulative effect on moose will continue until vegetation regenerates.

Criterion		Rating	Rationale
	Timing	Year-round	The effect is expected to occur year-round due to changes in habitat remaining until vegetation regeneration.
Reversibility		Reversible	The regeneration of the affected habitat is expected to be reversible over time.

8.3.6.2.1 Context and Confidence

The assessment of the cumulative change in habitat effects on moose considered the context of Regional Land Use Planning and the confidence in accurately quantifying and predicting those effects (**Table 8-24**). The characterization of effects is consistent with the Land Use Plans' objectives, and there is relatively high confidence that effects were accurately captured in the assessment. Although it is possible that some anthropogenic features were not fully accounted for in the total disturbance calculation, there is a high degree of confidence that most disturbances were included. Therefore, the confidence in this CEA is high.

Table 8-24. Characterization of Context and Confidence in the Assessment of Cumulative Change in Habitat Effects on Moose

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	There is high confidence in characterizing the cumulative effect and its persistence. A precautionary approach was taken to quantify the change in habitat effect.

8.3.6.3 Cumulative Mortality Risk Effect

Cumulative mortality risk effects result from linear features across the landscape, with higher linear feature densities (km/km²) supporting facilitated moose predation by wolves and human hunting. Therefore, linear feature density was used to assess cumulative mortality risk effects. Linear feature density was calculated as the total length of linear features divided by the size of the CESA.

A summary of the cumulative effect indicator for mortality risk effects is provided in **Table 8-25**. Due to the Project, linear feature density is expected to increase by up to 2.23 km/km² in the CESA relative to existing conditions. The increase in linear feature density occurs due to the Project contributing approximately 83.56 km of additional linear features.

The magnitude of cumulative mortality risk effects is expected to be high because the overall linear feature density is predicted to increase by >35% from baseline values. The likelihood of the cumulative effect is probable due to mitigation measures minimizing but not eliminating the effect. The Geographic Extent of the cumulative effect is expected to be regional, as effects may occur throughout the CESA due to projects and activities considered in this assessment. The duration of the effect is expected to occur over the medium-term as risk is expected to end following the activities in an area. The frequency of the cumulative effect is expected to be continuous as conditions that facilitate predator and human hunter access along linear features may occur all the time. The Timing of the effect is expected to occur year-round as projects

and activities within the CESA are expected to result in mortality risk throughout the year. Over time, it is predicted that mortality risk will likely end following the completion of reasonably foreseeable projects and activities in an area and will likely reverse the cumulative effect. A summary of the characterization of the cumulative effects on mortality risk is provided in **Table 8-26**.

Table 8-25. Cumulative Mortality Risk Effects from Existing and Project-Related Disturbances on Moose

Cumulative Effect Indicator	Condition[1]	Cumulative Effects Study Area
Linear Feature Density	Existing	0.78 km/km² (8,716.29 km)
	Future	3.01–3.01 km/km² (33,830.6–33,890.5 km)
	Net Effect	2.23–2.23 km/km² (25,177.10–25,237.02 km)

Net effect refers to the increase in the cumulative effect indicator from existing to future conditions due to the Project.

Table 8-26. Characterization of Cumulative Mortality Risk Effects on Moose

Criterion		Rating	Rationale
Magnitude		High	The increase in linear feature density due to the Project is expected to be >35%.
Likelihood		Probable	Mitigation measures are expected to minimize but not eliminate mortality risk. The Project contributes to the increased linear feature density that could result in facilitated hunting and predation.
Geographic Extent		Regional	Change in habitat quality is expected to occur across the CESA due to the location of the projects and activities.
Duration, Frequency and Timing	Duration	Medium-term	A change in mortality risk is predicted to end following the completion of projects and activities in an area.
	Frequency	Continuous	Conditions that could lead to mortality risk are anticipated to occur continuously.
	Timing	Year-round	Within a given year, conditions that could lead to mortality risk are mostly limited to fall and winter. However, those effects may continue throughout the year.
Reversibility		Reversible	The mortality risk is expected to be reversible following the cessation of projects and activities.

8.3.6.3.1 Context and Confidence

The assessment of the cumulative mortality risk effects on moose considered the context of Regional Land Use Planning and the confidence in accurately quantifying and predicting those effects (**Table 8-27**). The characterization of effects is consistent with the Land Use Plans' objectives, and there is relatively high confidence that effects were accurately captured in the assessment. It is possible that some anthropogenic features were not included in the linear feature density calculation, there is a high degree of confidence that most disturbances were included. Therefore, the confidence in this CEA is high.

Table 8-27. Characterization of Context and Confidence in the Assessment of Cumulative Mortality Risk Effects on Moose

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	There is high confidence in characterizing the cumulative effect and its persistence. A precautionary approach was taken to quantify the change in habitat effect.

8.4 BIRDS

A total of 353 bird species may occur in the Yukon, most of which are protected under the federal *Migratory Birds Convention Act* (*MBCA*) and the associated *Migratory Birds Regulations,* the *Yukon Wildlife Act, or the Species at Risk Act* (*SARA*) (Government of Canada 2002, 2018, Government of Yukon 2002). Baseline studies identified nine bird species of conservation concern (birds hereafter; species listed under *SARA* or the *Yukon Wildlife Act*) that could occur in the RSA and those species are the focus of this assessment (**Table 8-28**). Five of those species have been detected in the RSA and the other four are likely to occur, although it is uncertain if they breed regularly within the RSA.

Table 8-28. Bird Species of Conservation Concern that Could Occur in the Eagle Plains Regional Study Area During the Breeding Season

Species Common Name	COSEWIC[4]	SARA[5]	BCR 4 Priority[6]	Yukon Wildlife Act	RSA Count	NABBS Count (2014–2018)[7]
Horned Grebe[1]	SC (Apr 2009)	1 – SC	R – stewardship N/C – concern	No	0	0
Red-necked Phalarope	SC (Nov 2014)	1 – SC	N/C – concern	No	15	0
Peregrine Falcon[2]	NAR (Nov 2017)	1 – SC	R – stewardship N/C – concern	Yes	0	0
Gyrfalcon[2]	NAR (Apr 1987)	–	–	Yes	0	0
Short-eared Owl[1]	T (May 2021)	1 – SC	N/C – concern	No	0	4
Common Nighthawk[3]	SC (Apr 2018)	1 – T	N/C – concern	No	1	0
Olive-sided Flycatcher	SC (Apr 2018)	1 – T	R – stewardship R/N/C – concern	No	6	1
Bank Swallow[1]	T (May 2013)	1 – T	–	No	0	0

Species Common Name	COSEWIC[4]	SARA[5]	BCR 4 Priority[6]	Yukon Wildlife Act	RSA Count	NABBS Count (2014–2018)[7]
Rusty Blackbird	SC (Apr 2017)	1 – SC	R – stewardship R/N/C – concern	No	19	1
Totals					**41**	**6**

[1] Species that are 'Likely' to occur in the Eagle Plains Project RSA.
[2] Cliff nesting raptors that are 'Likely' to occur in the broader region, but do not have suitable habitat in the Eagle Plains Project RSA.
[3] A species that may occur in the Project RSA but is at its range limits. One occurrence was observed, but status remains uncertain.
[4] Most recent COSEWIC assessments; E = Endangered, NAR = Not at Risk, SC = Special Concern, T = Threatened.
[5] SARA statuses from the latest amended list in August 2019; Schedule 1 codes equivalent to COSEWIC.
[6] Priorities, concerns, and stewardships from BCR 4 2013 report; C = Continental, N = National, R = Regional.
[7] North American Breeding Bird Survey Counts (from routes that intersect the RSA)

Horned Grebe — Horned grebe is a small waterbird species that nests in small to medium (0.05 – 10 ha) ponds and wetlands with considerable amounts of emergent vegetation (Stedman 2020). It breeds and winters across the northern hemisphere, and in North America, it breeds principally from Alaska to western Ontario and winters on the east and west coasts of the continent (Stedman 2020). It breeds across the Yukon in suitable habitat and may occur from April through November (Cornell Lab of Ornithology 2023). No horned grebes were detected during the wildlife baseline surveys.

The horned grebe is listed as Special Concern under COSEWIC and *SARA* (B.C. Conservation Data Centre 2023). Initially, the horned grebe population was thought to have declined by 45% since the mid-1960s; however, a recent analysis has found a relatively stable continental population since the 1970s, but several regional populations may have declined (Canada 2021). Habitat loss and degradation are considered the primary threats, although pollution and mortality from fishing are also considered threats (Canada 2021).

Red-Necked Phalarope — The red-necked phalarope is a shorebird that nests primarily on or near freshwater wetlands, ponds, streams, and winters primarily on the open ocean and occasionally on evaporation ponds (Rubega et al. 2020). It has a circumpolar breeding distribution across the arctic or subarctic. In North America, it breeds from Alaska to Labrador, and it winters in tropical oceans, notably off the west coast of South America, the Arabian Sea, and Indonesia (Rubega et al. 2020). It breeds across the Yukon and generally occurs from May to September (Cornell Lab of Ornithology 2023). It was detected several times during the wildlife baseline surveys on open water.

Red-necked Phalarope is designated as Special Concern by both COSEWIC and *SARA* (B.C. Conservation Data Centre 2023). The current population size or trends are uncertain due to the remote nature of its breeding and wintering habitats, but large population declines have been noted in the Bay of Fundy (COSEWIC 2014). Threats to this species are relatively unknown, but declines in prey species have been implicated in the Bay of Fundy declines, and pollutants (e.g., pesticides, heavy metals) may affect reproductive success and health (COSEWIC 2014).

Peregrine Falcon — Peregrine falcons often nest on cliff ledges or crevices but may sometimes nest on buildings, river banks, raptor or raven nests, and tree hollows near generally open foraging habitat (White

et al. 2020). It has a widespread range and breeds on all continents, except Antarctica, and across North America, although it is reoccupying much of its historic range in the east and south (White et al. 2020). It breeds across most of the Yukon and generally occurs from April to October (Cornell Lab of Ornithology 2023). No peregrine falcons were detected during the wildlife baseline surveys, and no suitable nesting habitat is known within the RSA.

The peregrine falcon is designated as Not at Risk by both COSEWIC and *SARA*, but is included in the *Yukon Wildlife Act* as "Specially Protected Wildlife" (Government of Yukon 2012, B.C. Conservation Data Centre 2023). Populations across North America declined dramatically in the mid-20th century due to widespread reproductive failure from dichlorodiphenyltrichloroethane (DDT), an insecticide used in agriculture. Subsequently, populations recovered after banning DDT and a widespread reintroduction program (COSEWIC 2017a). The main threat continues to be pollution (e.g., pesticides, heavy metals, flame retardants) that can negatively affect their health and cause reproductive failure (COSEWIC 2017a).

Gyrfalcon — The gyrfalcon nests on rocky cliffs above the treeline in mountainous areas or the arctic tundra, and occurs in relatively flat, open areas during the rest of the year (Booms et al. 2020). The gyrfalcon is circumpolar in distribution, and in North America, breeds across northern Canada and Alaska and winters south to the northern United States (US) (Booms et al. 2020). It nests in mountainous areas across the Yukon and may occur year-round (Booms et al. 2020, Cornell Lab of Ornithology 2023). No gyrfalcons were detected during the wildlife baseline surveys, and no suitable nesting habitat is known within the RSA.

Gyrfalcon is designated as Not at Risk by both COSEWIC and *SARA*, but is included in the *Yukon Wildlife Act* as "Specially Protected Wildlife" (Government of Yukon 2012, B.C. Conservation Data Centre 2023). Most known threats to gyrfalcons (e.g., egg collecting, poaching, habitat loss, pesticides) do not appear to threaten North American populations, where most populations are stable (Booms et al. 2020).

Short-Eared Owl — The short-eared owl breeds and forages in open habitats such as grasslands, tundra and wetlands that are greater than 50 ha in area. It is one of the most widely distributed owl species, and breeds or is resident across most of Canada and the northern US. It occurs in winter across the southern US and northern Mexico (Wiggins et al. 2020). It is found across the Yukon as a breeding species and occurs from March to December (Cornell Lab of Ornithology 2023). Short-eared owls were not detected during baseline wildlife surveys, but several were detected during the North American Breeding Bird Surveys from 2014-2018.

The short-eared owl is designated as Threatened by COSEWIC and Special Concern by *SARA* (B.C. Conservation Data Centre 2023). Population declines of 79% between 1970 and 2019 and 27% between 2007 and 2019 were cited as rationales for their conservation listing (COSEWIC 2021). The main threat is habitat loss from agricultural conversion and intensification, climate change, urbanization, and invasive plants (COSEWIC 2021).

Common Nighthawk — Common Nighthawk nest and forage in open and partially open areas such as forest openings, burned areas, bogs, rocky or sandy habitats or disturbed areas (Brigham et al. 2020). The breeding range extends from Central America to northern Canada, wintering occurs primarily in South America, and it also occurs year-round in the Caribbean (Brigham et al. 2020). In the Yukon, it occurs only as a breeding species from June to September, primarily in the southern half of the territory, and sporadic records up to the north coast (Cornell Lab of Ornithology 2023). One common nighthawk was observed incidentally during baseline wildlife surveys in a riparian area.

The species is designated as Special Concern by COSEWIC and Threatened by *SARA* (B.C. Conservation Data Centre 2023). The primary rationale for listing was a 68% population decline between 1970 and 2015, and a 12% decline between 2005 and 2015 in southern Canada, although trends are hard to determine for this species (COSEWIC 2018a). Threats include reductions of flying insect feeding resources from pesticides, collisions with vehicles, and habitat loss and degradation (COSEWIC 2018a).

Olive-Sided Flycatcher — The olive-sided flycatcher nests in mature to old-growth, open coniferous or mixed wood forests, along the edges of these forests, riparian areas, burns, and clearcuts (Altman and Sallabanks 2020). Its breeding range is across the boreal forest and coniferous forests across western North America and wintering from Mexico through South America (Altman and Sallabanks 2020). It breeds across most of the Yukon and is found in the territory from May through September (Cornell Lab of Ornithology 2023). Baseline surveys detected individuals in riparian areas and deciduous/mixed shrub habitats.

The species is designated as Special Concern by COSEWIC and Threatened by *SARA* (B.C. Conservation Data Centre 2023). Population declines of 72% since 1970 and 19% between 2006 and 2016 were cited as reasons for their conservation listing (COSEWIC 2018b). Threats include habitat loss on breeding and wintering grounds, fire suppression, and prey reductions from pesticide use (COSEWIC 2018b).

Bank Swallow — Bank Swallow excavate nests in sand-silt substrates along vertical banks in natural (e.g., riverbanks, lake bluffs) and human-created (e.g., gravel pits, soil piles, road cuts) areas, often near open habitats used for foraging (Garrison and Turner 2020). The species has a near global distribution, breeds across much of Canada and the northern US, and winters from Mexico through South America (Garrison and Turner 2020). It occurs throughout the Yukon as a breeding species and may occur from May through September (Cornell Lab of Ornithology 2023). It was not detected during baseline surveys, likely due to its more specialized habitat requirements.

Bank Swallow is designated as Threatened by both COSEWIC and *SARA* (B.C. Conservation Data Centre 2023). Its listing results from population declines of up to 98% between 1970 and 2011 in Canada, with a potential decline of 31% between 2001 and 2011 (COSEWIC 2013). Principal threats include habitat loss (e.g., poor erosion control, dam building, aggregate mining), loss of foraging habitat (i.e., open areas near nest sites), prey reductions from pesticide use, and vehicle collisions (COSEWIC 2013).

Rusty Blackbird — Rusty Blackbird is a riparian-associated species that nests and forages in various open, shrub, and forest habitats adjacent to lakes, ponds, slow-flowing streams, and wetlands (Avery 2020). The breeding range is across the boreal forest, and the winter range is in the southeastern US and Canada (Avery 2020). In the Yukon, it occurs only as a breeding species and may occur from late April through October (Cornell Lab of Ornithology 2023). Baseline surveys detected the species at several riparian and herb sites across the RSA.

Rusty Blackbird is designated as Special Concern by both COSEWIC and *SARA* (B.C. Conservation Data Centre 2023). The primary rationale for its conservation listing are population declines of 85–90% since 1970 and is of special importance for Canadian conservation because 87% of the breeding population occurs in Canada (COSEWIC 2017b). The primary reasons for the decline are associated with the wintering range, including habitat loss and degradation, large-scale blackbird control programs, and agricultural pesticides (COSEWIC 2017b). Although habitat loss (i.e., wetland conversion) on the breeding grounds has also played a minor role (COSEWIC 2017b). Threats to the species in the Yukon are low; human

activities in the Yukon generally have limited interactions with Rusty Blackbirds and their habitats (COSEWIC 2017b).

8.4.1 Assessment Indicators and Parameters

The potential effects on birds include a change in habitat and mortality risk that may result from interactions with the Project. The Project can affect bird habitat by clearing vegetation and mortality risk during the brief overlap with seismic testing. The effect of change in habitat and mortality risk were assessed qualitatively.

8.4.2 Project Interactions and Potential Effects

This subsection characterizes interactions between the Project and birds and describes the potential adverse effects.

8.4.2.1 Interactions Table

Interactions between the birds and Project-related activities and components may result in a change in habitat (i.e., the direct loss of habitat and the indirect alteration of adjacent habitat) and mortality risk (for the brief times when Project activities might overlap with birds present in the RSA). However, interactions resulting in a change in mortality risk are predicted to be minor, not resulting in an immeasurable effect, and will not be carried forward into the residual effect characterization. Consequently, the potential effect of change in habitat is carried forward into the assessment of the summary evaluation in this section. **Table 8-29** summarizes the potential interactions, and those interactions and effects are discussed in more detail below.

Table 8-29. Expected Interactions Between Bird Change in Habitat and Mortality Risk and the Eagle Plains Exploration Project

Project Component / Activity	Change in Habitat	Change in Mortality Risk
Engagement	0	0
Seismic Exploration	2	1
Drilling Exploration	2	0
Extended Flow Testing (EFT)	1	0
Well Maintenance (Workovers)	1	0
Access Roads	2	1
Mix Bury Cover (MBC) Construction and Operation	2	1
Central Processing Facility (CPF)	2	0
Airstrip	2	1
Water Withdrawal	1	0
Transportation	2	1
Camp	2	1
Reclamation and Closure	1	1

Notes:
0 = no interaction
1 = minor interaction with birds possible, but small immeasurable effect (e.g., possible slight behavioural response, no vegetation effects, no measurable effect on water quality). Designates a summary of effects that are addressed in the effects assessment as a discussion. This rating does not lead into residual effects characterization.
2 = substantial interaction with birds, designates a more detailed assessment of potential effects. Carry forward into residual effects characterization.

8.4.2.2 Change in Habitat

Direct loss of suitable bird habitat may occur within the Project footprint because of vegetation clearing required to construct Project components (e.g., seismic lines, well pads, camp, and winter access roads). Each work area will require vegetation clearing once at the start of activity within the specific work area. The assessment of the effect, change in habitat, encompasses the entire operational period of the Project (i.e., 10 years).

Direct habitat loss and the alteration of habitat may result in the fragmentation of suitable habitat. Habitat fragmentation can result in a loss or reduction in habitat connectivity and generate isolated patches of suitable habitat below the minimum patch size required to support a species (Andrén 1994, Villard et al. 1999, Vance et al. 2003). When available suitable habitat is below a minimum patch size threshold, a reduction in occupancy may occur despite the continued presence of suitable habitat on the landscape (Robbins et al. 1989, Askins 1994, Butcher et al. 2010).

Sensory disturbances associated with human activity, construction activity, and anthropogenic features (e.g., camp, access roads) can affect bird behaviour and alter habitat use and suitability. In forested landscapes, the effect distances in response to industrial activities and roads can vary considerably, with most effects ranging from 50 – 300 m, but a few larger effect distances (i.e., up to 365 m or more) have been reported (Reijnen et al. 1997, Hanowski et al. 1999, Habib et al. 2007, Bayne et al. 2008, Francis et al. 2009). The larger effect distances were typically associated with a higher level of disturbance than anticipated for the Project.

8.4.2.3 Change in Mortality Risk

The primary sources of direct mortality risk from Project-related activities are vehicle collisions and nest destruction or disturbance. The primary source of indirect mortality is increased mortality risk from nest predators. If any changes in bird mortality risk occur, they are expected to be limited to active work areas and the surrounding ZOI during seismic testing. However, most Project activities will occur during the winter when most bird species are not present in the RSA, and none are breeding (Cornell Lab of Ornithology 2023). Mitigation measures are also expected to limit interactions between birds and potential sources of mortality, minimizing the potential effect of change in mortality risk.

Most Project activities will occur during the winter; however, seismic recording may stretch into the summer and will require vehicle traffic to transport materials, equipment, and workers. Bird mortality from vehicle collisions in Canada was estimated to be 13.8 million birds and 89 to 340 million birds in the US, with an average of 3,462 birds/km in Canada and 36 birds/km in the US (Bishop and Brogan 2013, Loss et al. 2014). In Canada, coniferous forests had some of the lowest vehicle mortality rates (0.34 – 1.5 birds/km) in contrast with wetlands 164 birds/km) and most mortality occurs during the breeding and fledging periods (Bishop and Brogan 2013). In addition, traffic volume is an important factor in the occurrence of vehicle

mortality of birds, and most estimates are for paved roads with higher levels of traffic than gravel roads (Bishop and Brogan 2013).

Seismic recording work will also require the placement of charges along seismic lines. Mortality risk associated with the work could destroy nests (i.e., incidental walking or running over a nest resulting in the death of young or eggs) or disturbance to nesting birds (i.e., disturbance to nesting birds that leads to the abandonment or predation of a nest and results in the death of young or eggs) (Baudains and Lloyd 2007, Calvert et al. 2013). However, compared to other potential sources of mortality, the upper limit of mortality estimate from seismic recording (16,438 nests nationwide) is relatively low (Calvert et al. 2013).

Nest predators of songbirds (e.g., Canada jay [*Perisoreus canadensis*], red squirrel [*Tamiasciurus hudsonicus*]) may occur at higher abundances or prefer foraging along forest edges (King et al. 1998, Ibarzabal and Desrochers 2004). Studies have linked this with an increased risk of nest mortality for songbirds (Manolis et al. 2002, Ibarzabal and Desrochers 2004). Project construction will require the clearing of vegetation that may increase the amount of forest edge habitat; however, mitigation measures are expected to minimize the amount of clearing required and the potential effect of change in mortality risk.

8.4.3 Mitigation Measures

Mitigation measures to avoid and minimize changes to bird habitat and mortality risk will be implemented as part of the Project design and during Project activities. Some mitigation measures may broadly apply to other VESECs, whereas others may be only to birds. Measures may also be applicable to both potential effects or each individually.

Mitigation measures to address both potential effects encompass several strategies. The most important mitigation measure to avoid potential effects is restricting most work activities to the winter. No birds will be breeding when most work activities occur, and few will be present within the RSA. Seismic recording may occur during the summer, resulting in the potential for mortality risk; however, mitigation measures are anticipated to minimize the residual effect to a minor interaction. In addition, Project activities and components will require the clearing of bird habitat, which may result in a change in bird habitat. To avoid and minimize changes to bird habitat, the spatial extent of the Project will be reduced to the smallest footprint required, and equipment and directed lighting will be limited to the Project footprint through the clear delineation of Project boundaries. For on-site personnel, mandatory environmental orientation, the use of wildlife reporting cards, and prohibitions on pets, firearms, hunting, and harassment will be enforced. Additionally, comprehensive plans addressing harmful substances, waste management, and traffic are expected to minimize and avoid further changes to habitat and mortality risks.

The environmental constraints mapping (**Section 3.3.2**) incorporates avoiding the placement of Project components (e.g., seismic lines, access roads) in potential bird habitat, to the extent possible, and avoiding work in riparian habitats and wetlands. Avoiding riparian habitats and wetlands is anticipated to eliminate interactions with horned grebe and red-necked phalarope. To minimize changes to bird habitat and facilitate natural regeneration, vegetation clearing will be limited to a height of 0.1 m high, except at the drill hole location and MBC sumps where grubbing will occur, and to larger stumps along winter access roads to improve snow packing and subsequent safe driving conditions. Pre-clearance wildlife feature surveys will be conducted before vegetation removal or grubbing to identify active bird nests, and if located, no-work buffers will be created and maintained to minimize disturbance. A plan will be developed to address

potential erosion and sediment control concerns that are also anticipated to avoid and minimize changes to bird habitat.

All mitigation measures applicable to birds, organized by potential effect, are summarized in **Table 8-30**.

Table 8-30. Mitigation Measures Relevant to Birds and the Eagle Plains Exploration Project

Mitigation Measure	Potential Adverse Effect
Minimize the spatial extent of new components by using existing infrastructure (e.g., access roads, winter trails, seismic lines) wherever feasible	Change in Habitat, Mortality Risk
Minimize seismic line widths and the total length of lines as much as possible (i.e., use as wide a spacing distance between lines as possible)	Change in Habitat, Mortality Risk
Delineate the Project footprint boundaries and restrict equipment use to within the defined areas	Change in Habitat, Mortality Risk
Use winter access roads for Project-related activities to the extent practicable	Change in Habitat, Mortality Risk
Use buses or vans for transporting employees, visitors, and contractors as much as practical to reduce Project-related traffic	Change in Habitat, Mortality Risk
Directed lighting or light shielding at well sites and camps, rather than broad lighting, to focus lighting toward the ground in work areas	Change in Habitat, Mortality Risk
Prohibit workers from having domestic pets within the RSA	Change in Habitat, Mortality Risk
Prohibit workers, visitors, or contractors from feeding or harassing wildlife within the maximum disturbance footprint	Change in Habitat, Mortality Risk
Implement a wildlife orientation for all site personnel. The orientation will include information about potential Project effects on water, fish, vegetation and wildlife, potential wildlife crossings, wildlife mitigation measures, and waste management policies that limit human-wildlife interactions	Change in Habitat, Mortality Risk
Require workers to report all bird observations through a logbook or information directly passed to the on-site environmental lead	Change in Habitat, Mortality Risk
Develop a plan to prevent deleterious substances from entering a water body	Change in Habitat, Mortality Risk
Maintain all machinery on site in a clean condition and free of fluid leaks	Change in Habitat, Mortality Risk
Wash, refuel and service machinery in upland areas in such a way as to prevent any deleterious substances from entering a water body	Change in Habitat, Mortality Risk
Store fuel and other materials for the machinery in such a way as to prevent any deleterious substances from entering a water body	Change in Habitat, Mortality Risk
Establish a spill response plan with the following key mitigation measures: • report all spills as soon as possible when a deleterious substance enters a water body; • install containment measures around the spill; and, • collect and dispose of contaminated water or soil substrates using an emergency spill kit and other necessary spill response measures. Disposal will be at approved disposal facilities.	Change in Habitat, Mortality Risk

Mitigation Measure	Potential Adverse Effect
Allow for the regeneration of natural vegetation following the cessation of exploration in a work area	Change in Habitat
Clear vegetation for winter access roads down to the shrub level only (0.1 m in height)	Change in Habitat
Limit grubbing activities (i.e., removal of groundcover) to the drill hole location and the MBC sumps, and to larger stumps along winter access roads to improve snow packing and subsequent safe driving conditions	Change in Habitat
Develop and implement an erosion and sediment control plan to prevent the introduction of sediment into any water body during all phases of the works, undertakings and activities	Change in Habitat
Install erosion and sediment control measures, where appropriate, before beginning works, undertakings and activities	Change in Habitat
Maintain and inspect erosion and sediment control measures and structures regularly during all phases of the works, undertakings and activities	Change in Habitat
Keep the erosion and sediment control measures in place until all disturbed ground has been stabilized, then remove all erosion and sediment control materials (unless biodegradable)	Change in Habitat
Keep organic layers intact (i.e., limit grubbing and vegetation removal) wherever possible	Change in Habitat
Operate machinery on land in stable, dry areas	Change in Habitat
Monitor waterbodies regularly for signs of sediment entry during all phases of the works, undertakings and activities and take corrective action	Change in Habitat
Use biodegradable erosion and sediment control materials whenever possible	Change in Habitat
Post and enforce a speed limit of 50 km/hr on Project-related access roads	Mortality Risk
Implement a policy to minimize disturbance of wildlife on access roads, including providing wildlife with the right-of-way on roads, not using vehicles to entice wildlife to move off the road, and slowing or stopping until wildlife have cleared the road	Mortality Risk
Implement an on-site policy prohibiting workers from shooting, hunting, and fishing within the RSA	Mortality Risk
Prohibit workers from having personal firearms within the RSA	Mortality Risk
Investigate all Project-related wildlife mortality and correct the root cause(s) through adaptive management where possible	Mortality Risk

8.4.4 Effects Characterization

8.4.4.1 Approach

Residual effects on birds follow those described in the Methods Section (**Table 8-1**), including consideration of magnitude, likelihood, geographical extent, duration, frequency, timing, reversibility, context, and confidence of the effect. The ratings and definitions for each residual effect characteristic are in **Table 8-1**and discussed explicitly in the relevant sections below.

8.4.4.2 Residual Change in Habitat Effects

Project activities will potentially alter a maximum area of <3% of vegetation and ecosystems within the RSA and are of low magnitude. Mitigation measures are anticipated to minimize the likelihood of a residual effect but not eliminate it, resulting in its possible occurrence. The geographic extent is local because habitat loss will occur within the Project footprint; however, habitat alteration due to sensory disturbances may occur within the ZOI, resulting in a local extent. The duration will be medium-term, as suitable habitat will regenerate through the life of the Project, and effects from sensory disturbances are expected to end following the completion of the Project. The frequency of changes in habitat is continuous, as work areas change annually and clearing occurs in different areas of the seismic program. The residual effect from habitat loss and alteration is expected to occur year-round until the Project is complete. Habitat alteration will end following the completion of exploration and associated reclamation, and the regeneration of natural vegetation will reverse the loss of habitat. Therefore, the potential residual effect is reversible.

Table 8-31. Characterization of Potential Project Effects on Bird Habitat

Criterion		Rating	Rationale
Magnitude		Low	The maximum potential change in the relative availability of vegetation and ecosystems within the RSA is <3%. Vegetation clearing, including trees, is expected to be required for access roads and seismic lines.
Likelihood		Possible	Mitigation measures are expected to minimize but not eliminate the potential for change in habitat.
Geographic Extent		Local	Changes in habitat alteration due to Project-related sensory disturbances are predicted to be limited to the ZOI. Direct habitat loss is predicted to be limited to the maximum disturbance footprint.
Duration, Frequency and Timing	Duration	Medium-term	A change in habitat is predicted to occur throughout the entire exploration period of the Project.
	Frequency	Continuous	Habitat loss will occur once in each work stage; however, habitat alteration through sensory disturbances are expected to occur continuously.
	Timing	Year-round	The residual effect of that vegetation clearing is predicted to remain year-round until vegetation has regenerated.
Reversibility		Reversible	The habitat alteration is expected to end after the completion of exploration and associated reclamation. The regeneration of natural vegetation is expected to reverse habitat loss.

8.4.4.2.1 Context and Confidence

The RSA overlaps with a Zone IV IMA in the North Yukon and Peel Watershed Planning Regions. This zone is an area of diminished ecological and cultural values in a moderately sensitive biophysical setting and allows for the highest level of development. Cumulative effect indicators are used in both plans if the current management and development are meeting the set goals and objectives. Two cumulative effects indicators included in the Plans are direct surface disturbance and linear density, with guidelines setting cautionary (0.75 km/km²) and critical (1.0 km/km²) indicator levels in both plans.

A network of linear features was previously created in parts of the RSA due to intermittent historical exploration activities. The Linear Feature Study (**Appendix 8-B**) determined the extent and characteristics of liner features in the RSA and addressed three objectives: (1) comprehensive mapping and classification of existing linear feature footprints within the RSA; (2) quantification of structural aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and (3) quantification of regeneration pathways and structural stages of linear features. That combined information supports assessing the Project's potential effects of linear features and refinement of mitigation measures for linear features to minimize possible effects. After accounting for natural features and regeneration, the adjusted linear feature density for the RSA was below the cautionary and critical indicator levels, at 0.52 km/km², in both regional land use plans.

The level of confidence in this prediction is Moderate (**Table 8-32**). The direct effects of both habitat loss and alteration on birds are well-documented, and the efficacy of mitigation measures has been supported through application in previous projects. However, there is some uncertainty in the specific context of those studies and the habitat conditions at Eagle Plains.

Table 8-32. Characterization of Context and Confidence in the Residual Project Effects on Bird Habitat

Criterion	Rating	Rationale
Context	Highest Development	The Project occurs within the IMA Zone IV Management Unit, designated as the highest level of disturbance.
Confidence	Moderate	Mitigation measures are expected to effectively avoid and minimize the changes in bird habitat; however, the uncertainty of the Project footprint results in Moderate Confidence in the residual effect prediction.

8.4.5 Significance

The Project is not expected to result in a change in bird habitat that will alter its integrity within the RSA to the point where it cannot sustain the regional populations of birds. The Project was designed to limit interactions with birds and bird habitat by avoiding suitable habitat to the extent practical. Standard mitigation measures, known to be effective at minimizing residual adverse effects, have been applied to the Project. Therefore, the residual effect is **not significant**.

8.4.6 Cumulative Effects Assessment

8.4.6.1 Approach

Project-related residual effects with the potential to interact cumulatively with the residual effects of projects and activities identified within or extending into the CESA was a change in habitat.

The spatial boundaries of the CEA on birds are delineated by the CESA as described in **Section 3.1.6.1.1**. Projects and activities outside the CESA but with potential effects within this area were also included in this assessment. Temporal boundaries for assessing cumulative effects encompass past, present, and reasonably foreseeable future activities spanning the Project's lifespan (**Section 1.3.1**).

8.4.6.2 Cumulative Change in Habitat Effect

The indicator used to characterize the change in habitat cumulative effect on moose was the total surface disturbance (area [km²] and percent [%]) from anthropogenic footprints (e.g., mineral exploration, oil and gas) disturbed by the footprints. Present conditions include a total area of 62.5 km² (0.6%) disturbed by past and present projects and activities within the CESA (**Table 8-33**). This is predicted to increase by 1.2 km² (0.0%) following the inclusion of reasonably foreseeable projects and activities. The Project is expected to increase the amount of disturbed area over the existing conditions by a maximum of 69.5 km² (0.6%) within the CESA, resulting in a maximum disturbed area of 133.2 km² (1.2%) when combined with past, present, and reasonably foreseeable projects and activities.

The magnitude of cumulative change in habitat is low because it is a <1% change from existing conditions. The likelihood of the cumulative effect is Probable due to mitigation measures minimizing but not eliminating the potential for habitat loss. Changes in habitat are expected to occur throughout the CESA due to the spatial location of the projects and activities part of the assessment; therefore, the cumulative effect is regional in geographic extent. The effect is predicted to end following the completion of projects and activities in an area, and as a result, it is medium-term in duration. The change in habitat is continuous, as vegetation clearing will likely occur occasionally, but its effects will be continuous until vegetation regenerates. The effect of a change in habitat due to projects and activities within the CESA is predicted to have year-round Timing until vegetation can regenerate. It is likely that the regeneration of the affected habitat will occur over time following the completion of the projects and activities considered in the assessment and is anticipated to reverse the cumulative effect. The cumulative effects characteristics are summarized in **Table 8-34**.

Table 8-33. Cumulative Change in Habitat Effects from Existing and Project-Related Disturbances on Birds

Cumulative Effect Indicator	Scenario	Cumulative Effects Study Area
Total Surface Disturbance (Footprints)	Present	62.5 km² (0.6%)
	Project	69.1–69.5 km² (0.6%)
	Future	1.2 km² (0.0%)
	Total Cumulative Effect	132.8–133.2 km² (1.2%)

Table 8-34. Characterization of Cumulative Change in Habitat Effects on Birds

Criterion		Rating	Rationale
Magnitude		Low	The change in habitat across the CESA is predicted to be <1% over existing conditions.
Likelihood		Probable	Mitigation measures are expected to minimize but not eliminate the potential for a change in habitat.
Geographic Extent		Regional	Change in habitat quality is expected to occur across the CESA due to the location of the reasonably foreseeable projects and activities.
Duration, Frequency and Timing	Duration	Medium-term	The effect is expected to end after completing projects and activities in an area.
	Frequency	Continuous	Vegetation clearing required for projects and activities may occur occasionally, but the cumulative effect on birds will continue until vegetation regenerates.
	Timing	Year-round	The effect is expected to occur year-round due to changes in habitat remaining until vegetation regeneration.
Reversibility		Reversible	The regeneration of the affected habitat is expected to be reversible over time.

8.4.6.2.1 Context and Confidence

The context of Regional Land Use Planning and the confidence in accurately quantifying and predicting those effects were considered in the CEA for change in habitat on birds (**Table 8-35**). The effects characterization is consistent with the objectives of the Land Use Plans, and there is relatively high confidence that effects were accurately captured in the assessment. The total disturbance calculation may not have included all potential anthropogenic features, and there is a high degree of confidence that most disturbances were included. Therefore, the confidence in this CEA is high.

Table 8-35. Characterization of Context and Confidence in the Assessment of Cumulative Change in Habitat Effects on Birds

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	Characterizing the cumulative effect and its persistence has high confidence, as a precautionary approach was taken to quantify the change in habitat effect.

9 CARIBOU

Caribou were selected as a key Valued Environmental and Socio-Economic Component (VESEC) for the Project due to their cultural, ecological, and economic value to the Gwich'in people, including subsistence hunting. The Project occurs exclusively within the Porcupine Caribou Herd (PCH) range. Activities outside the Project Regional Study Area (RSA), such as personnel or equipment transport, will have limited overlap with other caribou herd ranges, e.g., Forty Mile Herd and Hart Herd along the Dempster Highway. Project-related traffic on public roads and highways will be infrequent (up to 12 trucks/vehicles per week) and a small proportion of the overall traffic. Therefore, this assessment focuses on the PCH and does not include other herds.

The PCH is a subpopulation of barren-ground caribou (*Rangifer tarandus groenlandicus*) known for its widespread distribution, large population aggregations, dramatic fluctuations in population size, and lengthy seasonal migrations (COSEWIC 2016). Within the North Yukon Regional Land Use Plan, the PCH is considered "*the most significant and culturally important wildlife resource in the planning region*" (Vuntut Gwitchin Government and Yukon Government 2009). Barren-ground caribou, including the PCH, have been assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2016). However, the subspecies is not listed on Schedule 1 of the federal *Species at Risk Act*. In Yukon, barren-ground caribou are considered Vulnerable to Apparently Secure (Yukon Government 2020).

9.1 GENERAL ECOLOGY OF THE PORCUPINE CARIBOU HERD

A general understanding of the PCH's ecology and potential to interact with the Project are needed to frame and characterize effects appropriately. This section provides information on the herd's population size, seasonal ranges and distributions, movement patterns in the RSA, and habitat selection. The information comes from various primary publications and technical reports and includes results from the Project's baseline caribou study (**Section 6 Caribou** of **Appendix 9-A Wildlife Baseline**).

9.1.1 Subpopulation Size and Trends

Although most barren-ground caribou subpopulations are in decline (COSEWIC 2016), the PCH has increased in size over the last two decades. The last successful subpopulation survey in 2017 estimated 218,457 caribou (95% Confidence Interval [CI] = 202,106–234,808) (Porcupine Caribou Technical Committee 2019). Since the first survey in 1972, the PCH has had two periods of growth, with an interceding decline in the 1990s **(Figure 9-1**). During both periods of growth (1972–1989 and 2010–2017), the herd experienced an approximate 3.7% increase in abundance (Porcupine Caribou Technical Committee 2019).

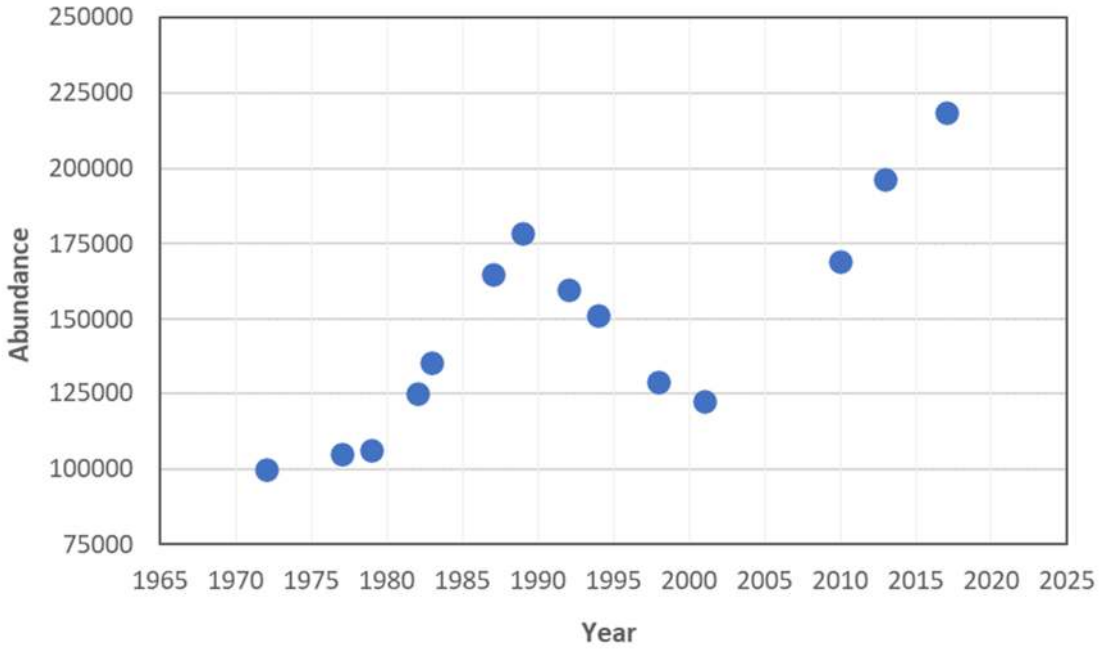


Figure 9-1. The Population Size of the Porcupine Caribou Herd from 1972 to 2017 (Porcupine Caribou Technical Committee 2019)

Large-magnitude fluctuations in population size are well-documented for barren-ground caribou (Bongelli et al. 2020). Subpopulations (herds) often experience >80% declines and >500% increases, which occur over several decades and caribou generations (COSEWIC 2016). Based on scientific studies and Traditional Knowledge, the time interval between peaks in abundance varies by approximately 30–80 years among subpopulations (Ferguson et al. 1998, Gunn 2003, COSEWIC 2016). Despite large-magnitude changes in the abundance of barren-ground caribou, there is still a poor understanding of how limiting factors regulate subpopulation dynamics. Predation, human harvest[10], parasites and disease, and food supply are limiting factors of barren-ground caribou (COSEWIC 2016). However, there has been no conclusive evidence to demonstrate a single, dominant factor that drives changes in abundance across herds and over time. Despite strong advocacy for certain factors by certain researchers (e.g., for predation by Bergerud [1996]), the weight of evidence suggests that subpopulation dynamics involve complex interactions among limiting factors that vary over time and space (Klein 1991, Whitten 1996).

After 50 years of PCH monitoring, the subpopulation has not exhibited fluctuations in size as large as other barren-ground caribou subpopulations (COSEWIC 2016). This may be due to the PCH's large annual and seasonal ranges and the diversity of habitats across these ranges (Russell et al. 1993, Whitten 1996). Whitten (1996) suggests that periods of decline are caused by nutritional stress and predation, exacerbated by adverse weather. Population growth during periods of favourable weather is dampened by a combination

[10] Human harvest is considered a natural population factor for barren-ground caribou because hunting has occurred for centuries (Sherry and Vuntut Gwitchin First Nation 1999, COSEWIC 2016). However, it is recognized that the nature of hunting has dramatically changed over the last century with the advent of high-powered rifles and snowmobiles.

of poor nutrition, predation, human harvest, and disease. There has been no evidence to suggest density-dependent regulation by the PCH (Whitten 1996).

9.1.2 Seasonal Ranges

Like most barren-ground caribou subpopulations, the PCH has a large annual range. Individuals make long-distance migrations, hundreds to thousands of kilometres in length, between seasonal ranges. These seasonal ranges can vary among and within years in response to variations in forage availability, snow cover, predation, or parasite risk (Russell et al. 1993). The PCH's annual range extends approximately 250,000 km² from Alaska, through Yukon, and into the western edge of Northwest Territories.

The PCH's long-distance migrations are necessary for key aspects of their life cycle. Eight (8) primary life cycle periods occur for the PCH (Porcupine Caribou Technical Committee 1993). Key information for the eight periods is summarized in **Table 9-1** (using information from Russell et al. 1993, Porcupine Caribou Technical Committee 1993, Ryder et al. 2007). The Porcupine Caribou Technical Committee (1993) assessed the relative importance of seasonal ranges using six criteria: energy balance, reproductive contribution, tolerance to disturbance, escape requirements, the intensity of use, and whether alternative habitats are available. Although all seasons are important to meeting the annual life requisites of the PCH, the calving and post-calving seasons are considered of the highest importance, and fall and winter are considered of the lowest importance (Porcupine Caribou Technical Committee 1993).

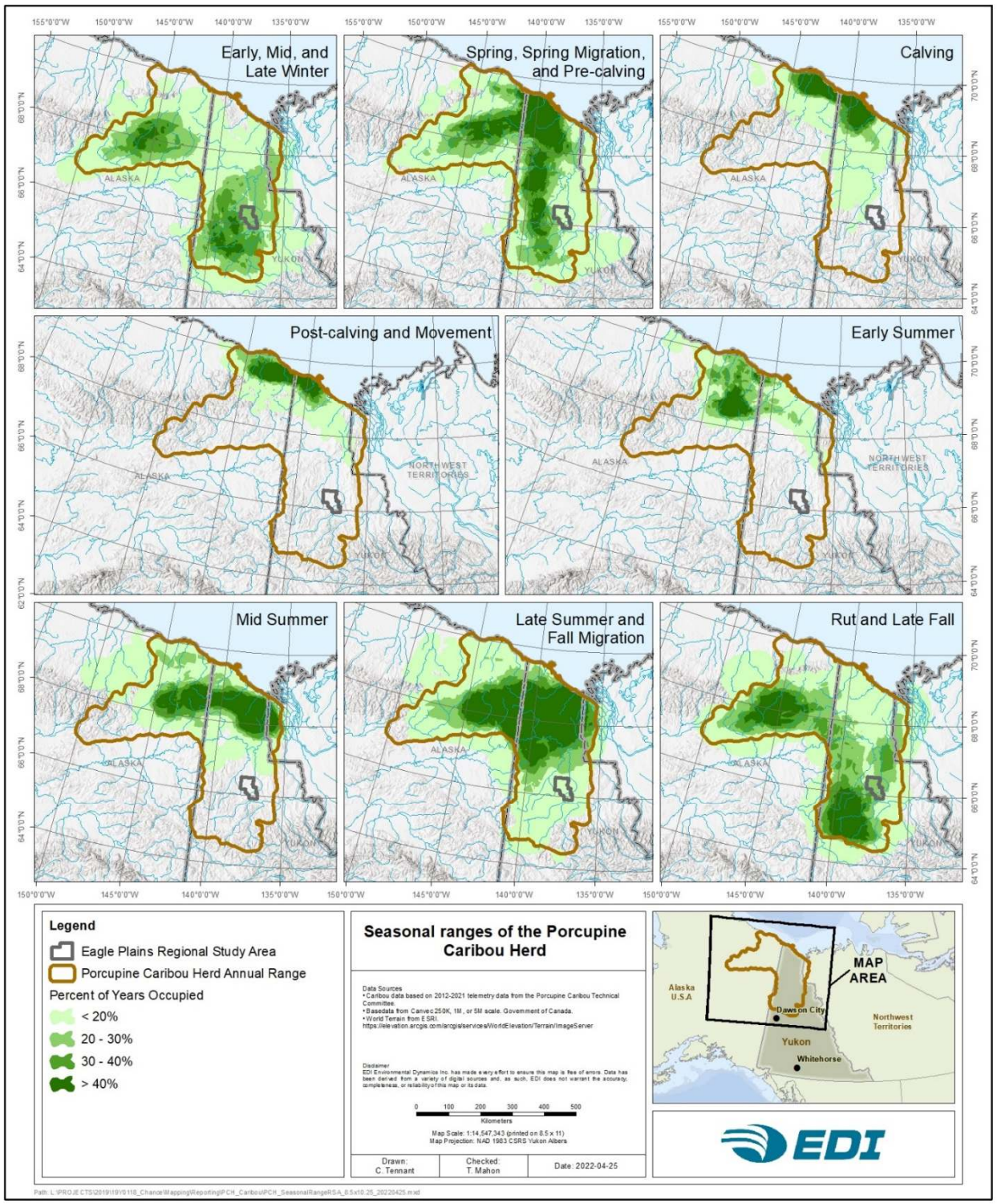
Typical patterns of seasonal range use by the herd from 1970–2016 are shown in **Map 9-1**. After calving on the north slope and Arctic coastal plains, the PCH typically splits in two, with portions of the herd moving southwest into Alaska and southeast into Yukon. Animals in the Yukon typically follow a clockwise movement through seasonal ranges, beginning at calving grounds on the north slope, moving to the British Mountains in summer, then to the Richardson Mountains in late summer, and dispersing widely and variably across northern Yukon in rut/ late fall and winter (but as far south as the Ogilvie Mountains) before returning to the northern coastal plains in spring. The PCH has historically overlapped the Project RSA in the rut/ late fall and winter periods (**Map 9-2**). However, the RSA overlaps a small portion of those seasonal ranges—6.0% during rut/ late fall and 6.5% during winter—and does not overlap with the most frequently used portions of those ranges.

Table 9-1. Key Life Cycle Periods for the Porcupine Caribou Herd

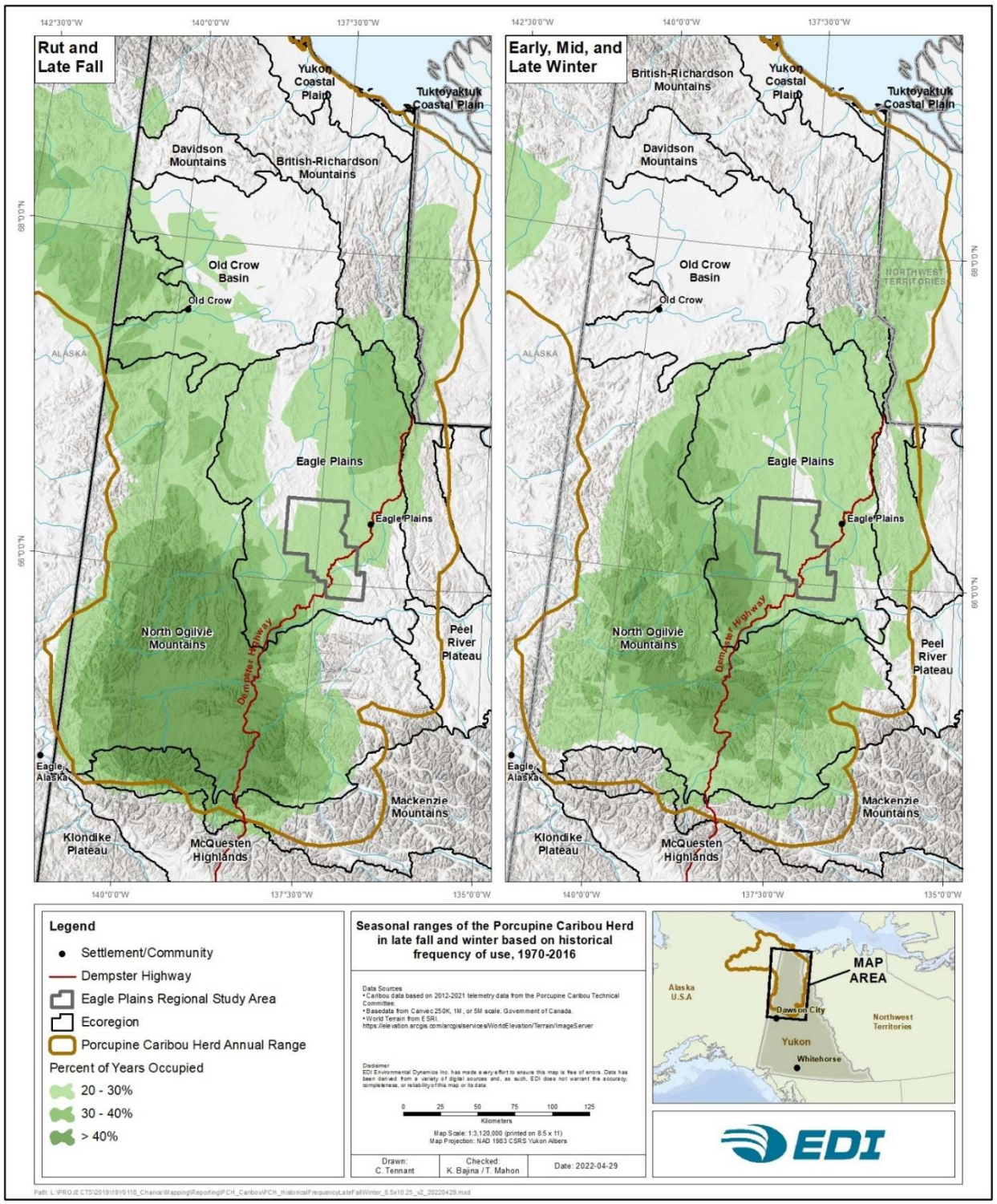
Season	Date	Characteristics	Importance*
Early, Mid, and Late Winter	Dec 1–Mar 31	The herd is most dispersed across two winter ranges: in Yukon, mainly south of the Porcupine River in boreal taiga, and in Alaska, centred in the Chandalar River/Arctic Village area. Winter range use varies annually, depending on snow depth and condition. Caribou at this time of year are relatively tolerant to human activity. In shallow to normal snow years, animals can gain weight.	4
Spring, Spring Migration, and Pre-Calving	Apr 1–May 31	Herd distribution varies depending on snowmelt; migration routes vary annually. Pregnant females typically have an energy deficit due to reduced forage once they leave the lichen-rich taiga.	3
Calving (cows)	Jun 1–10	Calving occurs on the coastal plain of northeast Alaska and, to a lesser degree, northwest Yukon. This area offers reduced predators and abundant spring forage; no alternative range is available. Cows are at the lowest point of physical condition and are least tolerant to human disturbance.	1
Post-Calving and Movement (cows)	Jun 11–30	As calves develop over the first two weeks of life, the cows and calves tend to aggregate into larger groups and increase movement rates to track the progression of plant green-up. The post-calving period imposes high energetic demands on lactating females, and cow/calf groups are relatively intolerant of disturbance. The post-calving range is primarily in Alaska, and cows that calved in Yukon tend to move west along the foothills into Arctic National Wildlife Refuge. Insect avoidance can affect distribution by the end of June.	1
Calving to Movement (bulls)	Jun 1–30	Bulls, non-pregnant cows, and subadults tend to concentrate east of the calving grounds in northern Yukon. Animals track green-up progression from the coastal plains to the northern foothills and into intermountain regions.	3
Early Summer	Jul 1–15	Cows continue requiring a high-energy forage intake for milk production, but insect avoidance drives distribution. Key areas selected for insect avoidance are the coastal plains adjacent to the Beaufort Sea (mostly cows/calves) and mountains in the Brooks and British Mountains (mostly bulls and cows without calves). Long-distance movements during this period are also insect avoidance behaviour.	2
Mid Summer	Jul 16–Aug 7	Mid-summer continues to be a period of high insect harassment. Two areas are consistently used: the northern Richardson Mountains in Yukon and the southern portion of the Brooks Range in Alaska. Females with calves may be in an energy-deficient state.	2
Late Summer and Fall Migration	Aug 8–Oct 7	As insect activity declines, the herd disperses widely but stays mostly north of the tree line until the latter part of the period—in Alaska south of the Brooks Range and Yukon north of the Porcupine River. Animals exhibit high feeding rates and gain fat for the winter.	3
Rut and Late Fall	Oct 8–Nov 30	The region where rut occurs has no affinity from year to year; rut occurs wherever the herd is along fall migration. In Yukon, distribution can occur from the southern Ogilvie Mountains to the Richardson Mountains.	4

*1 = highest importance, 4 = lowest importance.

Source: Porcupine Caribou Technical Committee (1993). The Porcupine Caribou Herd overlaps the Project Regional Study Area during Rut and Late Fall and Early, Mid, and Late Winter



Map 9-1. Seasonal Ranges of the Porcupine Caribou Herd (ranges provided by the Porcupine Caribou Technical Committee), 1970–2016



Map 9-2. Seasonal Ranges of the Porcupine Caribou Herd in Late Fall and Winter Based on Historical Frequency of Use, 1970–2016

9.1.3 Movement Patterns

To better understand the factors affecting PCH caribou movement, two analyses were conducted as part of baseline studies using PCH telemetry data (2012–2021) (**Section 6 Caribou** of **Appendix 9-A Wildlife Baseline**). First, daily movement rates and residency times were calculated for Porcupine caribou in the RSA and across the broader seasonal ranges. Residency times refer to how long caribou were present in the RSA or similarly sized parts of the broader seasonal ranges. Movement and residency within the RSA were compared to other equal-sized areas (or cells) in the rut/ late fall and winter ranges. Second, movement (migration) paths were delineated within and adjacent to the RSA.

The analyses indicated that Porcupine caribou typically make movements of several kilometres per day in both rut/ late fall and winter and rarely spend multiple days in the same location. Daily movement rates and residency times are summarized in **Table 9-2.** Rut/ late fall daily movements (9.0 km/day in the RSA) were substantially greater than during winter (4.0 km/day). Residency times were shorter during rut/ late fall than winter and shorter in the RSA compared to the broader seasonal ranges. The combination of faster daily movements and shorter residency times in the RSA to the broader seasonal ranges suggests the PCH's historical transient use of the RSA.

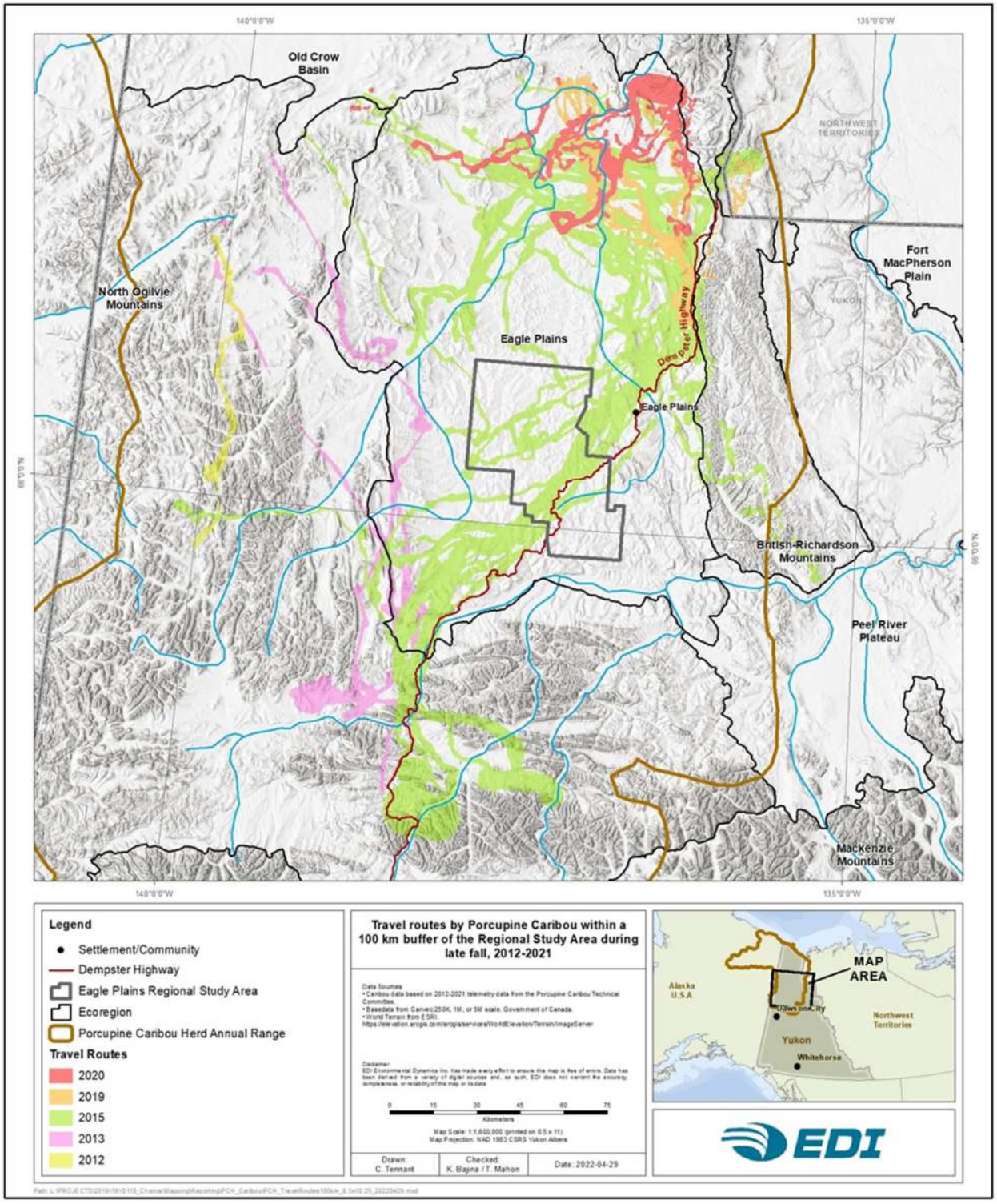
Global Positioning System (GPS) collar data (2012–2021) demonstrated that the only time caribou travelled through the RSA during the rut/ late fall season was in 2015; 14 collared caribou made clear, directed movements along the height-of-land parallel to the Dempster Highway, from the northeast to the southwest (**Map 9-3**). Most caribou appeared to avoid crossing the Dempster Highway while travelling through the Eagle Plains region; however, all animals eventually crossed the highway farther south, in the Ogilvie Mountains. The caribou moving through Eagle Plains crossed several historical two-dimensional (2D) seismic lines and winter roads/trails (mostly aged 35-years or older) and a large three-dimensional (3D) seismic grid (established 2013–2014) within the RSA.

Table 9-2. Mean Daily Movement Rates and Residency Times of the Porcupine Caribou Herd in the Project Regional Study Area and in Similarly Sized 50 km x 50 km Cells Covering Late Fall and Winter Range Extents

Season	Scale[1]	Daily Movement (km/day)		Residency Time (days)[2]	
		Mean	Standard Error	Mean	Standard Error
Late Fall	Project RSA (2,387 km² total)	9.0	± 0.6	4.5 (8.3%)	± 0.8
	Late Fall Range (88,149 km²) (2,500 km² per cell) – 53 cells total	15.0	± 2.1	7.7 (14.2%)	± 0.6
Winter	Project RSA (2,387 km² total)	4.0	± 0.6	15.69 (12.9%)	± 5.1
	Winter Range (65,077 km²) (2,500 km² per cell) – 40 cells total	4.8	± 0.5	25.93 (21.3%)	± 2.1

[1] Late fall and winter ranges were subsampled using 2,500 km² cells (approximately the same size and the RSA) to facilitate estimation of mean and variance. Estimates of mean and variance within the RSA are derived from differences in rates and residencies of individual caribou.

[2] Percent of the season indicated in brackets. Total days: late fall = 54 days, winter = 122 days.



Map 9-3. Travel Routes by Porcupine Caribou Within a 100 km Buffer of the Project Regional Study Area During Late Fall, 2012–2021

During this temporal extent (2012–2021), collared caribou were only present during late fall of 2012, 2013, 2015, 2019, and 2020.

9.1.4 Diet and Habitat Selection

During the growing season, barren-ground caribou forage on grasses, sedges, forbs, lichens, and shrubs. However, during winter, lichens constitute the primary forage of most barren-ground caribou populations (COSEWIC 2016). In a study over three winters, the composition of PCH fecal samples was similar and, on average, consisted of 64% fruticose lichens, 11% evergreen shrubs, 8% moss, 6% horsetails, and 5% foliose lichens (Russell et al. 1993).

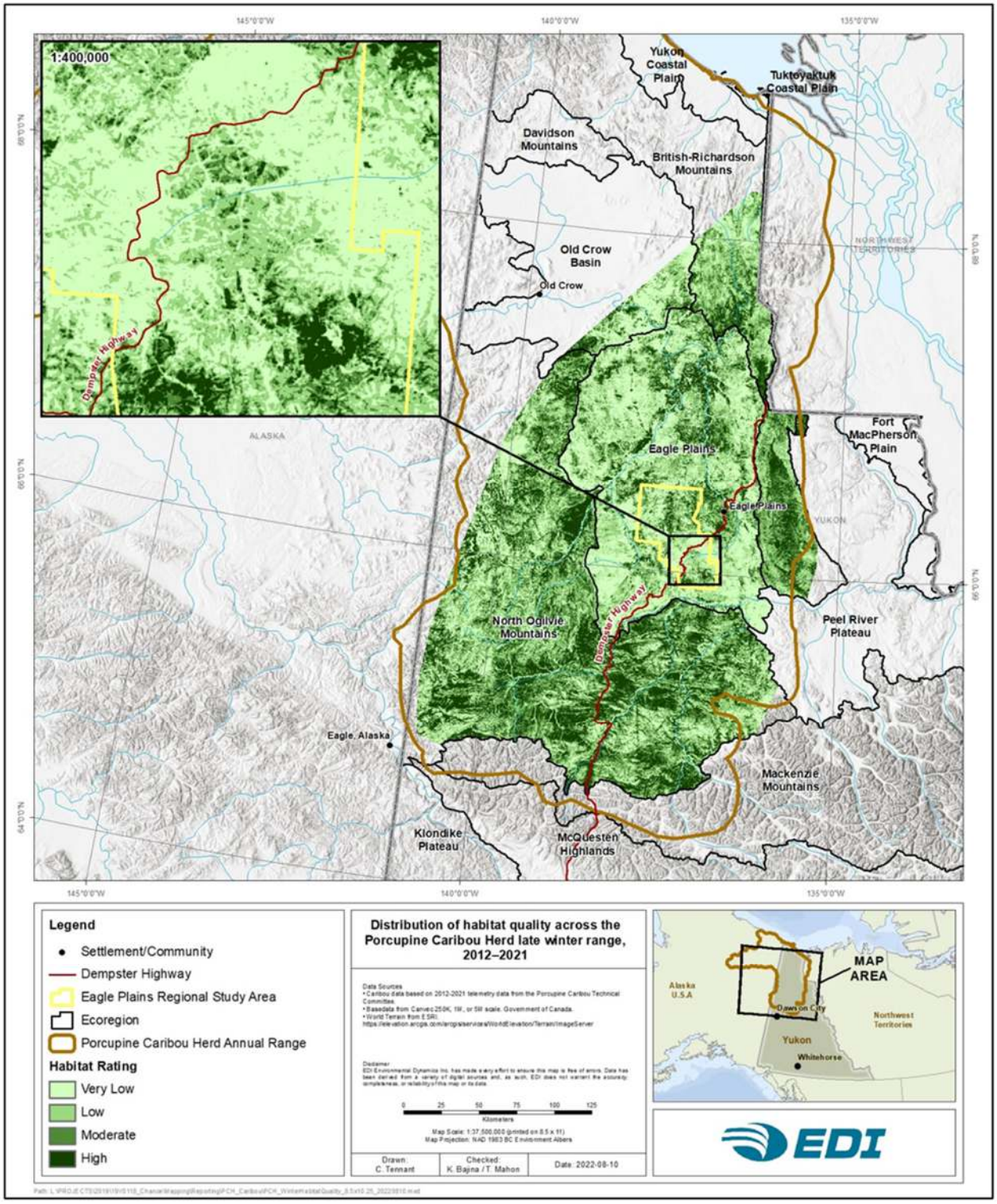
Generally, lichen biomass in the taiga is greatest in open conifer stands that are 125–175 years old (Klein 1982). Lichen biomass is often greatly reduced following wildfire. However, Russell et al. (1993) found that lichen biomass in the PCH range varied across stand ages. Stands <50 years old often had moderate-to-high lichen biomass, suggesting that young stands may contribute more to the PCH's lichen forage than other herds. Russell et al. (1993) emphasized the importance of a mosaic of stand age classes, resulting primarily from wildfire, to maintaining lichen biomass at the regional level over time. Although habitat selection is often driven by forage availability, especially in winter, caribou habitat selection is also influenced by the need to reduce predation risk (Latham et al. 2011a) and minimize exposure to insect harassment during summer (Russell and Nixon 1990).

The Project's PCH baseline studies involved quantifying habitat selection during rut/ late fall and winter (**Section 6 Caribou** of **Appendix 9-A Wildlife Baseline**), which required the development of Resource Selection Functions (RSFs) (Manly et al. 2002). Data for the RSFs consisted of GPS collar locations from 2012–2021 for 164 caribou during rut/ late fall and 172 caribou during winter. Spatial habitat data included a set of plant functional type layers (light macrolichens, graminoids, forbs, evergreen shrubs, deciduous shrubs, and conifer trees), elevation, aspect, slope, terrain ruggedness, and distance to waterbodies >1 hectare (ha). PCH caribou tended to select and avoid similar resources in both rut/ late fall and winter, though the range of selected habitats was narrower in winter.

Key covariates in models for both seasons that were statistically significant (i.e., $P < 0.05$) included light macrolichen cover (positive coefficient), conifer tree cover (negative coefficient), slope percent (negative coefficient), elevation (variable in fall and winter), and aspect (greater selection for south- and west-facing slopes). Coefficients for lichen cover had the greatest magnitude, which suggests that the selection of lichen is the primary driver of habitat selection during rut/ late fall and winter.

The RSFs were used to derive habitat quality maps with four rating classes (Very Low, Low, Moderate, and High), which were determined by assessing selection ratios across RSF predictions. The distribution and proportion of selected habitat (Moderate and High) were then examined within the RSA and broader seasonal ranges (**Map 9-4**). The proportion of selected habitat during late fall was equivalent between the RSA (0.4) and the broader range (0.4 ± 0.03) but was less in the RSA (0.3) than the broader range during winter (0.4 ± 0.03).

Selected habitat, especially areas of High quality, were mostly dependent on the amount and distribution of light macrolichen cover.



Map 9-4. Distribution of Habitat Quality Across the Porcupine Caribou Herd Late Winter Range, 2012–2021

The map inset shows the habitat in the southern half of the RSA in finer resolution. High ratings correspond mostly to mature open canopy spruce stands with high ground lichen cover; low ratings correspond mostly to recent burns.

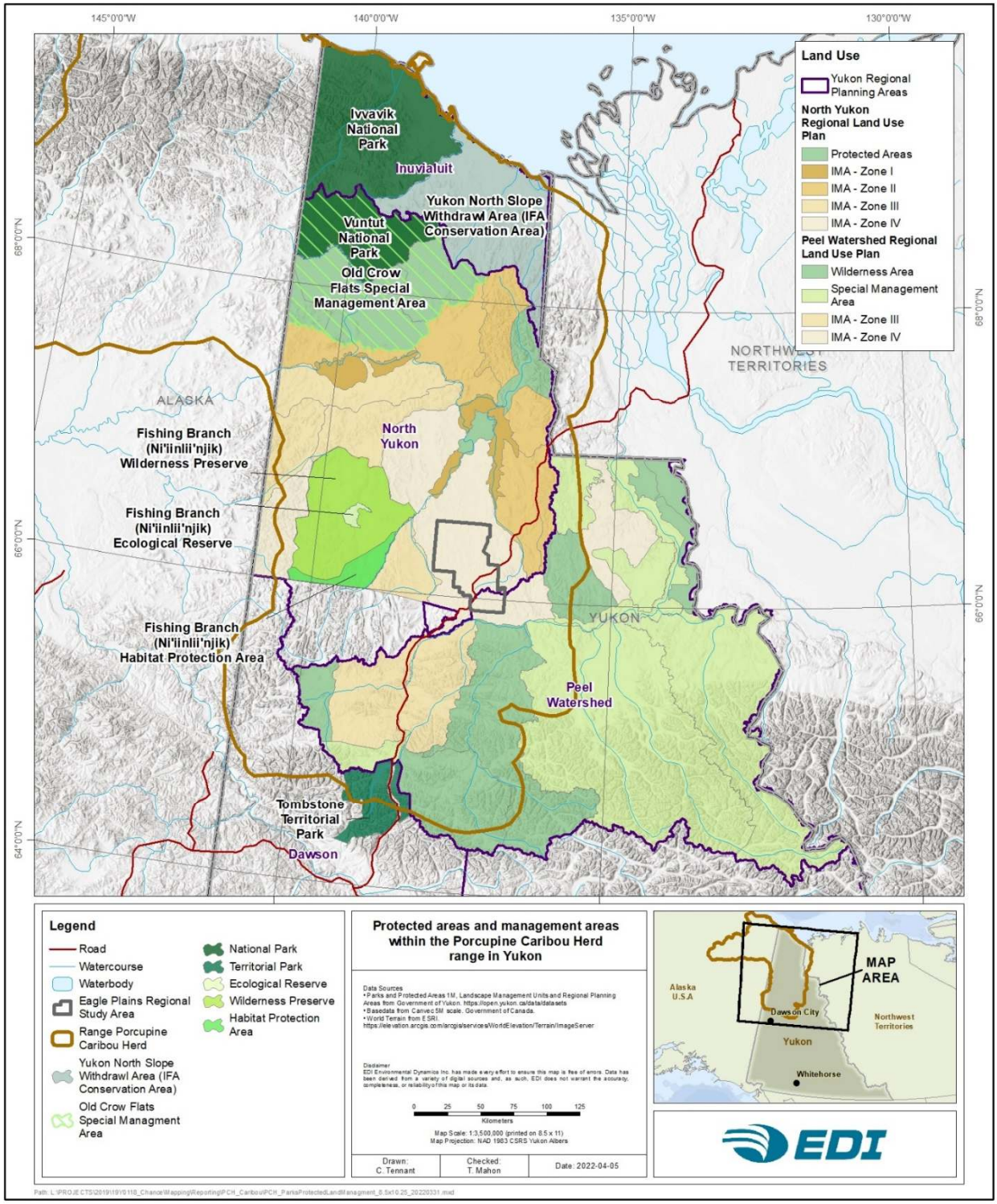
9.2 PORCUPINE CARIBOU MANAGEMENT AND CONSERVATION

There is a long history of co-management of the PCH among indigenous, state, territorial and federal governments in Canada and the United States of America (USA). Canada and the USA co-manage the herd under the *Agreement Between the Government of Canada and the Government of the United States of America on the Conservation of the Porcupine Caribou Herd* (Government of Canada and Government of the United States of America 1987). There are two primary management boards for the PCH: the International Porcupine Caribou Board (IPCB), comprised of Canadian and American representatives, and the Porcupine Caribou Management Board (PCMB), which is a co-management board for the Canadian portion of the herd's range, formed under the *Porcupine Caribou Management Agreement* (Government of Canada et al. 1985). The IPCB and the PCMB have developed multiple conservation plans for the PCH focused on population management and land use management, including:

- Plan for the International Conservation of the Porcupine Caribou Herd (International Porcupine Caribou Board 1993);
- *Wildlife Conservation and Management Plan for Yukon North Slope* (Wildlife Management Advisory Council [North Slope] 2002);
- *Harvest Management Plan for the Porcupine Caribou Herd in Canada* (Porcupine Caribou Management Board 2010a) and an associated *Implementation Plan* (Porcupine Caribou Management Board 2010b); and,
- Porcupine Caribou Herd Strategic Framework 2015–16 to 2019–20 (Porcupine Caribou Management Board 2016).

The 1987 international agreement provided for forming a joint technical committee, now known as the Porcupine Caribou Technical Committee (PCTC), to coordinate research and monitoring activities and to advise the IPCB and the PCMB on scientific matters surrounding the herd. The PCTC leads most monitoring and research work on the PCH, including population and demographic monitoring, seasonal movement monitoring (via GPS telemetry tracking), caribou body condition monitoring, habitat and human disturbance assessments, and annual snow surveys. Monitoring results are typically provided to the PCMB and the IPCB via annual reports (e.g., Porcupine Caribou Technical Committee 2019) and presentations at the annual harvest meetings.

The portion of the PCH annual range that occurs within Yukon is protected by a network of parks, special management areas, conservation areas, wilderness areas, protected areas, ecological preserves, habitat protection areas, and Integrated Management Area (IMA) zones within the North Yukon Regional Land Use Plan (NYRLUP; Vuntut Gwitchin Government and Yukon Government 2009) and the Peel Watershed Regional Land Use Plan (PWRLUP; Peel Watershed Planning Commission 2019) (**Map 9-5**). In total, 54% of the annual range of the PCH within Yukon falls within some type of protected area where industrial activity is prohibited, 36% of the annual range occurs within regional LUP IMA zones where development is limited, and any land management zonation does not cover 9% of the annual range.



Map 9-5. Protected Areas and Management Areas Within the Porcupine Caribou Herd Range in Yukon

9.3 ASSESSMENT INDICATORS AND ASSESSMENT PARAMETERS

Based on the PCH's ecology and possible interaction with the Project RSA (Section 9.1 General Ecology of the Porcupine Caribou Herd), the Project has the potential to affect PCH habitat, movement, mortality, and energetics. Details on each of these factors and the associated assessment parameters are summarized in **Table 9-3**.

Table 9-3. Indicators and Assessment Parameters for the Porcupine Caribou Herd and the Potential Effects of the Eagle Plains Exploration Project

Assessment Indicator	Pathway	Assessment Parameters/Approach
Direct Habitat Effects	Vegetation clearing associated with Project developments (e.g., well sites, winter access roads, seismic) is expected to result in direct habitat loss.	Quantitative assessment of the change in (modelled) suitable habitat based on development footprints.
Indirect Habitat Effects	Sensory disturbance associated with Project activities may cause caribou to avoid a Zone of Influence (ZOI) around work sites, resulting in temporary, indirect habitat loss.	Quantitative assessment of the change in (modelled) suitable habitat based on a Zone of Influence associated with annual work areas.
Movement Effects	Sensory disturbance associated with Project activities may cause caribou to avoid a Zone of Influence around work sites, potentially affecting movement patterns.	Qualitative assessment of the potential effects on movement based on a Zone of Influence associated with annual work areas. Changes to local and regional movement patterns are discussed.
Direct Mortality Effects	Vehicle travel has the potential to cause direct caribou mortality via vehicle collisions.	Mitigation measures are expected to reduce direct caribou mortality to a negligible level. As such, these direct effects are not formally assessed as part of the effects characterization.
Indirect Mortality Effects	The creation and use of linear features for the Project has the potential to cause indirect mortality of caribou by wolves and humans (facilitated predation).	Qualitative assessment that considers the extent of linear feature developments and PCH ecology in the context of the Eagle Plains ecoregion. Comparisons are made to boreal regions where the effects of linear features have been well documented.
Energetics Effects	Indirect habitat effects and altered movement could have cascading effects on the energetic output of caribou.	Effects on caribou energetics are expected to be low given the timing and magnitude of potential effects due to the Project. As such, these effects are not formally assessed as part of the effects characterization.

9.4 PROJECT INTERACTIONS AND POTENTIAL EFFECTS

9.4.1 Interactions

The potential for the Project to interact with and affect caribou was assessed by systematically reviewing each of the components listed in the Project description (**Table 9-4**). The Project includes several components that have the potential to interact with caribou. Each of these components received scores (0 = no interaction; 1 = minor interaction; 2 = substantial interaction) based on the expected interaction between caribou and that component. Only component-effect interactions with a score of 2 are considered in residual effects characterization, whereas lower scores are associated with effects that are small (immeasurable) or negligible (**Table 9-4)**.

Table 9-4. Expected Interactions Between Caribou and the Eagle Plains Exploration Project and the Resulting Potential Effects

Project Component / Activity	Direct Habitat	Indirect Habitat	Movement	Direct Mortality	Indirect Mortality	Energetics
Engagement	0	0	0	0	0	0
Seismic Exploration	2	2	2	0	2	1
Drilling Exploration	2	2	2	0	0	1
Extended Flow Testing (EFT)	0	2	2	0	0	1
Well Maintenance (Workovers)	0	2	2	0	0	1
Access Roads	2	2	2	1	2	1
Mix Bury Cover (MBC) Construction and Operation	2	2	2	0	0	1
Central Processing Facility (CPF)	2	2	2	0	0	1
Airstrip	2	2	2	0	0	1
Water Withdrawal	0	2	2	0	0	1
Transportation	0	2	2	1	0	1
Camp	2	2	2	0	0	1
Reclamation and Closure	2	2	2	0	0	1

Notes:
0 = no interaction
1 = minor interaction with caribou is possible, but small immeasurable effect (e.g., possible slight behavioural response, no vegetation effects). Designates a summary of effects addressed in the effects assessment as a discussion. This rating does not lead into residual effects characterization.
2 = substantial interaction with caribou, designates a more detailed assessment of potential effects. Carry forward into residual effects characterization.

Major Project components include seismic exploration, well sites, winter access roads, a winter air strip, and primary and secondary camp locations. Four main disturbance types common across most Project components have potential mechanisms (pathways) to affect caribou: vegetation clearing, access development, sensory disturbances, and vehicle operations (**Table 9-5**). Details associated with each potential effect are provided in the following sections. Their spatial and temporal overlap fundamentally determines the potential for interaction between the Project and the PCH. Where there was potential for the Project to interact with caribou due to spatial and temporal overlap, potential mechanisms (pathways) of effects on caribou were determined based on the details of the Project components, environmental conditions in the Eagle Plains ecoregion, and key aspects of PCH ecology. Determination of mechanisms of effects considered fundamental principles (e.g., that vegetation clearing can affect habitat) and detailed studies of specific types of effects in the literature (e.g., the effects of linear features on caribou mortality). The evaluation considered both direct and indirect effects of the Project.

Table 9-5. Potential Effects on the Porcupine Caribou Herd Associated with Disturbances from the Eagle Plains Exploration Project

Disturbance Type	Project Components	Potential Effects on Caribou
Vegetation Clearing	Most Project components are expected to involve some level of vegetation clearing during their development, including seismic lines, well sites, winter access roads, secondary camps, and the airstrip.	• Direct habitat effects via vegetation clearing • Indirect mortality via apparent competition[11]
Access Development	Seismic lines and the winter access roads used to access all Project components are expected to result in a network of cleared linear features that may enhance access and travel for human hunters and wolves.	• Indirect mortality via facilitated predation
Sensory Disturbance	All Project components are expected to produce a variety of sensory disturbances associated with human and mechanized activity that may cause caribou to avoid those areas plus a ZOI around them.	• Indirect habitat effects via sensory disturbance • Movement effects via sensory disturbance • Energetics effects via sensory disturbance
Vehicle Operations	Vehicle travel along winter access roads and trails can pose a mortality risk to caribou.	• Direct mortality effects via vehicle collisions

Key factors considered when determining Project interactions and potential effects include temporal overlap, spatial extent, caribou movement rates, and land use planning context (**Table 9-6**). Overlap between the Project and PCH will likely occur during the herd's rut/ late fall and winter seasons (October to April, annually) when the herd is present in Eagle Plains. However, rut/ late fall and winter are considered the seasons of lowest concern (**Table 9-1**; Porcupine Caribou Technical Committee 1993). During rut/ late fall and winter, caribou are typically in prime body condition, experience neutral to positive energy balances, do not experience stress from heat and insect harassment, and are least sensitive to human disturbances.

[11] For caribou, apparent competition refers to the situation where predation rates rise due to an increase of wolves in response to elevated alternative prey (moose) that results from increased forage (shrubs) due to forest clearing.

Furthermore, the Project RSA (2,400 km²) constitutes a relatively small portion of the PCH's rut/ late fall and winter ranges in Yukon, 6.0% and 6.5%, respectively.

During rut/ late fall and winter, the PCH is typically widely dispersed in small and medium-sized groups (Russell et al. 1993). In any given year, Project activities will be clustered to annual work areas so that disturbances are limited to approximately a third (32%) of the RSA, reducing the degree of overlap with the PCH rut/ late fall and winter ranges to about 2% of their total extent in Yukon. The 2% area of overlap could correspond to 2,180 caribou with the potential to interact with the Project. This calculation considers the latest population estimate of 218,000 caribou and assumes that approximately half the herd winters in Yukon. During rut/ late fall and winter, caribou tend to wander continually, travelling several kilometres daily and covering long distances over time. They do not seem to settle in one area for an extended period, i.e., individuals do not have central home ranges during these seasons. For caribou that might use the RSA, their residency would likely last only a small portion of the rut/ late fall and winter seasons. Overall, the relatively small spatial and temporal overlap between the Project and PCH would be expected to limit the exposure of individual caribou to Project-related disturbances.

Table 9-6. Key Factors Influencing the Degree and Nature of Potential Interactions Between the Project and the Porcupine Caribou Herd

Factor	Details
Temporal Overlap	The PCH are migratory and generally occur in the Eagle Plains ecoregion during the rut/ late fall (mid-October through November) and winter seasons (December through April). Project activities are expected to overlap the period when the PCH are present.
Spatial Extent	The Project RSA overlaps the rut/ late fall and winter ranges of the PCH. However, the RSA covers a relatively small portion of those ranges: 6.0% during rut/ late fall and 6.5% during winter. The RSA does not overlap with the most frequently used portions of those ranges.
Caribou Movements	The PCH are widespread and tend to wander continually during rut/ late fall and winter (15.0 km/day and 4.8 km/day, respectively). When caribou occur in the RSA, it is typically only for a small portion of the season: 4.5 days during rut/ late fall (54 days total) and 15.7 days during winter (122 days total). This has important implications for assessing and mitigating potential Project effects on the PCH.
Regional Land Use Planning Context	The Project falls within Integrated Management Area Zone IV of the North Yukon Regional Land Use Plan and the Peel Watershed Regional Land Use Plan. Zone IV has lower ecological and cultural values and the highest permissible development of the four IMA zones (37% of the PCH winter range is protected, and 29% is within more restrictive IMAs).

9.4.2 Direct Habitat Effects

As part of caribou baseline studies, rut/ late fall and winter habitat selection by the PCH was quantified using RSFs (see **Section 6 Caribou** of **Appendix 9-A Wildlife Baseline**). RSFs were fit to data that included locations from GPS-collared caribou (2012–2021) and location-specific habitat variables on the landscape. From RSF model predictions, spatially explicit habitat maps were developed across the seasonal ranges. The preferred habitat in both seasons consisted of a high cover of macrolichens in open conifer stands, undisturbed by fire, consistent with previous studies of diet and habitat use by the PCH (Russell et al. 1993). Many Project components require vegetation clearing, which could directly affect such caribou habitat. Several of these Project components are expected to consist of long, relatively narrow footprints (linear features), including seismic lines (2–5 metres [m] wide), winter access roads (5–15 m

wide), and an airstrip (approximately 50 m wide). Non-linear features include well sites (<2 ha) and secondary camps/staging areas (<4 ha). Vegetation clearing associated with all Project components will occur in winter and be limited to trees and tall shrubs. However, it is important to note that approximately 47% of the RSA has already been disturbed by fires <40-years old, which also affects caribou habitat and forage (lichen).

The effects of vegetation clearing on caribou forage appear mostly limited to footprint disturbances. Although some studies in temperate and tropical forests have observed significant edge effects adjacent to large openings, such as clearcuts, edge effects associated with linear features in boreal ecosystems are limited (Dabros et al. 2018). One study of the edge effects of conventional seismic lines (>7 m wide) on vegetation in boreal peatlands found that, although lichen was virtually absent on the seismic lines, the percent cover of lichens in the adjacent forest was highest immediately adjacent to the lines, apparently responding positively to the increased light and drier conditions associated with the edge (Dabros et al. 2022). A similar study of low-impact seismic lines (≤3 m wide) in upland boreal forest found that species diversity of herbaceous plants was reduced within 15 m of lines, but that percent cover of different vegetation types, including lichen, was not reduced from the seismic line edge out to 75 m (Dabros et al. 2017).



Photo 9-1. Macrolichen on a 3-Dimensional Receiver Line in the Regional Study Area Nine Years After Vegetation Clearing

This linear feature is one of many in a 3D seismic grid established in 2013–2014 as part of the Northern Cross exploration program.

9.4.3 Indirect Habitat Effect

Indirect habitat loss is a temporary effect where caribou avoid suitable habitat due to adjacent human disturbance. For example, caribou may avoid a well site by several hundred metres even though the habitat disturbance and human activity are limited to the 2-ha extent of the well site itself. The area over which this effect occurs is referred to as a ZOI.

The ZOI distances estimated for caribou vary widely from a few hundred metres to tens of kilometres (see summary of studies in **Section 6 Caribou** of **Appendix 9-A Wildlife Baseline**). Estimates of ZOI distances may vary with disturbance factors (e.g., geographic area, habitat, season, year, weather, herd, and sex/age classes) and study-related factors (e.g., caribou sample size and analytical methods). In some cases, studies for the same herd have resulted in substantially different ZOI estimates. For example, five studies that estimated ZOI effects for the Central Arctic Herd reported results ranging from no ZOI to 11 km (Cronin et al. 1998, Noel et al. 2004, Cameron et al. 2005, Johnson et al. 2020, Prichard et al. 2020). Johnson and Russell (2014) found that estimates of ZOI distances varied nearly two-fold for the PCH between two decadal periods. Indeed, estimated ZOIs for the same study area can vary by year and correspond to avoiding resource development or even attraction to it (Prichard et al. 2020, Boulanger et al. 2021)[12]. Although there is a weight of evidence that caribou typically avoid human disturbances (**Appendix 9-C Literature Summary**), several studies have found either no response or apparent selection for proximity to disturbances under certain circumstances or periods (Cronin et al. 1998, Noel et al. 2004, Prichard et al. 2020, Boulanger et al. 2021).

The mechanisms associated with ZOIs for caribou surrounding human disturbances are unclear. Most studies do not demonstrate a clear mechanism associated with the spatial patterns that caribou exhibit in response to human disturbances. Mechanisms likely vary across space (e.g., across herds and vegetation types) and time (e.g., seasons and years) and may involve a combination of factors. For example, Boulanger et al. (2012) suggest that visual disturbance, noise, and dust-fall associated with a mine may collectively affect habitat selection of caribou in the area surrounding a mine. One general theory is that large prey species, like caribou, perceive anthropogenic features and/or sensory disturbances as a threat, whether real or not, and avoid those areas (Frid and Dill 2002, Boulanger et al. 2021). Given the large ZOI distances reported in some studies, for this theory to apply would require a combination of (i) direct sensory perception and (ii) learned behaviours to account for apparent ZOIs beyond sensory perception distances (Fagan et al. 2013, Boulanger et al. 2021).

When caribou avoid a ZOI, the avoidance is incomplete (i.e., indirect habitat loss is a partial effect). In all the studies listed in **Appendix 9-C** that observed a ZOI, caribou continued to use habitat within the ZOI but at a lower rate than areas outside the ZOI. Similar to the estimates of ZOI distances, the degree to which habitat use is reduced within the ZOI varies among studies. Summarizing patterns across studies is further complicated because most studies use different approaches to quantify the magnitude of effects.

Typically, the effects within a ZOI are graded, with avoidance being greatest at or adjacent to the disturbance and diminishing with distances farther away from the disturbance. Most studies report the maximum effect of the estimated ZOI (i.e., at the ZOI distance), but the average magnitude of effect over the entire ZOI is approximately half (50%) of those reported values. Johnson et al. (2020) assessed the reduced habitat use of the Central Arctic Herd within estimated ZOIs using selection ratios that compared observed versus expected use rates. The estimated ZOI was largest during calving (5 km) and lowest during periods of mosquito harassment (1 km). The authors found that habitat use was reduced to approximately a quarter (25%) of expected levels within 1 km of oil and gas infrastructure during calving

[12] These studies presume that caribou are not actually selecting distances close to human disturbances, but instead are selecting the environmental conditions near those disturbances. Thus, the preference for the environmental conditions outweighs the detriment of the disturbance.

and post-calving seasons, and by roughly a half (50%) during the mosquito season (Johnson et al. 2020). Boulanger et al. (2021) estimated the degree to which habitat use was reduced by the Bathurst Herd in relation to two mines in Northwest Territories using odds ratios, which compares the odds of caribou occurring at the disturbance footprint (0 m) versus the ZOI distance. For the years when caribou avoided the mines and the estimates were statistically significant ($P < 0.05$), the odds ratio ranged from 1.1–7.4. Polfus et al. (2011) estimated the reduction in habitat effectiveness for a woodland caribou herd in northern BC by comparing habitat models with and without human developments. They found that ZOIs around human developments (including a town, mines, and roads) resulted in an 8% decrease in high-quality winter habitat across the study area.

Baseline studies for this Project quantified local ZOI distances in the RSA using PCH telemetry data. Data from 2014, when 3D seismic exploration last occurred in the area, were inadequate to derive unbiased estimates. Instead, analyses were conducted for 2012–2021 to test whether a ZOI effect was associated with inactive (historical) linear feature disturbances, such as 2D seismic lines, winter access roads, and trails. For these linear features, ZOI estimates ranged from 2 km during winter to 4 km during late fall. However, the overall effect of ZOIs was relatively weak. The magnitude of ZOI effects corresponded to a reduced likelihood of caribou occurrences on linear feature footprints compared to distances at or beyond the estimated ZOIs—maximum reductions of 27% during winter and 45% during rut/ late fall. Since the magnitude of the effect follows a linear relationship, the average effect on caribou is approximately half (50%) of the maximum effect. Thus, the average reduction in caribou occurrence would be 13% during winter and 22% during rut/ late fall. Furthermore, including the ZOI effect in habitat models did not change how habitat was selected (i.e., little to no change in habitat-related coefficients), which suggests that caribou did not alter their habitat selection due to those linear features.

9.4.4 Movement Effects

The PCH is a wide-ranging herd. Movements by individuals occur across a gradient of scales and time periods, from daily movements (several kilometres per day) needed to meet foraging requirements and predator avoidance to seasonal movements (hundreds of kilometres) needed to meet changes in seasonal forage availability. The Project can potentially affect caribou movements by altering habitat or creating structures that physically deter movements and creating sensory disturbances that cause caribou to alter movements in response to a ZOI.

Differentiating movement effects from indirect habitat effects is difficult because both relate to caribou distribution. For example, avoidance of a road by caribou could affect habitat use and movement. Differentiating these two effects is further complicated for PCH because the caribou wander continuously and do not settle in specific areas during rut/ late fall and winter. However, because the consequence of these two effects relate to different life requisites (i.e., achieving local forage requirements versus travelling between seasonal ranges), they are considered separately in this assessment.

For this assessment, effects on movement relate specifically to the ability of caribou to travel through the Project RSA and cross through Project features (i.e., winter access roads and seismic lines). In general, caribou seem to complete seasonal migrations across resource roads or areas of anthropogenic disturbance; however, at the local scale in proximity to these sources of disturbance, there is evidence that the location and timing of movements can be altered (Panzacchi et al. 2013, Wilson et al. 2016, Boulanger

et al. 2019, Golder Associates Ltd. 2019, Prichard et al. 2020). Local effects on caribou movement can be direct, such as delayed crossings and altered movement paths and travel speeds, or indirect, such as altered behaviour and avoidance of road corridors.

Delayed crossings — Some caribou appear to delay crossing roads when encountering them. The delay time varies from minutes to hours for ground-based observational studies of local movements (Fancy 1983, Curatolo and Murphy 1986) to several days for telemetry-based studies of migration patterns (Wilson et al. 2016, Boulanger et al. 2019, Prichard et al. 2020). Using two methods of analysis, Boulanger et al. (2019) estimated average crossing delays of 5.0 and 6.2 days for caribou crossings roads at the Meadowbank Mine in Nunavut. However, that delay did not affect arrival times at calving and wintering grounds (Golder Associates Ltd. 2019). Wilson et al. (2016) classified eight of 30 caribou as 'slow crossers', which took an average of 31 days longer to cross the Red Dog Mine road than 'normal crossers'. During spring migration, reindeer in the Setesdal Austhei area delayed crossing a secondary highway by approximately five days (Panzacchi et al. 2013).

Altered movement paths — Several studies have observed instances where caribou approach an active road but alter their apparent path (assumed to be a direct crossing) to first parallel the road for some distance before crossing, resulting in a delayed crossing (Wilson et al. 2016, Russell and Gunn 2017, Boulanger et al. 2019, Prichard et al. 2020). Boulanger et al. (2019) suggested that this type of movement may represent an attempt to travel around the feature or to find a favourable crossing location. Altered movements from encounters with resource development may last several kilometres, and the distances documented in studies have varied substantially. In 2015, 12 collared PCH caribou paralleled the northwest side of the Dempster Highway for >100 km between the Richardson and Ogilvie mountains before eventually crossing the highway (**Section 6 Caribou** of **Appendix 9-A Wildlife Baseline**)[13]. In a study of migration movements across the Red Dog mine road in Alaska, eight of 30 caribou that delayed crossing the road ('slow crossers') had significantly longer migrations than normal crossers (Wilson et al. 2016). In Norway, the Setesdal Austhei reindeer changed direction to parallel a secondary, cabin-lined road for approximately five days during spring migration before eventually crossing the road (Panzacchi et al. 2013).

Altered travel speeds — Caribou sometimes travel faster in proximity to roads and resource developments. Wilson et al. (2016) observed that 'slow crossers' exhibited daily movement rates >1.5-times faster after crossing the road, potentially trying to compensate for the time associated with their delayed crossing. In the Kuparuk oilfields in Alaska, caribou from the Central Arctic Herd travelled substantially faster while crossing roads, but that effect was limited to a relatively short period (<2 hours) and distance (<1 km) associated with the actual crossing event (Prichard et al. 2020). Reindeer in the Setesdal Austhei area increased their travel speed to the highest values recorded during migration while crossing a cabin-lined road (4 km/3 hrs vs. the average of 0.5 km/3 hrs) (Panzacchi et al. 2013).

Altered behaviours — Besides direct effects on caribou movements, anthropogenic activities and development can result in changes to caribou behaviours that can indirectly affect movement. Several studies have examined the behaviour response of the Central Arctic Herd to oilfield development (Fancy 1983, Murphy and Curatolo 1987, Prichard et al. 2022). Fancy (1983) reported that activity budgets did not different between development and control areas during the insect harassment season. Many localized

[13] However, in this case, the highway was parallel to the general direction of travel by caribou.

responses to the roads, pipelines, vehicle traffic, and other structures and activities were observed, but the type and strength of the responses varied dramatically. Murphy and Curatolo (1987) found that the effect on caribou behaviour was more evident when insects were absent. They found that caribou near pipelines and roads spent more time running and less time lying than caribou in control areas, but that time spent feeding was unaffected.

Prichard et al. (2022) reported that the behavioural responses of caribou to traffic along oilfields varied with traffic level, distance to road, and group composition. Responses were stronger and more frequent on low-use versus moderate-use roads, closer to roads, and when calves were present. The frequency of moderate (standing/walking) to strong (trotting/running) behavioural reactions within 100 m of a road was much lower at the moderate-use road (20–30% of observations) than the low-use road (60–70% of observations). At distances beyond 500 m from the moderate-use road, the frequency of moderate-to-strong reactions was negligible (<10%). In all cases, caribou without calves exhibited less avoidance of roads. Prichard et al. (2022) speculated that the higher degree of reactions along the low-use road may have been a result of caribou having less opportunity to habituate to vehicle passages and/or because the traffic on the low-use road was convoyed. The convoy (a string of vehicles) may have represented a stronger stimulus than a single vehicle, which was more prevalent on the moderate-use road.

Avoiding road corridors — Although caribou regularly cross roads during migration and intra-seasonal movements, multiple studies have documented caribou avoiding ZOIs around active roads, relative to areas farther from roads (Johnson and Russell 2014, Johnson et al. 2020, Prichard et al. 2020). This response may have a greater effect on indirect habitat loss, but it can also relate to movement by reducing the permeability of road corridors within seasonal ranges (Dyer et al. 2002). In the Central Arctic Herd, the size of ZOIs associated with active roads varied from 1–5 km depending on the season (Johnson et al. 2020, Prichard et al. 2020). However, responses varied, with some caribou selecting roads and well pads for insect relief (Prichard et al. 2020). Also, an earlier study of the Central Arctic Herd found that (i) the densities of calves and all caribou were not significantly lower within 1 km of a road during pre-road and post-road periods, and (ii) that calf density was higher in the interval within1 km of the road than in the intervals 1–6 km from the road during the post-road period (Noel et al. 2004). Boulanger et al. (2019) reported ZOIs of 5–60 km associated with the Meadowbank Mine roads and found that ZOIs were larger on the pre-crossing side of the road than the post-crossing side.

The effects of human disturbances on caribou movements appear to depend on a combination of (i) the intensity of human disturbances and (ii) factors associated with caribou biology.

Traffic level, or the disturbance intensity of facilities, has a substantial influence on caribou movements and behaviours near roads and developments (Curatolo and Murphy 1986, Dau and Cameron 1986, Dyer et al. 2002, Prichard et al. 2020, 2022). Curatolo and Murphy (1986) found that traffic rates >15 vehicles/hour (360 vehicles/day) reduced crossing rates for Central Arctic Herd caribou when pipelines were adjacent to roads. In the Setesdal Austhei wild reindeer area in Norway, spring migration patterns were markedly affected by disturbance during a period of high traffic volume (>500 vehicles/day) and intense human activities. During autumn, when traffic and human activities were lower, the effect of the road was minimal (Panzacchi et al. 2013). In northeast Alberta, average traffic rates of 91–780 vehicles/day reduced non-migratory crossings by six times compared to simulated roads in late winter (Dyer et al. 2002).

Hunting from roads can increase the displacement of caribou from those roads (Ciuti et al., 2012; Paton et al., 2017; Plante et al., 2018). In a six-year study of migratory caribou in northern Quebec, the ZOIs of roads with hunting varied from 0–15 km to 0–3 km for roads without hunting (Plante et al. 2018). The exclusion of hunting along portions of the Prudhoe Bay and Kuparuk oilfield roads through the Central Arctic Herd range is generally regarded as a successful measure to mitigate the effects of the road system on caribou movements (Prichard et al. 2020).

Combining many anthropogenic features can also have a cumulative effect on caribou movements. In the Prudhoe Bay oilfields, caribou crossed elevated pipelines or roads with a similar frequency to controls (Curatolo and Murphy 1986). However, when pipelines were adjacent to active roads, there appeared to be a cumulative effect and crossing frequencies were reduced by approximately 50%. Measures to separate pipelines and roads by at least 150 m appear to mitigate that effect (Prichard et al. 2020).

Several factors associated with caribou biology also affect how resource developments affect caribou movements. Likely the strongest biological factor is that the drive for caribou to complete seasonal migrations consistently overcomes apparent concern about those features, as expressed by local scale alterations to the location and timing of movements (Curatolo and Murphy 1986, Panzacchi et al. 2013, Wilson et al. 2016, Boulanger et al. 2019, Golder Associates Ltd. 2019, Prichard et al. 2020). The season also appears to substantially affect how caribou alter their movements in response to infrastructure. Caribou are most sensitive during the calving period, cross roads less often, express stronger behavioural responses, and have larger and stronger ZOIs around roads and developments than in other seasons (Murphy and Curatolo 1987, Johnson et al. 2020, Prichard et al. 2020, 2022). Effects on movements appear to be lowest during periods of insect harassment. During the insect season, effects on movements often do not differ from control areas, and some caribou appear to select roads and gravel pads for insect relief (Fancy 1983, Curatolo and Murphy 1986, Prichard et al. 2020). Finally, the presence of calves (i.e., post-calving) typically results in elevated effects on movement compared to groups without calves (Murphy and Curatolo 1987, Stankowich 2008, Prichard et al. 2022).

The interpretation of responses of caribou movements to anthropogenic activities and developments also vary depending on the study design, analysis method, and assessment criteria used in different studies. Earlier studies of caribou movement in relation to roads limited the assessment distance to a relatively short distance (e.g., 1 km) from the roads (Fancy 1983, Curatolo and Murphy 1986). More recent studies have demonstrated that effects can occur at farther distances (i.e., >1 km). However, the magnitude of effects is typically greatest in proximity to human developments (Boulanger et al. 2019, Johnson et al. 2020, Prichard et al. 2020).

Regarding non-migratory movements, active resource roads, though regularly crossed by caribou, can be avoided relative to areas without roads. In northeastern Alberta, woodland caribou crossed roads (average 91–780 vehicles/day) six times less frequently in late winter than simulated road networks (Dyer et al. 2002). In the Central Arctic Herd, Fancy (1983) observed that caribou on experimental and control sites had similar movement rates and activity budgets. Still, many localized responses were observed to the roads, pipelines, vehicle traffic, and other structures and activities. Of the 99 groups that approached a road, pipeline, or drill site, 70.7% crossed directly, 19.2% detoured around the drill site, and 10.1% reversed direction and left the observation area.

Most studies examining the effects on caribou movements explicitly identify or implicitly assume the primary mechanism affecting movement is sensory disturbance associated with human activities. Few studies have identified physical features associated with resource developments or other human disturbances impeding caribou movement. Features like seismic lines, roads, and inactive well pads generally do not physically obstruct caribou movements. However, during winter, road maintenance creates snow banks, which, combined with sensory disturbances of traffic, can deter caribou from crossing roads (Surrendi and DeBock 1976).

Based on the cumulative evidence from the studies discussed above, several components of the Eagle Plains Project, including winter access roads and trails, seismic operations, well sites, and camps[14], can affect caribou movements. In general, the Project's effects on movement are likely to be indirect (e.g., similar to indirect habitat effects; **Section 9.4.3 Indirect Habitat**). Sensory disturbances are expected to alter caribou movements in areas adjacent to human activity. Telemetry data (2012–2022) from GPS-collared Porcupine caribou demonstrated that individuals travelled across historical exploration developments (including winter access roads, 2D seismic lines, and 3D seismic lines) when exploration operations were not active in the area (**Map 9-3** and **Section 6 Caribou** of **Appendix 9-A Wildlife Baseline**). Still, caribou may alter the location and timing/rate of movements locally as they encounter disturbances, including winter access roads and trails, seismic operations, well sites, and camps. The result could be more tortuous movements (i.e., greater and more frequent turns) through work areas due to deflections around work sites and local movement rate changes (i.e., accelerated or delayed movements).

9.4.5 Direct Mortality Effects

The Project has limited pathways to cause direct mortality to caribou. The one Project activity that has the potential to cause direct mortality to caribou is use and maintenance of winter access roads, which could result in vehicle collisions with caribou. Several studies have reported caribou mortality caused by vehicle collisions (Forman and Alexander 1998, Edmonds 1998, Kinley and Apps 2001, Hegel and Russell 2013, EDI Environmental Dynamics Inc. 2015). For some woodland caribou herds, mortality rates due to vehicle collisions can be substantial. For example, 10% of a herd in west-central Alberta was killed by vehicle collisions over two years (Edmonds 1998). However, for most herds, vehicle collisions represent a small source of herd mortality. In Yukon, an average of 18 caribou per year were killed by vehicle collisions from 2003–2014 along the Territory's highways, representing approximately 0.1% of the Territory's mountain caribou population (EDI Environmental Dynamics Inc. 2015). No collisions with caribou were reported along the Dempster Highway during this period but detection and reporting of wildlife-vehicle collisions may have been incomplete (EDI Environmental Dynamics Inc. 2015).

Often, vehicle collisions with caribou occur when individuals cross roads as part of regular movements within their range. However, caribou may be attracted to roads in winter, due to the application of road salt or due to the ease of travel on the cleared road surface, which can result in elevated mortality (Brown et al. 2000). Once on a road in winter, especially in areas with deep snow and high snow banks, ungulates will

[14] As indicated above, the Dempster Highway is an existing feature within the RSA that appears to act as a semipermeable barrier to caribou movements. Although Project activities will include travel on the Dempster Highway, that is not expected to have a meaningful change on the existing effects of the highway.

often run down the road away from approaching vehicles, instead of escaping off the road, which elevates mortality risk (Horejsi 1981, EDI Environmental Dynamics Inc. 2015).

Most studies of wildlife-vehicle collisions (including for caribou) are along high-speed highways. Vehicle collisions with wildlife are also known to occur on secondary resource roads used by forestry and the oil and gas sector, but the mortality rates on resource roads are mostly unreported. One study in Sweden observed that collision rates of moose on forestry roads were about a third (33%) of the collision rates on highways (Neumann et al. 2012). Where resource operations employ appropriate mitigation measures, vehicle collisions with wildlife can be reduced to zero or near zero levels. For example, at three coal mines in southeastern BC where bighorn sheep, elk, deer, and bears frequently occur in work areas and along project roads, a combination of mitigation measures reduced vehicle collisions to zero over a three-year reporting period: slow speed limits, stopping to give wildlife the right-of-way, and notification of wildlife occurrence location among road users via two-way radio communication (Keim et al. 2014).

9.4.6 Indirect Mortality Effects

Several studies have linked changes in habitat and land use associated with industrial resource development to elevated caribou mortality levels (Wittmer et al. 2007, DeMars and Boutin 2018, Serrouya et al. 2019). This effect is believed to be the primary threat to several subpopulations of declining woodland caribou (Environment Canada 2014, Environment and Climate Change Canada 2019). The process includes a numerical increase in predators (primarily wolves) and a functional increase in per-capita predation rates. The numerical increase in predators is due to the rise in the abundance of other ungulates, like moose and deer, in response to increases in early seral habitats associated with human activities like forestry, oil and gas development, and natural disturbances like fire. The increase in moose and deer populations supports a higher population of predators, which results in higher predation rates on caribou (Wittmer et al. 2007, Anderson et al. 2017, Serrouya et al. 2019). This process is often called *apparent competition* (i.e., moose/deer appear to be competing with caribou, but the effects on caribou are due to increased predation). The functional increase in predation rates on caribou is due to the creation of linear features (roads, trails, seismic lines, pipelines, powerlines) and, in winter, packing of snow that allows wolves to travel faster and farther, which can result in increased encounters with and predation of caribou (Latham et al. 2011a, Dickie et al. 2017, DeMars and Boutin 2018). This process is often referred to as *facilitated predation*. The effects of apparent competition and facilitated predation are often called *habitat-mediated predation effects*.

Most studies of facilitated predation and apparent competition are of woodland caribou, where wolves are the primary predator and hunting by humans is limited. In northern herds, where hunting by humans does occur, it can be a substantial source of mortality (Boulanger et al. 2011, COSEWIC 2016). Creating new access in an area can potentially elevate mortality rates on caribou due to hunting similar to facilitated predation by wolves (Bergerud et al. 1984, Festa-Bianchet et al. 2011).

The effect of habitat-mediated predation has not been directly studied in barren-ground caribou, but where barren-ground caribou occur in forested areas, there is potential for the effect to occur.

9.4.7 Energetics Effects

As mentioned in **Section 9.4.4** Movement Effects, a consequence of caribou altering their movement patterns could be increased energy expenditure. The energy balance of caribou can affect body condition (e.g., fat reserves), which in turn can affect the fecundity of female caribou (Wolfe et al. 2000, Cameron et al. 2005).

Several studies have estimated the energetic cost of anthropogenic disturbances on caribou and potential consequences to calf production. In northeast Alberta, Bradshaw et al. (1998) estimated that the energy cost to woodland caribou disturbed by oil and gas development was equivalent to 0.1–0.2 kilograms per day (kg/day) of body weight per event, and 41–137 disturbance events would be required to reduce calf productivity. Based on caribou distribution and the level of petroleum exploration activity, it was estimated that the proportion of cases where calf productivity could be affected was <10% of the scenarios they examined over five years. Luick et al. (1996) estimated the effects of disturbances from military aircraft on the energetics and fecundity of the Delta Caribou Herd in Alaska. At the highest frequency of exposure (40 days), the estimated reduction in individual fecundity was 4–5%. Given that only a small proportion of the population was likely to be exposed to overflights, and that it was unlikely that any individual would be exposed to 40 days of disturbance, the authors concluded that potential effects on the fecundity of the herd were minimal.

In terms of annual energy expenditures, for most caribou that are exposed to anthropogenic disturbances, the effects of those disturbances are small relative to natural factors that result in energy expenditure, such as snow, insect harassment, seasonal migrations, and predation attempts (Fancy 1983, Luick et al. 1996, Bradshaw et al. 1998, Wolfe et al. 2000). Although the consequences of elevated energetic output from anthropogenic disturbance can theoretically affect population productivity, there is limited evidence of that occurring. The case where that was most likely to occur is for the Central Arctic Herd, where a substantial portion of the non-winter ranges have developed oil and gas projects. Several studies have documented effects on the behaviour, movement, and distribution of that herd in response to oil and gas development. Many of the responses are predicted to have elevated energetic costs (e.g., reduced resting, fleeing response to traffic, inhibited movements). However, the Central Arctic Herd subpopulation is generally considered healthy, i.e., population size fluctuations and demographic measures since development began have been within historic ranges of the Central Arctic Herd and, more broadly, within ranges observed for other barren-ground caribou herds. During the initial years of development of the oilfields in the 1980s and 1990s, when caribou were expected to be most sensitive to development, the herd increased from about 5,000 to approximately 28,000 individuals (Cameron et al. 2005). During the mid-2010s the Central Arctic Herd declined from about 68,000 in 2010 to about 28,000 in 2017 (Lenart 2021), when energy activities were relatively consistent. These patterns suggest that the effects of oilfield development are not the primary drivers affecting the population dynamics of the herd.

The CircumArctic Rangifer Monitoring and Assessment Network has developed a Caribou Cumulative Effects model that includes a body condition component to assess the potential effects of a range of factors, including human disturbances, on the population size and composition of a caribou herd. Variations of that model have been used in several assessments of barren-ground caribou (e.g., Russell and Gunn 2019, Russell et al. 2021). That model was not used as part of this assessment because the model is intended to be run as a full life cycle model over the entire range of a herd. Given that the extent of the Project RSA is

such a small portion of the seasonal and annual ranges, and that caribou occurrences in the RSA are during seasons when the caribou are generally in good body condition and alternative habitat is available, the results of the exercise were not expected to contribute meaningfully to this assessment.

9.5 MITIGATION MEASURES

The Project has a comprehensive set of measures designed to mitigate potential effects on caribou. These include contingencies to account for unexpected behaviours of caribou and the occurrence of large numbers of caribou. The Caribou Mitigation and Monitoring Plan includes a set of monitoring programs designed to inform mitigation measures and to assess the effectiveness of measures within an adaptive management framework. A summary of key components of the mitigation and monitoring components are listed below. These components mitigate several potential adverse effects, summarized in **Table 9-7**.

- Project work will be clustered within annual work areas to minimize the area within the RSA subject to disturbance in any given season.
- All ground-based work will be limited to winter operations to avoid the development of all-season roads.
- Winter access roads, wells, and secondary camps will be located to avoid high-value caribou habitat, to the degree possible, to minimize direct and indirect effects on caribou habitat and movements.
- The winter access road network will use existing, historical roads wherever possible to minimize the length of new access that is developed. Currently, no new mainline roads are planned to branch off the Dempster Highway; however, there is a possibility that several additional access points may be needed.
    - An objective of the Project is to have as neutral an effect on human access as possible (i.e., to maintain existing access that people are accustomed to but to minimize new access that could result in incremental hunting and disturbance).
- The Project has a comprehensive set of measures to minimize the extent and effects of linear features (winter access roads and seismic lines), including the following:
    - The length and width of linear features will be minimized to the degree possible; 3D Low-Impact Seismic (LIS) lines are narrower than historic 2D seismic and contain more bends (i.e., less linear).
    - The ground vegetation layer will be protected to maintain existing vegetation composition and to hasten regeneration.
    - Sightlines and ease of movement along seismic lines will be minimized using curving line paths, narrow widths, vegetation retention, and line breaks.
- Several measures are associated with access road use and maintenance to avoid the risk of wildlife-vehicle collisions and minimize the effects on caribou movements.
- A formal caribou observation and reporting program (see Section 9.8.1.2 Caribou Observations and Reporting) and a Caribou Interaction Response Plan (see Section 9.5.10 Caribou Interaction Response Plan) have been developed to document the occurrence of caribou near work sites and respond to unanticipated caribou interactions via the development of a site-specific plan.
- The primary mitigations above are designed assuming average caribou numbers occur in or near the annual work area (i.e., several hundred caribou). Special mitigation measures and

monitoring programs are identified to respond to the potential occurrence of atypically large numbers of caribou in or near the annual work area (i.e., several thousand caribou).

Details about each mitigation and monitoring component are provided in the following sections.

Table 9-7. Mitigation Measures Relevant to Caribou and the Eagle Plains Exploration Project

Mitigation and Management Measure	Potential Adverse Effect
Avoiding High-Value Habitat	• Direct habitat effects • Indirect habitat effects • Movement effects • Energetics effects
Clustering of Work in Annual Work Areas	• Direct habitat effects • Indirect habitat effects • Movement effects • Energetics effects
Access Management	• Indirect mortality effects
Seismic Operations	• Direct habitat effects • Indirect habitat effects • Indirect mortality effects
Construction of Winter Access Roads, Well Sites, and Other Features	• Direct habitat effects • Indirect habitat effects
Access Road Use and Maintenance	• Movement effects • Direct mortality effects • Energetics effects
Aircraft Operations	• Indirect habitat effects
Pre-Work Site Surveys	• Indirect habitat effects
Early Warning System for Caribou	• Direct habitat effects • Indirect habitat effects • Movement effects • Energetics effects
Caribou Interaction and Response Plan	• Indirect habitat effects
Response to Large Numbers of Caribou	• Indirect habitat effects
Worker Training	• Indirect habitat effects
Monitoring and Adaptive Management	• Direct habitat effects • Indirect habitat effects • Movement effects • Direct mortality effects • Indirect mortality effects • Energetics effects

9.5.1 Avoiding High-Value Habitat

Quantitative habitat models were developed for the rut/ late fall and winter seasons using PCH telemetry data from 2012–2021. The models were used to map relative caribou habitat quality across the RSA. Suitable caribou habitat is widespread across the RSA, especially in the rut/ late fall season. Not all suitable habitats need to be avoided to alleviate potential effects on caribou. However, small portions of the RSA (11%) with the highest winter habitat ratings offer exceptionally high forage values (lichen) and are used much more frequently by caribou. High-value winter caribou habitat should be avoided as much as possible because (i) Project footprints that clear vegetation can reduce lichen biomass and take decades to recover, and (ii) Project activities near those areas can displace caribou in the short term.

High-value winter caribou habitat was combined with maps of other sensitive or high-quality environmental and heritage areas into an overall constraints map (**Section 3.2.2.2.6**). The constraints map was used to plan the location of Project features like winter access roads, wells, and camps to minimize the overlap of those features with high-value caribou habitat and other sensitive and high-value environmental areas. Overall, high-value winter caribou habitat comprises 11% of the RSA. The proposed mainline winter road network was developed to minimize its overlaps with high-value winter caribou habitat, and only 4% of the road system's total length overlaps with this caribou habitat.

9.5.2 Clustering of Work in Annual Work Areas

The 2,400 km² (about 40 km x 60 km) RSA constitutes a relatively small portion of the PCH rut/ late fall and winter ranges in Yukon (6.0% and 6.5%, respectively). Annual work within the RSA will be clustered in smaller areas (e.g., 400–700 km²), and only a fraction of this will experience direct disturbance), leaving the remaining portion undisturbed. Accounting for road access to the main camp along the Dempster Highway and potential ZOI buffers around the combined work area, winter access roads, and camp, approximately one-third (32%) of the RSA could be subject to sensory disturbance each year the Project is active. Clustering the annual work areas reduces the degree of overlap with the PCH seasonal ranges in Yukon to approximately 2%.

9.5.3 Access Management

The goal of the Project is to have as neutral an effect on human access as possible (i.e., to maintain existing access that people are accustomed to but to minimize new access that could result in incremental hunting and disturbance). Measures to minimize changes to access in the RSA include the following:

- No all-season roads will be constructed.
- The winter access road network will use existing, historical roads wherever possible, to minimize the length of new access that is developed.
- No new mainline roads will be created off the Dempster Highway.
- At the end of the Project a combination of ditches, berms, debris piles and gates will be established to limit access to the mainline road network. The methods used at each site will be tailored to local site conditions.
- Access onto and along seismic lines will be limited using a combination of measures:

- Narrow widths and meandering paths will minimize sightlines and hinder all-terrain vehicle (ATV) travel. All seismic lines will be <3 m wide.
- The ground vegetation layer (mosses, lichens, and forbs), including low shrubs and tree seedlings, will be protected to hasten tree and shrub regeneration.
- Access onto seismic lines from the Dempster Highway and mainline winter access roads will be limited by (i) terminating lines ≥10 m short of the road (where operationally feasible) and (ii) where the line must cross the road by creating a sharp dogleg in the line where it crosses the line, to reduce the visibility of the line from the road[15].

- While the Project is active, the general public's access to the annual work area will be restricted for safety reasons.
  - Special access for First Nations land users into the annual work area will be accommodated on a case-by-case basis so long as appropriate safety conditions can be met by all parties (e.g., no use of firearms within 2 km of roads and work sites, use of two-way radios along roads, avoidance of active work sites).

9.5.4 Seismic Operations

Several studies have documented negative effects of linear features, especially seismic lines, on caribou and caribou habitat (James and Stuart-Smith 2000, Dyer et al. 2001, Latham et al. 2011a). In all those studies, seismic lines were predominantly older 'conventional' lines ≥5 m wide, mostly long and straight, and involved the removal of ground vegetation layer and the disturbance of topsoil via a bulldozer. Conventional lines also created windrows of debris that could potentially have trapped animals. Contemporary seismic operations, often referred to as 'low-impact seismic' (LIS), use different approaches and equipment that inherently reduce the degree of effects associated with the lines created (e.g., no creation of windrows). For example, LIS lines are mostly ≤3 m wide. The path of the LIS line includes frequent bends to reduce sightlines and to hinder travel of humans and predators. The ground vegetation layers are maintained and protected to enable faster regeneration, which limits the line's effectiveness for facilitating predation. Specific mitigation measures can further reduce effects beyond those that inherently result from LIS. Mitigation measures associated with seismic operations for this Project will include the following:

- Seismic lines will use narrow widths and meandering paths to minimize sightlines and hinder human travel (e.g., ATV) and predators.
  - Line widths will vary by line type:

Seismic Line Type	Size or Width	Percent of Total Seismic
• 3D Receiver Lines	• 1.75 m	• Approx. 40%
• 3D Source Lines	• 2.75 m	• Approx. 40%
• 2D Lines	• 2.75 m	• Approx. 20%

[15] During baseline studies, only four of 74 3D LIS lines from the 2013/14 program that crossed the Dempster Highway were detected during a driving survey along the highway **(Appendix 9-B Linear Feature Study**).

    - The tortuosity degree (i.e., angles, length of bends, and distance of offset from the theoretical centerline) will also vary to account for site factors, including topography and vegetation structure.
        - The target for the average sightline distance along seismic lines is 50 m for source and receiver lines, which corresponds to average sightline distances in undisturbed vegetation[16] in Eagle Plains (**Appendix 9-B**), and 75 m for combination lines, which require reduced tortuosity to permit equipment travel along them.
        - Generally, the meanders in seismic lines in the field will result in the line being offset 10–20 m from the theoretical centerline if the line were straight.
        - To hinder human and predator travel, the angle of the bends in the lines will be as sharp as possible, within the operating constraints of the mulcher equipment. Most angles will be 30–45 degrees. Sharp dogleg bends with winter access roads and other seismic lines will be established at most junctions.
- Vegetation clearing will be limited to trees and tall shrubs. The ground vegetation layer (mosses, lichens, and forbs), including low shrubs and tree seedlings, will be maintained by conducting clearing using low ground pressure mulchers in the winter when the ground is frozen and a minimum packed snow depth of 10 centimetres (cm) is present. Retaining the ground vegetation maintains existing vegetation composition and hastens vegetation regeneration (i.e., compared to disturbances, such as fire, where most of the existing vegetation is destroyed and primary succession is initiated on exposed soil).
    - The extent of trees and shrubs that will be cleared will be minimized by having the operator adjust the exact location of the line in the field to follow natural openings and vegetation gaps.
    - Wherever possible shrubs and tree saplings ≤2 m will be pushed over, instead of being cut.
- Access onto seismic lines from the Dempster Highway and mainline winter access roads will be limited by (i) terminating lines ≥10 m short of the road (where operationally feasible) and (ii) where the line must cross the road, by creating a sharp dogleg in the line where it crosses the line, to reduce the visibility of the line from the road.[17]

The primary method of reducing direct habitat effects on caribou is to maintain ground vegetation and lichen cover. The result of this mitigation is two-fold. First, existing lichen cover is expected to persist, at least initially, after vegetation clearing. On lines >3 m and other types of openings, as vegetation regenerates, lichen is expected to be substantially reduced as forbs and shrubs overgrow the sites, due to increased light exposure (Lee and Boutin 2006, Dabros et al. 2022). However, on seismic lines ≤3 m, the density of forb and shrub regeneration is expected to be limited and lichen is expected to persist, though potentially at reduced levels (Golder Associates 2016, Dabros et al. 2017, EDI unpubl. data) (**Photo 9-1**). For lines

[16] Average sightline distances along the 3D LIS lines created in 2013/14 were: 60 m, 76 m and 106 m for receiver, source, and combination lines, respectively, compared to an average distance of 46 m in adjacent undisturbed vegetation (**Appendix 9-B**).
[17] During baseline studies, only 4 of 74 3D LIS lines from the 2013/14 program that crossed the Dempster Highway were detected during a driving survey along the highway (**Appendix 9-B**)

≤3 m wide, the opening is typically not large enough to result in light exposure or competition from other vegetation types that elevate forb and shrub development to the point that lichens are replaced. Instead of following a transitional successional pathway of vegetation dominated by forbs, then shrubs, then trees, vegetation regeneration on narrow lines appears to follow more of a gap-phase dynamic pathway, where a combination of forbs, shrubs, and trees associated with the adjacent forest community regenerate concurrently. The extent of moss and lichen cover is maintained (Golder Associates 2016, Dabros et al. 2017, EDI unpubl. data). It is important to note that approximately 47% of the RSA has already been disturbed by fires <40-years old, which has likely already reduced lichen quantities by substantial amounts.

The second outcome of this mitigation is that it reduces the regeneration time for the site to recover to its pre-disturbance condition. Recovery time is expected to be fastest for lines ≤3 m wide. However, even on lines >3 m wide, where lichen cover is substantially reduced and the vegetation undergoes more of a traditional succession trajectory, regeneration times can be one or two decades faster than on sites where the original ground vegetation is removed. Primary succession begins on bare soil (Golder Associates 2016). For example, seedling trees and shrubs retained on the lines provide a much earlier start for those vegetation types than sites revegetating from bare soil (Golder Associates 2016).

9.5.5 Construction of Winter Access Roads, Well Sites, and Other Features

In addition to seismic operations, the Project will require the development of winter access roads, well sites, the airstrip, and secondary camps. The following measures will be applied to mitigate the potential effects on caribou:

- The location of all winter access roads, well sites, and secondary camps will be assessed relative to high-value winter caribou habitat within the constraints mapping and will be avoided as much as operationally feasible.
- The total extent of Project features will be minimized as much as possible while meeting operational requirements to minimize direct effects on caribou habitat. The maximum sizes of Project features are:

Feature Type	Size or Width
• Mainline Winter Access Roads	• 8–10 m (two-lane) • 16–20 m (pullouts, every 5 km)
• Well Site Access (Spur) Roads	• 10 m
• Well Sites	• 1.44 ha
• Airstrip	• 6.8 ha

- All features will be developed to ‘winter use’ standards, protecting the ground vegetation layer and minimizing the severity and persistence of direct effects on caribou habitat.
    - Vegetation clearing will be limited to trees and tall shrubs. The ground vegetation layer (mosses, lichens, and forbs), including low shrubs and tree seedlings, will be maintained by conducting clearing using low ground pressure mulchers in the winter, when the ground is frozen, and a minimum snowpack of 10 cm is present. Retaining the ground vegetation maintains existing vegetation composition and hastens vegetation regeneration.

    - For winter access roads and the airstrip, the ground vegetation and soil/peat substrate will be protected by creating a packed and frozen surface of snow/ice at a minimum 10 cm thickness. For well sites and the camp, the ground will be protected using a combination of rig mats and packed and frozen snow.
- Before initiation of work at new sites, a Pre-Work Site Survey (**Section 9.5.8 Pre-Work Site Surveys**) will be conducted.

9.5.6 Access Road Use and Maintenance

The following measures are designed to mitigate the risk of vehicle collisions and effects of access road use on wildlife movements:

- Speed limits will follow those posted for the Dempster Highway (on average, 90 kilometres per hour [km/h]), adjusted as needed for weather and road conditions, and 40 km/h along all winter access roads for all Project vehicles.
- During winter, the following measures will apply to managing snowbanks (i.e., to minimize hindrance to animals crossing them):
    - Maintain snowbanks at heights of less than 1 m above base snowpack depth.
    - Where snowbanks exceed 1 m in height above base snowpack depth (which could present a visual obstruction [Rescan Environmental Services Ltd. 2011]), create regular breaks (at least every 1,000 m) to facilitate easier animal crossings and as escape routes (run-outs) off the access road.
        - Create matched breaks in the snowbanks on either side of the access road that animals can use to cross.
    - On corners, create run-outs following the line of travel from each direction along the access road that provide obvious alternative routes for animals to use, instead of following the access road.
- Caribou (and other wildlife) on or near the access road will always have the right-of-way. Stop when wildlife is observed on or beside the access road, stopping as far back from the animals as possible, and allow the wildlife to cross at their discretion. Once the animals have crossed or retreated from the access road, wait 5 minutes, then resume travel at 10 km/h for 200 m past the point the animals were observed before resuming normal travel speed. If wildlife stays on the access road margin for more than 10 minutes, resume travel and pass the animals at 10 km/h or less.
- When caribou and other ungulates are on an access road, they will sometimes run down the access road away from a vehicle instead of moving off the access road. If this happens, stop, and wait at least 10 minutes for the animal to move off the access road. If the animal remains on the access road, drive forward at 10 km/h, then stop again when the animal begins to run away. Wait 2 minutes and repeat this procedure. If the animal still does not leave the access road, wait 10 minutes, and repeat the procedure, alternating with a 2- and 10-minute stop between driving attempts.
- Do not exit the vehicle to chase, catch, divert, follow, photograph, or otherwise harass wildlife.
- Use two-way radio communication and communicate the location of any wildlife observed along Project access roads to other road users on the radio.

- Fill-out a wildlife observation for all caribou observed along an access road and include the km marker location. Also include the number of caribou and their initial behaviour and the driving measures employed (e.g., stopped and waited for the caribou to move away) the response of the caribou.
- Report any caribou observations daily to the Environmental Monitor on site.

9.5.7 Aircraft Operations

Aircraft operations may include fixed-wing flights into the local airstrip to transport crews and supplies as well as local crew shuttles via helicopter.

9.5.7.1 Fixed-Wing Flights — Crew and Supply Flights

Crew and supply flights into the Chance Airstrip have low potential for collisions with caribou when landing and taking off. Pilots will conduct a low-elevation fly-by before landing to avoid aircraft collisions with caribou and other wildlife during landing to scan for wildlife on or adjacent to the airstrip.

9.5.7.2 Helicopter Flights

Most local travel between work sites and camps will be via ground transportation. However, a helicopter may be required to shuttle crews and supplies from the main camp to remote work areas. When this occurs, there will be multiple flights per day to deliver and retrieve crews. Helicopter operations will occur primarily during summer and will follow guidelines outlined in *Flying in Caribou Country* (Government of Yukon 2010). Key mitigations include the following.

- At the pilot's discretion for safety, all flights must maintain an altitude of at least 400 m above the ground.
- If/when caribou are spotted, the pilot will adjust the flight route to avoid flying over the animals, providing a 1,000 m horizontal clearance distance. The pilot will not fly toward, follow, fly over, hover over or near, circle, or land near any animals.
- If caribou persist at specific locations for an extended period (i.e., more than three days), flight routes will be developed to avoid those areas, providing a 1,000 m horizontal clearance distance.
- If large numbers of caribou occur in the area, the minimum flight altitude will be increased to 500 m and flight routes will be developed to avoid flying over high-value caribou habitat.
- Helicopter pilots will record and report all wildlife observations daily to Chance.

9.5.8 Pre-Work Site Surveys

Before work starts, pre-work site surveys are conducted to assess the presence of caribou (and other wildlife), wildlife features, and high-value habitat near proposed work sites.

Pre-work site surveys will be conducted primarily via ground surveys; drones may be considered if light and other logistical considerations allow for it. The primary type of caribou information assessed during the survey is the intensity of current caribou use within and near the proposed work area. This can include the actual presence of caribou and concentrations of caribou signs, including tracks, pellets, feeding sign, and beds. The survey route will consist of meandering transects within and adjacent to the work area.

Outside of when 'large numbers' of caribou are present, pre-work site surveys will be conducted for a subset of work locations where caribou are more likely to occur and for Project activities with a higher intensity of disturbance. Specifically, pre-work surveys will be conducted to construct winter access roads, well sites, the airstrip, and secondary camps where those sites overlap with or are within 200 m of high-value seasonal caribou habitat. Pre-work surveys will not be conducted in low-value caribou habitat areas (e.g., recent burns) because the value of those areas to caribou is low or for seismic operations because the disturbances associated with seismic work are less intense and more transitory. If large numbers of caribou are present, the scope of coverage of pre-work surveys should be expanded to include high-value caribou habitat associated with seismic operations and all areas associated with the construction of winter access roads, well sites, the airstrip, and secondary camps.

Pre-work site surveys should occur within 1–2 days of the start of work because caribou can travel several kilometres in a day. A series of surveys will be required before the development for access road construction or other developments where the location advances over time. Surveys will be conducted by personnel knowledgeable of caribou sign and habitat use, either by or under the direction of the Environmental Monitors or Project Biologists.

Results of pre-work site surveys will be used to inform modifications to the timing or location/route of work areas to minimize effects on caribou. In most situations, the most practical mitigation measure is to pause work until the caribou have moved away from the area, typically within 1–2 days. For example, if crews observe caribou during line construction, all nearby personnel would be notified by radio; a plan would be implemented to stop construction or change course (depending on the distance to caribou). If caribou persist in an area for a longer period, mitigations may require adjusting the work location/route to avoid the area or moving to an alternative work area until the caribou have moved away.

9.5.9 Early Warning System for Caribou

Discussion with the PCTC and PCMB led to a broad consensus among members to establish an early warning system for caribou presence in the RSA. The primary objective would be to forecast the potential timing and magnitude of Project interaction with Porcupine caribou based on data (surveys, GPS locations) collected and reported by the PCTC. This system would require regular, direct communication between Chance and the PCTC before the commencement of work in early winter and throughout active exploration periods during the winter. The PCTC has committed to regular communications and updates as more Porcupine caribou are tracked and observed moving toward the RSA. Once the PCTC has identified the possibility of caribou presence in the RSA, Chance commits to reconsidering the location of a given year's seismic program, and discussing the need for further monitoring that does not conflict with other surveys that may be implemented by the PCTC, Yukon Government, or other interested parties.

9.5.10 Caribou Interaction Response Plan

Pre-disturbance assessments and associated measures are designed to avoid disturbing/displacing caribou by initiating work at new locations. However, there could be situations where caribou move near an active work site. As mentioned above, the mostly likely response by caribou to Project activities is that they will avoid work areas due to sensory disturbance (Frid and Dill 2002, Stankowich 2008). If they are avoided, no further mitigations are required (i.e., because there will be no further interactions between the Project

and caribou). However, caribou may move near seismic operations, well site operations, or camps out of curiosity or if they have evaluated the activity occurring there and decided it is not a threat (i.e., habituate to the activity) (e.g., Cronin et al. 2000, Noel et al. 2004, Haskell et al. 2006, Haskell and Ballard 2008).

In general, the occurrence of caribou in proximity to Project activities (e.g., near a drilling rig or camp) is not a cause for immediate responses.

1. Most Project activities, such as seismic line development, have significant sensory disturbances (including visual, auditory, and olfactory) that caribou normally detect from several hundred metres away. Like other prey species, caribou are likely to treat a source of anthropogenic disturbance similar to a predation risk and avoid the area (Frid and Dill 2002). If a caribou decides to occur in proximity to a work site (i.e., within human sight distances), it means the individual has decided to investigate it further or determined that is does not pose an immediate threat (see Stankowich 2008 for a review of varied responses of ungulates to disturbance stimuli).
2. Most Project activities do not pose a mechanism to negatively affect caribou (other than the sensory disturbance the caribou has decided not to avoid). Given these factors, the initial response of a work crew to the observation of caribou will be to continue normal operations and intermittently monitor the location and behaviour of the caribou**.** Stopping work can cause more disturbance to the caribou (i.e., more disturbance than continuing normal operations) because it represents a change in the behaviour of the work crew in response to the presence of the caribou (Stankowich 2008).

If caribou are observed during Project activities (other than travelling along winter access roads and trails), the Caribou Interaction Response Plan, outlined in **Table 9-8**, is to be followed. For any interactions with caribou along winter access roads and trails, refer to **Section 9.5.6 Access Road Use and Maintenance**.

Table 9-8. The Caribou Interaction Response Plan. This Plan is Meant to be Followed if Caribou Approach an Active Work Area

Level	Trigger	Action/Response
Level 1	Caribou are first observed.	• Record as a Wildlife Observation. • Report the observation to the Environmental Monitor. o The Environmental Monitor will pass the location on to other workers in the vicinity, including helicopter pilots, to employ mitigation measures appropriate to their work activity. • Continue regular work activities. • Monitor caribou location and activity every 30 minutes while they are within sight of the work site. • Report details of the observations to the Environmental Representative at the end of the shift, who will forward the observation to Project Biologist for an initial assessment.
Level 2	Caribou persist near a work area for more than one day.	• The work crew will report the continued presence to the Environmental Monitor via radio, who will notify the Project Biologist. • The work crew will continue normal operations and monitoring for the remainder of the shift, as per Level 1. • The Project Biologist will direct a site assessment by the Environmental Monitor to collect additional information about the caribou occurrence, including the proximity of caribou to the work site and the behaviour of caribou,

Level	Trigger	Action/Response
		to ascertain the reason for the caribou persisting in the area and whether there is any interaction occurring between the work activity and the caribou.[1] • Based on the results of the assessment, a site-specific mitigation plan will be developed. [2]

1. If caribou persist within sight of a work area for more than one day, a Project Biologist will be involved to conduct a more detailed assessment of the situation. This will normally involve a site assessment to collect additional information to assess the reason for the occurrence of caribou in the area, the effects the drilling activity could have on the caribou, and, if appropriate, to develop site-specific mitigations. The Environmental Monitor will conduct the site assessment under the guidance of the Project Biologist remotely. The evaluation could vary depending on the details of the initial report but will generally involve the Environmental Monitor, observing the caribou intermittently over several hours to determine the locations the caribou are using and their behaviours (including behaviours associated with agitation and elevated vigilance). If the caribou occur intermittently in the area, the sites they occurred at will be investigated when they are not present, to look for signs of foraging, bedding, and other behaviours that could explain their presence at those sites. A site-specific management plan will be developed based on the assessment findings.
2. Depending on site conditions and caribou behaviour, a range of site-specific plans may be appropriate. However, two basic scenarios are most likely. (1) If caribou persist in the area but exhibit signs of agitation or elevated vigilance, the work site would be temporally shut down while caribou are present. This typically includes a no-disturbance buffer of 500 m or line-of-sight, whichever is greater. (2) If caribou persist in the area but do not exhibit signs of agitation or elevated vigilance (i.e., the caribou exhibit signs of habituation), work activities would continue with regular monitoring of the situation.

9.5.11 Response to Large Numbers of Caribou

Typically, in rut/ late fall and winter, the PCH is widely dispersed in small and medium-sized groups across its seasonal ranges. If the PCH were spaced evenly across the winter range, approximately 1,500 caribou would be expected to occur within an annual work area at any given time (based on the approximate 2% size of annual work areas relative to the size of the winter range in Yukon and the last population estimate of the herd). The actual number of caribou is expected to vary substantially within a typical year based on the dynamics of caribou movements and aggregations (e.g., perhaps 0.5–5% of the herd might occur at a given time). Under this typical distribution pattern, there will likely be regular caribou travelling through and foraging in the annual work area, even if some animals avoid the area due to sensory disturbances from the Project. In years with this typical distribution pattern, the mitigation measures outlined above, combined with caribou observation monitoring and implementation of site-specific mitigation plans as necessary, are expected to avoid any effects at the population level. For example, only 2% of the herd would be affected at a given time, and the effects would primarily be displacement of the herd to alternative habitat and travel routes outside the annual work area.

However, in some years, the distribution of PCH can be more concentrated. For example, deep snow in some parts of the winter range can make those areas less available to the herd, resulting in higher, concentrated use in other parts of the range (Russell et al. 1993). Although Eagle Plains is avoided in more years than selected, caribou concentrations can occur in Eagle Plains in some years for reasons such as the prevalence of deeper snowpacks there than in other parts of the winter range. If concentrated use of Eagle Plains were to occur when the Project was active, additional monitoring and mitigations may be warranted to minimize effects (i.e., because more caribou could be exposed to effects, possibly for a longer period, and because alternative habitat outside the RSA might be limited).

9.5.11.1 Monitoring Caribou Numbers

Determining the number and distribution of caribou will include a multi-staged approach. The first stage will consist of semi-weekly monitoring GPS collar data as a coarse index of potential caribou. The initial trigger of a 'large number' of caribou will be if ≥10% of the collared caribou in Canada occur within the annual work area plus a 20-km buffer[18].

The second monitoring stage will consist of aerial surveys to determine the number and distribution of caribou across the annual work area. Nearby control areas will also be surveyed to assess differences in the numbers and distribution of caribou within the annual work area relative to unaffected areas. Ultimately, this comparison will help to determine potential effects and support better-informed mitigations.

The third monitoring stage will consist of local effects monitoring studies to determine and characterize the effects of Project activities on caribou to support active adaptive management. The specific types of studies that are implemented will depend on the types of Project activities that are ongoing at the time, the number and distribution of caribou that are present (based on stage 1 and 2 surveys), and (iii) qualitative information about the types of Project-caribou interactions that are reported from worker observations, wildlife monitors, and caribou interaction investigations. Candidate studies include:

- Ground or aerial track surveys to estimate ZOI effects around different types of work sites (e.g., active well sites, 3D seismic areas, or mainline winter access roads);
- Ground or aerial track surveys to examine the effects of linear features on caribou movements (e.g., rates of turn-backs or deflections along paths near access roads); and,
- Near real-time analysis of GPS telemetry data in relation to active work sites to assess potential ZOI effects and effects on movement.

Effects monitoring studies will be initiated within one week of the occurrence of 'large numbers of caribou' and will be designed to provide actionable results within a week of a study's start. Site-specific measures will be developed based on the study's results, similar to the Caribou Interaction Response Program outcomes. For example, if a snow track study observed high rates of turn-backs or deflections of caribou along a mainline winter access road, potential mitigations could include (a) further reducing the snowbank height and (b) reducing traffic-passage rates by limiting access road use to convoys (a string of vehicles) during specific times of the day.

9.5.11.2 Mitigation Measures if a Large Number of Caribou are Present

If a 'large number' of caribou are present in the annual work area, the following measures will be implemented.

- Work at existing sites can continue, but work at new sites (i.e., requiring the construction of new winter access roads or plowing inactive rods to access the new areas) will be postponed until the large number of caribou has moved out of the annual work area.
- If the 'large number' of caribou persist in the annual work area for more than 10 days, a 'temporary constrained work area plan' will be developed. Development of the plan will consider

[18] The 20 km buffer is to account for animals that have potential to travel into the annual work area between collar checks.

(i) caribou habitat suitability mapping (i.e., to minimize overlap with suitable habitat), (ii) caribou occurrence data (i.e., from GPS collars, aerial surveys, and worker observations), and (iii) the results of effects monitoring studies. This plan will include the following.

  - Reducing the extent of operations to less than half (<50%) of the original annual work area.
  - Reducing the number and length of mainline winter access roads that are maintained and used to the minimum that is operationally feasible.
  - Restricting winter access road travel to convoys during limited operation windows (e.g., three 2-hour travel times at 6 am, 12 pm, and 6 pm) to limit the effects of access road use on caribou movements.

- As the results of the stage three effects monitoring studies become available, they will be reviewed semi-weekly. As warranted, the results will refine general mitigation measures and the constrained work area plan. This could include more restrictive measures, including up to the temporary shutdown of all Project activities or the relaxation of measures if caribou demonstrate tolerance or habituation to Project activities.

9.5.12 Worker Training

All Project personnel will receive basic training about wildlife mitigation measures and reporting wildlife sightings as part of their initial orientation. Training will be completed once a year for each person working on site, including contractors. The training aims to familiarize all personnel with the Company's policies and procedures related to wildlife, including caribou. The training will emphasize workers' responsibilities for avoiding or minimizing the effects of Project work on wildlife and wildlife habitat, including disruption and disturbance to caribou. The training will go through the specific mitigation measures outlined in the Caribou Mitigation and Monitoring Plan, that apply to each worker's position. Project personnel will be trained to identify focal wildlife and wildlife features, such as dens or nests, and report wildlife observations using a standard wildlife observation form. They will also be trained about wildlife encounters or chance finds of wildlife features that require special responses, such as stopping work until the Environmental Monitor, or the Project Biologist has assessed the area. During seismic line clearing, daily tailgate meetings will be held and any caribou sightings will be communicated to all personnel; reminders will be provided to report all observations.

The following topics will be included in the wildlife training session:

- introduction and overview of the Caribou Mitigation and Monitoring Plan;
- identification of wildlife and wildlife features, with emphasis on caribou;
- wildlife timing windows;
- roles and responsibilities of the Project Manager, Environmental Monitor, Project Biologist, and on-site personnel;
- when and how to contact the Environmental Monitor and Project Biologist;
- procedures for reporting observations of wildlife and wildlife features;
- pre-disturbance survey requirements;
- how and when stop work procedures occur; and,
- bear safety.

In addition to the general orientation for all personnel, the Project Biologist will provide more detailed training to the Environmental Monitor about specific tasks related to caribou, such as protocols for monitoring caribou if they occur in proximity to any of the Project operations (see **Section 9.5.9 Early Warning System for Caribou**).

9.6 EFFECTS CHARACTERIZATION

9.6.1 Approach

Characterizing the residual effects on caribou considers the Project's potential effects (including existing development and conditions) and the mitigations used to minimize those effects. The spatial boundaries of assessment include multiple scales that are specific to caribou: (1) the RSA, (2) the Eagle Plains ecoregion, and (3) the extent of the rut/ late fall and winter seasonal ranges for the PCH (**see Section 3.3.1.4.1 *Spatial Boundaries*, Table 3-3**). These scales of analysis correspond to the Caribou Study Areas (CSA) (see **Table 3-3**). The information and inferences presented in this section are based on the studies and literature discussed in **Section 9.4 Project Interactions and Potential Effects**.

Residual effects on caribou have each been characterized in terms of magnitude, likelihood, geographic extent, duration, timing, frequency, reversibility, context, and confidence. Each of these terms are defined and described for caribou in **Table 9-9**. For example, residual effects from the Project are classified into four levels of magnitude based on the percent change in an assessment indicator: Negligible (<1%), Low (1–10%), Moderate (11–35%), and High (>35%). These magnitude ratings were established by interpreting the relationship between habitat disturbance and population viability, as outlined for boreal caribou in *Scientific Assessment to Inform the Identification of Critical Habitat for Woodland Caribou, Boreal Population, in Canada* (refer to Table 9 in Environment Canada 2011). In that report, Environment and Climate Change Canada (ECCC) identified population risk levels associated with different amounts of total disturbances (hereafter referred to as 'ECCC-defined disturbance')[19]: very low (<10%), low (10–35%), moderate (35–45%), high (34–75%), and very high (>75%). To be cautious in this assessment, anything beyond 35% total disturbance is considered a high-magnitude habitat effect. Furthermore, in the absence of more relevant information for barren-ground caribou or other types of residual effects (e.g., mortality and movement), the ratings used to classify the magnitude of habitat effects was also used for all other residual effects. Assessment and characterization of residual effects are provided in **Sections 9.6.2** through **9.6.7**.

The significance of all residuals effects is assessed in combination to determine the overall affect of the Project on caribou after mitigations are applied (see **Section 9.7 Significance**).

[19] The total amount of disturbance refers to the area of anthropogenic footprints, plus a 500 m buffer around those footprints, and natural disturbances such as wildfires.

Table 9-9. Definitions of Effects Criteria Classifications for the Assessment of Caribou in the Eagle Plains Exploration Project

Criterion		Rating	Definition
Magnitude		Negligible	There will be no measurable change from existing conditions. **This corresponds to a <1% change in an assessment indicator.**
		Low	The residual effect will be a slight, but measurable change from existing conditions. **This corresponds to a 1–10% change in an assessment indicator.**
		Moderate	The residual effect will be a measurable change from existing conditions but will not affect the viability of Porcupine caribou. **This corresponds to a 11–35% change in an assessment indicator.**
		High	The residual effect will be a substantial, measurable change from existing conditions that may affect the viability of Porcupine caribou. **This corresponds to a >35% change in an assessment indicator.**
Likelihood		Unlikely	No residual effect is expected, but a residual effect is not impossible.
		Possible	A residual effect may occur but is not likely.
		Probable	A residual effect is likely to occur, but it is not certain.
		Certain	A residual effect will occur.
Geographic Extent		Maximum disturbance footprint	The residual effect will be confined to the maximum disturbance footprint.
		Region	The residual effect will be confined to the regional study area.
		Ecoregion	The residual effect will extend beyond the regional study area but will be confined within the Eagle Plains ecoregion.
		Seasonal Range	The residual effect will extend to the rut/ late fall and winter seasonal ranges.
Duration, Frequency and Timing	Duration	Short-term	The residual effect will occur for less than one year.
		Medium-term	The residual effect will occur for greater than one year and up to the life of the Project.
		Long-term	The residual effect will extend beyond the life of the Project.
		Permanent	The residual effect is predicted to be permanent and thus unlikely to recover to existing conditions.
	Frequency	Occasional	The residual effect will occur rarely (once or a few times over the life of the Project).
		Irregular	The residual effect will occur more than a few times but not at regular intervals. The effect will be dependent on the sporadic interactions between caribou and the Project.
		Periodic	The residual effect will occur consistently at regular intervals or associated with temporal events (e.g., during spring freshet, low flows, growing season).

Criterion		Rating	Definition
		Continuous	The residual effect will occur continuously.
	Timing	Year-round	The residual effect will occur year-round.
		Seasonal	The residual effect will be confined to a portion of the year.
Reversibility		Reversible	The residual effect is predicted to be reversible within a clearly defined period.
		Irreversible	The residual effect is predicted to be irreversible.

9.6.2 Residual Direct Habitat Effects

The Project is expected to have direct habitat effects on caribou via vegetation clearing associated with the development of seismic lines, winter access roads, well sites, and secondary camps. Vegetation clearing is expected to reduce the amount of 'selected' (moderate and high quality) habitats by caribou. To assess the residual direct habitat effects to caribou, several aspects of the Project's spatial extent and development pattern are considered:

- The extent of direct habitat effects is expected to be limited to a small portion of the available habitat within the RSA.
- Affected areas are expected to occur at narrow linear features and small openings <4 ha.
- Effects are expected to be widely dispersed across the RSA.
- Lichen cover is expected to be initially maintained at most sites. As taller vegetation regenerates on affected sites, lichen is expected to persist on seismic lines ≤3 m. On lines >3 m, and other types of openings, lichen is expected to be substantially reduced as forbs and shrubs overgrow the sites due to increased light exposure. However, approximately 47% of the RSA has already been disturbed by fires <40-years old, which has likely already reduced lichen quantities by substantial amounts.

Direct habitat effects were assessed by quantifying the extent of overlap of exiting features and Project features with rut/ late fall and winter caribou habitat model outputs. Calculations of direct habitat effects considered only moderate and high rated habitat, which are 'selected' by Porcupine caribou **Section 6 Caribou** of **Appendix 9-A Wildlife Baseline**), and excluding low and very low rated habitat. The age of existing features varies from the late 1950s to 2015, and the vegetation on those features has regenerated to varying degrees depending on the time since disturbance, type of disturbance, and site conditions (**EDI Linear Feature Baseline – Appendix 9-B**). However, since caribou habitat quality depends largely on the biomass of ground lichen, and because lichen takes several decades to regenerate, all existing features, except 3D LIS lines, were assumed to have nil habitat value for caribou. For 3D LIS lines (existing and proposed), lichen persists after the lines are cut, and a 50% downgrade was applied (e.g., if 100 ha of suitable habitat was affected by 3D LIS lines, the effect would be 50 ha).

Direct habitat effects will largely be limited to the RSA, specifically confined to the maximum disturbance footprint. A small amount of habitat could be affected along winter access roads to water withdrawal sites outside the RSA. The extent of direct habitat effects from the Project will be small: 2% for rut/ late fall and winter habitats in the RSA, and 0.2% for rut/ late fall and winter habitats at the Eagle Plains ecoregion scale (**Table 9-10**).

Table 9-10. Direct Habitat Effects from Existing and Project-Related Disturbances on 'Selected' Caribou Habitat During Rut/ Late Fall and Winter in the Project Regional Study Area (2,387 km²) and the Eagle Plains Ecoregion (21,984 km²)[1]

Effects Category	Rut and Late Fall		Winter	
	RSA	Ecoregion	RSA	Ecoregion
Existing (Baseline), Direct Effects	8.5 km² (0.9%)	32.3 km² (0.4%)	3.7 km² (0.6%)	19.6 km² (0.4%)
Project Wellsite Scenarios (n = 10), Direct Effects	18.5–18.8 km² (1.9–2.0%)	18.7–19.0 km² (0.2%)	12.4–12.6 km² (2.0%)	12.6–12.7 km² (0.2%)
Total Direct Effects on 'Selected' Habitat	27.0–27.3 km² (2.8%)	51.0–51.3 km² (0.6%)	16.1–16.2 km² (2.6%)	32.1–32.2 km² (0.6%)
Selected' Habitat Unaffected by Disturbance	937.8–938.2 km² (97.2%)	8,348.7– 8,349.0 km² (99.4%)	608.1–608.2 km² (96.2%)	5,422.9–5,423.1 km² (99.4%)
Total 'Selected' Habitat	965.1 km² (100.0%)	8,400.0 km² (100.0%)	632.4 km² (100.0%)	5,455.2 km² (100.0%)

[1] The Project's effects are calculated based on the lifetime of the exploration program.

* Percentages are relative to the total amount of 'selected' caribou habitat during rut/ late fall and winter seasons.

A summary of the characterization of residual direct habitat effects on caribou is provided in **Table 9-11.** Two aspects of the Project limit the magnitude of direct habitat effects: (i) protection of ground vegetation by clearing during the winter and (ii) the size and shape of Project features. The combination of maintaining ground vegetation and the Project's spatial extent and development pattern has two primary consequences on caribou habitat:

6. The shape, size, and distribution of Project footprints is expected to affect a relatively small area of habitat. This effected habitat will likely be dispersed across suitable habitat areas within the RSA. As a result, the distribution of suitable caribou habitat across the RSA will be largely maintained, with a relatively small reduction in the total amount of habitat spread out across all suitable habitat areas. This pattern differs from natural disturbances, like wildfires, and some types of human developments, like mines, which result in more contiguous disturbances that can affect habitat distribution at stand and sub-watershed scales.
7. The extent of effected caribou habitat is expected to be less than the total Project footprints because (i) substantial portions of the RSA are covered by recent burns where lichen is reduced or absent, (ii) the location of Project features have been planned to reduce overlap with high-value caribou habitat, and (iii) lichen cover is expected to partially persist on seismic lines ≤3 m wide.

All Project features will be developed during the winter, and vegetation clearing will be limited to trees and tall shrubs. The ground vegetation layer, including mosses, lichens, forbs, low shrubs, and tree seedlings will be left intact and protected from disturbance by compacted snow or rig mats, depending on the feature

type and site conditions. Maintaining ground vegetation will limit potential effects on caribou habitat by keeping caribou forage (i.e., lichen) and hasten vegetation regeneration by maintaining tree and shrub seedlings on the sites. The narrow widths of seismic lines (≤3 m) and the small sizes of well sites (≤2 ha) will also minimize habitat effects. The combination of the small size of the features and their dispersed pattern across the landscape is expected to minimize further potential habitat effects on a wide-ranging species, like caribou, which typically travel several kilometres per day.

Direct habitat effects are expected to be fully reversible, but the time for lichen to recover will vary depending on the width/size of the opening. For features >3 m wide, the time for lichen recovery is expected to be similar to, but somewhat shorter than, recovery after wildfire[20], due to the maintenance of the ground vegetation layer. Some studies have observed that vegetation recovery on conventional seismic lines has been delayed or stagnated (Lee and Boutin 2006, Jorgenson et al. 2010). However, both studies were of conventional lines where the ground vegetation was removed, and the soil was disturbed. Also, those study areas were subject to local factors that do not occur in Eagle Plains. For example, in the boreal forest of northern Alberta, where Lee and Boutin (2006) conducted their research, recovery of shrubs and trees was inhibited by (i) off-highway vehicle use and conversion of lines to roads and trails and (ii) a combination of site factors that favoured the persistence of graminoids and forbs and inhibited the initiation and growth of shrubs and trees. These factors are not an issue in Eagle Plains. Baseline studies of historical linear features in the RSA, including winter access roads, conventional seismic, and low-impact seismic, of various ages, found that most sites were undergoing normal successional pathways; only 5% of sites had stagnated at a forb stage (mostly on winter access roads) (**Appendix 9-B**). All low-impact seismic lines were undergoing normal succession, including growth of shrubs and tree seedlings/saplings left behind during vegetation clearing.

For features ≤3 m, where lichen cover is expected to persist on most lines, the time for lichen to return to pre-disturbance levels is expected to be much shorter. In the first several years after clearing, the extent of lichen cover could change due to the change in light and other environmental conditions and in response to the regeneration of other plants. However, those effects are expected to be site-specific and have a relatively small effect on the overall extent of lichen cover. At the small scale of ≤3 m wide openings, changes in microsite conditions can be positive or negative for lichen cover (Golder Associates 2016, Dabros et al. 2017, 2022). Over time, as vegetation regenerates on the line and continues to grow adjacent to the line, lichen cover is expected to return to pre-disturbance levels. The period over which this will occur is uncertain but is estimated to be two or three decades (compared to up to several decades for open areas following primary successional pathways).

[20] Lichen biomass generally peaks in stands 125-175 years old in the taiga (Klein 1982), though studies in Eagle Plains indicate that lichen can be relatively abundant in regenerating stands <50 years old (Russell et al. 1993).

Table 9-11. Characterization of Residual Direct Habitat Effects on Caribou

Criterion		Rating	Rationale
Magnitude		Negligible (Ecoregion) to Low (Region)	The extent of direct habitat effects on rut/late fall and winter habitat are 0.2% in Eagle Plains (Ecoregion) and up to 2% in the RSA (Region). Vegetation clearing along seismic lines, well pads and winter access roads will maintain existing ground vegetation, which maintains some caribou forage, maintains the existing vegetation community, and hastens regeneration. Overall, effects are expected to be negligible (<1% in Eagle Plains) to Low (1–10% in RSA) in magnitude based on the extent of direct habitat effects. However, the relative magnitude of effect on forested sites (where trees are cleared) will be higher than on non-forested and early seral sites (e.g., burns).
Likelihood		Certain	The probability of vegetation clearing causing direct habitat effects is certain.
Geographic Extent		Maximum Disturbance Footprint and Ecoregion	Exploration activities could occur at low density across much of the RSA, specifically the maximum disturbance footprint. Existing disturbances (including linear features) are present in the Eagle Plains ecoregion.
Duration, Frequency and Timing	Duration	Short-term to Long-term	Duration of effects depends on vegetation stage. On non-forested and early seral sites, effects are expected to be short-term. On forested sites, it may take up to several decades for trees to regenerate to the stage they were at when cut.
	Frequency	Continuous	Direct habitat effects are typically instigated as a single event (i.e., vegetation clearing), but the residual effect of that clearing will be continuous until the vegetation has regenerated.
	Timing	Year-round	Direct habitat effects are typically instigated as a single event (i.e., vegetation clearing), but the residual effect of that clearing will occur year-round. Note: a year-round effect does not imply that vegetation clearing occurs year-round; clearing will only occur during winter.
Reversibility		Reversible	Baseline studies and Yukon Government studies have examined regeneration patterns on historical linear features in Eagle Plains and found most sites are exhibiting normal succession, which are likely to result in similar vegetation communities and structures that occurred prior to disturbance.

9.6.2.1 Context and Confidence

Determining residual direct habitat effects on caribou considered the context of Regional Land Use Planning and the confidence in accurately quantifying and predicting those effects (**Table 9-12**). The effects characterization is consistent with the objectives of existing Land Use Plans, and there is relatively high confidence that effects were accurately captured in the assessment. A potential data limitation to this assessment is the temporal coverage (2012–2021) of GPS collar data used to quantify habitat quality for

the PCH; most of these caribou occupied the RSA in only one year. However, the RSF models used to quantify habitat quality identified consistent habitat selection patterns within rut/ late fall and winter seasons ranges that matched expectations of caribou habitat use. Therefore, the confidence in this assessment is high.

Table 9-12. Characterization of Context and Confidence in the Residual Project Effects on Caribou Direct Habitat Effects

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	The RSA is within Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans, which are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	There is high confidence in (i) the characterization of initial effects and (ii) the persistence and reversibility of direct habitat effects.

9.6.3 Residual Indirect Habitat Effects

Indirect habitat effects refer to reduced use of 'selected' (moderate and high quality) habitats by caribou due to sensory disturbances from adjacent areas (also referred to as reduced habitat effectiveness). Several Project activities, including winter access road construction and operation, seismic exploration, well development and operation, and camp operations, can potentially cause indirect habitat effects.

To characterize residual indirect habitat effects, results of PCH baseline studies were considered and ZOI estimates from other studies were evaluated in the context of the Project's activities, the Eagle Plains environment, the PCH's ecology, and potential mechanisms (pathways). Based on the range of ZOI distances reported in the literature and the factors that affect them, a ZOI distance of 1 km for linear features (seismic lines and winter access roads) and 3 km for facilities (well sites, camp, airstrip) is used to account for sensory disturbances associated with Project activities. These ZOI distances account for the weak effects of linear features estimated in PCH baseline studies (**Section 6 Caribou** of **Appendix 9-A**), aligns with the broader literature (primary and technical reports; **Appendix 9-C**), and account for a caribou's ability to perceive disturbances via sight, smell, and hearing while on the Eagle Plains landscape (i.e., rolling topography with taiga vegetation).

Overall, sensory perception was the key consideration in choosing ZOI distances rather than assuming caribou could develop a learned avoidance response to the Project. Based on the nature of the Project's exploration activities and the PCH's occurrence and movement patterns, caribou have limited opportunity to develop a learned response.

The following factors limit the potential for caribou to develop a learned response to the Project:

- The RSA constitutes a small portion of the rut/ late fall and winter ranges of the PCH, and most of the herd is unlikely to be exposed to Project activities due to the herd's broad distribution in Yukon and Alaska.
- For caribou that do interact with the Project, their exposure is expected to be limited both seasonally and annually because (i) caribou tend to wander continuously through the rut/ late

fall and winter (Russell and Gunn 2017) and individuals typically spend a small portion of these seasons in the RSA (**Section 6 Caribou** of **Appendix 9-A**), and (ii) caribou often vary the areas they use in rut/ late fall and winter from year to year (Russell et al. 1993).

- The Project's active work areas will vary from year to year, so the potential for caribou to encounter disturbances in the same area in multiple years, which could reinforce a learned response, is reduced.

The combination of these factors reduces the potential for the PCH to develop learned behaviours that would result in ZOI distances beyond sensory perception distances. ZOI distances of 1–3 km are on the lower end of the range of ZOI distances reported in the literature, but it is consistent with several studies of similar disturbances in forested areas (Dyer et al. 2001, Schindler et al. 2007, Polfus et al. 2011, MacNearney et al. 2021). From an assessment perspective, the precise choice of ZOI distances will have a limited effect on the estimates of indirect habitat loss because seismic lines are proposed to potentially occur across most of the RSA, and the distance between seismic lines is often less than 1 km. Thus, a 1-km ZOI will result in almost complete coverage within an annual work area. Consequently, the larger ZOI (3 km) associated with facilities will often overlap with the ZOIs of linear features.

This assessment assumes that habitat effectiveness is reduced by 75% within the 1-km (linear features) and 3-km (facilities) ZOIs. To calculate indirect habitat effects, 75% of 'selected' habitat within the ZOIs of Project features and activities was considered disturbed. This estimate is assumed to be biased to overestimate potential effects. The combination of ZOI distance and magnitude of effect results in a precautionary assessment, especially since the timing of indirect habitat effects will occur during the two seasons of least ecological importance to caribou and when caribou are most tolerant of human disturbance.

The presence of indirect habitat effects is tied directly to the occurrence of mechanized Project activities that cause sensory disturbances. The duration of Project activities will vary depending on the type of activity and site conditions. For this assessment, Project activities are assumed to persist for a full season. Many wells and winter access roads will only be active for part of the season. Similarly, seismic exploration operations will likely only cause sensory disturbance in approximately a third of the annual work area at any given time. Assuming that Project activities will occur for the entire season likely overestimates the potential effects. It provides a conservative assessment (i.e., errs on the side of a greater rather than a lesser potential effect). Indirect habitat effects will not result in the permanent loss of any caribou habitat. The effects will result in animals temporarily avoiding habitat areas for the year when exploration activities are active. Those areas will be available to caribou again in years after exploration is complete.

Due to the dynamic nature of the exploration program (i.e., the location and scheduling of work areas will be continually evolving as results are obtained), the location of work areas cannot be planned at this stage. Therefore, instead of calculating indirect habitat effects for specific work areas for each year of the Project, the total indirect habitat effects were estimated for the full life of the Project. Ten well site development scenarios and access routes were evaluated. The indirect habitat effects over the Project's lifetime are summarized in **Table 9-13**.

In the RSA, the maximum indirect habitat effect expected to occur in any given year is approximately 32% of the Project's total lifetime effect. This annual effect was estimated by multiplying the total indirect habitat effects (maximum 692.9 km² during rut/ late fall and 457.6 km² during winter), due to existing conditions

and the Project, by the proportion of the RSA in which operations will be conducted annually. To be prudent in this assessment (i.e., err on the side of overestimating an effect), the proportion of annual operations (i.e., area of annual operations/area of RSA = 500 km² / 2,387 km² = 0.2) was increased by an additional 50% to account for Project features like winter access roads and the camp, which occur outside of the exploration area (i.e., final proportion = 0.2 x 1.5 = 0.3). Therefore, annual sensory disturbance in the RSA is estimated to reduce habitat effectiveness by 221.7 km² (23.0%) during rut/ late fall and 146.4 km² (23.2%) during winter. Additionally, at the scale of the Eagle Plains ecoregion, an annual sensory disturbance is estimated to reduce habitat effectiveness by 487.1 km² (5.8%) during rut/ late fall and 280.6 km² (5.1%) during winter. Annual, indirect habitat effects at the ecoregion scale are calculated by subtracting the lifetime effects of the RSA from those of the ecoregion (e.g., fall: 958.3 km² – 692.9 km² = 265.4 km²) and adding the difference to the annual RSA effect (e.g., fall: 221.7 km² + 265.4 km² = 487.1 km²). Again, these estimates are biased to overestimate potential effects and, thus, provide a more prudent (i.e., likely overestimate the effect) assessment.

Table 9-13. Indirect Habitat Effects from Existing and Project-related Disturbances on 'Selected' Caribou Habitat During Rut/ Late Fall and Winter in the Project Regional Study Area (2,387 km²) and the Eagle Plains Ecoregion (21,984 km²)[1,2]

Effects Category	Rut and Late Fall		Winter	
	RSA	Ecoregion	RSA	Ecoregion
Existing (Baseline), Indirect Effects	53.0 km² (5.5%)	273.7 km² (3.3%)	9.1 km² (1.4%)	111.7 km² (2.1%)
Project Wellsite Scenarios (n = 10), Indirect Effects	625.0–639.9 km² (64.8–66.3%)	661.4–684.7 km² (7.9–8.2%)	443.8–448.5 km² (70.2–70.92%)	473.8–480.0 km² (8.7–8.8%)
Total Indirect Effects on 'Selected' Habitat	678.0–692.9 km² (70.3–71.80%)	935.1–958.3 km² (11.1–11.4%)	452.9–457.6 km² (71.6–72.4%)	585.6–591.7 km² (10.7–10.9%)
'Selected' Habitat Unaffected by Sensory Disturbance	272.2–287.1 km² (28.2–29.7%)	7,441.6–7,464.9 km² (88.6–88.9%)	174.8–179.5 km² (27.6–28.4%)	4,863.5–4,869.6 km² (89.2–89.3%)
Total 'Selected' Habitat	965.1 km² (100.0%)	8,400.0 km² (100.0%)	632.4 km² (100.0%)	5,455.2 km² (100.0%)

1 The Project's effects are calculated based on the lifetime of the exploration program.

2 Indirect habitat effects refer to reduced habitat effectiveness due to sensory disturbances. These effects are calculated independently from the direct habitat effects caused by vegetation clearing (see Table 9-10 in Section 9.6.2 Residual Direct Habitat Effects). Direct habitat effects would be subtracted from 'Selected' Habitat Unaffected by Sensory Disturbance and added to Total Indirect Effects on 'Selected' Habitat to calculate the total amount of (direct and indirect) disturbance.

* Percentages are relative to the total amount of 'selected' caribou habitat during rut/ late fall and winter seasons.

A summary of the characterization of residual indirect habitat effects on caribou is provided in **Table 9-14**. Applying 1-km (linear features) and 3-km (facilities) ZOIs around Project features results in the potential for indirect habitat effects of approximately 70–72% of the RSA over the Project's lifetime, reflecting the extensive distribution of seismic operations. In the broader Eagle Plains ecoregion, indirect habitat effects occur in approximately 11% of the total area over the Project's lifetime. In any given year, indirect habitat effects could result in about 23% reduced habitat effectiveness in the RSA and approximately 5–6%

reduced habitat effectiveness in the Eagle Plains ecoregion. Indirect habitat effects are temporary and cease once Project activities end. Indirect habitat effects will not result in the permanent loss of any caribou habitat. The effects will likely result in most caribou temporarily avoiding 'selected' habitat areas within an annual work area for the year when exploration activities occur. Those areas will be available to caribou again in the years after exploration is completed.

The magnitude of indirect habitat effects on the PCH is low at the population level (Ecoregion and Seasonal Ranges). The annual work areas are small relative to the rut/ late fall and winter season ranges, so a relatively small proportion of the population is likely to be affected. The residency time of caribou occurring in annual work areas is expected to be short (e.g., 1–2 weeks during winter), and caribou will have alternative habitat available to them outside annual work areas. The energetic cost for affected animals to use alternative habitat is expected to be relatively low because PCH caribou are typically in good body condition in fall and winter and usually travel several kilometres per day during these seasons, regardless of their proximity to disturbances. Therefore, the magnitude of indirect habitat effects is moderate at the RSA level.

The duration of indirect habitat effects is assumed to be directly tied to the operational period of Project activities that cause sensory disturbances. Once the disturbances stop, effects on caribou are expected to end. From a practical perspective, and to be conservative in estimating potential effects, it is assumed that effects could be associated with all Project features within an annual work area, during the entire season that area is active. Large portions of the annual work areas will likely not be subject to disturbances at any given time. However, due to the dispersed and variable nature of the work (e.g., having several seismic crews active at one time), it is impossible to predict the location and timing of disturbance in an annual work area. In years when human activity is not present (i.e., after exploration activities are complete), it is assumed that indirect effects on habitat do not persist.

Table 9-14. Characterization of Residual Indirect Habitat Effects on Caribou

Criterion	Rating	Rationale
Magnitude	Low (Ecoregion) and Moderate (Region)	The extent of indirect habitat effects in any year (i.e., an annual work area) is approximately 5% of the Eagle Plains (Ecoregion) and approximately 23% of the RSA (Region). Furthermore, within an annual work area, only approximately one-third (32%) of that area will likely be subject to disturbance at any given time within a season. The magnitude of effect at the Ecoregion level (Eagle Plains) is Low (1–10%) because most of the population is not expected to overlap with the annual work area in a given year, and those caribou have alternative habitat available. The magnitude of effect at the Region (RSA) level is Moderate (11–35%) because, although the annual work area constitutes a substantial portion of the RSA, (i) some caribou are still expected to use habitat within the ZOI, and (ii) caribou are a wide-ranging species, and there is relatively low impact to individual animals to use alternative habitat outside the affected annual work area.
Likelihood	Certain	The probability of Project activities causing indirect habitat effects is certain.

Criterion		Rating	Rationale
Geographic Extent		Region and Ecoregion	Indirect habitat effects could affect regional (RSA) and ecoregion (Eagle Plains) in any given year. Indirect habitat effects within the RSA could affect caribou distribution and habitat use beyond the RSA.
Duration, Frequency and Timing	Duration	Short-term	Most Project activities will last several weeks or months within a year. For this assessment, effects are assumed to occur for an entire season, to be precautionary.
	Frequency	Continuous	Indirect habitat effects are tied directly to mechanized Project activities. Most Project activities (seismic exploration, well development, winter access roads, and camp operations) will occur continuously within an annual work area during the period in which they occur. However, not all activities are expected to occur in the same year.
	Timing	Seasonal	Indirect habitat effects are tied directly to mechanized Project activities. Project activities (seismic exploration, well development, winter access roads, and camp operations) will occur seasonally, with the majority of these activities occurring in the winter.
Reversibility		Reversible	Indirect habitat effects are completely reversible. Once the sensory disturbance associated with mechanized activity stops, indirect habitat effects are expected to end.

9.6.3.1 Context and Confidence

The characterization of residual indirect habitat effects on caribou considered the context of Regional Land Use Planning and the confidence in accurately quantifying and predicting those effects (**Table 9-15**). The effects characterization is consistent with the objectives of existing Land Use Plans. There is moderate confidence that effects were accurately captured in the assessment; uncertainty remains regarding the ZOI distance and degree of caribou use within the ZOI. For example, a potential data limitation to this assessment is the temporal coverage (2012–2021) of GPS collar data used to quantify ZOIs; most of these caribou occupied the RSA in only one year. However, to be prudent, the potential effects (i.e., degree of avoidance within a ZOI) were overestimated to account for any uncertainties.

Table 9-15. Characterization of Context and Confidence in the Residual Project Effects on Caribou Indirect Habitat Effects

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	The RSA is within Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans, which are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	Moderate	There is moderate confidence associated with the ZOI distance and the degree to which some caribou will still use habitats within the ZOI. However, assumptions about the extent and timing of work are biased to overestimate potential effects to provide a more prudent assessment.

9.6.4 Residual Movement Effects

The Project can potentially affect caribou movements by creating sensory disturbances that result in avoidance of those areas by caribou. A summary of the characterization of residual movement effects on caribou is provided in **Table 9-16**.

The magnitude of residual effects on caribou movements depends on the scale of analysis. Most caribou travelling through the rut/ late fall and winter ranges will not be exposed to the Project. Based on the relatively small size of annual work areas compared to PCH rut/ late fall and winter seasonal ranges (≤1% of the seasonal ranges by area), a relatively small proportion of the PCH population is likely to be exposed to Project activities that could affect movement. Any residual effects at broader scales (Ecoregion and Seasonal Range) are predicted to be relatively small, and caribou are predicted to successfully proceed with broad seasonal movements/migrations across their seasonal ranges. Effects on seasonal migration movements are unlikely.

For caribou that do travel through or around the annual work area, the most likely effects are elevated energetic output or stress. Any effects on movement that do occur are expected to be limited to local alterations to the location and timing/rate of movement within the RSA. Modified movement responses could include (i) delayed movement upon encountering the Project, (ii) deflected travel routes around the Project, or (iii) modified movement patterns locally, within the RSA, possibly including slower or faster travel rates, or more tortuous travel paths. These local movement modifications, if they occur, could cause indirect effects on individual animals, such as stress or increased energy expenditures, but are unlikely to impede broad movements among seasonal ranges. The potential magnitude of these secondary effects (i.e., stress and energetic costs) are limited because caribou are typically in good body condition during rut/ late fall and winter, and caribou can modify their movements to avoid the annual work areas. Therefore, the magnitude of effects on movements at the RSA level is rated moderate.

Based on typical daily movement rates, the exposure period would be limited to a few days, and the distances associated with avoiding active work sites are small relative to normal rut/ late fall and winter movement patterns. The potential for negative effects is also reduced because caribou are typically in good body condition in rut/ late fall and winter and are not subject to stressors they experience in other seasons, such as insect harassment and heat stress. Like indirect habitat effects, the duration of Project effects on caribou movement is expected to be limited to periods when the Project is active and causing sensory disturbances (refer to the information provided in **Section 9.6.3 Residual Indirect Habitat Effects**).

Effects on movement are expected to be temporary and will be limited to the year that the Project is active within a given annual work area. Once sensory disturbances stop, movement effects are expected to end so that caribou resume normal movement patterns. The persistence of habitat disturbances associated with the exploration activities (seismic lines, winter access roads, and well sites) are not expected to affect caribou movements when no mechanized activity is associated with those features, i.e., in the absence of sensory disturbances. Historical telemetry data (2012–2021) shows that in years that PCH caribou occurred in the RSA (2015), caribou regularly travelled along and across historical seismic lines and winter access roads, though it appears that some caribou avoid crossing certain sections of the Dempster Highway (**Section 6 Caribou** of **Appendix 9-A**).

Table 9-16. Characterization of Residual Movement Effects on Caribou

Criterion		Rating	Rationale
Magnitude		Low (Ecoregion and Seasonal Range) to Moderate (Region)	For caribou interacting with the Project, animals are predicted to successfully complete seasonal movements/migrations across their seasonal ranges. Still, they may exhibit modified movement patterns that elevate stress and energy expenditures. The magnitude of effect related to movement is associated with the level of sensory disturbance that could affect caribou movement: approximately 23% of the RSA and about 5% of the Eagle Plains ecoregion, annually. The magnitude is rated Low (1–10%) at the Ecoregion (Eagle Plains) and Seasonal Range (rut/ late fall and winter) scales. The maximum annual work area size is approximately 2% of the late fall and winter seasonal ranges. Most of the PCH will not interact with the annual work area. The magnitude is rated Moderate (11–35%) at the RSA (Region) level. The maximum size of annual work areas is expected to be approximately 30 km in diameter or a third of the RSA.
Likelihood		Certain	The probability of Project activities affecting local caribou movements within the RSA is high. However, affected caribou are still expected to complete seasonal movements/migrations.
Geographic Extent		Region, Ecoregion, and Seasonal Range	Project activities affecting caribou movements could occur over as much as a third of the RSA in any given year. Effects on movement could extend outside the RSA to broader seasonal ranges.
Duration, Frequency and Timing	Duration	Short-term	Based on average daily movement rates of caribou of 4.4 km/day in winter and maximum annual work areas of 30 km in diameter, caribou within or adjacent to the RSA would be exposed to sensory disturbances that could affect their movement for approximately 1–2 weeks.
	Frequency	Irregular	Caribou wander throughout rut/ late fall and winter seasons, and their movement patterns are expected to result in multiple, irregularly timed interactions with the Project.
	Timing	Seasonal	Project activities will occur seasonally, with the majority of these activities occurring in the winter.
Reversibility		Reversible	Effects on caribou movements are reversible. Once Project activities stop, any effects on caribou movement are expected to cease. Telemetry data shows that the PCH regularly cross historical features similar to what the Project will create.

9.6.4.1 Context and Confidence

The characterization of residual movement effects on caribou considered the context of Regional Land Use Planning and the confidence in accurately quantifying and predict those effects (**Table 9-17**). The effects characterization is consistent with the objectives of existing Land Use Plans. There is moderate confidence

in how Project features and activities may affect local caribou movements within the RSA. Expected caribou movement through the RSA is mostly informed by GPS collar data of PCH caribou in a single year (2015) out of nine (2012–2015). Yet, those data also suggest that caribou occurrence in the RSA is relatively infrequent. There is higher (but still moderate) confidence that movement effects at broader scales (Ecoregion and Seasonal Range) will affect only a small proportion of the PCH subpopulation. However, there is still uncertainty about how many caribou could be affected. Overall, a synthesis of the literature and PCH data suggests that movement effects at broad scales will be limited given (a) the widespread distribution of the subpopulation, (b) the minimal traffic along linear features in the RSA, and (c) the dispersed and low density of active exploration (i.e., wells, traffic) in the RSA.

Table 9-17. Characterization of Context and Confidence in the Residual Project Effects on Caribou Movement Effects

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	The RSA is within Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans, which are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	Moderate	There is moderate confidence that movement effects will be limited to a small proportion of the PCH and that caribou that encounter the annual work area will likely not be prevented from completing seasonal movements. There is moderate certainty about how caribou in the annual work area may modify their local movements and the consequences of those modifications.

9.6.5 Residual Direct Mortality Effects

The potential pathways for the Project to cause direct mortality to caribou are limited to vehicle collisions. Measures associated with winter access road use and maintenance (**Section 9.5.6 Access Road Use and Maintenance**) are expected to mitigate this risk entirely. Therefore, residual direct mortality effects are considered negligible and are not characterized.

9.6.6 Residual Indirect Mortality Effects

The Project can potentially cause indirect mortality to caribou by creating linear features (winter access roads and seismic lines) that can enhance access and hunting efficiency of humans and wolves (facilitated predation). Indirect mortality associated with linear feature development has been linked to substantial population declines in specific herds of boreal and mountain caribou in Alberta and BC.

The Project is expected to create an extensive network of winter access roads and seismic lines that will theoretically result in indirect mortality to caribou (via facilitated predation and apparent competition). However, several factors associated with the Project, such as environmental conditions, ecology of the PCH, and land use practices in the Eagle Plains area, reduce the potential for indirect mortality.

Project Factors

- The primary type of linear features created by the Project are 3D LIS lines. Studies that have observed indirect mortality associated with linear features are where wider linear features (historical 2D seismic, pipelines, transmission lines, and roads) predominate (James and Stuart-Smith 2000, Latham et al. 2011a, DeMars and Boutin 2018). The low-impact seismic (LIS) planned for the Project has inherent characteristics, plus specific mitigation measures, that limit the potential for both apparent competition and facilitated predation:
    - In terms of apparent competition, the narrow width of the LIS lines limits the development of dense shrub production (i.e., as browse for moose) (Golder Associates 2016; **Appendix 9-B**).
    - In terms of facilitated predation, ease of travel and sightlines along the lines for predators and humans are limited by the narrow line widths, curves/bends in the lines, limited connectivity to roads, and vegetation piling (**Appendix 9-B**). Studies of 3D LIS lines in other areas indicate that use by wolves is dramatically reduced compared to other lines, likely due to the line width and vegetation height, and often does not differ from undisturbed habitats (Dickie et al. 2017, Keim et al. 2021).
    - The Project is minimizing the development of new winter roads by reactivating a relatively extensive network of historical winter roads in the area.
    - While the Project is active, access by hunters along Project roads and trails will be limited due to safety issues for Project staff and hunters. Safety controls will limit the potential for facilitated hunting to occur.

Environmental Factors

- The potential for indirect mortality associated with apparent competition (i.e., elevated wolf densities) in Eagle Plains is limited, relative to studies in southern areas, by two factors:
    - Alternative prey in the region is limited to moose. Deer, which have been attributed as important alternative prey in some studies (Darby and Duquette 1986, Latham et al. 2011b, Serrouya et al. 2016), are absent.
    - The region's northern latitude is assumed to result in relatively low forage productivity and moose densities. Population surveys for moose have not been conducted in Eagle Plains, but moose densities are estimated to be low compared to parts of southern Yukon (M. Suitor, n.d., pers. comm.).
- One study reported that wolf densities in a northern region of the boreal in Northwest Territories (NWT), with moose and caribou, were only a tenth of the density compared to an area in the southern boreal in Alberta, with caribou, moose and deer (Serrouya et al. 2016).
- The migratory nature of the herd limits the degree to which wolves can numerically respond to elevated caribou numbers (i.e., the density of non-migratory wolves is limited by their local, year-round prey base, Hayes and Russell 2000). A study of wolf predation on the PCH estimated that wolves killed about 7,600 adult caribou yearly, regardless of herd size (Hayes and Russell 2000).
- Although wolves are the primary predators of barren-ground caribou, wolf predation does not appear to regulate barren-ground caribou herds (Crête and Huot 1993, Messier 1995, Hayes and Russell 2000). However, the limiting effect of predation increases as population size

decreases, which can result in a cumulative effect with other limiting factors as the population declines (COSEWIC 2016). Hayes and Russell (2000) estimated that the predation rate would have had to be near twice the observed level to cause the PCH to decline during their study.

Factors Related to PCH Ecology

- The large seasonal ranges and the movement patterns of the PCH limit the degree to which caribou are exposed to potential effects of indirect mortality at both the population and individual animal levels. In subpopulations of woodland caribou where habitat-mediated predation is an issue, habitat effects often occur over large parts of the annual ranges of those herds.
    - The annual work area of the Project constitutes 2% of the PCH's rut/ late fall and winter ranges. Therefore, the potential effects of habitat-mediated predation are expected to be limited to a small proportion of the population.
    - The PCH tend to travel continuously through the fall and winter. Based on existing evidence (i.e., PCTC-derived seasonal ranges, 1970–2016; GPS telemetry data, 2012–2021), caribou that use the RSA are likely to be present for a small portion of the fall or winter, limiting their exposure period to indirect mortality risk from the Project. Historical residency times of collared caribou within the RSA averaged 16 days, corresponding to 13% of the winter season. The estimated period of exposure for caribou within an annual work area (a third of the RSA) is 5.5 days or 4% of the winter season.
- The PCH is presently at high population level and predation effects tend to be lower per capita at high densities (COSEWIC 2016).
- The migratory nature of the herd limits the degree to which wolves can numerically respond to elevated caribou numbers. (i.e., The density of non-migratory wolves are limited by their local, year-round prey base).
- Fall and winter are seasons when the PCH are typically least vulnerable to predation.
    - On average, animals are in good body condition. Young of the year have matured to a point where they are less vulnerable to predators.
    - The herd is at its most dispersed distribution.

Factors Related to Land Use

- In winter, the degree to which wolves use linear features depends on whether the snow on the lines is packed by human use. Human use of the Eagle Plains area in the winter is low in most years and few lines are packed (Dickie et al. 2017, Keim et al. 2021).
- Humans using linear features can extend the number of years predators use linear features by inhibiting vegetation regeneration (Lee and Boutin 2006). However, baseline studies of historical linear features in the RSA did not observe any evidence of human use after the oil and gas exploration work that created the features that inhibited regeneration (**Appendix 9-B**).

A summary of the characterization of residual indirect mortality effects on caribou is provided in **Table 9-18.** Due to the complexity of the factors involved, it is difficult to quantify the degree to which the Project may result in elevated indirect mortality of caribou. If indirect mortality were to result from the Project, the magnitude and duration of effects would likely be limited to the annual work areas in the years they were active, specifically when Project activities result in snow packing along linear features. The effects of indirect

mortality are expected to be negligible in years following exploration work, so long as there continues to be limited human activities in Eagle Plains that could pack the snow on linear features. If caribou avoid the annual work areas due to sensory disturbances (i.e., indirect habitat loss), the effects of the Project on indirect mortality could be negligible.

This assessment assumes a maximum 25% increase in predation due to the Project, which is precautionary (i.e., the 25% level is biased to overestimate effects). Twenty-five percent (25%) is likely the maximum capacity by which wolves can increase their functional response[21]. Accounting for the mitigating factors, outlined in **Section 9.5.3 Access Management**, that could limit indirect mortality, the magnitude of indirect effects will probably be much lower than 25%. If caribou avoid the annual work areas due to sensory disturbances (i.e., indirect habitat loss), the effects of the Project on indirect mortality could be negligible.

The increased potential for indirect mortality within the RSA would translate to a minimal population-level effect. The size of the annual work areas is simply so small, relative to the size of the rut/ late fall and winter seasonal ranges (approximately 2% of these ranges), that the majority of the PCH would not be exposed to Project effects for most of the rut/ late fall and winter seasons. To demonstrate the low magnitude of this effect, an overly cautious scenario is presented:

Assuming a reduced PCH subpopulation size of 152,000 caribou and 7,600 kills/year by wolves (Hayes and Russell 2000), the background predation rate during rut/ late fall and winter seasons would be approximately 5.0%. If caribou were distributed roughly evenly across the seasonal ranges, approximately 0.1% of that background mortality would occur within the Project's annual work area. Thus, if the Project facilitated predation by increasing the predation rate in an annual work area by 25% (which is very unlikely due to limitations in the functional response of wolves), then the herd's overall predation rate would not rise beyond 5.0%—a <0.1% increase. At the Seasonal Range scale, this equates to a 0.5% increase; at the Ecoregion scale (Eagle Plains), this equates to a 2.2% increase.

Table 9-18. Characterization of Residual Indirect Mortality Effects on Caribou

Criterion	Rating	Rationale
Magnitude	Negligible (Seasonal Range), Low (Ecoregion), and Moderate (Region)	For indirect mortality, magnitude refers to the extent to which the effect could occur. The magnitude of the effect is rated negligible (<1%) at the Seasonal Range (rut/ late fall and winter) scales because the annual work area size is only 2% of the rut/ late fall and winter seasonal ranges. Thus, only a small proportion of the population would be exposed to the effects. A maximum potential effect at this scale would be a <0.1% increase in predation. Furthermore, several factors associated with the Project activities, regional land use patterns, environmental conditions, and the ecology of the PCH reduce the potential for facilitated predation to occur in Eagle Plains. The magnitude of the effect is rated Low (1–10%) at the Ecoregion (Eagle Plains) scale because the overall rate of predation would be higher than in Seasonal Ranges

[21] A functional response is the change in the rate of predation that a fixed number of predators vary by, in relation to changes in factors that affect hunting efficiency and prey handling times.

Criterion		Rating	Rationale
			(due to a smaller area) but lower than the RSA. The maximum expected increase at this scale is a 2.2% increase in predation. The magnitude of the effect is rated moderate (11–35%) on the Region (RSA) scale because up to a third (32%) of the RSA could be subject to indirect mortality effects each year the Project is active. The maximum expected increase in predation is 25%, which is biased to overestimate effects.
Likelihood		Probable	The likelihood of Project activities resulting in indirect mortality is rated probable because, although the Project will create packed linear features that could result in facilitated predation, factors associated with the Project activities, regional land use patterns, environmental conditions, and the ecology of the PCH reduce the potential for facilitated predation to occur in Eagle Plains.
Geographic Extent		Region, Ecoregion, and Seasonal Range	The effects of indirect mortality will be associated with linear features within the RSA, but local mortality events within the RSA could translate to population effects at the broader Ecoregion and Seasonal Range scales.
Duration, Frequency and Timing	Duration	Short-term	The conditions that support indirect mortality by wolves, packing of snow along liner features, are assumed to occur for the entire exploration season within the annual work area. Effects are not expected to occur in subsequent years when Project activities do not pack snow.
	Frequency	Irregular	Within a given year, conditions that could lead to indirect mortality will persist along snow-packed linear features within an annual work area. However, the frequency is irregular and dependent on caribou occurrence on linear features.
	Timing	Seasonal	Within a given year, conditions that could lead to indirect mortality are mostly limited to winter within an annual work area. Sightlines and ease of travel are unlikely to be improved for predators/hunters during other seasons, but not impossible.
Reversibility		Reversible	Effects of indirect mortality are entirely reversible. Effects are expected to be limited to annual work areas in the year when exploration activities are active. Effects are not expected in years following the work because features with unpacked snow are not expected to support facilitated predation.

9.6.6.1 Context and Confidence

The characterization of residual indirect mortality effects on caribou considered the context of Regional Land Use Planning and the confidence in accurately quantifying and predicting those effects (**Table 9-19**). The effects characterization is consistent with the objectives of existing Land Use Plans. There is moderate confidence in how Project features and activities may facilitate predation within the RSA. Without data on wolf densities and predation rates, effects were overestimated to be prudent. It was assumed that the

maximum potential increase in predation rates would be 25% within the RSA. This overestimation at the RSA scale leads to a higher confidence that, on average, annual predation rates would not exceed <0.1% (Seasonal Range) or 2.2% (Ecoregion) increases relative to background predation rates.

Table 9-19. Characterization of Context and Confidence in the Residual Project Effects on Caribou Indirect Mortality Effects

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	The RSA is within Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans, which are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	Moderate (Region) to High (Ecoregion and Seasonal Range)	There is high certainty that the effects of indirect mortality would be limited to a small proportion of PCH across rut/ late fall and winter seasonal ranges. There is also high certainty that many of the fundamental factors contributing to the indirect mortality of caribou in other areas are reduced or not present in Eagle Plains. However, there is moderate uncertainty about the magnitude and severity of mortality in the RSA. Current harvest and predation rates in the RSA are unknown.

9.6.7 Residual Energetics Effects

The potential pathway for the Project to cause indirect energetic effects on caribou is through elevated energetic expenditures via altered behaviours or travel routes. However, the potential for the Project to have this effect on caribou is limited: (i) most caribou travelling through the rut/ late fall and winter ranges will not be exposed to the Project, and those that do will likely have a limited period of exposure (several days); (ii) the Porcupine caribou are typically in good body condition in rut/ late fall and winter; and (iii) the distances associated with avoiding active work sites are modest relative to regular rut/ late fall and winter movements. Like other indirect effects, the duration of effects on caribou energy expenditures are expected to be limited to periods when the Project is active and causing sensory disturbances. Once the disturbances stop, effects on energetics are expected to end.

Based on the limited potential for the Project to affect caribou energetics, and because such effects are mostly accounted for in the characterization of movement effects (**Section 9.6.4 Residual Movement Effects**), residual energetics effects are considered negligible and are not characterized further.

9.7 SIGNIFICANCE

The Project is not expected to substantially affect caribou habitat, movement, mortality, or energetics. Direct habitat effects reduce ‘selected’ caribou habitat by 2% within the RSA and 0.2% in the Eagle Plains ecoregion. Indirect habitat effects further reduce habitat effectiveness annually by 23% within the RSA and 5% in the Eagle Plains ecoregion. Therefore, the total habitat effects on ‘selected’ caribou habitat are approximately 25% within the RSA and about 6% in the Eagle Plains ecoregion. Overall, a large portion of total habitat effects are attributable to the extent of historical burns (<40-years old) on the landscape (i.e., approximately 47% of the RSA). Movement and indirect mortality effects are transient and depend on the degree of caribou interaction with annual work areas, which is moderate within the RSA (32%) and minimal

in the broader seasonal ranges (≤1%). Direct mortality and indirect energetic effects due to the Project are likely **negligible**.

Overall, there is moderate to high confidence in characterizing potential residual effects. Where there was uncertainty in the characterization, potential effects were overestimated to be precautious. However, all potential effects are reversible and are not likely to persist once Project activities are completed. Therefore, the collective residual effects on caribou from all potential sources (habitat, movement, mortality, and energetics) are **not significant**. These residual effects are unlikely to alter the population viability or persistence of PCH caribou at the scale of the Region (RSA), Ecoregion (Eagle Plains), or Seasonal Range (rut/ late fall and winter).

9.8 FOLLOW-UP MONITORING

Caribou mitigation and monitoring actions are consistent with adaptive management and will evolve through continued engagement and discussion. The proposed mitigations are based on the best available information (including the substantial analytical progress in this assessment to characterize the PCH's historical fall and winter habitat use and movements to support the current mitigation actions). However, the current knowledge (in terms of baseline information and predicted effects on caribou) has some limitations and uncertainty. Chance proposes monitoring and supplemental data collection programs/analyses to address those uncertainties. These programs will provide ongoing information to assess the success of the exploration program at mitigating effects on caribou, and to refine mitigation measures if required, as the level of knowledge about caribou use of the area increases over time.

Monitoring will have three components.

1. Compliance monitoring.
2. Wildlife training, observation, reporting, and response.
3. Applied Research and Effectiveness Monitoring.

9.8.1.1 Compliance Monitoring

An internal compliance audit will be conducted each month to verify and document that the various components of the Caribou Mitigation and Management Plan are being implemented. The results of this audit will be summarized in a monthly report. Key items in the report will include the following.

- A summary of the type and location of work conducted, including winter access road use and maintenance activities.
- A summary of all caribou observations, including locations, numbers, and behaviours.
- A detailed summary of any caribou encounters that triggered a site-specific response plan, including a summary of the implemented mitigation measures and the outcomes to caribou.

A Professional Biologist will review copies of the compliance monitoring reports each month. They will be made available to the Yukon Government, indigenous stakeholders, and the Porcupine Caribou Management Board upon request.

9.8.1.2 Caribou Observations and Reporting

Documenting observations of caribou by Project personnel will be a key tool for (i) monitoring the occurrence and distribution of caribou in the area and (ii) identifying local-scale interactions of caribou with the Project. As part of the broader wildlife observation reporting program, all caribou and caribou sign observations will be documented by Project personnel while in the field and submitted at the end of their shift to a central location in camp. Any observations of caribou will be reported directly to the Environmental Monitor via radio communication. The Environmental Monitor will review and enter the observations into a database weekly.

- All observations of caribou and caribou sign will be documented by Project personnel while in the field and recorded on tailored Wildlife Observation forms. Copies of Wildlife Observation forms will be kept in all Project vehicles, equipment, and camps.
- Key information to record for any wildlife observation includes the species, number of animals, activity/behaviour, date, time, observer name, location (e.g., access road name and km or well site number), GPS coordinates, and additional comments will be recorded.
    - For all occurrences along access roads, record whether the animal(s) crossed the access road or turned back from the access road, and, if the animals are on the access road, if they ran down the access road away from the vehicle and if so, for how far before moving off the access road.
- Any observations of caribou are to be passed on to other workers in the vicinity via two-way radio and reported to the Environmental Monitor as soon as possible. Digital copies of the observation forms will be submitted to the Environmental Monitor at the end of each shift.
- The Environmental Monitor will enter the caribou observations into the wildlife observation database daily, review the observations to determine whether any follow-up actions are required, and notify the Project Biologist, per the Caribou Interaction Response Plan.
- The Project Biologist will review the wildlife observation database weekly with any other available monitoring data.

9.8.1.3 Applied Research and Effectiveness Monitoring

Although the mitigation measures developed for caribou are supported by substantial information, it is recognized that some limitations of available information result in uncertainty about how caribou may respond to certain Project activities and features. In addition to the reactive monitoring activities outlined above, applied research studies may be initiated to address specific knowledge gaps or concerns identified by regulators and stakeholders. Specific studies have not yet been identified, pending feedback and discussion with regulators and stakeholders. Chance envisions leading or supporting relevant applied research studies if the Project is approved.

Examples of potential studies during the exploration program include:

- A remote camera study to quantify the use of linear features by caribou, wolves, and humans to (i) better understand the potential effects of indirect mortality on caribou, and (ii) determine the effectiveness of mitigation measures to reduce use by wolves and humans. Another study component could be establishing cameras at active well sites to document caribou occurrences and responses.

- A vegetation recovery study following completion of work in annual work areas to determine shrub and tree regeneration rates that affect the use of the lines for travel.

9.9 CUMULATIVE EFFECTS ASSESSMENT

9.9.1 Approach

Two potential cumulative effects were identified for caribou: (1) cumulative direct habitat and movement effects and (2) cumulative indirect mortality effects. Cumulative direct habitat and movement effects were combined because both are attributable to the amount of disturbance from anthropogenic activities. Characterizing cumulative effects on caribou generally follows the methods described in **Section 9.6.1 Approach** (see **Table 9-9**). These effects have each been characterized by magnitude, likelihood, geographic extent, duration, timing, frequency, reversibility, context, and confidence. However, the ratings assigned to each term differ by the cumulative effect type and are further described in the following sections.

The cumulative effects of the Project and other existing projects and activities were assessed at three spatial scales relevant to caribou: (1) Caribou Cumulative Effects Study Area (CCESA), (2) PCH rut/ late fall range, and (3) PCH winter range. Furthermore, the net cumulative effects of four scenarios were assessed: (1) present conditions, (2) the Project, (3) future projects and disturbances, and (4) the total cumulative effect into the future.

9.9.2 Cumulative Direct Habitat and Movement Effects

Three indicators were calculated to characterize cumulative direct habitat and movement effects on caribou: (1) total surface disturbance (area [km²] and percent [%]) from anthropogenic footprints (e.g., mineral exploration, oil and gas, transportation, communities, recreation; see **Table 3-7**); (2) total 'ECCC-defined disturbance' (km² and %), relevant to a herd's annual and seasonal ranges, and refers to the area disturbed by fires <40-years old and anthropogenic footprints plus 500 m buffers around those footprints; and (3) total disturbance (km² and %) to 'selected' caribou habitat within rut/ late fall and winter ranges. For indicator #3, disturbance due to 3D LIS lines were downgraded by 50% since lichen persists after these lines are cut (as completed in **Section 9.6.2 Residual Direct Habitat Effects**).

A summary of the cumulative effect indicators is provided in **Table 9-20**. At each spatial scale, the total surface disturbance is expected to be <1% and the net effect of the Project is expected to be a maximum of 0.10%. The total amount of ECCC-defined disturbance will likely be <19% at the PCH's annual range and ≤27% within seasonal ranges. However, most of these disturbances will occur either solely due to burns (<40-years old) or burns that overlap anthropogenic buffers. Of the total disturbance amounts, approximately 62% in the CCESA, 67% in the rut/ late fall range, and 65% in the winter range are attributable to burns. Though not directly applicable to barren-ground caribou, typically <35% total disturbance within the annual range of woodland caribou, as defined by ECCC (anthropogenic and natural), is an indication of a viable and self-sustaining population (Environment Canada 2011). Overall, the Project's net effect will likely result in a <1% disturbance increase relative to past conditions.

Finally, the amount of disturbed 'selected' habitat within the PCH's rut/ late fall and winter ranges is expected to be <1%. Only 0.2% or 76 km² (out of 42,417 km²) of 'selected' fall habitat is likely to be affected in the rut/ late fall range. Only 0.1% or 51 km² (out of 42,204 km²) of 'selected' winter habitat is likely to be

affected in the winter range. The Project is expected to produce a negligible net disturbance on 'selected' rut/ late fall (<0.1%) and winter (<0.1%) caribou habitat in those seasonal ranges.

A characterization of cumulative direct habitat and movement effects on caribou is provided in **Table 9-21.** The magnitude of cumulative direct habitat effects is expected to be Low to Moderate since surface disturbance and ECCC-defined disturbance within the CCESA are <1% and <19%, respectively. Cumulative effects at the seasonal range scales include surface disturbance up to 0.34% and ECCC-defined disturbance ≤27%. Most (>60%) of the ECCC-defined disturbances are attributable to burns <40-years old. There is certainty that these effects will occur and affect caribou habitat and movement across all geographic extents, which includes the PCH's annual range in Yukon (CCESA) and rut/ late fall and winter seasonal ranges. These cumulative effects may vary depending on where direct disturbance occurs (i.e., forested versus non-forested sites) but will be year-round and continuous. These cumulative effects are expected to be reversible for certain disturbances (e.g., mineral exploration and oil and gas) but not others with permanent human settlements and activities (i.e., communities).

Table 9-20. Eagle Plains Exploration Project Cumulative Effects Assessment of Direct Habitat and Movement Effects on Caribou from Present and Future Disturbances[1,2]

Cumulative Effect Indicator	Scenario	Caribou Cumulative Effects Study Area	Rut and Late Fall Seasonal Range	Winter Seasonal Range
Total Surface Disturbance (Footprints)	Present	285.6 km² (0.2%)	153.3 km² (0.2%)	148.4 km² (0.2%)
	Project	69.1–69.5 km² (0.1%)	69.1–69.5 km² (0.1%)	69.1–69.5 km² (0.1%)
	Future	2.2 km² (<0.1%)	2.2 km² (<0.1%)	2.2 km² (<0.1%)
	Total Cumulative Effect	356.9–357.3 km² (0.3%)	224.5–225.0 km² (0.3%)	219.3–219.7 km² (0.3%)
Total Disturbance to 'Selected' Habitat	Present	N/A	59.05 km² (0.1%)	39.59 km² (0.1%)
	Project	N/A	16.4–16.7 km² (<0.1%)	11.0–11.1 km² (<0.1%)
	Future	N/A	0.96 km² (<0.1%)	0.57 km² (<0.1%)
	Total Cumulative Effect	N/A	76.4–76.7 km² (0.2%)	51.2–51.3 km² (0.1%)
ECCC-Defined Disturbance (Anthropogenic 500 m Buffers + Fire)	Present	21,162.3 km² (18.0%)	19,485.4 km² (22.1%)	17,037.9 km² (26.2%)
	Project	570.7–570.8 km² (0.5%)	570.7–570.8 km² (0.7%)	570.7–570.8 km² (0.9%)
	Future	35.4 km²	35.4 km²	35.4 km²

Cumulative Effect Indicator	Scenario	Caribou Cumulative Effects Study Area	Rut and Late Fall Seasonal Range	Winter Seasonal Range
		(<0.1%)	(<0.1%)	(<0.1%)
	Total Cumulative Effect	21,768.4–21,768.5 km² (18.5%)	20,091.5–20,091.6 km² (22.8%)	17,633.5–17,633.6 km² (27.1%)

[1] Scales of analysis: Caribou Cumulative Effects Study Area = 117,820.6 km²; Rut and Late Fall Seasonal Range = 88,163.5 km²; Winter Seasonal Range = 65,075.8 km².

[2] The Net Project Effect refers to the increase in the cumulative effect indicator due to the Project.

Table 9-21. Characterization of Cumulative Direct Habitat and Movements Effects from the Eagle Plains Exploration Project on Caribou

Criterion		Rating	Rationale
Magnitude		Low to Moderate	The cumulative effect of total surface disturbance is expected to be Low (<1%) in magnitude across all spatial scales of assessment (CCESA, rut/ late fall and winter seasonal ranges). The Project is expected to increase total surface disturbance minimally relative to existing conditions (maximum 0.1% increase). The cumulative effect of direct disturbance to 'selected' caribou habitat is expected to be Low (<1%) in magnitude across all spatial scales of assessment. The Project is expected to have a negligible net disturbance effect on 'selected' rut/ late fall (<0.1%) and winter (<0.1%) caribou habitat in those seasonal ranges. The cumulative effect of ECCC-defined disturbance (fire and 500 m anthropogenic buffers) is expected to be Moderate (11–35%) in magnitude across all spatial scales of assessment. However, the Project is expected to increase total disturbance minimally relative to existing conditions (<1% increase).
Likelihood		Certain	The likelihood that the Project and existing projects and activities will cause habitat and movement effects is certain.
Geographic Extent		Caribou Cumulative Effects Study Area and Seasonal Range	Cumulative effects indicators span the PCH's rut/ late fall and winter range and the herd's annual range in Yukon (CCESA).
Duration, Frequency and Timing	Duration	Short-term to Long-term	The duration of cumulative direct habitats effects due to surface disturbance can range from short- to long-term depending on the disturbed site (non-forested versus forested).
	Frequency	Continuous	Vegetation clearing required for construction is infrequent, but the cumulative effect of this clearing on caribou can be continuous until vegetation regenerates.
	Timing	Year-round	Vegetation clearing required for construction is infrequent, but the cumulative effect of this clearing on caribou can occur year-round.

Criterion	Rating	Rationale
Reversibility	Reversible	Regeneration of vegetation along anthropogenic footprints are expected to occur, but the time required for complete regeneration will vary by feature. This effect is expected to be reversible for certain industries (e.g., mineral exploration, oil and gas) but not for others (e.g., permanent settlements and communities).

9.9.2.1 Context and Confidence

Determining cumulative direct habitat and movement effects on caribou considered the context of Regional Land Use Planning and the confidence in accurately quantifying and predicting those effects (**Table 9-22**). The effects characterization is consistent with the objectives of existing Land Use Plans, and there is relatively high confidence that effects were accurately captured in the assessment. It is possible that not all anthropogenic features on the landscape were captured to calculate the total level of disturbance, but there is a high degree of confidence that most disturbances were included. Furthermore, to provide a precautionary assessment of cumulative habitat effects, the effects of burns and 500 m buffers around all disturbance footprints were considered. Total disturbance within the PCH's annual and seasonal ranges were then calculated and compared against ECCC's 35% total disturbance threshold for woodland caribou (Environment Canada 2011), a subspecies that is likely more sensitive to vegetation clearing than barren-ground caribou. Therefore, the confidence in this cumulative effect assessment is high.

Table 9-22. Characterization of Context and Confidence in the Assessment of Cumulative Direct Habitat Effects on Caribou

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	There is high confidence in the characterization of cumulative effects and their persistence. A precautionary approach was taken to quantify direct habitat and movement effects.

9.9.3 Cumulative Indirect Mortality Effects

Cumulative indirect mortality effects result from linear features across the landscape, with higher linear feature densities (km/km²) potentially supporting facilitated predation of caribou by wolves and human hunters. Therefore, linear feature density was used to assess cumulative indirect mortality effects. Linear feature density was calculated as the total length of linear features divided by the size of the CCESA and PCH rut/ late fall and winter ranges.

A summary of the cumulative effect indicator for indirect mortality effects is provided in **Table 9-23**. Due to the Project, linear feature density is expected to increase by 0.2 km/km² in the CCESA and up to 0.4 km/km² in the PCH's winter range relative to existing conditions. The increase in linear feature density occurs due to the Project contributing approximately 25,000 km of additional linear features. As a percentage, this

equates to an approximate 160% increase in the CCESA, 170% increase in the rut/ late fall range, and 180% increase in the winter range.

These estimates are highly conservative because linear feature densities are not estimated by line type. Most of the linear features created by the Project are comprised of 3D LIS lines, which are unlikely to improve the travel and sightlines of predators and hunters (**Appendix 9-B**). Therefore, 3D LIS lines are expected to contribute minimally to facilitated predation of caribou.

A characterization of cumulative indirect mortality effects on caribou is provided in **Table 9-24**. The magnitude of cumulative indirect mortality effects is expected to be Low since the overall linear feature density is below the 'cautionary' indicator for land use planning (<0.75 km/km²). The Project's net effect also results in <0.4 km/km² additional linear feature density. At the broadest scale of analysis (CCESA), the total linear feature density is 0.4 km/km². Most of these linear features will be 3D LIS lines confined to the Project's RSA, which are unlikely to affect the PCH's broader annual and seasonal ranges. As discussed in **Section 9.6.6 Residual Indirect Mortality Effects**, even with increased potential for facilitated predation (due to higher linear feature density), the functional response by predators is expected to be relatively low within the PCH's range. Cumulative indirect mortality effects will mostly be during winter if packed snow on linear features increases the efficiency of predator/hunter movements. The effect will likely be irregular and seasonal (throughout winter) depending on caribou and predator/hunter use of linear features. The potential for effects outside of winter is unlikely (but not impossible) because ease of travel and sightlines are limited along 3D LIS lines due to narrow widths, curves/bends, and limited connectivity to roads (**Appendix 9-B**; also see **Section 9.5.4 Seismic Operations**). Overall, cumulative indirect mortality effects are expected to be reversible: (a) by limiting the spatial extent of linear features with packed snow (e.g., mostly confined to annual work areas for the Project), and (b) over time, due to vegetation regeneration along linear features.

Table 9-23. Characterization of Cumulative Indirect Mortality Effects from the Eagle Plains Exploration Project on Caribou from Present and Future Disturbances[1,2]

Cumulative Effect Indicator	Condition	Caribou Cumulative Effects Study Area	Rut and Late Fall Seasonal Range	Winter Seasonal Range
Linear Feature Density	Present	0.1 km/km² (16,785.6 km)	0.2 km/km² (15,078.2 km)	0.2 km/km² (14,636.8 km)
	Project	0.2 km/km² (25,031.7–25,091.7 km)	0.3 km/km² (25,031.8–25,091.7 km)	0.4 km/km² (25,031.8–25,091.7 km)
	Future	<0.1 km/km² (145.4 km)	<0.1 km/km² (145.4 km)	<0.1 km/km² (145.4 km)
	Total Cumulative Effect	0.4 km/km² (41,962.7–42,022.7 km)	0.5 km/km² (40,255.3–40,315.2 km)	0.6 km/km² (39,787.4–39,847.4 km)

1 Scales of analysis: Caribou Cumulative Effects Study Area = 117,820.6 km²; Rut and Late Fall Seasonal Range = 88,163.5 km²; Winter Seasonal Range = 65,075.8 km².

2 The Net Project Effect refers to the increase in the cumulative effect indicator due to the Project.

Table 9-24. Characterization of Cumulative Indirect Mortality Effects from the Eagle Plains Exploration Project on Caribou

Criterion		Rating	Rationale
Magnitude		Low	The increase in linear feature density due to the Project is expected to be High in magnitude (>100%). However, the maximum total linear feature density is <0.75 km/km², the 'cautionary' indicator for land use planning. Increased risk of facilitated predation of caribou by wolves and hunters is more likely at the local scale, proximate to the Project. Thus, the overall magnitude of the effect on PCH caribou across their annual (0.4 km/ km²) and seasonal ranges (0.5–0.6 km/km²) is expected to be Low.
Likelihood		Probable	The likelihood of cumulative indirect mortality effects on caribou is probable, but it is unclear to what extent this would affect caribou within their annual and seasonal ranges.
Geographic Extent		Caribou Cumulative Effects Study Area and Seasonal Ranges	The cumulative effect indicator spans the PCH's rut/ late fall and winter range and the herd's annual range in Yukon (CCESA).
Duration, Frequency and Timing	Duration	Short-term	Indirect mortality effects are mostly isolated to winter when packed linear features facilitate the movement/ travel of predators and hunters. Effects are expected to be relatively limited during other times of the year.
	Frequency	Irregular	Within a given year, conditions that could lead to indirect mortality will persist along snow-packed linear features. However, the frequency is irregular and dependent on caribou occurrence on linear features.
	Timing	Seasonal	Within a given year, conditions that could lead to indirect mortality are mostly limited to winter. Sightlines and ease of travel are unlikely to be improved for predators/hunters during other seasons, but not impossible.
Reversibility		Reversible	Effects of indirect mortality are reversible. Due to human travel, cumulative effects are expected to be limited to packed snow linear features. Effects are expected to be reversible when activity along linear features is stopped and snow remains unpacked, limiting predators' ability to move efficiently along those features. Regeneration of linear features over time will reduce effectiveness of linear features for predator/hunter travel.

9.9.3.1 Context and Confidence

Determining cumulative direct habitat and movement effects on caribou considered the context of Regional Land Use Planning and the confidence in accurately quantifying and predicting those effects (**Table 9-25**). The effects characterization is consistent with the objectives of existing Land Use Plans, and there is relatively high confidence that the effects were accurately captured in the assessment. Though there is a substantial increase in linear feature density at all scales (CCESA and seasonal ranges), the effects are mostly isolated to the RSA. Furthermore, even with a relatively high predicted functional response by wolves (see **Section 9.6.6 Residual Indirect Mortality Effects**), there would only be a small effect on the PCH's

overall mortality rate due to predation. Therefore, the confidence in this cumulative effect assessment is high.

Table 9-25. Characterization of Context and Confidence in the Assessment of Cumulative Effects on Caribou

Criterion	Rating	Rationale
Context	Conforms to Regional Land Use Plans	Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs.
Confidence	High	There is high confidence in the characterization of cumulative effects and their persistence. Though a substantial increase in linear feature density is evident, it is mainly confined to the Project RSA, and the functional response by wolves is unlikely to have a population-level effect.

10 HERITAGE RESOURCES

Heritage Resources were selected as a key Valued Environmental and Socio-Economic Component (VESEC) for the Project because of their cultural value. Heritage Resources include archaeological, historic, and palaeontological resources. As of February 2024, eight archaeological sites (LlVc-1, LlVd-1, MaVc-4, MaVc-5, MaVc-6, MaVe-1, MbVf-1, and McVd-1) and one Yukon Historic Sites Inventory site (116I/03/001 - Tth'an Dhidlii Njik Dalgish Creek Resource Area) have been recorded within the Regional Study Area (RSA). No palaeontological sites have been recorded within the RSA. Given the size of the RSA, this is considered to be a very low site density, and additional currently undocumented Heritage Resource sites are very likely to be present. See **Appendix 10-A Heritage Resource Overview Assessment: Eagle Plains Basin Exploration Project, Appendix 10-B Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2022 Final Report (22-22ASR),** and **Appendix 10-C Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2023 Interim Report (23-03ASR).**

10.1 ASSESSMENT INDICATORS AND ASSESSMENT PARAMETERS

Indicators related to Heritage Resources include known Heritage Resource sites, identified areas of potential for currently undocumented Heritage Resource sites within the RSA, and chance finds of Heritage Resources in areas not associated with known sites or identified areas of potential for currently undocumented archaeological and historic sites. These indicators were selected to support protection of known sites and areas of potential for undocumented sites from being adversely affected by Project activities, to comply with the cultural values of people who utilize the RSA, and to adhere to applicable legislation (Government of Canada 1993; Yukon Government 2002, 2003a, 2003b). The assessment parameter used to evaluate effects on these key indicators is whether or not the Project has caused a qualitative change to the nature or condition of each of the three indicators.

10.2 PROJECT INTERACTIONS AND POTENTIAL EFFECTS

10.2.1 Interactions Table

The potential interactions between Heritage Resources and the Project are primarily related to activities that require ground disturbance. Such ground-disturbing activities have the potential to disturb both known Heritage Resource sites and currently unknown sites that may be present within the Project footprint. The potential for Project activities to interact with the Heritage Resources VESEC is summarized in **Table 10-1**, and the specific potential effects are summarized in **Sections 10.2.2, 10.2.3,** and **10.2.4.**

Table 10-1. Expected Interactions Between the Heritage Resources Valued Environmental and Socio-Economic Component and Project Activities, by Type of Potential Effect

Project Component / Activity	Disturbance of Known Heritage Resource Site	Disturbance of an Unassessed Area of Potential for Currently Unknown Heritage Resource Sites
Engagement	0	0
Main Camp Development and Operation, including Central Processing Facility (CPF)	2	2

Project Component / Activity	Disturbance of Known Heritage Resource Site	Disturbance of an Unassessed Area of Potential for Currently Unknown Heritage Resource Sites
Secondary Camp Development and Operation	2	2
Well Site Development	2	2
Well Testing	0	0
Winter Road Construction	0	0
Water Withdrawal	0	0
Seismic Line Construction	2	2
Seismic Testing	2	2
Drilling	2	2
Well Testing	0	0
Airstrip Construction	2	2
Airstrip Operation	0	0
Vehicle Traffic	0	0
Well Site Abandonment and Reclamation	2	2
Mix Bury Cover (MBC) Sump Site Development and Reclamation	2	2

10.2.2 Disturbance of a Heritage Resources Site

This effect applies to both known Heritage Resource sites and Heritage Resource sites that are currently undocumented. Disturbance here is defined as any activity that damages Heritage Resource materials (e.g., archaeological artifacts, historic structures, fossils) or alters the depositional context of a Heritage Resource site (e.g., alters the spatial relationships between the materials that make up an archaeological site) in an uncontrolled fashion that diminishes the interpretive value of the material culture at the site.

Disturbance of a known Heritage Resources site could occur during any Project activities that could directly affect the ground. This may occur during drilling operations, Mix Bury Cover (MBC) construction/excavation, Central Processing Facility (CPF) construction, secondary camp development, airstrip development, and well site abandonment and reclamation.

The confirmed Project footprints (e.g., Chance camp, MBC sump, winter access roads) do not currently overlap known Heritage Resources sites, and thus no effect is expected as a result of these Project footprints. Currently undefined Project footprints, including well sites and well spur roads, have the potential to affect known Heritage Resource sites.

10.2.3 Disturbance of an Unassessed Area of Potential for Currently Unknown Heritage Resource Sites

Disturbance here is defined as any ground disturbance within an identified area of potential for currently unknown Heritage Resource sites that occurs prior to the assessment of the area of potential by a Heritage Resource management professional.

Disturbance of a known Heritage Resources site could occur during any Project activities that could directly affect the ground. This may occur during drilling operations, MBC construction/excavation, CPF construction, secondary camp development, airstrip development, and well site abandonment and reclamation.

Most confirmed Project footprints (e.g., Chance Camp, MBC sump) do not currently overlap with unassessed areas of potential for currently unknown Heritage Resource sites, and thus no effect is expected as a result of these Project footprints. Winter access roads do have some overlap with untested areas of potential, but effects are expected to be minimal due to the low risk of ground disturbance of the winter road construction methodology. Currently undefined Project footprints, including well sites and well spur roads, have the potential to affect unassessed areas of potential for currently unknown Heritage Resource sites.

10.3 MITIGATION MEASURES

The primary mitigation measures Chance will use to control potential effects to Heritage Resources within the RSA are avoidance of known Heritage Resource sites and potential Heritage Resource sites using the results from a combination of a Heritage Resource Overview Assessment (HROA) and Heritage Resource Impact Assessment (HRIA). An HROA covering the RSA was completed in 2022 (Bennett 2022). This study was conducted to establish the initial baseline conditions with regard to Heritage Resources by identifying all known Heritage Resources within the RSA and developing a model mapping areas of high potential for currently unknown Heritage Resource sites. Specific HROA tasks included:

- a desktop review of the physical/environmental setting of the study area including biogeoclimatic zones, physiography, hydrology, bedrock and surficial geology, and vegetation and wildlife distributions;
- a desktop review of the cultural/historical setting of the study area including a review of the Precontact, Protohistoric, and Historic eras, as well as modern First Nations with traditional territories that overlap with the RSA (Vuntut Gwitchin First Nation, Tetlit Gwich'in First Nation, and First Nation of Na-Cho Nyak Dun);
- consultation with the Yukon Government Heritage Resource Unit to identify any relevant known heritage resource sites and/or studies in the vicinity of the study areas;
- a detailed review of specific landforms within the study area to identify specific areas of elevated heritage resource potential that should be investigated further via archaeological field assessment before any ground disturbance is conducted within them; and,
- Project-specific recommendations for the ongoing management of heritage resources within the study area.

This methodology is commonly used in cultural resource management and is designed to err on the side of caution by identifying areas of potential concern before the commencement of any ground disturbing activities.

HRIA studies represent the first stage of fieldwork aimed at ground truthing and testing the predicted areas of potential from the HROA. To date, eight phases of HRIA work have been conducted in relation to the Project and its previous iterations, including the two most recent phases that were commissioned by Chance (see Hammer 2000, 2002; Heffner 2007; Commisso and Heffner 2008; Buchanan and Gallagher 2013; Buchanan 2014; Bennett 2023, 2024), but much of the RSA remains unassessed at this time.

Chance will continue to sponsor additional phases of HRIA work as their exploration plan expands into new parts of the RSA. These additional studies will be conducted under a Class 2 permit as defined by the *Archaeological Sites Regulation* (Yukon Government 2003a), and will seek to confirm the presence or absence of Heritage Resource sites within the HROA areas of potential. HRIA tasks will include:

- pedestrian survey throughout predicted areas of Heritage Resource potential to identify surficial Heritage Resources and areas of elevated subsurface Heritage Resource potential;
- shovel testing in areas with substantiated potential for subsurface Heritage Resources;
- in-field documentation of all Heritage Resource sites encountered during the HRIA; and,
- reporting of all documented Heritage Resource sites encountered during the HRIA to the Proponent, the Yukon Government Heritage Resource Unit, and First Nations. Interim and final reports, site forms, and artifact curation preparations will meet the Yukon Archaeological Sites Regulations Guidelines for Permit Holders (Yukon Government 2020). These reports will include recommendations for the ongoing management of all documented Heritage Resource sites encountered during the HRIA.

If Heritage Resource sites are identified during an HRIA, the site area will be delineated, and a 30-metre (m) avoidance buffer, within which no ground disturbing work is allowed to occur without the application of additional mitigation measures (see following paragraph), will be applied as required by Yukon Land Use Regulation YOIC 2003/51 (Yukon Government 2003b). As such, each new phase of HRIA work updates the baseline conditions that the Project must consider while developing Environmental Constraints Mapping and planning future infrastructure (e.g., well pad placement, access road alignments, seismic send/receive lines, camp locations). The Project is committed to ensuring that all areas that will be affected by Project activities will be fully assessed by HRIA before ground-disturbing work commences. The HROA potential model will also be refined based on data obtained during HRIA work to improve its predictive ability (e.g., if a new Heritage Resource site is recorded in an unexpected location, similar locations with then be considered to have high potential for undocumented Heritage Resource sites).

As the primary mitigation measure for potential interactions between Project activities and known Heritage Resource sites, Chance will avoid the established site area and its 30-m avoidance buffer whenever possible. If avoidance is not feasible, then Chance will consider other mitigation measures. These mitigation measures would need to be developed by the proponent in conjunction with the Vuntut Gwitchin First Nation, Tetlit Gwich'in First Nation, and First Nation of Na-Cho Nyak Dun, as well as the Yukon Government Heritage Resource Unit. The most common form of these further mitigation measures is Systematic Data Recovery (SDR) excavation, conducted under a Class 2 permit as defined by the Yukon Government Archaeological Sites Regulation (Yukon Government 2003a), where controlled excavation of the site area

will be conducted to recover as much information about the site as possible before it is affected by Project activities. SDR tasks will generally include:

- initial shovel testing within the known site area to refine the site boundaries and identify clusters of subsurface Heritage Resources;
- excavation of 1 m x 1 m excavation units, placed as per the results of the shovel testing program as single units, trenches, and/or blocks, to recover a representative sample of cultural materials the site being mitigated;
- in-field documentation of all Heritage Resources encountered during the SDR program; and,
- reporting of all documented Heritage Resources encountered during the SDR program to the Proponent, the Yukon Government Heritage Resource Unit, and all First Nations whose traditional territory overlaps with the site area. Interim and final reports, site forms, and artifact curation preparations will meet the Yukon Archaeological Sites Regulations Guidelines for Permit Holders (Yukon Government 2020). These reports will include recommendations for the ongoing management of all documented Heritage Resource sites encountered during the SDR program.

To mitigate potential effects to unknown Heritage Resources sites, Chance will develop and implement a Chance Finds procedure as part of the Project Environmental Management Plan (EMP). The Chance Finds procedure will be communicated to all Project staff and contractors who will be working in the field where they may encounter unexpected Heritage Resources. This plan will lay out policies and procedures for how to proceed if chance finds are made. These policies and procedures will include the immediate cessation of work at the find site until contact can be made with the Yukon Government Heritage Resource Unit and First Nations heritage staff. The Proponent will then develop a plan in consultation with the Yukon Government Heritage Resource Unit and First Nations heritage staff for the ongoing management of the chance find site.

The potential adverse effects of not implementing these mitigation measures are presented in **Table 10-2.**

Table 10-2. Mitigation Measures

Mitigation Measure	Potential Adverse Effect
Avoidance of known Heritage Resources during Project design. Heritage Resources are prioritized for avoidance within the Environmental Constraints Mapping	Disturbance of a known Heritage Resources site.
Further assessment of known Heritage Resource Sites that cannot be avoided (e.g., systematic data recovery excavations).	Disturbance of a known Heritage Resources site.
Assessment of identified areas of potential for Heritage Resources through HRIA studies prior to the commencement of any ground disturbing Project activities.	Disturbance of a known Heritage Resources site; Disturbance of an unassessed area of potential for currently unknown Heritage Resource sites.
Establishment of a procedure for dealing with chance finds of Heritage Resources.	Disturbance of a known Heritage Resources site.

10.4 EFFECTS CHARACTERIZATION

10.4.1 Approach

Residual effects were assessed based on whether or not the Project is predicted to cause a qualitative change to the nature or condition of any Heritage Resources and/or areas of potential for unknown Heritage Resources, the importance of the Heritage Resources that are affected, and the significance of the adverse effects.

Criteria used for characterizing residual effects to Heritage Resources are defined in **Table 10-3**.

Table 10-3. Definitions of Effects Criteria Classifications for the Assessment of Heritage Resources

Criterion		Rating	Definition
Magnitude		Negligible	There will be no measurable change from existing conditions
		Low	The residual effect will be a slight, but measurable change from existing conditions (e.g., an incursion onto the avoidance buffer surrounding a Heritage Resource site)
		Moderate	The residual effect will be a measurable change from existing conditions, but will not affect the VESECs viability, role, or function (e.g., a minor disturbance to a portion of a Heritage Resource site)
		High	The residual effect will be a substantial, measurable change from existing conditions that may affect the VESECs viability, role, or function (e.g., a major disturbance or the complete destruction of a Heritage Resource site)
Likelihood		Unlikely	No residual effect is expected, but a residual effect is not impossible
		Possible	A residual effect may occur, but is not likely
		Probable	A residual effect is likely to occur, but it is not certain
		Certain	A residual effect will occur
Geographic Extent		Maximum disturbance footprint	The residual effect will be confined to the maximum disturbance footprint
		Local	The residual effect will be confined to the Local Study Area
		Regional	The residual effect will extend beyond the Local Study Area, but be confined to within the regional study area
		Beyond regional	The residual effect will extend beyond the Regional Study Area
Duration, Frequency and Timing	Duration	Short-term	The residual effect will occur for less than one year
		Medium-term	The residual effect will occur for greater than one year and up to the life of the Project
		Long-term	The residual effect will extend beyond the life of the Project
		Permanent	The residual effect is predicted to be permanent and thus unlikely to recover to existing conditions

Criterion		Rating	Definition
	Frequency	Occasional	The residual effect will occur rarely (once or a few times over the life of the Project)
		Periodic	The residual effect will occur consistently at regular intervals or associated with temporal events (e.g., during periods of ground-disturbing work)
		Continuous	The residual effect will occur continuously
	Timing	Year-round	The residual effect will occur year-round
		Seasonal	The residual effect will be confined to a portion of the year
Reversibility		Reversible	The residual effect is predicted to be reversible within a clearly defined period
		Irreversible	The residual effect is predicted to be irreversible

10.4.2 Residual Effect

If the mitigation measures described in **Section 10.3** are followed, there should be negligible adverse residual effects resulting from the Project. The one case where an adverse residual effect may occur is if SDR excavations are required at a Heritage Resource site. In this case, the site will have been permanently removed from the landscape. However, the SDR work will provide a much more detailed understanding of the excavated site compared to what we know about sites that were avoided completely, so the adverse effect brings with it a positive effect to our understanding of Heritage Resources within the Project footprint.

The residual effects of adverse effects to Heritage Resource sites are summarized in **Table 10-4**.

Table 10-4. Residual Effects Characterization

Criterion		Rating	Rationale
Magnitude		Negligible	Mitigation measures are expected to prevent/minimize any Project-related adverse residual effects to Heritage Resource sites to the point where there are no measurable effects predicted
Likelihood		Unlikely	Mitigation measures are expected to prevent/minimize any Project-related adverse residual effects to Heritage Resource sites
Geographic Extent		Maximum disturbance footprint	Adverse residual effects will not extend beyond the Project footprint of the Project component that will affect a Heritage Resource site
Duration, Frequency and Timing	Duration	Permanent	Once adversely affected, a Heritage Resource site cannot be restored to its original condition
	Frequency	Occasional	Mitigation measures are expected to prevent/minimize any Project-related adverse residual effects to Heritage Resource sites
	Timing	Year-round	Once incurred, adverse residual effects to Heritage Resources are continuous

Criterion	Rating	Rationale
Reversibility	Irreversible	Once adversely affected, a Heritage Resource site cannot be restored to its original condition

10.4.2.1 Context and Confidence

The confidence of no residual adverse effect anticipated is high with regard to Heritage Resources within the highest development for the Project (**Table 10-5**).

Table 10-5. Rating and Rationale for Context and Confidence

Criterion	Rating	Rationale
Context	Highest Development	The RSA is within Land Management Unit IV zones of the North Yukon and Peel Regional Land Use Plans (LUPs), which are areas zoned for the highest level of development. The Project activities are consistent with the integrated resource management objectives of the LUPs
Confidence	High	The RSA has not been thoroughly studied with reference to Heritage Resources, but the indicators, assessment parameters, and mitigation measures have been applied with great success on other projects throughout western Canada and beyond

10.5 SIGNIFICANCE

The predicted residual effects for Heritage Resources were assessed for their significance as part of the Project assessment. **Table 10-6** provides definitions for significant and not significant.

Table 10-6. Determination of Significance

Characterization	Definition
Not Significant	Effects to Heritage Resources that occur as part of a mitigation measure (e.g., SDR excavations)
Significant	Adverse effects to Heritage Resources that occur in the absence of the mitigation measures presented above

A significant adverse residual effect on Heritage Resources is one that results in a permanent Project-related disturbance to, or destruction of, all or part of a Heritage Resource that is considered to be of major importance due to factors such as rarity, condition, cultural significance, or opportunities for research, and that cannot be mitigated or compensated. The implementation of mitigation is a key element of this significance criterion. Therefore, in consideration of the above discussion, the significance threshold, the mitigation that has been implemented to date, and the mitigation that will be implemented as the Project moves forward, the residual effects of the Project on Heritage Resources for all phases of the Project are rated **not significant**.

10.6 CUMULATIVE EFFECTS ASSESSMENT

Given that residual effects of the Project on Heritage Resources were predicted to be **negligible**, an assessment of cumulative effects on Heritage Resources was not conducted.

11 SOCIO-ECONOMICS

This section describes and summarizes the assessment of potential effects of the Project on the human environment related to social, economic, health, and culture conditions. The assessment follows the general methodological approach and concepts described in **Section 3 Methods**. Specific methods for socio-economic assessment are provided here, as well as assessment findings. Assessment findings include identification of Project interactions and effects, proposed approaches to mitigation to reduce and manage potential socio-economic impacts, characterization of residual Project and cumulative effects, and determination of significance. Monitoring and follow-up programs to assess effectiveness of mitigation measures and unforeseen Project-related effects are also described where appropriate.

The Valued Environmental and Socio-Economic Component (VESECs) identified for the socio-economic assessment and the rationale for their selection are provided in **Table 3-1** in **Section 3 Methods**. Identified Socio-economic VESECs consist of:

- Land and Resource Use: assesses the Project effects to commercial, recreation, and traditional land and resource use;
- Community Infrastructure and Services: assesses the Project effects on community related infrastructure and services;
- Employment and Economy: assesses the Project effects to labour, goods and services, employment and business opportunities, and the regional or local economy; and,
- Community Health and Wellbeing: assesses the Project effects on the health and wellbeing of the communities in the vicinity of the Project.

The indicators and parameters used for determining a Project-related change to Socio-economic VESECs are presented in **Table 3-2** in **Section 3 Methods**.

Spatial boundaries related to Socio-economic VESECs are presented in **Table 11-1.** Each socio-economic VESEC detailed in the following sections will include specific technical and administrative boundaries, and data limitations that apply to the analysis provided (see **Section 11.1.1. Methods: Assessment Boundaries**).

The socio-economics assessment is informed by the following related VESEC assessments:

- Permafrost and Terrain (**Section 4**);
- Water Resources (**Section 5**);
- Fish and Fish Habitat (**Section 6**)
- Vegetation (**Section 7**)
- Wildlife and Wildlife Habitat (**Section 8**); and,
- Caribou (**Section 9**).

Any assessment boundaries or limitations related to these related VESECs will be inherent in the analysis provided in the socio-economic assessment.

11.1 METHODS

The scope of the Socio-economic VESECs was developed based on *Yukon Environmental Socio-economic Assessment Act, S.C. 2003, c. 7* (*YESAA*) requirements (Section 50(3)) to identify and select environmental and socio-economic components, including components identified by First Nations and communities that may be affected by Project-related activities and/or may experience significant adverse environmental effects. Consistent with *YESAA* requirements, the scope of this socio-economic assessment was based on an understanding of the Project-related components and activities, issues and concerns identified by First Nations and local communities gathered through ongoing consultation and engagement since 2015, and through consideration of existing environmental and socio-economic conditions.

Selected methods used in the socio-economic assessment align with established guidance for environmental and socio-economic assessment process in the Yukon, federal guidance from Impact Assessment Agency of Canada (IAAC), and best practice for socio-economic assessment practice (Impact Assessment Agency of Canada 2023; Yukon Environmental and Socio-economic Assessment Board 2021).

11.1.1 Assessment Boundaries

11.1.1.1 Spatial Boundaries

The spatial boundaries identified for the Socio-economic VESECs vary from those identified for the biophysical VESECs in **Table 3-3** in **Section 3 Methods**. **Table 11-1** presents the Local Study Area (LSA) and Regional Study Area (RSA) boundaries for each Socio-economic VESEC.

Table 11-1. Socio-economic Spatial Boundaries

VESEC	Spatial Boundary	
	Local Study Area	**Regional Study Area**
Land and Resource Use	Project footprint (including access roads) plus a 500 m buffer where the Project may potentially directly affect land use or access and/or users may experience a sensory disturbance.	Game Management Subzones overlapping the Project footprint where the Project could affect regional management of wildlife and harvesting.
Employment and Economy	The LSA and RSA for the Employment and Economy subcomponent include the boundaries of the regional government and municipalities from which the Project could potentially source business services and labour. Includes the following communities: • Whitehorse • Old Crow • Fort McPherson (NWT) • Dawson City • Village of Mayo	
Community Infrastructure and Services	The LSA for the Community Infrastructure and Services subcomponent consists of the local government and municipality of Dawson City, from which the Project may directly source community	The RSA for the Community Infrastructure and Services subcomponent includes the boundaries of the regional government and municipalities from which the Project may potentially source municipal services and infrastructure and related regional public transportation networks.

VESEC	Spatial Boundary	
	Local Study Area	Regional Study Area
	services and infrastructure, and the Dempster Highway, which is the main public roadway accessing the Project.	This boundary includes the following communities: Whitehorse Old Crow Fort McPherson (NWT) Village of Mayo
Community Health and Wellbeing	The LSA for the Community Health and Wellbeing - Environmental Determinants of Health subcomponents consist of the Project footprint (including access roads), plus a 500 m buffer where the Project may directly affect land use or access that would impact environmental determinants of human health.	The RSA for the Community Health and Wellbeing - Environmental Determinants of Health subcomponent consists of Game Management subzones overlapping the Project footprint where the Project could affect regional management and harvesting of wildlife in its relation to environmental determinants to human health outcomes.
	The LSA for the Community Health and Wellbeing - Social Determinants of Health subcomponents consists of the local government and municipality of Dawson City, from which the Project may directly source health services and social services related to wellbeing.	The RSA for the Community Health and Wellbeing - Social Determinants of Health subcomponents includes the boundaries of the regional government and municipalities from which the Project may potentially source community health and social services related to wellbeing. This boundary includes the following communities: • Whitehorse • Old Crow • Fort McPherson (NWT) • Village of Mayo

Notes: LSA = Local Study Area; RSA = Regional Study Area; NWT = Northwest Territories; m = metres

These boundaries include consideration of the overlapping Traditional Territories of the following First Nations:

- Vuntut Gwitchin First Nation;
- Na-Cho Nyäk Dun First Nation;
- Tetłʼit Gwichʼin Council;
- Gwichʼin Tribal Council; and,
- Trʼondëk Hwëchʼin First Nation.

11.1.1.2 Temporal Boundaries

As stated in **Section 3.1.1.4.2 Temporal Boundaries**, the Project will be conducted in one phase to take place over approximately 10 years, with all Project activities (e.g., infrastructure/well development, drilling, testing, reclamation) occurring somewhat concurrently during this period. Temporal boundaries related to Socio-economic VESECs for specific Project activities and design features include:

- Construction activities for the Central Processing Facility (CPF) and other facilities at the Chance Camp (e.g., air strip, water reservoir, aviation fuel storage) are anticipated to be temporary (e.g., up to 1 year) and occur as an early construction period of the total 10-year temporal boundary.
- If required, temporary use of the Eagle Plains Hotel for personnel overflow accommodation is anticipated to be infrequent and for short periods (e.g., up to 3 months) and primarily during the winter months.

11.1.1.3 Technical Boundaries

Technical boundaries are the constraints imposed on the assessment by limitations in the ability to predict or measure potential effects of the Project (e.g., unavoidable data gaps or model limitations). Technical boundaries related to Socio-economic VESECs include:

- The locations of well sites are not certain at the time of the assessment due to the exploratory nature of the Project. As a result, the evaluation of potential effects on specific area use and access within the Project footprint considered constraints analysis to focus the analysis on potential areas of interaction.
- The analysis and prediction of socio-economic effects depends on the technical boundaries of related VESECs. This includes available information and analysis related to fish and fish habitat, wildlife and wildlife habitat, caribou, vegetation, soils, geology, soils, and permafrost, and water resources. This also includes limited technical information related to air quality, noise and vibration, lighting, and visual quality. Where technical information was limited, the analysis and prediction of socio-economic effects was based on conservative, industry-standard information and reasonable professional judgment.
- Assessment of the effects on land and resource use related to cultural use, recreation and tourism, hunting, and trapping depend on the details of information regarding when, where and how use and access occurs in the LSA. While there is confidence that information presented in this socio-economic assessment is appropriate to characterize general patterns of land and resource use and predict potential effects in the LSA, detailed knowledge of the specific locations and periods or patterns of use is less certain. As a result, there are limits for interpreting existing conditions and future levels of use related to cultural use, recreation and tourism, hunting, and trapping in the LSA.

The assessment addresses remaining technical boundaries by taking a precautionary and conservative approach to identifying interactions and Project effects based on an understanding of existing socio-economic conditions within the LSA and RSA, professional knowledge and experience.

11.1.1.3.1 Data Limitations

- Publicly available information on potentially affected First Nations and communities is limited. Information available from sources including Statistics Canada, Yukon Bureau of Statistics, Northwest Territories (NWT) Bureau of Statistics, Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) and Indigenous community websites has been included where available. Primary data collection to confirm demographic patterns has been conducted. Census data are also typically limited for smaller communities due to confidentiality concerns and suppression of data. While this information is not a comprehensive representation of the

identified First Nation communities, it is sufficient to characterize existing conditions and predict potential socio-economic effects.

- No primary Traditional Knowledge information was collected for this assessment. Sources of Traditional Knowledge were limited to publicly available secondary sources. **Section 11.1.3.4 Traditional Knowledge** summarizes how Traditional Knowledge was collected and applied to this assessment.
- The primary data collection program was focused on members of the Gwich'in Tribal Council and Vuntut Gwitchin First Nation government services and related administration within the communities of Old Crow, Fort McPherson, and Inuvik. These First Nations communities represent key centres that may be affected by the Project and First Nations whose traditional use areas would most directly overlap the Project. The other First Nations of First Nation of Na-Cho Nyäk Dun, Tr'ondëk Hwëch'in First Nation and residents of Aklavik, Dawson City, Mayo and Tsiigehtchic were consulted more broadly on the Project but were not involved in socio-economic primary data collection.
- Limited traffic count information was available for the portion of the Dempster Highway in the Yukon. The interpretation of 2011 Yukon Traffic Count Survey and 2019 NWT traffic report for the Dempster Highway in the NWT was used to address this limitation and to characterize traffic on the Dempster and Klondike Highways for the purposes of this assessment.
- Detailed information was not available related to motor vehicle accidents and safety. General information on injuries and fatalities from motor vehicle collisions in the Yukon from a 2019 study was used to characterize regional safety concerns related to traffic within the LSA and RSA.
- Information on municipal infrastructure was limited to publicly available information from Yukon Government, Yukon Energy Corporation, and community websites. This information was confirmed and supplemented by information gathered during informational interviews as part of the socio-economic primary data collection program.
- Statistical information for small communities is often limited or intentionally suppressed by the Yukon Bureau of Statistics, NWT Bureau of Statistics, and Statistics Canada to safeguard the confidentiality of personal information. As a result, statistical information typically available for large communities is not available for smaller communities. This is often seen for unincorporated communities and communities with small populations. In addition, direct comparison between data sources and time periods can be problematic due to differences in geographical and statistical reporting units.
- Detailed information regarding the Project's labour and procurement requirements for each of the proposed activities/components was not available.
- Detailed information regarding the expected Project capital spending in goods and services for the communities situated within the LSA and RSA was not available.
- Detailed information regarding the goods and services offered by the businesses located within the LSA and RSA was not publicly available.

11.1.1.4 Administrative Boundaries

Administrative boundaries refer to the limitations imposed due to political, social, and economic constraints (e.g., municipal boundaries, First Nations community boundaries). These may represent the extents of management areas or information collected as part of regional or provincial surveys that are not the same

as the spatial boundaries of the socio-economic VESECs and could influence the assessment of the Project effects. Administrative boundaries identified in relation to socio-economic VESECs include:

- Municipal or community boundaries are the jurisdictional areas for management of municipal services, as well as administrative boundaries for population and economic data analysis and reporting.
- Within the Yukon, Settlement Lands are the parcels of land, identified in each First Nation's Final Agreement, that are owned and managed by a First Nation and represent the administrative boundaries for the purposes of First Nations land planning and development activities. As a result, Settlement Lands are typically the focus of detailed information and management planning rather than the broader Traditional Territories which represent a larger area of cultural use by First Nations members.
- Game Management Zones are administrative areas established for managing the harvest of wildlife species. Data for big game harvesting is reported for overlapping game management zones which may be larger than the area of the LSA resulting in limits for interpreting existing conditions. However, it is expected that patterns shown by big game harvesting data will be generally indicative of patterns in the LSA.
- Trapping Concessions are areas for which one or more licensed trappers is granted exclusive rights for the trapping of fur bearing animals. Data for furbearer harvesting is reported for whole concession areas which may be larger than the area of the LSA and may not represent actual areas actively accessed for trapping. It is expected that trapping patterns shown by the data will be generally indicative of patterns in the LSA.

11.1.2 Input from Engagement

Chance is required to meet consultation requirements under Sections 3 and 50(3) of the *YESAA* (Government of Canada 2003). The *YESAA* requires Chance to consult with potentially affected First Nations and residents of communities prior to submitting the Project Proposal to the Executive Committee. Potentially affected First Nations and residents of communities that have been engaged on this Project to date include:

- Vuntut Gwitchin First Nation;
- First Nation of Na-Cho Nyäk Dun;
- Tr'ondëk Hwëch'in First Nation;
- Gwich'in Tribal Council and the Designated Gwich'in Organizations; and,
- Residents of Aklavik, Dawson City, Fort McPherson, Inuvik, Mayo, Old Crow, and Tsiigehtchic.

Details of the consultation and engagement process conducted for the Project are provided in **Section 2 Consultation and Engagement**.

Issues and concerns related to socio-economic conditions have been raised by First Nations and communities during past and ongoing consultation and engagement activities. A summary of the general Project-related socio-economic issues and concerns raised include:

- Cultural value of the Porcupine Caribou Herd and concern about their decline.
- Effects on wildlife behaviour and habitat that are valued as traditional food and for cultural and spiritual wellbeing.

- Concern about effects on traditional trails and traditional sites related to cultural use areas for trapping and hunting (i.e., moose and caribou).
- Increased access to traditional territories and resulting damage to the livelihood of First Nations residents.
- Interest in employment and contract opportunities.
- Concern over the capacity of local communities to meet the demand for employment opportunities without further training and funding.
- Effects on the potential visual aesthetics of the landscape.
- Concern about the human land use-related disturbances such as noise, smell, and light and potential mitigations.
- Concern related to increased traffic on the Dempster Highway.
- Opportunities for involvement in monitoring.
- Concerns about Project-related effects to climate change to the land and the wildlife on which Forst Nations depend for food, and ability of to travel and use the land for traditional purposes.
- Concern about potential for water contamination (used by land users while on the land).
- Concern for potential Project-related effects to water bodies and wetlands from new winter road and permafrost/terrain stability.
- Identifying that the landscape is a key cultural value for the First Nations.
- Concern about Project access roads and effects on water and fish.
- Concern over increased risk of increased skidoo traffic and access management.
- Comment highlighting the importance of upholding objectives from the North Yukon Regional Land Use Plan (NYRLUP).
- Comment requesting clarification on process for protecting oral history.
- Comment highlighting the issue of oil and gas exploration's effect on the quality of Traditional Territory and impact to the livelihood of First Nations.

These issues and concerns have informed the scoping of the socio-economic VESECs, the definition of study area boundaries, and the identification of Project interactions and effects. Further detail on the socio-economic related engagement input is provided in **Appendix 11-A Eagle Plains Exploration Project Socio-Economic Baseline Technical Data Report (TDR**).

11.1.3 Existing Conditions Data

11.1.3.1 Secondary Data Collection

A desktop review was conducted to gather information on existing demographic and socio-economic conditions. This included a review of publicly available data (including analysis of tabular and mapping data), the results of ongoing Project-related engagement and consultation activities, available traditional use information and studies, applications from other similar projects within the region, and the details of the Project design (**Section 1 Details of the Proposed Project**).

Publicly available secondary information included:

- Demographic data from Statistics Canada, Yukon Bureau of Statistics, and CIRNAC First Nation Profiles.

- Labour force, business, and economic data from the Yukon Business Survey, Statistics Canada, Yukon Bureau of Statistics, Indigenous Services Canada, CIRNAC, and local community websites.
- Local and regional land use planning documents from the Yukon Land Use Planning Council and local community websites.
- Information about land use tenure, licences, mining claims, game management, guide outfitting and registered traplines, parks and protected areas, and commercial resource development projects (e.g., forestry, oil and gas, mining) from the Yukon Government databases and GeoYukon mapping services.
- Community infrastructure and service information Yukon Health and Social Services, First Nations Regional Health Survey, Yukon Education and local community websites.
- Land use and health related information from the Yukon Government databases, the North Yukon Planning Commission, Indigenous Services Canada, CIRNAC, and local community websites.

A report assessing the environmental determinants of health for the Project was completed in November 2023 (Moher 2023). The report assessed the potential effects of Project activities on the environmental determinants of health for human receptors (people) in the LSA. To establish environmental risk pathways, the following components were evaluated through a desk-based assessment:

- environmental hazards (i.e., contaminant or stressor in the air, water, soil, or traditional foods);
- pathways of exposure (i.e., contaminant or stressor transported from its source to a human receptor); and,
- humans present within the area who could be exposed to contaminant or stressor.

The desktop assessment evaluated whether any Project activities present a complete risk pathway for exposure, consisting of an identified hazard, a pathway of exposure and a human that would be exposed. The evaluation considered the seasonality of Project activities as well as varying harvesting seasons that affect land users time on the land. Where complete pathways are determined, a risk to human health is possible. Additional assessment steps would be required to determine actual environmental determinants of health risks and characterize the scale of this risk, though limitations are noted in the assessment where applicable.

The assessment of social determinants of health was conducted according to the methods set out in **Section 3 Methods**. Further detail on socio-economic related secondary information collected for this assessment is provided in **Appendix 11-A**.

11.1.3.2 Primary Data Collection

Primary data collection with key informants was undertaken as a part of this assessment to confirm the findings from secondary data collection and to address identified data gaps. Building on available information from secondary sources, informational interviews were coordinated with representatives from First Nations and Yukon Territory government services, local administrators, and relevant land users such as commercial operators and recreation organizations. Both in-person interviews and virtual interviews were conducted with key informants to obtain information on the socio-economic conditions in the LSA and RSA including population demographics, traditional economy and First Nations cultural land use,

commercial and recreational land use, employment and contracting opportunities, community infrastructure and services, and community health and wellness.

Interviewees were selected based on their knowledge and expertise as representatives of communities and organizations. Individuals who were interviewed or provided data for this report included representatives from Vuntut Gwitchin First Nation/Old Crow and Gwich'in Tribal Council community services related to energy and community services, health and social services, land use, heritage and culture, natural resources, local Royal Canadian Mounted Police (RCMP), Yukon University, Chief Zzeh Gittlit School, Blackstone Outfitters, and the Yukon Snowmobile Association. Interviews with First Nations community representatives were conducted in accordance with relevant license agreements and protocols from the Gwich'in Social and Cultural Institute (GSCI) and Vuntut Gwitchin First Nation Heritage Department.

11.1.3.3 Disaggregating Data

The social context within a community is critical to understanding the issues that are important in that setting, and how these issues can contribute to potential Project-related interactions or effects. Where possible, collected data were disaggregated to capture information about the conditions of different sub-groups within the population of the LSA and RSA. This approach recognizes that socio-economic conditions in a community may be experienced differently by different people or groups, according to identity factors such as sex, gender, age, ethnicity, Indigeneity, and other unique characteristics. The research approach is aligned with the Canadian Gender-based Analysis Plus analytical process for the assessment of diverse groups (Government of Canada 2021).

11.1.3.4 Traditional Knowledge

For the preparation of this assessment, sources of Traditional Knowledge were limited to publicly available Traditional Knowledge studies or reports not specifically prepared for the Project Proposal; also known as secondary Traditional Knowledge. Secondary Traditional Knowledge was collected for Tr'ondëk Hwëch'in First Nation, First Nation of Na-Cho Nyäk Dun, Vuntut Gwitchin First Nation, and Tetl'it Gwich'in Council/Gwich'in Tribal Council. These included studies or reporting prepared for other projects or initiatives in the region (e.g., Dempster Highway Shoreline Stabilization Project, Michelle Creek Quartz Exploration), other First Nations-published Traditional Knowledge studies and documents (e.g., Traditional Knowledge policy documents, First Nations Land Use Planning documents, harvest studies), or reporting of environmental and/or First Nations cultural activities on traditional territories.

Permission for use of secondary sources of Traditional Knowledge was requested of Tr'ondëk Hwëch'in First Nation, First Nation Na-Cho Nyäk Dun, Vuntut Gwitchin First Nation, and Tetl'it Gwich'in Council/Gwich'in Tribal Council. Permission was only provided by Vuntut Gwitchin First Nation and Gwich'in Tribal Council. As a result, the Traditional Knowledge used in this assessment is limited to sources for which consent has been received. Secondary sources used in this assessment include:

- Vuntut Gwitchin First Nation materials related to Traditional Knowledge from the Vuntut Gwitchin Government Heritage Branch;
- Vuntut Gwitchin First Nation studies related to traditional harvests, and reporting on environmental monitoring of the Vuntut Gwitchin First Nation Traditional Territory;
- Mapping of Vuntut Gwitchin First Nation resource use and cultural use areas;
- The Gwitch'in Place Names Atlas and regional natural resource mapping;

- Gwich'in Tribal Council studies related to caribou harvesting from the Gwich'in Social and Cultural Institute/Gwich'in Renewable Resources Board, and the Gwich'in Harvest Study; and,
- Gwich'in Land Use Plan and zoning related to traditional/cultural activities in the Gwich'in Settlement Area.

Further detail on Traditional Knowledge studies or reports collected for this assessment is provided in **Appendix 11-A**.

11.1.4 Effects Assessment

The general methodology used to assess the potential adverse effects of the Project is provided in **Section 3 Methods**. A summary of the specific methodology as it relates to the assessment of Socio-economic VESECs is provided below.

11.1.4.1 Potential Project Interactions and Effects

Potential interactions between Project components or activities and Socio-economic VESECs were evaluated to identify pathways for potential socio-economic effects. In cases where a Project interaction is expected, preliminary consideration was given to the potential effect. In cases where no or negligible interaction was expected, the potential effect was not carried forward for further assessment. Interactions resulting in positive effects (e.g., local economic benefits) were described but not carried forward for further assessment. A rationale is provided describing the VESEC-specific interactions, the direction of effect and cases where no effect or negligible effects are expected.

For those Project interactions carried forward in the assessment, the potential adverse effects arising from those interactions were analyzed and described. This analysis draws on an understanding of the characteristics and interactions of the Project components or activities with the existing conditions of the affected Socio-economic VESECs, reviewed of similar VESEC assessments, and information from ongoing engagement and consultation.

11.1.4.2 Mitigation Measures

Mitigation measures are required to reduce, eliminate or control potential adverse socio-economic effects. Mitigation measures may include standard measures such as Best Management Practices (BMPs), protocols, policies and strategies. Mitigation will consider the input of First Nations and local communities gathered through ongoing engagement and consultation. Mitigation measures will be applied to socio-economic effects to further identify the potential for residual Project effects.

For the purposes of this assessment, management strategies to address potential effects included the Project design are summarized in this section as well.

11.1.4.3 Characterization of Residual Effects

Based on the effects classification presented in **Section 3.1.4 Effects Characterization**, definitions for residual effects classification criteria specific to Socio-economic VESECs are presented in **Table 11-2** below.

Table 11-2. Socio-economic Effects Criteria Classifications

Criterion		Rating	Definition
Magnitude		Negligible	There will be no measurable change from existing conditions, or a minor effect that will be adequately addressed by standard management measures and practices.
		Low	The residual effect will be a slight, but measurable change, not easily distinguished from existing conditions
		Moderate	The residual effect will be a measurable change from existing conditions but will not affect the VESECs viability, role or function
		High	The residual effect will be a substantial, measurable change from existing conditions that may affect the VESECs viability, role or function
Likelihood		Unlikely	No residual effect is expected, but a residual effect is not impossible
		Possible	A residual effect may occur but is not likely
		Probable	A residual effect is likely to occur, but it is not certain
		Certain	A residual effect will occur
Geographic Extent		Maximum disturbance footprint	The residual effect will be confined to the maximum disturbance footprint
		Local	The residual effect will be confined to the Local Study Area
		Regional	The residual effect will extend beyond the Local Study Area but be confined to within the regional study area
		Beyond regional	The residual effect will extend beyond the regional study area
Duration, Frequency and Timing	Duration	Short-term	The residual effect will occur for less than one year
		Medium-term	The residual effect will occur for greater than one year and up to the life of the Project
		Long-term	The residual effect will extend beyond the life of the Project
		Permanent	The residual effect is predicted to be permanent and thus unlikely to recover to existing conditions
	Frequency	Occasional	The residual effect will occur rarely (once or a few times over the life of the Project)
		Periodic	The residual effect will be occur consistently at regular intervals or associated with temporal events (e.g., during spring freshet, low flows, growing season)
		Continuous	The residual effect will occur continuously
	Timing	Year-round	The residual effect will occur year-round
		Seasonal	The residual effect will be confined to a portion of the year
Reversibility		Reversible	The residual effect is predicted to be reversible within a clearly defined period
		Irreversible	The residual effect is predicted to be irreversible

11.1.4.4 *Context and Confidence*

Limitations of existing data and uncertainty associated with the assessment as well as confidence estimates associated with the Project's residual effects were characterized by assigning according to the approach in **Section 3.1.4.3.1 Context and Confidence**.

11.1.4.5 Significance Determination

The determination of significance of potential residual effects for Socio-economic VESECs was based on consideration of the residual effects rating assigned, a review of contextual information, consultation with First Nations and local communities, and professional judgment. The significance of all residual effects are assessed collectively to determine the overall residual effect for each Socio-economic VESEC as significant, or not significant, based on the following definitions:

- **Significant**: Potential residual effects are considered significant if they are high magnitude at any duration or geographical extent. Adverse residual effects will also consider significance in relation to sensitive context and the likelihood of occurrence.
- **Not significant**: Potential residual effects determined to be not significant are those that result in a measurable change but do not meet the definition of significant.

11.1.4.6 Cumulative Effects

The assessment of cumulative effects on Socio-economic VESECs follows the methods outlined in **Section 3.1.6 Cumulative Effects**. The Cumulative Effects Assessment (CEA) was completed for all Socio-economic VESECs with predicted residual effects and considers the potential residual effects of the Project that may interact with the effects from other projects and activities listed in **Table 3-8** in **Section 3.1.6 Cumulative Effects**.

The historical context for Socio-economic VESECs provides an overview of past and present development and activities that have influenced the socio-economic conditions of the region (see **Appendix 11-A**). For the CEA of Socio-economic VESECs, past and present projects and activities whose status is listed as being complete were considered to be reflected within the existing conditions characterizations. Present projects and activities whose status is listed as being ongoing were further considered where they have the potential to result in additional activities that could interact with the residual effects of the Project and reasonably foreseeable future projects and activities. Cumulative effects analysis for Socio-economic VESECs also includes some context about the current and ongoing effects of climate change that may result in a cumulative effect during the 10-year life of the Project.

Cumulative effects were assessed within the respective RSA boundaries for each Socio-economic VESEC as identified in **Section 11.1 Methods**. These boundaries were selected because they provide a regional context for the assessment of Project effects, and to encompass the area within which the residual effects of the Project on Socio-economic VESECs have the potential to combine cumulatively with the effects of other projects and activities.

Potential cumulative effects were determined by comparing existing conditions (includes past and present) to predicted future conditions. All residual cumulative effects are characterized following the same methods as potential residual effects, as outlined in **Section 11.1.4.3 Characterization of Residual Effects**.

11.1.4.6.1 Potential Influences of Climate Change on Future Conditions

Potential climate change effects have the potential to directly or indirectly interact with Socio-economic VESECs. For example, climate change effects such as extreme weather events (e.g., flooding, wildfires, and periods of drought) or changes to seasonal weather norms can damage community infrastructure, disrupt land and resources use activities, and cause stress to affected people and communities' subsistence use of the land and resources. Climate change effects can also disproportionately affect more vulnerable members of the population.

Climate change effects are acknowledged as already contributing to the environmental quality of the Yukon, and these effects are expected to continue (Government of Yukon 2024). Climate changes effects that are expected to cumulatively interact with predicted adverse residual effects in the Socio-economic VESEC RSAs include:

- warming temperatures;
- an increase in average annual precipitation;
- permafrost thaw;
- extreme weather events;
- changes to snow, ice and water; and,
- changes to vegetation and wildlife (Perrin and Jolkowski 2022).

Potential climate change effects that could cumulatively interact with Project residual effects during the 10-year life of the Project and result in a meaningful change within that timeframe will be considered for each Socio-Economic VESEC.

11.2 COMMUNITY INFRASTRUCTURE AND SERVICES

11.2.1 Assessment Indicators and Assessment Parameters

Project effects on community infrastructure and services were assessed by taking into consideration changes in the demand for housing and temporary accommodation, physical infrastructure, social services, and in the use of transportation infrastructure from existing conditions. The assessment indicators and parameters selected for the assessment of potential Project effects on the Community Infrastructure and Services VESEC are provided in **Table 3-2** in **Section 3 Methods**.

11.2.2 Project Interactions and Potential Effects

The assessment approach for identifying Project interactions and potential effects was a systematic review of each of the listed Project components or activities within the context of existing conditions of the LSA for each of the indicators and assessment parameters of the Community Infrastructure and Services VESEC. As indicated in **Table 3-4** in **Section 3 Methods**, the Project is anticipated to interact with community infrastructure and services. Most of the interactions with Project components and activities expected to result in either no effects or small effect that would result in no measurable change from existing conditions. These interactions and effects are described in **Section 11.2.2.1 Rationale for No or Negligible Interaction** to provide a rationale for these findings. Interactions that are anticipated to result in a more substantial effects are described in **Section 11.2.2.2 Interactions**.

11.2.2.1 Rationale for No or Negligible Interaction

Potential interactions that were evaluated as having no or negligible interactions with the Project are described below. These are not further considered in the assessment.

11.2.2.1.1 Demand for Housing or Temporary Accommodation

Project workforce requirements will vary over the life of the Project and will ultimately be limited by the existing Chance Camp capacity of approximately 75 people on-site. Chance plans to hire from local communities such as Old Crow, Fort McPherson, and Dawson City were possible. With the relatively small workforce requirements, and use of the main camp (and remote or mobile camp facilities) for accommodation, it is not expected that workers and their families will relocate to local communities within the LSA and create a measurable demand on housing beyond current levels. As a result, no effect is expected for the demand on housing and is not considered further in the assessment.

There is a potential for minor Project effects on the demand for temporary accommodation related to overflow from the existing 75-person Chance Camp. The Eagle Plains Hotel, located 40 km away, can accommodate up to 64 people and has an associated Recreational Vehicle (RV) campground. Effects related to temporary accommodation are dependent on the size of the workforce that requires temporary housing but are expected to be minor and temporary, and related most typically to periods of winter exploration activities.

The Eagle Plains Hotel is a destination in the summer for motorists travelling along the Dempster Highway and effects may be more pronounced if they occur during this period. Beyond the early period of construction near the main Chance Camp site, the summer workforce related to the seismic exploration is expected to be accommodated by the Chance Camp. Chance will coordinate requirements for overflow accommodation with the Eagle Plains Hotel staff to minimize effects on other seasonal users and avoid restricting accommodation for other projects or activities during potential overflow periods. As a result, a negligible effect is expected for the demand on housing related to temporary accommodation and the potential effect is not considered further in the assessment.

11.2.2.1.2 Demand for Physical Infrastructure

The main Chance Camp, located at km 325 of the Dempster Highway, is accessible year-round and is used for storing and transporting equipment and supplies needed for well maintenance operations and exploration activities. It has accommodations for up to 75 people in trailers, as well as kitchen facilities, wastewater treatment, sanitary facilities (washing, showers, toilets) and potable water. During the seismic and drilling programs, workers are expected to use amenities at the main camp.

During Project exploration activities, water at the Chance Camp used for sanitary purposes will be extracted from local surface water sources and may be stored in a water reservoir at the camp. Source and volumes of water will be in accordance with issued water permits. Fuel stored at the main camp (diesel and propane) will be used for heating and electricity generation. All garbage and recyclable materials will be taken off site and disposed of at facilities licensed to accept such material. Hazardous waste material associated with operation of the Chance Camp (e.g., used motor and hydraulic oils, chemical cleaning fluids, batteries) will be sorted and either recycled or disposed of following the waste management procedures included in the Project Environmental Management Plan. It is expected that solid and hazardous waste disposal will be within the existing capacity of landfills and recycling facilities already utilized by the Chance Camp.

Well sites will include mobile camps comprised of trailers as accommodation and offices for the rig crew and personnel, a garbage incinerator, and water storage tank and treatment containers to provide potable water. Well sites will utilize portable generators for power. All wastewater and sewage will be collected and transported off-site for disposal at an approved facility. Hazardous waste material associated with operation of the mobile camps will be managed in the same way as at the main Chance Camp.

Construction activities will occur in the early period of the Project and are related to the Central Processing Facility (CPF) adjacent to the existing Chance Camp, as well as the airstrip, and other surface facilities. It is expected that construction workers will use amenities and physical infrastructure at the Chance Camp during the early period of the Project (i.e., electricity sources, potable water, waste disposal). Additional water used for construction (e.g., dust suppression and material production) is expected be in accordance with issued water permits. Construction-related wastewater will be treated at the wastewater treatment facilities on-site, and solid waste material will be sorted and either recycled or disposed at sites authorized and with capacity to accept such material.

As municipal infrastructure requirements for the Project are expected to be minimal (i.e., solid waste management) and to be within permitted limits, the Project is not expected to result in a change in the demand for physical infrastructure from existing conditions. As a result, the potential effects on physical infrastructure are not considered further in the assessment.

11.2.2.1.3 Demand for Community Healthcare Services and Cultural and Recreation Services

The communities within the LSA provide a variety of community services related to primary and long-term healthcare (e.g., hospitals, community clinics, and nursing and residential care facilities), as well as cultural and recreation services (e.g., museums, galleries and historical sites, libraries, cultural centres and community recreation facilities). Some of these services are available regionally (i.e., in Whitehorse), while others are provided within individual local communities. A new health centre is planned to replace the existing community health centre in Old Crow and is anticipated for completion in 2024. The new health centre will provide regional social services, home care services, mental wellness and substance use services, as well as community nursing health services. There are counsellors who rotate through Old Crow on a monthly basis providing mental wellness, substance use, and youth counselling services. Dawson City has a range of health care facilities, including a hospital, a nursing and residential care facility that offer women's health, and other facilities offering chronic disease follow-up services, geriatric services, home visits, health education, and communicable disease programs and services. Based on available information, many of these facilities have the capacity to service existing community needs, although some services are limited in particular communities (e.g., childcare services, alcohol and drug addiction support services) and experience staffing challenges.

Project workforce requirements will vary over the life of the Project but are expected to be equivalent to up to 70 jobs. Chance plans to hire from local communities where possible. With the relatively small workforce requirements, and use of the main Chance Camp (and remote or mobile camp facilities) for accommodation, it is not expected that workers and their families will relocate to communities within the LSA and create a measurable demand on existing community long-term health services, or cultural and recreational facilities and services beyond existing conditions. As a result, the potential effects on community healthcare services and cultural and recreation services are not considered further in the

assessment. Effects related to health and wellbeing of citizens within the communities is assessed within **Section 11.4 Community Health and Wellbeing**.

11.2.2.1.4 Demand for Educational Services

Communities within the LSA are home to a variety of educational facilities, including Yukon University's regional campuses with available programs for certificates, diplomas, degrees and vocational training. The Old Crow campus of Yukon University offers in-person training such as culinary, driving (Class 5 and Class 7) and first aid courses. It has been expressed that educational opportunities in local communities are limited, particularly for local residents seeking training related to jobs in the resource industry. Further training opportunities at educational facilities within the RSA (and beyond), such as those in Whitehorse or Alberta, may be facilitated through remote learning, or require travel to access educational programs and services. Although the range of educational services for local residents supports training opportunities to meet some of the requirements for the regional labour market, there are barriers to access.

Project workforce requirements will vary over the life of the Project but are expected to be equivalent to up to 70 jobs. Chance plans to hire from local communities where possible. Based on current labour force statistics within the LSA, it is anticipated that a relatively small local workforce is available with the skills and experience related to Project workforce needs. Engagement activities for the Project have identified community concerns over the capacity of local communities to meet the demand for employment opportunities without further training and funding. Skills and training related to jobs for the drilling and seismic programs (e.g., truck driver/operators, flow test crew, surveyors, wildlife monitor), and camp operations (e.g., cooks, attendants, cleaning staff) are likely to be required for prospective Project workers within the LSA as there are a number of credentials needed to meet occupational health and safety requirements (e.g., Workplace Hazardous Materials Information System [WHMIS], Emergency First Aid, H2S Aware, Foodsafe). Additional specific training will be required to meet industry standards related to jobs for the drilling and seismic programs. The number of potential workers in the LSA who may require training to access job opportunities is difficult to predict, however, for the purposes of this assessment, it is anticipated that this may be a modest subset of the total predicted workforce hired locally.

Training and employment opportunities will be tied to the success of the exploration program. Chance will coordinate with local and regional education and training organizations or institutions to communicate and encourage the provision of programs or courses necessary to meet Project workforce requirements. The availability and enrolment in training opportunities may result in an increased demand for education services. Educational services within the LSA and RSA are anticipated to have the capacity to accommodate a modest increased demand for vocational training considering their historic responsiveness to coordinating trades and vocational programming; the availability of particular programs is uncertain at this time. It is possible that some apprenticeship programs and accreditations which would involve training may not be available readily from education and training organizations in the LSA or RSA.

Based on the modest number of workers that are anticipated to require training within the LSA for the proposed Project and the potential access to a range of available education programs and services in the LSA or RSA (or beyond), it is expected that the incremental increased demand for training is not likely to adversely affect education services in the LSA. There is the potential for a positive effect on education services within communities related to the Project stimulating the expansion or addition of programs available for local residents. This would enable more local residents to meet the employment requirements

of the Project and the broader regional labour market. As a result, effects on educational services are not considered further in the assessment.

11.2.2.1.5 Demand for Community Social Services

Communities within the LSA provide a variety of social services such as childcare, eldercare and assisted living, addiction services, services for people with disabilities, child welfare and adult protection services. Some of these services are available within individual local communities in the LSA and others are available regionally (i.e., within Whitehorse). Based on available information, many of these community service providers have the capacity to service existing community needs, although some services (e.g., childcare services, alcohol and drug addiction support services) are limited in particular communities. A new health centre and housing complex is planned to be completed in Old Crow in 2024. This new facility will provide regional social services, home care services, mental wellness and substance use services.

The Project will require rotational shiftwork that will typically be structured around a 20-day-on and 10-day-off crew rotation cycle. This will take local residents who are employed by Chance out of their communities and away from their families for extended periods during a crew rotation cycle. Community members who are employed for the Project may require access to social services, such as childcare or eldercare and assisted living, to support community or family obligations while participating in the Project's workforce. The number of workers in the LSA who may require support from social services is difficult to predict, however, for the purpose of this assessment it is assumed that the proportion of workers requiring these services is a modest subset of the total predicted workforce. The need for and selection of social service options is a highly personal choice and will likely depend on factors such as availability, suitability and cost. Where social services are limited within a community, there is the potential for additional Project-related demand on social services to result in a more pronounced but generally minor effect.

The assessment of **Section 11.4 Community Health and Wellbeing** did not identify the potential for the Project to result in any noticeable change in community mental health and wellness (e.g., substances use) or safety (e.g., family violence) that would result in an increased demand on the community social services for support. It is not expected that workers and their families within local communities will contribute measurably to an increased demand for existing community social services. The demand for certain social services varies depending on the challenges providing those services in individual communities. For example, Dawson has experienced a shortage in availability of childcare services. Old Crow experienced an addictions crisis in 2023 that resulted in increased access to alcohol and drug addiction support services.

The potential incremental Project-related effects on community social services is negligible and is not considered further in the assessment.

11.2.2.1.6 Demand for Emergency Response Services

Communities within the LSA are serviced by a number of emergency response providers. Fire protection services are provided by local departments of staff and volunteers. Ambulatory services are coordinated by the Yukon Emergency Medical Service through local ambulance stations and the Air Ambulance Program. The Royal Canadian Mounted Police (RCMP) provides police services through local detachments in LSA communities.

There is a potential for the Project to increase demand for emergency ambulance services in the event of work-related accidents and injuries, police services in the event of Project-related security or safety issues, or fire response services in the event of fire at accessible Project facilities. Use of the main Chance Camp and the Project's exploration activities will include detailed safety measures in accordance with accepted industry practices and standards to prevent and manage emergencies, including health and safety management, training and emergency response planning, onsite fire detection, and control and response systems. The Chance Camp will include first aid facilities and trained personnel to provide primary care in the event of an accident, and to address minor injuries. The drill and seismic exploration activities will include support by trained first aid staff and remote medical supplies or first aid facilities. Trauma patients requiring further medical attention will be transported to nearby facilities such as the Dawson City Community Hospital or facilities in Whitehorse. It is anticipated that the Chance Camp will include private security personnel and monitoring systems to provide site safety and security. The Project's emergency response management will be coordinated with, but independent of, existing emergency response services within the LSA.

Construction activities will occur in the early period of the Project related to the CPF, as well as the airstrip, and other surface facilities. Construction activities could potentially generate a demand for emergency response services in the event of construction-related accident or incident. Contractors and other suppliers are expected to adhere to Project health and safety management and provide emergency response management during construction. Communications plans will be developed as part of the Environmental Management Plan (EMP) to inform emergency service providers of construction activity and expected delays well in advance, to prevent delay in response to non-Project emergencies within the LSA.

Based on health and safety procedures, emergency response facilities and management plans that are expected to be in-place at the main Chance Camp or for remote exploration activities, the Project is not anticipated to contribute to a change in demand for emergency response services in the LSA beyond existing conditions. As a result, the potential effect on emergency response services is negligible and is not considered further in the assessment.

11.2.2.1.7 Transportation Infrastructure Road Conditions and Safety

The surface of the North Klondike Highway is paved. The surface of the Dempster Highway is predominately gravel with some paved sections near Dawson City and Inuvik. General wear and tear on these highways results from harsh winter conditions, use by heavy trucks and other vehicles, as well as thawing permafrost. Road maintenance crews are continually grading and repairing the Dempster Highway and provide ongoing maintenance to the North Klondike Highway. The governments of Canada and Yukon have dedicated funding for rebuilding and rehabilitating portions of the North Klondike Highway focused at increasing resistance to climate change (e.g., thawing permafrost) and to upgrade the road for use by larger vehicles and higher levels of traffic. In winter, both highways are snow-packed and winter maintenance of road surfaces includes snow removal, application of anti-icing and sanding materials, and removal of drifts, slides and avalanches.

Project-related traffic, particularly heavy trucks, have the potential to contribute to increased wear and tear of public roadways including the Dempster Highway and the North Klondike Highway. It is expected that the movement of heavy and/or oversized loads during construction in the early period of the Project would involve temporary increases in the volume of large vehicles, particularly during the summer. Traffic

management measures for public road use will be developed and incorporated into the Project EMP. These would include compliance with road use and safety requirements, speed limitations to minimize damage to road surfaces, and coordination with the Yukon Department of Highways and Public Works. Project-related traffic along public roads during the winter will occur when potholes or surface breakup is less prevalent, and snowpack and winter conditions provide some protection for the road surface and structure. Considering the current pattern of use by larger vehicles (e.g., heavy trucks, RVs) and typical road conditions along the Dempster Highway and the North Klondike Highway, the estimated volume of Project-related vehicle traffic (a potential increase of approximately 6 to 8 vehicles per day) would not contribute to wear and tear on the roads beyond what is expected to be addressed by ongoing maintenance programs. As a result, the potential effect on transportation infrastructure road conditions is determined to be negligible and is not considered further in the assessment.

The Yukon has a relatively high overall risk of motor vehicle collision injuries and fatalities (see **Section 11.4 Community Health and Wellbeing**). The Yukon also exhibits variability in access to trauma care related to traffic incidents, and enforcement measures in remote areas that can contribute to higher rates of causality. Project-related traffic management measures, such as Journey Management planning, security monitoring, and radio controls will be incorporated into the Project EMP and implemented to effectively manage safe use of public roads by Project traffic vehicles. Considering the estimated volume of Project-related vehicle traffic volume (a potential increase of approximately 6 to 8 vehicles per day) and traffic management procedures to be implemented, the rate of motor vehicle collision injuries and fatalities is not expected to experience a measurable change from existing conditions. The potential effect on the safety of transportation infrastructure is negligible and is not considered further in the assessment.

11.2.2.2 Interactions

Project components and activities interactions with land and resource use were evaluated following the approach in **Section 3.1.4.1 Project Interactions and Potential Effects**. Only one potential effect on community infrastructure and services is expected. A potential effect on the pattern of transportation infrastructure from increased traffic is expected to result from Project components and activities as shown in **Table 11-3** below. The pathway for the potential adverse effect is described in the following section.

Table 11-3. Expected Interactions between Community Infrastructure and Services and the Eagle Plains Exploration Project and Resulting Potential Effects

Project Component / Activity	Increased Traffic
Engagement	0
Seismic Exploration	1
Drilling Exploration	1
Extended Flow Testing (EFT)	1
Well Maintenance (Workovers)	1
Winter Access Roads	0
Mix Bury Cover (MBC)	1
Central Processing Facility (CPF)	0

Project Component / Activity	Increased Traffic
Airstrip	0
Water Withdrawal	0
Transportation	2
Camp	1
Reclamation and Closure	0

Notes:
0 = no interaction. A rationale for no effects is addressed in **Section 11.2.2.1 Rationale for No or Negligible Effects**.
1 = minor interaction with community infrastructure and services is possible, but small immeasurable effect. A rationale for negligible effects is addressed in **Section 11.2.2.1 Rationale for No or Negligible Effects**. This rating does not lead into residual effects characterization.
2 = substantial interaction with community infrastructure and services, designates a more detailed assessment of potential effects. Carry forward into residual effects characterization.

11.2.2.3 Increased Traffic

The Project is expected to result in an effect on the use of transportation infrastructure from increased traffic. Concerns related to increased traffic on the Dempster Highway from proposed Project-related traffic have been expressed through engagement with local communities and First Nations. Project traffic from construction and exploration activities may have an effect on public transportation infrastructure due to the increased traffic associated with the movement of material, equipment, and workers to and from the Project footprint. This potential effect is contingent on the volume of proposed Project-related traffic, the schedule of Project-related traffic, and the levels of traffic in the LSA.

Project-related vehicles will use portions of the Alaska Highway and Klondike Highways to access the Dempster Highway and the Project footprint or related access roads. The existing pattern of traffic conditions for the Alaska Highway and Klondike Highway are related to local and regional traffic between communities such as Whitehorse, Haines Junction, Carcross, Carmacks, and Dawson City, as well as seasonal tourism and recreation within the Yukon. The Alaska Highway and most of the Klondike Highway will not likely experience a noticeable effect on existing traffic patterns considering the relatively high volume of traffic on these routes. As a result, this assessment of potential effects on transportation infrastructure focuses on the portion of the North Klondike Highway near the entrance to the Dempster Highway (between Dawson City and Highway #11 junction to Mayo), and the Dempster Highway extending to Fort McPherson in the NWT, where the effects of Project-related traffic are most likely to occur.

Traffic on the Project-controlled winter access roads (e.g., Chance Road, Blackie Road) will be limited to authorized personnel and controlled to the extent possible. These access roads are private roads and are not considered in the assessment of transportation infrastructure which focuses on public roadways. Effects on Project-related access roads will be assessed in the Land and Resource Use VESEC (**Section 11.3**). Use of public transportation infrastructure for the movement of equipment, materials for use along the access roads into and out of the Project footprint (e.g., road grader, service rigs) is considered in the analysis below.

It is expected that the initial mobilization and movement of exploration and drilling equipment and materials to and from the Project footprint will result in increased traffic on public roadways connected to the Project

footprint, such as sections of the Dempster Highway. The seismic exploration program will include the mobilization of larger vehicles and equipment (e.g., mulchers, drill vehicles, water trucks, and picker trucks), as well as smaller vehicles and equipment (e.g., light-duty trucks, all-terrain vehicles [ATVs]/snowmobiles, and storage trailers) to the main Chance Camp or staging areas related to winter access roads. The drilling program will include the mobilization of drill rigs and other equipment or materials for establishing well sites (e.g., matting material, boilers, incinerators, ancillary trailers, storage units and tanks) to the main Chance Camp or staging areas. The movement of this equipment and materials along public roadways is expected to occur infrequently and over relatively short periods (i.e., days). As a result, the movement of exploration and drilling equipment and materials represents a temporary effect on transportation infrastructure.

Similarly, the occasional movement of Project vehicles and material related to ongoing operations and maintenance (e.g., EFT, well maintenance activities, and MBC) has the potential to result in increased traffic on public roadways. While crude oil produced during the EFT will be preferentially stored temporarily for future shipment to market, this may require some truck transport to a suitable crude oil marketing point off-site. The amount of crude oil that may need to be transported offsite is currently uncertain, but it is anticipated this would result in little to no additional traffic to and from the Project site during EFT for the purposes of this assessment.

Completed or suspended wells may require ongoing maintenance during the Project's 10-year lifespan. Maintenance activities may be required regularly on an annual basis and involve the mobilization of service rigs and crews to and from the Project footprint along public roadways. Regular well maintenance activities will primarily use access roads involving minimal use of public roadways and will be consistent with existing levels of industrial-related vehicle traffic within the LSA for projects such as roadway maintenance and resource use. Operation of the MBC will involve the regular transportation of drill cuttings from the well sites to the MBC along public roadways. The preferred MBC location is along the Dempster Highway near km 336. It is expected that regular transport of drilling waste will be focused on a small portion of the Dempster Highway and will be consistent with existing levels of industrial-related vehicle traffic within the LSA for projects such as roadway maintenance and resource use. As a result, the movement of vehicles and material related to EFT, well maintenance activities, and MBC operation represents a temporary effect on transportation infrastructure.

Continued use of the main Chance Camp for rotational shiftwork will minimize traffic related to a commuting workforce. During the 10-year life of the Project, planned Project-related off-site traffic between the site and supply points will involve approximately 40 to 50 vehicles per week on public roads during the winter; a potential increase of approximately 6 to 8 vehicles per day. This will involve water and fuel trucks (transiting to the Project footprint approximately three times per week), and lightweight service vehicles travelling along portions of the North Klondike Highway and the Dempster Highway to the Chance Camp as required. Project activity in the summer will be primarily related to seismic recording and EFT, and for the purposes of this assessment will assume the same volume of Project-related traffic as winter.

Traffic volumes along the North Klondike Highway and the Dempster Highway within the LSA are generally low relative to traffic volumes in the region. Traffic volumes along the North Klondike Highway are characterized by annual average daily traffic of between 207 and 296 vehicles. Traffic volumes along the Dempster Highway are characterized by annual average daily traffic of between 63 and 108 vehicles. In the summer, there is an approximately 63.2% average increase of average daily traffic related to seasonal tourism and recreation traffic and road maintenance or industrial activity. The change in traffic volume along

the North Klondike Highway related to the planned Project-related off-site traffic would represent an average increase of approximately 2.5% to 3.2% of the annual average daily traffic and 1.6% to 2.1% of the average summer daily traffic22. The change in traffic volume along the Dempster Highway related to the planned Project-related off-site traffic would represent an average increase of approximately 7.2% to 9.4% of the annual average daily traffic and 4.3% to 5.7% of the average summer daily traffic. This level of increased traffic (< 10%), while potentially noticeable, is not expected to affect the overall use of the North Klondike Highway and Dempster Highway beyond existing conditions. The change in traffic would represent a minor increase in the traffic volume that would likely be most evident in the summer months when Project vehicles would overlap with the highest volume of tourism and recreation traffic, road maintenance or industrial activity in the region[23]. It is expected that increased traffic would be experienced as an inconvenience (e.g., reduced speeds) or as a nuisance effect (e.g., dust) by other motorists and highway users.

Construction activities will occur related to the CPF, the airstrip, and other surface facilities near the Chance Camp. Construction activities will potentially generate traffic related to transport of construction material, equipment, and workforce as well as site preparation and the building of facilities. Construction in the early period of the Project is anticipated to last up to two years and would primarily occur between late spring and early fall. While it is expected that construction workers will use the main Chance Camp to minimize traffic related to a commuting workforce, there is the potential for some contractors and/or suppliers to commute to the Project footprint for occasional portions of construction. For the purposes of this assessment, traffic related to transport of construction-related material, equipment, and workforce is represented conservatively as an increase of 25% of Project-related off-site traffic described above. During the early period of the Project, the increase in planned Project-related off-site traffic and estimated construction traffic volume along the North Klondike Highway would represent an average increase of approximately 8.2% of the annual average daily traffic and 2.5% of the average summer daily traffic. During the early period of the Project, the incremental increase in planned Project-related off-site traffic and estimated construction traffic volume along the Dempster Highway would represent an average increase of approximately 12.0% of the annual average daily traffic and 7.4% of the average summer daily traffic. The additional temporary increase in construction-related traffic volume, while potentially noticeable, would not affect the overall use of the North Klondike Highway and Dempster Highway beyond existing conditions. This would represent a minor increase in the traffic volume that would likely be most evident in the summer months. There would be the potential for construction-related transport of materials to affect public road use through intermittent delays during the movement of large or hazardous loads along the North Klondike Highway and Dempster Highway.

Chance is proposing to construct an airstrip along the existing Chance winter trail approximately 4 km off the Dempster Highway. This airstrip will be used seasonally during the winter for transportation of staff to and from the Chance Camp. The proposed airstrip may be upgraded if additional air traffic support is required. Chance will continue to use a portion of the Dempster Highway near to the Chance Camp (i.e.,

[22] Project-related traffic represents a smaller percentage increase in the summer due to the annual average daily summer traffic in the region being higher during this part of the year than the annual average daily traffic.

23 Although this period represents a smaller incremental increase in traffic volume compared to winter, it is the period mostly likely to result in interactions with other highway users and the greater potential to produce an acute effect.

the Wiley Aerodrome) until the airstrip becomes serviceable and as an airstrip during the summer. Project-related air traffic is estimated to be two flights in/out per week. The establishment of a new airstrip along the Chance winter trail will eliminate interactions with the Dempster Highway during the winter.

The existing Wiley Aerodrome is currently used for seasonal traffic related to tourism and mining activities, and emergency services. Management of this site is informed by Canadian Aviation Regulations and road signage identifies the aerodrome to motorists. Ongoing seasonal use of this aerodrome has the potential to result in brief delays on a weekly basis during the summer months but will be consistent with current controlled use of this transportation infrastructure.

11.2.3 Mitigation Measures

The Project design includes management measures to avoid or reduce anticipated effects that have been identified through ongoing engagement, applicable standards, guidelines, and Best Management Practices. These include the components listed in **Table 11-4** relevant to addressing Project-related effects on traffic.

Table 11-4. Mitigation Measures Relevant to Community Infrastructure and Services and the Eagle Plains Exploration Project

Mitigation and Management Measure	Potential Effect Addressed by Mitigation
Continued use of the main Chance Camp and remote camps to accommodate employees	Increased traffic
Implementation of traffic management measures for safe road use incorporated into the Project EMP that include compliance with road use and safety requirements, access controls and signage, and coordination with the Yukon Department of Highways and Public Works as warranted.	Increased traffic

No further mitigation measures were identified to address potential Project effects on the use of transportation infrastructure from increased traffic.

11.2.4 Effects Characterization

11.2.4.1 Approach

The assessment approach used to characterize the predicted adverse residual effect to community infrastructure and services follows the methodology outlined in **Section 11.1.4 Methods: Effects Assessment.** The residual effect characterization is based on criteria specific to socio-economic VESECs, as presented in **Section 11.1.4.3 Methods: Characterization of Residual Effects**.

11.2.4.2 Residual Effect

After mitigation is applied, a residual effect on the Community Infrastructure and Services VESEC is expected, in the form of a change in the use transportation infrastructure from increased traffic. This residual effect is characterized in **Table 11-5** below.

Table 11-5. Characterization of Residual Effects on the Use of Transportation Infrastructure from Increased Traffic

Criterion		Rating	Rationale
Magnitude		Low	Project-related vehicles for the seasonal exploration programs and early construction have the potential to result in a minor increase in traffic that would be potentially distinguished within the existing volume of traffic along the Dempster Highway and portions of the North Klondike Highway
Likelihood		Probable	A Project-related increase in traffic will likely occur as a result of planned Project-related off-site traffic between the site and supply points.
Geographic Extent		Local	Project-related increase in traffic is expected be localized to portions of the Dempster Highway and portions of the North Klondike Highway
Duration, Frequency and Timing	Duration	Medium-term	Project-related increase in traffic is expected occur throughout the life of the Project (i.e., 10 years)
	Frequency	Periodic	Project-related increased traffic is related to the regular (three times per week) and/or scheduled (during construction) movements of material, equipment, and workers to and from the Project
	Timing	Seasonal (Summer)	While Project-related change in the pattern of transportation infrastructure from increased traffic will occur consistently throughout the year; effects are likely to be most evident in the summer when they overlap with tourism and recreation, road maintenance or industrial activity in the region
Reversibility		Reversible	The Project-related increased traffic will decrease or stop with closure and reclamation of the Project.

11.2.4.2.1 Context and Confidence

The Project's environmental and/or socio-economic context and potential limitations of data and uncertainty associated with the assessment are considered in determining adverse residual effects of increased traffic. The ratings and rationale for the context and confidence of predicted residual effects are described in **Table 11-6**.

Table 11-6. Context and Confidence of Residual Effects on Community Infrastructure and Services

Criterion	Rating	Rationale
Context	Moderate	The role of transportation infrastructure within the LSA (i.e., the Dempster Highway and portions of the North Klondike Highway) for community connectivity, recreation, tourism, and other uses are reasonably documented and understood. Concerns have been expressed about a Project-related increase in traffic on the Dempster Highway through engagement with local communities and First Nations.

Criterion	Rating	Rationale
Confidence	Moderate	Traffic count information used to characterize the existing traffic volumes of the Dempster Highway and portions of the North Klondike Highway are limited to data from a 2011 survey. This was addressed with the use of other more current data for a portion of the Dempster Highway in NWT. There is uncertainty of Project-related traffic levels related to some activities such as construction of Project facilities, mobilization of exploration, and ETF. Traffic management strategies are based on road use and safety requirements that have proven to be effective.

11.2.5 Significance

The determination of significance of the predicted residual effects of increased traffic is based on definitions presented in **Section 11.1.4.3 Methods: Characterization of Residual Effects**. Magnitude, geographic extent, and duration are the primary factors affecting the significance determination.

The predicted Project-related increase in traffic has the potential to result in a minor change to the use of transportation infrastructure that, while potentially noticeable, would not affect the overall use of the North Klondike Highway and Dempster Highway beyond existing conditions. Residual effects are predicted to be localized and occur over the 10-year life of the Project. With the implementation of traffic management measures for safe road use, the residual effects of the Project on the use of transportation infrastructure are anticipated to be **not significant**.

11.2.6 Follow-up Monitoring

To address the uncertainty of potential interactions of the Project, follow-up monitoring is required to identify unanticipated social effects and to respond adaptively through coordination with First Nations, residents of local communities, and the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee or relevant regulators (if required). Chance will organize and implement coordination of follow-up monitoring to support identification and response to potential community and economic effects of the Project. This coordination will involve the review of results from Chance's proposed follow-up monitoring programs as well as feedback from First Nations and local communities to provide direction on the adaptive implementation of Project design, mitigation and benefit enhancement measures related to potential socio-economic effects.

11.2.7 Cumulative Effects Assessment

11.2.7.1 Approach

The assessment of cumulative effects on the Community Infrastructure and Services VESEC follows the methods outlined in **Section 3.1.6 Cumulative Effects** and **Section 11.1.4.6 Cumulative Effects**. The community infrastructure and services CEA considers potential residual effects of the Project on the use of transportation infrastructure from Project-related changes in traffic volumes that may interact spatially and temporally with past, present and reasonably foreseeable projects and activities listed in **Table 3.8** in **Section 3 Methods**.

Due to the limitations in available traffic count data for the Dempster Highway (see **Section 11.1.1.3.1 Data Limitations**), it is expected that the characterization of existing conditions does not account for traffic volumes associated with most currently active and ongoing gravel quarries, the Ogilvie Grader Station Solar, Eagle Plains Solid Waste Disposal, or the Yukon Fiber Optic Network projects. There is also uncertainty about the schedule of vehicle movement for these projects beyond the general seasonal nature of their operations. A conservative approach was taken that considers the context and likelihood of cumulative effects with the residual effects of the Project.

11.2.7.2 Cumulative Effects

Since residual effects of Project-related changes in traffic volumes will be most evident along the Dempster Highway, the CEA focused on projects and activities that may impact Dempster Highway traffic volumes. Projects and activities that may contribute to increased traffic on the Dempster Highway are presented in **Table 11-7** below. These include regular maintenance of the Dempster Highway, the transport of aggregate to and from gravel pit sites, the movement of material, equipment, and workers to project sites and temporary camps, the removal and disposal of hazardous waste, and ongoing post-closure monitoring.

Table 11-7. Past, Present, and Reasonably Foreseeable Projects and Activities with Potential to Act Cumulatively with Project Effects on Community Infrastructure and Services

Project Name or Activity	Spatial / Temporal Overlap	Project or Activity Contributions
Dempster Highway (ongoing)	• Within RSA (along the Dempster Highway) • Overlaps with 10-year Life of Project	• Increased traffic from regular maintenance (e.g., grading and repairing) of the Dempster Highway
Dempster Highway Granular Pit Development: km 188, 208, and 232 (proposed)	• Within RSA (within 93 to 137 km from Project) • Overlaps with 10-year life of Project (project activity will occur every 2–3 years until 2046)	• Increased traffic from transportation of aggregate and equipment from pit sites, as well as materials to temporary camp.
Sheep Creek Gravel Pit: km 433 Dempster Highway (ongoing)	• Within RSA (within 108 km from Project) • May overlap early period of Project (project activity will occur every 2–3 years until 2031)	• Increased traffic from transportation of aggregate and equipment from pit site.
Ogilvie Grader Station Solar, km 195 Dempster Highway (ongoing)	• Within RSA (within 130 km from Project) • May overlap early period of Project (construction to start from 2023–2028 and last 4 month. Lifespan of project is 25 years)	• Increased traffic from movements of material, equipment, and workers during construction
Granular Pit Exploration + Development – km 158 (ongoing)	• Within RSA (167 km from Project) • Overlaps with 10-year life of Project (activity will occur every 3–5 years)	• Increased traffic from transportation of aggregate and equipment from pit, as well as materials to temporary camp.
Eagle Plains Solid Waste Disposal (ongoing)	• Within RSA (approximately 15 km from Project) • Overlaps with 10-year life of Project (to occur over the 25 years, starting in 2024)	• Increased traffic from removal and disposal of hazardous waste stockpile, site stabilization, and post-closure monitoring

Project Name or Activity	Spatial / Temporal Overlap	Project or Activity Contributions
Yukon Fiber Optic Network (ongoing)	• Within RSA (along the Dempster Highway) • May overlap early period of Project (to occur 2020 and 2025)	• Increased traffic and roadside work from installation of fibre optic line along right-of-way
ROHL Camp (ongoing)	• Within RSA (approximately 65 km from Project footprint) • May overlap early period of Project (to occur 2020 and 2025)	• Increased traffic from movements of material, equipment, and workers to temporary work camps
Mineral Exploration	• Within RSA (potentially accessed along the Dempster Highway) • May overlaps with 10-year life of Project	• Increased traffic from movements of material, equipment, and workers to exploration sites
Gravel quarries- Unnamed	• Within RSA (potentially accessed along the Dempster Highway) • May overlaps with 10-year life of Project	• Increased traffic from movements of material, equipment, and workers to quarry sites
Oil and Gas	• Within RSA (potentially accessed along the Dempster Highway) • May overlaps with 10-year life of Project	• Increased traffic from movements of material, equipment, and workers to oil and gas exploration sites

Not all ongoing and proposed projects and activities will overlap the full 10-year life of the Project. The Eagle Plains Solid Waste Disposal project, Yukon Fiber Optic Network, and ROHL Camp are likely to overlap only the first few years of the Project if scheduled operations occur as planned. Nearly all the listed gravel pit projects will occur every 2–5 years resulting in periodic contributions to increased traffic along the Dempster Highway.

While each ongoing and reasonably foreseeable project is expected to contribute to minor changes in Dempster Highway traffic, there is the potential for occasional periods of delay or disruption should the traffic volume combine from multiple projects in a given period.

Placer and quartz claims, and land use permits for gravel extraction occur on lands within the RSA that may be accessed from the Dempster Highway. Oil and gas exploration in the region is primarily related to the Chance exploration claims. As a result, there is the potential for mineral exploration and the development of future gravel quarries that may use the Dempster Highway to access lands and result in increased traffic activities from movements of material, equipment, and workers. Cumulative effects from these activities are expected to occur seasonally with unknown operation dates.

A characterization of cumulative effects for a change in the use of transportation infrastructure from increased traffic is provided in **Table 11-8** below.

Table 11-8. Characterization of Cumulative Effects on the Use of Transportation Infrastructure from Increased Traffic

Criterion		Rating	Rationale
Magnitude		Low	Ongoing projects and other reasonably foreseeable projects that may use the Dempster Highway to access lands have the potential to act cumulative with the regular and/or scheduled movements of material, equipment, and workers to and from the Project footprint. It is expected that the incremental increase in overall traffic will not be noticeable within existing conditions but may result in reduced speeds and/or delays.
Likelihood		Certain	The likelihood of cumulative effects from increased traffic is certain as most of the other projects and activities are existing and ongoing with planned schedules of operation.
Geographic Extent		Local	The cumulative effect of increased traffic is expected to be localized to the Dempster Highway.
Duration, Frequency and Timing	Duration	Short-term to Medium-term	The cumulative effect of increased traffic is expected to occur throughout the life of the Project (i.e., 10 years) with some of the other projects and activities scheduled to overlap for only the first few years of the Project.
	Frequency	Periodic	The cumulative effect of increased traffic from other projects and activities are expected to generally occur seasonally with most occurring every 3–5 years.
	Timing	Seasonal	The cumulative effect of increased traffic from other projects and activities are expected to occur seasonally, and are likely to be most evident in the summer when they overlap with tourism and recreation, road maintenance or industrial activity in the region
Reversibility		Reversible	The cumulative effect of increased traffic will decrease or stop with closure and reclamation of the Project and/or other projects and activities.

Potential climate change effects could cumulatively interact with residual Project effects and anticipated ongoing and proposed projects and activities effects resulting in changes to transportation infrastructure over the 10-year life of the Project. Climate change effects such as extreme weather events could result in seasonal disruption to use of transportation infrastructure from poor driving conditions for motorists along the Dempster Highway and portions of the North Klondike Highway such as winter storms or increased dust or airborne particulate matter from wildfire events. Events such as flooding, erosion, and permafrost thaw may also reshape the condition of roads for use by communities, commercial operators, recreational users and tourists. These climate change interactions have the potential to combine with the cumulative effect of increased traffic to result in further disruptions or delays to the use of the Dempster Highway.

11.2.7.3 Context and Confidence

The Project's environmental and/or socio-economic context and potential limitations of data and uncertainty associated with the assessment were considered for the assessment of cumulative effects. The ratings and rationale for the context and confidence in accurately quantifying and predicting cumulative effects are described in **Table 11-9** below.

Table 11-9. Characterization of Context and Confidence in the Assessment of Cumulative Effects on Community Infrastructure and Services

Criterion	Rating	Rationale
Context	Moderate	• The role of transportation infrastructure within the LSA (i.e., the Dempster Highway and portions of the North Klondike Highway) for community connectivity, recreation, tourism, and other uses are well documented and understood. • Concerns have been expressed related to a Project-related increase traffic on the Dempster Highway through engagement with local communities and First Nations.
Confidence	Low	• High degree of uncertainty of the traffic volume related to each ongoing or reasonably foreseeable project and activity. • Traffic management strategies are based on road use and safety requirements that are proven to be effective.

11.3 LAND AND RESOURCE USE

11.3.1 Assessment Indicators and Assessment Parameters

Project effects on land and resource use were assessed by taking into consideration potential changes in commercial and recreational land and resource use, and First Nations culture and land and resource use. Commercial and recreational land and resource use refers to the use of lands and waters for commercial and non-commercial purposes such as forestry, mining, trapping, hunting, fishing and outdoor recreation and tourism activities. Land and resource use in this context also refers to the formal disposition and designation of lands through federal, territorial, or municipal authorities.

First Nations culture and land and resource use refers to Yukon First Nation Citizens and Gwich'in Participants (Gwich'in peoples that are represented by the Gwich'in Tribal Council) cultural practices, beliefs, and values expressed through traditional uses of lands and resources. The ability of First Nations to conduct cultural practices that maintain their cultural identity and support intergenerational knowledge transfer is dependent on access to areas for traditional cultural practices, and the availability and quality of lands and resources for those practices. First Nation culture and land and resources use also includes traditional economic activities related to subsistence activities that provide goods and services to individuals and communities without involving the exchange of money. These activities may include the harvesting of traditional foods, as well as activities such as gathering firewood and using non-timber forest products.

The assessment indicators and parameters selected for the assessment of potential Project effects on the Land and Resource Use VESEC are provided in **Table 3-2** in **Section 3 Methods.**

11.3.2 Project Interactions and Potential Effects

The assessment approach for identifying Project interactions and potential effects involved a systematic review of listed Project components or activities and qualitative analysis for each relevant indicator and assessment parameter of the Land and Resource Use VESEC within the context of existing conditions for the LSA. Identified concerns or interests are included for each potential effect as context. Project components that are expected to interact with the Land and Resource Use VESEC are listed in **Table 3-4**

in **Section 3 Methods**. Most of the interactions with Project components and activities are expected to result in either no effects or minor effects that would be expected to result in no measurable change from existing conditions. These interactions and effects are described in **Section 11.3.2.1 Rationale for No or Negligible Interaction** to provide a rationale for these findings. Interactions that are anticipated to result in a more substantial effect are identified in **Section 11.3.2.6 Interactions.**

11.3.2.1 Rationale for No or Negligible Interaction

Interactions that were identified as having either no or negligible interaction with the Project, and are not assessed further, are described below.

11.3.2.1.1 No Effects on Designated Lands

Concerns related to changes in land use planning or designated lands have been expressed through engagement on the Project with local communities and potentially affected First Nations (see **Section 2 Consultant and Engagement**). These include:

- Comment about the importance of upholding objectives from the North Yukon Regional Land Use Plan; and,
- concern from Vuntut Gwitchin First Nation and Gwich'in Tribal Council related to their Treaty and Aboriginal Rights and expressed interest in advancing discussions related to potential Project effects on their Treaty Rights.

Commercial and recreational land and resource use refers, in part, to the designated and undesignated use of lands. Land use designations are typically established through federal, territorial, or municipal authorities and processes such as land use plans and zoning, tenures and concessions (including license or leases), designated park lands or ecological reserves, or land settlement agreements. The Project overlaps with the boundaries of the North Yukon Planning Region and the Peel Watershed Planning Region and is subject to the approved North Yukon Regional Land Use Plan (2009) and the Peel Watershed Regional Land Use Plan (2019) (Peel Watershed Planning Commission 2022; Government of Yukon and Vuntut Gwitchin Government 2009). The Project is compliant with land use management objectives and policies included in both the North Yukon Regional Land Use Plan (NYRLUP) and Peel Watershed Regional Land Use Plan (PWRLUP).

The Project also overlaps a number of land tenures and concessions, and Yukon first Nation Traditional Territories. The Project is not expected to interact with or result in a change to these existing designated lands. Additional detail is provided below, specific to the Project and overlap with applicable regional land use plans, land tenures and concessions, and land claims agreements.

11.3.2.1.1.1 Regional Land Use Plans

The Project overlaps the boundaries of the North Yukon Planning Region and the Peel Watershed Planning Region. Proposed Project activities are located in Land Management Unit (LMU) 9 (Eagle Plains) of the NYRLUP, and within LMU 7 (Dalglish Creek) of the PWRLUP. See **Appendix 11-A** for figures of the extents of these planning regions**.**

Yukon Regional Land Use Plans were developed in response to Section 11 of the Umbrella Final Agreement and these plans identify how and where land uses may or may not occur (Yukon Land Use

Planning Council 2022). Both NYRLUP and PWRLUP identify land use values, valued environmental components, and management objectives that focus on intended land use for environmental assessment. Both the NYRLUP and PWRLUP propose general land use categories of which the Project overlaps the Integrated Management Area (IMA) Zone 4. The IMA Zone 4 category has a management intent focused on higher levels of land use such as for oil and gas, mining, and other industrial land uses, including road access. The Project is committed to meet the objectives outlined in both the NYRLUP and PWRLUP to effectively manage Project-related effects and address concerns raised through the ongoing engagement on the Project. Further information on consideration of these regional land use plans is provided in **Section 1.7.**

11.3.2.1.1.2 Land Tenures and Concessions

The following is a summary of the land tenures and concessions overlapping or adjacent to the Project footprint within the LSA (or RSA where applicable):

- There are no water licences within the LSA. There are 3 water licences within the RSA, one of which is held by Chance.
- The LSA does not overlap with any placer or quartz mineral claims. The closest quartz claims in relation to the LSA are located approximately 48 km to north and 30 km to the east.
- There are six dispositions within the LSA: a Lease for commercial uses purposes and five Reserves for gravel pit use (Government of Yukon 2021). All are located along the Dempster Highway.
- Neither the LSA nor RSA overlap with any forestry licences.
- There are no parks or protected areas within the LSA. The RSA has a minor overlap (0.03%) with the Ni'iinlii Njik (Fishing Branch) Territorial Park and Conservation Area.
- The LSA overlaps two registered trapping concessions (RTC); RTC 401 and RTC 402. Information was not available about active trapping within these trapping concessions.
- There are no outfitting concessions within the LSA. The closest outfitting concession in relation to the LSA to the south is Outfitting Concession # 2 registered to Blackstone Outfitters Ltd.

Land tenures and concessions are not expected to be affected by the Project. See **Appendix 11-A** for figures of the extents of these tenures and concession areas**.**

11.3.2.1.1.3 Yukon First Nation Traditional Territories and Settlement Lands

Within Canada, Indigenous peoples have constitutionally protected rights and interests related to activities that are an element of practices, customs, or traditions integral to distinctive cultures, and that have continuity with traditions that existed prior to European contact. They may include (but are not limited to) rights and interests related to traditional uses such as habitation, hunting, fishing, trapping, and harvesting. These rights (and treaty rights) are recognized and affirmed by Section 35 of the *Constitution Act (1982)* (Government of Canada 2020).

Within the Yukon, the Umbrella Final Agreement provides a framework for negotiating individual First Nation Final Agreements and Self-Government Agreements (Government of Yukon 2018). Vuntut Gwitchin First Nation, Gwich'in Tribal Council, the First Nation of Na-Cho Nyäk Dun, and Tr'ondëk Hwëch'in First Nation have signed Final Agreements and Self Government Agreements with the Government of the Yukon and the Government of Canada that outline the laws, powers, and governance structures that each First Nation

uses to govern its Citizens and lands (Government of Yukon 2019). These agreements include the designation and definition of Settlement Lands, which are lands owned and managed by a Yukon First Nation, and Traditional Territory that individual First Nations have traditionally used and have rights and interests within.

The Project footprint overlap any First Nation Settlement Lands. The Project footprint does border portions of the Vuntut Gwitchin First Nation Class A Settlement Lands to the east and southwest, and Tr'ondëk Hwëchin Class A Settlement Lands to the southwest. The Project footprint does overlap the Traditional Territories, as defined in Land Claim Agreements with Yukon First Nations, of the Tetl'it Gwich'in Council, Tr'ondëk Hwëchin, the First Nation of Na-Cho Nyäk Dun, and Vuntut Gwitchin First Nation.

The majority of the Project activities and components are located in the Traditional Territory of the Vuntut Gwitchin, the First Nation. Tetl'it Gwich'in Council Traditional Territory overlaps a portion of the Project footprint in the southeast, including a Secondary Use Area along the Dempster Highway and a small portion of Primary Use Area near Dalglish Creek. Most of the Traditional Territories for the Tr'ondëk Hwëchin and the First Nation of Na-Cho Nyäk Dun occur to the south and southwest of the Project footprint, respectively (Government of Yukon 2021). See **Appendix 11-A** for figures of the extents of these Settlement Lands and Traditional Territories**.**

The Project activities and components will occur within Traditional Territories of potentially affected First Nations. Assessment of effects on cultural use of Traditional Territories will be discussed in the subsequent analysis of First Nations culture and land and resource use.

11.3.2.1.2 No Effects on Availability and Abundance of Resources for Commercial Use

Project-related activities and components have the potential to affect the availability and abundance of resources used for commercial purposes within the Project footprint through vegetation clearing or potential disturbance to wildlife species or habitat. Changes to the availability and abundance of resources for commercial land and resource uses such as forestry, mining, oil and gas, hunting, and trapping were assessed. Concerns about the Project-related effects on the availability and abundance of resources for commercial use have been expressed through engagement on the Project with local communities and First Nations (see **Section 2 Consultation and Engagement**). These focused on increased access of predatory species to areas used for commercial purposes, as well as reduced opportunity to access a historic trapline that overlap the Project footprint.

Based on the assessment of land tenures within the LSA (see **Section 11.3.2.1.1 Regional Land Use Plans**), no forestry licences, outfitting concessions, placer claims, or quartz claims were identified, indicating no activities related to these commercial activities are occurring or planned for the area. The Project footprint encompasses approximately 2,400 km² of oil and gas claims held by Chance Oil and Gas Ltd. Two RTCs (i.e., RTC 401 and RTC 402) overlap the Project footprint. This indicates that there is the potential for commercial land and resources related to trapping within the LSA. Information related to the current level of trapping activity within the Project footprint was not available at the time of writing the Project Proposal; however, information gathered through interviews with key informants (including representatives from First Nations and local communities) suggests that minimal to no commercial trapping is occurring within the Project footprint (see **Appendix 11-A**).

As the LSA does not include active commercial land uses, beyond oil and gas exploration which is the focus of the Project Proposal, no Project-related effects on the abundance and availability of resources for commercial uses in the LSA are expected. Therefore, these effects are not carried forward in the assessment.

11.3.2.1.3 Negligible Effects on the Land Area and Access for Commercial and Recreational Use

Project-related components and activities have the potential to affect the land available for, and access to, areas of commercial and recreational uses within the LSA as the Project will involve the temporary use of lands for seismic exploration, and the sustained use of land areas for winter road access, camp facilities, well sites, and surface infrastructure. The Project will also involve temporary restrictions on public access within the LSA near well sites and along winter access for safety reasons. Concerns about Project-related effects on land use areas and access have been expressed through engagement on the Project with local communities and First Nations. These include:

- comment about a historic trapline in the southern portion of the Project and concerns over reduced opportunity; and,
- concern about resource road access and regulation.

While the locations and extent of Project-related exploration within the Project footprint are not certain at the time of the assessment due to the exploratory nature of the Project, there is potential for the use of up to approximately 7,019 ha from the development of the winter roads and seismic features, well sites, camps, and areas for surface infrastructure (see **Section 7 Vegetation** for further details). This represents approximately 2.8% of the 256,975 ha of the LSA.

Based on the assessment of land tenures (see **Section 11.3.2.1.1 Regional Land Use Plans**), the LSA does not include active commercial lands uses, beyond oil and gas development which is the focus of the Project Proposal. As the LSA does not include active commercial lands use, beyond oil and gas development, no Project-related effects on the land area and access for commercial uses in the LSA are expected.

There is the potential for the Project to affect the land available for, and access to, areas for recreational use within the LSA due to the use of lands for Project activities and restrictions on public access. While there is the potential for recreational use of the LSA for activities such as fishing or hunting, based on available information, a small amount of recreational use occurs in the LSA with most being focused along the Dempster Highway (see **Appendix 11-A**).

Historical operations in the LSA by Chance have observed that access restrictions do not effectively prevent the public from accessing the Project footprint and it is expected that enforcement of restricted access will be focused on localized areas during active exploration. Within the LSA, there are a number of existing trails, access roads, and other existing seismic cutlines that will not be affected by Project-related activities or access restrictions and may continue to be used. There is the potential that the uncontrolled portions of Project-related access roads may be used and increase accessibility within the LSA, as land users are often attracted to the development of new resource roads to access remote areas.

Considering the limited amount of commercial and recreational activity that is understood to be currently occurring within the LSA, the small area of the LSA (2.8%) that will be affected by Project-related exploration, and that accessible travel routes will continue to be available throughout the LSA. It is anticipated that the overall land available for, and access to areas for recreational use will experience an incremental change from existing conditions. This potential effect is considered to be negligible and is not carried forward for further assessment.

Potential effects on access by commercial and recreational users (including tourists) on the North Klondike and Dempster Highways from Project exploration activities are assessed in **Section 11.2 Community Infrastructure and Services**.

11.3.2.1.4 Negligible Effects on Resource Availability, Abundance, or Quality for Subsistence Use by First Nations

The ability of Yukon First Nation Citizens and Gwich'in Participants to conduct cultural practices based on customs, beliefs, and values (such as subsistence use) is dependent, in part, on the availability of quality lands and resources to support those practices. Lands and resources in the LSA are important to the Gwich'in Tribal Council, Tr'ondëk Hwëchin, the First Nation of Na-Cho Nyäk Dun, and Vuntut Gwitchin First Nation for subsistence activities including hunting, trapping and harvesting for cultural purposes.

Yukon First Nation Citizens and Gwich'in Participants harvesting of wildlife, fish and vegetation is dependent upon the availability, abundance and quality of valued species that support subsistence activities. Concerns about the Project-related effects on harvesting and subsistence activities have been expressed through engagement on the Project with local communities and First Nations, including:

- concerns from Gwich'in Tribal Council related to Project effects on trapping, caribou and moose hunting activities, and wildlife on which Gwich'in depend for food;
- concerns about access roads and effects on water and fish;
- concerns from the Vuntut Gwitchin First Nation about a potential effect on the quality of Traditional Territory and the potential effect on the livelihood of Vuntut Gwitchin First Nation;
- concerns from Trondëk Hwëch'in related to trapping and caribou hunting and caribou, which has a high value as traditional food and for cultural and spiritual wellbeing; and,
- concerns about reduced opportunity for trapping on the historic trapline in the southern portion of the Project footprint.

11.3.2.1.4.1 Pattern of Subsistence Use Within the Local Study Area

The following is a summary of Yukon First Nation Citizens and Gwich'in Participants subsistence uses within the LSA, as described by available information, to provide context for the assessment of Project effects. Further details are available in **Appendix 11-A**. This information indicates that Vuntut Gwitchin First Nation Citizens and Gwich'in Participants currently use areas in the LSA for cultural purposes including wildlife, fish and vegetation harvesting for subsistence.

Vuntut Gwitchin First Nation Citizens depend on the Porcupine Caribou Herd to maintain their traditional way of life and continue to actively participate in traditional subsistence harvesting activities for harvesting of caribou, moose, waterfowl, fish and berries/edible plants. Caribou harvesting may occur in the LSA but is identified as being most focused north of the LSA near Old Crow. The LSA is identified as has having good quality moose habitat and is used for moose harvesting by Vuntut Gwitchin First Nation Citizens

although the majority of moose hunting effort takes place in the vicinity of Old Crow. The lands within the LSA have been a major fur trapping area for Vuntut Gwitchin First Nation Citizens as it is a productive area for fur bearers, like marten. Trapping has historically been focused near Old Crow and in the Whitestone area to the southwest of the LSA, but trapping is identified as occurring around the Dempster Highway corridor. Vuntut Gwitchin First Nation Citizens mainly fish along the Lower Porcupine River and areas to the north of the LSA, as well as in the Whitestone area to the west. Historic fish trapping locations occurred along the Lower Porcupine River and Chance Creek near Whitestone Village and Ellen Creek areas in the vicinity of Eagle Plains. Vuntut Gwitchin First Nation Citizens have stopped fishing in some historic fishing sites due to the shortages of fish and changes in fish habitat in some creeks within their Traditional Territory. Vuntut Gwitchin First Nation Citizens also rely on harvesting plants as an important food source, as medicinal plants for treating illnesses and diseases, and as material for wildlife harvesting such for traps or for drying meat. Key areas for berries and medicinal plant gathering have been identified around the southeast corner of the LSA near Dalglish Creek, Enterprise Creek, and the Dempster Highway.

Trapping furbearers, hunting caribou, and harvesting plants, berries, roots, and pitch are all key subsistence harvesting practices that Gwich'in Participants have traditionally engaged in within the LSA. During engagement on the Project with local communities and First Nations, Gwich'in Tribal Council representatives stated that the Project footprint is a known hunting area for moose and barren-ground and Woodland Caribou. Gwich'in Tribal Council representatives noted the Project footprint overlaps with Tetl'it Gwich'in Council traplines and that trapping activity in the area focuses on marten, lynx, beaver, and wolf. It was acknowledged that Gwich'in Participants of Fort McPherson typically hunt moose and pick berries along the border of the Yukon and NWT, as well as along the Dempster Highway. Subsistence fishing activities for Gwich'in Participants was characterized as being focused on the Peel and MacKenzie Rivers located outside of the LSA.

Tr'ondëk Hwëch'in Citizens conduct subsistence harvesting within their Traditional Territory throughout the year to take advantage of migrating animals and fish, harvesting plants in season and trapping in winter to collect thick furs. Available information did not identify specific subsistence use areas within the LSA for either of the Tr'ondëk Hwëch'in First Nations Citizens or First Nation of Na-Cho Nyäk Dun Citizens.

See **Appendix 11-A** for additional information on First Nations subsistence use.

11.3.2.1.4.2 Effects on Vegetation, Wildlife and Fish Species that Support Subsistence Use

The following is a summary of potential effects on vegetation, wildlife and fish species to support the assessment of Project effects to the availability and quality lands and resources to support subsistence use.

Based on the assessment of the **Section 7 Vegetation**, there is a potential for interaction between Project activities and vegetation within the LSA that are valued by Yukon First Nation Citizens and Gwich'in Participants for subsistence harvesting (e.g., tamarack, willow, berries, roots). Trees and tall shrubs will be cleared for access roads and well sites, but winter ground preparation will protect the active ground vegetation layer and preserve saplings and small shrubs. Low impact seismic methods will substantially reduce vegetation removal, including large trees. Constraints mapping will minimize effects to areas identified as high-value wetlands and riparian areas. Existing disturbances, burn areas, and natural open areas will be used where possible rather than disturb existing vegetation (e.g., CPF surface infrastructure

within the disturbed area near the main camp). Project activities related to access roads and well sites will disturb or remove vegetated areas within the LSA, but proposed management measures and practices will minimize the potential effects on the availability and abundance of tree and plant species. The overall availability and abundance of trees and plants for traditional cultural food sources, medicinal uses, and materials are expected to experience a minor change from existing conditions due to Project-related clearing that is predicted to result in a negligible effect on the ability of First Nations to harvest culturally important vegetation for subsistence activities within the LSA.

Based on the assessments in **Section 8 Caribou** and **Section 9 Wildlife and Wildlife Habitat,** there is a potential for interactions between Project activities and wildlife or wildlife habitat within the LSA, which are considered important for Yukon First Nation Citizens and Gwich'in Participants subsistence harvesting (e.g., marten, moose, and caribou). Localized effects on wildlife distribution may occur from the potential for avoidance by wildlife in and near the Project footprint due to the disturbance from active exploration activities as well as minor effects on wildlife habitat availability from vegetation clearing. The Project will occur during the winter when many wildlife species are absent in the LSA (e.g., migration out of the region by birds, denning by bears) and/or less sensitive to disturbance (e.g., caribou). Project activities are expected to affect moose habitat availability and use and possibly have a negligible effect on mortality risk. Project activities are scheduled to occur when caribou may be present in the LSA during the fall and winter; however, caribou do not use the Project footprint every year, and when they do, it is typically for short periods (up to approximately two weeks). When caribou are present, the Project may affect localized movements within the LSA. Potential localized effects on wildlife are not expected to represent a change to Yukon First Nation Citizens and Gwich'in Participants ability to harvest culturally important wildlife species for subsistence within their Traditional Territories.

Based on the assessment in **Section 6 Fish and Fish Habitat**, there is no measurable anticipated effect between Project activities and fish and fish habitat. Although there are abundant waterbodies in the Project area, many of which are expected to support fish in the warmer months, most Project activities will occur in the winter when most of these waterbodies are frozen, and fish are not present in the LSA. Mitigation measures related to fish and fish habitat are detailed in **Section 6 Fish and Fish Habitat**.

Based on the assessment in **Section 11.4 Community Health and Wellbeing**, and the evaluation of changes in traditional food quality, there is a potential for the Project to affect the quality of traditional food sources (e.g., fish, moose, berries and plants) due to contamination of environmental media (i.e., surface water, groundwater, soil, air quality, sediments) that may affect the overall health of culturally important species for subsistence use. Limited information was available on existing tissue quality or contamination of wildlife, fish, and plant or vegetation species. The degree of potential effects on the quality of vegetation, wildlife, or fish is expected to be in alignment with potential Project-related effects on air, water, vegetation and soil disturbance, and water sources, with consideration for bioaccumulation and biomagnification potential.

As the Project's activities are largely limited to the winter, it is assumed that the Project will result in minimal soil and vegetation disturbance, minimal sedimentation and dust emissions, or effects on surface and groundwater that would be a source of contaminates and result in an exposure risk to plants, wildlife or fish. Consequently, the effects on the quality of vegetation, wildlife, and fish species for subsistence use are anticipated to be negligible.

11.3.2.1.4.3 Effects on Subsistence Use

Based on the predicted effects on vegetation, wildlife and fish species provided previously, the presence and distribution of wildlife is expected to be minimally changed, characterized by the potential for moose and caribou to temporarily avoid localized areas of the Project footprint related to active seismic line preparation and drilling sites. It is anticipated that the overall availability of wildlife species for subsistence harvesting activities would be consistent with existing conditions. Similarly, the availability of trees and plants for subsistence harvesting is anticipated to experience a minor change from existing conditions.

The availability of fish is not expected to be affected by the Project. Effects on the quality of vegetation, wildlife, and fish species for subsistence use are anticipated to be negligible. As a result, Project-related effects on resource availability, abundance, or quality for subsistence use by First Nations in the LSA are considered to be negligible. This potential effect is not carried forward for further assessment.

11.3.2.1.4.4 Related Effects on First Nations Culture and Traditional Economy

First Nations values related to cultural identity and cultural activities such as the transmission of the Traditional Knowledge are often interconnected with the ability to practice subsistence use. It is expected that the negligible effects on First Nations subsistence use will allow for the continued harvesting of culturally important wildlife, fish, and plants for subsistence use and will not interfere with the aspect of cultural identity of the Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in, Gwich'in Tribal Council and First Nation of Na-Cho Nyäk Dun or the transmission of Traditional Knowledge related to subsistence use.

Concern about potential perceived adverse effects on the availability and quality of resources for subsistence activities may occur for First Nations users who harvest within the LSA despite the application of mitigation measures. First Nations values related to the condition of lands and wildlife are often interconnected with a broader sense of community health and wellness. An effect, actual/or perceived, to one value may result in effects on other cultural values. Effects on health and wellbeing are assessed in **Section 11.4 Community Health and Wellbeing.**

Considering the negligible effects on the availability, abundance and quality of resources for subsistence activities within the LSA, no effects on the traditional economy that rely on subsistence activities are predicted. The Project is not expected to reduce Gwich'in Tribal Council Participants, or Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in, and First Nation of Na-Cho Nyäk Dun Citizens' participation and contribution in traditional economy activities.

11.3.2.2 Interactions

Project components and activities interactions with land and resource use were evaluated following the approach in **Section 3.1.4.1 Project Interactions and Potential Effects.** Project components and activities that have the potential to interact with land and resource use are shown in **Table 11-10**. Three potential effects on land and resource use are expected. The pathway for potential adverse effects is described in the following sections.

Table 11-10. Expected Interactions between Land and Resource Use and the Eagle Plains Exploration Project and Resulting Potential Effects

Project Component / Activity	Potential Effect #1	Potential Effect #2	Potential Effect #3
Engagement	0	0	0
Seismic Exploration	2	2	2
Drilling Exploration	2	2	2
Extended Flow Testing (EFT)	1	1	1
Well Maintenance (Workovers)	0	0	0
Winter Access Roads	2	2	2
Mix Bury Cover (MBC)	2	2	2
Central Processing Facility (CPF)	2	0	2
Airstrip	1	1	1
Water Withdrawal	0	0	0
Transportation	1	1	1
Camp	1	1	1
Reclamation and Closure	1	1	1

Notes:
0 = no interaction. A rationale for no effects is addressed in **Section 11.3.2.1 Rationale for No or Negligible Effects**.
1 = minor interaction with land and resource use is possible, but small immeasurable effect. A rationale for negligible effects is addressed in **Section 11.3.2.1 Rationale for No or Negligible Effects**. This rating does not lead into residual effects characterization.
2 = substantial interaction with land and resource use, designates a more detailed assessment of potential effects. Carry forward into residual effects characterization.

11.3.2.3 Change in Environmental Conditions for Recreational Use

Concerns about the Project-related effects on environmental conditions have been expressed through engagement on the Project with local communities and First Nations. These include the following:

- concerns about visual effects on motorists travelling along the Dempster Highway; and,
- concerns about human land use-related disturbances such as noise, odour, and light and potential mitigation measures.

Local communities and First Nations have also expressed support for the monitoring for air quality and emissions.

The following is a summary of the Project's existing environmental setting and relevant Project components that are anticipated to interact with air quality, the acoustic environment, or the visual landscape and affect the experience of recreational users in the LSA.

11.3.2.3.1 Air Emissions

No major sources of anthropogenic air pollutants, such as quarrying, industrial activity, or incineration are located within the LSA, although some sources are located within the broader regional context (e.g., mining

and settlements). Sources of air pollutants within the LSA include vehicles along the Dempster Highway (e.g., exhaust and dust), generators used at the Chance Camp, and possible remote work sites that minimally contribute to the existing local air quality. Wildfire smoke is a potential seasonal source of particulate matter and other air pollutants that are capable of travelling long distances and reduce the air quality within the region. For the purposes of this assessment, the LSA is assumed to have clean air quality with minimal pollutants.

Air emissions may occur from Project components and activities that could affect the environmental setting for recreational users in the LSA. Airborne particulates in the form of fugitive dust are anticipated to result primarily from activities occurring in summer under dry conditions, such as the use of vehicles on roads or seismic lines, or from excavation of the MBC sump area. With the exceptions of seismic exploration, Project activities will occur mostly during the winter months when soils are frozen and site access occurs along winter access. As a result, fugitive dust produced by the Project is anticipated to be minimal and to only occur during the summer.

Flaring related to EFT is a potential source of short-term air emissions. It consists of burning off natural gas at height (up to approximately 30 m) to minimize possible interactions with receptors on the ground, although some odours may be associated with flaring as well as noise and light disturbances (Yukon Environmental and Socio-economic Assessment Board 2020).

Air emissions may occur from Project activities that involve the combustion of fossil fuels (i.e., exhaust) during seismic exploration, drilling, reclamation, and closure activities. Sources of exhaust may include mobile sources such as light-duty trucks, ATVs and snowmobiles, heavy equipment (e.g., mulchers and Low-Impact Seismic [LIS] drills), air transportation (i.e., airplanes and helicopter), as well as stationary sources such as a drilling rig and camp equipment (e.g., generators, boilers). Air emissions in the LSA from these sources are expected to be localized to areas where equipment is being operated. Once mobile or stationary equipment has moved to a site, air quality is expected to return to baseline conditions within a brief period (e.g., a few days).

Quantification of air emissions from combustion of fossil fuel sources identified above are not characterized at this time but will be reported in accordance with relevant territorial and federal air emission regulations. Based on previous air quality assessments for the Project area, air quality effects from the mobile and stationary sources are anticipated to be minor and localized in areas of active road construction, well sites, and camp operations (Yukon Environmental and Socio-economic Assessment Board 2020).

11.3.2.3.2 Noise

The existing acoustic environment within the LSA is characterized by a generally low level of ambient noise. Natural ambient noise sources within the LSA include wildlife and weather (e.g., wind). Anthropogenic noise sources within the LSA include vehicle traffic along the Dempster Highway, operations at the Chance Camp and may include occasional ATV or skidoo engines or overhead air traffic. Summer is likely to experience noise levels related to increased seasonal traffic and construction or maintenance work along the Dempster Highway. For the purposes of this assessment, the existing ambient noise levels within the LSA are predicted to be low overall and have been conservatively characterized by baseline rural noise levels of

between 35–45 decibels (dBA)[24] as applied in other assessments and established guidelines (British Columbia Energy Regulator 2023).

Noise from Project-related activities is expected to occur within the LSA due to heavy equipment and vehicle use, exploration drilling, seismic detonation, diesel power generation, and construction activities. Noise related to drilling at well sites will be a key source; drilling rigs have a noise level of approximately 68 dBA at 100 m from source (Noise Monitoring Services 2020). Noise from diesel generators (approximately 50 dBA at 100 m from source) will occur at well sites as well as at the Chance Camp[25] (AMEC 2015). Construction of the CPF and MBC will generate noise from the use of heavy equipment (truck, graders, pneumatic tools) and activities related to site preparation and assembly of materials (approximately 73 dBA at 100 m from source) (AMEC 2015).

Temporary noise generated during construction is expected to occur predominately during the summer. Noise generation from detonation during seismic testing will be minimal as it will occur below the surface. The regular movement of aircraft transporting crews during the winter and the summer seismic program will also generate intermittent, but potentially perceptible, noise overhead. Noise from flaring may occur when large volumes of high-pressure natural gas are being flared. While Project-related activities may result in an evident increase in noise levels[26], perception will be dependent on the receptors locations relative to the noise source as the level of sound decreases with distance from the source. As a result, the perception of most sources of Project-related noise are anticipated to be limited to the area in proximity to Project activity. Recreational users travelling along the Dempster Highway will have the highest potential for exposure to noise from the Chance Camp and MBC sites (i.e., excavation) as activities at these Project sites are located near the roadway, but Project drilling and seismic exploration activities occurring throughout the more remote portions of the LSA will be less perceptible due to the sound diminishing over long distances. Inversely, recreational land users may come into closer proximity to sources of noise from exploration activity and well sites. Considering the small amount of recreational use that occurs in the LSA, exposure to increased noise is expected to be minor and infrequent.

The overall incremental increase in noise generated by Project components and activities is not anticipated to be evident to most recreational users in the LSA, considering that drilling and seismic exploration activities will occur in remote areas outside the areas where recreational activities within the LSA are conducted. Perceptible noise for most recreational users will occur closer to the Dempster Highway (i.e., near the surface infrastructure at the CPF and MBC site) where there are existing noise sources. It is anticipated that the incremental increase in noise from the Project, while audible, would not be easily discernible to most recreational users within the existing ambient noise level of the LSA.

11.3.2.3.3 Visual Disturbance

The predominately natural landscape setting of the LSA is composed of a large expanse of mostly flat to rolling sub-arctic terrain, covered by generally sparse forests and scattered wetlands. Built features include

[24] Decibels are a unit describing the amplitude of sound commonly used to express ambient sound levels.
[25] Noise from generators already occurs during operations at the Chance Camp and, while it may be perceivable, is not considered to be an incremental noise effect related to the Project (Victoria Gold Corporation and Stantec 2010).
[26] Generally, for each +/- 10 decibel change in sound level, the sound intensity increases/decreases 10 times and is perceived as twice/half as loud.

the gravel surfaces of the Dempster Highway and resource roads, as well as a network of seismic cut lines throughout the forested landcover. The scenic value of the landscape is a key attractor to recreational users and tourists in the region. The visual landscape is further described in **Appendix 11-A.**

The landscape of the Project footprint will experience visual disturbances related to the clearing of vegetation for access and seismic exploration, the introduction of built features (e.g., wellsite surface infrastructure), and related safety and security lighting that may be visible from viewing locations within the LSA. Visual disturbance from exploration activities will occur progressively throughout the Project footprint in relation to the clearing for new access, and the construction of up to 30 well sites over 10-years. Well sites will include surface infrastructure (e.g., boilers, incinerators, ancillary trailers, storage units and tanks) and tall structures (i.e., up to approximately 30 m) such as the drill rig derrick and flare stack that may be visible above the surrounding canopy of vegetation. **Photo 1-8** in **Section 1 Details of the Proposed Project** provides an illustration of the typical drill rig and wellsite components and lighting. During drill stem testing, gas may be control-burned through the flare stack and create a temporary but visible light emission that would likely attract the attention of viewers.

Construction of the MBC will involve clearing of an area of approximately 6 ha to prepare the site. The development of the MBC site will include landform modifications from excavation, berms and stockpiling of materials. Similarly, the construction of the CPF adjacent to the camp will result in the visibility of additional surface infrastructure (e.g., separators, flare stacks, storage tanks) at the southernmost end of the main camp and related safety and security lighting.

It is anticipated that temporary visual disturbances will occur related to the presence of construction equipment and materials at the Chance Camp site during the early construction period, and the presence of Project vehicles for vegetation clearing, drilling, and well maintenance activities along Project access during the exploration activities. The movement of aircraft using the airstrip during the winter, as well as aircraft and helicopters during the summer seismic program, would be temporary and may attract the attention of recreational users.

The potential for public viewing of Project activities is expected to be minimal due to its remote nature and a relatively low amount of recreation and tourism activities occurring in the LSA. Viewing opportunities are most likely related to recreational users and tourists travelling through the LSA along the Dempster Highway. The overall visual disturbance of the Project components and activities are not expected to be readily evident to most viewers along the Dempster Highway considering the scale of Project components and visibility over long viewing distances across the Project footprint; visual elements of the landscape are less discernible and prominent the farther they are from the observer. Visual disturbances that will occur closer to the Dempster Highway (i.e., near the Chance Camp area and MBC site) will likely be more evident but will be partially screened from view.

Lighting of the surface infrastructure at the CPF, well sites (and related to flaring events) and from Project vehicles (e.g., mulchers, LIS drills, light-duty trucks) will likely be most visible during the winter and periods of low light and is likely to attract the attention of viewers within an otherwise naturally dark nighttime environment. It is anticipated that most Project components and activities would blend into the existing visual landscape of the LSA and is expected to result in minimal disturbance to viewing opportunities LSA.

The overall minor increases in air emission, noise level and visual disturbance are expected to be perceivable and have the potential to affect the environmental conditions valued by recreational users as a

setting for outdoor activities within some portions of the LSA. However, these incremental effects are not expected to change the overall experience of recreational users from existing conditions.

11.3.2.4 Change in Land Area and Access for First Nations Cultural Use

The Project footprint overlaps the Traditional Territories of the Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in, Gwich'in Tribal Council and First Nation of Na-Cho Nyäk Dun. The ability of Yukon First Nation Citizens and Gwich'in Participants to conduct cultural practices based on customs, beliefs, and values is dependent, in part, on access to and area of their Traditional Territories for cultural use. It has been identified through available information, that lands and waters in the LSA are important for cultural activities including habitation and other traditional and cultural purposes. Concerns about the Project-related effects on cultural use areas and access have been expressed through engagement on the Project with local communities and First Nations. These include:

- concerns from Gwich'in Tribal Council related to Project effects on trapping and hunting activities, and the ability to travel and use the land for traditional purposes;
- comment highlighting presence of documented important traditional places and traditional trails and travel routes across the Project footprint;
- concerns about access roads (e.g., Blackie Road) and both increased access to the Project area and use by ATV and skidoo traffic; and,
- concerns from the Vuntut Gwitchin First Nation about the effect on the quality of Traditional Territory and effect on the livelihood of Vuntut Gwitchin First Nation.

11.3.2.4.1 First Nations Cultural Use Within the Local Study Area

The following is a summary of Yukon First Nation Citizens and Gwich'in Participants cultural use areas and routes, as described by available information, to provide context for the assessment of Project effects. Further details are available in **Appendix 11-A.** This information indicates that Vuntut Gwitchin First Nation Citizens and Gwich'in Participants have traditionally and/or currently use areas in the LSA for cultural purposes including habitation, and land navigation and trails related to subsistence harvesting.

Historically, Vuntut Gwitchin First Nation Citizens had a nomadic lifestyle in their Traditional Territory dictated by the movement of food sources and harvesting times. They were known to have semi-permanent dwellings at many sites throughout the LSA as they followed the Porcupine Caribou and trapped. Vuntut Gwitchin First Nation Citizens established settlements at Driftwood Village, Johnson Creek Village, and Whitestone Village adjacent to the Project footprint, as well as cabins in the Old Crow region. Whitestone is a traditional village site and one that Vuntut Gwitchin First Nation Citizens continue to visit annually for hunting and fishing activities. It is stated that there are Vuntut Gwitchin First Nation Citizens with camps along the Dempster Highway, some in the Eagle Plains area, that are still used. It has been noted that Vuntut Gwitchin First Nation Citizens do not frequent the Project footprint as often as they have historically, due to its distance from Old Crow.

Vuntut Gwitchin First Nation Citizens have used trails to hunt, trap and trade within their Traditional Territory. The Vuntut Gwitchin Final Agreement identifies heritage routes from Old Crow to Whitestone Village and Old Crow to Fort McPherson. Vuntut Gwitchin First Nation Citizens access most of their traditional hunting and gathering areas around Eagle Plains by boat and snowmobiles. The Eagle River, located to the east and within the south portion of the LSA, has been identified as a key travel corridor for Vuntut Gwitchin First

Nation Citizens. The establishment of the Dempster Highway in the late 1970s created easier access to locations in Eagle Plains for cultural harvesting purposes.

The Primary and Secondary Use Areas defined in the Gwich'in Settlement Region includes areas in the Yukon that overlap the LSA. Available information did not identify habitation sites within the LSA for Gwich'in Participants. The Dempster Highway follows a traditional Tetl'it Gwich'in Council trail for part of the highway's length. Available information indicates that most cultural travel routes used by Gwich'in Participants are located outside the LSA near the Yukon and NWT border. The Peel, Arctic Red, and Mackenzie rivers, to the northeast of the LSA, are identified as key travel routes for Gwich'in Participants to access fish camps and harvesting areas and link different areas of their Traditional Territory.

First Nation of Na-Cho Nyäk Dun Citizens have historically had a semi-nomadic lifestyle, moving across their traditional territory to follow seasonal rounds[27] for hunting, fishing, and gathering food. Tr'ondëk Hwëch'in Citizens conduct subsistence harvesting within their Traditional Territory taking advantage of migrating animals and fish, harvesting seasonal plants and trapping. Tr'ondëk Hwëch'in Citizens travelled between harvesting sites but often returned to the same harvesting camps and established seasonal settlements. Available information did not identify habitation sites, travel routes and trails, or specific subsistence use areas within the LSA for either First Nation of Na-Cho Nyäk Dun or Tr'ondëk Hwëch'in.

Additional information on First Nations Cultural Use is referenced in **Appendix 11-A**.

11.3.2.4.2 Effects on Cultural Use

The Project will involve the temporary reduction of land area in the LSA available for Yukon First Nation Citizens and Gwich'in Participants cultural use from the incremental production of the seismic lines and seismic exploration activity, and the sustained use of land areas for winter roads, camp facilities, well sites and the surface infrastructure. The Project will establish a maximum of 200 km of active winter access roads (e.g., new and existing access roads) per season within the Project footprint. Project activity on the winter access roads will be related to winter road clearing, transport of drilling rigs and site construction material, and the daily transport of workers from the main Chance Camp or remote camp sites. While the locations and extent of Project-related activities within the LSA are not certain at the time of the assessment due to the exploratory nature of the Project, there is potential for the use of up to approximately 7,019 ha from the establishment of the winter roads and seismic features, well sites, camps, and areas for surface infrastructure (see **Section 7 Vegetation** for further details). This represents approximately 2.8% of the 256,975 ha of the LSA.

There is the potential for a change in the area of land available for Yukon First Nation Citizens and Gwich'in Participants cultural use within the LSA due to the temporary and sustained use of lands for the Project's activities. A small percentage of overall land area of the LSA is expected be disturbed. This area will be progressively explored over 10 years with areas of active exploration representing a smaller proportion of the total affected area at any given time. As a result, Yukon First Nation Citizens and Gwich'in Participants who currently use the LSA may experience a minor decrease in the availability of lands within the LSA for cultural purposes.

[27] Seasonal Rounds are related to the natural events and cycles that take place over the course of a year and are often related to planning harvest times through observations in nature.

The Project will involve the temporary restriction to public access within the LSA. Because of the potential to encounter sour gas (H_2S), access to well sites will be restricted to authorized personnel only. Winter roads will be restricted from public access for safety reasons as well. Historical exploration by Chance in the LSA have observed that this does not effectively prevent the public from accessing the Project footprint and it is expected that enforcement of restricted access will be focused on localized areas during active clearing, drilling, and transportation of equipment, materials and workers.

There is the potential for a change to access by potentially affected Yukon First Nation Citizens and Gwich'in Participants to cultural use areas due to public access restrictions to be enforced by Chance for safety reasons. Beyond identified heritage routes and trails, it is not certain where access to culture use areas may explicitly occur within the LSA. It is assumed, for the purposes of this assessment, that access to cultural use areas will occur by established routes or seasonal means that provide relatively easy travel (e.g., by ATV or skidoo). Within the LSA, there are a number of established travel routes, such as existing trails, access roads, and other existing seismic cutlines, that will not be affected by Project-related activities or access restrictions and may continue to be used. There is also the potential that the uncontrolled portions of Project-related access roads may be used and increased accessibility within the LSA as land users are often attracted to the development of new resource roads to access remote areas.

Considering the small amount of Yukon First Nation Citizens and Gwich'in Participants cultural use identified as occurring within the LSA, the small area of the LSA (2.8%) that will be affected by Project-related exploration, and that accessible travel routes will continue to provide access throughout the LSA, it is anticipated that Yukon First Nation Citizens and Gwich'in Participants will experience a small decrease in the availability of lands and temporary interruptions of access within the LSA for cultural purposes that will represent an minor change from existing conditions. This potential effect may be more prominent for particular cultural use areas or travel routes used by potentially affected First Nations within the LSA as the Project progresses, but the overall effect is considered consistent within the existing pattern of available land and access that Yukon First Nation Citizens and Gwich'in Participants currently use to practice rights and interests related to traditional practices.

Concern about potential perceived adverse effects on access to and area for cultural use within potentially affected First Nations Traditional Territories in the LSA may remain despite the application of management strategies. Yukon First Nation Citizens and Gwich'in Participants values related to the availability of and access to land and waters for cultural use are often interconnected with a broader sense of community health and wellness. An effect, actual/or perceived, on one value may results in effects on other cultural values. Effects on health and wellbeing are assessed in **Section 11.4 Community Health and Wellbeing**.

11.3.2.5 Change in Environmental Conditions for First Nations Cultural Use

Collectively held customs, beliefs, and values of individual Yukon First Nation Citizens and Gwich'in Participants are recognized as being linked to specific places and environments. Available information about cultural use of the LSA expressed that the environment surrounding the Project is valued for the way it supports cultural identity and cultural activities such as the transmission of the Traditional Knowledge. Consequently, the ability of potentially affected First Nations to maintain their cultural identity is partially dependent on the environmental conditions that support cultural practices.

Concerns about the Project-related effects on cultural identity and transfer of Traditional Knowledge, or sensory effects which may adversely affect the experience of First Nations cultural use have been expressed through engagement on the Project with local communities and First Nations. These include:

- interest in the process for protecting oral history;
- Gwich'in Tribal Council identified that the landscape is a key cultural value;
- concern about human land use-related disturbances such as noise, odour, light, and visual effects;
- concern related to the seismic program's noise effects; and,
- concerns about the effect of exploration on the quality of the Traditional Territory of Vuntut Gwitchin First Nation.

The following is a summary of the Project's existing environmental setting**,** and relevant Project components and/or activities that are anticipated to interact with the experience of First Nations cultural practices in the LSA. Details of Yukon First Nation Citizens and Gwich'in Participants cultural use in the LSA are available in **Section 11.3.2.4.1**, and in **Appendix 11-A.**

Available information on Yukon First Nation Citizens and Gwich'in Participants cultural use provides some perspective on the cultural value of a landscape context to that precedes the current pattern of industrial exploration activity and transportation infrastructure within the LSA. As such, it is acknowledged that Yukon First Nation Citizens and Gwich'in Participants may be vulnerable to changes in the environmental conditions that further alter the natural character of the LSA, and that Yukon First Nation Citizens and Gwich'in Participants may experience differential effects related to air quality, noise, or visual disturbance of the landscape that support cultural use, the transmission of Traditional Knowledge, and cultural identity.

11.3.2.5.1 Air Emissions

No major sources of anthropogenic air pollutants, such as quarrying, industrial activity, or incineration are located within the LSA although some sources are located within the broader regional context (e.g., mining and settlements). For the purposes of this assessment, the LSA is expected to have a clean air quality with minimal pollutants.

Air emission may occur from Project components and activities that could affect the environmental setting for First Nations cultural practices in the LSA. With the exception of summer seismic exploration, Project activities will occur mostly during the winter months when soils are frozen. As a result, fugitive dust produced by the Project is anticipated to be minimal and to only occur during the summer.

Air emissions may occur from Project activities that involve the combustion of fossil fuels (exhaust) during seismic exploration, drilling, and reclamation and closure activities. Air emissions in the LSA from sources such as light-duty trucks, ATVs and snowmobiles, heavy equipment, as well as stationary sources such as the drilling rig, and camp equipment are expected to be localized to areas where equipment is being operated.

Based on previous air quality assessments for the Project area, air quality effects from the mobile and stationary sources is anticipated to be minor and localized in areas of active road construction, well site, and camp operations (Yukon Environmental and Socio-economic Assessment Board 2020).

11.3.2.5.2 Noise

The existing acoustic environment within the LSA is characterized by a generally low level of ambient noise. Anthropogenic noise sources within the LSA include vehicle traffic along the Dempster Highway, operations at the Chance Camp and may include occasional ATV or skidoo engines or overhead air traffic.

While Project-related activities may result in an evident increase in noise levels, perception will be dependent on the receptors locations relative to the noise source as the level of sound decreases with distance from the source. As a result, the perception of most sources of Project-related noise are anticipated to be limited to the area in proximity to Project activity. Yukon First Nation Citizens and Gwich'in Participants engaged in cultural practices along the Dempster Highway may be near sources of noise from the surface infrastructure at the CPF or activity at the MBC sites. There are existing noise sources at these locations related to operations at the Chance Camp and traffic along the Dempster Highway and, consequently, it is anticipated that the incremental increase in noise from the Project would not be easily discernible from the existing ambient noise level in these portions of the LSA.

Yukon First Nation Citizens and Gwich'in Participants engaged in cultural practices within the remote areas of the LSA may be near sources of noise from Project exploration activity and well sites. Considering the small amount of Yukon First Nation Citizens and Gwich'in Participants cultural use that was identified as occurring in the LSA, the overall exposure to increased noise from the Project is expected to be limited and infrequent. There is, however, the potential for Yukon First Nation Citizens and Gwich'in Participants exposure to increased noise from the Project to be more prominent at particular cultural use areas within the LSA where they may be in closer proximity to Project exploration activity and well sites. As a result, the incremental increase in noise from Project components and activities is expected to be discernible to Yukon First Nation Citizens and Gwich'in Participants within the existing ambient noise level of the LSA as the Project progresses.

11.3.2.5.3 Visual Disturbance

The predominately natural landscape setting of the LSA is composed of a large expanse of mostly flat to rolling sub-arctic terrain covered by generally sparse forests and scattered wetlands. Built features include the gravel surfaces of the Dempster Highway and resource roads, as well as a network of seismic cut lines throughout the forested landcover.

Visual disturbance from exploration and drilling activities will occur progressively throughout the Project footprint in relation to clearing for new access roads and seismic exploration, the introduction of built features (e.g., wellsite surface infrastructure), and related safety and security lighting. It is anticipated that temporary visual disturbances will occur related to the presence of equipment and materials at the Chance Camp site during the early construction period, and the presence of Project vehicles for vegetation clearing, drilling, and well maintenance activities along Project access roads during exploration activities.

The movement of aircraft and helicopters during the summer seismic program, would be temporary and may attract the attention of Yukon First Nation Citizens and Gwich'in Participants on the land. Lighting of the surface infrastructure at the CPF, well sites (and related to flaring events) and from Project vehicles (e.g., mulchers, LIS drills, light-duty trucks) will be most visible during the winter and periods of low light and is likely to attract the attention of Yukon First Nation Citizens and Gwich'in Participants on the land within an otherwise naturally dark nighttime environment.

It is anticipated that visual disturbances from Project structures and vegetation clearing that will occur along the Dempster Highway (i.e., near the Chance Camp and MBC site) will be partially screened from view by Yukon First Nation Citizens and Gwich'in Participants engaged in cultural use activities. Visual disturbances related to seismic exploration and well sites in more remote portions of the LSA may blend into the existing visual landscape when viewed from a distance but have the potential to be more evident to Yukon First Nation Citizens and Gwich'in Participants within close proximity while engaged in cultural use activities. Based on the small amount of Yukon First Nation Citizens and Gwich'in Participants cultural use that was identified as occurring in the LSA, the overall potential for viewing of Project activities is expected to be limited. Considering the overall scale and form of the visual disturbance that would result from the Project, and the expected limited viewing opportunities, the Project is not anticipated to be a prominent feature within the LSA and is expected to result in a minor disturbance to potential viewing opportunities related to Yukon First Nation Citizens and Gwich'in Participants cultural use in the LSA.

The minor increases in air emission, noise level and visual disturbance are expected to be perceivable and have the potential to affect the environmental conditions valued by Yukon First Nation Citizens and Gwich'in Participants as setting for cultural activities within some portions of the LSA. However, these incremental effects are not expected to change the overall experience of Yukon First Nation Citizens and Gwich'in Participants engaging in cultural activities from the existing conditions. As a result, the effects on environmental conditions are not anticipated to affect the cultural identity of Yukon First Nation Citizens and Gwich'in Participants or their ability to continue the transmission of Traditional Knowledge with the LSA.

Concern about potential perceived adverse effects on the environmental surroundings of the LSA may occur with First Nations despite the application of mitigation measures. First Nations values related to cultural identity and cultural activities such as the transmission of the Traditional Knowledge are often interconnected with a broader community health and wellness. An effect, actual or perceived, on one value may result in effects on other cultural values. Effects to health and wellbeing are assessed in **Section 11.4 Community Health and Wellbeing.**

11.3.3 Mitigation Measures

The Project design includes management measures to avoid or reduce anticipated effects that have been identified through ongoing engagement, applicable standards, guidelines, and Best Management Practices (BMPs). These include the components listing in **Table 11-11** relevant to addressing Project-related effects on land and resource use.

Table 11-11. Mitigation Measures Relevant to Land and Resource Use and the Eagle Plains Exploration Project

Mitigation and Management Measure	Potential Effect Addressed by Mitigation
Application of constraints analysis and mapping	To minimize effects to high-value wildlife habitat, wetlands, and riparian areas.
Use of existing disturbances, burn areas, and natural open areas.	To minimize the spatial extent of new cutting for winter roads and seismic line preparation where possible.
Implementation of BMP to minimize air emissions, noise, and visual disturbance.	To minimize air emissions, noise, and visual disturbance.

Mitigation and Management Measure	Potential Effect Addressed by Mitigation
Use of doglegs in seismic lines.	Reduce the visual effect of straight linear features visible from the Dempster Highway.
Disturbed areas will be subject to the measures in a Reclamation and Closure Plan.	Allows for progressive decommissioning and reclamation of areas when they are no longer necessary for the Project.
Other VESEC-specific mitigation measures related to wildlife, fish, and vegetation as outlined in **Sections 6, 7, 8 and 9**.	Address effects related to wildlife, fish, and vegetation.

No further mitigation measures are identified to address potential effects on land and resource use.

11.3.4 Effects Characterization

11.3.4.1 Approach

The assessment approach used to characterize the predicted adverse residual effects on land and resource use follows the methodology outlined in **Section 11.1.4 Methods: Effects Assessment.** The residual effect characterization is based on criteria specific to Socio-economic VESECs, as presented in **Section 11.1.4.3 Methods: Characterization of Residual Effects.**

11.3.4.2 Residual Effect

Residual effects on the Land and Resource Use VESEC are expected, including a change in the environmental conditions for recreational use, a change in land area and access for First Nations cultural use, and a change in environmental conditions for First Nations cultural use. The Project's environmental and/or socio-economic context and potential limitations of data and uncertainty associated with the assessment are also considered in determining adverse residual effects. Residual effects and related context and confidence are characterized in **Table 11-12** to **Table 11-17** below.

These residual effects on environmental conditions for recreational use are characterized in **Table 11-12**.

Table 11-12. Characterization of Residual Effects on Environmental Conditions for Recreational Use

Criterion	Rating	Rationale
Magnitude	Low	The Project-related changes to environmental conditions for recreational use as a result of minor increases in air emission, noise level and visual disturbance are expected to be perceivable by recreational users but are not expected to change the overall experience compared to existing conditions.
Likelihood	Probable	The Project-related changes to environmental conditions for recreational use are likely to occur as a result of minor increases in air emission, noise level and visual disturbance
Geographic Extent	Local	The Project-related changes to environmental conditions for recreational use are predicted to be localized to small portions of the LSA

Criterion		Rating	Rationale
Duration, Frequency, and Timing	Duration	Medium-Term	The Project-related changes to environmental conditions for recreational use are predicted to occur progressively during the Project-lifecycle (i.e., 10-years)
	Frequency	Periodic	The Project-related changes to environmental conditions for recreational use is related to periods when recreational activities overlap with Project activities
	Timing	Year-round	The Project-related changes to environmental conditions for recreational use have the potential to occur throughout the year
Reversibility		Reversible	The Project-related change to environmental conditions for recreational use are predicted to decrease or stop with closure and reclamation of the Project.

11.3.4.3 Context and Confidence

The ratings and rationale for the assessment of residual effects on environmental conditions for First Nations cultural use are described in **Table 11-13.**

Table 11-13. Context and Confidence of Residual Effects on Environmental Conditions for Recreational Use

Criterion	Rating	Rationale
Context	Moderate	• Environmental conditions have been identified in regional land use plans as being valued for supporting recreation and tourism. • Concerns have been expressed related to Project-related effects on air quality, noise, visual effects, and light (including along the Dempster Highway) through engagement with local communities and First Nations.
Confidence	Moderate	• Information about recreational use within the LSA was limited. This was addressed through interviews with key informants (including representatives from First Nations and local communities). • Technical assessments were not available to quantify the environmental conditions or measure Project effects on air quality, noise, and visual disturbance. This was addressed with qualitative characterizations of the existing environmental setting and anticipated interactions with Project components. • Management measures identified in the Project design will be partially effective at addressing effects (e.g., established BMPs).

These residual effects on land area and access for First Nations cultural use are characterized in **Table 11-14**.

Table 11-14. Characterization of Residual Effects on Land Area and Access for First Nations Cultural Use

Criterion		Rating	Rationale
Magnitude		Low	Project-related disturbance footprint and access restrictions have the potential to decrease the availability of lands and disrupt access for First Nations cultural uses that will represent a minor change from existing conditions but is considered consistent within the existing pattern of available land and access.
Likelihood		Possible	A Project-related change to the availability of lands and disruption of access may occur dependent on First Nations cultural use of the Project footprint.
Geographic Extent		Local	Project-related change to the availability of lands and disruption of access for First Nations cultural uses are predicted to be localized to portions of the LSA.
Duration, Frequency, and Timing	Duration	Medium-Term	Project-related change to the availability of lands and disruption of access for First Nations cultural use are predicted to occur progressively throughout the life of the Project (i.e., 10-years).
	Frequency	Periodic	Project-related change to the availability of lands and disruption of access is related to periods when First Nations cultural use overlaps with Project activities.
	Timing	Year-round	Project-related change to the availability of lands and disruption of access for First Nations cultural uses have the potential to occur throughout the year.
Reversibility		Reversible	The Project-related change to the availability of lands and disruption of access for First Nations cultural uses are predicted to decrease or stop with closure and reclamation of the Project.

11.3.4.4 Context and Confidence

The ratings and rationale for the assessment of residual effects on land area and access for First Nations cultural use are described in **Table 11-15.**

Table 11-15. Context and Confidence of Residual Effects on Land Area and Access for First Nations Cultural Use

Criterion	Rating	Rationale
Context	Moderate	• Yukon First Nation Citizens and Gwich'in Participants have constitutionally protected rights and interests related to cultural activities on Traditional Territories and established land settlement agreements. • The ability of First Nations to conduct cultural practices based on customs, beliefs, and values, is dependent, in part, on access to areas of their Traditional Territories for cultural use. • Concerns have been expressed related to Project-related effects on land and resource use through engagement with local communities and First Nations.

Criterion	Rating	Rationale
Confidence	Moderate	• Information about Yukon First Nation Citizens and Gwich'in Participants cultural use areas and access to the LSA was limited. This was addressed with the review of secondary Traditional Knowledge sources and interviews with key informants (including representatives from First Nations and local communities). • Management measures identified in the Project design will be partially effective at addressing effects (e.g., established BMPs).

These residual effects on environmental conditions for First Nations cultural use are characterized in **Table 11-16**.

Table 11-16. Characterization of Residual Effects on Environmental Conditions for First Nations Cultural Use

Criterion		Rating	Rationale
Magnitude		Low	The Project-related changes to environmental conditions for First Nations cultural use are expected to be perceivable by Yukon First Nation Citizens and Gwich'in Participants but are not expected to affect their cultural identity or ability to continue the transmission of Traditional Knowledge compared to existing conditions.
Likelihood		Probable	The Project-related change to environmental conditions for First Nations cultural use are likely to occur as a result of increases in air emission, noise level and visual disturbance.
Geographic Extent		Local	The Project-related change to environmental conditions for First Nations cultural use are predicted to be localized to portions of the LSA.
Duration, Frequency and Timing	Duration	Medium-Term	The Project-related change to environmental conditions for First Nations cultural use are predicted to occur progressively throughout the life of the Project (i.e., 10-years).
	Frequency	Periodic	The Project-related change to environmental conditions is related to periods when First Nations cultural use overlaps with Project activities.
	Timing	Year-round	The Project-related change to environmental conditions for First Nations cultural use has the potential to occur throughout the year.
Reversibility		Reversible	The Project-related change to environmental conditions for First Nations cultural use are predicted to decrease or stop with closure and reclamation of the Project.

11.3.4.5 Context and Confidence

The ratings and rationale for the assessment of residual effects on environmental conditions for First Nations cultural use are described in **Table 11-17.**

Table 11-17. Context and Confidence of Residual Effects on Environmental Conditions for First Nations Cultural Use

Criterion	Rating	Rationale
Context	Moderate	• Yukon First Nation Citizens and Gwich'in Participants have constitutionally protected rights and interests related to cultural activities on Traditional Territories and established land settlement agreements. • Environment conditions have been identified as being valued for the way they support cultural uses and identity. • Concerns have been expressed related to Project-related effects on air quality, noise, visual effects, and light through engagement with local communities and First Nations.
Confidence	Moderate	• Information about Yukon First Nation Citizens and Gwich'in Participants cultural use in the LSA was limited. This was addressed with the review of secondary Traditional Knowledge sources and interviews with key informants (including representatives from First Nations and local communities). • Technical assessments were not available to quantify the environmental conditions or measure Project effects on air quality, noise, and visual disturbance. This was addressed with qualitative characterizations of existing environmental setting and anticipated interactions with Project components. • Management measures identified in the Project design will be partially effective at addressing effects (e.g., established BMPs).

11.3.5 Significance

The determination of significance of the predicted residual effects on land and resource use is based on definitions presented in **Section 11.1.4.3 Methods: Characterization of Residual Effects.** Magnitude, geographic extent, and duration are the primary factors affecting the significance determination. The significance of all residuals effects is assessed in combination to determine the overall affect of the Project on land and resource use after mitigations are applied.

The predicted Project-related changes to the environmental conditions are expected to be perceivable by recreational users but are not expected to change the overall experience on the land compared to existing conditions. The Project-related disturbance footprint and access restrictions have the potential to decrease the availability of lands and temporarily disrupt access for First Nations cultural uses as the Project progresses.

The predicted Project-related changes to the environmental conditions are expected to be perceivable by Yukon First Nation Citizens and Gwich'in Participants but are not expected to affect their cultural identity or ability to continue the transfer of Traditional Knowledge compared to existing conditions. The collective residual effects on land and resource use represent a minor change from existing conditions. Residual effects are predicted to be localized and occur over the 10-year life of the Project. With the implementation

of management measures (e.g., regulatory requirements and established BMPs), the collective residual effects of the Project on land and resource use are anticipated to be **not significant**.

11.3.6 Follow-up Monitoring

To address the uncertainty of potential interactions of the Project, follow-up monitoring is required to identify unanticipated social effects and to respond adaptively through coordination with First Nations, residents of local communities, and the YESAB Executive Committee or relevant regulators (if required). Chance will organize and implement coordination of follow-up monitoring to support identification and response to potential community and economic effects of the Project. This coordination will involve the review of results from Chance's proposed follow-up monitoring programs as well as feedback from First Nations and local communities to provide direction on the adaptive implementation of Project design, mitigation and benefit enhancement measures related to potential socio-economic effects.

11.3.7 Cumulative Effects Assessment

11.3.7.1 Approach

The assessment of cumulative effects on the Land and Resource Use VESEC follows the methods outlined in **Section 3.1.6 Cumulative Effects** and **Section 11.1.4.6 Cumulative Effects.**

Three residual Project effects were identified for land and resource use that could act cumulatively with other past, present or reasonably foreseeable projects and activities: (1) Residual Effects for Change in Environmental Conditions for Recreational Cultural Use (2) Residual Effects for Change in Land Area and Access for First Nations Cultural Use, and (3) Residual Effects for Change in Environmental Conditions for First Nations Cultural Use. For the purposes of the CEA, effects for changes in environmental conditions for Recreational Use and for First Nations Cultural Use were combined because both are attributable to a common set of sensory factors (i.e., air quality, noise, visual disturbance). The land and resource use CEA considers potential residual effects of the Project on the changes to environmental conditions, and changes to area use and access for cultural use that may interact spatially and temporally with past, present and reasonably foreseeable projects and activities listed in **Table 3.8** in **Section 3.1.6.4 Cumulative Effects Analysis.**

11.3.7.2 Cumulative Effects

The land and resource use CEA identified ongoing projects and reasonably foreseeable projects that may occur within the land and resource use RSA defined in **Table 11-1** in **Section 11.1 Methods**. This area consists of Game Management Subzones overlapping the Project footprint and provides a regional context for the assessment of Project-related effects to area use and access, wildlife resources that may support land and resource use, and environmental conditions. Other ongoing projects and reasonably foreseeable projects that may contribute to changes to environmental conditions, and changes to area use and access for cultural use within the RSA are presented in **Table 11-18**. These include the removal and disposal of hazardous waste at the Eagle Plains Solid Waste Disposal, the construction and maintenance of the Old Crow winter and all-season road, and the development of lands for mineral, gravel, and/or oil and gas resources within the region.

Table 11-18. Past, Present, and Reasonably Foreseeable Projects and Activities with Potential to Act Cumulatively with Project Effects on Land and Resource Use

Project Name or Activity	Spatial / Temporal Overlap	Project or Activity Contributions
Eagle Plains Solid Waste Disposal (ongoing)	• Within the RSA (approximately 15 km from Project) • Overlaps with 10-year life of Project (to occur over the 25 years, starting in 2024)	• Change in environmental conditions related to the potential for increased air emissions and noise.
Old Crow Winter (ongoing) and All-Season Road	• Within the RSA (traversing from Eagle Plains to Old Crow adjacent to the Project footprint) • Overlaps with 10-year life of Project (control access opened in 2022 and is ongoing)	• Increased access for First Nations to cultural use areas.
Mineral Exploration	• Potentially located within the RSA (location not known) • May overlap with 10-year life of Project	• Change in environmental conditions related to the potential for increased air emissions, noise, and visual disturbance. • Reduction in the availability of lands from the exploration area footprint and disruption to access for First Nations cultural uses.
Gravel quarries- Unnamed	• Potentially located within the RSA (location not known) • May overlap with 10-year life of Project	• Change in environmental conditions related to the potential for increased air emissions, noise, and visual disturbance. • Reduction in the availability of lands from the quarry footprint.
Oil and Gas	• Potentially located within RSA (location not known) • May overlap with 10-year life of Project	• Change in environmental conditions related to the potential for increased air emissions, noise, and visual disturbance. • Reduction in the availability of lands from oil and gas exploration or development area footprint and disruption to access for First Nations cultural uses.

The Eagle Plains Solid Waste Disposal project activity is likely to overlap only during the first few years of the Project (to be completed prior to 2026) if scheduled operations occur as planned. It is predicted to result in some increased air emissions related to the exhaust from heavy equipment and project vehicles, as well as fugitive dust from closure activities such as removal of remaining stockpiles, backfilling, and topping (particularly during dry summer conditions). Noise related to closure activities is anticipated from heavy equipment and closure activities. Changes to environmental conditions are predicted to be localized to small portions of the LSA and temporary. Post-closure monitoring is not expected to create a change to existing conditions.

The Old Crow winter road was opened to restricted traffic in 2022 to facilitate the movement of materials into the community of Old Crow and support future infrastructure projects (Government of Yukon 2022). The road is anticipated to be open seasonally depending on the weather with the intent of further

development into an all-season road. The Vuntut Gwitchin Government will control access and the road has the potential to increase accessibility for Vuntut Gwitchin First Nations Citizens to remote areas within the LSA for cultural uses more easily.

Existing placer and quartz claims are located outside the RSA and it is unlikely that development of lands for mineral exploration will occur within the region. The NYRLUP and PWRLUP identify the highest potential for industrial development of the RSA to be in relation to oil and gas production. Current oil and gas exploration in the RSA is related to oil and gas claims held by Chance Oil and Gas Ltd. (which are the focus of this Project Proposal). Several dispositions for gravel pits occur within the RSA along the Dempster Highway. As a result, there is the potential for the development of future gravel quarries that may result in a change to environmental conditions from increased air emissions (e.g., dust), noise, and visual disturbance, as well as a reduction in the availability of lands that may be related to First Nations cultural uses along the Dempster Highway.

A characterization of cumulative effects for land and resource use is provided in **Table 11-19** below**.**

Table 11-19. Characterization of Cumulative Effects on Land and Resource Use

Criterion		Rating	Rationale
Magnitude		Low	Ongoing projects and reasonably foreseeable projects that may occur within the region have the potential to act cumulatively with Project-related residual effects resulting in minor changes to environmental conditions (i.e., increases in air emissions, noise, and visual disturbance), and/or minor changes to the access to or area available for First Nations cultural uses from existing conditions.
Likelihood		Certain to Possible	The likelihood that cumulative effects will occur is certain for ongoing projects, but dependent on the development of other reasonably foreseeable projects.
Geographic Extent		Local	Cumulative effects are expected to be localized to the Dempster Highway and adjacent to the Project footprint.
Duration, Frequency and Timing	Duration	Short-term to Medium-term	Cumulative effects are expected to occur throughout the life of the Project (i.e., 10 years) with some of the other projects and activities scheduled to overlap only the first few years of the Project.
	Frequency	Periodic	Cumulative effects are expected to generally occur in relation to seasonal operating periods (i.e., summer or winter).
	Timing	Seasonal	Cumulative effects are expected to occur seasonally.
Reversibility		Reversible	The cumulative effect will decrease or stop with closure and reclamation of the Project and/or other projects and activities.

Potential climate change effects could cumulatively interact with residual Project effects on land and resource use resulting in changes to the overall environmental setting of the landscape for recreational and cultural use, and changes to the area and access for Yukon First Nation Citizens and Gwich'in Participants cultural use over the 10-year life of the Project. Climate change effects such as flooding, erosion, and wildfires may reshape landforms and the pattern of vegetation resulting in changes to the structure and overall character of the landscape setting within the RSA. Climate change effects such as erosion and

wildfires may also affect the air quality from an increased dust or airborne particulate matter from wildfires. Access to, and areas of Yukon First Nation Citizens and Gwich'in Participants Traditional Territories for cultural use within the RSA may be disturbed or altered by climate change effects such as flooding, erosion, and permafrost thaw.

11.3.7.3 Context and Confidence

The Project's environmental and/or socio-economic context and potential limitations of data and uncertainty associated with the assessment were considered for the assessment of cumulative effects. The ratings and rationale for the context and confidence in accurately quantifying and predicting cumulative effects are described in **Table 11-20** below.

Table 11-20. Characterization of Context and Confidence in the Assessment of Cumulative Effects on Land and Resource Use

Criterion	Rating	Rationale
Context	Moderate	• Yukon First Nation Citizens and Gwich'in Participants have constitutionally protected rights and interests related to cultural activities on Traditional Territories and established land settlement agreements. • Information about recreational use and First Nations cultural use within the RSA was limited. This was addressed through review of secondary Traditional Knowledge sources and interviews with key informants (including representatives from First Nations and local communities). • Concerns have been expressed related to Project-related effects on land and resource use through engagement with local communities and First Nations.
Confidence	Moderate	• There is some uncertainty related to the ongoing or reasonably foreseeable project and activities. • Management measures identified in the Project design will be partially effective at addressing effects (e.g., established BMPs).

11.4 COMMUNITY HEALTH AND WELLBEING

This section provides an analysis of potential Project-related interactions with the Community Health and Wellbeing Valued Environmental and Socio-economic Component (VESEC). The assessment of Community Health and Wellbeing includes the following:

- potential Project-related changes to Environmental Quality that may affect human health (including changes to air quality, noise, drinking water quality, soil and sediment quality, and traditional foods quality); and,
- potential changes to Social Determinants of Health (including access to healthcare services, incidence of infectious and chronic disease, personal and relational safety, and Indigenous and cultural health).

This section focuses on potential Project-related effects to Community Health and Wellbeing for potentially affected First Nations and communities as identified in **Section 1.1**.

11.4.1 Assessment Indicators and Parameters

Community Health and Wellbeing was selected as a VESEC because of the potential for the Project to interact with health and wellbeing conditions of potentially affected First Nations and communities in the LSA. Spatial boundaries used for the assessment of Community Health and Wellbeing are listed in **Table 11-1**. Engagement activities with affected communities have also identified concerns associated with community health and wellbeing. These concerns include drilling locations and the potential to contaminate air and water and reduced trapping and hunting opportunities, as the Project footprint overlaps with traditional subsistence areas. **Section 2 Consultation and Engagement** describes the results of the Project Engagement Program with potentially affected First Nations and communities.

The communities in the LSA and RSA (**Table 11-1**) are the main communities and administrative centres for Yukon First Nation Citizens and Gwich'in Participants (Gwich'in peoples that are represented by the Gwich'in Tribal Council) potentially affected by the Project. However, some First Nations Citizens may not reside within these RSA communities. For example, approximately 200 Vuntut Gwitchin Citizens reside in Old Crow, though most Citizens reside in Whitehorse (refer to **Appendix 11-A** for further information relating to key informant interview data). In addition, non-Indigenous community members also reside in LSA and RSA communities. Yukon First Nation Citizens and Gwich'in Participants using the land around the Project for traditional activities may not be residents of the RSA communities. For this reason, this section refers to "First Nations and communities" to encompass all those who may be potentially affected by the Project.

The assessment indicators and parameters selected for the assessment of potential Project effects on the Community Health and Wellbeing VESEC are provided in **Table 3-2** in **Section 3 Methods.**

The assessment of human health effects associated with Project-related changes to environmental quality was informed by a desktop report on potential interactions between the Project and existing environmental conditions for air quality and noise, and by the results of biophysical VESECs (**Section 4** to **Section 9** of the Project Proposal). Methods used for this report are included in **Section 11.1**.

The assessment of community health effects was informed by the results of Project engagement, existing socio-economic conditions as described in the **Appendix 11-A** and the results of other socio-economic VESECs (**Section 11.2, 11.3,** and **11.5** of the Project Proposal).

11.4.2 Project Interactions and Potential Effects

Interactions may occur between Project-related activities and Community Health and Wellbeing during exploration, which is expected to include concurrent construction, operation, and maintenance activities. Potential interactions between Project activities and all VESECs are provided in **Table 3-5** in **Section 3 Methods.**

The Project is expected to interact with Community Health and Wellbeing. Most Project activities are anticipated to have a minor interaction. The assessment of potential interactions between Community Health and Wellbeing and selected Project activities is focused on assessing the interactions that may result in adverse effects. Project interactions and associated effects are described in this section. Interactions with Project components and activities expected to result in either no effects or a small effect that would result in no measurable change from existing conditions are described in **Section 11.1.4.1 Rationale for**

No or Negligible Interaction to provide a rationale for these findings. Interactions that are anticipated to result in a more substantial effect are described in **Section 11.4.1 Interactions**.

11.4.2.1 Rationale for No or Negligible Effects

Potential interactions that were evaluated as having no or negligible effect with the Project are described below and are not considered further in the assessment.

11.4.2.1.1 Negligible Effect on Human Health Associated with Changes to Drinking Water Quality

First Nations Citizens and other land users present in the LSA may drink from surface water sources while engaged in activities on the land. For example, key informant interview data confirms First Nations land users boil snow for use as drinking water during winter land use activities (see **Appendix 11-A** for further information). Key informant interview data also identifies that surface water is sampled to establish baseline conditions for creeks and rivers within Vuntut Gwitchin First Nation territory, with the Whitestone River being used as an important cultural area for harvesting trips. The extent of surface water use for drinking water by other First Nations and LSA or RSA community land users is unknown, particularly during spring, summer, and fall months. Information about whether this water is treated or boiled before consumption is also uncertain. Therefore, a conservative approach is required, and it is assumed that people in the LSA may be using surface water for drinking, which could affect human health if water sources contain COPCs.

Drilling activities have been noted as a concern by First Nations Citizens, noting they are concerned that fluid injections from drilling at well sites may change groundwater quality. These are acknowledged as key concerns by LSA and RSA communities, and as an important indicator of community perceptions and potential stressors to mental health. Gwich'in Tribal Council expressed concern about spills and the effect of fluid injection in geological formations on groundwater specifically. Gwich'in Tribal Council also requested that Chance outline the risk levels for each well to be explored, based on the type of fluid used for injection and the spill response plan to be shared with Gwich'in Tribal Council when a spill occurs. Gwich'in Tribal Council also identified concerns about the use of temporary and permanent Project roads affecting water quality and associated risks to fish within the LSA. First Nation of Na-Cho Nyäk Dun identified concerns about the potential for soil and surface water contamination resulting from the drilling project, with particular attention to the active injection wells and well maintenance activities. Vuntut Gwitchin First Nation and residents of Old Crow also expressed concerns around the impact of seismic activities and drilling locations (and related effects) to water quality, and that water was a key issue for them.

Current COPCs present in surface water within the LSA include aluminum, cadmium, copper, iron, and manganese in levels that exceed the Canadian Water Quality Guidelines for the Protection of Aquatic Life (see **Section 5 Water Resources** and **Section 6 Fish and Fish Habitat).** Isolated surface water quality that exceeds drinking water guidelines within the LSA include:

- arsenic from Chance and Dalglish creek sites;
- selenium from McParlon, Eagle and Dalglish creek sites; and,
- mercury, which was observed to be slightly elevated in a single sample at a single site (Environmental Dynamics Inc. 2023a; Moher 2023).

These exceedances occurred at specific sites for specific chemical parameters (**Section 5 Water Resources**) (Moher 2023). The source of these elevated COPCs is unknown, though naturally occurring metals are known to be present in regional soils (Moher 2023).

Project components that could negatively affect the quality of surface water used for drinking include increased sedimentation from erosion (e.g., removal of riparian trees to accommodate temporary stream crossings, use of mobile equipment), and contaminant or nutrient influxes indirectly from increased metal concentrations (due to increased runoff). Project activities that may increase sedimentation from erosion may enhance soil erosion on waterbodies that could exacerbate the previously high level of COPCs in LSA water bodies that would impact drinking water quality for land users. The potential effects to surface water identified that some residual effects to surface water (including increased sedimentation, and contaminant or nutrient influxes) will be negligible after mitigations (**refer to Section 5 Water Resources for further discussion).**

The health risk associated with ingestion of drinking water is only present if land users within the LSA are regularly ingesting contaminated surface water (Moher 2023). There is the potential for surface water to be used as drinking water within the RSA, including Glacier Creek, Rock River, and Sheep Creek, located roughly 120 kilometres north of the LSA. These creeks all drain from the Richardson Mountain that flows into Peel or Eagle River System. While key informant interviews have confirmed that snow is boiled and used as drinking water for winter land-based activities in the LSA, it is uncertain how or if surface water is used by First Nations or recreational land users for drinking during spring, summer, or fall land use activities (e.g. harvesting, hunting, or trapping), or whether this surface water is treated prior to ingestion (refer to **Appendix 11-A** for further information). Concerns from First Nations Citizens around changes to surface and groundwater may also lead to the reduction or abandonment of land use activities within the LSA or RSA due to health and safety concerns around drinking water sources for land users. While there is limited information around land users ingestion of surface water as drinking water during spring, summer, and fall months, mitigation measures for surface water are expected to maintain negligible changes to surface water quality. The mitigation measures identified in **Section 5 Water Resources** minimize the likelihood of changes to drinking water quality, which is assessed as negligible but acknowledging the uncertainties around land user behaviour.

11.4.2.1.2 Negligible Changes to Health Associated with Changes to Air Quality

Project emissions from the use of equipment in the Project footprint (as described in **Table 3-3**) will present some local and transitory effects to air quality which could be detectable by First Nation Citizens and other land users in close proximity to the Project footprint. First Nations Citizens may be engaged in activities on the land in the LSA, such as harvesting and subsistence activities, cultural activities, and travel to traditional use areas. Ambient air quality in the LSA is assumed to be generally good as the Project is located in a remote area with limited human activity. Air quality may be adversely affected by wildfire smoke during the summer wildfire season.

Air emissions may contain contaminants of potential concern (COPC), which could be inhaled by land users (Moher 2023). COPCs for this assessment refer to any contaminant that has the potential to cause risk or adverse effects to humans related to their release in air, water, soil, or country foods (Health Canada 2017; Moher 2023). Anticipated or potential emissions from the Project are expected to include carbon dioxide emissions from fossil fuel combustion, small quantities of sulphur dioxide (if unanticipated hydrogen

sulphide is present in natural gas) during flaring activities, methane (fugitive emission in oil and gas activities), and to a lesser extent, nitrous oxide emissions may also occur (see **Section 1 Details of the Proposed Project**).

Localized Project-related changes in air quality could also occur related to flaring activities and combustion of fossil fuels primarily during the winter months (see **Section 1 Details of the Proposed Project**). There may be some minor dust generation from Project activities in the summer months, relating to seismic recording and helicopter use, though these will be intermittent and localized occurrences.

Hydrogen sulphide is not expected to be present in the reservoir based on data obtained historically by Chance and during drilling activities conducted by Chance between June 2012 and June 2013. Therefore, hydrogen sulphide from the reservoir or exposure to sulphur dioxide from flaring is not expected. The risk of greenhouse gas exposure to land users (from flaring) within the LSA is considered to be very low, due to quick dissipation into the ambient air (Moher 2023; Yukon Environmental and Socio-economic Assessment Board 2020). Based on data obtained during drilling operations and historic data, there does not appear to be naturally occurring H_2S, and exposure risks to H_2S and greenhouse gases for land users are not anticipated.

Fossil fuel combustion may affect air quality during seismic exploration and drilling activities where equipment is being operated (such as trucks, service vehicles or ATVs operating around a well site or a seismic line) (**Section 11.3 Land and Resource Use**). Combustion of fossil fuels to transport and operate equipment will be relatively low and localized in areas of active road construction or within well site vicinities (Yukon Environmental and Socio-economic Assessment Board 2020). First Nations citizens who are intermittently using areas of the LSA during their hunting or trapping periods may be able to detect localized and transitory changes to air quality due to the Project.

Some airborne particulates in the form of dust are commonly produced by vehicles driving on unpaved roads and erosion of sediment or soil from areas cleared of vegetation. The Project is not expected to produce large quantities of airborne particulates as it has been scheduled during the winter months when soils are frozen and access to well sites can be accomplished through winter roads. Most of the summer harvesting activities for First Nations would occur adjacent to the Dempster Highway, where vehicle use may release some dust particulates from the road (**refer to Section 11.1 Community Infrastructre and Services** for further information about traffic assessments relating to dust). Helicopter use in the summer months relating to seismic exploration and recording may cause increased dust in localized areas during take-off or landing in areas where the site has been cleared, those these are anticipated to be local and intermittent occurrences. There is a suitable amount of moisture in the soil during summer months that would also limit land user inhalation of dust in the LSA. Refer to **Section 11.2 Land and Resource Use** for further information on air quality.

Overall, human health risks associated with changes to air quality from Project activities are expected to be infrequent and intermittent for First Nations and recreational land users in the LSA. Based on current information, this potential effect is considered to be negligible and is not further assessed.

11.4.2.1.3 Negligible Changes to Health Associated with Changes to Traditional Food Quality

Traditional foods include plants, wildlife, fish, and other resources in the LSA that may be harvested by First Nations Citizens for consumption. For the purposes of this assessment, the Community Health and Wellbeing VESEC addresses Project interactions that may change the quality of traditional resources used as foods. Project components may adversely affect the quality of resources in the Project footprint and LSA through potential pathways such as air emissions (including dust), or release of potential COPCs to surface water and soils (due to surface runoff during freshet and rainfall events which may transport emissions and dust to water bodies). Changes to human health associated with changes to the quality of traditional foods may occur through the ingestion of plants and berries, fish, or wildlife. Key informants (including representatives from First Nations and local communities) shared through the socio-economic interview program (see **Section 11.1 Methods and Appendix 11-A**) was used to address concerns and current traditional food practices. No mapping information was available for the assessment.

11.4.2.1.3.1 Traditional Plant and Berry Harvesting

Traditional plant and berries harvested by First Nations citizens may be affected by increased fugitive dust associated with Project activities. Fugitive dust from the Project may be inhaled directly by people engaged in land-based activities, or dust may settle on vegetation in areas of the LSA used for traditional plant and berry harvesting and may be consumed. Key informant interviews identified berry and medicinal plant harvesting in the LSA, including gathering areas around the southeast corner of the proposed Project Footprint, near Dalglish Creek, Enterprise Creek, and the Dempster Highway. Traditional plants and berries harvested in these areas include blueberries, salmonberries, and cranberries. Primary interview data also indicated that a small number of First Nations land users harvest plants and berries around the Dempster Highway during the summer months).

Exposure to contaminants from fugitive dust may occur from construction activities, seismic recording, or increased transportation on access roads and around the Dempster Highway. Fugitive dust from Project activities could be inhaled by people present in the LSA, with inhalation associated with increased respiratory irritation that could have a detrimental effect to human health.

The potential for dust inhalation is expected to be limited to summer months from Dempster Highway traffic. Airborne particulates in the form of fugitive dust are anticipated to result primarily from helicopter takeoffs and landings, the use of vehicles on roads in the summer under dry conditions, during clearing or mulching of woody vegetation for seismic line preparations, excavation of the MBC sump area, and wind erosion on exposed soil.

Apart from seismic operations (including seismic exploration and recording), the majority of Project activities are scheduled for the winter months (such as the drilling exploration activities, EFT flaring, and seismic line construction) when soils are frozen and site access can be accomplished via winter roads. Any dust from seismic recording or increased transportation on the Dempster Highway that may increase dust on traditional plants and berries is anticipated to be limited, due to the high moisture content of the soils within the LSA during the summer. Therefore, fugitive dust produced by the Project is anticipated to be minimal, and the potential effects to human health associated with changing quality of plants and berries is anticipated to be negligible.

11.4.2.1.3.2 Fish Food Quality

Fish harvested during the summer months could potentially be affected by the Project, due to the potential for surface water quality changes, such as increased sedimentation from erosion (e.g., removal of riparian trees to accommodate temporary stream crossings, use of mobile equipment), and contaminant or nutrient influxes indirectly from increased metal concentrations (due to increased runoff). (see **Section 5 Water Resources** and **Section 6 Fish and Fish Habitat** for further discussion).

Key informant interview data informed that fish consumption has declined in the area due to the depletion of salmon stocks in waterbodies, with ice fishing occurring intermittently for burbot. Engagement with First Nations identified concerns around the perception of water quality and subsequent potential impacts to fish: First Nation of Na-Cho Nyäk Dun identified concerns about the potential for soil and surface water contamination resulting from the drilling project, with particular attention to the active injection wells and well maintenance activities. Vuntut Gwitchin First Nation and residents of Old Crow also expressed concerns around the impact of seismic activities and drilling locations (and related effects) to water quality, and that water is an important issue.

As described in **Section 6 Fish and Fish Habitat**, existing conditions indicate that the LSA provides a summer habitat for fish, though no salmon species were detected during summer or winter fish surveys. During the winter, most waterways were frozen to the bed, dewatered, or had dissolved oxygen levels that could not sustain fish. While most Project activities will be conducted during the winter (i.e., EFT flaring, drilling exploration, well injections, access trail and seismic line construction), it is understood that seismic recording will occur during the summer months. Best practices were considered for bore well design and operation practices in order to support environmental protection measures from contamination.

While perceived impact to fish quality may impact the quantity of fish caught in the summer by First Nation land users, primary interview data indicates that there has not been a high volume of land users fishing in the area due to existing declines in salmon and other fish species in nearby waterways. Therefore, changes to health associated with changes to fish food quality is anticipated to be negligible.

11.4.2.1.3.3 Game Foods (Wildlife) Quality

Project components could result in increased COPCs in surface water or soils. Based on current information, Project-related activities are not expected to result in elevated tissue concentrations of COPCs in wildlife within the LSA. Wildlife may also be affected by Project-related changes to sensory conditions (such as noise, vibration, and light), which could result in changes to wildlife movements and avoidance of affected areas.

Yukon First Nations land users may hunt and trap game animals in the LSA (Moher 2023). Key informant interview data noted that marten, lynx, wolves, moose, and caribou are hunted and/or trapped within traditional territories that overlap with the proposed Project Footprint. Trapping in the Eagle Plains area by Yukon First Nations largely occurs around the Dempster Highway, and usually in the winter season for marten, lynx, and wolf furs. Caribou and moose hunting occurs by Yukon First Nation land users in the spring and fall in the area around Old Crow. Hunting, trapping, and harvesting of wildlife is an important key for cultural continuity which informs health and wellbeing for Yukon First Nations.

Further information and detail relating to key informant interview summaries can be found in **Appendix 11-A**. The majority of hunting and trapping activities are understood to occur around the Dempster Highway

during the winter months and around Old Crow during the spring and summer months. There is no direct contaminant exposure for wildlife from Project activities that would expose Yukon First Nation land users to contaminants through the ingestion of wildlife. Based on current information, this potential effect is negligible and is not further considered in the assessment.

11.4.2.1.4 Negligible Effects to Access to Healthcare Services

Increased demand from Project employees and staff on healthcare services in LSA and RSA communities could put additional pressure on healthcare services in LSA and RSA communities. The additional demand could in turn contribute to reduced access and/or longer waiting times for LSA community members, which could negatively affect health outcomes for some individuals if.

The communities in the Social Determinants of Health LSA and RSA include Whitehorse, Old Crow, Fort McPherson (NWT), Dawson City, and Village of Mayo. These communities have a variety of healthcare services and community services related to long-term healthcare (such as nursing and residential care facilities), social services, and addiction services. Key informant interview data identified that current healthcare staff in LSA and RSA communities tailor educational programs and workshops to the community's needs. Services are scheduled to accommodate and target specific sub-groups within community populations in an attempt to reduce current healthcare access barriers.

The Project workforce will be small (roughly 75–80 staff), with direct employment opportunities varying based on Project components. The highest demand for project labour will be during Exploration (specifically during the winter drilling and EFT activities). Project employees will have access to a full-time nurse practitioner on site at the main Chance Camp (see **Section 1 Details of the Proposed Project**). Project medical emergency plans include identification of nearest hospital, alternative hospital locations, and transportation protocols (e.g., use of medivac where needed, airlift to Whitehorse) (see **Section 1 Details of the Proposed Project**). It is not anticipated that Project workers or their families will relocate to LSA or RSA communities or create a measurable demand on existing healthcare services. Given the small workforce for the Project, it is unlikely that there would be additional pressures placed on accessing regular healthcare services in the LSA and RSA. Access to healthcare services is assessed as negligible and is not carried forward for further assessment.

11.4.2.1.5 Negligible Effects to Infectious Disease Rates

Transmission of infectious diseases is an important consideration in camps where many people are working in close quarters. This issue is also important to communities in the LSA and RSA if workers visit or live in LSA and RSA communities. The Chance Camp is located on the Dempster Highway at km 324, and is anticipated to have a small labour force, with some employees residing at the Eagle Plains hotel for short periods of time that may encounter hotel employees or other temporary hotel residents. Given the remote location of the Chance Camp, it is not anticipated that employees would be at high risk of spreading any camp-wide infectious disease outbreaks into the LSA or RSA communities. As a result of this analysis, the potential interaction of the Project with infectious diseases is not carried forward for further assessment.

11.4.2.2 Interactions

Project components and activities interactions with Community Health and Wellbeing were evaluated following the approach in **Section 3.1.4.1 Project Interactions and Potential Effects.** Three potential effects are expected for Community Health and Wellbeing:

- A potential adverse effect on human health associated with personal and relational safety; and,
- a potential adverse effect on human health associated with changes to First Nations cultural practices.

The pathways for the potential adverse effects are described in the following section.

11.4.2.3 Potential Effects

11.4.2.3.1 Potential Adverse Effects to Health Associated with Personal and Relational Safety

Personal safety refers to the conditions necessary to prevent harm and worry around changes to physical and emotional safety, such as through hostility, aggression, and harassment (Vector Research, Hanson and Associates, and Jen Jones Consulting 2022). Relational safety considers Indigenous perspectives and knowledge of safety and focuses on the broader relationships between an individual and their community, the land, and ecology (Vector Research, Hanson and Associates, and Jen Jones Consulting 2022). This includes how a person's identity can expose them to different forms of discrimination, violence, or harassment, and other harms that affect relationships to land, family, and community.

This subsection assesses personal and relational safety subcomponents related to the Project. The Project may affect personal and relational safety in LSA and RSA communities through increased availability of substances (including alcohol and illegal drugs), which may contribute to increased substance use and crime in LSA and RSA communities. Key informant interview data are used to support this assessment, for further details please refer to **Appendix 11-A.**

11.4.2.3.1.1 Substance Use

Employment related to the Project may increase the average income of people living in the RSA, including local First Nations employees hired for Project activities, or indirectly through increased economic opportunities for local businesses (refer to **Section 11.5 Employment and Economy** for further detail). Although increased income is rightly viewed as a positive economic effect, increased income may also adversely affect community health and wellbeing through contributing to increased substance use. Some Project workers may also increase their substance use because of having increased income during off-rotation periods. There is no anticipated increase in the availability of alcohol in communities within the RSA relating directly to the Project, although larger incomes from Project employment opportunities may make alcohol and substances more affordable to workers and their families. The increase in incomes may also increase demand for recreational and illegal drugs, which would fuel an increased local supply and availability for residents.

Substance use (including use of alcohol and drugs) is closely related to both individual physical and mental health and personal and relational safety, including increased incidences of crime. The data available on substance use and consumption can be an indicator for the prevalence of substance use-related incidences

within the LSA and RSA. In Yukon overall as of 2015, adults aged 25 and over made an average of over 1,000 visits to the Emergency Department annually for problems directly associated with drug and or alcohol use (Government of Yukon 2015). While Old Crow is a dry community (alcohol is prohibited), there is currently a community emergency declaration for Old Crow by Vuntut Gwitchin First Nation to recognize the substance use crisis faced by residents of Old Crow and the broader Vuntut Gwitchin community due to increased drug poisoning from alcohol and opioids (MacIntyre 2023).

The Government of the Yukon declared a substance use health emergency in January 2022 in response to the ongoing effects of contaminated illicit drug supplies across the territory (Government of Yukon 2022b). Support centres for mental wellness and substance use services are available at the Dawson City Health Centre in Dawson City, as well as in Whitehorse for withdrawal management services, counselling, and intensive treatment programs (Government of Yukon 2022b). Key informant data interviews indicated that the COVID-19 pandemic exacerbated feelings of isolation and stress, which likely led to a spike in substance use in remote Yukon communities.

Although Chance cannot be responsible for any employee's actions while not at work, the company can promote a reduction of substance use harm among its employees and the employees of any Project contractors to help ensure a safe worksite, reduce employee turnover, and help to protect the general health and wellbeing of its employees and their communities. The Project will run a substance-free workplace to enhance safety, with substance testing required by individual employees. However, potential adverse effects on health could occur if employees increase their alcohol use during the weeks they spend at home. Additional measures to reduce risks related to increased alcohol and substance use may include support through the provision of information about health and wellness education resources available to employees and their families, and access to counselling services made available through worker benefits.

The Project labour force is anticipated to be small (approximately 75-80 persons at the main camp), and moderate precautions are taken within the assessment to reflect the context of the RSA, where there are higher levels of vulnerable community members and an ongoing, territory-wide state of emergency in Yukon for drug poisoning). Based on the analysis summarized above, the potential effect on community health and wellbeing related to increased substance use is carried forward for further assessment.

Mitigation measures, such as the implementation and enforcement of Project employment and anti-discrimination policies, and cultural awareness and sensitivity training) have been identified for minimizing (and wherever possible) avoiding increases in violence and crime. Mitigation actions and policies will help increase the positive outcomes of the Project and reduce the adverse risks of increased income (such as drug and alcohol consumption, and the effects of stress from work rotations on individuals, families, and local communities). Steady employment and increased incomes are associated with better individual and family health, and improved family stability. Once construction and exploration activities are completed, there will be a reduction in the workforce. Thus, potential effects are predicted, with increased income offering both positive and negative effects to LSA and RSA communities. This is carried forward for further assessment.

11.4.2.3.1.2 Crime

There is potential for increased crime and subsequent demand on policing services from LSA communities (as described in **Section 11.3 Community Services and Infrastructure**), which would be associated with increased presence of transient workers from the Project in LSA communities. Key informant interview data

identified that within RSA communities there are generally few instances of crime, largely made up of thefts and public disturbances (refer to **Appendix 11-A** for further information). Key informant interview data also indicated that RSA communities generally share similar crime patterns to other small and remote northern communities, with the isolation and lack of winter employment anecdotally linked to restlessness and crime increases during the winter months.

An adverse effect on community wellbeing may occur based on alcohol and drug-related crimes resulting from an influx of transient workers recreationally visiting RSA communities during off-shift rotations. Chance will transport employees from the LSA and RSA communities directly to their home and back to the work site. Employees hired from outside the local northern region will also be transported to and from site and home base, while passing through Dawson or Whitehorse. It is anticipated that there will be limited or no interaction in local communities from Chance employees during these transitions. In addition, limited number of workers (approximately 25) will be located at any given time at smaller fly-in camps at remote well sites, roughly 40 kilometres from the Chance Camp. It is currently unknown whether workers will be in communities during any phase of Project activities, or whether they would be visiting RSA or LSA communities during their 10 day off-rotation shifts.

Police services in LSA communities are provided by the Royal Canadian Mounted Police (RCMP) detachments within each RSA community. RCMP detachments are present in Whitehorse, Old Crow, Fort McPherson, and Dawson City. The RCMP also provides policing services to the community of Mayo and surrounding area, although limited information is available for this detachment (Royal Canadian Mounted Police 2023).

11.4.2.3.1.3 Summary

While the Project has a small work force in a remote area, there remains uncertainty as to whether local residents will be employed by the Project (see **Section 11.5 Employment and Economy**), and uncertainty on whether and to what extent non-local (out of region) employees will be visiting LSA and RSA communities. The Project could increase substance use rates within LSA and RSA communities, which may subsequently increase crime rates, as seen in seasonal patterns of petty crime incidents noted through key informant interview data.

Substance use increases in RSA communities are currently high and precautions are taken within the assessment to address the uncertainty of actual substance use rates for local and transient employees. The potential for substance use to increase in LSA and RSA communities as a result of the Project may contribute to a change in personal and relational safety for LSA and RSA communities, and this effect is carried forward for further assessment.

11.4.2.3.2 Potential Adverse Health and Wellbeing Effects Associated with Changes to First Nations Cultural Practices

Connection with the land, culture, and tradition are essential foundations for diverse First Nation wellness (Council of Yukon First Nations 2015). Project components that could negatively affect the ability of Yukon First Nations Citizens to engage in cultural practices may therefore have an indirect effect on community health and wellbeing. For example, Project components such as seismic recording, drilling, and transport of materials, workers and equipment will create noise and visual changes. These sensory disturbances may result in altered wildlife behaviour, that may subsequently reduce traditional food quantity or access.

Engagement activities identified concerns around changes to land that may negatively affect spiritual and cultural uses and relationships to the land, thereby negatively affect mental health of First Nations Citizens (see **Section 2 Consultation and Engagement** for further detail). Vuntut Gwitchin First Nation and residents of Old Crow identified concerns about changes to the land in relation to potential Project effects to permafrost, air and water quality, seismic activities, drilling locations, and overall effects on the Porcupine Caribou Herd. Similarly, Gwich'in Tribal Council identified concerns around climate change from Project-related activities that may change the land and wildlife that Gwich'in Participants depend on for food, land use, and travel for traditional purposes. Tr'ondëk Hwëch'in First Nation identified concerns related to permafrost and the Porcupine Caribou Herd from Project-related effects, noting that the herd not only has high value as a source of traditional food, but that the herd is important for cultural and spiritual wellbeing.

Ongoing engagement with LSA and RSA communities identified how First Nations teachings around traditional food may extend beyond subsistence activities to include cultural values, teachings, and perspectives around identities and community responsibilities. The Project may disrupt the protection, persistence, and living of Yukon First Nations indirectly either through physical changes to the environment, reduced resources used (including traditional food resources), or effects on the experience of being on the land and water in ways that inform Yukon First Nations' health. Yukon First Nation Citizens in the RSA may be discouraged from harvesting plants for traditional foods or medicines, or hunting and trapping, due to perceptions around reduced availability of vegetation and wildlife, access restrictions related to safety from the winter access trails, or increased noise affecting the experience. Key informant interview data and ongoing engagement with Yukon First Nations have identified concerns relating to the potential reduction in hunting for fur-bearing animals (particularly moose and caribou), as well as Project-related effects that may impact permafrost and Porcupine Caribou Herd migrations and behaviours. Refer to **Appendix 11-A** for further information from key informant interviews.

Perceived effects on the quality and quantity of traditional foods, including plants, berries, and culturally important wildlife species (such as the Porcupine Caribou Herd, moose, marten, lynx, and wolf) may adversely affect First Nation members participation in harvesting and subsistence activities, as well as cultural and spiritual practices relating to health and wellbeing. The real or perceived potential for the Project to adversely effect traditional foods may adversely affect the perceived value of traditional foods and could lead to a decline in harvesting activities in the LSA or RSA. This may have an indirect adverse effect on First Nation health and wellbeing based on culturally defined understandings of health.

First Nation Citizens that practice traditional activities within the LSA may come into closer proximity to Project-related sources of noise, but this would be minimal, infrequent, and intermittent in exposure. Due to the minimal nature of the potential exposure to noise to First Nation Citizens and recreational land users, the risk of effects to human health for First Nations and recreational land users from noise is predicted. It is possible that Project-related sources of noise could influence wildlife behaviours, leading to avoidance behaviours and a reduced wildlife presence at areas with noise, light disturbances, and other sensory effects (particularly for moose and caribou, which are culturally important species for RSA communities). Refer to **Section 9 Caribou** and **Section 10 Wildlife and Wildlife Habitat** for further information on wildlife behaviour assessments.

The avoidance or reduced presence of traditional game species may alter how Yukon First Nation land users hunt and trap in the LSA across the exploration activities of the Project. It is unknown how this may impact quantity of traditional foods, though a low disturbance rate is anticipated. There are no anticipated

effects to hunting, trapping, or fishing, or the cultural activities practiced within sustenance harvesting areas as a result of Project-related noise (see **Section 11.3 Land and Resource Use**) (Government of Yukon 2021).

In addition to the potential effect to community health and wellbeing due to physical changes associated with the Project, Project employees that are locally sourced from LSA and RSA communities may experience reduced health associated with changes in their ability to practice traditional cultural activities due to the boundaries of employment. Stress relating to shift rotations for local First Nations employees and its associated lifestyle changes may lead to increased workplace stress and isolation, and a reduced feeling of health if cultural practices on the land are not able to be maintained. There is a potential adverse health effect of the Project on mental health and wellness in potentially affected communities, where effects related to stress on workers and their families can increase due to shift rotations and associated lifestyle changes. There is a potential adverse effect for First Nations and recreational land users' mental health and wellness, understanding that visual changes to their landscape and land use experience may impact their mental health and wellbeing.

Enhanced measures associated with current traditional Land and Resource Use (see **Section 11.3 Land and Resource Use**) may be used to support the local values and potential benefits that the Project can contribute to the potentially affected First Nations through all phases of the Project.

Based on current information, health and wellbeing changes associated with Project-related changes to Yukon First Nations cultural practices is predicted as a potential adverse effect.

11.4.3 Mitigation or Enhancement Measures

The Project design includes management measures to avoid or reduce anticipated effects that have been identified through ongoing engagement, applicable standards, guidelines, and Best Management Practices. These include components listed in **Table 11-21** relevant to addressing Project-related effects.

Table 11-21. Mitigation Measures Relevant to Community Health and Wellbeing and the Eagle Plains Exploration Project

Mitigation and Management Measure	Potential Effect Addressed by Mitigation
Continued use of the main Chance Camp and remote camps to accommodate employees	Minimizes needs for a commuting workforce and reduces changes to personal and relational safety for RSA and LSA communities.
Implementation of substance-free workplace to enhance safety, with substance testing required by individual employees	Reduces changes to personal and relational safety for RSA and LSA communities.
Transportation of local and southern Yukon employees directly from Chance Camp to their home and back to work site	Limit or reduce interactions in local communities from Chance employees during these transitions to reduce changes to personal and relational safety for LSA and RSA communities.
Implementation and enforcement Project anti-discrimination policies, harm reduction training, and cultural awareness safety training	Support employees experiencing difficulties with substance use or discrimination; supports local First Nation employees' traditional practices and cultural important time periods; reduce changes to personal and relational safety for local First Nations employees and RSA and LSA communities

Mitigation and Management Measure	Potential Effect Addressed by Mitigation
Providing space (if available) for people to quietly connect with online Alcoholics Anonymous or Narcotics Anonymous meetings where rooms are available	Support local First Nations employees experiencing difficulties with substance use; reduce changes to personal and relational safety for RSA and LSA communities.
Cultural awareness through cultural safety training and cultural awareness training for Project employees may be supportive through such practices as describing traditional land and resource uses, traditional territories, and other important cultural dimensions of local Yukon First Nations through the Introduction and Overview of the Project area during new employee orientation. The Project may also enhance employee understanding through supportive practices that allow for First Nations and other Indigenous employees to pursue traditional activities on the land (outside of Project area) during their off-shift work rotation schedules.	Supports local First Nation employees' traditional practices and cultural important time periods; reduce changes to health associated with reduced access to First Nations cultural practices and traditional food sources
Take measured approach under guidance of the NYRLUP to limit potential negative effects to ungulates from Project activities	To reduce altered behaviours and avoidance in game animals that would impact First Nation Citizens harvesting, hunting, and trapping in the LSA and RSA
Noise management plan to provide further direction on reductions in noise exposures for land users in the LSA	To reduce altered behaviours and avoidance in game animals that would impact First Nation Citizens harvesting, hunting, and trapping in the LSA and RSA
Reduction or limit to Project activities during key wildlife timing windows (i.e., rutting, or calving season)	Reduce impact on First Nation Citizens access to land and quantity of traditional food sources

11.4.4 Residual Effects Characterization

The assessment approach used to assess the characterization of potential adverse effects follows the methodology outlined in **Section 11.1.4.3 Characterization of Residual Effects**, based on the definitions for residual effects classification criteria specific to Socio-economic VESECs presented in **Section 11.1 Methods.**

Residual adverse effects to Community Health and Wellbeing VESEC include:

- residual adverse effects to community health associated with personal and relational safety; and,
- residual adverse effects to community health associated with changes to First Nations cultural practices.

11.4.4.1 Residual Adverse Effects to Personal and Relational Safety - Increased Substance Use

Despite mitigation measures aimed at supporting employees in reducing harm from substance use (inclusive of alcohol, opioids, and other illicit drugs), the Project may contribute to increased substance use in the LSA during construction and exploration activities, due to presence of non-residents in LSA and RSA communities and an increase in income for local employees and contractors in LSA communities (**Table 11-22**).

The residual effect is likely to be low to moderate in magnitude, assessed to acknowledge the increased vulnerability within the Yukon for a territory-wide emergency, and due to the age-adjusted rate (per 100,000 individuals) for drug poisoning in the Yukon being the highest in the country. The timing of the effect will likely reflect current substance use and drug poisoning rates. An increase in substance use indicators, including total number of emergency-department visits relating to alcohol or substance use, as well as any increases in drug poisoning deaths in the LSA may be used to monitor for any increases within the LSA.

Based on similar projects within the Yukon (Coffee Gold 2016) and the above characterization, the residual adverse effect is likely to result in **significant** residual effects for employees and community members in the LSA. The confidence in this assessment is moderate, as the proportion of employees and potentially affected LSA residents is unknown and due to uncertainty in the effectiveness of mitigation measures.

Table 11-22. Effects Characteristics Ratings and Significance Increased Substance Use (alcohol, opioids, and non-opioid drug use)

Residual Effects Characterization		Rating	Rationale
Magnitude		Low to moderate	Increased substance use rates in the north exceed Canadian averages, and the relative increase in substance use related to the Project is likely to be relatively low in magnitude, but moderate in the context of a vulnerable LSA and RSA population.
Likelihood		Likely	It is likely that there will be an increase in substance use related to an increase in incomes for employees and indirectly for LSA community members.
Geographic Extent		Social determinants of health LSA	Concern is focused on the Project workers and their families, with some connection to LSA communities that would indirectly have increased income from the Project's presence in the region.
Duration, Frequency and Timing	Duration	Short-term	Any incidents of increased substance use will likely be isolated.
	Frequency	Infrequent	Any incidents of increased substance use will likely be isolated and infrequent.
	Timing	Seasonal	Possible increase in seasonal fluctuations, though no data are available on peak times for alcohol or substance-use hospitalizations or poisoning available through Yukon Government.
Reversibility		Reversible	Any increase in substance use would likely be related to increase in income for employees and indirectly for LSA community members related to Project activities.
Context		Moderate	The number of employees (or total proportion of employees) and LSA community members that will be affected is unknown

Residual Effects Characterization	Rating	Rationale
Confidence	Low	Uncertainty in the effectiveness or implementation of mitigation measures.

11.4.4.2 Residual Adverse Effect to Human Health Associated with Changes Yukon First Nation Cultural Practices

Project-related effects to health associated with changes to Yukon First Nation cultural practices include any changes related to reduced access to the land or reduction in traditional food quantity. These may occur through Project activities that increase noise and sensory disturbances that may alter game animal behaviour and or reduce their presence in the LSA in ways that would limit or modify how Yukon First Nations land users are able to participate in cultural activities that are essential for health. Changes to health may also occur through mental health stressors relating to Project employment for local First Nations employees, such as increased stress or isolation that would interrupt their ability to practice important cultural activities. Project-related effects to health are expected to be negative, with a low to moderate likelihood of occurring, with uncertainties on total impact to quantity of wildlife in the LSA (**Table 11-23**).

Table 11-23. Effects Characteristics Ratings and Significance for Changes Health Relating to Changes to Yukon First Nation Cultural Practices

Residual Effects Characterization		**Rating**	Rationale
Magnitude		Low to moderate	Project-related activities that would affect health for Yukon First Nations land users that hunt and trap wildlife in the LSA or local First Nations employed by the Project is likely to represent a small proportion of land users accessing the LSA based on seasonal movements of wildlife.
Likelihood		Likely	The adverse residual effect may occur should exploration activities proceed. Stress from shift work structures and isolation is likely to occur for local First Nations employees due to the nature of shift work and fly-in remote camps.
Geographic Extent		Local to environmental determinants of health LSA	Concern is focused on areas where Yukon First Nations land users would typically hunt or trap wildlife for traditional food sources in the LSA, including the main Chance Camp where any local First Nations Project employees would reside.
Duration, Frequency and Timing	Duration	Short-term	If a residual effect were to occur, a reduction in traditional food quantity or access would be limited to periods where noise or sensory disturbances occur within Project exploration phase. Periods of mental stress would also be limited to phases of the Project that involve

Residual Effects Characterization		Rating	Rationale
			shift work that may impede ability to participate in cultural activities for health.
	Frequency	Periodic	Reduction in quantity of traditional foods or access may be limited to periodic phases of the Project that would include noise or sensory disturbances (i.e., seismic recording, EFT flaring, drilling activities, and well injection activities) and based on movement patterns of wildlife (e.g., for moose or caribou)
	Timing	Year-round	Project activities would occur seasonally, with majority of activities occurring through winter, that may affect year-round hunting and harvesting of traditional food.
Reversibility		Reversible	Effects of wildlife movements and behaviours are reversible; once Project activities stop, effects on traditional food quantity and access would be expected to cease.
Context		Moderate	Despite isolated nature of Project footprint, the area overlaps with traditional territories where Yukon First Nations have rights for traditional hunting and harvesting activities under the Umbrella Agreement.
Confidence		Moderate	Moderate confidence that wildlife movement effects will be limited to a small proportion of game animals that would affect traditional food quantity and access for land users. Moderate certainty about how wildlife in the annual work area may modify their local movements and consequences of those modifications for land users.

11.4.5 Significance

The determination of significance of the predicted residual effects on health associated with changes to drinking water quality, changes to personal and relational safety, and changes to Indigenous cultural practices are based on the definitions presented in **Section 11.1.4.3 Methods: Characterization of Residual Effects.** Magnitude, geographic extent, and duration are the primary factors affecting the significance determination.

The predicted Project-related impacts on First Nations and recreational land user health values are understood as both actual and perceived, understanding that varying opinions exist on whether the mitigation measures will be sufficient to ensure the lasting health of individuals, communities, land, water, and wildlife within Yukon First Nation Traditional Territories. Despite the proposed mitigation measures, community members may have remaining concerns about the damage that will extend beyond the physical environment, as land, water, and wildlife relationships are closely tied with the health and culture of the

people living within the LSA and RSA. Each of these community values are interconnected, and as a result, impacts to one value may have a ripple effect throughout each connected value. As an example, potential (actual or perceived) changes to surface water quality include contamination of drinking water that may have associated changes to human health from ingestion of contaminated sources. It may also impact traditional cultural practices or the ability to maintain relationships with fish, fishing areas, and riverbank vegetation that may be used for medicinal or traditional consumption.

The potential Project-related changes will occur throughout the life of the Project (i.e., 10 years), related to ongoing and periodic occupational exposures through seasonal Project activities, and regular movements of material, equipment, and workers to and from the Project footprint. After the implementation of mitigation measures, the Project is predicted to result in some **significant** residual adverse effects for RSA communities and First Nations land users (**Table 11-24**).

Table 11-24. Determination of Significance for Changes to Social Determinants of Health

Characterization	Definition
Significant	The low to moderate magnitude of adverse residual effects for RSA communities, including First Nations Citizens and other recreational users that hunt, trap, harvest, and access the land around the Project footprint during seasonal periods within the Social Determinants of Health LSA. Sensory disturbances from Project activities are most likely to occur during winter months, though Project design and Occupational Health and Safety measures will mitigate and reduce some risks (e.g., mental health and substance use for local First Nations employees).

11.4.5.1 Follow-Up Monitoring

To address the uncertainty of potential interactions of the Project (e.g., surface water quality for drinking purposes), follow-up monitoring is recommended to identify any unanticipated social effects and to respond adaptively through coordination with First Nations, residents of local communities, and the YESAB Executive Committee or relevant regulators (if required). Chance will organize and implement the coordination of follow-up monitoring to support identification and responses to potential community health and wellbeing effects of the Project. This coordination will involve the review of results from Chance's proposed follow-up monitoring programs, as well as feedback from First Nations and other local residents within RSA communities to provide direction on the adaptative implementation of Project design, mitigation, and benefit enhancement measures related to potential socio-economic effects.

Monitoring activities may include air, water, wildlife, or other monitoring activities as suggested by community engagement.

11.4.6 Cumulative Effects Assessment

11.4.6.1 Approach

The assessment of cumulative effects on the Community Health and Wellbeing VESEC follows the methods and criteria outlined in **Section 3.1.6 Cumulative Effects** and Section **11.1.4.6 Cumulative Effects.**

Three potential cumulative effects were identified for Community Health and Wellbeing:

- adverse residual effect to health associated with personal and relational safety; and,

- adverse residual effect to health associated with changes to Yukon First Nations cultural practices.

For the purposes of the Cumulative Effects Assessment (CEA), the discussion of cumulative effects to health associated with changes to drinking water quality and changes to Yukon First Nations cultural practices were combined, as both are attributable to a common set of sensory factors (i.e., air quality, noise, visual disturbance, water quality, traditional food quantity). The Community Health and Wellbeing CEA considers the potential residual effects of the Project on the changes to environmental conditions, and changes to use and access of the area for Yukon First Nations cultural practices that may interact spatially and temporally with past, present, and reasonably foreseeable projects and activities listed in **Table 3.8** in **Section 3.1.6.4 Cumulative Effects Analysis.**

While there is the potential for broader interactions between RSA communities and Project employment that may affect health associated with personal and relational safety, it is difficult to assess the cumulative effects for this from the list of projects provided and are not considered within the CEA.

11.4.6.2 Cumulative Effects

The Community Health and Wellbeing CEA identified ongoing projects and other reasonably foreseeable projects that may occur within the community health and wellbeing RSA defined in **Table 11-1** in **Section 11.1 Methods.** This area consists of the Game Management Subzones overlapping the Project footprint and provides a regional context for the assessment of Project-related effects to area use and access for Yukon First Nation cultural practices, including wildlife and water resources that may support access and quantity of traditional food for Yukon First Nation health. Other ongoing projects and other reasonably foreseeable projects that may contribute to changes to environmental conditions, and changes to area use and access for health associated with Yukon First Nation cultural practices within the RSA are presented in **Table 11-25** below. These include the removal and disposal of hazardous waste at the Eagle Plains Solid Waste Disposal, the construction and maintenance of the Old Crow winter and all-season road, and the development of lands for mineral, gravel, and/or oil and gas resources within the region.

Table 11-25. Past, Present, and Reasonably Foreseeable Projects and Activities Identified for Cumulative Effects on Community Health and Wellbeing

Project Name or Activity	Spatial / Temporal Overlap	Project or Activity Interaction with VESEC
Dempster Highway Granular Pit Development: km 188, 208, and 232 (proposed)	• Within RSA (within 93 to 137 km from Project) • Overlaps with 10-year life of Project (project activity will occur every 2-3 years until 2046)	• Effects on soil and vegetation; adverse environmental effects on caribou that could contribute to traditional food quantity loss or reduced access to land associated with health for Yukon First Nations
Sheep Creek Gravel Pit: km 433 Dempster Highway (ongoing)	• Within RSA (within 108 km from Project) • May overlap early period of Project (project activity will occur every 2-3 years until 2031)	• Contaminants may be introduced in small amounts and remain in the environment over several years; contributions to changes in traditional food quality associated with health

Project Name or Activity	Spatial / Temporal Overlap	Project or Activity Interaction with VESEC
Ogilvie Grader Station Solar, km 195 Dempster Highway (ongoing)	• Within RSA (within 130 km from Project) • May overlap early period of Project (construction to start from 2023-2028 and last 4 month. Lifespan of project is 25 years)	• Heritage resource loss, alteration, or destruction has the potential to act cumulatively with the potential changes to health associated with changes to Yukon First Nations cultural practices (include access to land and traditional food quantity)
Granular Pit Exploration + Development – km 158 (ongoing)	• Within RSA (167 km from Project) • Overlaps with 10-year life of Project (activity will occur every 3-5 years)	• Heritage resource loss, alteration, or destruction has the potential to act cumulatively with the potential changes to health associated with changes to Yukon First Nations cultural practices (include access to land and traditional food quantity) • Adverse effects on wildlife may act cumulatively with changes to health associated with traditional food quality or quantity
Old Crow Winter (ongoing) and All-Season Road	• Within RSA (traversing from Eagle Plains to Old Crow adjacent to the Project footprint) • Overlaps with the 10-year life of the Project (control access open in 2022 and is ongoing)	• Increased access for Yukon First Nation Citizens to traditional food harvesting, hunting, and trapping areas (potential to increase access and quantity of traditional foods)
Mineral Exploration - general	• Within RSA (potentially accessed along the Dempster Highway) • May overlaps with 10-year life of Project	• Adverse effects on wildlife may act cumulatively with changes to health associated with traditional food quality or quantity
Gravel quarries-Unnamed	• Within RSA (potentially accessed along the Dempster Highway) • May overlaps with 10-year life of Project	• Adverse effects on wildlife may act cumulatively with changes to health associated with traditional food quality or quantity
Oil and Gas – general	• Within RSA (potentially accessed along the Dempster Highway) • May overlaps with 10-year life of Project	• Adverse effects on wildlife may act cumulatively with changes to health associated with traditional food quality or quantity

Specific projects in the RSA with activities may overlap with the Project are detailed as follows:

- Several land use permits for gravel pits occur within the RSA along the Dempster Highway. Quarry pit project activities (including Dempster Highway Granular Pit Development, Sheep Creek Gravel Pit, and Granular Pit Exploration + Development) are likely to overlap with the Project if scheduled operations occur as planned. Quarry activities are predicted to result in some effects to soil and vegetation, as well as to important game animals such as caribou using explosives once every 3 to 5 years and vegetation clearage. Changes to environmental conditions for vegetation and wildlife is anticipated to be localized to small areas of the RSA, will be mostly seasonal (occurring in summer to early fall), and temporary or reversible. Post-

closure monitoring is not expected to create a change to existing conditions. The development of future gravel quarries may result in a change to environmental conditions from increased air emissions (e.g., dust), noise, and visual disturbance, that may reduce the traditional food quantity or access for First Nations Citizens or reduce the availability of lands that may impact health associated with First Nation cultural practices within the RSA.

- The Eagle Plains Solid Waste Disposal project is likely to overlap only the first few years of the Project (to be completed prior to 2026) if scheduled operations occur as planned. The project is predicted to result in some contamination of water and aquatic resources related to the release of leachate into the natural environment. Changes to environmental conditions will be localized to small portions of the LSA and temporary. Post-closure monitoring is not expected to create a change to existing conditions.
- The Old Crow winter road was opened to restricted traffic in 2022 to facilitate the movement of materials into the community of Old Crow and support future infrastructure projects (Whitehorse Star 2022). The road is anticipated to be open seasonally depending on the weather with the intent of further development into an all-season road. The Vuntut Gwitchin Government will control access and the road has the potential to increase accessibility for Vuntut Gwitchin First Nations Citizens to access remote areas within the LSA for cultural practices associated with health and wellbeing more easily.
- Existing placer and quartz claims are located outside the RSA. It is unlikely that the development of lands for mineral exploration will occur within the region. The **NYRLUP** and **PWRLUP** identify the high potential for industrial development of the RSA in relation to oil and gas production. Oil and gas exploration in the RSA is related to oil and gas claims held by Chance Oil and Gas Ltd. (the focus of this Project Proposal).

A characterization of cumulative effects for land and resource use is provided in **Table 11-26** below**.**

Table 11-26. Characterization of Cumulative Effects on Community Health and Wellbeing

Criterion	Rating	Rationale
Magnitude	Low	Ongoing projects and other reasonably foreseeable projects that may occur within the region have the potential to act cumulatively with Project-related residual effects resulting in minor changes to environmental conditions (i.e., increases in noise, and visual disturbance affecting traditional food sources, contamination of surface water sources), and/or minor changes to the access or quantity of traditional foods important for First Nation cultural practices associated with health and wellbeing. It is expected that cumulative effects will represent a minor change from existing conditions.
Likelihood	Certain to Possible	The likelihood that cumulative effects will occur is certain for ongoing projects, but dependent on the development of other reasonably foreseeable projects.
Geographic Extent	Local	Cumulative effects are expected to be localized to the Dempster Highway and adjacent to the Project footprint.

Criterion		Rating	Rationale
Duration, Frequency and Timing	Duration	Short-term to Medium-term	Cumulative effects are expected to occur throughout the life of the Project (i.e., 10 years) with some of the other projects and activities scheduled to overlap only the first few years of the Project.
	Frequency	Periodic	The cumulative effects from other projects and activities are expected to generally occur in relation to seasonal operating periods (i.e., summer or winter).
	Timing	Seasonal	The cumulative effects of other projects and activities are expected to occur seasonally.
Reversibility		Reversible	The cumulative effect will decrease or stop with closure and reclamation of the Project and/or other projects and activities.

Potential climate change effects could cumulatively interact with residual Project effects to community health and wellbeing resulting in changes to the overall natural environment and landscape for First Nations cultural practices related to traditional food hunting, harvesting, and trapping over the 10-year life of the Project. Climate change effects such as flooding, erosion, and wildfires may reshape landforms and the pattern of vegetation resulting in changes to the structure and overall character of the landscape setting within the RSA. Climate change effects such as erosion and wildfires may also affect the air quality from an increased dust or airborne particulate matter from wildfires. Community health and wellbeing associated with First Nations cultural practices may be affected by changes in the access or quantity of traditional food hunting, harvesting, and trapping areas within the RSA that are disturbed or altered by climate change effects. These may include effects such as warming temperatures, as flooding, erosion, and permafrost thaw.

11.5 EMPLOYMENT AND ECONOMY

11.5.1 Assessment Indicators and Assessment Parameters

Potential effects of the Project on employment and economy were assessed using the methods described in Section 11.1 Methods. In addition, desk-based research was conducted to gather information on the existing socio-economic conditions. The research included a review of publicly available information and secondary using official sources such as Statistics Canada, Yukon Bureau of Statistics, NWT Bureau of Statistics, First Nations websites, and community websites (see **Appendix 11-A**).The assessment indicators and parameters selected for the assessment of potential Project effects on the Employment and Economy VESEC are presented in **Table 3.2** in **Section 3 Methods**.

11.5.2 Project Interactions and Potential Effects

The assessment approach for identifying Project interactions and potential effects was a systematic review of each of the listed Project components or activities within the context of existing conditions of the LSA for each of the indicators and assessment parameters of the Employment and Economy VESEC. As indicated in **Table 3-4** in **Section 3 Methods**, potential interactions of Project components and activities are expected to result in beneficial effects to existing conditions. The potential beneficial effects associated with these

interactions and the rationale for these determinations are described in this section to provide a rationale for these findings.

Potential interactions between Project components and activities and the Employment and Regional Economy VESEC are anticipated to have the following beneficial effects:

- positive effects on local and regional employment opportunities;
- positive effects on local and regional business opportunities;
- positive effect on economic diversity; and,
- no effect on territorial and local government finances.

11.5.2.1 Demand for Local and Regional Labour

Project-related effects on local and regional employment opportunities are expected to be positive. The Project is anticipated to be conducted over a ten-year period, with all the Project components and activities (e.g., infrastructure/well development, drilling, testing, reclamation) occurring somewhat concurrently. During this period, the Project will require a small workforce of up to 70 jobs. Direct employment opportunities resulting from Project components will vary depending on the activity (e.g., seismic exploration operations, exploratory drilling and EFT testing, and associated reclamation and closure). It is anticipated that the highest demand for labour will occur during the Exploration Phase (winter), specifically during the drilling and EFT activities.

Through the Project Engagement Program described in **Section 2 Consultation and Engagement**, concerns were expressed related to the ability for First Nations Citizens and residents of potentially affected communities to access employment opportunities created by the Project. Some of these concerns are related to the lack of qualified workers and training opportunities in the LSA and RSA. Additional concerns were raised about receiving information related to the Project's employment opportunities and requirements in a timely manner (see **Section 2 Consultation and Engagement**).

Project demands for labour, goods, and services have the potential to create job opportunities for communities located within the LSA, including Old Crow, Mayo, Dawson, and Fort McPherson, as well as other communities within the RSA such as Whitehorse and other Yukon communities. Economic effects on employment opportunities in the local and regional economies can be divided into three categories:

- Direct effects: related to positions directly required by Chance for each Project component.
- Indirect effects: related to employment opportunities arising from the purchase of goods and services for the Project, and labour for the production of these goods and services.
- Induced effects: associated with consumers and households spending wages and income earned from direct and indirect employment generated by the Project.
- Detailed information on the anticipated Project demands for direct labour for the duration of the Project are presented in **Table *11-27***.

Table 11-27. Estimated Employment Requirement for the Project

Project Component	Role	Direct Employment Estimates
Seismic Program	Line preparation supervisor	2 jobs
	Equipment operators	2 to 4 jobs
	Survey coordinator	2 jobs
	Surveyor	2 jobs
	Source preparation supervisor	2 jobs
	Equipment helpers	2 jobs
	Cruisers	2 jobs
	Slashers	2 jobs
	Packers	2 jobs
	Water truck driver	2 jobs
	Line crew	2 to 4 jobs
	Wildlife monitor	2 jobs
	Heritage monitor	2 jobs
	Road/Trail Construction and Maintenance	2 to 4 jobs
Drilling Program	Wellsite supervisor	2 jobs
	Service rig	2 to 4 jobs
	Security	2 jobs
	Wireline crew	2 jobs
	Slickline crew	2 jobs
	Truck drivers/operators (e.g., water tank, vacuum truck, picker/bed truck, fuel truck)	2 to 4 jobs
	Flow test crews	2 to 4 jobs
	Tool hand	2 jobs
	Cementing crew	2 jobs
	Wildlife monitor	2 jobs
	Heritage monitor	2 jobs
General Camp Operations	Nurse practitioner/medic	2 jobs
	Camp cooks	2 jobs
	Office staff	2 jobs
	Camp attendants	2 to 4 jobs
	Maintenance and cleaning staff	2 to 4 jobs
Total		**60 to 70 jobs**

Notes:

[1]Employment estimates were developed for the purpose of this assessment based on the Details of the Proposed Project (See **Section 1**) and information provided by Chance from previous projects with similar characteristics.

[2] Actual Project employment requirements may vary depending on the outcomes of the exploration activities.

The Project workforce will likely be comprised of a range of occupations, including trades, engineering and technical, heavy equipment operators, management, administrative and support roles. Filling employment opportunities resulting from Project demands for labour has the potential to increase employment within the communities located in the LSA and RSA.

Based on a review of other projects with similar characteristics (i.e., comparable scale and scope), the Project anticipates that between 15% to 30% of the Project labour requirements will be sourced from the communities located within the LSA. Between 15% to 30% of the Project labour requirements will be sourced from the broader Yukon, and 40% to 70% from beyond the RSA (e.g., AB, BC, and NWT). Entry-level and trades positions are likely to be available to individuals located within the LSA and RSA. Direct and indirect employment opportunities (e.g., contractors) are anticipated for activities such as:

- camp operations;
- logistics for freight and crew;
- equipment operation support;
- fuel supply;
- water and waste hauling;
- environmental and archaeological monitoring;
- winter roads, airfield, and well pad construction and maintenance; and,
- drilling and seismic programs.

The ability of people to benefit from Project-related employment opportunities is related to their ability to meet the employment requirements of the contractors who will perform Project-related components and activities, as well as their level of education and training. Actual Project employment requirements may vary depending on the outcomes of the Project's exploration activities.

In some cases, Project demands for labour may exceed the number of individuals in the communities in the LSA and RSA available for work and/or with experience in occupations related to the Project labour requirements. The benefits of increased Project-related employment will be more pronounced in communities where Project labour demand exceeds or absorbs the majority of qualified individuals, such as Old Crow, Fort McPherson, and Mayo. Given the size of the labour force in occupations related to the Project employment requirements in the LSA and RSA, it is anticipated that a large proportion of Project employment requirements can be addressed from within the LSA and RSA (up to 60%) and the rest from beyond the RSA (up to 50%).

Table *11-28* provides the number of individuals working or with experience in occupations related to the Project's labour requirements in communities located within the LSA and RSA.

Table 11-28. Labour Force Employed in Occupations Related to the Project Labour Requirements

Community	Labour Force in occupations related to Project employment requirements
RSA	
Yukon	8,965 persons
Whitehorse	6,190 persons
LSA	
Old Crow	55 persons
Fort McPherson (NWT)	100 persons
Dawson	350 persons
Mayo	50 persons

Notes:
[1] Labour Force in occupations related to Project employment requirements includes individuals working on senior management occupations, natural and applied sciences and related occupations, health occupations, trades, transport and equipment operators and related occupations, natural resources production occupations, and occupations in manufacturing and utilities.
Source: (Government of Canada 2022)

Individuals in other occupations and industries will likely seek employment opportunities in Project-related occupations to meet the increased demand. This may result in an indirect positive effect on the local and regional labour market due to an increase of skilled workers in these occupations. Overall, effects related to increased employment opportunities within the LSA and RSA resulting from the Project's demand for labour are anticipated to be positive.

Other resource extraction and development projects in the Yukon with similar types of labour requirements may compete with the Project for labour and services. The Project may also benefit from workers who have been employed by mines that are anticipated to be in temporary or full closure at the start of proposed Project activities. In 2023, there were eight major mining projects in the Yukon at various stages of development, ranging from proposed developments going through the YESAB review process to active mines and those in closure or post-closure phases (**Table 11-29**). Global commodity prices are a key factor in determining if projects come out of temporary closure or begin production.

Table 11-29. Major Mining Projects in the Yukon Territory (2023)

Project	Proponent/Owner	Approximate Location in Relation to the Project's Main Camp	Stage
Brewery Creek	Golden Predator Exploration Ltd.	310 km (south)	Project Proposal Application
Carmacks Copper	Granite Creek Copper	650–800 km (south)	Project Proposal Application
Casino	Casino Mining Corporation	800 km (south)	Project Proposal Application
Eagle Gold	Victoria Gold Production	600 km (east)	Production
Keno Hill Silver District	Hecla Mining Company	600 km (east)	Production

Project	Proponent/Owner	Approximate Location in Relation to the Project's Main Camp	Stage
Minto	Minto Metals Corporation	180 km (southeast)	Temporal Closure – For Sale
Sä Dena Hes	Sa Dena Hes Mine Operating Corporation	650 km (southeast)	Permanent Closure
Wolverine	Welichem Equipment Limited	180 km (east)	Temporal Closure

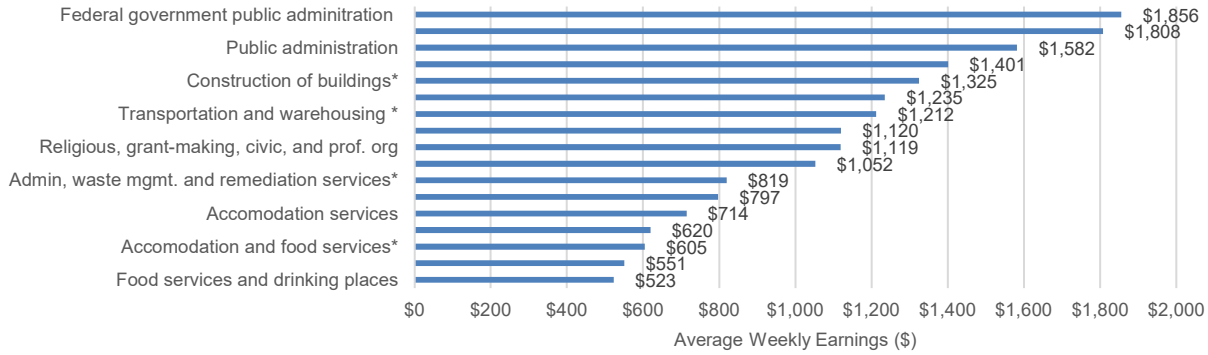
Source: (Government of Yukon 2023; Yukon Environmental and Socio-economic Assessment Board, n.d.)

In addition to direct employment opportunities, indirect benefits are anticipated for local and regional businesses that can supply goods and services to the Project. The purchase of goods and services for the Project can result in an increase in the economic activity of supplying companies, which could lead to additional indirect employment from Project-related activities.

Additional induced positive effects will likely result from the purchase of goods and services by those directly and indirectly employed by the Project. When wages and salaries are spent, the employment opportunities related to the businesses supplying these consumers with goods and services may increase (e.g., retail, hospitality, and other consumer sectors).

In addition, individuals within the LSA who may benefit from a direct Project-related employment opportunity are more likely to experience changes in their income levels than individuals working in other industries. Overall net effect on income distribution for individuals located within the LSA resulting from the Project's demands for labour are anticipated to be positive.

Information related to the average weekly earnings (including overtime) by selected industry sector and subsector for the Yukon in 2021, is presented in **Figure 11-1.**



Notes:
[1] Industry sectors, subsectors and industry groups displayed in this figure are the only ones that have average earnings data available for 2021 in Yukon
[2] * denotes the industrial sectors and subsectors directly supplying labour to the Project.
Source: (Yukon Bureau of Statistics 2021b)

Figure 11-1. Average Weekly Earnings by Selected Industry Sector and Subsector for the Yukon, 2021

Median incomes may also be influenced by the Project. Currently, effects related to income distribution are expected to be more pronounced in smaller LSA and RSA communities that exhibit lower median individual incomes. Information regarding the individual median incomes for communities located in the LSA and RSA is presented in **Table *11-30*.**

Table 11-30. Median Individual Incomes for Communities Located within the Local Study Area and Regional Study Area Communities, in 2021

	Yukon	Whitehorse	Fort McPherson (NWT)	Dawson
Total	$54,800	$59,200	$31,200	$49,600
Male	$56,400	$61,200	$28,200	$51,600
Female	$53,600	$57,200	$35,600	$46,800

Notes:
[1]Information related to the individual median income for the communities of Old Crow and Mayo was not available online.
Source: (Government of Canada 2022)

11.5.2.2 Demand for Local and Regional Goods and Services

Project-related effects on local and regional business opportunities are anticipated to be positive. Business and procurement opportunities are anticipated to be associated with all Project components. Specific information on business and procurement opportunities, such as contract amounts and timing, will be developed during detailed Project design. Potential opportunities may include, but are not limited to:

- drill rigs;
- drilling mud tanks, pumps, and mud mixing and separation systems;
- power generators;
- boilers;
- flare tanks and flare stack;
- blowout preventer accumulator system;
- fuel storage;
- well cement mixing and storage;
- storage bins for rock cuttings removed from the drilling mud;
- trailers for offices, first aid, rig crew sleeping quarters, water storage and treatment, sewage storage, and food waste incinerator;
- vehicle parts and service;
- heavy machinery;
- road maintenance equipment;
- camp catering;
- personnel transport;
- trucking services (e.g., fuel, water hauling, waste, and vacuum trucks);
- heaters;
- flow lines; and,
- metering equipment.

Through the Project Engagement Program, concerns were expressed about the ability of local and regional businesses to access Project-related business and procurement opportunities. These concerns were related to receiving information about Project opportunities in a timely manner (see **Section 2 Consultation and Engagement**).

Effects related to business opportunities in the communities located within the LSA and RSA can be divided into three categories:

- **Direct effects:** associated with direct employment and expenditures from the Project and industries supplying the Project with goods and services.
- **Indirect effects:** related to all industries comprising the Project's value chain that would supply goods and services used to directly supply the Project.
- **Induced effects:** associated with consumer and household spending wages and income arising directly or indirectly from the Project in the consumer and services industries, which in turn has the potential to create additional business opportunities within the LSA and RSA.

Businesses located within the LSA and RSA are likely to benefit from Project expenditure in goods and services, including but not limited to construction equipment, road maintenance equipment, trucking services, fuel, vehicle parts and service, provisions and groceries. The larger and more diversified economy of Whitehorse may offer a greatest range of the goods and services required by the Project.

The capacity of local and regional business that may benefit from Project-related employment and business opportunities depends on their ability to access these opportunities, as well as to meet Project procurement requirements. Further, the Project expects to source specialized services and equipment – typically not available in the Yukon – from Alberta, British Columbia, or the Northwest Territories. Drilling equipment and rigs, cementing equipment, wireline data logging equipment, and oilfield equipment rental are anticipated to be included in this category.

Overall, the net effect on local and regional business opportunities from Project demands for goods and services is expected to be positive. An increase in local and regional business and contracting opportunities is expected to contribute to the economic growth of the region.

In addition to direct business opportunities, indirect benefits are anticipated on local and regional businesses that would supply goods and services throughout the Project. The purchase of goods and services for the Project can result in an increase in the economic activity of supplying companies. Throughout the Project, construction, wholesale traders, transportation, and warehousing are among the industries likely to benefit most from the oil and gas industry's purchases of goods and services (e.g., transport trucking, water hauling, vacuum trucks, and drilling equipment). Indirect employment is expected to result in induced effects from spending of wages on goods and services. When wages and salaries are spent, the businesses that supply these consumers with goods and services experience an increase in economic activity (e.g., retail, hospitality, and other consumer sectors). Information related to the businesses, by industry sector in the Yukon, available to supply goods and services to the Project is presented in **Table 11-31**.

Table 11-31. Number of Businesses Available to Supply the Project by Industrial Sector in the Yukon, 2021

Industrial Sector	Number of Businesses
Mining, quarrying, and oil and gas extraction	667
Utilities and manufacturing	103
Construction	1,154
Wholesale trade	378
Retail trade	266
Transportation and warehousing	1,891
Professional, scientific, and technical services	813
Management of companies and enterprises: administrative and support services	72
Waste management and remediation services	426
Educational services	164
Health care and social assistance	1,273
Accommodation and food services	977
Other services (except public administration)	419

Notes:
Information related to the number of businesses by industry is only available at the territorial level.
Source: (Yukon Bureau of Statistics 2023).

11.5.2.3 Economic Diversity

Economic diversity is defined as the distribution of economic activities across various industries and sectors. Diversification can contribute to the region's economic sustainability and stability by helping to reduce potential adverse effects from external shocks or downturns in specific industries. Project demand for labour, goods, and services has the potential to create additional employment and business opportunities for specific industries in local and regional economies. Changes in the structure of the local and regional economies can also affect income levels, especially if there is a transition from lower-paid employment to higher-paid employment or vice versa.

The Project is expected to have a positive effect on the construction, wholesale traders, transportation, and warehousing sectors, as well as on industries supplying goods and services to those sectors. The increased demand for labour is expected to be covered by the labour force in the Yukon working in these sectors. As of 2021, the Yukon had 2,045 construction businesses, 865 transportation and warehousing companies, and 290 wholesale traders (Yukon Bureau of Statistics 2022).

The Yukon had a Gross Domestic Product (GDP) of $2,933 million in 2021. The largest contributor was the public administration sector, with $661.1 million in economic output, representing 23.1% of the Yukon's GDP. Depending on the proposed Project components and associated activities, the annual capital spending for the Project is anticipated to range between $15 million and $35 million per year, representing between 0.5% and 1.1% of the Yukon's GDP for 2021.

The economic sectors that may benefit from the Project are relatively small in comparison. In 2021, the construction sector represented 9.9% of the total GDP, transportation and warehousing represented 2.3%, and wholesale trade represented 1.3% of the GDP. Information related to the Yukon's GDP for 2021 is only available at a territorial scale (Yukon Bureau of Statistics 2021a).

The Project is anticipated to strengthen the local and regional, construction, whole sales, transport, and warehousing sectors. This is expected to contribute to strengthening the regional economy and the economic diversity of communities located within the LSA. Therefore, Project-related effects on local and regional economy diversity are expected to be positive and are not considered further in the assessment.

11.5.2.4 Territorial and Local Government Finances

The Project is anticipated to have a net positive effect over territorial and local government finances. The Project has the potential to indirectly contribute to the Government of Yukon and local government finances through payment of income taxes paid by individuals and businesses directly and indirectly benefiting employment and business opportunities arising from the Project. In turn, income tax contributions will depend on the changes of income levels of individuals and businesses within the LSA and RSA who are directly and indirectly benefiting from Project-related employment and business opportunities.

Considering the number of individuals and businesses expected to benefit from Project-related employment and business opportunities, changes in territorial and local government finances from income taxes are expected to be negligible and are not considered further in the assessment.

Although the Government of Yukon has an oil and gas extraction royalty program, no oil and gas production is currently occurring, and no royalties are being collected. Based on the anticipated level of oil and gas to be produced through the EFT program, the Project is not expecting to conduct payments for oil and gas royalties. Chance will monitor oil and gas production of the proposed wells (see **Section 1 Details of the Proposed Project**) and determine if and when royalty payments to the Government of Yukon are required. No Project-related effects on territorial and local government finances are expected from the payment of oil and gas royalties and are not carried forward in the assessment.

The Project will contribute to the finances of the territorial government through the payment of land lease fees. Since the Project is located on Crown lands, the Project is required to pay land lease fees to the Government of Yukon. The Project is anticipated to have a net positive effect on territorial and local governments finances from the payment of land lease fees. However, the amount the Project expects to pay for this concept will not be significant enough to alter the Government of Yukon finances.

Project demands for emergency services and road infrastructure has the potential to increase demands on community infrastructure and services and impose additional costs to territorial and local governments. Potential effects and mitigation measures for the potential effects to local and regional infrastructure and services are qualitatively assessed in the Community Infrastructure and Services VESEC (**Section 11.2**).

Community Infrastructure and Services VESEC (**Section 11.2**) does not identify any adverse effects on demand for physical infrastructure. The increased demand for emergency services is expected to be negligible and are not carried forward in the assessment.

11.5.3 Mitigation or Enhancement Measures

Mitigation measures include any practical means or measures implemented to avoid or reduce potential adverse socio-economic effects resulting from the Project. Proposed enhancement measures are intended to improve positive effects (i.e., Project benefits). Proposed enhancement measures for Employment and Economy were developed based on feedback gathered through the Project Engagement Program (see **Section 2 Consultation and Engagement**), industry best practices, and knowledge gained from previous projects with similar characteristics.

The selection of mitigation and enhancement measures for Employment and Economy was based on primary and secondary data collection, review of mitigation and enhancement measures, monitoring programs from previous projects with similar characteristics, and input provided by First Nations and residents through the Project's Engagement Program.

11.5.3.1 Local and Regional Employment Opportunities

The overall effects of Project-related components and activities on the regional economy are anticipated to be positive. The Project's demand for labour may result in some effects on local employment, as the Project will require labour from other industries. These effects are expected to be offset by an increase in employment and business opportunities throughout the duration of the Project. While mitigation is not required, the Project will develop strategies designed to enhance local and regional benefits by identifying opportunities to increase local direct employment and by promoting the procurement of Project-related goods and services from regional suppliers. For additional information, refer to **Section 1.4.13 Proposed Project Benefits.**

11.5.3.2 Local and Regional Recruitment Strategies

Opportunities exist for enhancing employment benefits in the region by increasing the percentage of direct employment for the Project from within the LSA and RSA. Proposed enhancement measures associated with local and regional recruitment strategies may include:

- Communicate with local and regional educational institutions and local and regional communities on training requirements for entry-level and trades positions within the Project to support the potential availability of training opportunities for local and regional residents.
- Promote the recruitment of qualified local and regional workers (e.g., First Nations Citizens and residents of potentially affected communities), including those aspiring to level entry positions.
- Develop culturally appropriate employment policies that enable First Nations Citizens to access potential employment opportunities and participate in traditional harvesting and cultural activities if and when appropriate. First Nations Citizens who intend to participate in these activities will be required to inform interested parties (e.g., supervisors and contractors) in advance so that work schedules can be adjusted accordingly.
- Communicate relevant information (e.g., qualifications, years of experience, certifications) promptly regarding potential Project- employment opportunities to help potential candidates to obtain necessary training and experience. Employment opportunities will be advertised through local organizations, local and territorial governments, community mural boards, social media platforms (e.g., Facebook), and the Project website.

In accordance with section 68 of the Yukon *Oil and Gas Act,* RSY 2002, c 162 (*YOGA*), the Project is required to establish benefits agreements outlining local and regional recruitment opportunities related to the Project. These agreements will identify employment and training opportunities for Yukon residents, especially for First Nations Citizens and residents of potentially affected communities (Government of Yukon 2002).

11.5.3.3 Local and Regional Procurement Strategies

There is the opportunity to enhance economic benefits in the region by increasing the proportion of Project-related goods and services procured from suppliers located within the LSA and RSA. Proposed enhancement measures related to local and regional procurement strategies may include:

- development of a procurement strategy that promotes the purchase of Project-related goods and services from local and regional suppliers; and,
- The Project will communicate information about any procurement opportunities, pre-qualification factors (e.g., safety certifications) and evaluation criteria in a timely manner, so that local and regional businesses have ample opportunity to prepare and seek any required qualifications before the start of the Project. Procurement opportunities will be advertised through local organizations, local and territorial governments, community mural boards, social media platforms (e.g., Facebook), and the Project website.

To meet the requirements of Section 68 of the *YOGA*, the Project will develop benefits agreements with potentially affected First Nations and communities detailing local and regional procurement opportunities associated with the Project. These agreements will identify opportunities available for Yukon-based businesses to provide goods and services to the Project (Government of Yukon 2002).

11.5.3.4 Engagement with Local and Territorial Governments

The Project will continue to engage with local and territorial governments to identify potential effects on community services and identify potential mitigation measures to avoid or minimize effects on service delivery. In addition to mitigating potential effects on service delivery, the measures identified in the Community Infrastructure and Services (**Section 11.2**) are expected to mitigate potential effects on local and regional finances from costs associated with disruption of community services and infrastructure.

Chance is committed to ongoing engagement to discuss potential benefits, uncertainty associated with assessment predictions, and unanticipated Project effects with potentially affected First Nations Citizens and residents of local communities. Chance will plan a follow-up program to support the identification and response to potential community and economic effects resulting from the Project. This will involve the review of results from Chance's follow-up programs as well as feedback from First Nations and local communities to provide direction on the adaptive management of Project design, mitigation and benefit enhancement measures related to potential socio-economic effects.

11.5.3.5 Summary of Enhancement Measures

A summary of potential effects and proposed mitigation (enhancement) measures are presented in **Table *11-32***. With proposed mitigation, no adverse residual effects to employment and economy are identified. Only positive effects are anticipated.

Table 11-32. Enhancement Measures for Employment and Economy

Potential Effect	Enhancement Measure	Project Component
Changes in employment opportunities	Recruitment strategy to increase local and regional employment.	Seismic exploration, drilling exploration, EFT and reclamation and closure
Changes in employment opportunities	Procurement policy to enhance local and regional business opportunities	Seismic exploration, drilling exploration, EFT and reclamation and closure
Changes in economic diversity	Recruitment strategy to increase local and regional employment.	Seismic exploration, drilling exploration, EFT and reclamation and closure
	Procurement policy to enhance local and regional business opportunities	
Changes in territorial and local government finances	Engagement with local and territorial governments to reduce costs associated with any disruption to service delivery	Seismic exploration, drilling exploration, EFT and reclamation and closure

11.5.4 Residual Effects Assessment

No adverse residual effects on employment and regional economy are likely to result from the Project. As such, no residual effects have been carried forward for further assessment. Similarly, no effects have been carried forward to the cumulative effects assessment.

12 EFFECTS MANAGEMENT

12.1 MANAGEMENT AND MONITORING PLANS

Management and monitoring plans and associated subplans will be developed for the Project as required, and will include safety, prevention, mitigation, management, and monitoring measures where appropriate. Developed plans may include, but not be limited to:

- Environmental Management Plan:
  - Spill Response Plan;
  - Erosion and Sediment Control Plan;
  - Water Management Plan;
  - Waste Management Plan; and,
  - Remedial Action Plan.
- Wildlife Management and Monitoring Plan:
  - Caribou Mitigation and Monitoring Plan; and,
  - Caribou Interaction Response Plan.
- Conceptual Reclamation and Closure Plan:
  - Wellsite Decommissioning and Abandonment Plan.
- Safety Management and Emergency Response Plan:
  - Blowout Prevention and Response Plan; and,
  - Medical Emergency Response Plan.
- Consultation and Engagement Plan.

12.1.1 Environmental Management Plan

The Environmental Management Plan (EMP) will describe the measures that are to be implemented by employees and contractors to minimize environmental risks and mitigate impacts. The EMP will cover the following environmental components/sub-plans:

- spill response;
- appropriate oil and fuel handling and storage;
- erosion and sediment control measures;
- water use management;
- waste management; and,
- remediation measures.

The spill contingency plan will include spill reporting procedures, types of spills and their potential impacts, spill response actions and resources, and reporting procedures. The water use plans will describe permitted water uses, sources, withdrawal limits, and measures to conform with permit conditions. The waste management planning will identify sources and types of hazardous and non-hazardous solid and liquid waste (e.g., fluid from drilling and extended flow testing, camp waste), management and mitigation actions, and measures to reduce waste.

The EMP will outline regulatory requirements with regard to the environmental components covered in the Plan, reporting agencies and contacts, record keeping, employee and contractor training, and the roles and responsibilities of employees and contractors for oversight and implementation of the EMP.

12.1.2 Wildlife Management and Monitoring Plan

The Wildlife Management and Monitoring Plan will identify terrestrial and aquatic species of conservation concern (e.g., caribou) that have the potential to be adversely affected by the Project and species-specific mitigation actions, how wildlife will be monitored during operations, and adaptive management actions if management targets are not being achieved. This will include actions to reduce human-wildlife conflict and to avoid impacts to important wildlife habitat features (e.g., active dens). The Wildlife Management and Monitoring Plan will also outline regulatory requirements, reporting agencies and contacts, record keeping, employee and contractor training, and the roles and responsibilities of employees and contractors for oversight and implementation of the Wildlife Management and Monitoring Plan and subplans.

12.1.3 Conceptual Reclamation and Closure Plan

Chance plans to complete progressive abandonment, decommissioning, reclamation, and closure activities during and following the life of the Project. The Conceptual Reclamation and Closure Plan will outline the timeline and measures used to reclaim the winter roads, appropriately suspend and abandoned wells and well pads, seismic lines, and clearings due to accessory activities, following appropriate legislation. The plan will also include monitoring and adaptive management measures for reclamation success.

12.1.4 Health, Safety and Emergency Response Plan

A comprehensive Health, Safety and Emergency Response Plan (HS/ERP) will be developed for the Project and may include the following components and subplans related to occupational health, hazard assessment, safety procedures and emergency response preparation:

- safety training requirements;
- hazard assessment planning;
- evacuation procedures;
- well blowout prevention and procedures;
- fire response planning; and,
- medical emergency response planning.

12.1.5 Consultation and Engagement Plan

The Consultation and Engagement Plan will describe how Chance will engage with affected communities and groups prior to commencing work and during the life of the Project. The Consultation and Engagement Plan will identify affected communities and groups, including Indigenous organizations/governments, and the engagement strategy for each affected party. Chance employees or contractors responsible for consultation and engagement activities will be identified. The Consultation and Engagement Plan will also describe how records of consultation, comments received, and follow-up actions will be tracked.

12.2 FOLLOW UP MONITORING

Management and monitoring plans and associated subplans, as described above, will be developed for the Project, as necessary. The plans are required as part of Project design and all Project activities, and will consider potential environmental and socio-economic effects, effectiveness of applied mitigation measures, and will include adaptive management measures and associated follow-up monitoring requirements.

13 REFERENCES

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Section 12 Effects Management

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APPENDIX A. Designated Office Evaluation Report, YESAB, February 9, 2016

YESAB
Yukon Environmental and
Socio-economic Assessment Board

Designated Office Evaluation Report

Eagle Plains Multi-Well Exploration Program

Project Number: 2014-0112

Proponent: Northern Cross (Yukon) Ltd.

Assessment Completion Date: February 9, 2016

Dawson City Designated Office

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Executive Summary

Northern Cross (Yukon), the Proponent, is proposing to drill twenty wells for oil and gas extraction in the Eagle Plains basin over an area of up to 700 km^2. In order to test the potential productive capacity of oil and gas reservoirs, the Project proposes extended flow tests for a period of up to two years per well drilled. The Proponent expects that these tests will produce a combined likely maximum of 4 000 barrels (636 000 L) of oil per day. A number of auxiliary activities are also proposed.

A central value of the assessment is the way of life of First Nations and the Inuvialuit as it relates to the Porcupine Caribou Herd (PCH). This value represents a number of interrelated and codependent sociocultural values including: community health and vitality; cultural identity and continuity; food security; and traditional economy. The Project may result in changes in access to and use of the PCH by First Nations and the Inuvialuit. The Designated Office has focused its analysis on access to and use of the PCH by FN and the Inuvialuit in order to assess potential adverse effects to this central value.

The Porcupine Caribou Management Board states that the "Porcupine Caribou are the most valued ecosystem component in the project area and are likely one of the most valued ecosystem components for the whole northern Yukon, portions of the NWT, and Alaska. Harvesting provides communities with traditional healthy food options that are directly tied to the maintenance of cultural practices, as the communities, First Nations, and Inuvialuit utilize this important resource" (YOR 2014-0112-133-1). First Nation communities that value access to and use of the PCH for their community health and vitality, cultural identity and continuity, food security and traditional economy include the:

- First Nation of Na-Cho Nyäk Dun
- Inuvialuit
- Tetlit Gwich'in Council
- Tr'ondëk Hwëch'in
- Vuntut Gwitchin First Nation

In attempting to understand whether the Project will, or is likely to have, significant adverse socio-economic effects to this value, the Designated Office considered:

- the proposed scope of activities;
- relevant proponent mitigations;
- baseline information related to access to and use of the Porcupine Caribou Herd;
- baseline information related to the Porcupine Caribou Herd;
- the North Yukon Regional Land Use Plan;
- current Porcupine Caribou interaction with the project area;

- consequences of Porcupine Caribou interaction with the Project including an examination of the potential zones of influence of the project and the potential magnitude, probability, duration, extent and reversibility of project effects; and

- the potential significance and probability of scenarios ranging from the best to the worst-case for how this Project could affect access to and use of the Porcupine Caribou Herd.

In considering this information, the Designated Office makes a number of conclusions. First, there is insufficient information to understand pre-development conditions for access to and use of the PCH and for the PCH. Second, while the North Yukon Regional Land Use Plan (NYRLUP) provides valuable guidance, there are a number of outstanding priorities that remain unaddressed by the parties to the NYRLUP.

The Designated Office is unable to determine if the Project will, or is likely to have, significant adverse sociocultural effects. The Designated Office is able to determine the significance of adverse environmental effects directly to the PCH, such as direct habitat loss and injury/mortality, from the Project; however, the Designated Office is unable to predict how the PCH will interact with the Project and as such is unable to determine the significance of adverse sociocultural effects related to the access to and use of the PCH.

The inability of the Designated Office to determine the significance of adverse sociocultural effects is rooted in an inability to predict changes in baseline movement, migration, and occupancy of the PCH as a result of project activities. Specifically, the Designated Office is unable to determine the probability or magnitude of changes to caribou migration and seasonal distribution in relation to project activities and the associated duration, reversibility, and extent of such effects. Therefore, the Designated Office is unable to determine the significance of adverse effects to these sociocultural values.

Assessment Outcome

Under s. 56(1)(d) of the *Yukon Environmental and Socio-economic Assessment Act*, the Dawson City Designated Office refers the Project to the Executive Committee for a screening, as after taking into account any mitigative measures included in the project proposal, the Designated Office could not determine whether the Project will have, or is likely to have, significant adverse socio-economic effects.

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YESAB

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1.0 REQUIREMENT FOR AN ASSESSMENT

The purpose of the Eagle Plains Multi-well Exploration Program ("the Project") is to explore and delineate the extent of hydrocarbons within the project area using extended flow tests. While several activities are likely to be undertaken in conjunction with this Project, under s. 47 of the *Yukon Environmental and Socio-economic Assessment Act* (YESAA), the Project is subject to an assessment by the Dawson City Designated Office due to the following circumstances:

- The proposed activity is listed in column 1 of Schedule 1 of the *Assessable Activities, Exceptions and Executive Committee Projects Regulations* (Activity Regulations) and not listed in column 2 as excepted. The proponent proposes to undertake activities listed in Part 3, item 1 of the Activity Regulations. The specific activity is listed as:

  On other than an Indian reserve, exploration for oil or natural gas, or other activity in relation to exploration for oil or natural gas

- Is proposed to be undertaken in Yukon; and
- An authorization or the grant of an interest in land by a government agency, independent regulatory agency, municipal government, or First Nation is required for the activity to be undertaken.

The Decision Body for this Project and associated triggering authorization for this assessment are indicated in Table 1.

Table 1: The Decision Body

Decision Body	Authorization Required	Act or Regulation
Government of Yukon, EMR – Oil and Gas Branch	Well License	*Oil and Gas Act*

2.0 REFERRAL CRITERIA

Under YESAA, Section 56(1), the Designated Office must refer a Project to the Executive Committee for a screening where

> "after taking into account any mitigative measures included in the project proposal, it cannot determine whether the project will have, or is likely to have, significant adverse environmental or socio-economic effects."

The outcome of this assessment, to refer the Project to the Executive Committee, does not require consideration of potential mitigations to reduce significance. Potential mitigations can only be considered if there are significant adverse effects. The Designated Office is unable to determine if adverse effects are significant and therefore, is unable to consider potential mitigations not included in the proposal.

3.0 CONSIDERATION OF SIGNIFICANCE

In order to mitigate a potential adverse effect, the Designated Office must first find significance. In addressing what may constitute a "significant" adverse effect, the Designated Office considered the following factors:

Magnitude: The intensity of an effect or extent of change, where "effect" is defined as the change from baseline conditions resulting from an activity.

Probability: The likelihood that an adverse effect will occur.

Duration: The length of time the effect lasts and how often the effect occurs. The duration of an effect can be short term or long term.

Geographic Extent: The geographic extent of project effects (e.g. the distance from the project and/or the area in which effects are detectable). The geographic extent of effects can be local or regional.

Reversibility: The degree to which the effect is reversible. Effects can be reversible or permanent. Reversible effects may have lower impacts than irreversible or permanent effects.

Context: The particular environmental and/or socio-economic context within which the project occurs. Context is related to the importance of valued environmental and socio-economic components, their resiliency to potential effects and the extent to which those valued components may successfully adapt to change.

4.0 VALUES CONSIDERED IN THE ASSESSMENT

The assessment of this Project considered a number of valued environmental and socio-economic components. Valued environmental components include:

- Air Quality
- Aquatic Resources
- Avian Wildlife
- Climate Change
- Water Quality and Quantity
- Wildlife and Wildlife Habitat, excluding access to, and use of, the Porcupine Caribou Herd, but including: black bears; fur-bearers; grizzly bears; moose; and wolf

Valued socio-economic components include:

- Access to, and use of, the Porcupine Caribou Herd, including the following sociocultural values that reflect the way of life of First Nations and the Inuvialuit: community health and vitality; cultural identity and continuity; food security; and traditional economy
- Heritage Resources
- Human Health and Safety
- Traditional Land Use, excluding access to, and use of, the Porcupine Caribou Herd, but including: trapping; fishing; harvesting of plants and animals; and traditional pursuits.

The Designated Office is able to determine significance of effects to – and mitigate in the event of significant adverse effects – all of the above valued components with the exception of access to and use of the PCH. As the Designated Office is unable to determine the significance of adverse effects to the access to and use of the PCH, the Designated Office is required to refer the Project to the Executive Committee under section 56(1)(d) of YESAA. As this value is the only value for which the Designated Office is unable to determine significance, this evaluation report focuses on this value exclusively.

Structure of the Referral

This evaluation report outlines the:

- value of access to and use of the Porcupine Caribou Herd (section 5.0);
- Porcupine Caribou Herd, its characteristics, and baseline properties (section 6.0);
- current interaction of Porcupine Caribou with the project area (section 7.0);
- project activities (section 8.0);
- consequence of Porcupine Caribou interaction with the Project (section 9.0)
- significance analysis conducted by the Designated Office (section 10.0); and
- conclusions of the assessment (section 11.0).

This report also includes the following appendices:

- project location, scope and proponent mitigations (Appendix A);
- baseline information related to access to and use of the Porcupine Caribou Herd (Appendix B);
- baseline information related to the Porcupine Caribou Herd (Appendix C);
- zone of influence (Appendix D); and
- consideration of the North Yukon Regional Land Use Plan (Appendix E).

5.0 VALUE OF ACCESS TO AND USE OF THE PORCUPINE CARIBOU HERD

Access to and use of caribou, for social, cultural, health, and traditional economy purposes, is a central value in evaluating the effects of the Project. Appendix B provides a summary of information gathered by the Designated Office to understand baseline conditions for how First Nations and the Inuvialuit access and use the PCH.

The NYRLUP speaks prominently to the social, cultural, and economic reasons behind the value of the PCH. The guiding principle of the NYRLUP is “beneficial socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent” (North Yukon Planning Commission, 2009). The Porcupine Caribou Management Board (PCMB) also gives prominence to the social and cultural values associated with access to caribou, for harvest or cultural transmission. A Vuntut Gwitchin First Nation (VGFN) comment best demonstrates the role of caribou being a fundamental

part of their culture, “The Creator gave the Gwich’in the Caribou to feed and sustain the people, and to keep the teachings and responsibilities to our past, current and future generations alive” (North Yukon Planning Commission, 2009).

Given the central role of the PCH in community health and vitality, cultural identity and continuity, food security, and traditional economy of First Nations and the Inuvialuit, the Designated Office requires a high degree of confidence in both effects predictions and significance determinations. When the PCH suffers, First Nation and Inuvialuit communities that rely on the herd, and have relied on for centuries, also suffer.

6.0 DESCRIPTION OF THE PORCUPINE CARIBOU HERD

Background

The PCH is a migratory barren ground subspecies of caribou, *Rangifer tarandus granti*. The herd ranges along the Arctic Coast from Alaska, through Yukon, into Northwest Territories and stretches south towards the Ogilvie and Richardson mountains. Appendix C provides a summary of information gathered by the Designated Office to understand baseline conditions for the PCH.

The herd’s population is estimated at 197 000, but with a wide confidence interval. The PCMB has a management objective for the herd population of 135 000. Baseline herd population levels are believed to be cyclical and are expected to decrease in the near future.

In relation to other barren-ground caribou herds, the PCH has the lowest capacity for growth. An Alaskan study concludes that the PCH capacity for growth is 4.9 percent, while other Arctic herds were significantly higher (Central Arctic herd 10.8 percent, Teshekpuk Lake herd 13 percent, and Western Arctic herd 9.5 percent) (USGS, 2002). The low growth rate indicates that the PCH has less capacity to accommodate anthropogenic, biological, and abiotic stresses than other barren-ground herds. As a result, any absolute effect of development would be expected to have a larger relative effect on the PCH than on other herds.

The overall population and health of the PCH is shaped by both natural effects such as forest fire and climate change, as well as anthropogenic effects, such as harvesting and industrial development.

Life history

The Arctic National Wildlife Refuge in Alaska provides critical calving and summer habitat for the PCH. Calving generally occurs during late May to mid-June annually. The post calving period is from mid/late June to July. In August, and extending until mid-October, the herd's annual fall migration begins as the PCH moves towards the wintering grounds south of the Brooks Range in Alaska and the southern Richardson and Ogilvie Mountain Ranges in Yukon. Rutting occurs for about a two week period in mid-October, after which the herd continues migrating towards the winter ranges. In the spring, migration back to the calving grounds begins in early March, with the PCH generally following three broad routes north (see Figures 9, 11 and 13 – 15 in Appendix C).

Winter is considered a difficult time for the PCH, as food sources, such as lichen, are covered in snow and can be difficult to access. In addition, the plants themselves are not as nutritious or as easily digested by the animals at this time of the year. Russell notes “whatever happens to the PCH in the winter affects the calf survival numbers, affects the pregnancy the next year, and virtually every aspect of productivity from age of first reproduction to calf survival. Winter is not considered a limiting factor for herd productivity as it is with woodland caribou herds in southern Yukon” (YOR 2014-0112-133-1).

There is overlap between the preferred winter habitat and migration routes of the PCH and the project area. The extent of high-quality winter habitat in the project area is currently unknown, as is the importance of migratory routes that overlap the project area.

7.0 CURRENT PORCUPINE CARIBOU INTERACTION WITH THE PROJECT AREA

The PCH may migrate through the area of the proposed Project in October and November while on their way to more southern wintering areas along the Ogilvie River and surrounding areas, and then may pass through the Project area again in the spring on their way north towards the calving grounds. The PCH may also choose to over-winter in the project area or its vicinity.

In any given year, there is approximately a fifty percent chance of Porcupine Caribou occupying the project area. The PCMB indicates that there may be wide use of the project area from tens of thousands of animals, to small or no groups of caribou, in a given year, and that the period of PCH presence in the project area may vary from days to all winter. During the winter of 2015, up to three quarters of the herd was in close proximity to the Dempster Highway; up to 50 000 caribou passed directly through the project area (YOR 2014-0112-267-1).

The project area is primarily a winter migration corridor for the PCH, though it may have other habitat functions for caribou in any given year. The project area straddles the divide between the Peel and Porcupine drainages; this ridgeline appears as a natural corridor for caribou movement. The Designated Office is not aware of other specific migratory corridors in the vicinity of the Project.

Natural factors and climate change

Baseline herd interaction with the project area will be modified due to the effects of climate change. The project area – and northern areas in general – is projected to experience climate change faster with greater intensity than more moderate latitudes. Climate change will result in increased variability in PCH movement, migration, and occupancy.

Natural baseline interaction between the PCH and the project area is variable due to a number of occurring factors such as snow, insect presence, temperatures, and forest fires. The project area was largely burned in the 2000s (see Figure 16 in Appendix C).

Existing disturbance

The project area has a history of oil and gas exploration. Nearly 40 wells have been drilled in the Eagle Plain basin, predominately in the 1960s and 1970s. Only five wells have been drilled since 2000, one in 2005 and four others by the Proponent in 2012. In addition to existing wells, approximately 14 000 km of seismic lines exist in the Eagle Plain basin. The project area also contains an existing authorized camp capable of housing 75 people.

The Dempster Highway was constructed through the project area in the 1960s and 1970s. To the north of the Project, 60 km away, is the Eagle Plains Lodge.

8.0 PROJECT ACTIVITIES

The Project takes place within the area of the NYRLUP. Specifically the Project is proposed in Land Use Management area 9, zone IV, which is designated for “highest development”. The Project proposes the

drilling of 20 wells across an area of approximately 700 square kilometers.[1] Support activities for the construction and maintenance of these wells includes the construction of up to 87 km of all season roads, development of 23 quarries, and the construction of a mix-bury-cover sump (see Appendix A.2. for a project scope and A.3. for a detailed description of project activities).

Extended flow testing will last for up to two years. These tests require daily access, flaring of gas (up to 2 000 000 cubic feet per day or 5 700 m^3 per day), installation of pump jacks and surface equipment, and up to 20 round trips per day by tanker to and from the Project. A central processing facility is also required. The Project will produce up to an estimated 4 000 barrels (646 000 L) of oil per day. The Project will also require two round trips by aircraft per week.

9.0 CONSEQUENCES OF PORCUPINE CARIBOU INTERACTION WITH THE PROJECT

Herd interaction with Project activities

The Proponent states that the Project will disturb caribou movements due to sensory disturbance (YOR 2014-0112-201-1). Caribou movement through the project area will be affected by a zone of influence (ZOI) surrounding the Project.

A ZOI refers to the effective area of an activity or disturbance. Developments not only exclude wildlife from their physical footprint, but also reduce the use and functionality of surrounding areas, resulting in habitat degradation through reductions in suitability. The magnitude of such effects depends on land uses and the rate at which related adverse effects decrease with distance from a project.

The ZOI for projects involving the Porcupine Caribou, or other caribou subspecies, is unclear at best and unknown at worst. Studies of potential ZOI around industrial projects in the north have demonstrated that the ZOI is not a fixed width, but rather that it changes over time given the season, animal characteristics such as age and sex, and intensity of the land use by human activities (see Appendix D for further information on ZOI).

The Project, and its associated ZOI, will likely reduce caribou occupancy and movement through the project area and along the migration corridor that bisects the project area. This effect may diminish after project completion. The magnitude of this effect, however, remains unclear.

There is a wide range of potential changes to movement, migration, and distribution of the PCH due to project activities. Different outcomes may result in significantly different effects for users of the PCH.

Direct sociocultural consequences

Changes to the migration routes of the PCH could result in fewer caribou in proximity to the Dempster Highway. The Dempster Highway is one of three key zones for accessing and harvesting Porcupine Caribou (see Appendix B, Figure 5 and 6). This change may in turn result in reduced access to and use of the PCH. This reduction may adversely affect hunter success and food security, traditional economy,

[1] Proposal documents state that the Project's area is 325 km^2; however, the Designated Office has determined that the proposed Project covers an area of 700 km^2. This was based on comparing proposed activities to those in the previous project, a 3D seismic survey (YOR 2013-0067). More details on this determination are available in Appendix A.1.

individual and community health and the opportunity for intergenerational transfer of knowledge and culture. Ultimately, this reduction may affect the way of life of First Nations and the Inuvialuit.

Herd level changes and indirect sociocultural consequences

Changes to migration routes can also result in occupancy of lesser quality habitats, increased encounters with predators, and disrupted life cycles. Changes to migration routes that change population dynamics may or may not result in sociocultural effects in either the short or long term.

Potential magnitude of effects

Changes in herd migration, distribution, and occupancy are likely as a result of project activities. The potential variation in the magnitude of changes to herd migration, distribution, and occupancy ranges between the following extreme outcomes:

- almost no change in access to and use of caribou – if migration is shifted to other areas in close proximity to the Dempster Highway; or
- to reduced access or no access to and use of caribou – if migration is shifted to other areas that are not in proximity to the Dempster Highway.

Probability of effects

Each potential magnitude of effect has an accompanying probability. The probabilities for each magnitude are unknown. The Designated Office is unable to determine how the herd might respond to the Project, which in turn makes predictions on probable effects impossible.

Herd response to development in the Eagle Plain basin is unknown, but is vitally important to the effects assessment.

The NYRLUP prioritizes further investigation of cause and effect relationships for recommended cumulative effects indicators, including:

- relationship between barren-ground caribou and land use activities, with focus on range utilization in response to surface disturbance and linear density;
- cumulative impacts of exploration and development activities on Porcupine Caribou Herd population viability; and,
- cumulative surface disturbance impacts and potential effects on habitat quantity and quality.

These priorities have not been addressed. The most recent annual report for the NYRLUP still prioritizes, in 2015, the collection of baseline data required to assess cumulative effects and developmental thresholds. Further, the Government of Yukon and VGFN still prioritize the research of "caribou related issues to address concerns related to exploration activities in the Eagle Plain region including the development of Best Management Practices as guidance to oil and gas activities and a process to establish safe operating distances and critical numbers for the Porcupine Caribou Herd" (Government of Yukon and VGFN, 2014).

The PCMB states that neither best management practices nor mitigations for caribou avoidance are known, further limiting the Designated Office's ability to determine how the Project's design and commitments influence the probability of adverse effects to caribou migration.

Based on information available to the Designated Office, both extreme ends for the range of potential magnitudes are equally probable.

Duration of project effects

The likely duration of project effects hinges upon both the magnitude and the probability of effects to the access to and use of the PCH. The duration of effects to the access to and use of the PCH is not dependent on the duration of project activities. Effects that have a larger magnitude and higher probability may result in changes to caribou migration and occupancy that may endure for longer durations.

Extent of project effects

The geographic extent of project effects hinges upon both the magnitude and probability of project effects to the access to and use of the PCH. The Project may cause potential variation in the magnitude of changes to herd migration, distribution, and occupancy ranges. The resulting extent of effects on access to and use of the PCH is equally variable in terms of geographic extent (see Appendix D for further information).

Reversibility of project effects

The reversibility of project effects hinges upon both the magnitude and probability of project effects to the access to and use of the PCH. Reversibility of effects to cultural continuity depends on duration as well. Effects that have a larger magnitude and higher probability will be less reversible, especially if cultural traditions, community well-being, and traditional economies are affected.

Contrast with similar effects assessments

Unlike previous assessments involving effects to caribou, the magnitude and probability of project adverse effects in this case are not proportional to the project size or intensity. Projects undertaken within the range of non-migratory herds have effects that are generally proportional to the size and intensity of the Project. In considering a migratory herd, the adverse effects of a Project may result in changes to migratory patterns that result in disproportional changes to habitat use and range extent. The Project is an outlier compared with previous development in the region and thus it is possible that the Project may result in disproportionate effects to caribou migration, occupancy, and distribution.

10.0 SIGNIFICANCE INDETERMINATION

The Designated Office cannot determine the magnitude of the adverse effects; it can, however, determine a range of magnitudes. Likewise, the Designated Office cannot determine the probability of adverse effects to the access to and use of the PCH.

Given the range of magnitude of adverse effects, the Project may or may not result in significant adverse effects. The Designated Office, using available information, considers both extremes, the best and worst scenarios as having equal probabilities.

In the absence of any confidence in the relevant parameters used in assessment (i.e. magnitude, probability, duration, reversibility), the Designated Office is unable to determine if the Project will result, or is likely to result, in significant adverse effects.

Consideration of Proponent mitigations

The Designated Office considered the relevant mitigations proposed by the Proponent to eliminate, reduce or control potential adverse effects of the Project to access to and use of the PCH (see Appendix A.4.). The Designated Office concludes that there are no mitigations related to access to and use of the PCH – the mitigation measures listed relate specifically to the PCH or to wildlife in general.

The Designated Office requested information from the Proponent to determine the current and traditional use of the project area by affected First Nations and possible mitigations for effects to current uses. The Proponent's response was cursory – in part, the Proponent responded that "Traditional uses of the area will be able to continue outside of the footprint of the Project and hunting with firearms can continue within the bounds identified in the Yukon Hunting Regulations" (YOR 2014-0112-199-1).

10.1 Best-case Scenario

A project best-case scenario results in no change to access to and use of the PCH. The best-case scenario is possible if:

- Changes to caribou distribution, migration, and occupancy
    - result in no change to access to caribou along the Dempster Highway;

  or

- The caribou naturally avoid the project area for the duration of the Project as a result of environmental factors, eliminating the interaction between the Project and the PCH.

The best-case scenario(s) represents an unchanged or minimal change to baseline conditions.

Significance determination of best-case scenario

The best-case scenario represents an undetectable or minimal change from baseline conditions. These changes by definition are not significant.

Probability of best-case scenario

A range of factors increases the probability of the best-case scenario. Most notably, the NYRLUP states that "specific recommendations relating to the management of oil and gas exploration and development activities are not required at this time."

Further, the project area has been a site of historic oil and gas development since the 1950s. Despite the Proponent's previous seismic survey, caribou were present in the project area numbering in the tens of thousands. The project area itself is also largely burned, resulting in less valuable habitat. The stochastic nature of PCH migration also suggests that the landscape hosts alternative or redundant habitats in a patchwork configuration.

10.2 Worst-case Scenario

The project worst-case scenario results in changes to caribou distribution, migration, and occupancy that reduces caribou presence in proximity to the Dempster Highway, reducing or eliminating access to and use of the PCH along the Dempster Highway. Alternatively disturbance effects resulting in changes in distribution, migration and occupancy may result in reductions in essential caribou habitat.

The worst-case scenario represents a significant reduction or complete elimination of access to and use of the PCH, through displacement of the herd, or reduction in the herd's long-term health and viability due to project-related changes in occupied habitat and range.

Significance determination of worst-case scenario

In the event of changes to the distribution, occupancy, and migration of the PCH that greatly reduce or eliminate caribou in proximity to the Dempster Highway, the magnitude of the effect is the complete, or nearly complete, elimination of the access to and use of the PCH in this region. The magnitude of this effect severs First Nations' and the Inuvialuit's connection with the herd. Effects to community health and vitality, cultural identity and continuity, food security, and traditional economy may be irreversible due to the central role of the PCH to these fundamental values and the way of life of First Nations and the Inuvialuit.

Changes to caribou behaviour may only return to baseline conditions in the long-term. In the worst-case scenario, the magnitude of this change results in abandonment or severe reduction in use of a large portion of winter habitat.

Comments received by Renewable Resource Councils and First Nations reinforce the significance of worse or worst-case scenarios. The Mayo Renewable Resource Council states "The large foot print and time scope of this Project could permanently adjust or eliminate the caribou migratory pattern through this area, to the disadvantage of the First Nations subsistence hunters and all others" (YOR 2014-0112-243-1). The Gwich'in Tribal Council further elaborates on the potential significance of a worse or worst-case scenario,

> Without regular use of sites the knowledge of those sites may diminish over time as knowledge is forgotten or not passed on to newer generations. At a certain temporal range, an environmental effect that prevents a harvester from accessing a traditional site or seasonal round may mean that such site specific practices are lost for a much longer duration than the project effect lasts for in the biophysical sense. (YOR 2014-0112-127-1)

Most succinctly, one comment from a VGFN citizen clearly states the significance of a worst case scenario, "it could lead to the permanent destruction of what I hold most closely to my heart" (YOR 2014-0112-109-1).[2]

The PCMB indicate that the PCH population will likely enter a downward phase during the life of the Project due to natural cyclical patterns, reducing baseline caribou presence along the Dempster Highway and increasing the severity of the worst-case scenario (YOR 2014-0112-133-1).

The Designated Office determined that these effects are significant and adverse because project effects would result in a complete, or near complete, elimination of access to and use of the PCH. This represents a significant departure from baseline conditions, as they are currently understood.

[2] The comment continues: "Not only does my standpoint come from a concern that this project will adversely affect the environment, it also stems from the fact that Northern Cross's proposal will degrade my sense of place and my connection with the land. My ancestors have used this land for their physical, spiritual and cultural sustenance for countless generations and I would like to afford the same privilege to my children and grandchildren some day; therefore I would like to see the project rejected."

Probability of worst-case scenario

A range of factors increases the probability of the worst-case scenario. Comments from stakeholders suggest that the worst-case scenario is, at the very least, probable. The potential intensity of land use includes the combustion of up to 2 000 000 cubic feet of gas per day by flaring, such activities may increase the ZOI through effects to air quality. Regardless, ZOI for heavy industrial development, including the construction of the Dempster Highway, suggest avoidance distances of up to 30 km. Research on the Dempster Highway's ZOI suggests that they are long lived.

The large ZOI, along with increased heavy traffic, make a disproportionate impact by the Project on land use patterns of caribou increasingly likely, especially as the Project is located in the only known migration corridor in the immediate vicinity. Alternative migration corridors may be far from existing preferred routes.

The Proponent will not cease all project activities in the event of large scale caribou presence within the project area – without aerial surveys it may not be possible to determine thresholds for adaptive management plans in any event – which further increases the risk of the Project interfering or disrupting caribou distribution, occupancy, and migration.

A worst-case scenario's probability is increased by the unprecedented proposed intensity of land use in an area with a relatively low level of industrial development. The Project is an escalation of land use intensity that reduces the reliability of making predictions based on previous experience, lowering the probability of a best case scenario.

11.0 CONCLUSION

The Designated Office is unable to determine if adverse effects to the access to and use of the PCH are or are not significant. Consequently, the Designated Office must refer the Project to the Executive Committee for screening.

As noted, the Project takes place within the area of the NYRLUP. Specifically the Project is proposed in Land Use Management area 9, zone IV, which is designated for "highest development"; however, industrial development must still take place within the parameters laid out by the plan, which notes that there is a need for coordinated and effective management of PCH habitat and population, prior to industrial development. The Plan also notes that industrial development may lead to land use conflicts between industrial development on one hand and the PCH and land users on the other. The most recent annual report for the NYRLUP stresses the need for baseline data collection and development of best management practices in order to better understand and predict effects. Industrial development in the region is predicated upon fulfillment of goals for information collection as set out in the NYRLUP and associated annual reports.

Many comments build on the priorities of the NYRLUP: development in the region is not intrinsically adverse, but rather that additional information is required to make confident effects predictions and to determine the significance of those adverse effects. The requirement for confidence in predicting effects in this assessment is elevated for two reasons: first, the significant importance for the First Nation and the Inuvialuit way of life that is intrinsically linked to the PCH; and second, the unprecedented scale of the Project within this region.

Information that would have helped to inform this assessment includes the following:

- Access to and use of the Porcupine Caribou Herd by First Nations and the Inuvialuit in relation to the project area and potential zones of influence from project activities.
- Relationship between barren-ground caribou and land use activities, with focus on range utilization in response to surface disturbance and linear density.
- Baseline data to assess cumulative effects and developmental thresholds (e.g. cumulative surface disturbance impacts and potential effects on habitat quantity and quality).
- Cumulative impacts of exploration and development activities on access to and use of the Porcupine Caribou Herd by First Nations and the Inuvialuit.
- Development of Best Management Practices as guidance to oil and gas activities in relation to the Porcupine Caribou Herd (Government of Yukon and VGFN, 2014).
- A process to establish safe operating distances and critical numbers for the Porcupine Caribou Herd (Government of Yukon and VGFN, 2014).

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Appendix A PROJECT LOCATION, SCOPE AND PROPONENT MITIGATIONS

A.1. PROJECT LOCATION

The Designated Office scoped the Project as covering an area of 700 km^2. The scoped area is defined by a previous Project conducted by the Proponent, a 3D seismic survey (YOR 2013-0067).[3] Some Project activities will take place outside of this area and these activities include: water withdrawals, data collection, and transportation of materials to or from the Project area.

The Project area is approximately 30 km south of Eagle Plains and straddles the Dempster Highway. The Project area also straddles the drainage divide between the Peel and Porcupine rivers; however, the vast majority of the Project area, including all proposed drill sites, is located in the Porcupine River watershed.

The Project will take place in the traditional territories of the First Nation of Nacho Nyäk Dun (FNNND) and VGFN as well as in the Tetlit Gwich`in Council's (TGC) Secondary Use Area. Figure 1 provides an overview of the Project in relation to First Nation Settlement Lands and use areas.

The Project is in the North Yukon Planning Region. Table 2 provides an overview of information on the Project location.

Table 2: Project location, coordinates, and geographical paramaters

Project Coordinates: Map Sheet: 116I04, 116I02, 116I03	**UTM** (Zone 8N) NW 383092E 7341280N NE 408965E 7342290N SW 387852E 7333277N SE 410282E 7332500N	**Decimal Degrees** NW 66.1700˚ N 137.5937˚ W NE 66.1876˚ N 137.0209˚ W SW 66.1000˚ N 137.4812˚ W SE 66.1002˚ N 136.9848˚ W
First Nation Traditional Territories:	Vuntut Gwitchin First Nation First Nation of Nacho Nyäk Dun Tetlit Gwich'in Council Secondary Use Area	
Drainage Region:	*Sub-sub Drainage Area:* Upper Porcupine – Bell, Headwaters – Porcupine, Upper Peel	
Nearby Watercourses:	Eagle River, Glacier Creek, Chance Creek, McParlon Creek, Canyon Creek, Dalglish Creek.	

[3] Project 2013-0067 resulted in a 3D seismic over a portion of the 700 km^2 assessed. The Project, 2014-0112, proposes wells within this same portion; however, roads and quarries are proposed outside of this portion but within the 700 km^2 area. The portion that was actually surveyed is greater than 325 km^2 as it is closer to 400 km^2. Further supporting a 700 km^2 assessment area, "Twenty exploratory wells program within the 3D seismic area assessed under YESAB project 2013-0067" (2014-0112-073-1). Proposal documents for the 3D seismic survey confirm that the seismic area is 700.87km^2 (2013-0067-003-1). It is possible that the location of the camp, at km 325 of the Dempster Highway, was confused with the project area in proposal documents.

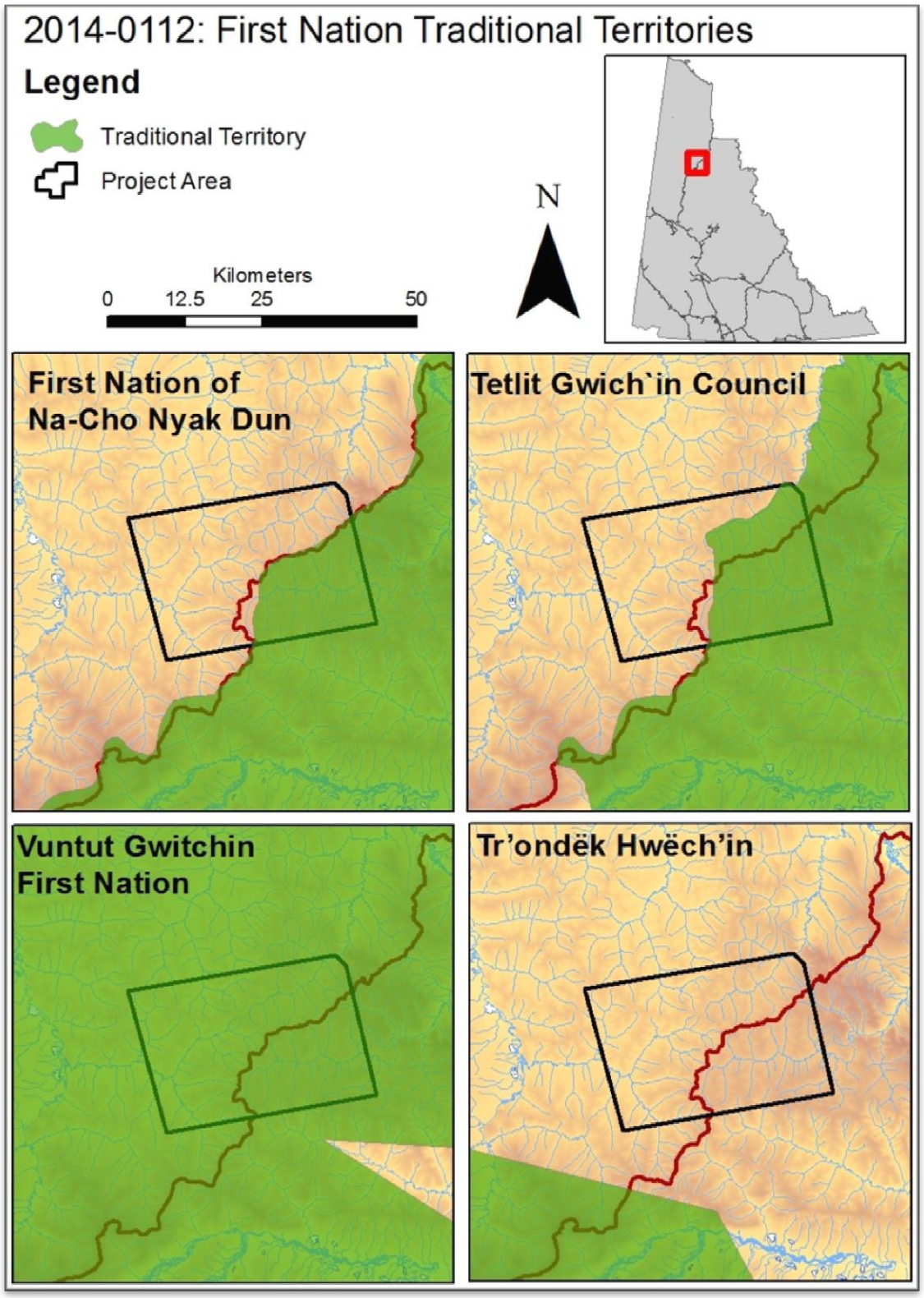


Figure 1: The Project area in relation to traditional territories of FNNND, THFN and VGFN, and the use areas of the TGC. The Dempster Highway is shown bisecting the Project area.

A.2. PROJECT SCOPE OVERVIEW

The Project is to take place over an area within the Eagle Plains basin (i.e. as described above in section A.1.). The Project will occur over a period of up to eight years beginning as soon as possible. This section provides an overview of Project activities included in the scope while the next section (section A.3.) provides additional details on each activity and how it is scoped. Project activities include:

- Development and drilling of twenty wells within the Project area, including:
    - Establishment of drill pads (up to 19 pads)
    - Use of drilling mud
- Testing of Project wells, including:
    - Drill stem tests
    - Acid simulation
    - Extended flow testing, up to two years per well, including:
        - Installation of
            - Standard pumpjacks
            - Christmas tree installation
            - Separators
            - Flare systems
            - Storage tanks
        - Production of a maximum of 4 000 barrels (636 000 L) of crude oil per day during flow testing
- Well suspension and abandonment

Road and Quarry Development

- Quarrying of 1 800 000 m^3 of aggregate for use in Project activities, including:
    - Winter development of 23 quarries
    - Use of approximately 450 000 m^3 of aggregate for well pads
    - Use of approximately 1 350 000 m^3 of aggregate for access road construction
    - Use of explosives
    - Reclamation of borrow sources
- Development of all season access roads up to 87 kilometers in length, including:

- Up to five water crossings and use of culverts

Waste Disposal

- Flaring of gas, up to approximately two million cubic feet per day (57 000 L)
- Use of deep well injection to dispose of produced waters and liquid wastes, up to 381 600 L/day
- Use of a mix-bury-cover sump (70 000 m^2) for disposal of drill cuttings and the solid fragment of drilling mud
- Trucking of waste to appropriate waste disposal facilities using public highways

Water Use

- Use of up to 300 m^3 per day, not exceeding 10 percent of instantaneous flow at extraction points, including:
  - Year round extraction from the Eagle River
  - Seasonal extraction from Glacier Creek

Other Project Facilities

- Use of an established camp
- Use of a mobile drill camp (five to eight people)
- Construction of a central processing facility
- Storage of fuel and produced crude at the central processing facility and camp, including:
  - 151 000 L diesel, 24 000 L propane
  - 3 180 000 L crude oil, 119 000 L produced water

Baseline Data Collection and Environmental Monitoring

- Fisheries sampling at each watercourse crossing
- Surface water, groundwater, and permafrost monitoring/sampling
- Wildlife surveys and monitoring
- Helicopter access to support sampling and monitoring programs

Transportation

- Transport by tanker truck of produced crude oil to a point of export, up to 4 000 barrels per day
- Two flights in/out per week to Project location

A.3. DETAILED SCOPE OF PROJECT ACTIVITIES

The proposal and the Proponent's supporting documents, including documents submitted after the adequacy phase, neither clearly define nor delineate Project activities. While exploration Projects often present a wide range of potential outcomes and configurations, proposal documents are often conflicting and contradictory.

Where conflicting information is present, the Designated Office used the Proponent's maximums as the limits of proposed activities. Incorporating maximums into the Project scope allows potential mitigation of all potential scenarios suggested by proposal documents. This section provides details not only on the Project scope but also how the Designated Office determined the scope of Project activities; however, this section provides details only on those activities that are integral to the effects assessment's outcome.

A.3.1 Well Development and Testing

Timing of Activities

Given that the proposed timeline only tentatively assumes which wells will be drilled during winter and that the timeline cannot be accurate as it assumes a 2015 start date, the Designated Office assumes that any well may be bored in either winter or summer. Proposed timelines assume that the Project should have begun in 2015 and thus are no longer up to date; the Designated Office assumes Project activities will commence as soon as the Proponent receives the required authorizations. Project activities will occur for a period of no more than eight years.

Number and Location of Wells

The Proponent intends on drilling up to 20 wells, though "approximately half of these wells are firm proposals to evaluate prospects [the Proponent] has identified for drilling and the rest are contingent on any of the initial wells discovering crude oil or natural gas" (YOR 2014-0112-073-1, 13). While some Project documents indicate that legacy wells may be used for extended flow tests (YOR 2014-0112-056-1, 2), the proposal's Project description clearly states that the program centers around the drilling and testing of 20 wells (YOR 2014-0112-073-1, 13). Further, all predictions of flows and estimates of gas production are based on the assumption of 20 wells. The Designated Office scoped the number of wells for drilling and extended flow tests as 20 and has not scoped in exploration activities at existing legacy wells.

The proposal provides well locations within the Project area; however, well locations may change as the Project is completed. Modifications to well locations have occurred in previous assessments. The Designated Office has scoped the geographic boundaries within which the wells are to be drilled as equal to the area covered by the recent 3D seismic survey (assessment 2013-0067).

Well Pads

The drilling of up to 20 wells will require the establishment of drill pads 14 400 m^2 in size (120 m x 120 m) at 19 well sites, as one site will use an existing well pad. Well pads will be constructed out of granular material excavated from Project borrow pits. Each pad will require 21 600 m^3 of granular material on average (1.5 m depth); however, in winter, wooden mats may be used as opposed to granular material.

A.3.2 Road and Quarry Development

Quarry Development

The Project requires the development of quarries to construct access roads and well pads. The Proponent identifies 23 quarry locations for borrow material extraction; however, final locations may be different from proposed locations. One well site is already prepared for exploration due to the previous establishment of a drill pad and will not need borrow material. The remaining 19 well sites will require a little over 400 000 m^3 of borrow material.

Borrow material is required principally for road development; however, the proposal is contradictory on borrow requirements for road construction as the total length of road requiring borrow material is unclear. The response to information request one indicates a total Project requirement of approximately 1 800 000 m^3 of borrow and 87 km of road (YOR 2014-0112-036-1, 2). The response to information request three indicates a total Project requirement of approximately 1 700 000 m^3 of borrow and 82 km of road, with no explanation of the change (YOR 2014-0112-056-1, 5). The Designated Office has used the upper estimate, 1 800 000 m^3, in its scoping of the Project.

Road Development

As indicated above, the total length of all-season roads to be constructed is unclear in proposal documents. In the revised Project proposal (YOR 2014-0114-074-1, 85) road segment lengths provided indicate 82 km of access roads while the Proponent's final information submission (YOR 2014-0112-265-1, 1) reaffirms 87 km of access road. While these estimates are quite similar, the Designated Office is using the larger of the two estimates in its scoping. Roads, like well and quarry locations, may have different final alignments than proposed but are scoped as being located within the Project area.

Roads for the initial drilling of wells may be winter roads; however, as the Proponent anticipates that all wells will be selected for extended flow testing "it should be assumed that all the proposed access roads will be upgraded to all-season roads" (YOR 2014-0112-036-1, 1). As such, all roads proposed are assessed as though they will either be constructed as all-season roads or will become all-season roads.

Winter roads would only be constructed in the event of sufficient snow coverage and if water bodies are frozen. All-season roads will require the construction of five water crossings. These crossings will be constructed with culverts.

A.3.3 Flaring

Flaring and Natural Gas Disposal

The Proponent notes that drill stem tests and extended flow tests may require flaring. Drill stem testing will not generate sustained flows of natural gas. The Proponent indicates that flaring is not expected to last longer than a day during these tests. However, for extended flow tests large amounts of natural gas are likely to be generated and flaring may last for extended periods.

The proposal is not clear on flaring requirements. Volumes of flared gas depend on how much gas is contained in recovered fluids. The Proponent provides different sets of predictions:

- 300 cubic feet of gas per barrel extracted: from a single data point from past exploration (YOR 2014-0112-199-1, 11)

- "typically less than" 500 cubic feet of gas per barrel extracted: as described in the revised Project proposal (YOR 2014-0112-073-1, 11).
- "expected" less than 571 cubic feet of gas per barrel extracted: as described in the revised Project proposal (YOR 2014-0112-073-1, 40)

The response to information request four provides an estimate of volumes of flared natural gas using three assumptions. These assumptions are production of 2 000 barrels of oil per day, 300 cubic feet of gas per barrel (as listed above), and the "unlikely scenario that 100% of natural gas is flared and not consumed in the operation" of the Project (YOR 2014-0112-172-1, 12). This scenario results in gas volume of 600 000 cubic feet that would require flaring every day.

Using the higher estimate of gas recovery listed above, 571 cubic feet of gas per barrel, a "likely" maximum production scenario of 4 000 barrels per, as well as an assumption that 100 % of natural gas is flared, the upper limit of gas flaring approaches 2 300 000 cubic feet per day. This assumes that all wells are selected for extended flow testing, which the response to information request four indicates is unlikely; however, the Proponent also assumes that all wells will be selected for extended flow tests.

Excess natural gas production may be reduced by using produced gas for heating or electric power generation on site (though this still results in emissions). The Designated Office is using an upper bounds for flaring volumes of approximately 2 000 000 cubic feet of gas per day.

The Proponent has indicated it is possible that natural gas will be reinjected, though no details on this activity are provided. The storage, processing for sale, or re-injection of natural gas is not included in this Project's scope "as discussed previously, gas would either be used for heating, power generation or as a last resort flared" (YOR 2014-0112-073-1, 12).

The scope of the Project does not include flaring of crude oil.

A.3.4 MBC Sump

The response to information request four definitively states that the mix-bury-cover (MBC) sump will only contain the solid fraction of drilling mud and any drill cuttings.[4] Earlier proposal documents had suggested drilling fluids might be deposited in the MBC; however, the Designated Office is scoping the Project to include an MBC sump that will be filled with only solid waste products. The proposed sump is 70 000 m^2 in size and consists of 800 m^2 cells, one of which will be used at a time.

Drill cuttings and the solid fraction of drilling mud will be disposed of in the MBC sump in accordance with the Alberta Energy Regulator's (AER) Directive 50. Each well may produce up to 300 m^3 of cuttings, totaling 6 000 m^3 over the course of the Project. A further 200 m^3 of drilling mud will also be disposed in the MBC sump. Replacement of the drilling mud will increase volumes of drilling mud requiring disposal. In addition to the described wastes, cement returns (excess cement that flows back to the surface during

[4] The revised proposal indicates that the proposed disposal option for drilling fluids is the MBC sump, "fluid would be added to the drill cutting and then mixed with the required amount of soil in accordance with AER Dir 50" (YOR 2014-0112-074-1, 53). The fourth information request response indicates that disposal of drilling fluids in the MBC sump is possible, "if the drilling fluid and cuttings are not mix-bury-cover suitable, they will be transported …" (YOR 2014-0112-0172-1, 28). However, in a submission after the final public comment period, the Proponent indicates, "only solid material will be disposed of in the MBC sump" (YOR 2014-0112-265-1, 4), this is also confirmed in the revised final information request submission, "Drilling mud, as an untreated liquid phase, will never be disposed of in a MBC sump" (YOR 2014-0112-199-1, 31). The Designated Office scoped the Project according to this most recent commitment, that fluid wastes will not be deposited in the MBC sump.

cementing) will be separated from returning fluid, allowed to cure, broken up, and disposed of in the MBC sump. In accordance with AER Directive 50, materials deposited in the sump are mixed at a ratio of three parts soil to one part waste.

A.3.5 Other Project Facilities

Main Camp

The Proponent established the primary camp for the Project in 2011, during previous activities. The camp is located at km 325 of the Dempster Highway. The camp operates under a municipal water licence and has a capacity of 75 people. The camp also has an authorization for incineration of wastes and storage of fuel. The Proponent does not propose any changes to the operation of the camp. The main camp will house all personnel except for critical frontline supervisors who will be housed at the mobile rig camp.

Mobile Rig Camp

The mobile rig camp is on the drilling rig. This facility will house five to eight personnel who are frontline supervisors such as the geologist, medic, and rig manager.

Drill Rig

The drill rig for the Project is NCY Rig #1. This rig is a 'super single' that can hold a single section of drill pipe in the derrick at a time. The drill rig has a capacity of 2 400 m (YOR 2014-0112-012-1), as such the Project is scoped with a maximum depth of 2 400 m. The drill rig requires a drill pad of 120 m by 120 m.

Service Rig

A service rig may be used by the Proponent to perform completion or work overs for Project wells should the need arise. The service rig would not house any personnel but would be staffed by three to five personnel.

Central Processing Facility

A central processing facility is proposed near the main camp. The central processing facility will "comprise of additional multi-stage and multi-phase separators, heater treaters, [a] vapour and gas collection system, and possibly [a] central power generation facility to power all discrete well batteries" (YOR 2014-0112-073-1, 17). The central processing facility will require storage facilities that allow storage of up to 20 000 barrels of oil (3 180 000 L).[5] Produced water and propane will also be stored to a lesser extent at the central processing facility.

[5] Total storage requirements for produced crude remain unclear. The Proponent states that a ten-day storage requirement is used to base the amount of storage capacity. The conceptual map (YOR 2014-0112-163-1) of the central processing facility show 7 x 750 barrel storage tanks (835 000 L), while the revised proposal notes five tanks and a storage capacity of 20 000 barrels (3 180 000 L) based on production of 2 000 barrels per day (YOR 2014-0112-073-1, 17). Further, the "likely maximum" production of 4 000 L per day with a ten day storage requirement would suggest a volume of 4 000 barrels (6 360 000 L) (YOR 2014-0112-074-1, 64). The Designated Office has scoped the size requirements as 20 000 barrels as this prediction is the most clear and substantive of all storage predictions.

A.3.6 Other Activities

Helicopter Access to Support Baseline Sampling and Monitoring

Helicopter access/support may be used in areas where ground access is limited or non-existent, or may be used to minimize environmental impacts or disturbances that would result from the construction of ground access. Helicopter access will be used by NCY for support activities that may occur only intermittently over time such as during sampling, surveying and monitoring including follow up monitoring.

Transportation of Crude Oil

With a likely maximum production of 4 000 barrels (6 360 000 L) of crude oil per day, transport requirements to the south will have a high likely maximum. The Project proposal is unclear on the volume of tanker traffic south along the Dempster, Klondike and Alaska highways. The revised proposal projects 120 round trips per month carrying produced fluids (YOR 2014-0112-074-1, 130); however, the proposal also indicates that produced liquids would be carried in B-trains with a capacity of about 65 000 L (YOR 2014-0112-074-1, 128). The use of B-trains would require approximately 10 round trips per day, for approximately 300 round trips per month. The Designated Office has scoped the Project to include 10 round trips per day of crude as the maximum amount of transport of crude oil along public highways.

Crude will be transported from Eagle Plains to Skagway via the Dempster Highway, Klondike Highway, and Alaska Highway to the port in Skagway, Alaska. Other possible ports include Haines and Valdez. If this route is not feasible, crude will travel by truck to: Fort Nelson, BC; Fort St. John BC; or Grande Prairie AB.

Transportation of Natural Gas

While the Proponent describes the possibility of shipping surplus natural gas via truck to "industrial consumers or northern communities" the proposal clearly and definitely states that processing gas for sale is outside of the scope of this Project (YOR 2014-0112-073-1, 12).

Other Road Transportation

The Proponent defines and estimates that its normal traffic levels during the winter season will reach about 40 vehicles per day within the Project area. Project activities such as drill mobilization, access road construction and summer mobilization will generate the highest traffic. Mobilizing the drill rig, for example, requires 15 to 20 vehicle loads. Extended flow testing will require the least traffic volume, at about 20 vehicle trips per day. Daily traffic on site will at minimum include eight – nine light-weight service trucks, one water truck and one fuel truck. The proposal also includes the “occasional” transport of drill cuttings from the well sites to the sump location. Onsite traffic will use the Dempster Highway within the Project area.

Fuel and water trucks will travel to the site once per week or as needed.

When a site is decommissioned, materials will be trucked out of the Project area; for example, the decommission plan includes the sale or recycling of removed culverts as roads are decommissioned. The Proponent does not provide estimates of traffic generation for this activity.

Air Transportation

The Project forecasts twice weekly flights to and from the Project camp at km 325 of the Dempster Highway. This airstrip is located on the Dempster Highway and requires use of control vehicles to allow flights to land or take off.

A.4. RELEVANT PROPONENT MITIGATIONS

The following are relevant mitigations proposed by the Proponent to eliminate, reduce or control adverse effects to the PCH that were considered by the Designated Office.

Sources:

- Wildlife Management Plan (YOR 2014-0112 188-1)
- Access Management Plan (YOR 2014-0112-0187-1)
- Project Proposal, Appendix E – Operational Plan Porcupine Caribou and Safety Plan. Plan to Avoid Impact on Harvesting Activities during the Drilling Program and Create (YOR 2014-0112-025-1)
- Project Proposal, Appendix L – Blasting Mitigation Plan for Wildlife (YOR 2015-0114-067-1)
- Project Proposal (YOR 2014-0112-074-1)

Operational Mitigations

- NCY will use existing access (e.g. trails, roads, etc.) for movement of personnel and equipment rather than creating new access where possible.
- Roads will only be wide enough to accommodate equipment required to complete the Project and will include appropriately spaced passing sections for traffic safety.
- Low impact winter roads will be used for exploratory drilling as much as possible to minimize the intensity of physical surface disturbances.
- To the extent possible, sensitive areas will be avoided particularly during important biological seasons. Sensitive areas include: riparian corridors, wetlands, steep slopes, old growth forest, and critical wildlife habitat and permafrost features.
- One drill rig will be active in the area at any time and wells are planned to be developed sequentially. A maximum of two drills will be operational if required to meet seasonal or permitting schedules.
- Activities are planned and scheduled to minimize interactions with wildlife, as practical.
- Movements of the Porcupine Caribou Herd will be monitored and Project activities will be managed as much as possible to avoid disturbance and to minimize potential habitat avoidance that results from human features and activities.
- Windrows, when built, will be constructed with gaps placed periodically

- Snow embankments along access roads will be ploughed back to allow animals easier crossing of roads.

Wildlife Awareness and Training

- NCY will enforce a “no wildlife harassment” policy for employees and contractors. The policy will encompass “no wildlife feeding,” employee education and wildlife avoidance.
- NCY will provide wildlife awareness orientation to staff and service providers.
- A “no firearms” policy will be enforced. Firearms will be banned except as authorized for protection of employee’s safety while in the field.
- NCY employees and their contractors are prohibited from hunting within the program area.
- Aircraft will adhere to best management practices for “Flying in Caribou Country” (Environment Yukon), as permitted by weather and work requirements.
- All NCY employees and their contractors that enter the program area will be mandated to wear brightly colored safety clothing so that they are visible to other personnel, the public, vehicles (both commercial and private), and harvesters.

Access

- Access roads that lead off the Dempster Highway will be gated so only authorized personnel can enter.
- Access roads will be decommissioned using best management practices to reduce the likelihood of the Project providing long-term access for hunters.
- Low impact winter roads will be used for exploratory drilling as much as possible to limit the extent of physical surface disturbance
- Access roads off the Dempster Highway will be controlled (i.e. gated and radio controlled), and use will be restricted to authorized personnel to minimize off-highway access.
- Access points off the Dempster Highway will be limited to the smallest number technically feasible with the goal of minimizing new access off the highway.
- All industrial exploration activities will be kept within the road right-of-ways and well sites.
- All wildlife will have the right-of-way on roads and vehicles will stop when wildlife are encountered to reduce risk of mortality and disturbance. Vehicles will remain stopped and wait for animals to move off roads. If animals have not moved off the road within five minutes then the driver can proceed at 10 km/h.
- Vehicles will be restricted to 50 km/h or less on all Project access roads with the exception of the Dempster Highway.
- Noise will be minimized by ensuring that all exhaust systems have mufflers installed properly and that all machinery is operating as per specifications.

- Dust dispersal will be managed by enforcing reduced speeds and traffic volumes on access roads.

Blasting

- Environmental/wildlife monitors will survey the surrounding area for any sign of focal wildlife species: moose, caribou, and bears. Blasting will be delayed if focal species are found during surveys, and will recommence once focal species are determined to be further than 1 km away from blasting sites.
- Environmental/wildlife monitors will survey the surrounding area for high value habitat features such as dens, raptor nests and mineral licks or wallows. If high value wildlife feature(s) are found, more detailed mitigation plans will be made in consultation with the Regional Biologist/Conservation Officer.
- Use noise reduction measures (e.g., matting) during blasting.
- All wildlife observations made during development and operation of borrows will be documented and submitted to applicable regulatory agencies: Environment Yukon, Vuntut Gwitchin and others.
- Noise reduction measures will be taken if decibel levels are considered disruptive to wildlife.

Problem Wildlife Management

- Regular (daily) garbage management will be undertaken to remove materials (e.g. metals, plastics, grease, food waste), which may be potentially harmful to wildlife.
- Wildlife monitors will document and report wildlife encounters to the Project Supervisor. Actions to deter wildlife will be considered with input from the local Conservation Officer.
- Any animals destroyed because of imminent human safety risk will be immediately reported to the local Conservation Officer and followed up with a detailed investigation by qualified Project staff.

Caribou-specific Mitigations

- When greater than 500 caribou or one collared caribou are known to be within 30 km of active drilling sites. Operation will continue as permitted mitigation actions that will be taken while the condition lasts will include:
    a. Continue to apply general mitigation measures.
    b. Heightened alert for Project staff. NCY holds daily safety meetings for each work shift; included as part of the agenda for these meetings will be notification to all staff that caribou are in the area. General mitigation measures that apply to caribou will be reviewed by all staff at these meetings.
- When 1 collared caribou is known to be within 6 km of active drilling sites. Operation will continue as permitted mitigation actions that will be taken while the condition lasts will include:
    a. Continue to apply general and Level 1 caribou mitigation measures.
    b. Discontinue snow track monitoring to reduce disturbance.
    c. Restrict non-essential activities on Project roads to reduce disturbance.

d. Reduce speed limit to 40 km/h on Project roads to reduce likelihood of collisions with caribou.

e. Plan access road activity to reduce the frequency of disturbance to caribou (e.g., convoy vehicles during shift changes when necessary to reduce disturbance).

f. All non-essential Project activities will be deferred to a later time.

g. Regularly monitor Project infrastructure to ensure that caribou are not blocked from moving through the area or getting caught in infrastructure (e.g. bear fencing in April).

- When 2 or more collared caribou are known to be within 6 km of active drilling sites. Operation will continue as permitted mitigation actions that will be taken while the condition lasts will include:

    a. Continue to apply general and Level 2 caribou mitigation measures.

    b. Reduce speed limit to 30 km/h on Project roads.

    c. No blasting will be permitted.

    d. No new construction will be permitted.

    e. No drill moves will be permitted

    f. Mitigation measures will remain in effect until NCY contacts the Regional Biologist to discuss Project Activity options or the caribou move out of the areas.

Monitoring (General Wildlife Including Caribou)

- Monitoring:

    a. Monitor and verify wildlife uses of the area.

    b. Monitor and evaluate the effectiveness of mitigation measures.

    c. Identify unanticipated Project effects.

    d. Inform adaptive management and additional mitigation measures

- Annual footprint survey using GPS and GIS to measure the area of Project disturbance (i.e. direct habitat loss) is consistent with Project Proposal (assessment) and North Yukon Regional Land use Plan Landscape Disturbance Levels for surface and linear disturbance.

- Monitor by logging vehicle traffic and road use, also reporting any unauthorized road/trail use. This is to ensure traffic volumes are consistent with Project proposal (assessment) and is mitigations are effective.

- Continuous logging of focal species by Project personnel and contractors to document occurrences near Project facilities.

- Record collisions, near misses and all other observed wildlife mortalities within Project area (those involving caribou will be reviewed to determine if further cation is needed).

- Record hunter kills from Project related access.

Caribou-specific Monitoring

- Regional monitoring: request weekly collared caribou distribution maps from the Regional Biologist. NCY will provide the location of active drill sites so accurate buffers can be mapped.

- Level 1 caribou mitigation measures apply when greater than 500 caribou or one collared caribou are known to be within 30 km of an active drill sites. Operation will continue as permitted and mitigation actions that will be taken while the condition lasts will include:

    a. Continue to apply general mitigation measures.

    b. Heightened alert for Project staff. NCY holds daily safety meetings for each work shift; included as part of the agenda for these meetings will be notification to all staff that caribou are in the area. General mitigation measures that apply to caribou will be reviewed by all staff at these meetings to further ensure compliance.

- If Level 2 caribou mitigation measures apply when 1 collared caribou is known to be within 6 km of active drilling sites. Operation will continue as permitted and mitigation measures while the condition lasts will include:

    a. Continue to apply general and Level 1 caribou mitigation measures

    b. Discontinue snow track monitoring to reduce disturbance.

    c. Restrict non-essential activities on Project roads to reduce disturbance.

    d. Reduce speed limit to 40 km/h on Project roads to reduce likelihood of collisions with caribou.

    e. Plan access road activity to reduce the frequency of disturbance to caribou (e.g. convoy vehicles during shift changes when necessary to reduce disturbance).

    f. All non-essential Project activities will be deferred to a later time.

    g. Regularly monitor Project infrastructure to ensure that caribou are not blocked from moving through the area or getting caught in infrastructure (e.g. bear fencing in April).

- Level 3 caribou mitigation measures apply when 2 or more collared caribou are known to be within 6 km of active drilling sites. Operating drills will continue as permitted and mitigation measures while the condition lasts will include:

    a. Continue to apply general and Level 2 caribou mitigation measures.

    b. Reduce speed limit to 30 km/h on Project roads.

    c. No blasting will be permitted.

    d. No new construction will be permitted.

e. No drill moves will be permitted.

f. Mitigation measures will remain in effect until NCY contacts the Regional Biologist to discuss Project activity options or the caribou move out of the areas.

- Regional monitoring: NCY depends on continued collaring for triggering caribou mitigation measures, so will consider supporting the government's long-term population monitoring efforts.

Decommissioning

- Reclaim and decommission all surface disturbances when no longer required.
- The first hundred meters of roads connecting to the Dempster Highway will be made impassable using appropriate methods (e.g. rock fencing and ditches).
- Where vegetation has not reoccupied all-season roads at closure NCY will scarify the roadbed to promote water infiltration and vegetation establishment.
- Where possible stockpiled organic material from road construction and slash debris will be spread across the old roadway to promote re-vegetation. When this is not possible, roadway sections will be seeded using native grass seed mixes.
- At creek crossings, culverts will be removed and flow channels will be re-established.

Reporting

- NCY will provide weekly and annual reports; these reports will be submitted to: Vuntut Gwitchin First Nation's manager of Natural Resources, Nacho Nyäk Dun First Nation's manager of Lands and Resources, and Government of Yukon manager of the Oil and Gas Branch.
- **Weekly** - summary reports on wildlife monitoring activities including:

    a. Application of wildlife mitigation measures.

    b. Implementation of wildlife monitoring activities (e.g., snow track survey).

    c. Incidental wildlife sightings.

    d. Project-related wildlife incidents and near misses.

    e. Project-related wildlife mortalities within the Project area.

- **Annually** - Project mitigation and monitoring activities which will generally include the following key pieces of information:

    a. Summary of annual Project activities.

    b. Description of updates to environmental baseline information.

    c. A review of annual monitoring results.

    d. Proposed changes to mitigation measures and monitoring actions, if necessary.

Appendix B BASELINE INFORMATION RELATED TO ACCESS TO AND USE OF THE PORCUPINE CARIBOU HERD

B.1. Overview

A number of First Nation and Inuvialuit communities rely on access to and use of the PCH. The Project area is within the FNNND and VGFN Traditional Territories and the TGC Secondary Use Area. The Project is adjacent to the Tr'ondëk Hwëch'in First Nation (THFN) Traditional Territory. The Dempster Highway begins in the THFN Traditional Territory, therefore, road access to the Project location will cross through THFN's Traditional Territory. The PCH are equally culturally significant and highly valued by the Gwich'in Tribal Council (GTC) and the Inuvialuit.

Baseline information for access to and use of the PCH is critical for determining whether this Project will have, or is likely to have, significant adverse effects to that access and use. A reasonable amount of baseline is required in order to understand the pre-development conditions. An understanding of pre-development conditions is the basis for predicting the level of change expected due to the implementation of Project activities and any associated accidents and malfunctions. Predicting the level of change from baseline conditions (i.e. magnitude), the amount of time effects to baseline occur (i.e. duration), how long it takes to return to normal (i.e. reversibility) and the acceptability of change (i.e. context) are key factors in determining whether effects are adverse, significant and likely.

The following sections summarize baseline information related to access to and use of the PCH that was gathered by the Proponent and by the Designated Office.

B.2. Baseline Information Gathered by the Proponent

The Proponent was requested to contact affected First Nations to determine their current and traditional use of the Project area (YOR 2014-0112-138-1). Requested information included:

- the current use of the Project area including timing and duration;
- the cultural and economic significance of current uses;
- the effects of the Project on current uses; and
- possible mitigations for effects to current uses.

The Proponent's response (YOR 2014-0112-199-1) provided a cursory level of detail. For example:

- General notes that meetings had taken place with the VGFN and that the First Nation had provided comments to YESAB about their traditional land use.
- A summary list of communications with FNNND.
- A summary of communication with the TGC and GTC and that the GTC had provided comments to YESAB.
- General information about subsistence hunting and trapping in the Project area.
- Noting that "hunting, fishing and trapping are very important activities for the Gwich'in culture".

- General list of potential effects and the statement that "Traditional uses of the area will be able to continue outside of the footprint of the Project and hunting with firearms can continue within the bounds identified in the Yukon Hunting Regulations."

In turning its attention to the matters to be considered (s.42 of YESAA) and concluding the assessment (s.58 of YESAA) the Designated Office has concluded that the Proponents response is lacking in substance. The GTC supports this conclusion in stating that the proposal "does not adequately capture the extent of current land use within the Secondary Use Area, nor does it provide adequate information on the use of the PCH." (YOR 2014-0112-127-1) The GTC feel the Proponent has not demonstrated any consideration of whether they have important harvesting areas in or near the proposed Project area.

B.3. Baseline Information Gathered by the Designated Office

The Designated Office compiled the following information to better understand the value First Nations and the Inuvialuit have for accessing and using the PCH.

B.3.1 Cultural Importance of the PCH

The importance of the PCH extends beyond ecological valuation as they are an intimate part of the culture, health and wellbeing of numerous First Nation, Inuvialuit, aboriginal and other communities. The Porcupine Caribou Management Agreement (1985) recognizes Porcupine Caribou as a “value” to Canada generally and that “a special relationship exists between native users and these caribou.” During the Northern Yukon land use planning process, the PCH was deemed "the most important and valued ecological and socio-cultural resource" in north Yukon (North Yukon Planning Commission, 2009). The plan in fact provides the following statement in relation to the PCH:

> "In North Yukon, the Porcupine Caribou hold a special place in Gwich’in culture and life. It has been said that the Gwich’in and the Caribou hold a piece of each other’s heart. The Creator gave the Gwich’in the Caribou to feed and sustain the people, and to keep the teachings and responsibilities to our past, current and future generations alive."

The continuing health of the PCH is of critical importance to the health and well-being of communities in the herd's range. Continuing the traditions associated with access to a healthy PCH is critical for the well-being of communities in the herd’s range. First Nations continue to use the PCH for shelter, clothing and tool making. Teaching traditional practices and ways of utilizing and respecting caribou is an integral part of the health, traditions, culture, lifestyle and economy of First Nations. This socio-cultural connection between First Nations and the PCH is part of the intergenerational transfer of knowledge when families spend time on the land, hunting, fishing and trapping. The importance of the PCH to the culture, lifestyle and identity of First Nation and Inuvialuit people cannot be overstated - it is fundamental to understanding the significance of effects posed by this Project.

B.3.2 Cultural Importance of the Project Area

According to the VGFN, there may be culturally significant areas within the Project area, which include routes, harvesting areas, camps and places of legend. First Nation people such as the VGFN and TGC have used the area over millennia for cultural, subsistence and traditional pursuits. Several areas within the area of the Project have cultural values based on wildlife values, topographical features, proximity to waterways, and logical stopping points along travel routes.

The VGFN related the following traditional uses and/or cultural significance of this area:

- Connection to Dagoo ancestral homeland
- Long-ago physical evidence of Gwich'in ancestors
- Cultural preservation
- VGFN unique sense of place and relationship with the land
- Subsistence reliance on wild food sources
- Trapping

Figure 2 is an excerpt from a heritage and traditional land use map produced by the North Yukon Planning Commission (2006). The areas identified on the map do no overlap with the Project but are in proximity to the general area. Orange polygons represent areas that are culturally significant and/or for community land use by the VGFN. Also demarcated on the map are the following First Nation Settlement Lands:

- VGFN – R-06A, R-08A and R-09A
- THFN – R-49A

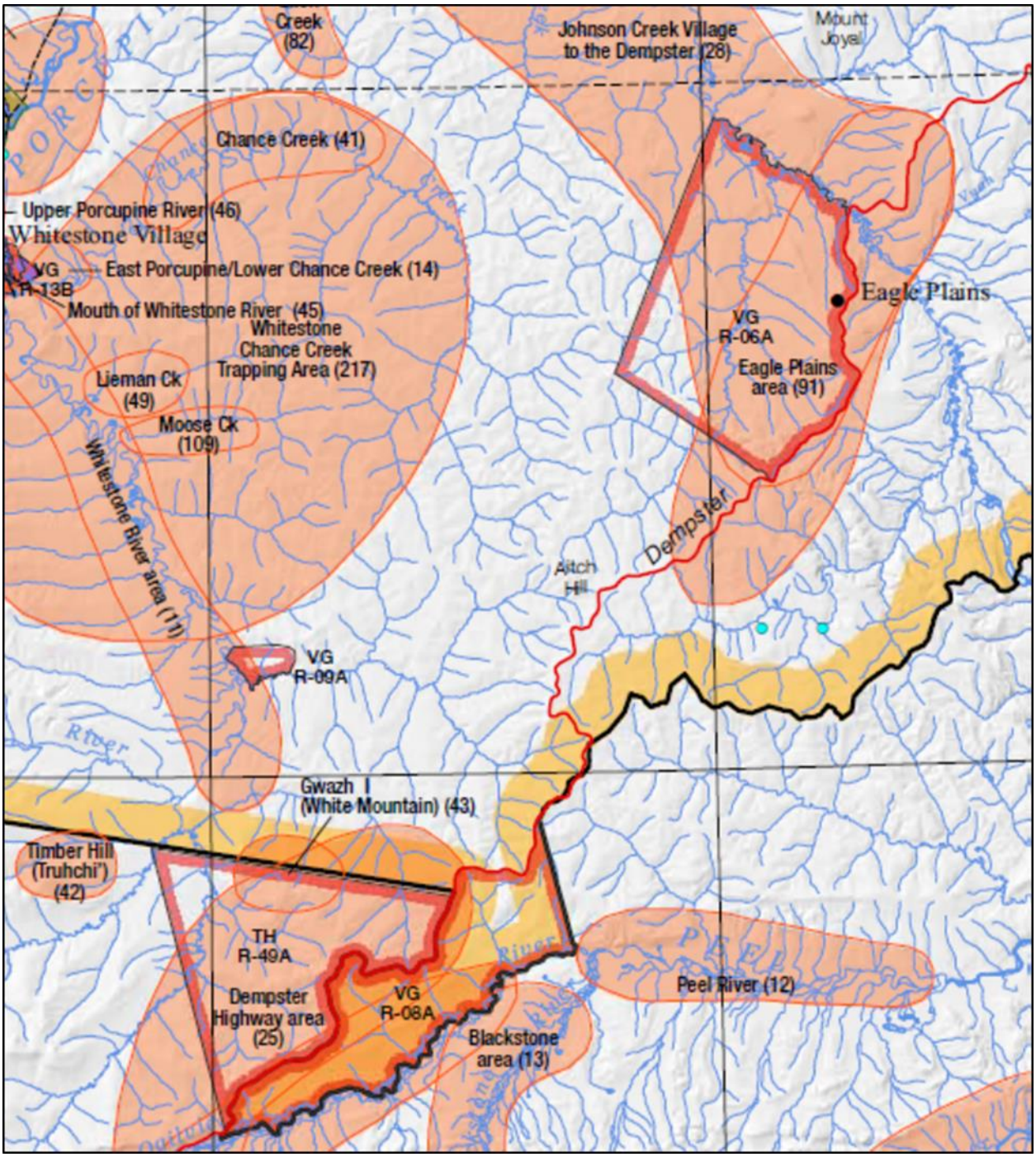


Figure 2: Excerpt from the heritage values and traditional land use resource assessment map

B.3.3 Harvesting

The PCH is a significant food source for northern communities in Alaska, Yukon and NWT. The herd is a major source of subsistence for five major aboriginal harvesters of the PCH in Canada (i.e. Inuvialuit, FNNND, TGC, THFN and VGFN).

Beneficiaries of a Yukon First Nation have the right to hunt for food within the Traditional Territory of his/her own First Nation. For example, a VGFN beneficiary can hunt for caribou or moose within the VGFN traditional territory. These individuals can also harvest male or female caribou and moose, at any time of the year and without a bag limit. Beneficiaries of the TGC (i.e. GTC transboundary agreement) may also harvest Porcupine Caribou anywhere along the Dempster Highway except on Yukon First Nation Settlement Land without that First Nation Government's permission.

The Gwich'in Renewable Resources Board notes that the PCH is the most important traditional food resource for subsistence harvesters in the Gwich'in Settlement Area (Benn 2001). During the 2013 assessment for NCY's Seismic Program, the PCMB noted that the status of the PCH affects First Nation communities and suggested that when the herd suffers that the First Nation and Inuvialuit communities suffer too as they have used the caribou for centuries.

The THFN describe for the Designated Office that the presence of caribou on the landscape is fundamental to the First Nations communities, including the THFN, who have sustained themselves for millennia within this region. The PCH is notably the most important food source of traditional foods for First Nations of the area. There is a deep spiritual connection between THFN subsistence harvesters and the land. Reliance on caribou resources ensure healthy food sources, cultural integrity of harvest and continued access to the guaranteed harvesting rights by the THFN Final Agreement and under the Porcupine Caribou Management Agreement (1985). Therefore, the PCH and associated harvesting rights are a central concern for the THFN (YOR 2014-0112-265-1).

Similarly, the VGFN explain that Old Crow maintains a mixed economy with subsistence harvest of wild foods constituting a valuable part of the economy, alongside wage-based earnings. Subsistence harvest of caribou, moose and fish help offset the high cost of food in the community (YOR 2014-0112-250-1). The PCH is of special cultural significance to Old Crow as this community relies heavily on the herd for subsistence where approximately 600 caribou are harvested each year (North Yukon Planning Commission, 2009). As previously described, Old Crow is the only Yukon Community that cannot be reached by road - it is a fly in community. The population of Old Crow is less than 300 (i.e. according to census data, in June 2015 the population was 258). Based on the understanding that 473 caribou were harvested in 2013/14, the consumption of caribou was 1.6 per capita and up to 2 per capita based on older figures. Surveys results from the 1990s found households serving caribou on average 240 times per year; and traditional foods were reported twice daily in Old Crow diets (Wein, 1995).

The North Yukon RRC notes that: "some of the traditional hunting, trapping fish and wildlife areas down river and around the development to occur, have been VGFN harvesting areas for thousands of year and continue to provide for many families today and will be trusted upon tomorrow" (YOR 2014-0112-139-1).

Additionally, the PCH provides food and economic benefits for others in Yukon through licensed harvesting as well as in Alaska.

B.3.4 Harvest Data

According to information on the PCMB website, based on reported data the total average annual harvest of Porcupine Caribou was 2 571 from 1979 to 2006. Data retrieved for 2013/14 calculated a total estimated harvest by Canadian users of 2 920. The following table (Table 3) presents this information:

Table 3: Total estimated annual harvest, 1979 - 2006 and 2013/14

	1979 - 2006		2013/14	
NWT Gwich'in	1 157	45%	1 936	66%
Inuvialuit	514	20%	368	12.6%
YFN	334	13%	478 (473 VGFN)	16%
AK Native	309	12%	n/a	n/a
YT Resident	154	6%	49	1.7%
AK Resident	77	3%	n/a	n/a
YT Non-resident	26	1%	n/a	n/a
NWT residents	n/a	< 1%	n/a	n/a
	2 571		2 920	

B.3.5 Harvest Timeline

Data collected by the PCMB from 2011 - 2013 indicates that harvesting of PCH occurs throughout the year (Figure 3 and Figure 4). Generally, the majority of harvest takes place from July to October. Minimal harvesting occurs from November to June - however, data from 2012 indicated moderate harvest levels from March to June.

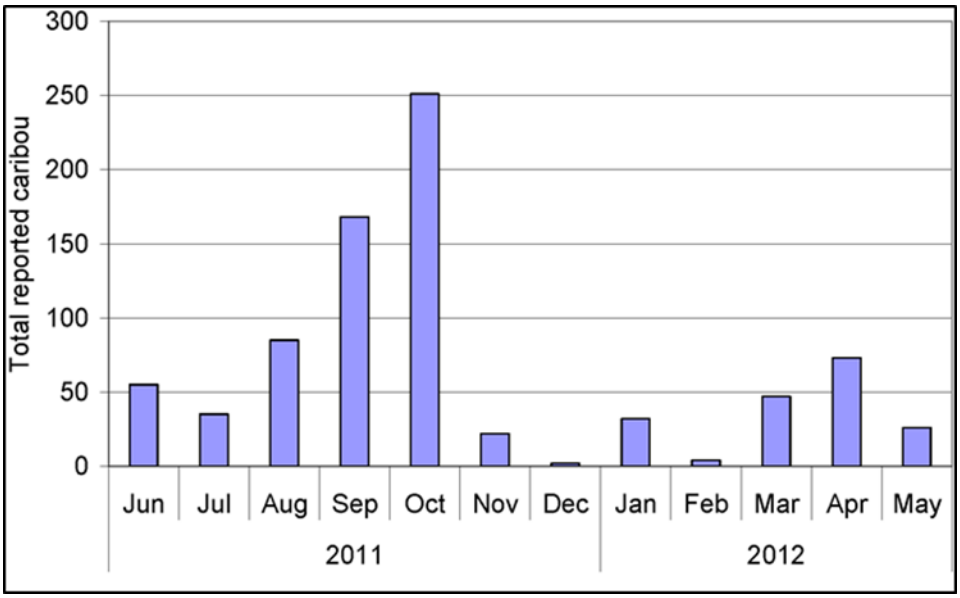


Figure 3: Month of reported Porcupine Caribou harvest, June 2011 to May 2012

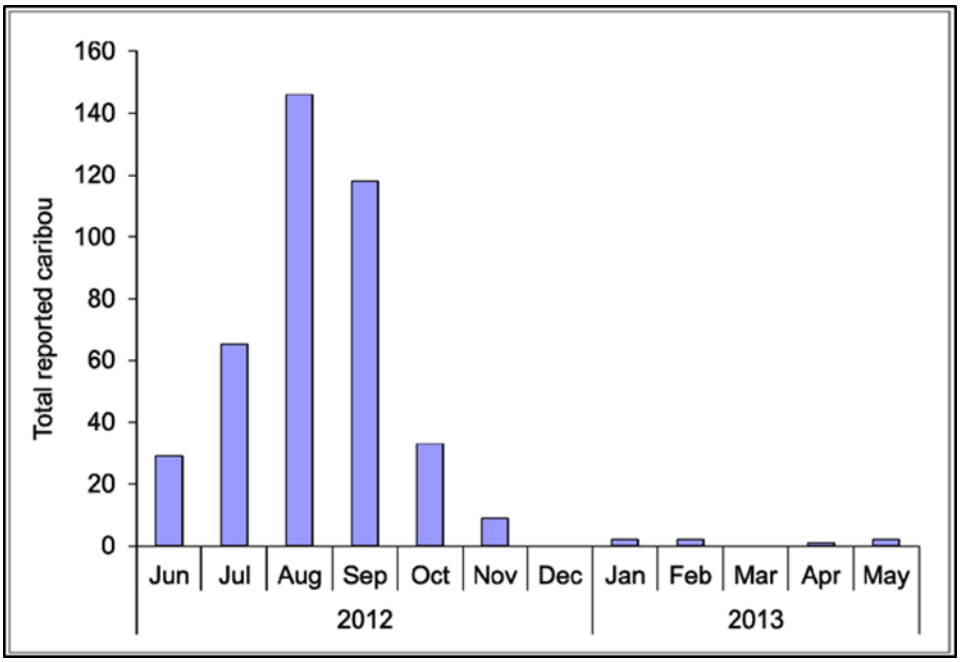


Figure 4: Month of reported Porcupine Caribou harvest, June 2012 to May 2013

B.3.6 Harvest Locations

Data collected by the PCMB from 2011 - 2013 indicates that harvesting of PCH occurs adjacent the Dempster Highway, in proximity to Old Crow and along the northern coast (Figure 5 and Figure 6). Highest densities were observed on either side of the Yukon-NWT border and along the northern coastline. This data is not a complete picture of the harvest since in both years an average of 594 caribou harvests occurred in unknown locations. Further, this data only captures reported harvest.

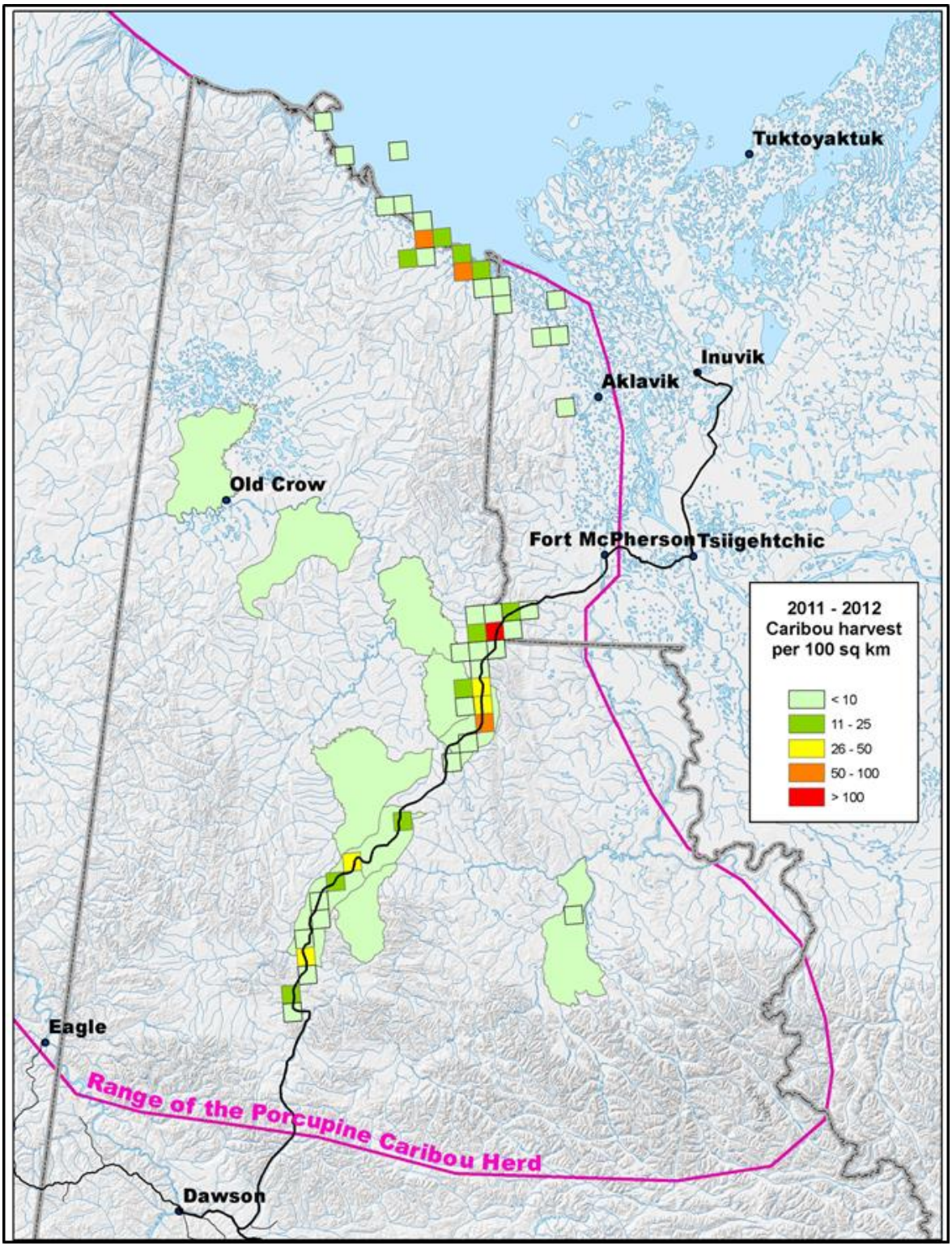


Figure 5: Density of reported Porcupine Caribou harvest 2011 – 2012 (not including 576 caribou of unknown location)

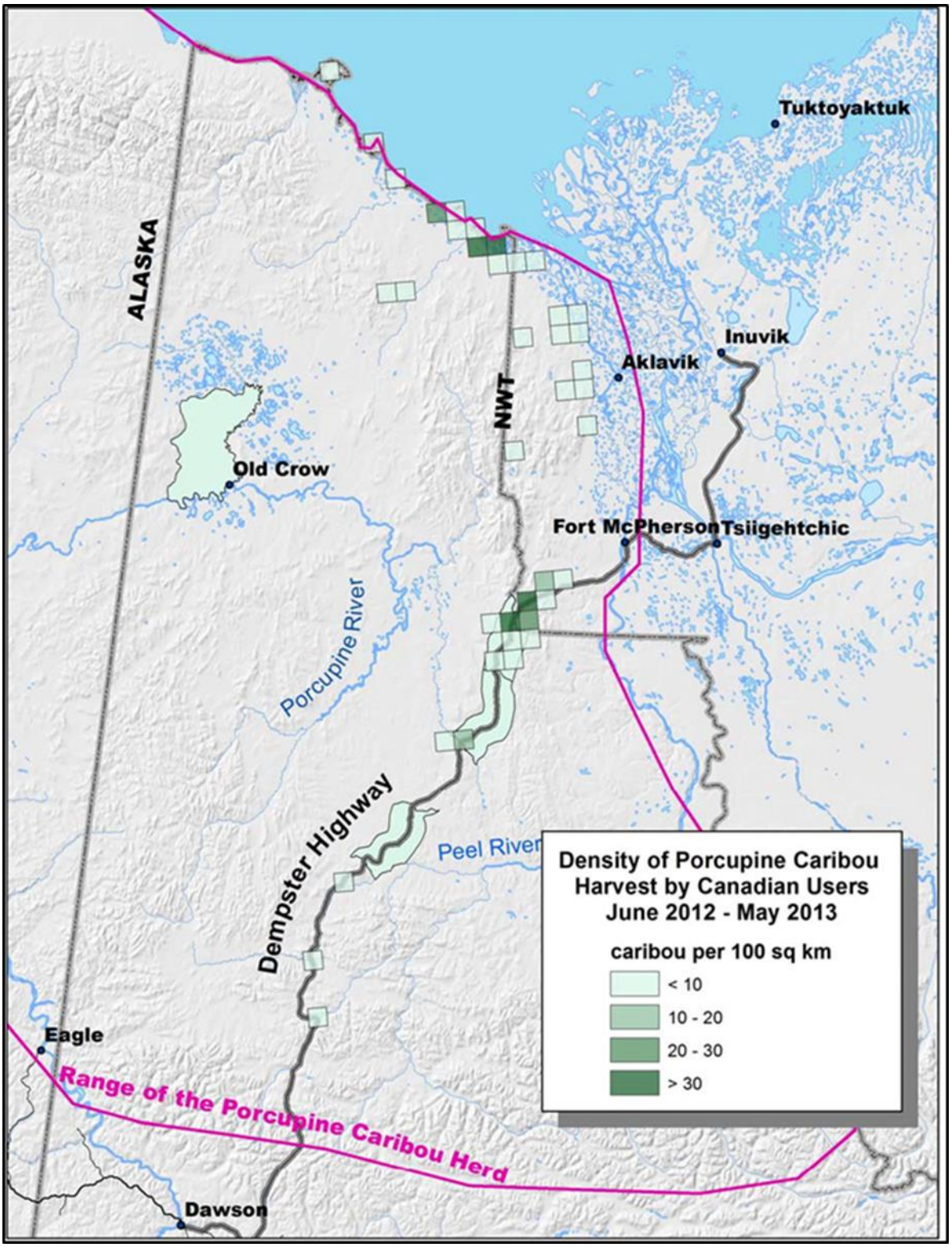


Figure 6: Density of reported Porcupine Caribou harvest 2012 - 2013 (not including 612 caribou of unknown location)

B.3.7 Harvest Success

The PCMB (YOR 2014-0112-133-1) provided the following information relating the level of harvesting in and around the Project area:

> "During the 2013-14 3D seismic program, harvest did occur throughout the length of the winter within proximity to the project and likely totaled in the thousands of caribou (please note this number will be better identified during the PCMB's Annual Harvest Meeting in February 2015). Based on reports and firsthand observations, harvest in the seismic area did not intensify until April when significant harvest did occur in the project area. In winters when Porcupine Caribou numbers are high in this area but not readily available elsewhere, it can be expected that harvest could number into the hundreds or even the thousands in the project area. We also note that the presence of all-season roads would negate the seasonality of the program, making it year-round, thus potentially extending the timing of impacts. NCY suggests that "[i]n the event the ability to harvest is impacted by the proposed Project, FN have the potential to hunt elsewhere, or at another time." The PCMB is very concerned about this statement, in light of the points noted above. As indicated, harvesters need to be able to hunt when and where caribou are available — including the project area — as it is their right to do so when conservation is not a concern."

The PCMB also issues an Annual Summary Report which includes a traditional knowledge section. The 2015 report presented information on whether hunters met their needs for caribou in the year of the report. The dataset is from 2000/01 to 2014/15 and relies on interview responses - Figure 7**Error! Reference source not found.** displays this data.

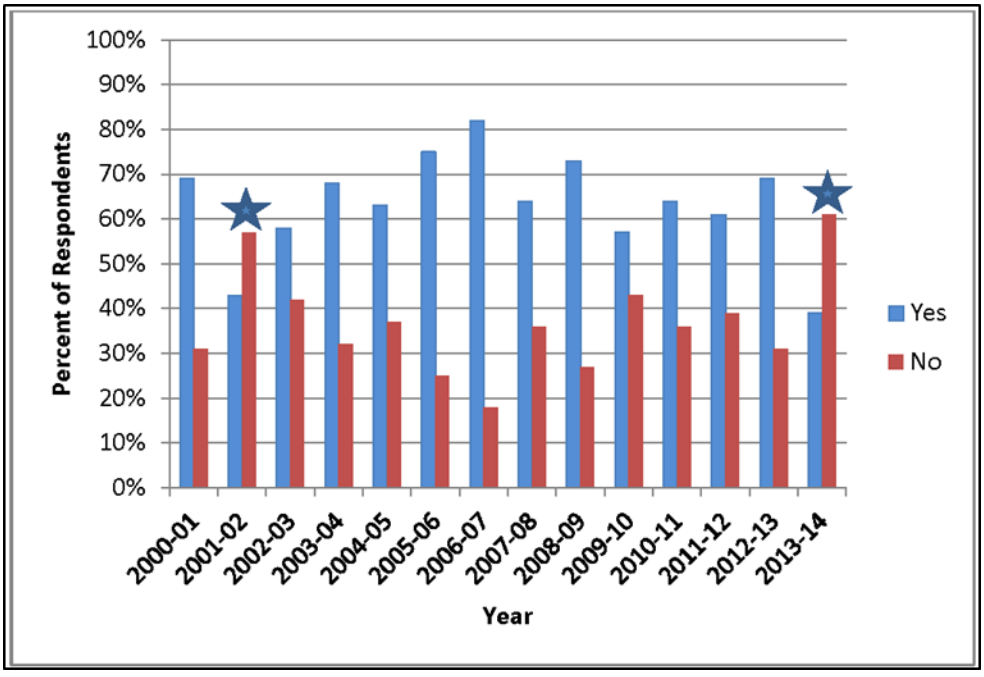


Figure 7: Percentage of respondents that met their needs for caribou from 1996-97 to 2013-14. Stars indicate years that are significantly different than other years.

For 2014/15 the conclusion was that the majority of respondents (61%) did not meet their needs for caribou in 2013-14. This represents the first year since 2001-02 where hunters that were interviewed did

not meet their needs for caribou. This result is significantly different than all years with the exception of 2001-2002. Two reasons are provided: first, 33% of respondents did not go hunting because they bought reindeer, had no transportation, or the caribou were late or too far; second, of the 67% of respondents that did go hunting, they were not successful due to:

- A lack of transportation.
- Low availability in hunting area or changes to traditional migration routes of caribou.
- Purchase of commercial reindeer meat.
- Low water for boating.
- Poor health or advanced age of hunter.

The conclusion of this section of the annual report is that there are many factors affecting the ability of hunters to meet their needs including changing distributions, caribou migration routes and social factors.

B.3.8 Observations on PCH Abundance

The traditional knowledge section of the PCMB's 2015 annual report also presented information on the abundance of PCH over the previous year. According to the findings, out of 63 respondents:

- 46% reported seeing fewer caribou that previous years.
- 27% commented that caribou had changed their migration route.
- 21% commented that the caribou were not in their area.

Appendix C BASELINE INFORMATION RELATED TO THE PORCUPINE CARIBOU HERD

The Designated Office utilized the following maps and tables to better understand the baseline conditions for the PCH range, seasonal distribution, migration, and occupancy. Figure 8 and Figure 9 provide a visual for the PCH range and migratory routes.

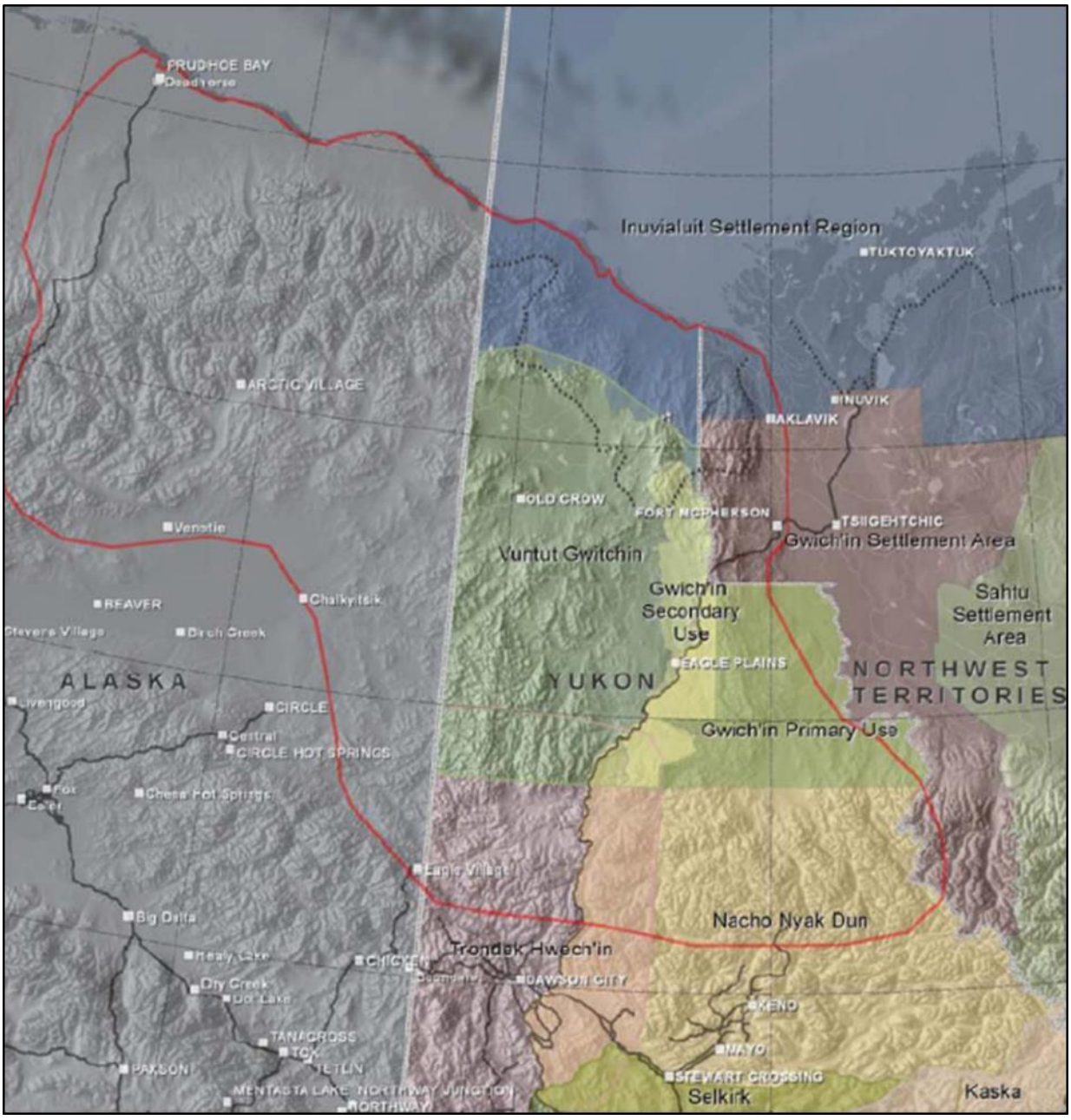


Figure 8: Porcupine Caribou Herd range (Government of Yukon, 2016)

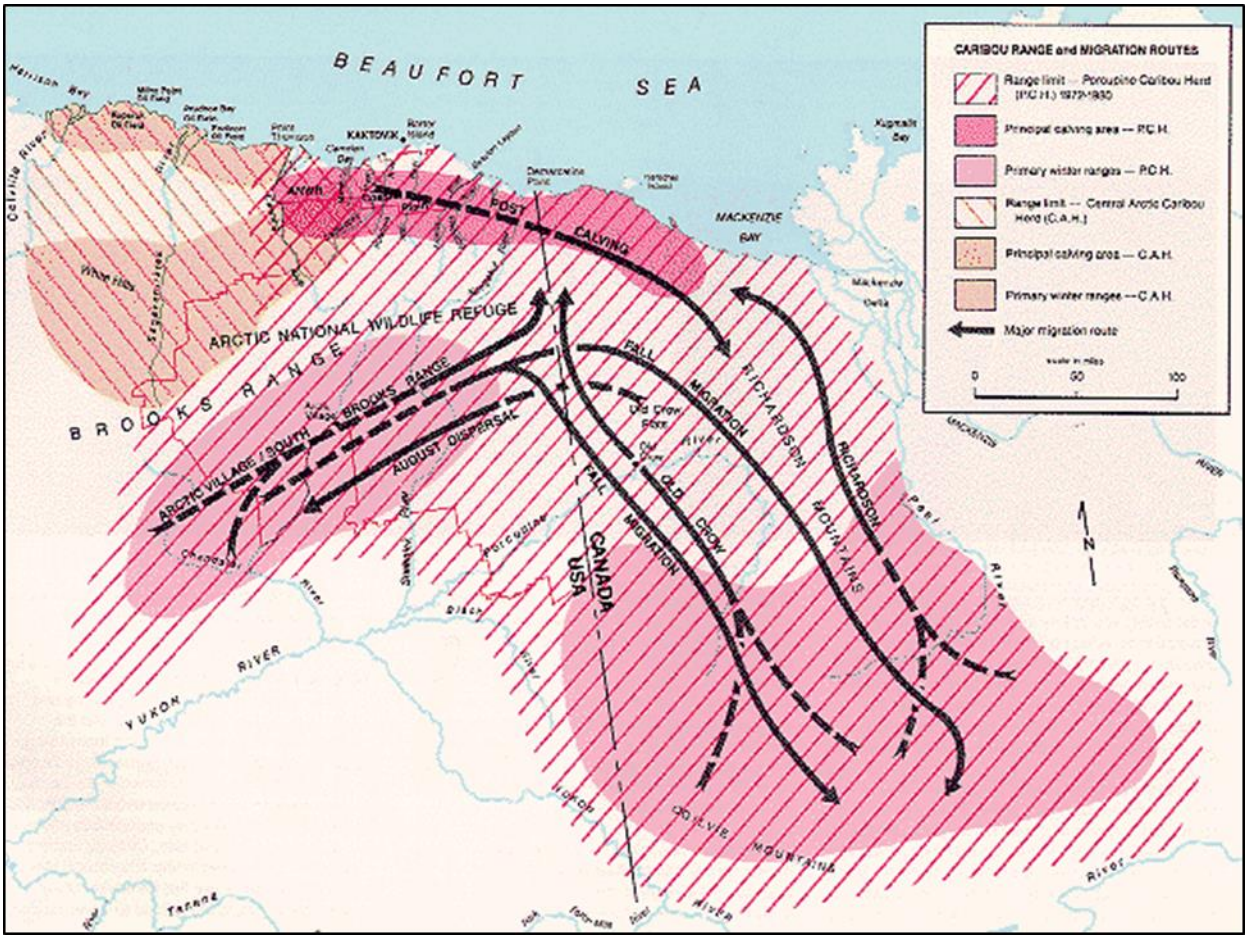


Figure 9: Migration routes of the Porcupine Caribou Herd (Caribou in the Arctic Refuge, 1994)

The PCMB provided satellite collar imagery demonstrating overlap between PCH and the Project area from October 18 - December 11, 2015 (YOR 2014-0112-223-1). **Error! Reference source not found.**Figure 10 is a clear indication of the overlap – it's important to note that the data points observed reflect the presence of caribou with satellite collars, meaning there could in fact be many more caribou present that do not have collars.

As noted by the PCMB, "Movements in November of this year [2015] likely represented 50,000+ caribou migrating directly through the Project area with many tens of thousands immediately adjacent, for a total of >100,000 caribou." And further, the PCMB state: "Movements this year typify what can be expected in the future, although it is impossible to anticipate the frequency which could range from many consecutive years to more sporadic occupation of the area. It is clear that we can anticipate a wide range of use of the Project area from tens of thousands to small or no groups of caribou in a given year, and the period may vary from days to all winter. Therefore, detection of groups in the Project area prior to new activities is key to successful mitigation." This information is demonstrative of why the Designated Office is unable to determine how the herd might respond to the Project, and this in turn makes predictions on probable effects impossible.

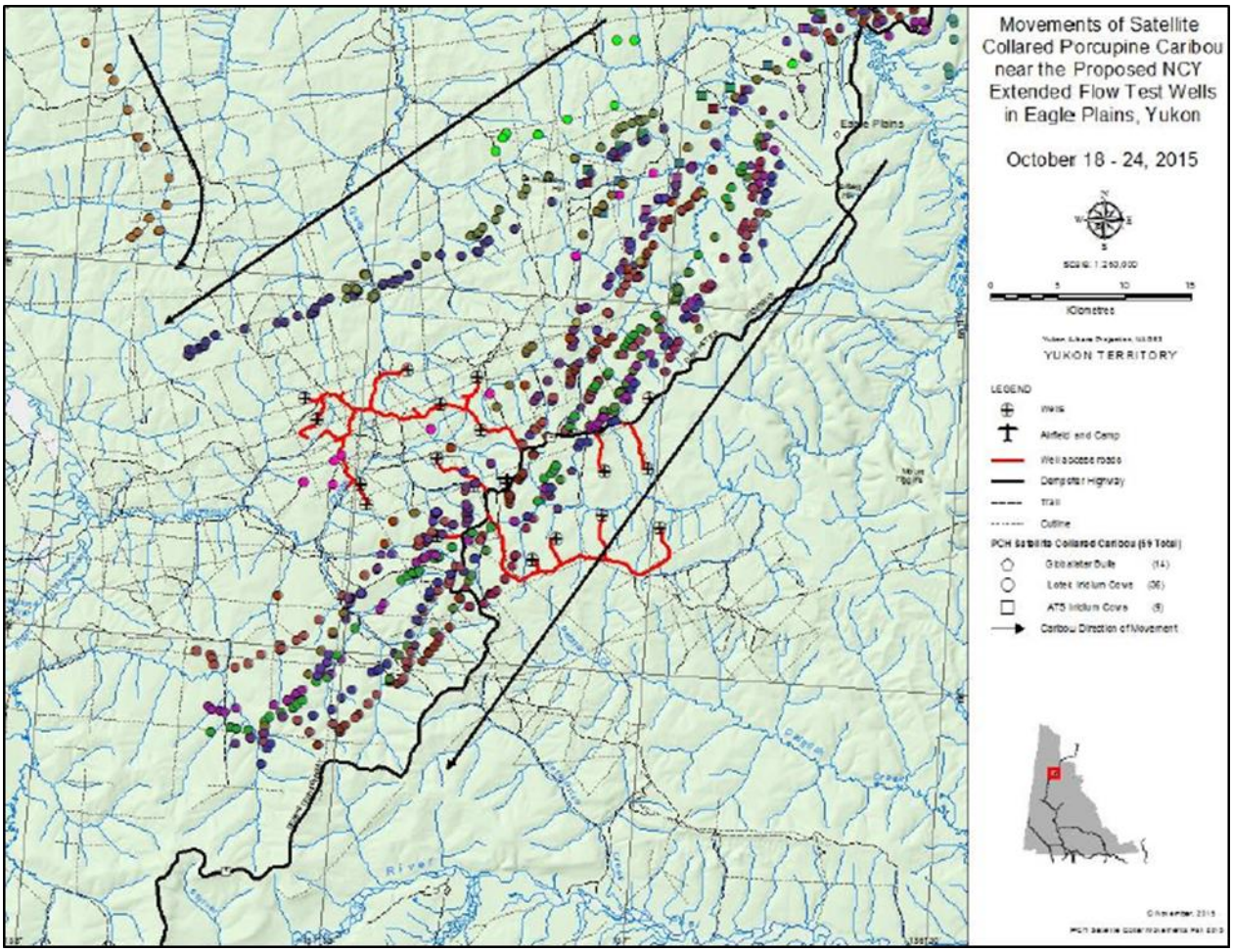


Figure 10: Location and movement of collared Porcupine Caribou in vicinity to the Project area (YOR 2014-0112-223-1)

Ryder et.al. (2006) produced an integrated assessment of the PCH that describes their seasonal distribution, movements and habitat preferences. The study considered both local knowledge and habitat suitability mapping. The following two maps (Figure 11 and Figure 12Figure 12) help to demonstrate the general overlap between the PCH and the Project during the fall, winter and spring migration and over-wintering. These maps provide a bigger picture view of the PCH patterns of movement and range use and complement the Project-specific satellite collar imagery provided by the PCMB.

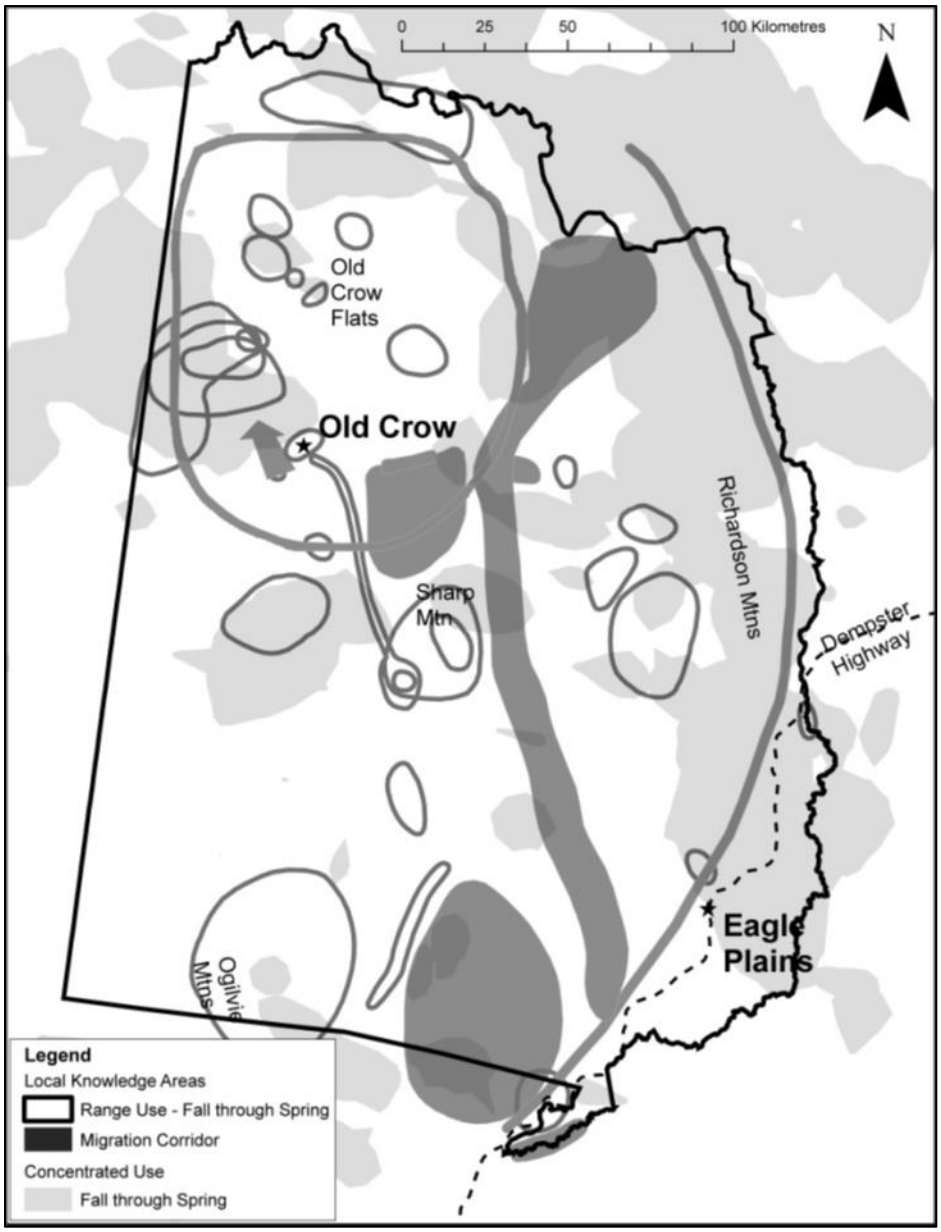


Figure 11: Overlay of local knowledge and concentrated use areas for fall, winter and spring migration seasons. Important caribou range areas within the North Yukon Planning Region from August to May, as indicated by Old Crow residents, are shown as polygons (dark grey outline). Migration corridors (dark grey shading) and concentrated use areas (light grey shading) are also shown.

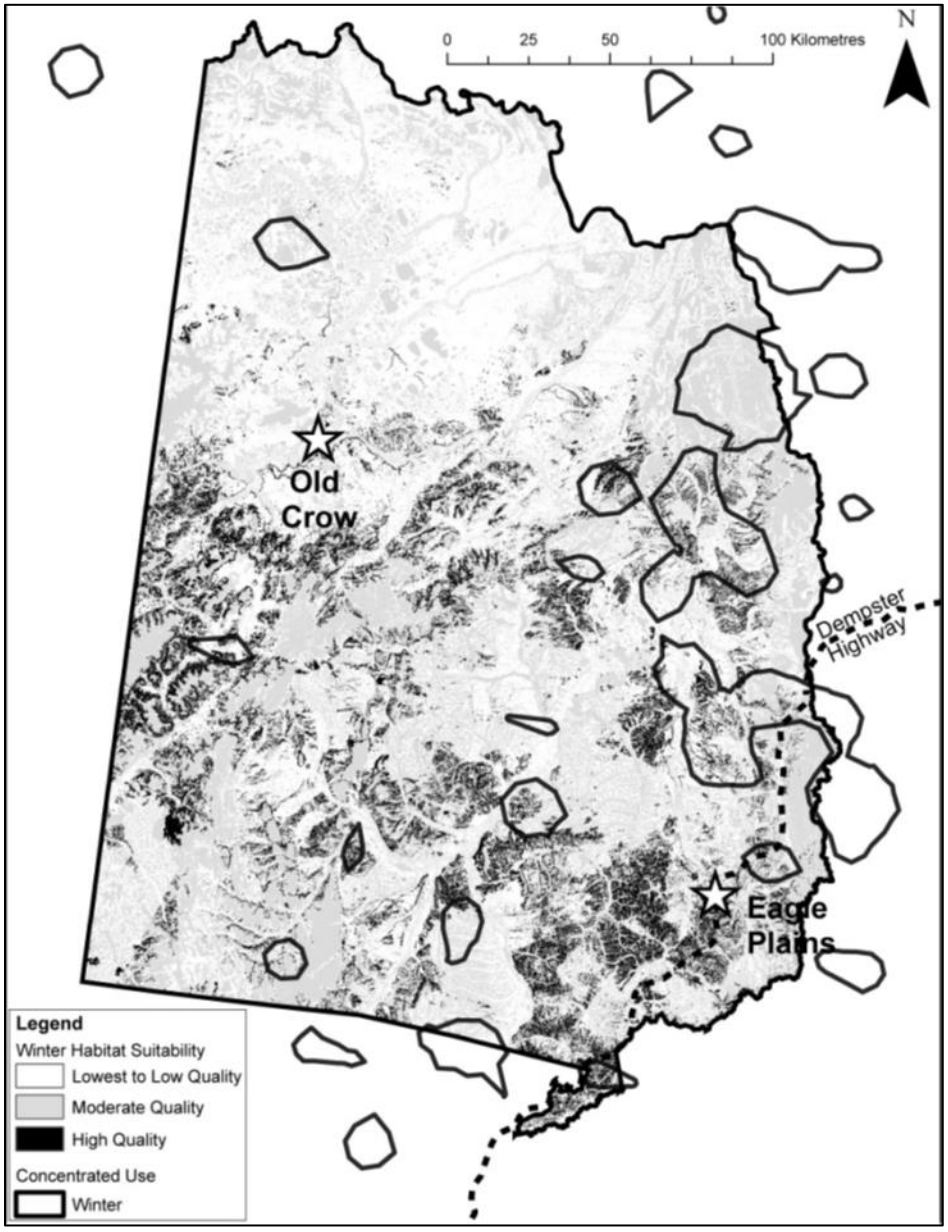


Figure 12: Overlay of concentrated use areas and habitat suitability map for the winter season. Concentrated use areas (thick black outline), high quality habitat (black shading), moderate quality habitat (light grey shading), and lowest to low quality habitat (no shading) are shown.

The International Porcupine Caribou Board (IPCB) developed a booklet in 1993 titled “Sensitive Habitats of the Porcupine Caribou Herd”. In this document, the IPCB presents an assessment criteria of seasonal habitats across the periods shown in Table 4:

Table 4: Assessment of criteria of seasonal habitats

TABLE 2

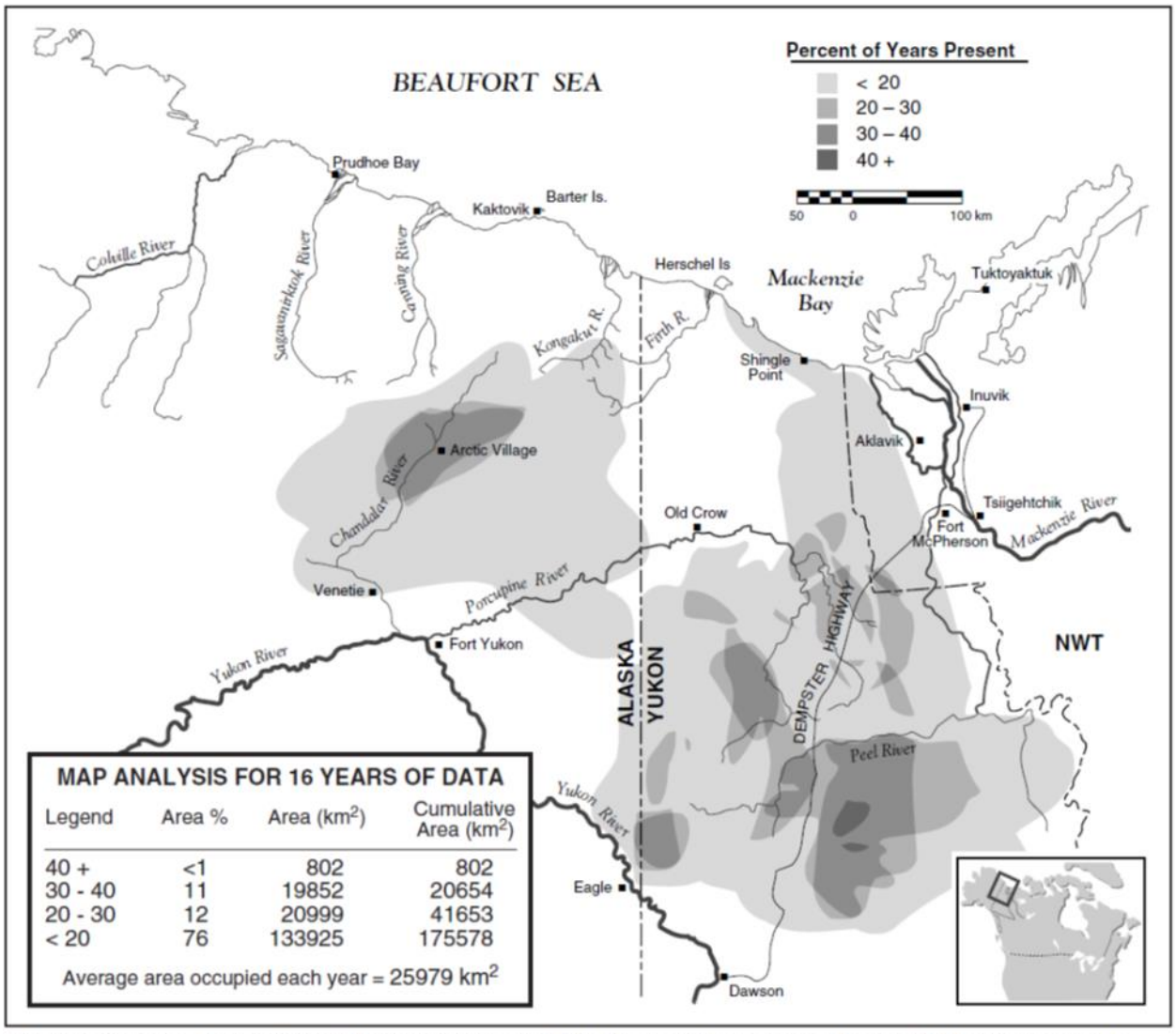
ASSESSMENT OF CRITERIA OF SEASONAL HABITATS

PERIOD	CRITERIA[1]						TOTAL[2]	IMPORT[3]
	energy balance	reproductive contribution	tolerance to disturbance	escape requirements	intensity of use	alternatives available		
Early, Mid and Late Winter 1 Dec. - 31 March	2	3	3	3	3	3	17	4
Spring, Spring Migration and Pre-calving 1 April - 31 May	1	2	3	3	3	2	14	3
Calving (cows) 1 - 10 June	1	1	1	1	1	1	6	1
Calving to Movement (bulls) 1 - 30 June	3	3	2	3	2	1	14	3
Post-calving and Movement (cows) 11 - 30 June	2	1	1	1	1	1	7	1
Early Summer 1 - 15 July	1	2	2	1	1	2	9	2
Mid Summer 16 July - 7 Aug	1	2	2	1	2	2	10	2
Late Summer and Fall Migration 8 Aug - 7 Oct	3	1	3	3	3	2	15	3
Rut and Late Fall 8 Oct - 30 Nov	3	3	3	3	3	3	18	4

[1] scores - based on a 1 - 2 - 3 rating (1 = highest concern)
[2] total of criteria ratings
[3] level of importance (1 = highest importance)

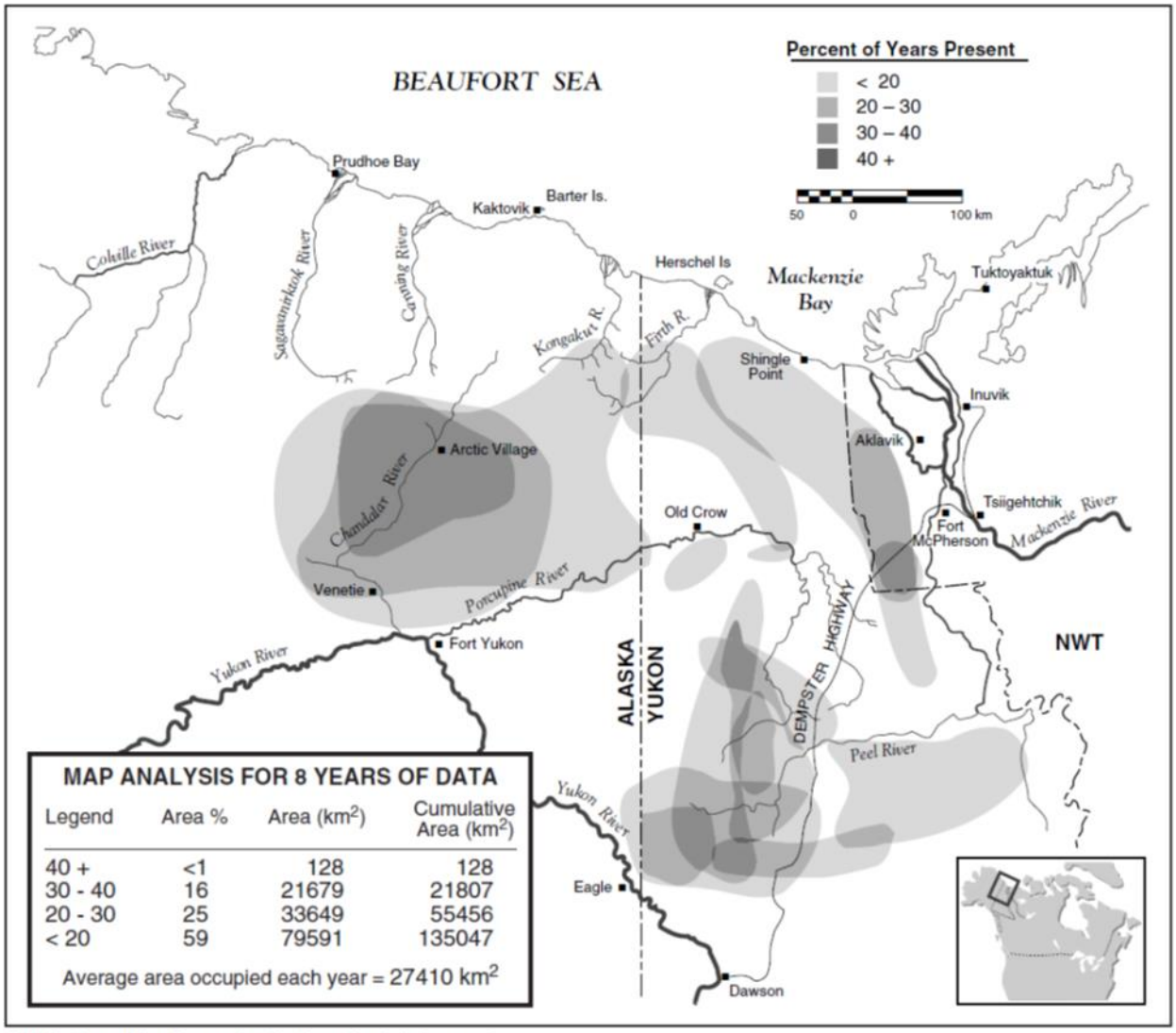
Based on review of maps provided by the PCMB and those documented by Ryder et.al, the Project area overlaps with these periods from September – April. The assessment done by the IPCB suggests that the level of importance attributed to habitat for this period of time is less than the level afforded the habitat for calving. This is based on how they scored the level of importance for the following criteria: energy balance, reproductive contribution, tolerance to disturbance, escape requirements, intensity of use, and availability of alternatives. While the Designated Office has considered this perspective, it has also considered the perspective of the PCMB provided during the assessment which stated that: "although winter is not considered as crucial as periods like calving, whatever happens to PCH in winter can affect calf survival rates, the following year’s pregnancy rates, along with every aspect of the caribou’s productivity from age of first reproduction to calf survival" (YOR 2014-0112-113-1).

The following maps (Figure 13, Figure 14 and Figure 15) were included in the IPCB's booklet and further demonstrate a general understanding of the overlap between the rut, over-wintering and spring migration of the PCH in relation to the Project area.



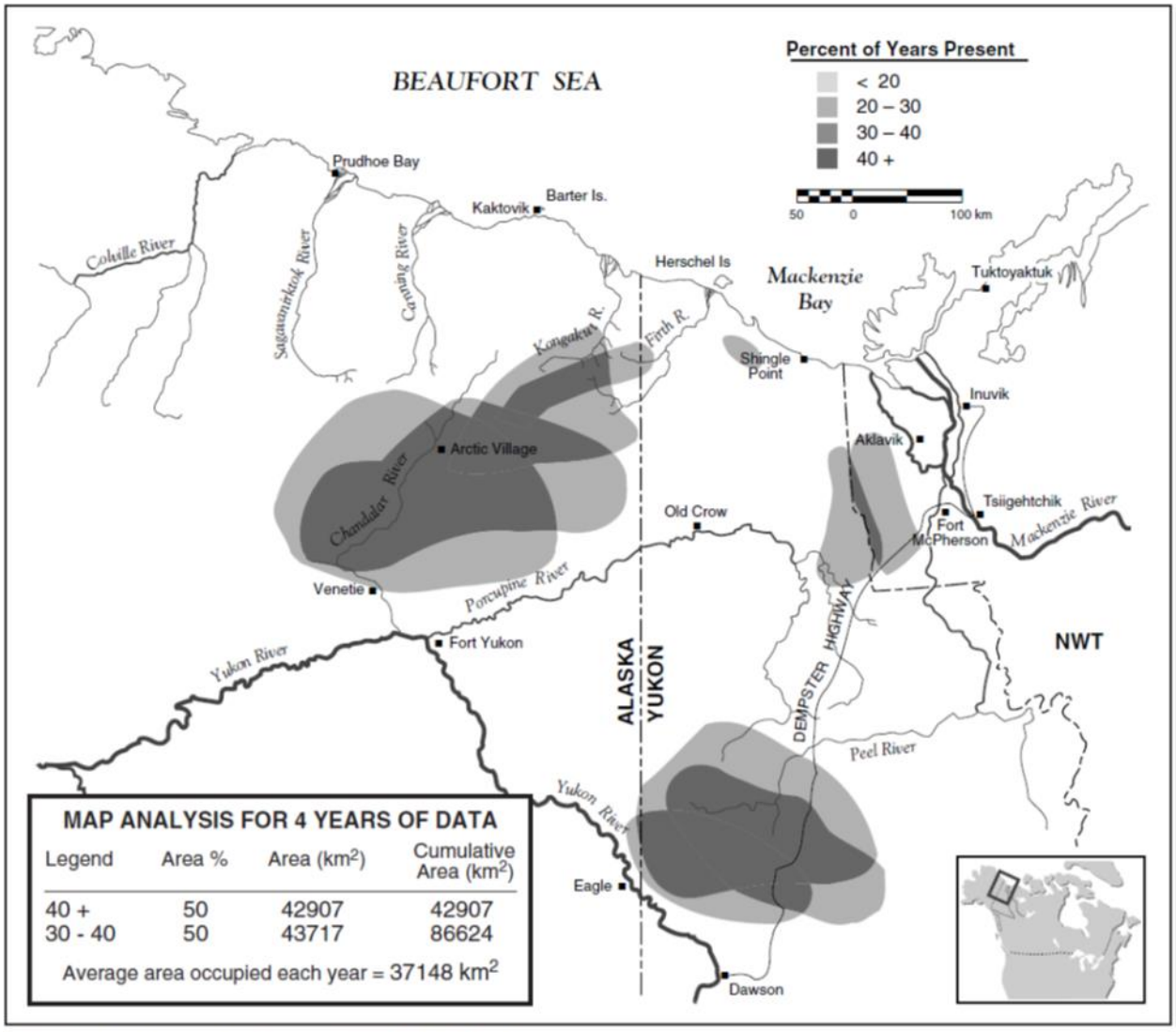
This map represents the distribution of the herd in late winter for all years with data. Early and mid-winter distributions tend to overlap with late winter distributions.

Figure 13: Porcupine Caribou Herd distribution in late winter for all years with data



Distribution of the Porcupine Caribou Herd during spring.

Figure 14: Distribution of Porcupine Caribou Herd in spring



Distribution of the Porcupine Caribou Herd during the rut.

Figure 15: Distribution of Porcupine Caribou Herd during rut

Figure 16 depicts the areas within and near the Project area affected by forest fire since 1970.

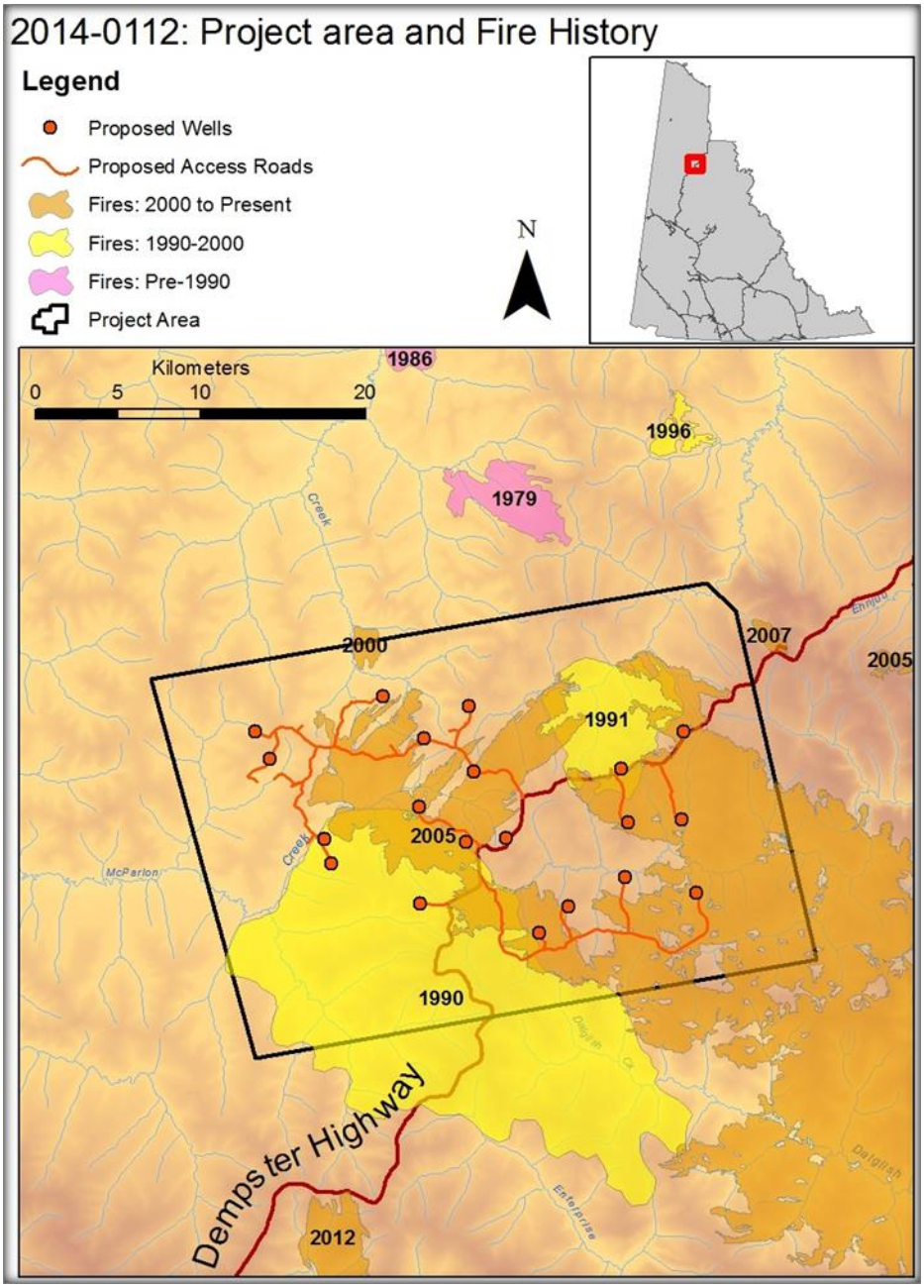


Figure 16: Fire history in the Project area from 1970 onwards.

Appendix D ZONE OF INFLUENCE

In attempting to understand the potential significant adverse effects of this Project to access to and use of the PCH, the Designated Office considered the potential ZOI that Project activities could impose. The ZOI refers to the area in which a species changes its behaviour, habitat selection, and distribution due a particular activity or development. ZOI are generally associated with negative changes to habitat selection, distribution, and behaviour. ZOI may also be used to characterize potential adverse effects to access to and use of the PCH as a result of Project activities.

Russell (2014) summarizes the ZOI from multiple projects affecting caribou, but most relevant to this Project are displacement distances caused by all-season roads and point-source disturbances. He identifies in his review a ZOI of 4 km during construction of all-season roads and 1.5 km during road operations for barren-ground caribou in the NWT and NT, noting that projects there have acknowledged that ZOI may reach out to 5 km for exploration activities and road components alone. Johnson and Russell (2014) found low densities or widely distributed but low use access roads and 2D seismic lines were avoided by the PCH in this area by 11 km shortly after their development and reducing that avoidance to 6 km following at least 20 years of non-use. As indicated by the PCMB, avoidance of the Dempster Highway was 30 km shortly after construction and reducing to 18.5 km after the features had been present for at least 20 years (YOR 2014-0112-133-1).

Figure 17 provides a visual of the potential ZOI caused by this Project as identified by Mr. Russell and the PCMB. Using a ZOI model, disturbances to caribou extend beyond the relatively small area of projected direct disturbance identified by the Proponent and considered in the threshold discussion in the NYRULP conformity check. Where the surface and linear disturbance indicators used in the conformity check are meant to measure direct disturbances to caribou and their habitat resulting from Project activities, a ZOI is arguably a better indicator of adverse effects to caribou in relation to disturbance and habitat avoidance. The NYRLUP does not speak to ZOI in terms of indicators or thresholds of disturbance. The ZOI for existing past development within land management unit #9, in which the proposed Project is based, is currently unknown in relation to critical habitat or within the range of the PCH.

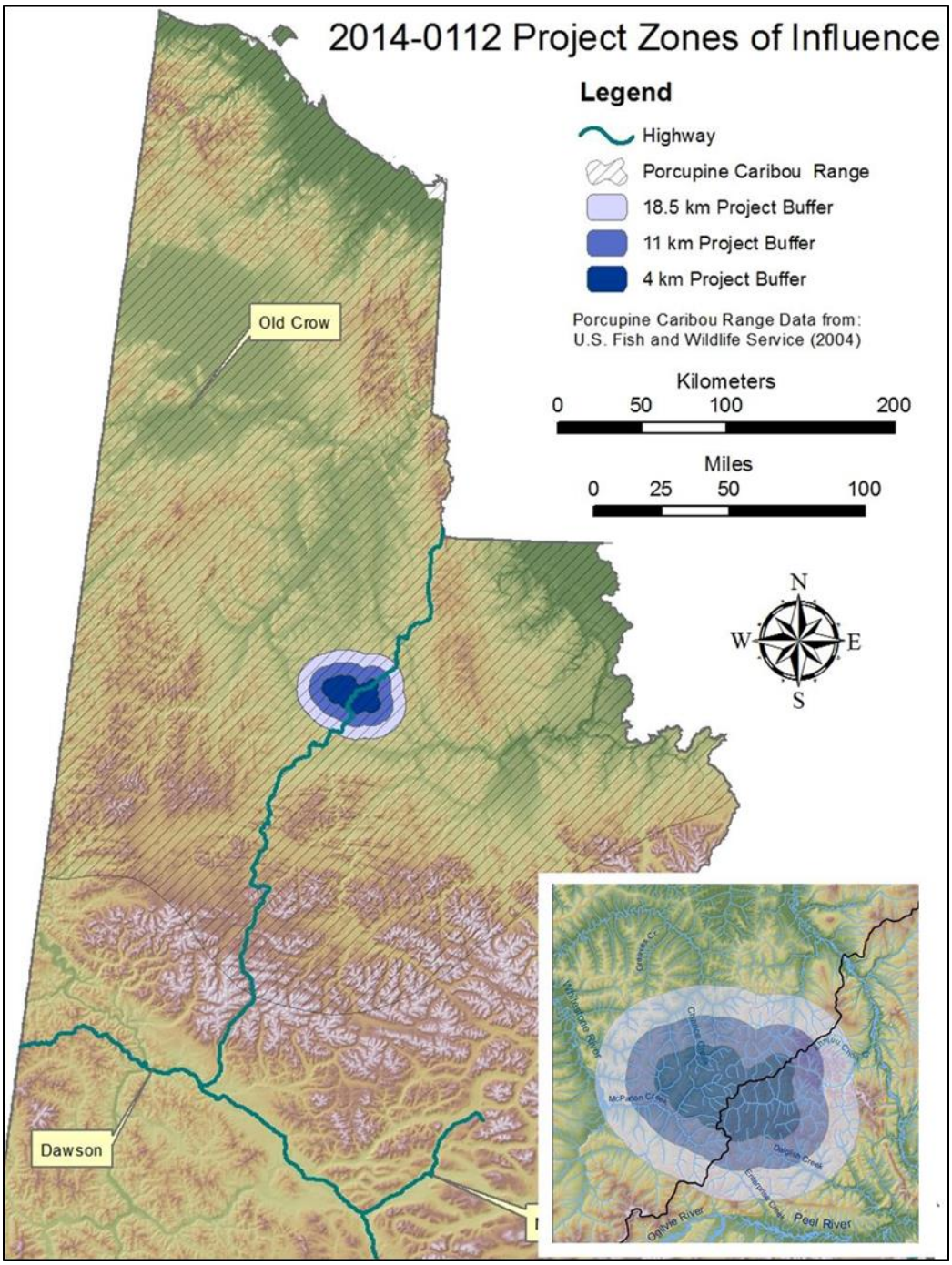


Figure 17: Estimated zone of influence for Porcupine Caribou in relation to potential avoidance of activities associated with Project 2014-0112

Appendix E CONSIDERATION OF THE NORTH YUKON REGIONAL LAND USE PLAN

In 2009 the NYRLUP was approved by the Government of Yukon and the VGFN. The plan was developed and recommended by the North Yukon Planning Commission. This commission was established by the Yukon Land Use Planning Council as per chapter 11 of the Umbrella Final Agreement.

The NYRLUP was developed in accordance with the principles of sustainable development, precautionary principle, conservation and adaptive management and set out to achieve the following goals:

- Promote sustainable development by ensuring that social, cultural, economic and environmental policies are applied to the management, protection and use of land, water and resources in an integrated and coordinated manner.
- Maintain terrestrial habitat in a condition required to sustain regional wildlife populations.
- Maintain aquatic habitat in a condition required to sustain regional fish populations.
- Maintain the integrity of wetlands, lakes, rivers and sensitive permafrost areas.
- Recognize, conserve and promote the heritage and cultural resources and values of the Vuntut Gwitchin, other affected First Nations, and the Yukon.
- Facilitate economic development opportunities and activities that result in socio-economic benefits to the community of Old Crow, other affected First Nations and Yukon as a whole, and that meet the sustainable development criteria established by this Plan. (North Yukon Planning Commission, 2009)

The plan provides important guidance for wildlife in general and specifically for the PCH. Figure 18 identifies the objectives and strategies in relation to wildlife:

GOAL 2 – WILDLIFE **Maintain terrestrial habitat in a condition required to sustain regional wildlife populations.**	
OBJECTIVES	STRATEGIES
2.1. Minimize direct and indirect human-caused habitat disturbance and alteration.	2.1.1 Reduce size, intensity and duration of human-caused physical surface disturbances (e.g., utilize low impact seismic, winter roads and enhanced reclamation). 2.1.2 Reduce other human land use impacts such as noise, smell and light.
2.2. Minimize habitat fragmentation as a result of human features.	2.2.1 Coordinate, manage and minimize new road and trail access.
2.3. Minimize potential habitat avoidance that results from human features and activities.	2.3.1 Avoid or reduce activities in significant wildlife habitats during important biological periods (e.g., utilize timing windows).
BEST MANAGEMENT PRACTICES – GENERAL	• Avoid or minimize the creation of new access roads and trails; utilize existing routes unless their use will cause additional long term environmental impacts (e.g., permafrost degradation). • Avoid or minimize the size, extent, duration and level of activities in concentrated seasonal use areas. • Use appropriate operational timing-windows in significant wildlife habitats to minimize activities, whenever possible, during periods of wildlife use. • When new access creation is necessary: o Non-permanent winter access routes should be developed and utilized versus all-season access routes. o Gate or otherwise restrict hunting along new access routes. o Where possible, direct new access routes through less significant wildlife habitats.
INDICATORS	• Surface disturbance. • Linear density. • Other indicators to be determined through future research and plan implementation.

Figure 18: NYRLUP - objectives, strategies and best management practices for wildlife

The plan also provides the following best management practices for the PCH:

- Avoid or minimize the size, extent, duration and level of activities in concentrated seasonal use areas.
- Avoid using or crossing seasonal migration corridors with new access routes.
- Define and implement safe operating distances from the herd.

- Consider the following seasons when determining appropriate operational timing-windows:

Winter:	December 1 to March 31
Spring migration:	April 1 to May 31
Early summer:	July 1 to July 15
Mid to late summer:	July 16 to August 7
Fall migration:	August 8 to October 7
Rut:	October 8 to November 30

The planning region is divided into thirteen land management units (LMU). The project is located within LMU#9 - Eagle Plains, an area representing 11% of the planning region. The plan provides special management considerations and of relevance to this assessment is the following recommendation:

> "potential new all-season access roads into LMU#9 from Dempster Highway corridor require careful assessment and management." (North Yukon Planning Commission, 2009)

The plan identifies Eagle Plains access management as a key issue and recommends that "in advance of significant levels of energy sector activity, an access management plan should be developed for the Eagle Plain oil and gas basin." (North Yukon Planning Commission, 2009)

The plan also identifies the following key issues in relation to the development of oil and gas reserves within this management unit (note: only content relevant to this assessment is quoted):

- Coordinated and effective management of the Porcupine Caribou Herd habitat and population requires and integrated approach, in advance of increasing industrial use.
- Land use conflicts might arise between: b) oil and gas and traditional economic activities and cultural pursuits, and c) oil and gas and Porcupine Caribou Herd use of winter range.

The plan concludes in this section that "specific recommendations relating to the management of oil and gas exploration and development activities are not required at this time… existing best management practices, used in combination with the direction provided by this Plan, are considered adequate to mitigate potential impacts of oil and gas activity." (North Yukon Planning Commission, 2009)

The NYRLUP provides important guidance to the assessment of this project. There are two caveats to the utility of this plan for this assessment. First, the plan is an expression of the interests and vision of the VGFN and the Government of Yukon for the North Yukon The plan does not formally capture the interests and vision of other First Nations and the Inuvialuit in relation to the PCH and their habitat. Second, the plan recommends two landscape disturbance indicators (i.e. surface disturbance in hectares and linear disturbance in kilometres) to track potential cumulative effects of land use. The plan includes cautionary and critical thresholds of land use within each LMU. These thresholds are intended to provide a clear statement regarding the level of human-caused environmental change (i.e. functional disturbance) that might be considered acceptable within a specific LMU. While these indicators are important to consider, determining the significance of effects necessarily consider factors beyond these concise parameters.

APPENDIX B. Linear Feature Study

Chance Oil and Gas, Eagle Plains Project: Linear Feature Study



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Down to Earth Biology

EXECUTIVE SUMMARY

The Eagle Plains Exploration Project (the Project) is an oil and gas exploration project located in north Yukon. Chance Oil and Gas Ltd. (Chance) intends to conduct exploratory activities to confirm the quality, quantity, and extent of hydrocarbons over ten years. Work will include seismic exploration and exploratory wells supported by an expanded winter road network. Oil and gas exploration activities create long, narrow clearings through natural vegetation, such as seismic lines and roads, collectively known as 'linear features.' Linear features can be a management challenge because they can affect how people and animals move and plants disperse within a landscape. For example, in southern parts of the boreal forest, linear features appear to affect predator-prey dynamics that can result in increased caribou mortality by wolves. The North Yukon and Peel Watershed Regional Land Use Plans identify mitigations to minimize the potential effects of linear features, including cautionary (0.75 km/km^2) and critical (1.0 km/km^2) indicator levels of linear disturbance.

Intermittent exploration activities in the Eagle Plains area from the 1950s to 2014 have created a network of winter roads, 2D seismic lines, and, most recently, 3D seismic lines in parts of the Regional Study Area (RSA). However, the extent of liner features that currently occur in the RSA, the structural, vegetation, and functional characteristics of different linear feature types, and their degree of regeneration are unknown. EDI Environmental Dynamics Inc. conducted a linear features study to characterize the structural, vegetation, and functional aspects of linear features in the RSA to address these information gaps. The study addressed three objectives: (1) comprehensive mapping and classification of existing linear feature footprints within the RSA; (2) quantification of structural aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and (3) quantification of regeneration pathways and structural stages of linear features. This combined information supports assessing potential effects of linear features in the Project application and refinement of mitigation measures for linear features to minimize possible effects.

The linear features inventory was compiled from multiple spatial datasets and was verified and supplemented using satellite imagery in a Geographic Information System. Linear feature densities were estimated for each linear feature type. Estimates were adjusted to account for (i) overlap with open habitats, such as recent burns, where vegetation heights were similar on and off the line, and (ii) for average rates of regeneration determined from field studies.

Site selection used a stratified random design to obtain a representative sample of different feature types across the RSA. Ground and aerial surveys measured specific structural, vegetation, and functional characteristics across the different line types. Measures included width, successional class, structural stage, vegetation composition and height, and sightline distances. A 'walk test' was used to index ease of movement for large mammals. A driving survey documented the visibility of seismic lines from the Dempster Highway (i.e., as an index of potential human access onto the seismic lines). An aerial winter track survey was conducted in March 2020 to assess ungulates' relative use of different linear feature types.

Four primary types of linear features occur in the RSA, totalling 4,269 km: 2D seismic (34%), 3D seismic (51%), winter roads (14%), and the Dempster Highway (1%). The unadjusted linear feature density for the RSA totalled 1.79 km/km^2. After accounting for burns, natural openings and regeneration, the adjusted linear

feature density for the RSA totalled 0.52 km/km², below the cautionary and critical indicator levels in the North Yukon and Peel Watershed Regional Land Use Plans.

Structural, vegetation, and functional characteristics differed substantially among linear feature types. 3D seismic accounts for the largest extent of linear features in the RSA and had the narrowest widths and limited functional effects (e.g., the proportion of features used by ungulates in the winter was less than a third of the rates of use on 2D and winter roads). Winter roads had the widest average widths and the greatest functional effects except for the Dempster Highway. However, a substantial portion (39%) had also regenerated into or past the Tall Shrub stage (which this study suggests may be the best criterion for functional recovery). Most 2D lines had substantial vegetation regeneration, resulting in the shortest average sightlines and slowest movement speeds. However, ungulates still appeared to select them to travel on during winter.

Except for the Dempster Highway, where walking speeds were near twice the rate of other linear feature types, there was relatively little difference in movement rates among linear feature types and control areas. The density of shrubs and trees primarily limited movement rates. 2D lines, which had the highest density of shrubby regeneration, had the slowest average movement rates. For other linear feature types, the combination of vegetation regeneration on linear features and the naturally open nature of most adjacent undisturbed areas did not convey a substantial increase in movement rates on linear features compared to undisturbed areas.

Sightline distances on 2D lines and winter roads were also affected mainly by the degree of vegetation regeneration. Where regeneration was limited, sightlines on 2D lines and winter roads regularly exceeded 150 m. On 3D lines, which have not had enough time since their creation for vegetation to regenerate to the height that restricts vision, sightlines were limited by meanders purposely constructed to reduce sightlines. The meanders employed on 3D lines were also effective in reducing the detectability of the lines from the Dempster Highway. In the blind test, where observers did not know the location of the 3D lines, only 5% (4 out of 74) crossings were spotted. With a map showing the crossing locations, only two additional 3D lines were detected.

These results provide information to assess the potential effects of linear features in the Project application and refine mitigation measures.

ACKNOWLEDGEMENTS

EDI Environmental Dynamics Inc. (EDI) completed the work within the traditional territories of the Vuntut Gwitchin First Nation (VGFN), First Nation of the Na-Cho Nyäk Dun, and the Tetlit Gwich'in Council (Secondary Use Area). Tyrel Kassi, a VGFN citizen, played an active role in the field components of the project. We thank him for his diligence and shared perspectives during the project.

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Todd Mahon, Hannah Gray, Rachelle Robitaille, and Brodie Smith conducted the field surveys for this study.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
2D	Two Dimensional
3D	Three Dimensional
AIC	Akaike's Information Criterion
asl	above sea level
BC	British Columbia
°C	degrees Celsius
ELC	Ecosystem and Landscape Classification
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectares
IMA	Integrated Management Area
km	kilometers
km^2	square kilometers
km/hr	kilometer per hour
LIS	Low Impact Seismic
LMU	Landscape Management Unit
m	meter
mm	millimeter
NND	Na-cho Nyäk Dun
NWT	Northwest Territories
NYRLUP	North Yukon Regional Land Use Plan
PCH	Porcupine Caribou Herd
OHV	Off-Highway Vehicle
PWRLUP	Peel Watershed Regional Land Use Plan
RSA	Regional Study Area
the Project	the Eagle Plains Project (proposed by Chance Oil and Gas Ltd.)
YLUPC	Yukon Land Use Planning Council

1 INTRODUCTION

1.1 PROJECT OVERVIEW

The Eagle Plains Project (the Project) encompasses a 2,386 km² area in north-central Yukon, approximately 605 km north of Whitehorse and 40 km south and west of Eagle Plains hotel, along the Dempster Highway (Map 1-1). The Project occurs within the Eagle Plains petroleum basin, north of the Ogilvie River and west of the Richardson Mountains. The basin contains proven natural gas and oil reserves (Peel Watershed Planning Commission 2019), including 4.6 billion m³ of gas and 3.2 million m³ of oil (Hannigan 2014).

The Regional Study Area (RSA) has had intermittent periods of oil and gas exploration since the 1950s. That activity has developed winter roads, seismic lines, and exploratory wells across parts of the current RSA. Approximately 40 exploration wells have been drilled at Eagle Plains. Eight wells are maintained in suspended status, and the remaining wells have been plugged and abandoned. Seismic exploration has included approximately 10,000 km of two-dimensional (2D) lines (mainly before 1985), and about 325 km² of three-dimensional (3D) seismic was conducted in 2013–2014 (Northern Cross (Yukon) Ltd. 2014).

The current exploration program will build on past exploration to better define the extent, amount and quality of oil and gas deposits. Under the current program, Chance Oil and Gas Ltd. proposes conducting additional 3D seismic over large extents of the RSA and drilling up to 30 exploratory wells. Depending on the drilling program results, extended flow testing over several months may be conducted at a subset of the wells to determine the quantity and quality of the oil and gas deposit. The existing winter road network will be expanded to support the seismic and drilling programs. Most work is expected to be conducted in the winter (e.g., seismic line clearing and drilling); however, seismic recordings and extended flow testing may also occur during summer.

Oil and gas exploration activities create long, narrow clearings through natural vegetation, such as seismic lines and roads, collectively known as 'linear features.' Linear features can be a management challenge because they can affect how people and animals move and plants disperse within a landscape. For example, in southern parts of the boreal forest, linear features appear to affect predator-prey dynamics that can result in increased caribou mortality by wolves. The North Yukon and Peel Watershed Regional Land Use Plans identify mitigations to minimize the potential effects of linear features. The Plans also include cautionary (0.75 km/km²) and critical (1.0 km/km²) linear density indicator levels.

1.2 PURPOSE AND OBJECTIVES

Intermittent exploration activities in the Eagle Plains area from the 1950s to 2014 have created a network of winter roads, 2D seismic lines, and, most recently, 3D seismic lines in parts of the RSA. However, the extent of liner features that currently occur in the RSA, the physical and functional characteristics of different linear feature types, and their degree of regeneration are unknown.

EDI Environmental Dynamics Inc. (EDI) conducted a linear features study to characterize the physical and functional aspects of linear features in the RSA to address these information gaps. The three objectives of this study were to: (1) conduct comprehensive mapping and classification of existing linear feature footprints within the RSA; (2) determine physical aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and, (3) quantify regeneration pathways and stages of linear features. The combined information forms the basis for assessing the potential effects of linear features in the RSA and refining mitigation measures for linear features.

1.3 STUDY AREA

The RSA for the Eagle Plains Project is approximately 2,386 km² (238,566 ha), centred in the Eagle Plains Ecoregion in north Yukon (Map 1-1). The area consists of subdued topography of rolling hills and sloping plains. The RSA is centred on a major watershed divide (denoted by the location of the Dempster Highway), with the northwestern two-thirds of the RSA draining into the Porcupine River watershed to the north, via Chance Creek, and west, via McParlon Creek and the Whitestone River. The southeastern third of the RSA drains into the Peel River watershed via Dalglish Creek.

Development in the RSA and the surrounding Eagle Plains is low. The Dempster Highway is the primary vehicle access corridor, running from approximately Dawson City, Yukon in the south to Inuvik, Northwest Territories in the north, and transiting the RSA. The Eagle Plains settlement is on the Dempster Highway, approximately 40 km northeast of the RSA and includes the Eagle Plains Hotel and the Government of Yukon's Highway Maintenance camp. The Eagle Plains area has had intermittent periods of oil and gas exploration since the 1950s. That activity has created winter roads, seismic lines, and exploratory wells across parts of the RSA. Approximately 40 exploration wells have been drilled at Eagle Plains. Eight wells are maintained in suspended status, and the remaining wells have been plugged and abandoned. Approximately 10,000 km of 2D lines have been developed across the Eagle Plains Ecoregion, mostly between 1961 and 1984 (Access Consulting Group and EBA Engineering Consultants Ltd. 2001, GEOTIR 2014). More recently, approximately 2,200 km of 3D LIS exploration was conducted in a 325 km² area between November 2013 and April 2014 (GEOTIR 2014). This 3D exploration grid is near the centre of the RSA, spanning north and south of the Dempster Highway.

1.3.1 REGIONAL ECOLOGICAL SETTING

The Eagle Plains Ecoregion is a 20,400 km² portion of the Taiga Cordillera Ecozone in north Yukon between the Richardson and Ogilvie Mountains. Unlike much of the mountainous Taiga Cordillera, most of the Eagle Plains Ecoregion occurs as low altitude rolling topography between 300 m and 600 m above sea level (masl), with few scattered peaks above and around 1,000 masl (Ecological Stratification Working Group 1995). Most of the ecoregion is unglaciated terrain, with surficial features formed due to permafrost and frozen ground-related processes, including thermokarst subsidence, soil creeps, cryoturbation, solifluction, and active layer detachment slides on shale (Yukon Ecoregions Working Group 2004).

The Eagle Plains Ecoregion experiences moderate precipitation, with annual amounts around 400 mm. Most precipitation falls as rain throughout the summer, averaging 50 to 80 mm per month, June through August. Precipitation is lighter through September to April and falls as snow, with average winter snowpacks of 80 cm peaking in April. The climate is strongly affected by latitude, with extended winter conditions from October to early May. There is a substantial variation in seasonal temperatures in the Eagle Plains, with cool short summers and long cold winters. Average winter temperatures are between −30°C and −25°C, with extremes as low as −60°C. Average summer temperatures are around 13°C, with extremes as high as 30°C. Due to the northern latitude, this region experiences continuous sun above and below the horizon, in summer and winter, respectively.

Most of the Ecoregion, including the northeast portion of the RSA, drains north into the Yukon River via the Whitestone, Porcupine and Eagle rivers. That part of the RSA includes the headwaters of the Eagle River and several other tributaries of the Porcupine River, along with the Chance and McParlon Creek subdrainages of the Whitestone River. The southeast corner of the Ecoregion drains east to the Mackenzie River via the Peel, Wind and Ogilvie Rivers. Dalglish and Enterprise creeks flow directly into the Peel River. The few lakes in the Ecoregion are generally oxbow or thermokarst lakes (Yukon Ecoregions Working Group 2004). Several wetland complexes are associated with larger creeks in the RSA.

The Eagle Plains Ecoregion is within the continuous permafrost zone where permafrost can be found up to 200 m thick. The Eagle Plains Ecoregion is dominated by the Cryosolic soils that occupy much of the northern third of Canada, characterized by near-surface permafrost. Turbic Cryosols predominate, exhibiting patterned ground formations and hummocks, and are often associated with open stands of black spruce (*Picea mariana*), tamarack (*Larix laricina*) and birch (*Betula* spp.). The active permafrost layer in these ecosystems generally ranges between 20 cm and 90 cm below the surface. The active layer depth is generally deeper directly under hummocks and shallower under inter-hummock areas (Yukon Ecoregions Working Group 2004).

The RSA is entirely within the Subarctic Bioclimate Zone (Environment Yukon 2014). Vegetation in the RSA is characterized by open-canopy, spruce-dominated habitats where permafrost and short cool growing seasons limit tree growth and often result in stunted, disclimax vegetation communities (Environment Yukon 2016). Hummocky, black and white spruce (*Picea glauca*) woodlands with well-developed shrub communities are common in upland areas. White spruce and ground lichens increase in abundance in well-drained sites. Areas with low slope gradients and fine-textured soils often have ground cover dominated by cottongrass tussocks beneath a shrub layer of birch, black spruce, Labrador tea (*Rhododendron groenlandicum*), and occasionally tamarack (*Larix laricina*) (Yukon Ecoregions Working Group 2004).

Forest fires are a common disturbance agent in the region, and burns of various ages occur throughout the RSA. Fires increase the depth of the active permafrost layer and changes in soil moisture and productivity, affecting vegetation regeneration and resulting in terrain disturbances, such as slope failures and erosion. Regenerating burns are dominated by shrubs, such as scrub birch (*Betula glandulosa*), willows (*Salix spp.*) and alder (*Alnus spp.*), with Alaskan paper-birch (*Betula neoalaskana*) often the first tree species to colonize burn areas. As burns regenerate into young and mature forest, black and white spruce typically become the dominant forest species. Residual Alaskan birch in spruce-dominated stands often defines the extent of old burns (Yukon Ecoregions Working Group 2004).

Mammal diversity is relatively low in the Eagle Plains Ecoregion due to its northern location and low productivity. Voles (*Microtus* spp., *Myodes* spp., *Phenacomys* spp.), American marten (*Martes americana*), ermine (*Mustela erminea*), and red fox (*Vulpes vulpes*) are common smaller mammals. Wolves (*Canis lupus*), wolverines (*Gulo gulo*), and both black and grizzly bears (*Ursus americanus* and *U. arctos*.) are present at low densities. Moose (*Alces alces*) inhabit the region year-round. The RSA overlaps a small portion of the winter range of the Porcupine caribou herd (PCH), a subpopulation of the barren-ground caribou (*Rangifer tarandus granti*). The PCH is an iconic species in north Yukon, with high cultural, social, economic, and ecological values. The PCH's population has been increasing over the last several decades and is currently estimated to consist of 202,106 to 234,808 caribou (Caikoski 2017, Porcupine Caribou Technical Committee 2018). The PCH is known to occupy portions of the Eagle Plains Ecoregion in fall and winter when they tend to occur in smaller groups over a larger area than during other seasons.

1.3.2 REGIONAL LAND USE PLANNING

The RSA overlaps four First Nation Traditional Territories. Most of the RSA is within the Traditional Territory of the Vuntut Gwitchin First Nation. The southeastern portion is in an area of overlapping Traditional Territories of Vuntut Gwitchin First Nation, the Tetlit Gwich'in Council, the First Nation of Na-cho Nyäk Dun, and Tr'ondëk Hwëchin. Although the RSA is located outside of any First Nation Settlement Lands, it does abut Vuntut Gwitchin First Nations Settlement Lands on parts of its east and southwest borders. Each First Nations government has provided input to, and approved of, the Regional Land Use Plan(s) on their Traditional Territory under the respective First Nation Final Agreements.

1.3.2.1 North Yukon Regional Land Use Plan

The RSA lies mainly within the North Yukon Planning Region and is subject to the North Yukon Regional Land Use Plan (NYRLUP) (Map 1-1). The NYRLUP was created to protect the natural and cultural resources of the region while allowing sustainable economic development opportunities (Vuntut Gwitchin Government and Yukon Government 2009). It provides management direction for using public and settlement lands based on four principles: sustainable development, precautionary principle, conservation, and adaptive management. The NYRLUP divides the Planning Region into 23 land management units classified into three categories: protected area, integrated management area (IMA), and community area. IMAs are further classified into four zones: Zone 1 (lowest development), Zone II (low development), Zone III (moderate development), and Zone IV (highest development). IMA zones are classified based on the area's sensitivity to landscape disturbance, ecological and cultural values, risk of significant impacts, and level of acceptable change. The RSA is a Zone IV IMA with lower ecological and cultural values in a moderately sensitive biophysical setting. Subsequently, Zone IV IMAs allows for the highest development level to occur.

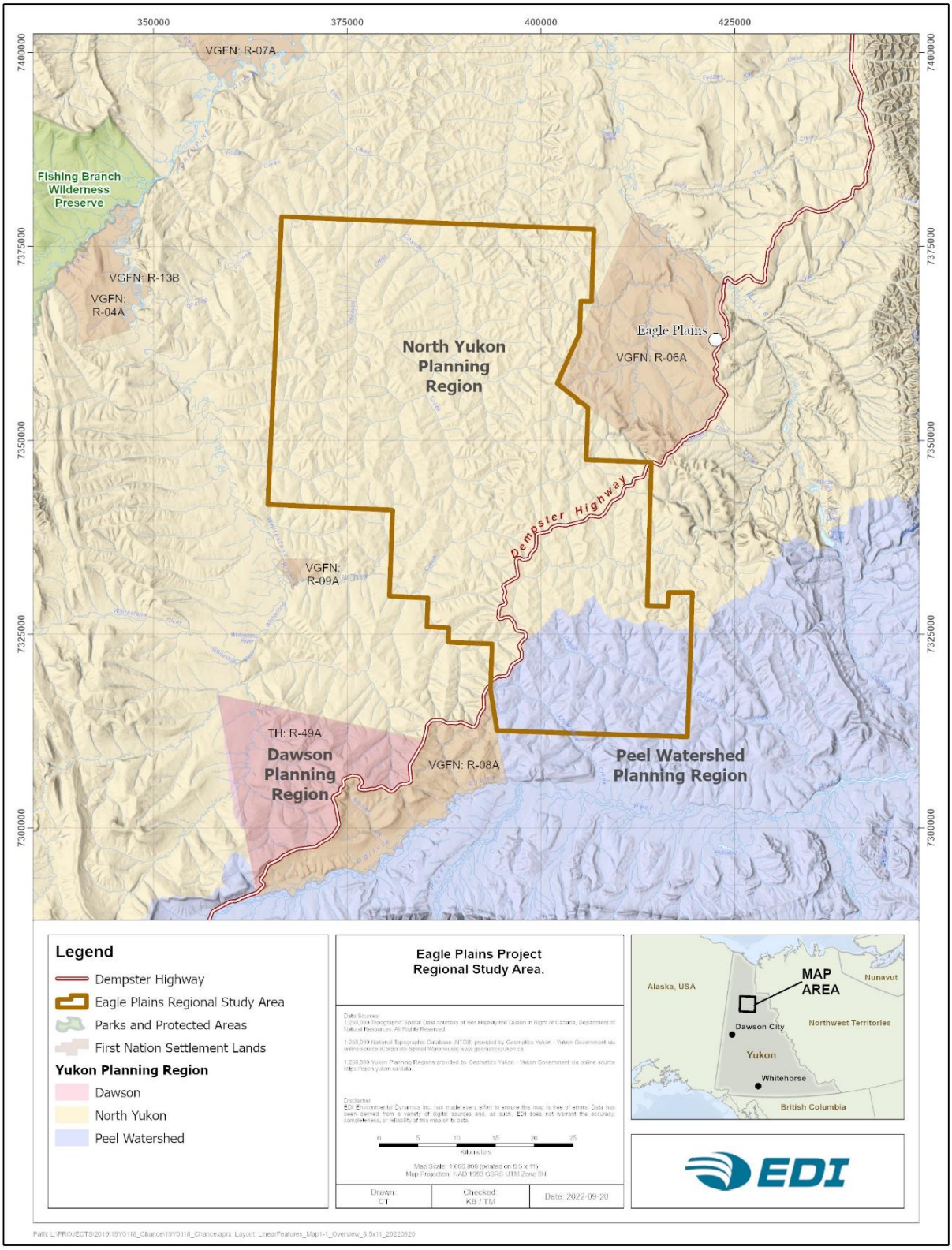
The NYRLUP encourages results-based management and uses cumulative effects indicators to determine if goals and objectives are met. Results-based management allows for innovation and creativity in land-use strategies and approaches. The two cumulative effects indicators included in the NYRLUP are direct surface disturbance and linear density. The NYRLUP guidelines for Zone IV IMAs are 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density (Vuntut Gwitchin Government and Yukon Government 2009).

However, as surface disturbances and linear features reach a level of functional recovery and become part of the continuous landscape, they can be subtracted from the total amount of disturbed area (Vuntut Gwitchin Government and Yukon Government 2009). The NYRLUP suggests using a height of 1.5 m for woody vegetation in forested areas, as vegetation above this height would likely no longer allow for travel or access by humans or wildlife and is, therefore, considered functionally recovered. Activities considered exempt from functional disturbance restrictions are (1) new linear features less than 1.5 m wide; (2) land-use activities that occur on frozen water bodies; (3) winter work with no required clearing of trees; and (4) winter work that uses existing disturbances and linear features.

1.3.2.2 Peel Watershed Regional Land Use Plan

The southeastern corner of the RSA lies within the Peel Watershed Planning Region (PWPR) and is subject to the Peel Watershed Regional Land Use Plan (PWRLUP) (Peel Watershed Planning Commission 2019) (Map 1-1). Like the NYRLUP, the PWRLUP was established to provide management direction and ensure long-term sustainable development in the Planning Region. The PWRLUP was founded on three main themes: environmental protection, social considerations, and economic development. It follows a similar framework as the NYRLUP. The PWPR is divided into 16 Landscape Management Units (LMU), which each share similar ecological characteristics, planning issues, and management intent. Each LMU is categorized by a land-use designation system. Conservation Areas are managed to protect ecological and cultural resources, while IMAs are 'working' landscapes where new development and surface disturbance may be allowed. IMAs are further classified into Zones, which correspond to the level of allowable development with comparable justification as the NYRLUP. The RSA is part of LMU 7 (Dalglish Creek), classified as an IMA Zone IV, allowing for the highest level of development.

Like the NYRLUP, the PWRLUP encourages results-based management and uses the same cumulative effects indicators, surface disturbance and linear density to inform decisions. The PWRLUP cautionary and critical indicators are identical to those of the NYRLUP: 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density. As surface disturbances reach a level of functional recovery and no longer enable travel or access by wildlife and people, they can be subtracted from the total amount of disturbed area. The PWRLUP suggests using a 1.5 m woody vegetation height as a threshold for functional recovery in forested or shrubland areas. In areas dominated by low-growing vegetation, a feature could be considered functionally recovered when covered by native species roughly the same height and composition as the surrounding vegetation. To be considered as "functionally recovered," features must have similar sediment and run-off compared to background levels, roughly match original contours, and have no human-brought materials on the site. Exceptions to the linear density calculation are identical to those outlined in the NYRLUP.



Map 1-1. Eagle Plains Project Regional Study Area.

2 BACKGROUND

The term "linear feature" refers to any narrow, linear clearings of vegetation on the landscape. They include roads, seismic lines, power lines, and pipelines. Seismic lines are the dominant linear feature class in northern Canada, accounting for approximately 46% of all linear features in the Canadian boreal region (Pasher et al. 2013). Seismic exploration detects underground oil and natural gas reservoirs by analyzing sound waves reflected from the underlying geology (Yukon Energy Mines and Resources 2006). Sound waves are emitted by detonating small charges in a series of drilled shot holes (up to 20 m deep) or by vibrating a heavy metal plate on the ground's surface using a truck-mounted vibrator (Yukon Energy Mines and Resources 2006). Both methods require cleared travel corridors for equipment transportation, which results in a network of seismic lines across the landscape where seismic exploration has occurred.

Until the late 1990s, conventional 2D was the primary form of seismic exploration used in North America. 2D seismic lines were created using bulldozers to clear all vegetation in straight swaths, approximately 5–10 m wide in their earliest form. These wide, straight lines were necessary to enable large, heavy equipment movement. This process resulted in significant physical disturbance, often removing most surface vegetation and roots and the top layer of soil (Bliss and Wein 1972). Progressive improvements in 2D seismic exploration methods reduced the environmental impact, such as clearing in winter instead of summer and raising and adding mushroom shoes to the bulldozer blade to reduce soil disturbance. Despite these improvements, many of the 2D seismic lines created in the 1960s and 1970s in northern Canada remain disturbed, with little evidence of ecological recovery (Lee and Boutin 2006, van Rensen et al. 2015).

3D seismic exploration provides more accurate subsurface geological structure data than 2D technology. 3D seismic exploration techniques were developed in the mid-1990s, and their use became widespread in the early 2000s (Dabros et al. 2018). At the same time as the transition to 3D, the seismic industry was transitioning to smaller and more specialized equipment that reduces cost, improves efficiency and reduces environmental impacts. Modern seismic equipment and methods typically use what is referred to as Low Impact Seismic (LIS) methods that minimize line widths and site disturbance and compaction. Typical 3D seismic lines are 2–3 m wide, constructed in 100–500 m spaced grids, and follow meandering rather than straight routes. There have been substantial improvements in the equipment used for 3D seismic line creation: low ground pressure mulchers, lighter equipment, ATV-mounted equipment, mushroom shoes and smear blades, and 'envirodrills' greatly reduce physical and vegetation disturbance (Dabros et al. 2018). These methods often leave the ground vegetation intact and only remove trees and tall shrubs, reducing overall disturbance and facilitating faster regeneration. The location of the seismic line can be adjusted on the fly in the field to minimize impacts, such as avoiding the cutting of large trees.

Continuous advancements in seismic exploration technology have improved geophysical accuracy while simultaneously reducing environmental impact. Numerous studies have examined the effects of linear disturbances on soil, hydrology, vegetation, regeneration, and wildlife responses (see Dabros et al. 2018 for a comprehensive review). Although the bulk of literature focuses on 2D seismic lines, as they have been part of the landscape for over 60 years, there have been several recent studies investigating the effects of LIS and 3D seismic lines (e.g., Kemper and Macdonald 2009a, Kansas et al. 2015, Golder Associates 2016).

Linear features have been associated with various environmental effects, including permafrost thaw, soil compaction and rutting, increased soil moisture and pooling, altered snow cover, temperature and wind patterns, and varied vegetation and wildlife responses (Dabros et al. 2018). In addition to the immediate loss of vegetation, linear features can create extensive edge effects, facilitate non-native or disturbance-induced species establishment, alter species composition, and positively and negatively affect wildlife (Dabros et al. 2018).

One of the most extensively studied effects of linear features in the southern boreal forest is the indirect effects that linear features can have on mortality risk to woodland caribou (*R. tarandus caribou*). Linear features can result in complex effects on populations dynamics that include (i) increases in secondary prey (moose and deer), which elevate wolf populations (apparent competition) and (ii) more efficient hunting by predators along linear features (facilitated predation) (Wittmer et al. 2007, Latham et al. 2011, Dickie et al. 2017a, Keim et al. 2019b, 2021). Research has also documented the responses of birds to linear features (Bayne et al. 2005, Machtans 2006, Lankau et al. 2013), bears (Tigner et al. 2014, Finnegan et al. 2018), and furbearers (Tigner et al. 2015).

Most studies investigating impacts and recovery of seismic lines and other linear features were conducted in southern boreal forest ecosystems (i.e., Boreal Plains Ecozone; e.g., Lee and Boutin 2006, Kansas et al. 2015, van Rensen et al. 2015, Dickie et al. 2017a). There are fundamental differences in the climate, vegetation communities, wildlife communities, and ecological processes in taiga ecosystems that may result in different patterns and responses to linear features. For example, regeneration patterns of linear features in taiga ecosystems over permafrost can follow different successional trajectories than those of southern boreal regions (Simpson 2008). The few studies that have examined linear features in taiga regions have found similarities and differences to southern studies revegetation (Kemper and Macdonald 2009, Dabros et al. 2018). One of the key objectives of this study was to collect local information from Eagle Plains that can be used to better contextualize or adapt the findings from other studies to the Eagle Plains Project.

3 METHODS

A GIS analyses and field surveys were conducted to characterize linear features within the RSA. The inventory of linear features in the RSA was developed in a GIS by compiling available spatial data and then verifying and updating that against satellite imagery. Field studies quantified the width, vegetation characteristics, ecological function (line-of-sight, large mammal ease of movement assessment), and visibility of lines from the Dempster Highway.

3.1 LINEAR FEATURES INVENTORY

The inventory of existing linear features in the RSA was developed in a GIS by compiling available spatial data and then verifying and updating that against satellite imagery. A preliminary linear feature database was first developed that was used to support field surveys (described below in this section). A second step linked the field data to the linear feature database and conducted a more thorough review and verification process using satellite imagery to produce a final linear feature dataset for the RSA (see details in section 3.5.1).

Linear feature spatial data were obtained from the following sources:

- Yukon Government Energy, Mines and Resources "Oil and Gas Seismic Lines" dataset (a combination of less detailed National Energy Board data pre-1999 and the more detailed company-submitted data post-1999) (Yukon Government 2019)
- Natural Resources Canada CanVec "Roads," "Trails," and "Cut Lines" 1:50,000 scale datasets (Natural Resources Canada 2019)

The two datasets were merged into one dataset of all linear features documented in Yukon and clipped to the RSA. Key attribute data included (if available) the linear feature type (i.e., 2D and 3D seismic lines, winter roads, trails, Dempster Highway), width, year of establishment, and data source. This preliminary linear feature dataset was compared against satellite imagery at a (minimum) 1:10,000 scale to verify its accuracy. Any linear features that did not correspond with features visible in satellite imagery were either corrected or deleted based on satellite imagery interpretation. In the case of duplicate features across datasets, the 'best' data were attributed to a single feature by considering the spatial accuracy and the amount and accuracy of attribute data, as assessed against satellite imagery. Where duplicate widths occurred in the two source datasets, the wider width was retained.

3.2 LINEAR FEATURE CHARACTERISTICS SURVEY

Field studies quantified the width, vegetation characteristics, line-of-sight, and large mammal ease of travel assessment across the linear feature types identified from the GIS inventory. One aspect of the field study was to compare vegetation, line-of-sight, and ease of movement on the linear features to undisturbed areas adjacent to the cleared lines. Three types of surveys collected data for the linear feature study: ground surveys

(finest level of detail), air surveys (medium level of detail), and air calls (coarsest level of detail). EDI crews collected field data between July 28 and August 8, 2019.

3.2.1 SITE SELECTION

All ground surveys and aerial surveys occurred at predetermined, random sites. Sample sites were selected using a clustered, random sampling approach. This approach balanced obtaining a random, representative sample across linear feature types with survey efficiency (i.e., without clustering sites, the travel time between points would have been substantially greater and resulted in smaller sample size). Survey sites were drawn from 5,000 points distributed randomly across the set of mapped linear features (minimum spacing of 200 m between points). Each point was randomly assigned a unique number.

Each survey cluster included options for both ground and air surveys. For ground surveys, the cluster used a 2 km radius designed to accommodate approximately four ground survey sites, intended to be surveyed within a half-day of work (and close enough so crews could walk between sites). The objective was that two ground clusters could be surveyed by a crew each day. For air surveys, a 4 km radius was used that generally provided at least ten random survey site options. The objective for air survey clusters was that they could be surveyed while transiting between ground survey clusters.

Survey sites were selected via a two-stage process. The first stage was randomly drawing 100 points from the 5,000-point dataset. These points defined the survey clusters and served as actual survey sites. In this first stage, site selection was stratified to obtain an approximately equal sample across 2D, 3D and winter roads. This overweighted sampling of 2D and winter roads, relative to their extents in the RSA, but those features had the highest uncertainty in terms of their widths, vegetation characteristics, and functional characteristics. Stratification was necessary to obtain sufficient sample sizes across these less-common features. The second site-selection stage selected additional random points from the 5,000-point dataset in proximity to the first point, using the 2 km radius for ground surveys and the 4 km radius for aerial surveys.

The RSA was divided into 10 work areas to implement the sample design, each corresponding to a day of surveys. Each day the survey crew selected clusters to survey using the ascending order of the random identification number of the first point used to define each cluster. Similarly, points within each cluster were prioritized in ascending order of the random identification number. Normally, at least two ground clusters and two air clusters were sampled each day. However, that varied somewhat depending on the number of sample sites available in each cluster and the availability of the helicopter.

3.2.2 LINEAR FEATURE CHARACTERISTICS AND SURVEY METHODS

3.2.2.1 Linear Feature Characteristics

A range of structural, vegetation, human use, and functional characteristics was assessed in the field. A list of the various characteristics examined, with a description of each, is provided in Table 3-1. Successional classes and structural stages of vegetation are defined in Table 3-2 and Table 3-3, respectively.

Table 3-1. Description of physical, ecological and function characteristics assessed in the Eagle Plains linear feature study.

Parameter	Description	Survey Measured [1]
Plot location	Latitude and longitude using WGS 1984, measured by Garmin GPS units to ~4 m accuracy.	G, AS, AC
Linear feature type	Dempster Highway, winter road, 2D, 3Dc (conductor lines), 3Dr (receiver lines), and 3D5 (3D lines used both for seismic and local equipment/vehicle travel.	G, AS, AC
Linear feature width	During ground surveys, measured to the nearest 0.05 m and replicated four times. During aerial surveys, they were visually estimated to the nearest 1 m.	G, AS
Percent mulch	Percent cover of mulch (wood chips) on the seismic line, estimated to the nearest 1% using visual estimates. In areas with dense trees or large shrubs, the thick mulch layer produced during line clearing can hinder vegetation regeneration.	G, AS
Successional class	Refers to the successional trajectory of vegetation regeneration on the linear feature. Includes normal, magnified, stagnated, retrogressive, no succession, or recent disturbance class following Simpson (2008)[1].	G, AS, AC
Burn status	Burnt or not burnt; based on visual assessment (i.e., burned trees, charred ground vegetation).	G, AS, AC
Structural stage	Categorical descriptor of the dominant vegetation life form in the plot following the *Field Manual for Describing Yukon Ecosystems* criteria (Environment Yukon 2017). Structural stage categories are defined in Table 3-3.	G, AS
Height and species of tallest vegetation	Measured to the nearest 0.1 m for the tallest vegetation layer, approximated by the 90th percentile height to exclude extreme heights of individual plants.	G
Cover and species of dominant trees	Percent cover was recorded to the nearest 1% if less than 10%, and to the nearest 5% if over 10%. One or two dominant tree species were recorded.	G, AS
Cover and species of dominant shrubs	Percent cover was recorded to the nearest 1% if less than 10%, and to the nearest 5% if over 10%. Up to five co-dominant shrub species were recorded. Ground shrubs were excluded.	G, AS
Ecosite	Ecosite was recorded using Predictive Ecosystem Mapping (PEM) Units, available at the time of the survey. However, separate vegetation surveys indicated that the accuracy of the PEM mapping was poor, and ecosites were not used in subsequent analyses.	G
Permafrost activity/degradation	Present or absent. Additional comments (i.e., type of activity, percent cover) were recorded if applicable.	G
Wildlife trails	Present or absent. If present, rated as poorly, moderately, or well defined.	G
Potential for Off-Highway Vehicle (OHV) passage	Present or absent. Based on professional judgment, a 4x4 side-by-side is summer, considering obstructing vegetation, ground conditions (e.g., wetlands, peatlands), and graminoid tussocks.	G, AS
Signs of human activity	Present or absent. If present, applicable comments were recorded.	G
Ground disturbance	Percent cover of visibly disturbed ground. If present, type and additional descriptive comments were recorded.	G

[1] G=Ground Survey, AS=Aerial Survey, AC=Air Call.

[2] Between 2006 and 2008, Yukon Government, Department of Energy, Mines, and Resources investigated the recovery status of linear features in the Eagle Plains, British Mountains, and Peel River Plateau Ecoregions (Simpson 2008). They found that linear features typically regenerated into one of six categories: normal succession, magnified succession, retrogressive succession, successional stagnation, no succession, and recent disturbance (Table 3-2).

Table 3-2. Descriptions of successional classes on linear features in the Eagle Plains area (following Simpson 2008).

Successional Class	Description
Normal succession	Vegetation is similar to the adjacent undisturbed area but often in an earlier seral stage. E.g., often young trees surrounded by early successional shrubs and forbs. The disturbance was likely limited to removing trees and shrubs, with little to no disturbance to soil or permafrost.
Magnified succession	Vegetation on the feature is taller than the adjacent undisturbed area. Deciduous species often dominate tree and shrub layers, but a similar pattern was also observed for coniferous trees on some sites. The response is likely due to increased site productivity (including increased soil moisture, nutrients, and temperature) due to soil disturbance or increased depth to permafrost. Most frequently, but not exclusively, observed in burns.
Retrogressive succession	Sites are typically moss or sedge-dominated (rarely forb or low shrub), with high moisture content, often including standing water (i.e., micro wetlands), that contrast to upland conditions in adjacent undisturbed areas. The condition appears to result from permafrost melting and water pooling associated with vegetation removal and removal/compaction of the peat layer and mostly associated with winter roads.
Successional stagnation	Vegetation is typically dominated by graminoids or shrubs and not progressing to more advanced successional stages. Disturbance to soil or permafrost is likely. The ground may have been compacted. Almost exclusively associated with winter roads.
No succession	No ecological differences between the linear feature and adjacent undisturbed areas except that there is no or very little tree or shrub regeneration on the line, other than what was left after creation of the feature. Disturbance appears to be limited to the removal of trees and shrubs, with little to no disturbance to ground vegetation, soil, or permafrost.
Recent disturbance	Newer seismic line where successional patterns could not be determined. Features in this class were most likely trending to 'normal succession' or 'no succession', but the degree of regeneration was too limited to classify confidently.

Table 3-3. Structural stage categories used in ground and air surveys for the Eagle Plains linear feature study.

Structural Stage Code	Structural Stage Name	Description
1	Non-vegetated	Very recent disturbance (e.g., fire or flood) and no vegetation or less than 5% vegetation.
2	Sparse/Cryptogram	Either the initial stages of primary succession or a cryptogram community maintained by environmental conditions (e.g., bedrock, talus). Sparse tree, shrub and herb cover. Either sparsely vegetated overall (low cover of vascular plants and cryptograms, if present) or dominated by cryptograms.
2a	Sparse	5–10% vegetation cover.
2b	Bryoid	Bryophyte-dominated.
2c	Lichen	Lichen-dominated.
3	Herb	Early successional stage (e.g., post-fire forest succession) or a herb community maintained by environmental conditions or disturbance. Vegetation is dominated by herbs, although if the site overall is sparsely vegetated, herb cover can be low as long as herbs characterize the vegetation. Trees and shrubs are usually sparse or absent; however, shrub cover and stature (compared to herb cover and stature) determine whether the site is considered herbaceous.
3a	Forb-dominated	Includes non-graminoid herbs and ferns.

Structural Stage Code	Structural Stage Name	Description
3b	Graminoid-dominated	Includes grasses, sedges, reeds, and rushes.
3c	Aquatic	Floating or submerged plants dominate.
3d	Ground shrub-dominated	Dominated by dwarf woody species such as kinnikinnick (*Arctostaphylos uva-ursi*) or dwarf willows.
4	Shrub	Early successional stage of a forest or a shrub community maintained by environmental conditions or disturbance. Dominated either by shrubby vegetation, including tree seedlings or saplings; or, if sparsely vegetated overall, dominated by shrubs, which characterize the community as a shrubland.
4a	Tall Shrub	Dominated by woody plants >2 m tall with diameter at breast height (dbh) ≤7 cm.
4b	Low Shrub	Dominated by woody plants <2 m tall.
5	Treed: Pole/Sapling	Trees >2 m tall and with dbh >7 cm, typically densely stocked. Self-thinning and vertical structure are not yet evident in the canopy. Younger stands are vigorous (usually >15 to 20 years old); older stagnated stands (up to 100 years old) are also included; time since disturbance usually <40 years; up to 100+ years for dense (5,000–15,000+ stems per ha) stagnant stands.
6	Treed: Young Forest	Self-thinning has become evident and the forest canopy has begun to differentiate into distinct layers. A more open stand than at the pole/sapling stage.
7	Treed: Mature Forest	Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understoreys become well developed as the canopy opens up.
8	Treed: Old Forest	Stands of old age with complex structure; patchy shrub and herb understoreys are typical; regeneration is usually of shade-tolerant species with a composition similar to the overstorey. Fire-maintained stands may have a single-storey appearance.
9	Treed: Very Old Forest	Very old stands with complex structures, abundant large trees, snags and coarse woody debris (CWD); snags and CWD occurring in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species, with well-established canopy gaps.

3.2.2.2 Survey Methods

Three types of surveys assessed linear feature characteristics: ground surveys (finest level of detail), air surveys (medium level of detail), and air calls (coarsest level of detail). The reason for using different survey types was to maximize the sample size obtained, recognizing that the ability to collect certain types of data, or the level of measurement precision, decreased from ground surveys to aerial surveys to air calls. The characteristics that were measured during each survey type are noted in Table 3-1. Surveys were conducted between July 28 and August 8, 2019.

Ground surveys collected the most information and had the highest measurement precision of the three survey methods. All parameters listed in Table 3-1 were recorded. Field measurements generally followed methods in *Field Manual for Describing Terrestrial Ecosystems* (BC MFLNRORD and BC MOE 2010) with parameter specific details noted in Table 3-1. Photographs were taken of representative on-line and off-line plots.

Air surveys collected moderate resolution data on linear features. Air surveys efficiently collected a larger quantity of more generalized data than ground surveys. The subset of parameters recorded for aerial surveys is noted in Table 3-1. The survey methods generally followed procedures outlined for helicopter-based 'visual checks' in *Standard for Terrestrial Ecosystem Mapping in British Columbia* (Resources Inventory Committee 1998). Data were collected by hovering in a helicopter approximately 30 m over the sample sites for approximately three minutes while field crews recorded data for the reduced set of variables. Like ground surveys, relevant data were collected for both on-line and off-line plots. Photographs were taken at representative air survey plots (Attachment A).

Air calls collected data at the coarsest resolution of the three survey types, and no off-line data were collected. The data collected during air calls were limited to linear feature type, successional class, and burn status. Air calls were opportunistically conducted when EDI crews were flying through the RSA and linear features were encountered.

A fundamental aspect of the field study was to compare linear feature characteristics to adjacent undisturbed areas. Hence, field surveys included paired on-line and off-line plots at each sample site (excluding sites assessed via air calls). Off-line plots were located 50 m off the linear feature, with the direction off the feature selected randomly at each site using a coin toss. Data collected for each sample site were recorded on tailored survey forms (Attachment B).

3.2.2.3 Line-of-Sight and Ease of Travel

In addition to the structural and vegetation measures noted above, line-of-site and ease-of-movement were assessed as functional characteristics of the linear features at each ground plot. The sightline, measured to the nearest metre, was calculated as the farthest line that could be sighted using a range finder at the height of 1.5 m off the ground. Two measurements were recorded, one in each direction along the linear feature. Sightline measurements were repeated using the same bearings in the off-line plot.

Ease of travel was assessed using a 'walk test,' as Keim et al. (2019a) described in a study assessing the functional recovery of linear features. They found that ease of travel, as measured by a walk test conducted by human researchers, positively correlated with the intensity of use by several wildlife species. One EDI crew member timed themselves to the nearest second for the walk test while walking an approximately 75 m transect, measured to the nearest metre using a hip chain. This walk test was repeated in both the on-line and off-line plots, the paired transects spaced in parallel, approximately 50 m apart. The same observer conducted both walk tests to minimize observer bias at each site.

3.3 VISIBILITY OF LINEAR FEATURES FROM THE DEMPSTER HIGHWAY

One of the management concerns associated with seismic exploration is that seismic lines create travel routes that humans use. The probability of human use of seismic lines to access the surrounding landscape likely increases if the seismic line is visible and accessible from roads. The intersections of seismic lines and winter roads with the Dempster Highway are the primary locations where this could originate. Driving surveys were conducted along the 47 km section of the Dempster Highway within the RSA to determine the number and

type of linear features that could be located and accessed by the public from the Dempster Highway. Two types of surveys were conducted: a blind search where the location of the linear features was unknown and a 'map search,' where the observers had a map of the linear features that showed where they occurred. Both surveys were conducted on August 8, 2019.

The blind search approximated the proportion and type of linear features that the public could locate and access without prior knowledge of their locations. An EDI field crew drove along Dempster Highway at 35 km/h and attempted to identify linear features by visual inspection alone, unaware of where they intersected the highway. When a linear feature was identified, the crew stopped to record the following parameters:

- linear feature type;
- sight line distance;
- evidence of human use;
- evidence of wildlife use; and
- potential for OHV passage.

Photographs were taken, and relevant comments were recorded for each linear feature intersection where applicable.

The map search was a targeted search designed to approximate the proportion and type of linear features the public could spot from the Dempster Highway with prior knowledge of their locations. Using a map of linear features present in the RSA, an EDI field crew drove along the Dempster Highway, slowing to 10 km/h and attempting to identify the linear features when passing a point where the map showed they intersected the highway. When a linear feature intersection was reached, the crew recorded whether the line was visible or not and the parameters listed above for the blind search where a line was detected.

3.4 WINTER TRACK SURVEY

An aerial survey was conducted to assess the relative frequency of use of different liner feature types by ungulates and humans in late winter (March 2020). The survey consisted of 11 transects spanning the width of the RSA. Three of the transects were established parallel to the Dempster Highway at 50 m, 1 km and 5 km off the highway. The remaining transects were spaced approximately 5 km apart across the remainder of the RSA.

Before the field survey, each transect was established in a GIS. Each intersection with a linear feature was given a unique identification point and used to generate a field form (i.e., with a row for each linear feature intersection). The field survey involved flying along each transect and recording the presence of ungulate tracks or human tracks (e.g., snowmobile tracks) at each linear feature that was traversed. Surveys were conducted via helicopter at approximately 70 km/h, 50 m above the ground, with one navigator/data recorder and one primary observer. The surveyors classified tracks to species and counted the number of unique tracks. However, overlapping tracks and dustings of new snow made track identification and counts uncertain in over

half the detections. Therefore, analyses defaulted to the simple presence/absence of ungulate tracks. The primary metric examined was the proportion of linear features with ungulate tracks.

The original survey plan was also to count tracks in undisturbed areas between linear features. However, tracks were so numerous that surveying the entire area between linear features would have required substantially reducing the aircraft speed. This would have reduced the number of transects that could have been surveyed. As a compromise, field crews subsampled the area between lines by surveying an approximate 200 m band of an undisturbed area adjacent to each linear feature.

In conjunction with winter fish habitat assessments, the transects were surveyed over six days (March 7–13, 2020). Each day, one or two transects were surveyed while transiting to/from the study area. No track-erasing snowfalls occurred during the survey period. Snow depths ranged from 65 to 80 cm.

3.5 DATA PREPARATION AND ANALYSIS

3.5.1 SPATIAL DATA

The project generated two primary spatial datasets — a point database corresponding to all field survey sites and the linear feature database. The Linear Feature Survey Point Database (ArcGIS point feature class) contains all location-specific (point coordinate) field data collected at sample sites in summer 2019. Several fields were added to this database based on calculations and spatial joins (e.g., year of linear feature establishment and most recent fire). Paired on-line and off-line plot data were recorded as part of the same sample site coordinate.

The Linear Feature Inventory (ArcGIS polyline feature class) is a compilation of all documented linear features within the RSA, verified by comparing the preliminary linear feature inventory to aerial and satellite imagery and ground-truthing results.

Several modifications were made to improve the accuracy and detail of the Linear Feature Inventory:

- Linear features were classified into the following categories:
  - 2D (historical seismic lines, typically >3m wide),
  - 3D5 (including 4–5 m wide 3D lines that were used for both seismic and local vehicle/equipment travel);
  - 3Dc (3 m wide 3D seismic conductor lines);
  - 3Dr (2 m wide 3D seismic receiver lines);
  - winter roads (any trails or limited use roads used by vehicle or equipment, generally wider than 5 m and often with an obviously curving path); and,
  - Dempster Highway.
- Overlapping features (within a 3 m tolerance) were addressed according to the following rules:

- If two linear features of the same or unknown age overlapped, the wider feature was saved and the narrower feature deleted.
- If two linear features of the same or unknown width overlapped, the more recent feature was saved and the older feature deleted.
- If a 3D line overlapped with a 2D line, both lines were saved. This is because the older 2D lines were often still evident on the landscape in some state of regeneration, as were the 3D lines. However, both were saved since it was unknown at what state each line was in (i.e., if the 2D line was still evident, or only the 3D line, or both in varying states of regeneration). This occurred for 33 km of linear features within the RSA.

The preliminary linear feature inventory within the RSA was compared against a recent high-resolution satellite or aerial imagery (generally, 0.5–1 m resolution) at a 1:10,000 (or finer) scale to verify the accuracy of the source data. Any features that were visibly offset from georeferenced imagery were corrected to match the imagery.

Some older (1960s and 1970s) 2D seismic lines included in the source databases did not appear in satellite imagery. These 2D lines were compared against the imagery along the length of the feature to search for any sign of linear disturbance and then cross-referenced with field surveys conducted along the line, if present. These unverified linear features were classified as 'not applicable' and excluded from analysis if there was no evidence of linear disturbance along the feature's length in the imagery, which could often be verified with associated surveys noting that the feature was 'not present,' 'not visible,' or 'completely regenerated.' Unverified linear features were retained if there was evidence of linear disturbance along any feature's length in the imagery or if associated surveys had noted that the feature was present and in some state of regeneration, even if the feature was not visible in the imagery. A total of 199,473 m of erroneous or regenerated linear features were deleted from the linear feature inventory within the RSA.

Some linear features were visible on the imagery that had not been included in any of the source databases. In these cases, the linear features were manually digitized and classified into linear feature types based on visual assessment and attributes of adjacent connecting features, if present. Digitized linear features were assigned a year if they were obviously a continuation of a documented feature or if they were surrounded by features of the same type and year. Otherwise, the year was not included. High-resolution imagery was not available for the southernmost portion of the RSA (approximately 25 km by 15 km). This area was compared against lower quality Google Earth imagery, but this was not detailed enough to detect undocumented linear features if any existed (Google Earth 2019). However, existing linear features were verified using this method. A total of 202,945 m of linear features were digitized within the RSA.

After the Linear Feature Inventory was verified and corrected to be consistent with imagery and field observations, it was spatially joined to the Linear Feature Survey Point Database. In cases where the survey point did not correspond with any nearby linear feature, or if a linear feature was deleted (following the methods described above), the data were retained in the survey point database, but the linear feature type was updated to 'not applicable' and excluded from data analysis. Ten survey plots were identified as 'not applicable' and excluded from analyses; thus, the corrected sample size for survey plots is n = 210.

3.5.2 FIELD DATA

After completing field sampling, data forms and field notes were reviewed for completeness and accuracy during an internal data quality-assurance process. All associated digital photographs and GPS coordinates were reviewed to correspond to the appropriate field plots. A summary of field plots by linear feature type and survey type is provided in Table 3-4. All recorded data were entered into MS Excel databases (Microsoft 2019). Spatial data were uploaded to the ArcGIS platform (ESRI 2019).

Field-collected data were summarized primarily using Excel spreadsheets (Microsoft 2019). More detailed statistical analyses were performed on select data using R Statistical Software (R Development Core Team 2020). For example, the variation in ease of travel and vegetation cover as a function of linear feature types, burn history, successional stage, or ecosite were explored. During formal analyses, standard assumptions of normality and homogeneity of variance were assessed, and variance-covariance structures were applied to model heterogeneity (of residuals) if required. For instance, the sightline distance (m) was fourth-root transformed to meet normality. In certain models, random effects were included to account for variance among different subjects. For example, observers were included as a random variable to account for observer bias (i.e., a random intercept model; package "nlme", Pinheiro et al. 2016). Corrected Akaike's Information Criteria (AICc) scores were used to compare sets of candidate models. Models with the lowest AICc score were selected because they yielded the best balance (parsimony) between explained variance and level of complexity.

Table 3-4. The number of sites surveyed using ground surveys, air surveys, and air calls for each linear feature type in the Eagle Plains RSA.

Linear Feature Type	Survey Type			
	Ground Survey	Air Survey	Air Call	Total
2D	31	32	44	107
3D-5m wide	5	0	0	5
3D-Conductor	26	3	0	29
3D-Receiver	23	1	0	24
Winter Road	18	17	8	43
Dempster Highway	2	0	0	2
Not Applicable	3	2	5	10
Total	108	55	57	220

3.5.3 LINEAR FEATURE DENSITY CALCULATION

Linear feature densities were calculated in two ways: (1) using the total linear feature extents, and (2) adjusting the extents to account for (a) lines through 'open' habitats, such as wetlands and recent burns, where the vegetation on the line did not differ from vegetation off the line, and (b) functionally recovered linear features such as 2D lines from the 1960s and 1970s that had advanced regenerated at least to the Tall Shrub structural stage. Adjustments were determined by intersecting the Linear Feature Inventory with a recently developed

Ecological Landscape Classification (ELC) map of the RSA (a companion Eagle Plains Project baseline report). The ELC map documented the type and structural stage of vegetation communities across the RSA. The extent of linear features in open habitats was determined by the lengths of linear features overlapping Low Shrub, Herb and Bryoid structural stages in the ELC maps. This includes seral habitats regenerating from burns and ecosystems that are maintained in those stages over time, such as wetlands and shrub-carrs. The extent of regenerated linear features was determined by integrating the proportion of regenerated lines observed from the field surveys (e.g., 61% for 2D lines) with the length of lines through non-open vegetation types in the ELC map. Adjustments were applied to generate functional linear feature densities for each linear feature type individually (i.e., to compare the relative extents of different feature types) and combined to provide an overall density for all linear feature types. For example, the linear feature density for 2D lines was calculated by starting with the total length of 2D lines in the RSA, reducing that by the length of lines through open vegetation types, then reducing the remaining extent by the average proportion of 2D lines that were observed to be regenerated, and then dividing the remaining total length of lines by the extent of the RSA.

4 RESULTS

4.1 LINEAR FEATURE INVENTORY AND DENSITIES

A total of 4,269 km of linear features were mapped and verified in the RSA (Map 4-1, Table 4-1). Winter roads and 2D seismic occur in varying densities across much of the RSA. The extent of 3D seismic is limited to the one area straddling the Dempster Highway in the centre of the RSA.

The total linear feature density in the RSA was 1.79 km/km², based on a total length of 4,269 km and the RSA area of 2,386 km². 3D seismic lines accounted for approximately half of the total length of linear features in the RSA, 2D seismic lines accounted for about one-third, followed by winter roads and the Dempster Highway (Table 4-1). Adjusting for open habitats (i.e., areas in structural stages Low Shrub, Herb, and Bryoid) and vegetation regeneration[1] resulted in substantially lower densities of 0.52 km/km² (Table 4-2). Relatively large extents of recent wildfires were the greatest factor reducing linear feature densities. The relative proportions of the different linear feature types were similar after adjustments, though the proportion of 3D increased and 2D decreased. This was mainly due to the greater degree of vegetation regeneration on 2D lines, consistent with their age since disturbance.

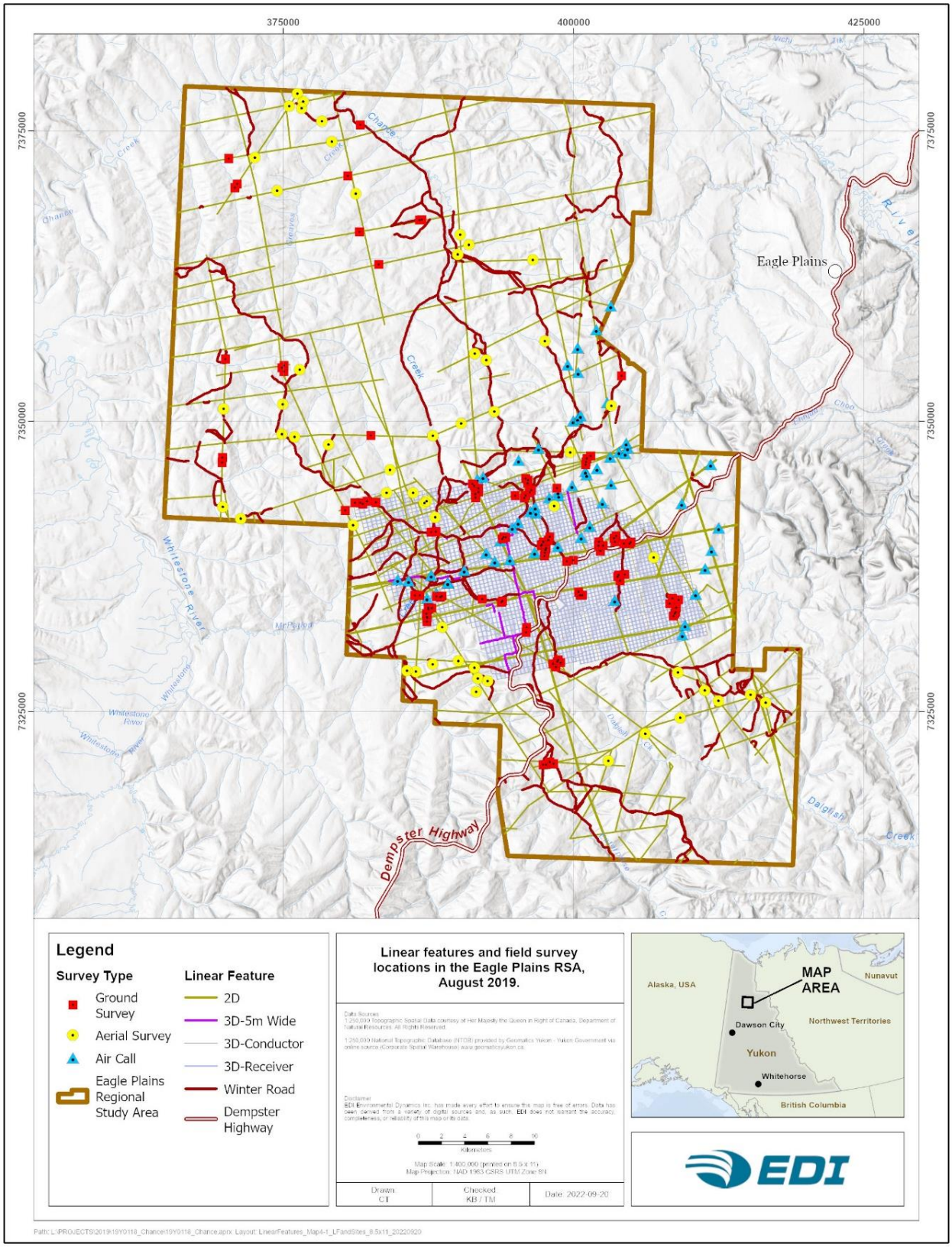
Table 4-1. Summary of total length and density of linear features documented in the Eagle Plains RSA.

Linear Feature Type	Total Length (km)	The Proportion of Total Length	Linear Feature Density (km/km²)
2D	1,452	34%	0.608
3D (combined)	2,165	51%	0.907
3D-5m wide	48	1%	0.020
3D-Conductor	1,189	28%	0.498
3D-Receiver	928	22%	0.389
Winter Road	596	14%	0.250
Dempster Highway	47	1%	0.020
Unknown	8	<1%	0.003
Total	**4,269**	**100%**	**1.788**

[1] See Section 5.5 Functional Recovery of Linear Features for details about vegetation regeneration criteria.

Table 4-2. Summary of total effective length and density of linear features in the Eagle Plains RSA adjusted for open habitat and vegetation regeneration.

Linear Feature Type	Total Length (km)	Proportion of Total Length	Linear Feature Density (km/km²)
2D	289	23%	0.121
3D (combined)	750	60%	0.314
3D-5m wide	21	<1%	0.009
3D-Conductor	401	32%	0.168
3D-Receiver	328	26%	0.138
Winter Road	171	14%	0.072
Dempster Highway	26	<1%	0.011
Unknown	8	<1%	0.003
Total	1,243	100%	0.521



Map 4-1. Linear features and field survey locations in the Eagle Plains RSA, August 2019.

4.2 LINEAR FEATURE CHARACTERISTICS

4.2.1 LINE WIDTHS

Line width varied by linear feature type. Mean line widths ranged from 1.96 m for the narrowest line type (3D receiver lines) to 33.75 m for the Dempster Highway (Table 4-3). Standard error around mean estimates were smallest for 3D seismic lines, which were cleared in the same season using the same equipment and methods, and greatest (by a large margin) for winter roads. The average difference in widths between 3D conductor (wider) and 3D receiver lines was 1.2 m.

Table 4-3. Widths of different linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Minimum mean width (m)	Maximum mean width (m)	Overall mean width (m)	Standard Error (m)
2D	107	3.97	8.5	5.42	0.11
3D-5m wide	5	5.30	6.40	5.68	0.22
3D-Conductor	29	2.50	4.80	3.17	0.13
3D-Receiver	24	1.63	2.53	1.96	0.04
Winter Road	43	2.53	17.97	7.42	0.66
Dempster Highway	2	33.00	34.50	33.75	0.75

4.2.2 MULCH COVER

Mulching of woody vegetation is common during seismic line clearing activities and was used in the 2013/14 3D program. In areas with thick tree or shrub cover, mulching can create a thick blanket of wood chips that inhibits vegetation regeneration (Golder Associates 2016). There was no evidence that this was an issue with any of the seismic lines within the RSA. On average, the percent cover of mulch was <1% on all line types.

4.2.3 HUMAN USE

No sign of human use was detected along linear features during the summer ground surveys (e.g., OHV tracks, ruts, water crossings, vegetation trampling/scarring, tree blazes, trap sets, garbage, and campsites), except for the two sites on the Dempster Highway.

On average, 42% of on-line sites were deemed passable to an OHV (a 4x4 side-by-side) during summer, considering obstructing vegetation, ground conditions (e.g., wetlands or peatlands), and the presence of graminoid tussocks (Table 4-4).

Table 4-4. Proportion of survey sites deemed passable to OHV in summer across different linear feature types in the Eagle Plains RSA.

Linear Feature Type	No. Survey Sites	% Passable
2D	55	9%
3D-5m wide	5	80%
3D-Conductor	29	59%
3D-Receiver	24	75%
Winter Road	29	55%
Dempster Highway	2	100%
Total	144	42%

4.2.4 SUCCESSIONAL CLASSES

Linear features surveys in the Eagle Plains RSA observed five of the six of the successional classes documented by Simpson (2008): normal succession, magnified succession, stagnated succession, no succession, and recent disturbance (Figure 4-1) (Attachment A). No retrogressive succession sites were observed at official survey sites. However, a small number of retrogressive sites were incidentally observed on winter roads while travelling through the RSA.

Most sites surveyed (79%) were undergoing normal succession. The next most common successional class was magnified succession, occurring in 11% of sites, followed by stagnated succession, occurring in 5% of sites. All 3D seismic lines surveyed followed a normal successional trajectory, except for one site that was classed as recently disturbed. Magnified succession was most common in 2D seismic lines (21%), while stagnated succession was most common in winter roads (19%). Successional classes were defined as 'not present' if the linear feature was not present in the field or had regenerated to a stage that was not discernable from the adjacent areas. The Dempster Highway was classified as recently disturbed due to the regular maintenance of the road.

Fire history appeared to influence some successional classes. Magnified succession was more common at burnt sites (19 burnt versus 5 unburnt). In contrast, stagnated succession was more common at unburnt sites (3 burnt versus 7 unburnt). Sites on a normal successional trajectory did not appear to have any relationship to burnt status. The remaining successional classes were too uncommon to draw any conclusions.

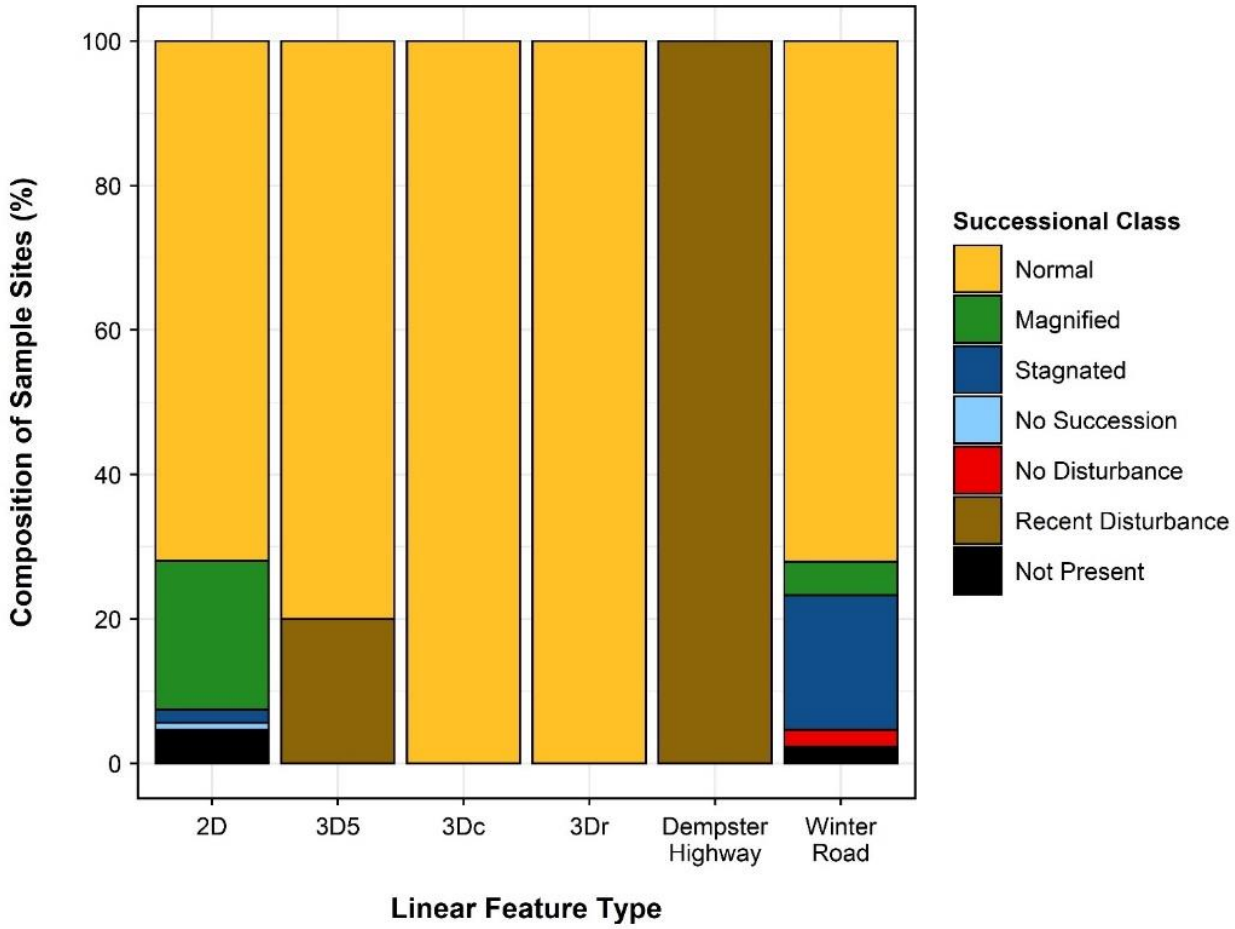


Figure 4-1. Summary of successional classes observed across different linear feature types in the Eagle Plains RSA.

4.2.5 STRUCTURAL STAGE

Most linear features were in a Low Shrub (56.1%) or Tall Shrub (29.0%) structural stage. However, the distribution of structural stages varied substantially across linear feature types (Table 4-5). Although herbaceous and forested stages occurred at some on-line plots, they were not common (less than 5%each). Nearly all forested structural stages were observed on 2D seismic lines and winter roads, reflecting the long time since they were created. Tall Shrub stages were almost twice as frequent in 2D seismic lines than any other linear feature type. Conversely, 83% of 3D linear features were in the Low Shrub structural stage, with most of the remaining in the Tall Shrub stage. The differences in structural stages between 2D and 3D lines appear to be primarily due to the time since disturbance. Winter roads were less consistent in their structural stages; herbaceous, shrubland and forested stages were all observed with moderate frequency. The two Dempster Highway plots were the only non-vegetated stages recorded.

Off-line plots were also mostly in Low Shrub and Tall Shrub stage, but they also included a higher proportion of Young Forest and Mature Forest compared to on-line plots (Table 4-5; Photos A-15 to A-20 in

Attachment A). For off-line plots, the Low Shrub sites were mostly burned areas, and the Tall Shrub sites were mostly stunted, open-canopy, black spruce forest 2–8 m tall.

Fire had a strong effect when comparing structural stages between paired on-line and off-line plots (Figure 4-2). The top two charts in Figure 4-2 show that the pattern of structural stages for burnt areas was very similar between on-line and offline plots. The bottom two charts show that the pattern of structural stages differs substantially between on-line and offline plots in unburnt areas. In unburnt areas, off-line plots had much lower numbers of sites in Low Shrub and much higher numbers of sites in Young Forest and Mature Forest than on-line plots. For burnt areas, the on-line and off-line plots at the same site were the same structural stage in 72% of cases, and within one structural stage of each other 91% of the time (e.g., Tall Shrub vs Pole Sapling). For areas that were not burnt, the on-line and off-line plots at the same site were the same structural stage in only 29% of cases. These results demonstrate that in the absence of fire, pronounced differences between linear disturbances and the surrounding community are evident in both recent (3D) and legacy (2D and winter road) linear feature types. But following a fire, the vegetation structure on-line and off-line are likely to be similar (Photos A-22 to A-24 in Attachment A).

Table 4-5. Vegetation structural stages observed on different linear feature types as a proportion of all plots sampled (n = 156) in the Eagle Plains RSA.

Linear Feature Type	No. Sites	Structural Stage[1]								
		Non-vegetated	Bryoid	Herb	Low Shrub	Tall Shrub	Pole-Sapling	Young forest	Mature forest	Old Forest
2D	62	0%	0%	2%	37%	47%	2%	8%	3%	2%
3D-5m wide	5	0%	0%	20%	80%	0%	0%	0%	0%	0%
3D-Conductor	29	0%	0%	0%	83%	14%	0%	3%	0%	0%
3D-Reciever	24	0%	4%	0%	83%	13%	0%	0%	0%	0%
Dempster Highway	2	100%	0%	0%	0%	0%	0%	0%	0%	0%
Winter Road	33	0%	0%	12%	48%	27%	3%	3%	6%	0%
Off-line	155	0%	1%	1%	33%	29%	1%	18%	17%	1%

[1] See Table 3-3 for structural stage codes and descriptions.

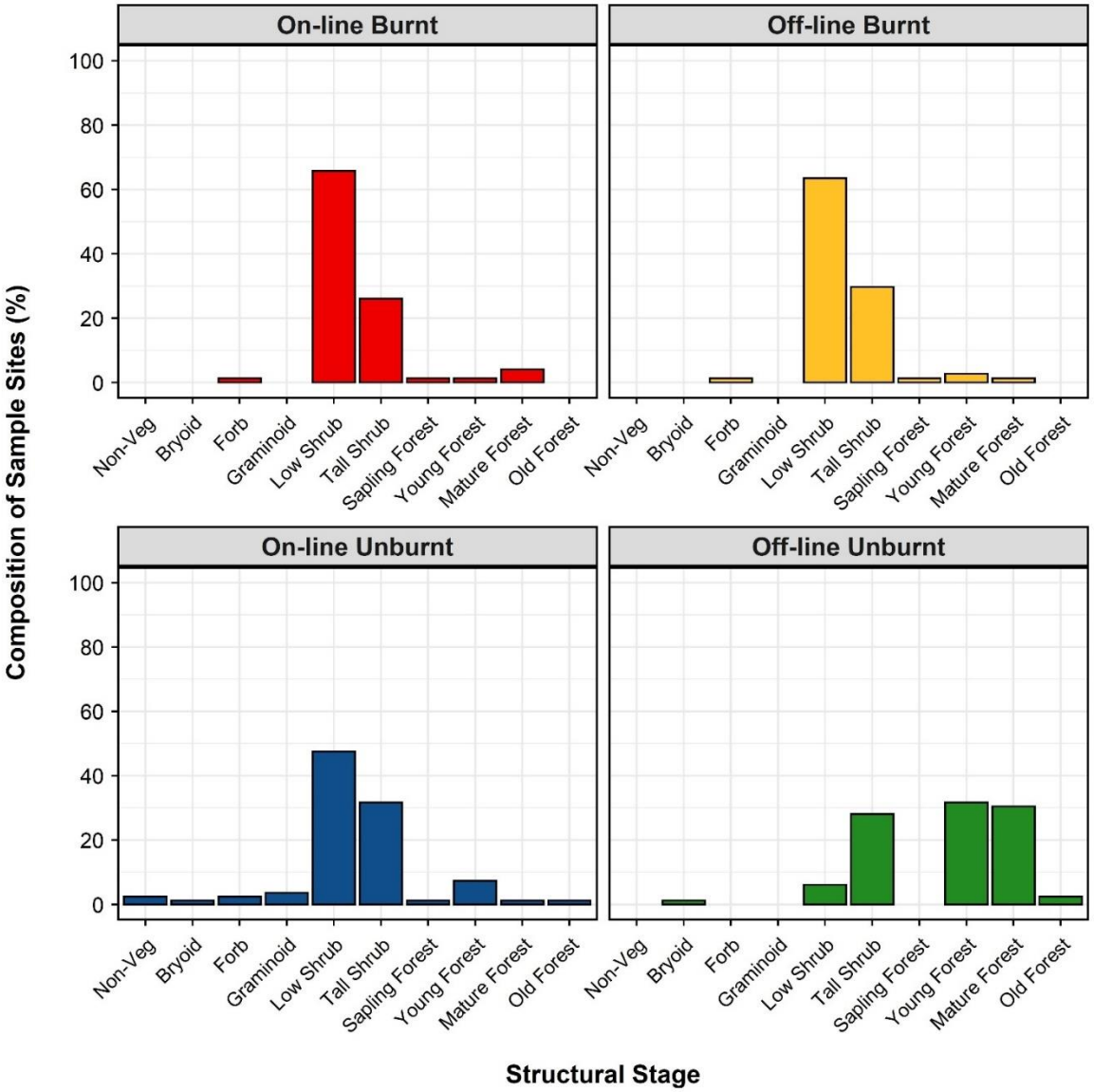


Figure 4-2. Comparison of structural stages on linear features to off-line plots in burnt and unburnt areas, in the Eagle Plains RSA.

4.2.6 VEGETATION HEIGHT

Based on the similarity of patterns in vegetation composition and structure, linear feature types were combined into two groups for assessment of patterns in height: (i) 2D and winter roads and (ii) 3D. A wide range of vegetation heights was recorded at both on-line and off-line plots in the RSA, from 0.3 m to 16 m. Collectively, off-line plots had a normal distribution of vegetation heights between 0 m and 4 m, and then a scattered distribution across heights up to 16 m (Figure 4-3). Plots with ≥4 m tall vegetation accounted for approximately 40% of all off-line reference plots.

In comparison, recovering 2D seismic lines and winter roads shared a relatively uniform distribution between 0 m and 4 m but with a peak occurring at vegetation heights measuring 1.5–2 m tall (Figure 4-4). Only 21% of 2D and winter roads contained dominant vegetation ≥4 m, and only 5% were ≥8 m tall. 3D seismic lines were rarely composed of vegetation ≥2 m, and most of the vegetation (67%) recovering on 3D lines was less than 1 m (Figure 4-5). This is very different from the off-line undisturbed height distribution. However, 3D lines were all only five years old at sampling, and shorter vegetation was expected.

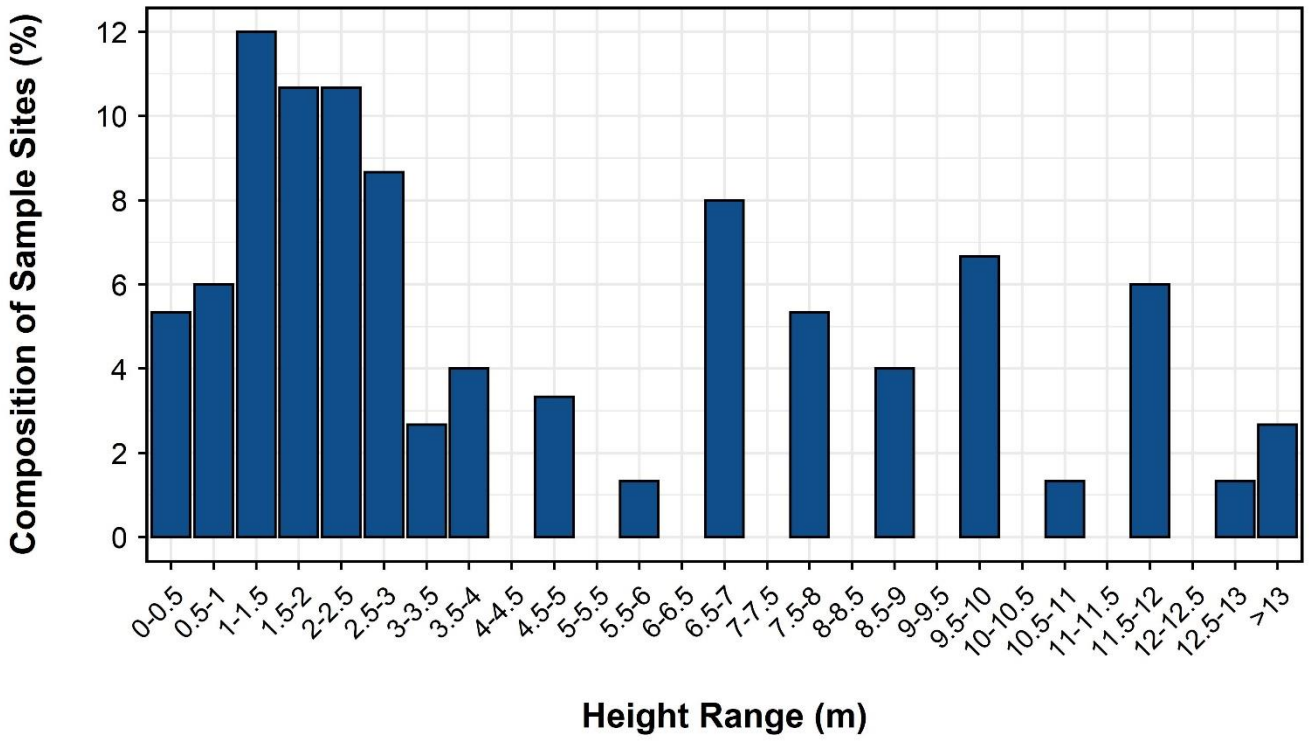


Figure 4-3. Vegetation height distribution of off-line reference plots in the Eagle Plains RSA.

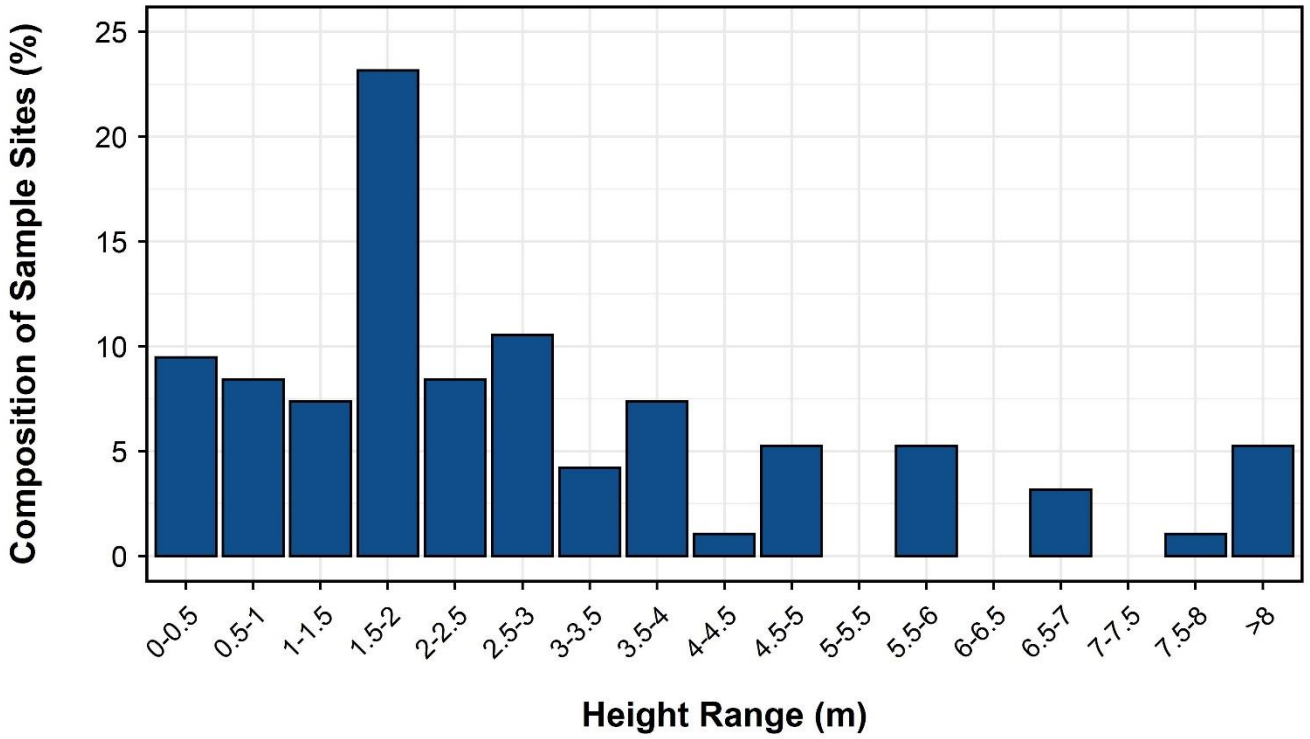


Figure 4-4. Vegetation height distribution of on-line 2D and winter road plots in the Eagle Plains RSA.

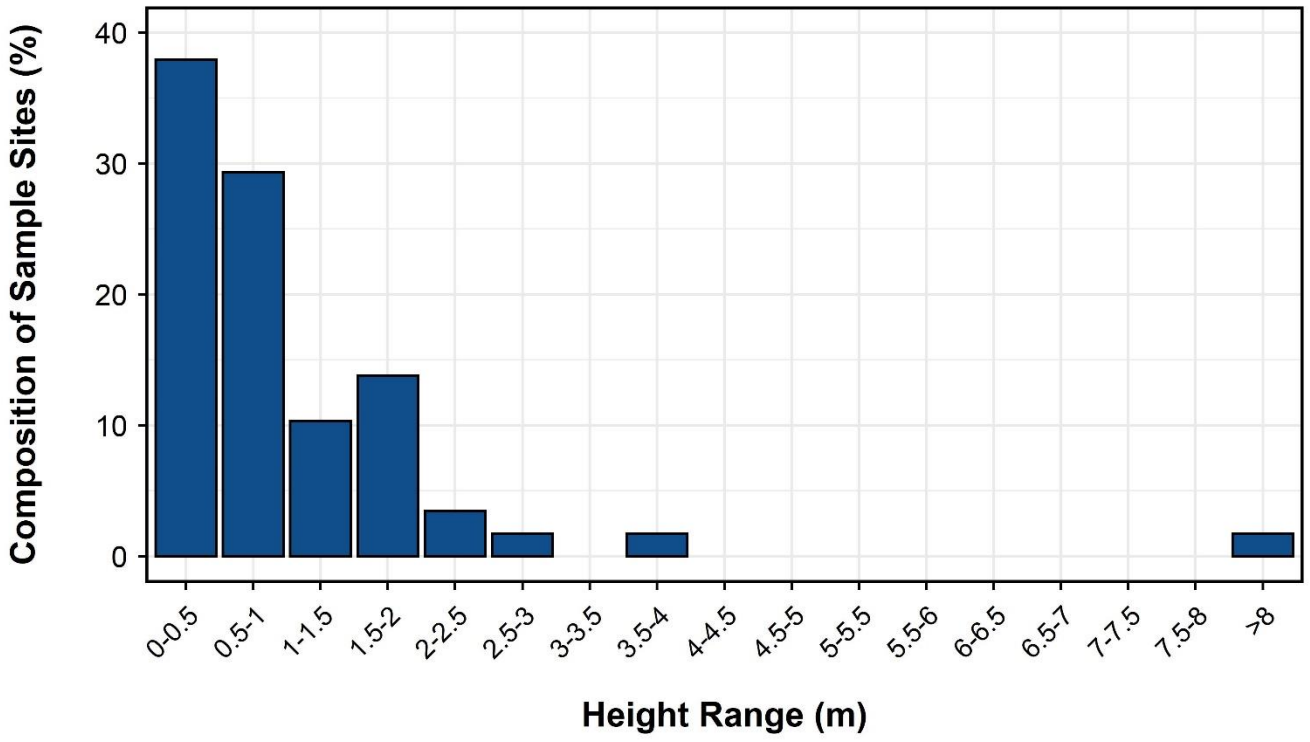


Figure 4-5. Vegetation height distribution of on-line 3D plots in the Eagle Plains RSA.

4.2.7 VEGETATION COVER

Tree and shrub cover varied between linear feature types and burn status (Table 4-6). Generally, tree cover was low on undisturbed reference plots (mean tree cover of 8% on unburnt and 2% on burnt sites). This is typical of the taiga cordillera landscape — forests are generally stunted and sparse due to poor nutrient regime and continuous permafrost conditions (Smith et al. 2004). Of the on-line plots, tree cover was greatest on 2D seismic lines and burnt winter roads (5% to 8%) and lowest on 3D seismic lines and the Dempster Highway (0%), regardless of burn status. This is likely due to the recently disturbed 3D seismic lines that are too young for trees to have re-established. Burnt 2D seismic lines and winter roads had greater tree cover than unburnt lines.

Shrub cover was much greater than tree cover overall. Shrub cover was typically 30–40% on unburnt off-line plots and 40–50% on burnt off-line plots. Shrub cover was highest on 2D seismic lines (~54%), regardless of burn status. Shrub cover was moderate on winter roads (38–45%) and lowest on unburnt 3D seismic lines (8–22%). Burnt 3D seismic lines had approximately twice as much shrub cover as unburnt 3D lines.

Table 4-6. Summary of the mean tree and shrub cover (%) between on-line and off-line, and burnt and unburnt plots surveyed in the Eagle Plains RSA.

Linear Feature Type	Burn Status	Mean Tree Cover (%)		Mean Shrub Cover (%)	
		On-line	Off-line	On-line	Off-line
2D	Burnt	7.0	3.5	54.0	36.0
	Unburnt	5.5	13.4	53.2	32.8
3D5	Burnt	0.0	0.3	41.7	60.0
	Unburnt	0.0	0.5	7.5	42.5
3Dc	Burnt	0.0	0.2	40.4	46.1
	Unburnt	0.4	6.0	21.5	34.3
3Dr	Burnt	0.0	0.7	35.0	51.9
	Unburnt	0.0	5.5	20.6	32.5
Winter Road	Burnt	7.7	1.0	45.0	43.8
	Unburnt	1.3	4.0	37.5	32.3
Dempster Highway	Unburnt	0.0	1.0	0.0	37.5

4.2.8 LINE-OF-SIGHT AND EASE OF TRAVEL

Line-of-sight (sightline) distance was examined primarily as a function of line type; however, vegetation height (the primary factor affecting sightlines) was also examined for on-line and off-line plots for each linear feature type using multiple linear regression. Mean sightlines varied significantly by linear feature type (Table 4-7, $F_{4,187} = 3.3$, $P = 0.01$). For reference, the average sightline distance for offline controls was 46.7 m. This relatively far distance reflects the open stand structure on most sites in the region. Burn status had little influence on sightlines (e.g., burnt off-line=50.2 m, unburnt offline=43.6 m). 2D lines had the shortest average sightline distances at 41.2 m. This was mainly due to the advanced stage of regenerating vegetation on the lines. Where regenerating vegetation was limited, sightline distances on 2D lines frequently exceeded 150 m.

On 3D lines, the time since clearing was too recent for regenerating vegetation to obscure sightlines. Instead, sightline distances on 3D lines were generally controlled by bends in the lines, which were specifically designed as mitigation measures to reduce sightlines. For 3D lines, sightline distances decreased from 3D5 to 3Dc to 3Dr lines. The reduction in sightline distances resulted from differences in line width and the average distance between bends across the feature types.

The regression analysis also found a significant interaction between on-line versus off-line occurrence and vegetation height ($F_{1,187}$ = 13.0, P = 0.0004), whereby on-line plots had, on average, more negative slopes than off-line plots. In other words, sightlines at on-line plots decreased more drastically than off-line plots with each incremental increase in vegetation height. This is consistent with the qualitative observations of field crews that the regenerating vegetation on lines was thicker than the vegetation off lines.

Similar to sightline distances, determining differences in ease of travel among line type the primary factor of interest for the walking speed tests. However, burn status, and the percent cover of trees and shrubs were expected to be the most important explanatory variables related to walk speeds, so they were included as secondary variables using a mixed-effects linear regression. Walking speeds across linear feature types and the differences between on- and off-line plots within linear feature types varied significantly (Table 4-8, $F_{5,170}$ = 3.4, P = 0.006). However, the magnitude of the difference between on-line and off-line plots was modest. Even the Dempster Highway only conveyed a 35% increase in walking speed over off-line plots. Other researchers, in other areas, often observed walk speeds on linear features were often at least twice as fast as off-line transects (Keim et al. 2019a).

Notwithstanding the modest magnitude of faster walking speeds on-lines, there were clear patterns in walking speed differences across linear feature types. 2D lines were the one feature type where walking speeds were slower on lines than off lines. This reflected the thick, shrub stage vegetation that had regenerated on most 2D lines, which impeded travel (similar to the effect that regenerating vegetation had on sightline distances in the previous section). Walk speeds decreased across the other feature types in relation to line width and the degree to which ground cover was levelled or compacted.

Statistical analyses indicated that both burn status ($F_{1,170}$ = 17.85, P < 0.0001) and percent cover of shrubs and trees (hereafter woody vegetation; $F_{5,170}$ = 5.29, P = 0.0002) affected walking speeds, both on and off lines. On average, walk speeds in burns were approximately 10% slower than in unburnt areas. This is partly related to thicker woody cover in most burns, which hinders walking speed because of the time it takes to push through or walk around it. Walking speeds significantly decreased, on average, by 0.04 (CI = 0.02–0.06) km/h and with every 10% increase in the percent of woody cover off-line and 0. 11 (0.07–0. 15) km/h on 2D lines.

Table 4-7. Average sightline distances along different linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Average Sightline Distance (m)	Comments
2D	30	41.2	Sightlines are frequently reduced by regenerating vegetation >1.5m tall
3D-5m	5	105.6	Has fewer bends than 3Dc and 3Dr
3D-Conductor	26	75.9	Sightlines limited by bends in lines; too recent for regenerating vegetation to impede sightlines
3D-Receiver	23	60.2	Sightlines limited by bends in lines; too recent for regenerating vegetation to impede sightlines
Dempster Highway	2	814.8	
Winter Road	17	106.2	
Off-Line Controls	103	46.7	

Table 4-8. Differences in walking speeds among linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Average Walk Speeds (km/h)		Difference (%)
		On-line	Off-line	
2D	28	2.5	2.8	-10%
3D5	5	3.8	3.0	30%
3Dc	23	3.5	3.1	13%
3Dr	23	3.2	2.9	10%
Dempster Highway	2	5.6	4.1	35%
Winter Road	16	3.6	3.1	17%
Off-Line Controls	97	n/a	2.9	

4.3 VISIBILITY OF LINEAR FEATURES FROM THE DEMPSTER HIGHWAY

Overall, the blind search identified 11 of 100 possible linear feature intersections with the Dempster Highway (Table 4-9). Five of the features were roads that were classified as winter roads in the GIS inventory, but most (four) were actually short, all-season roads leading to gravel pits or well sites. Two of the observed features were human truck/OHV trails that led to camp sites 100–200 m off the Dempster Highway, and four were 3D seismic lines. The map search detected two more 3D lines, one 2D line, and one old winter road. The 2D line and the old winter road had regenerated into Young Forest structural stages. Excluding the four short secondary roads into gravel pits and well sites, and the two human trails, only 8% of linear features that intersected the Dempster Highway were visible during the two driving surveys.

Only 6 of the 74 3D lines that crossed the Dempster were detected. The combination of construction design (i.e., creating a bend in the 3D line adjacent to the highway) and regenerating vegetation in the right-of-way made it difficult to detect the 3D lines. Evidence of human use (e.g., packed vegetation, tire tracks, rutting, garbage, campfire remnants, tree stumps, or tree blazes) was observed on four of the short, all-season roads

and the two trails. No evidence of human use was noted on any of the 2D or 3D seismic lines, or the three winter roads (including the Chance and Blackie winter roads). However, some types of human use do not leave sign during the snow-free season (e.g., snowmobile use in the winter).

Table 4-9. Summary of linear features identified and intersecting the Dempster Highway during a blind search test.

Linear Feature Type	No. Features Intersecting the Dempster	No. (%) Observed Blind Search	No. (%) Observed Map Search	Total No. (%) Observed	OHV Accessible	Sign of Human Use
2D	18	0 (0%)	1 (6%)	1 (6%)	0	0
3D	74	4 (5%)	2 (5%)	6 (8%)	4	0
Secondary Roads	8	5 (63%)	1 (13%)	6 (75%)	5	4
Trail	n/a	2 (n/a)		2	2	2
Total	100	11 (11%)	4 (4%)	15 (15%)	11	6

4.4 WINTER TRACKS

In total, 462 linear features were surveyed for winter tracks over 358 km along the 11 transects. No human sign was observed on any linear features, except the Dempster Highway. Ungulate tracks were frequently observed travelling along linear features. The proportion of linear features with tracks decreased with decreasing linear feature widths, from 29% on winter roads, 24% on 2D lines, 8% on 3D conductor lines, and 6% on 3D receiver lines (Figure 4-6).

The frequency of use in adjacent undisturbed areas, corrected to account for different survey extents between the linear features and the undisturbed areas, was 1%. As discussed in the methods, it was difficult to compare the frequency of use along linear features to use in undisturbed areas. The issue is that for the comparison to be relevant, the survey design needs to account for the size of the sample units (i.e., the extent of the undisturbed area needs to be comparable to the width of the linear features), and the two samples should be independent. These conditions were not achieved under the current survey design (i.e., the extent of the survey area in the undisturbed area was much larger than the width of the linear feature, and the location of the undisturbed area was spatially correlated to the linear feature). The estimated relative use rate of 1% in undisturbed areas adjusts the total counts within the 200 m survey area to 5 m (i.e., the average linear feature width); however, the adjustment fails to account for spatial correlation between the two samples. Therefore, the estimate of use in undisturbed areas could be biased. Notwithstanding this limitation in the estimate of travel rates in undisturbed areas, it is supported by qualitative observations of the survey crew that travel rates on even the least used linear features (i.e., 3D lines) are higher than undisturbed areas.

The relative use of linear features by ungulates also appeared to vary with distance from the Dempster Highway, with features within 1 km of the highway receiving lower use than features equal to or greater than 5 km from the highway (Figure 4-7). It is worth noting that the Highway and 1 km transects were completed on the first and second day of surveys, respectively, and the other transects were surveyed one to six days later, providing more time for tracks to accumulate. Snowfall data prior to the crew's arrival on site was not

available; however, road crews at Eagle Plains reported that there had not been a major snowfall in the area for at least a week. Based on this information, the issue of time since last snow has less potential to bias results than if a track-erasing snow event had recently occurred.

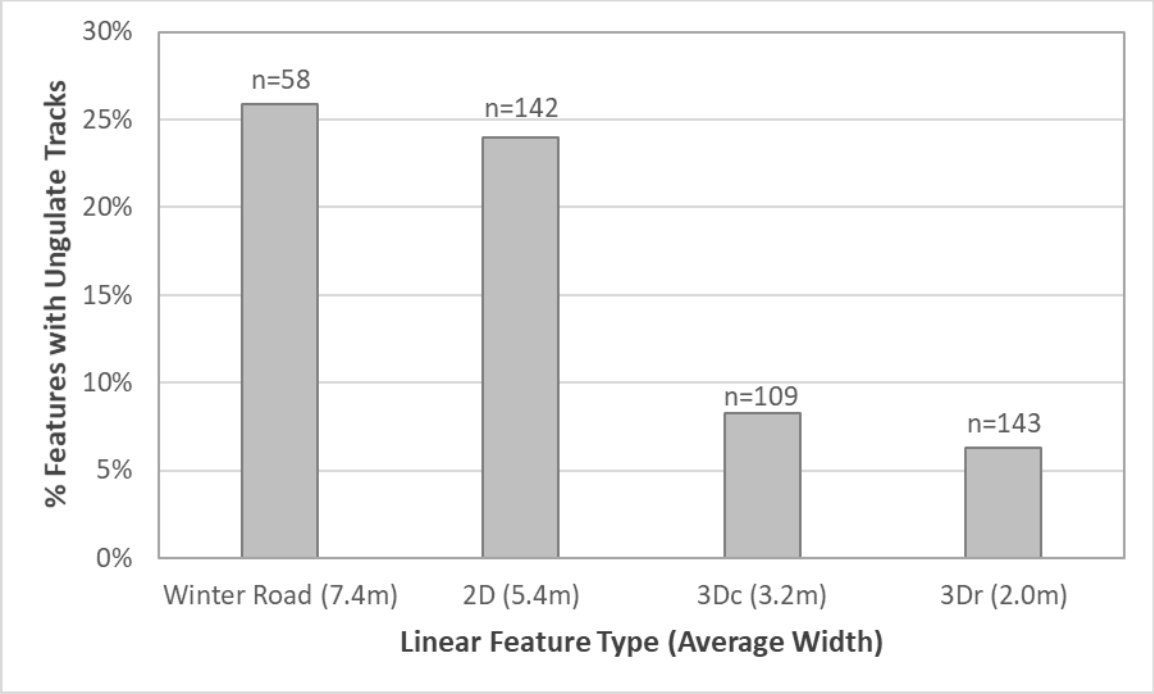


Figure 4-6. Relative use of different linear feature types by ungulates in the Eagle Plains RSA, March 2020.
The numbers above bars indicate the number of features surveyed.

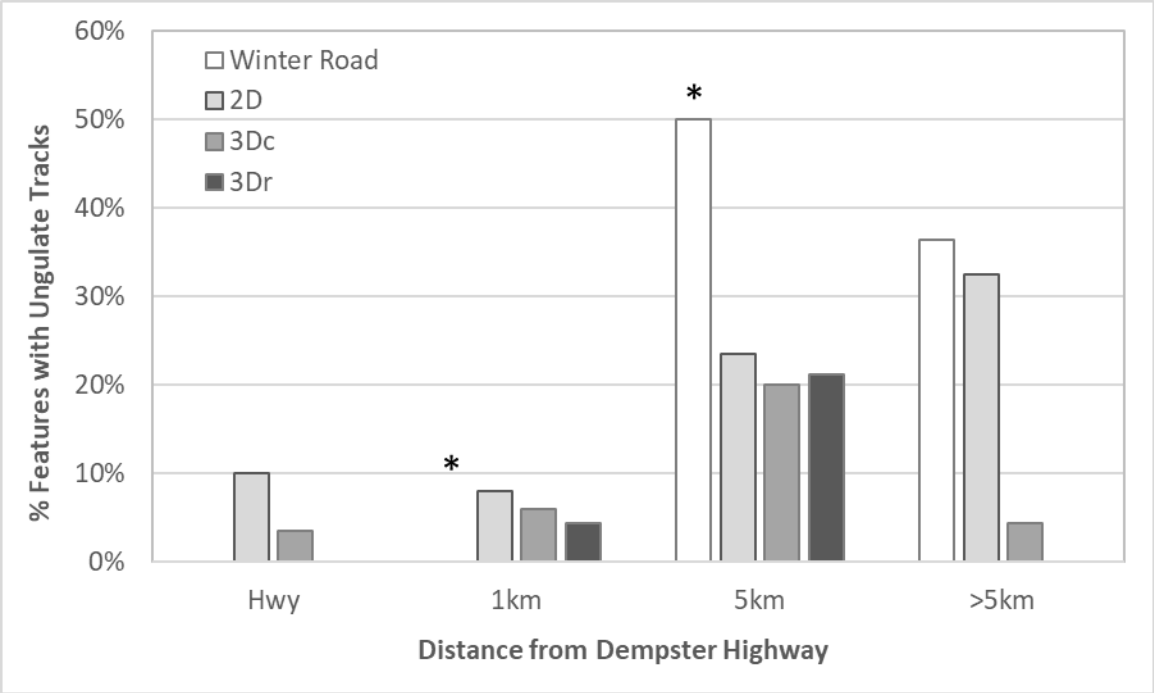


Figure 4-7. Relative use of different linear feature types by ungulates in relation to distance from the Dempster Highway in the Eagle Plains RSA, March 2020.

*The * indicates bars with small samples sizes (n=5-10); all other instances have at least 10 data points per feature type within each distance class*

5 DISCUSSION

5.1 SUMMARY OF LINEAR FEATURES IN THE EAGLE PLAINS RSA

Table 5-1 summarizes key characteristics across linear feature types in the Eagle Plains RSA.

Table 5-1. Summary of structural, ecological and functional characteristics of linear feature types in the Eagle Plains RSA.

Linear Feature Type	Mean Width (m)	Mean Sightlines (m)	Mean Movement Speed (km/h)	% Regenerated[1]	% Inhibited Regeneration[2]	Linear Feature Density (km/km²)	Adjusted Linear Feature Density (km/km²)[3]	% Ungulate Use[4]
3D seismic	2.6	71.98	3.36	14	0	0.91	0.31	7
2D seismic	5.4	41.17	2.53	61	4	0.61	0.12	24
Winter Roads	7.4	106.18	3.58	39	19	0.25	0.07	26
Dempster Highway	33.8	814.75	5.60	0	100	0.02	0.01	N/S
Off-line Controls	N/A	46.67	2.95	N/A	N/A	N/A	N/A	N/S

[1] as characterized by reaching a tall shrub stage, or greater.
[2] including stagnated and disturbed successional patterns.
[3] accounting for burns, natural openings, and regeneration.
[4] percent of lines with ungulate tracks during March 2020.

2D Seismic — 2D lines are, on average, the oldest features in the area and have had the longest time to regenerate. Most features were cleared before 1985, but some were developed in the early 2000s. Historical 2D lines were generally long and straight, with moderate widths of 4–8 m. Lines were typically constructed with bulldozers that cut into the moss layer and often included some patches of soil disturbance. The combination of site disturbance and wider widths generally resulted in a successional reset to pioneering vegetation (including early seral graminoids, forbs, and shrubs). Most sites were following a normal successional pathway (73%). However, 27% of sites exhibited atypical pathways, dominated by magnified succession (21%, mostly in burns), stagnated succession (3%) or no succession (1%). Sixty-one percent of the 2D sites had regenerated to a Tall Shrub or more advanced structural stage. 2D lines had the shortest sightlines and slowest walk test speeds of all feature types (including off-line controls), reflecting the regenerating vegetation's effect on these functional metrics. During winter, ungulates regularly used 2D lines to travel along.

3D Seismic — All 3D lines were created during the last exploration period, during the winter of 2013/14. 3D lines constitute the most extensive combined lengths of the different linear feature types, but their areal extent is limited to a relatively small portion of the RSA along the Dempster Highway. Due to their basic design, as well as specific mitigations, 3D lines minimize environmental effects compared to other linear feature types. They are narrow (averaging 3.2 m and 2.0 m for conductor and receiver, respectively), often

narrower than average tree spacing in the region. They were constructed during winter, over snow, using low-ground pressure equipment, which avoids ground disturbance and maintains vegetation in the moss, herb and low shrub layers. The lines were constructed with a meandering path, and strategically placed sharp angle dogleg bends to reduce the visibility of the lines from roads, reduce sightlines along them, and hamper travel by OHVs. All 3D lines that were surveyed were undergoing a normal successional pathway and were dominated by the same vegetation as in adjacent undisturbed areas. Regenerating vegetation was mostly in a Low Shrub structural stage, consistent with the relatively short six-year period since they were cleared. Sightlines and movement speeds were intermediate compared to other linear feature types, with sightlines primarily controlled by dogleg bends purposely designed to reduce sightline distances. Ungulates occasionally used 3D lines to travel on in winter, but at less than a third of the rate as 2D lines and winter roads.

Winter Roads — A network of winter roads across much of the RSA results from the historical exploration programs that have occurred. Although many of the winter roads were initially developed during the earliest exploration programs, vegetation has not had the same opportunity to regenerate as on 2D lines because the vegetation was re-cleared on several roads during subsequent exploration programs. The average width of winter roads was 7.4 m, but major roads, like the Chance road, were often 10–12 m wide. Historical winter roads were typically cleared with a bulldozer, and then snow was packed and graded to create a road surface. Similar to historical 2D seismic, the combination of site disturbance and wider widths (i.e., that increases solar exposure) generally resulted in a successional reset to pioneering vegetation (including early seral graminoids, forbs, and shrubs). Most sites were following a normal successional pathway (72%), but 26% of sites exhibited atypical pathways, dominated by stagnated succession (19%), magnified succession (6%) and no succession (1%); 2% of the sites were classified as no disturbance (indistinguishable from vegetation community off the road). Thirty-nine percent of the winter road sites had regenerated to a Tall Shrub or older structural stages. Winter roads had the longest sightlines and fastest walk test speeds of all feature types, other than the Dempster Highway, reflecting the variable levels of regenerating vegetation that occurred on winter roads. During winter, ungulates regularly used 2D lines for travel.

Dempster Highway — The Dempster Highway is the only all-season road in the RSA (except for short spurs off the Dempster to well sites and gravel pits). It is fundamentally different from all other linear features in the area in terms of wide width, surface material and maintenance, long sightlines, regular traffic, and base of access for human land use activities such as hunting, camping, and trapping.

5.2 LINEAR FEATURE CHARACTERISTICS

5.2.1 FIRE

The presence or absence of recent forest fires affected several linear feature characteristics, including linear feature width, successional class, structural stage, and vegetation height and cover. Mean measured linear features widths were 0.2–0.6 m wider at burnt sites than at unburnt sites. This may be due to the already shorter vegetation at burnt sites, which would reduce overgrowth occurring from forest edges and decrease the measured width between driplines (branches extending into the linear feature from either side of the line).

Magnified succession was nearly four times more common in burnt plots than unburnt plots, and stagnated succession was half as common. Fire likely facilitates magnified succession by increasing soil temperatures, accelerating decomposition, and releasing stored water and nutrients to promote vegetation growth (Seccombe-Hett and Walker-Larsen 2004, Simpson 2008). Stagnated succession is likely less common at burnt sites because the associated nutrient and water increase allows woody plant species to colonize more easily and advance through successional stages.

Overall structural stage distribution was very similar between burnt on-line and off-line plots, but was markedly different between unburnt on-line and off-line plots. Furthermore, when the structural stages were compared between paired on-line and off-line plots, they matched two to four times more frequently at burnt sites than at unburnt sites and were mismatched two to six more frequently at unburnt sites than at burnt sites. Nearly all burnt plots were in a low shrub, or tall shrub structural stage, which is expected as fires tend to remove overstory trees, and shrubs generally colonize rapidly post-fire (Seccombe-Hett and Walker-Larsen 2004).

Vegetation height was 4.4 m shorter in burnt than unburnt reference plots, and tree cover was approximately 6% less. These modest differences reflect the stunted and open nature of the taiga forest. There was little change in vegetation height between burnt and unburnt linear features, likely because there were very few linear disturbances in a forested structural stage; most of them, even in unburnt conditions, were already in a shrub-dominated stage due to the clearing of trees. For shrub cover, except for 2D seismic lines, the mean was approximately 10% to 20% greater at burnt plots than at unburnt plots. The increase in shrub cover at burnt sites was most prominent in 3D seismic lines due to their comparatively lower pre-fire shrub cover.

Post-burn vegetation was, on average, shorter and shrubbier than unburnt off-line plots, but taller and shrubbier than unburnt on-line plots. Furthermore, burnt paired plots were more similar in vegetation characteristics than unburnt paired plots. This evidence supports the theory that forest fires in taiga ecosystems resets the landscape to some extent and effectively erase signs of anthropogenic disturbance (Seccombe-Hett and Walker-Larsen 2004, Simpson 2008). Forest fire in the taiga returns ecosystems to an early successional stage (i.e., low shrub) and synchronizes baseline biophysical conditions on a landscape scale, allowing previously disturbed and undisturbed areas to recover at equal rates, as has been documented by Seccombe-Hett and Walker-Larsen (2004). Thus, most linear features that have experienced forest fires no longer create different ecological conditions or functional disturbances than the surrounding landscape.

5.2.2 SUCCESSIONAL CLASS

The idea that vegetation regeneration on linear features could follow different successional trajectories came out of work by the Yukon Government in the early 2000s (Simpson 2008). That work described six successional trajectory classes observed in the Eagle Plains area. However, that study did not quantify the relative extents of linear features that followed the different trajectories. This study used the classes that the Yukon Government work developed and quantified the proportion of linear features in each successional class across a random sample of linear features.

Successional classes in the Eagle Plains RSA varied according to linear feature type and burn status. However, one of the key findings was that normal succession was the dominant trajectory observed for all linear features except the Dempster Highway. All 3D seismic lines followed a normal successional trajectory, except for one recently disturbed site. This was likely attributable to the low impact methods used in 3D line creation that minimize ground and vegetation disturbance, creating conditions more likely to result in a normal successional trajectory (Yukon Energy Mines and Resources 2006, Golder Associates 2016). Magnified and stagnated succession were only observed in 2D seismic lines and winter roads. These linear features were generally wider and were created using methods that cause greater disturbance to soils, hydrology, and vegetation, leading to these alternative successional trajectories (Simpson 2008, Jorgenson et al. 2010, Dabros et al. 2018). Magnified succession is unique among the classes in that it results in accelerated vegetation regeneration. Magnified succession was most common on burned 2D seismic lines where the combination of site disturbance associated with the 2D lines and fire is suspected of causing accelerated soil warming, moisture availability, and nutrient flush, which increase on-line vegetation growth (Simpson 2008). Successional stagnation was most common on unburnt winter roads. Stagnation tends to occur on features that have experienced ground disturbance or have been seeded to agronomic species, which may have happened on winter roads in the RSA (Simpson 2008). Repeated disturbance associated with multiple exploration programs over time may also limit successional advancement and contribute to successional stagnation (Lee and Boutin 2006, Jorgenson et al. 2010).

Although some alternative successional pathways were observed in this study, most linear features in the Eagle Plains RSA are following a normal successional trajectory. This implies that most of these disturbances will recover to an ecological condition like that of the surrounding community with adequate time.

5.2.3 STRUCTURAL STAGE

The taiga forest in Eagle Plains presents a unique situation where the Tall Shrub stage is applied to two very different stand conditions. One condition, the more traditional, is of regenerating stands following a natural or anthropogenic disturbance. In this setting, the vegetation consists of deciduous shrubs and 2–8 m tall, 10–30 years old trees. The stage is transitional, with the vegetation expected to advance to the Pole-Sapling stage over time. The second condition where the Tall Shrub stage is applied is to stunted, old, black spruce stands in a disclimax state. In this setting, the vegetation consists of open, stunted, black spruce stands that are typically ≥50 years old and 2–8 m tall. Stands in this condition are expected to remain in the same condition over time(i.e., a disclimax state). Structurally, the stunted black spruce trees function more like shrubs than trees. Both Tall Shrub conditions (referred to as disturbance and disclimax forms hereafter) are widespread across the RSA in off-line sites. Only the disturbance form was observed on linear features.

The structural stage on linear features was predominantly Low Shrub or Tall Shrub, determined mainly by the time since line clearing and burn status. Less than 4% of surveyed features were in forested stages (Pole-Sapling or greater). Off-line plots had a higher proportion of forested structural stages (37%). However, they were still predominantly Low Shrub and Tall Shrub, resulting from extensive burns across the RSA and large extents in the disclimax form for Tall Shrub in un-burned areas.

The structural stage of on-line plots was also influenced by successional class. The small number of forested structural stages observed on features only occurred on sites undergoing normal succession. Stagnated succession was associated with only the Herb structural stage, which was expected as stagnation is defined by its high herbaceous species cover (among other factors) that limits the establishment of other structural groups. Magnified succession was the one atypical successional class with accelerated vegetation growth. Most structural stages on sites with magnified succession were in Tall Shrub and, occasionally, Pole/Sapling. Often the structural stage on magnified succession sites was one stage greater than the off-line plot.

5.2.4 VEGETATION HEIGHT

This study observed a range of vegetation heights across different feature types. Except for the 3D lines, the linear features' age was unknown, so it was impossible to estimate growth rates. Although some regenerating vegetation on 2D seismic lines and winter roads reached 8 m high, most were between 1.5 m and 2 m. Though the ages of specific features were mostly unknown, the minimum age for most was at least 35 years. Having most vegetation heights at only 1.5–2.0 m after this long period suggests regeneration growth rates on linear features may be quite slow. This pattern of slow vegetation growth on linear features may partly reflect the generally poor growing conditions in the taiga region. Still, it is also a pattern that has been observed on linear features in other studies in the southern boreal forest.

Interestingly, the vegetation heights on linear features in Eagle Plains are greater than reported in several other studies. For example, approximately 65% of sites on linear features in northeast Alberta had not advanced beyond a cover low forbs after 35 years (Lee and Boutin 2006). Key factors that have been linked to slow vegetation regeneration on linear features were continued human disturbance (e.g., OHV travel), ecosystem type (bogs and fens regenerated much slower than upland sites), competition from early seral and invasive graminoids and forbs, and soil or site degradation associated with feature construction (Lee and Boutin 2006, van Rensen et al. 2015, Finnegan et al. 2018).

There is limited data on vegetation regeneration in the taiga. A study from NWT found that vegetation regeneration on conventional seismic lines was affected by both a time lag for seedling establishment (as long as 17 years for black spruce) and slow growth rates (83 years to reach 5 m) (Seccombe-Hett and Walker-Larsen 2004). In burned areas, the seedling establishment delay was reduced to five years.

Although the 3D lines in Eagle Plains were only six years old when they were surveyed, a combination of field survey results and information from other studies suggests that vegetation recovery on 3D lines could be much faster than the previous examples for conventional 2D lines. This is because the undisturbed ground conditions and maintenance of the vegetation community in the moss, forb and low shrub layer provide both plants and growing conditions that support faster shrub and tree growth compared to sites beginning primary succession. In northeast British Columbia, Golder Associates (2016) found that in the first year following 3D seismic line creation, there were already black spruce seedlings exceeding 0.5 m in height. These seedlings were plants that were initially present on the site and that had survived line clearing. This is consistent with the results of this study, where nearly all of the 3D plots contained black spruce seedlings. Despite their relatively young age, most 3D seismic lines in Eagle Plains included shrubs and trees between 0.5 m and 1 m

tall. Although growth rates in Eagle Plains are not known, similar species that occur in Eagle Plains were observed to grow 5–10 cm per year on 3D lines in the boreal forest in northeastern British Columbia (Golder Associates 2016). If similar growth rates occur in Eagle Plains, regeneration on the 3D lines can be 2 m over the next 5–20 years.

5.3 HUMAN USE AND ACCESS ALONG LINEAR FEATURES

The NYRLUP and the PWRLUP indicate that one of the primary concerns about linear features is that they can increase human access into remote areas. This has been demonstrated in southern regions, and that access can have secondary effects of inhibiting vegetation regeneration (Lee and Boutin 2006) and, in winter, packing snow that can affect predator-prey dynamics (Latham et al. 2011, McKenzie et al. 2012, Keim et al. 2019a). In the boreal forest in northern Alberta, OHV travel was common on most conventional 2D seismic lines. After 35 years, approximately 20% of the lines were considered to have been converted to tracked access routes (Lee and Boutin 2006). In the same study, about 65% of the lines remained cleared after 35 years, and OHV use along the lines was identified as one factor contributing to the lack of vegetation regeneration. In contrast, there is little evidence of human use along linear features in the Eagle Plains RSA. No sign of human use was detected along linear features during the summer ground surveys (e.g., OHV tracks, ruts, water crossings, vegetation trampling/scarring, tree blazes, trap sets, garbage, campsites, etc.) or the winter track survey (e.g., snowmobile tracks). Although these surveys provided limited snapshots in time, and that some types of human activity leave little sign (e.g., evidence of snowmobile tracks have limited persistence during winter and leave no sign behind after snow melt), the results suggest that human use of the area is very limited outside of the Dempster Highway corridor. This is consistent with general comments from highway workers, staff at the Eagle Plains Hotel, pilots, and some First Nation residents that most areas beyond the Dempster Highway corridor receive very little human use. Specific instances of use of the area outside the Dempster Highway corridor include intermittent activity on the community trapline that occurs in Eagle Plains and occasional forays by hunters (First Nation and non-First Nation), mostly in winter.

People's limited use of the Eagle Plains area is likely due to its far distance from any human settlements and the difficulty of travel off the Dempster Highway. The network of winter roads in the area does provide access via specific types of OHVs in summer and snowmobiles in winter. However, there was no evidence observed that this occurs regularly. Travel along seismic lines, though possible in specific locations, would be hampered over any substantial distance by vegetation regeneration along the historical 2D lines, the narrow widths of and frequent dogleg bends in 3D lines and, during summer, difficult terrain (extensive peatlands and graminoid tussocks).

5.3.1 EFFECTIVENESS OF MITIGATION MEASURES FOR 3D SEISMIC LINES

In addition to the narrow widths of 3D lines, which hampers OHV travel, the 3D lines included regular bends in the lines, which were designed to limit the visibility of the lines at intersections with roads and other seismic lines, and to hamper OHV along the lines further. The driving survey along the Dempster found that this mitigation was very effective in reducing the visibility of the 3D lines from the road (i.e., only 6 of the 74 3D

lines intersecting the Dempster Highway were visible). Incidental observations during ground surveys observed similarly reduced visibility of 3D lines crossing winter roads. Regular bends in the 3D lines away from roads were also designed to limit human access by reducing sightlines and making travel more difficult along the line (i.e., needing to reduce speed to navigate the tight turns of a dogleg bend approximately every 70 m).

5.4 FUNCTIONAL CHARACTERISTICS OF LINEAR FEATURES

In addition to human travel, linear features can also affect how wildlife move within a landscape. Several studies in western Canada have documented the effects of linear features on the movements and population dynamics of large mammals, such as caribou, moose, deer, wolves and bears (Latham et al. 2011, McKenzie et al. 2012, Dickie et al. 2017b, Keim et al. 2019a). EDI focused on two established indicators of human and wildlife access and travel on linear features: sightline distance and ease of travel. These measurements act as a proxy for the functional recovery of disturbed areas. They are mainly dependent on vegetation height, cover, and terrain.

5.4.1 LINE-OF-SIGHT

Line-of-sight or sightline distance is how far one can see under normal conditions and was compared between linear features and paired reference plots. It has been proposed that humans and predators select linear disturbances because it is easier to travel and detect prey using those features (Finnegan et al. 2018). As vegetation grows taller and denser, sightlines diminish, and the use of linear features decreases (e.g., for wolves, Dickie et al. 2017a). This study found that average sightlines were farther on-line versus off-line for most linear feature types, but that sightlines varied substantially across line types. Sightlines were shorter on seismic lines than on roads, especially 2D lines which had more advanced vegetation regeneration than other feature types. On 3D lines, sightlines averaged approximately 30 m farther on lines than off lines. However, this difference probably provides little advantage to predators or human hunters because the increase is still within the olfactory and auditory detection zone for most large prey species. Average sightlines were 60 m farther on winter roads than surrounding forest, which may begin to confer more advantage to predators and hunters.

The range of sightlines observed on most linear features probably do not provide an advantage to detect prey species visually. For 2D lines and winter roads, sightline distances were primarily driven by the height and density of regenerating vegetation. The recovery period for 2D seismic lines appears to be sufficient to support vegetation that reduces visibility to a similar level as the surrounding habitats. The reason for longer sightlines on winter roads is that they are subject to intermittent re-activation, where the vegetation is cleared once again, which resets vegetation recovery and maintains longer sightlines. In contrast to 2D lines and winter roads, where sightlines were largely determined by vegetation regeneration, the sightlines on 3D lines were presently limited by the bends purposely constructed into the lines. Sightlines along all feature types will continue to diminish over time as vegetation regeneration continues.

5.4.2 EASE OF TRAVEL

Ease of travel is a fundamental indicator of functional recovery of linear features. Wolves, bears, and humans have been documented to select linear features with greater ease of travel, which is generally associated with lower and more sparse vegetation and stable, even terrain (Dickie et al. 2017b, Keim et al. 2019a). Access and travel resistance are the main determinants of predator and human use of linear features and the key concern of linear disturbances in the RSA (Vuntut Gwitchin Government and Yukon Government 2009, Peel Watershed Planning Commission 2019).

The walk test used in this study, as an index of ease of travel, found differences among linear feature types and between linear features and controls. However, the magnitude of the differences for both comparisons was modest. Even the Dempster Highway only conveyed a 35% increase in walking speed over off-line plots. Other researchers, in other areas, often observed walk speeds on linear features were often at least twice as fast as off-line transects (Keim et al. 2019a). Two conditions associated with the Eagle Plains area appear to limit the advantage of travelling on linear features. One is that the vegetation in most ecosites and structural stages is relatively open and has a limited effect on impeding movement. The second factor is that ground conditions limiting movement, including soft, thick peat and graminoid tussocks, were similar on both on-line and off-line plots for most linear feature types.

Notwithstanding the modest magnitude of faster walking speeds on-lines, there were clear patterns in walking speed differences across linear feature types. 2D lines were the one feature type where walking speeds were slower on lines than off lines. This reflected the thick, shrub stage vegetation that had regenerated on most 2D lines, which impeded travel (similar to the effect that regenerating vegetation had on sightline distances in the previous section). Walk speeds decreased across the other feature types in relation to line width and the degree to which ground cover was levelled or compacted. 3D seismic lines allowed slightly easier travel than paired off-line plots. They usually had lower vegetation cover and clearer route selection. As linear feature width decreased in 3D lines, walking speed also decreased. This implies that width may be related to functional recovery, with narrower lines having smaller impacts than wider lines, even within an already narrow linear feature type. Although ease of travel was greater in 3D seismic lines than surrounding community, it is expected that this will decrease in future years as vegetation increases in height and density.

5.5 FUNCTIONAL RECOVERY OF LINEAR FEATURES

Functional disturbance is defined in the NYRLUP and PWRLUP as "*physical land use disturbance that results in disruption of soil or hydrology, or that requires the cutting of trees*." One of the main concerns with linear disturbances under these land use plans is that such features can technically allow increased access to previously remote areas, potentially leading to a greater harvest of wildlife and fish, higher predation rates, and a change in how people and wildlife use the land (Vuntut Gwitchin Government and Yukon Government 2009). A disturbance can be considered functionally recovered and subtracted from the overall linear density when it no longer facilitates access or travel by humans or wildlife (Vuntut Gwitchin Government and Yukon Government 2009), or otherwise no longer functions as a surface disturbance (Peel Watershed Planning Commission 2019). Both plans use 1.5 m vegetation height as a threshold for functional recovery in forested communities. The

PWRLUP includes the following additional criterion for recovery "*in non-forested areas (dominated by vegetation under 1.5 m), when the disturbed area is covered by native species roughly the same height and composition as the surrounding dominant vegetation*" (Peel Watershed Planning Commission 2019):

One limitation of using height alone as a functional recovery criterion is that it does not consider vegetation density. Although regeneration may meet the recommended height criteria, if it is very sparse (as is often the case in the Eagle Plains Ecoregion), it may still facilitate access and travel by humans and wildlife. Attachment Photo A-25 provides an example in the Eagle Plains RSA where tall but sparse regeneration meets the 1.5 m criteria but does not inhibit access or travel.

The combined results of this study indicate that using regeneration to the Tall Shrub structural stage may be a more appropriate criterion for functional recovery. Attachment Photo A-3 and Attachment Photo A-10 provide examples of linear features that have regenerated to a tall shrub structural stage. Using the Tall Shrub criterion, 38% of all linear features in the RSA would be considered functionally recovered compared to 53% using the 1.5 m height criterion. For this study, the more conservative criterion of reaching the Tall Shrub structural stage was used to adjust (reduce) linear feature densities.

5.6 LINEAR FEATURE INVENTORY AND DENSITY

This study was successful in mapping all linear features within the RSA. The combined results of the mapping exercise and the field studies found that the extent of open habitats (burns and naturally open habitats like wetlands and shrublands), and the degree of vegetation regeneration, played a significant role in the effective density of linear features across the RSA. Before accounting for open areas and regeneration, the total linear feature density was 1.79 km/km². After accounting for open areas and vegetation regeneration (to the Tall Shrub structural stage), the effective linear feature density was 0.52 km/km². The NYRLUP and PWRLUP suggest cautionary levels for linear density of 0.75 km/km² and critical levels of 1.0 km/km² (Vuntut Gwitchin Government and Yukon Government 2009, Peel Watershed Planning Commission 2019).

The Yukon Land Use Planning Council (YLUPC) was conducting a pilot study of surface disturbance across the broader Eagle Plains Ecoregion (Skinner 2021) at the same time as this study. The methods they used consisted of mapping and attributing human-caused disturbances solely using high-resolution satellite imagery. The YLUPC classified vegetation into eight broad classes based on whether the surrounding area was forested or non-forested, the similarity of vegetation on-line to off-line, and the presence or absence of woody cover (i.e., shrubs or trees). The features were then classified as recovered or not-recovered based on the presence of woody cover (recovered) or, if woody cover was not present, the similarity to surrounding vegetation (i.e., if similar then recovered, if not similar, then not-recovered). Historical field data and photographs from the area (Simpson 2008) were used to verify interpretations.

The spatial data from the YLUPC work was not available to compare in detail to the linear feature inventory compiled in this study. However, the mapping linework is expected to be very similar because satellite imagery was used to verify and supplement the linear feature geospatial data compiled in this study (presumably the same satellite imagery that YLUPC used because the imagery was obtained from Yukon Geomatics). One

difference between the two products is that the YLUPC completed the inventory for the entire Eagle Plains Ecoregion, while this study was restricted to the RSA. Another difference is that the attribute data in this study is expected to be more detailed and more precise than the YLUPC data because (i) the original geospatial data includes some information, like date of creation, that would be impossible to estimate from imagery, and (ii) because this study linked field surveys to the mapping exercise to determine line widths and other characteristics more precisely.

Although it is impossible to directly compare the linear feature density estimates between the two studies, due to the different study extents, the general pattern of results is similar. The YLUPC estimated the linear density (accounting for recovery) to be 0.38 km/km² across the entire Eagle Plains Ecoregion. This is consistent with the estimate from this study for the RSA of 0.52 km/km² because the portion of the Ecoregion outside the RSA has lower linear feature density than the RSA.

6 CONCLUSION

This study successfully mapped all linear features within the RSA and measured a suite of structural, vegetation, and functional characteristics across different feature types. Generally, the effects associated with linear features (i.e., differences between conditions on-line and adjacent off-line areas) correlated to feature width and the degree of ground disturbance. In terms of combined effects across the range of feature types that occur in the Eagle Plains RSA, the ranks were:

Dempster Highway >>> Winter Roads > 2D Seismic > 3D-5m >> 3D Conductor > 3D Receiver[2]

The effects of 3D lines (both conductor and receiver lines) appear to be substantially lower than other feature types. This reduced magnitude of effects is important because 3D lines have the longest combined length of exiting linear features. They are also the predominant feature planned for the next exploration program. Important findings for 3D lines include:

- Relatively narrow line widths of 2–3 m are often smaller than natural tree spacing and minimize the potential for changes to microsite conditions (e.g., solar radiation, air and ground moisture) reported in other studies.
- Minimal ground disturbance and maintenance of the moss, herb, and low shrub layers, which retains the natural vegetation community and accelerates vegetation regeneration.
- Successful application of mitigations, notably dogleg bends that minimize sightlines, ease of human travel, and visibility of lines from roads.
- Ungulate use of 3D lines in winter was less than a third of the rate observed on 2D lines and winter roads.

The adverse effects of linear features in other areas are often caused or exacerbated by human use after the lines are initially constructed, including effects on vegetation regeneration and predator-prey dynamics. Human use does not appear to be a significant factor in Eagle Plains. No sign of human use was observed outside the Dempster Highway corridor.

Substantial vegetation regeneration has occurred on existing features in the Eagle Plains RSA. Previous work by the Yukon Government identified the potential for atypical successional trajectories to occur on linear features in the region. Although atypical succession occurred to a limited extent, this study determined that 81% of the sites exhibited a normal succession (100% on 3D lines). Only 5% exhibited inhibited regeneration trajectories (mostly stagnated succession on winter roads). Regarding functional recovery, 53% of sites met the NYRLUP and PWRLUP criterion of vegetation reaching 1.5 m, and 38% of sites met the criterion of attaining a Tall Shrub structural stage. Using the Tall Shrub structural stage as a criterion of functional recovery may be a more ecologically appropriate criterion to meet LUP objectives.

The extent of open habitats (e.g., burns, wetlands and shrublands) and the degree of regeneration on existing linear features (mostly the older 2D lines and winter roads) play an important role in calculating effective linear

[2] Relative magnitudes of effects: >>> large effect, >> moderate effect, > small effect.

feature density in the RSA. Before accounting for open areas and regeneration, the total linear feature density was 1.79 km/km². After accounting for open areas and vegetation regeneration (to the Tall Shrub structural stage), the effective linear feature density was 0.52 km/km².

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ATTACHMENTS

ATTACHMENT A EAGLE PLAINS PROJECT LINEAR FEATURES SURVEY PHOTOGRAPHS



Attachment Photo A-1. Air survey plot SL237, an unburnt 2D seismic line undergoing normal succession at a young forest structural stage when surveyed.



Attachment Photo A-2. Air survey plot SL269, an unburnt 2D seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-3. Ground survey plot SL310, an unburnt 2D seismic line undergoing normal succession at a tall shrub structural stage when surveyed.



Attachment Photo A-4. Aerial view of 3D seismic lines undergoing normal succession – meandering routes were used to mitigate some functional disturbance impacts.



Attachment Photo A-5. Ground survey plot SL357, a burnt 3D5 seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-6. Ground survey plot SL277, an unburnt 3Dc seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-7. Ground survey plot SL255, an unburnt 3Dr seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-8. Aerial view of a burnt 2D seismic line undergoing magnified succession at a tall shrub structural stage when observed.



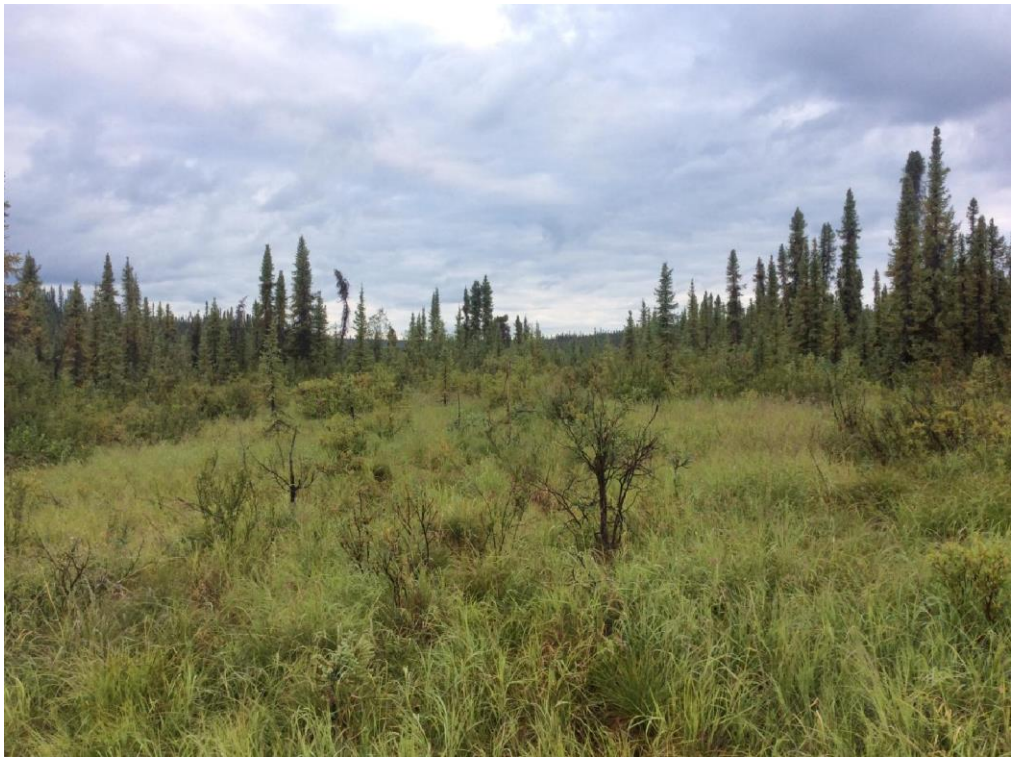
Attachment Photo A-9. Air survey plot SL234, an unburnt winter road undergoing magnified succession at a sapling forest structural stage when surveyed.



Attachment Photo A-10. Ground survey plot SL317, a burnt 2D seismic line undergoing magnified succession at a tall shrub structural stage when surveyed.



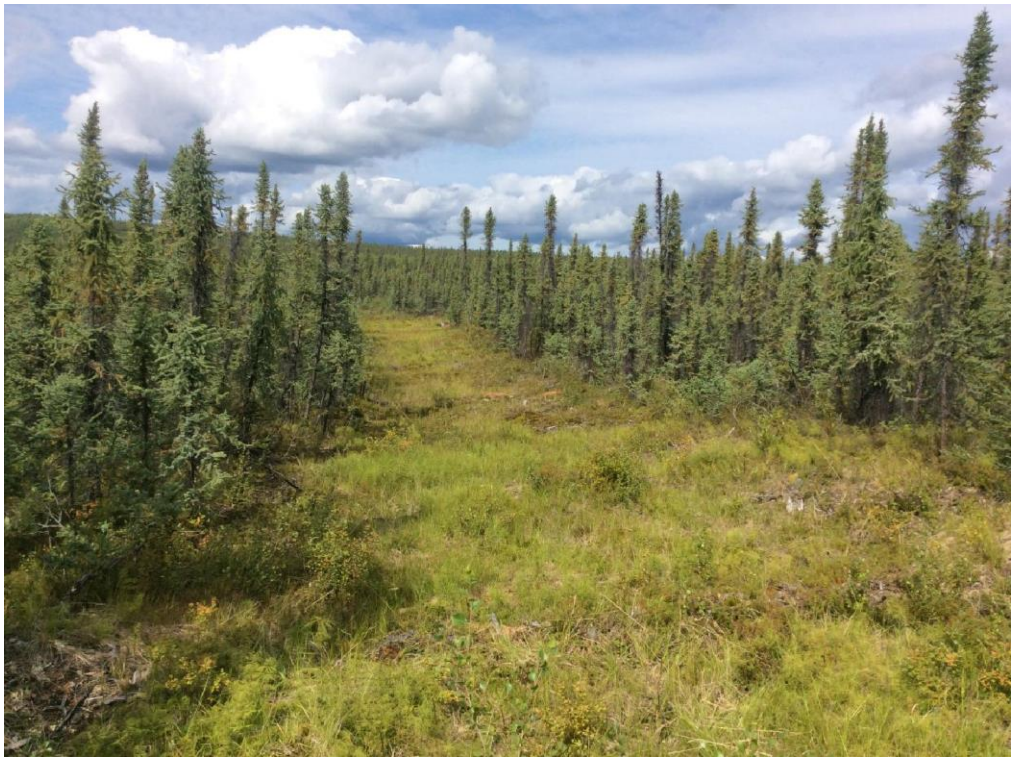
Attachment Photo A-11. Air survey plot SL238, an unburnt winter road undergoing stagnated succession at a forb-dominated herb structural stage when surveyed.



Attachment Photo A-12. Ground survey plot SL264, an unburnt winter road undergoing stagnated succession at a graminoid-dominated herb structural stage when surveyed.



Attachment Photo A-13. Ground survey plot SL226, a burnt 2D seismic line undergoing normal succession at a forb-dominated herb structural stage when surveyed.



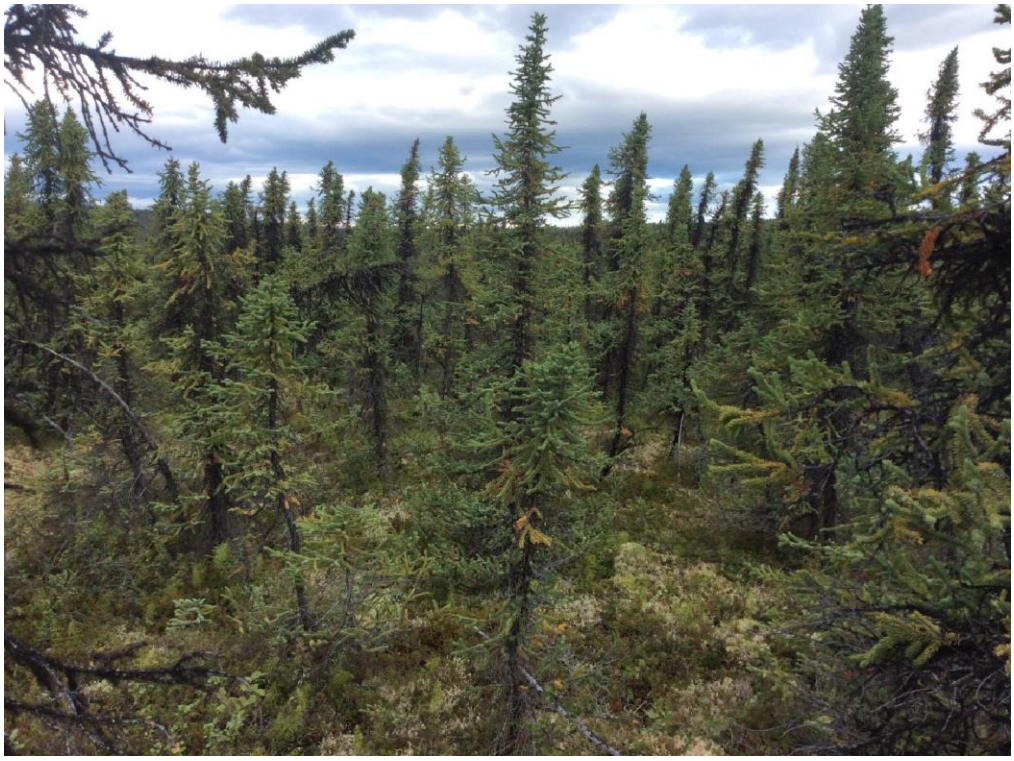
Attachment Photo A-14. Ground survey plot SL329, an unburnt 3D5 seismic line classified as recent disturbance at a forb-dominated herb structural stage when surveyed.



Attachment Photo A-15. Ground survey plot SL338, an unburnt, undisturbed reference plot at a low shrub structural stage when surveyed.



Attachment Photo A-16. Ground survey plot SL350, a burnt undisturbed reference plot at a low shrub structural stage when surveyed.



Attachment Photo A-17. Ground survey plot SL304, an unburnt undisturbed reference plot at a tall shrub structural stage when surveyed.



Attachment Photo A-18. Ground survey plot SL346, a burnt undisturbed reference plot at a tall shrub structural stage when surveyed.



Attachment Photo A-19. Ground survey plot SL3260, an unburnt undisturbed reference plot at a mature forest structural stage when surveyed.



Attachment Photo A-20. Ground survey plot SL264, an unburnt undisturbed reference plot at an old forest structural stage when surveyed.



Attachment Photo A-21. Ground survey plot SL243, a burnt winter road with melt pockets present, indicating permafrost degradation.



Attachment Photo A-22. Air survey plot SL228, a burnt 2D seismic line recovering at the same rate and stage as the surrounding community.



Attachment Photo A-23. Air survey plot SL326, a burnt winter road recovering at the same rate and stage as the surrounding community.



Attachment Photo A-24. Ground survey plot SL287, a burnt 3Dr seismic line recovering at the same rate and stage as the surrounding community.



Attachment Photo A-25. Ground survey plot SL216, a feature with regenerating trees over 1.5 m tall but very sparse, illustrating one of the limitations of the NYLUP and PWRLUP functional recovery threshold.

ATTACHMENT B DATA FORMS

Eagle Plains Linear Features Study

Surveyors: _____ **Date**: _____ **Type**: Air / Ground

Waypoint: _____ **Map Info**: _____

Line Widths: ____/____/____/____ **% Mulch**:_____

Succ. Class: Normal / No Succ / Magn / Stagn / Regress / Rcnt Dist

	On Line	Off Line
Struct. Stage		
Veg Ht / Spp	/	/
% Tree		
Tree Spp		
% Shrub		
Shrub Spp		
Ecosite		
Photos		
Sight Line (m)	/	/
Walk Test*	Dist: Time: Surveyor:	Dist: Time: Surveyor:

*Use same Surveyor for both walk tests.

Comments: _____

Eagle Plains Linear Features Study

Surveyors: _____ **Date**: _____ **Type**: Air / Ground

Waypoint: _____ **Map Info**: _____

Line Widths: ____/____/____/____ **% Mulch**:_____

Succ. Class: Normal / No Succ / Magn / Stagn / Regress / Rcnt Dist

	On Line	Off Line
Struct. Stage		
Veg Ht / Spp	/	/
% Tree		
Tree Spp		
% Shrub		
Shrub Spp		
Ecosite		
Photos		
Sight Line (m)	/	/
Walk Test*	Dist: Time: Surveyor:	Dist: Time: Surveyor:

*Use same Surveyor for both walk tests.

Comments: _____

APPENDIX 2-A. First Nation of Na-Cho Nyäk Dun and Residents of Mayo Consultation and Engagement Records

APPENDIX 2-A-01. January 22, 2018, Meeting Summary – *document not available at time of submission.*

APPENDIX 2-A-02. April 9, 2018, Meeting Summary - *document not available at time of submission.*

APPENDIX 2-A-03. May 1, 2018, Meeting SUMMARY - *document not available at time of submission.*

APPENDIX 2-A-04. May 5, 2018, Meeting Summary - *document not available at time of submission.*

APPENDIX 2-A-05. August 3, 2018, Meeting Summary - *document not available at time of submission.*

APPENDIX 2-A-06. November 6, 2018, Meeting Summary

First Nation of Na-cho Nyak Dun and Chance Oil and Gas Limited Meeting

Date: November 6, 2018

Location: Teleconference

Attendees:

Na-cho Nyak Dun:

[redacted] Lands and Resources Manager

Chance Oil and Gas Limited:

[redacted] President
[redacted] VP Government and Community Relations
[redacted] Regulatory, Environmental and Community Relations Coordinator

Hemmera:

[redacted] Senior Project Manager
[redacted] Community Engagement and Consultation Specialist

Purpose and Objectives

The purpose of this meeting was to discuss implementation of the Engagement and Communications Plan. As per the Plan, Chance and FNNND were to meet and discuss implementation within three months of August 8, 2018, the date on which the Plan was completed. Chance hopes to outline a schedule for implementation of the plan.

To advance engagement, Chance discussed their potential exploration activity in Permits 14, 19 and 20. Chance intends to do limited amounts of exploration activity in these permits and recognizes there is a partial overlap with Vuntut Gwitchin Traditional Territory. In addition, Chance wanted to begin discussions on capacity funding and how this will be provided.

Meeting Discussion:

[redacted] began the meeting with introductions and a review of the meeting agenda. [redacted] remarked that the Confidentiality Agreement was being reviewed internally. [redacted] did not have any introductory comments. [redacted] said, as an introductory statement, that he is thankful [redacted] was able to join the call and that Chance looks forward to this relationship and moving forward with a project once it gets

defined. Chance is moving forward with engaging all the First Nations and implementing the Communications and Engagement Plans. Chance has a meeting with Gwich'in Tribal Council and Tetlit Gwich'in Council next week to discuss the implementation of the Plans. Chance has a small delay with Vuntut Gwich'in due to their election of a new Chief and Council. [redacted] asked [redacted] if there is an upcoming election in Mayo? [redacted] responded that there will be an election in March 2019 and she anticipates that it will be called in January 2019.

[redacted] explained that since meeting last with FNNND, Chance has relinquished Exploration Permit 0005 because this permit was close to a Vuntut Gwitchin habitat protection area. Therefore, Chance's acreage has shrunk by approximately 30,000 hectares. This difference is featured on the latest map that Chance will send to FNNND.

Moving on to the next agenda item, [redacted] began to explain Chance's outlook for activity in the next year. [redacted] explained how chance wants to work collaboratively with First Nations regarding the project size and scope. Some of Chance's acreage will expire on August 2019 (Permits 0006 – 0011 and 0019), and some permits have been extended for five years (Permits 0012-0017). [redacted] said that Chance is hopefully meeting with Yukon Government at the end of next week to address a settlement to Chance's lawsuit.

[redacted] explained that Chance's work for next year will involve many conversations with First Nations about what a potential project will look like. Chance will have to create a project definition, and an application for YESAB. Chance will need First Nations' support and to meet YESAB's requirements. In terms of the YESAB application, Chance would prefer to apply with a larger project and do a regional assessment. It is hard for Chance to know where the wells will be before they complete more exploration because the location of new wells will be determined by the results of drilling. They may find something that redirects their efforts. Chance requires more fulsome conversations to adapt the project to meet First Nations' needs and to establish economic benefits.

[redacted] further explained how the scale of Chance's activity is intended to be small. Chance will move from one location to the next and spend one month at each well. The work will start-off as seasonal as they are restricted to winter operation initially. Winter operations will continue until they find a significant discovery that they will then want to test for two-years. The two-year testing period would require all-season access for maintenance and safety reasons.

For now, [redacted] said that Chance is anticipating operating on the west side of the Dempster, and potentially on the east side once they are further into exploration. They may want more seismic, but they have not decided where yet. [redacted] said he would forward a summary of the exploration project to D. Hope. This summary explains the rationale for a regional assessment, a few reasons being that Chance would like to provide time for learning curves for new employment opportunities and it is expensive to start and stop activities.

[redacted] explained that Chance is planning an in-person all-party meeting. [redacted] also wondered how the FNNND election would affect that meeting, and the process of working with Chance on implementing the Plans and creating a project description. [redacted] responded that FNNND is working on some internal organization to enable processes to move smoother in the future as they are tightening up implementation and operations internally. She does not think that the election will hold up too much with

[redacted] asked if Victoria Gold took a large portion of FNNND's capacity. [redacted] responded that that project had a separate staff. [redacted] also added that an all-party meeting was a good way to go because everyone would come away with the same understanding, and information can be provided all at once.

[redacted] asked about timing for FNNND's review of the Confidentiality Agreement. [redacted] said she would follow-up internally and get back to Chance and Hemmera.

Everyone on the call shared some information regarding general availability for an all-party meeting. No conclusive date was set.

[redacted]

to the potential project. [redacted] said that FNNND would discuss capacity funding internally. [redacted]

[redacted]

[redacted] raised that she would be including additional FNNND colleagues. They are [redacted] and [redacted], both Executive Directors. [redacted] would confirm how involved these employees would be in upcoming meetings with Chance, or if they would just be involved internally.

The next meeting was scheduled for November 26th at 1:30pm as a teleconference and this concluded the meeting.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Review Confidentiality Agreement	FNNND	November 26, 2018
Conduct internal discussion on capacity funding needs	FNNND	November 26, 2018
Send Exploration Project Description	Chance	Sent on November 7, 2018
Send Chance's latest Exploration Permit Map	Chance	Sent on November 7, 2018

Key Meeting Outcomes

Outcome	Responsible Party	Notes
Initial implementation of the Communications and Engagement Plan	All	

Outcome	Responsible Party	Notes
Sharing of Chance's project plans for the next year	Chance	
Support established for an All-Party Meeting	All	

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APPENDIX 2-A-07. February 1, 2019, Meeting Summary

Summary

Chance Oil and Gas Limited All-Party Meeting

Date: February 1st, 2019 **Time:** 8:00 am to 4:15 pm

Location: Princess Louisa Room, Fairmont Waterfront Hotel, Vancouver, BC V6C 3L5

Meeting Participants:

Vuntut Gwitchin Government:

- Chief [redacted]
- [redacted] Fish and Wildlife Manager
- [redacted] Lands Manager
- [redacted] Intergovernmental Coordinator

First Nation of Na-cho Nyak Dun:

- [redacted] Deputy Chief
- [redacted] Lands and Resources Manager
- [redacted] Strategic Advisor

Gwich'in Partners (Gwich'in Tribal Council and Tetlit Gwich'in Council):

- Chief [redacted]
- [redacted] Director, Lands and Resources

Yukon Government

- Minister [redacted] Energy, Mines and Resources and Economic Development
- [redacted] Assistant Deputy Minister, Oil, Gas and Mineral Resources, Energy, Mines and Resources
- [redacted] Director, Oil, Gas and Mineral Resources, Energy, Mines and Resources

Chance Oil and Gas Limited:

- [redacted] Chairman/ CEO
- [redacted] President
- [redacted] Vice President of Community and Government Relations
- [redacted] Regulatory, Environmental and Community Relations Coordinator

Hemmera:

- [redacted] VP Human Environment
- [redacted] Business Leader, Human Environment
- [redacted] Human Environment Specialist
- [redacted] Human Environment Specialist

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Summary:

Topic	Lead
Introduction to Meeting • Review of Agenda • Meeting purpose and objectives Summary: Hemmera was hired in 2017 to assist with the consultation and engagement activities for Chance's exploration project in Eagle Plains.	[redacted]
Round Table Introductions and Opening Statements by Chiefs Summary: Chief [redacted], Minister [redacted] Chief [redacted], and [redacted] provided opening statements.	All Parties
First Nation Engagement Plans • Overview of how we got here and an update on implementation Summary: Chance's current round of engagement was spurred by the 2016 OIC, followed by the 2017 Ministerial Order. A series of meetings started in 2018 to collaboratively create engagement plans, starting with a template, then building out from there. This resulted in unique documents between Chance and each First Nation. Annual reports are required under the 2018 Ministerial Order. Likely not an onerous task, and along the lines of a communication summary. Level of detail will likely be decided by individual First Nations. ***See Appendix 1 – Chance All-Party Meeting: Engagement Plan Presentation***	[redacted]
Overview of Vuntut Gwitchin Government Oil and Gas Engagement Policy Summary: Vuntut Gwitchin Government (VGG) wanted an opportunity to share with the group the work VGG has done over the past year. Guiding principles of the VGG Oil and Gas Engagement Policy (Policy): sustainable development; the NYRLUP; VGG Final Agreement; past learning experiences with YESAB (e.g., gaps in regulatory regime in the Yukon); international standards. The development of oil and gas is a community decision. The Policy is two pieces/themes: internal engagement within the community and how the community will decide on oil and gas; and, external engagement with industry (i.e., the Policy establishes a committee). The Policy itself has three phases. All phases are meant to occur prior to a YESAB submission. VGG believes the new YESAB process (i.e., Pre-Submission Engagement process) largely aligns with the objectives of the Policy. Currently, we are before stage one – waiting for notification from Chance Question: Regarding the format/structure diagram – in terms of YESAB, once an application is complete and there is feedback, does that go to the Council? VGG: Feedback goes back into the whole loop – the loop including Council, the committee, and citizens. The committee isn't an interface between the VGG and YG. The committee would be tasked, as per its specific role, and then they would	[redacted]

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report back to the Chief and Council after having done their work. At a later date VGG could expand on the internal processes for clarity.

See Appendix 2 – Chance All-Party Meeting: VGG Oil and Gas Engagement Policy Presentation

Exploration Project Description and Discussion

- Overview of the exploration project plans, oil and gas disposition plans, and YESAB application
- Answer questions or provide clarity on the Exploration Project Description

[redacted]

Summary: First exploration of oil and gas occurred in the Yukon when it was still being permitted by Ottawa back in the 50s, 60s, 70s. Red polygons on the permit map – legacy of exploration done approximately 1959-1968 when oil was found in the Yukon. These properties by themselves are not adequate to move forward with development – more needs to be discovered.

Question: For the discoveries, are conventional or non-conventional means required?

Chance: Do not need to stimulate the rock to facilitate production. Conventional means of extraction would be used.

Winter 2013/2014 had 3D seismic activity, the first in the Yukon. Chance has a base camp that can house 75 people. A limiting factor is man power (i.e., limited places to stay). Land tenure is the period of time that a permit is valid. On the Permits Map, the colour pertains to how the tenures have been extended.

Exploration activities can entail a number of things. Seismic: now lines carved through the bush are not straight, there is no line of sight, and the line are much narrower than those in the 1950s and 1960s. 3D seismic allows you to collect subsurface information in all directions. Exploration activities will include running a basecamp. Chance has to bring up everything needed in order to undertake an activity. Exploration is the riskiest part of the oil and gas industry, and the hardest part of the industry to get money allocated. A population of wells, in order to drill, learn more, and increase your probability of success is preferred.

Question: If Chance went with a 35 well program – is it 35 well pads on the surface with horizonal drilling under ground, or 35 wells total?

Chance: Not certain if we've thought well enough ahead to know that. Not all 30 wells will be exploratory. If something is found, then may need to drill in the vicinity. Possibly drill from the same well pad or one close to it in order to get a better idea of the resource.

YTG: Each well would be authorized. Not by pad.

Question: Would activities be primarily seismic first?

Chance: We do not necessarily have to shoot seismic in order to drill right now as there is legacy data. Chance does not have to do new seismic in all cases.

Chance's goal is to discover and develop a resource that meets the needs of the North and then expand. Chance wants to build local capacity. Around 80% of what Chance needs to

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execute a program they cannot get from the Yukon (i.e., a supply line from the Edmonton area is required). If the supply chain can be shortened, it is building capacity and economy in the Yukon. Additionally, it is cheaper to operate in a continuous fashion as opposed to stopping and starting (more costly).

Question: Would activity be year-round?

Chance: Depends on the production, depends on the nature of the access. All weather access is the Dempster. However, if discoveries are made elsewhere, may need to consider all weather access off the Dempster.

Chance would assess before going out on the land to minimize footprint (e.g., build winter access on existing access routes is preferable)

Chance's drilling plan would have one rig maybe two at any given point. Trying to have a smaller scale over a longer period of time. This gives people/community time to get ready, buy equipment, get training.

Question: The concept around winter road versus summer road. All season road would be required if you need to flow test, correct? A year-round fixture on the land?

Chance: Yes, if you are flow testing then you are taking a product out of the ground, over longer periods of time, and you need to get equipment to test it (e.g., trucking operations in the testing period).

Question: For the purpose of the proposal, would that be addressed?

Chance: Yes, it would be covered off in the proposal.

First Chance would go with winter access. and then explain what would happen in the future with a well (e.g., if a well bears fruit, then this is where permanent access would need to be). This would be in the proposal to YESAB.

A multi-well program in an identified area of interest would ensure flexibility. If something is discovered, there will be a significant green house gas reduction (i.e., supply line will be reduced). The camp location was the location used when the highway was under construction – Chance is trying to reactivate/reuse previously disturbed areas.

Question: What does 300 million litres mean?

Chance: The amount of fuel trucked around the Yukon. Fuel is carried in two truck trailers that carry 50,000L each. Chance is likely not going to take out the full 300 million litres but could reduce it to 200 million litres. 2000-3000 barrels a day would remove the need to get fuel to the Yukon. The source would be local instead of foreign. 2000 barrels is about 11 truck loads.

Question: VGG has about 20 monitoring stations to keep a close eye on what's going on in the watershed – how can Chance participate in that?

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Chance: Will need clarification, but Chance will be identifying data gaps. E.g., creeks in the area of interest. There is going to be monitoring place for parties to track what's going on. With respect to the Policy. There are stages to go through, and they align well with YESAB processes. Fairly soon Chance is going to have to work on/refine its project scope. Chance's objective is to build capacity and try to operate as continuously as possible. Sequencing of project activities would need to meet Chance's capacity. In the start limited to winter activities. Steady work gives the basis for local businesses to commit to local training. YESAB takes quite a bit of time, and the tenure clock is always ticking. There is a cost associated with multiple entries into YESAB. Question: 400 km/sq area? What area? Chance: Area of interest is about 40% of the total area under permits (See Appendix 3) Question: Expectation of timing for field work and the YESAB process? Chance: Ideally, field work two years from now, after YESAB. Also, likely an application to the Yukon Water Board. Confirming scale and scope with the hope to enter YESAB later this year. Have to satisfy the Policy and any new changes to YESAB. VGG: Can see the benefits but weigh it with concerns for the land and waters. Parties have different mandates but there is overlap. Cooperation Agreement and the front-end approach could be beneficial. Time pressure yes, but it will facilitate YESAB and YOGA agreement. A balance to be struck with timelines and capacity. There is limited oil and gas experience in the Yukon, and the Yukon is nothing like the rest of the country because there is robust land use planning and the power of the people. Mandates come from the people and this will benefit the people. Both sides have significant investments. Acknowledges that parties have and are seeking different requirements: certainty versus flexibility. Question: Is the NYRLUP up for review? It was completed in 2009, parties to the plan have been talking about what a review looks like. Currently assessing the plan to see where it's doing its job and where it might not be (Note: the plan will have new lines/boundaries). Minister Ranj Pillai departed 11:26 am. ***See Appendix 4 – Chance All-Party Meeting: Chance Oil and Gas Project Description Presentation***	
In-camera First Nations Session	
Review of Afternoon Agenda and Opportunity for Statements/Questions Following In-camera Session and Lunch Summary: No questions or comments.	[redacted] All Parties

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Presentations and Discussion • Yukon Environmental Assessment Process • Other regulatory processes such as YOGA and the Water Act Summary: YESAA, YOGA, and the Water Act each have various regulations that could apply to any number of activities. There are other departments involved as well (e.g., workers compensation). No work or activity can occur before a decision document and a water license has been issued. Question: What will be the decision body be for Chance's project? YG: Likely Oil and Gas Branch if YESAB process is District Office (DO), or Major Projects Office if it is an Executive Committee (EC). There are three types of processes. DO, EC (typically a longer process and handled out of the head office in Whitehorse, has timelines, specific requirements for consultation prior to submitting an application to YESAB), and panel process. January 2019 YESAB released information around a new process. Pre-Submission Engagement process (PSE). Currently, proponents are creating the entirety of the project proposal and submitting it all at once. Proponents have not had a facilitated process with YESAB prior to submission (i.e., opportunity to receive feedback on scope and size) and this has downsides. It's possible to have 5-10 years of exploration and baseline data. Then have YESAB require baseline data on a separate matter. Providing guidance and direction around scope and valued components would be beneficial to the process and ensure that a proposal is moving in the right direction during development. There are information sessions in the coming weeks, and the process may come into force fall 2019. It is possible that this could reduce time spent on information requests. The intention being to take time away for the stages/process after submission. Question: How will this mirror or link into VGG Oil and Gas Policy? VGG: VGG is also new to what is being proposed by YESAB. After looking at preliminary materials, it appears to align well with the Policy. Question: If Chance proceeds through the three stages of VGG, is the new YESAB process a requirement? Hemmera: Not a requirement yet, but it will be. If a proposal is submitted to YESAB before the new process is in effect, it would proceed under the old/current process. The new PSE process is consistent with what the Federal Government has done and also what BC has done with their new Environmental Assessment process. Question: If Chance proceeded prior to the implementation of the PSE and followed the Policy, would Chance be doing the same activity? Hemmera: The Policy is only for VGG. The PSE process is for everyone, including VGG. Additionally, YESAB collects the views of all of the Yukon. Question: Should Chance implement the PSE process before it is mandatory?	[redacted] All Parties

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Hemmera: That is for the group to weigh the pros and cons and decide. Nov 2019 is an estimated date and a Federal election may cause more delays. Question: Is this legislation? Is parliamentary time required? Is this a policy, regulatory, or legislative change? Hemmera: This is a question for YESAB. YESAB is independent of the government and they are changing their rules. Maybe gazetting? Because YESAA is a Federal act. YESAA will set out the rules for processes and what consultation is necessary. ***See Appendix 5 – Chance All-Party Meeting: Regulatory Processes Presentation***	
YESAB Application Process • Where are we? • Anticipated timelines and mapping next steps Suggestion (Chance): Moving forward there will need some form of information exchange. Depending on the information, may need to be exchanged in a confidential manner. Finish Confidentiality Agreements. Chance has shared project ideas. Chance is open to feedback. Look into which steps can be done concurrently. Budget estimates and items associated with capacity will assist Chance with internal approval processes. Suggestion (Chance): Future discussion on whether or not there could be agreement or interest in using common consultants – where needed for professional and technical advice. Trying to get common recommendations. Feedback: This may be a good idea on the technical front and a capacity one. However, a biological or cultural assessment, First Nations may want to do that independently. Question: Is YG interested in doing oil and gas 101? YG: YG is amenable to doing oil and gas 101s. Different presentations could be tailored for different audiences Suggestion (VGG): Use previous documents (multi-well project) and analyze the criticism against them, to work on the areas within them, and bring them to a place where the parties support them. E.g., are concerns some that were raised by multiple people, or ones born of miscommunication? Feedback: Hemmera will be conducting a gap analysis to evaluate what is needed to apply to YESAB again (i.e., looking at everything from the DO screening and, if there is an EC, what more is needed). Take those comments from the registry (from the DO process) and evaluate whether there were adequate responses or if since then, different information has arisen, or more adequate best practices have been developed. Suggestion (VGG): Put our minds to the monitoring plan and whether mitigation measures are doing what they should (i.e., applying adaptive management). **Next steps as they were listed on the flipchart** • **Confidentiality Agreements**	[redacted] All Parties

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• **Project Scope** • **Processes in Parallel vs. Sequentially** • **Shared consultants – technical disciplines** • **Oil and Gas 101** • **Adaptive Management**	
Wrap Up and Closing Statements Question: Is it useful to have All-Party meetings? Summary: Parties agreed it was valuable. Future All-Party meetings could be timed with key milestones and planned to proceed/follow other key dates/events. VGG: Offered to send a list of key dates/events that could be used. Summary: Chief [redacted], Chief [redacted], and Yukon Government provided closing statements.	S. Shaw

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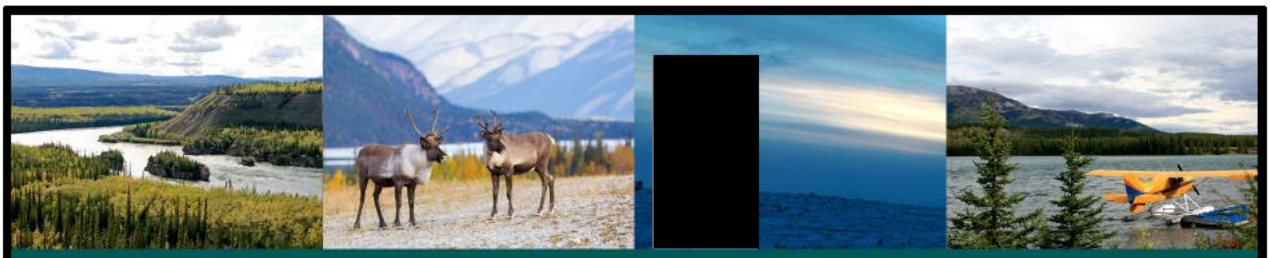


The Engagement Plans:
Development and Next Steps

Hemmera
An Ausenco Company

Creating the Engagement Plans

- Chance's current engagement with First Nations was prompted by M.O. 2017/37
- M.O. 2017/37 requested that Chance file Engagement Plans with each of the affected First Nations listed in the M.O.
- All Engagement Plans were filed in summer 2018

O.I.C. 2016/169
OIL AND GAS ACT

OIL AND GAS ACT

Pursuant to section 10 of the *Oil and Gas Act* and subsection 12(6) of the *Oil and Gas Disposition Regulations*, the Commissioner in Executive Council orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by the subject permittee

(a) oil and gas permit No. 0005,

(b) oil and gas permit No. 0006,

M.O. 2017/37
OIL AND GAS ACT

OIL AND GAS ACT

Pursuant to section 31.01 of the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"affected First Nation" means each of the Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in First Nation, First Nation of Na-Cho Nyak Dun, Gwich'in Tribal Council and Tetlit Gwich'in Council; « *Première nation concernée* »

"subject permit" means each of the following oil and

Next Steps

- M.O. 2018/ 42 orders that Chance submit annual reports on the First Nations Engagement Plans (due on July 31 of each year)
- Continue with Plan implementation
- Continue engagement with each First Nation individually, and also as a group

YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

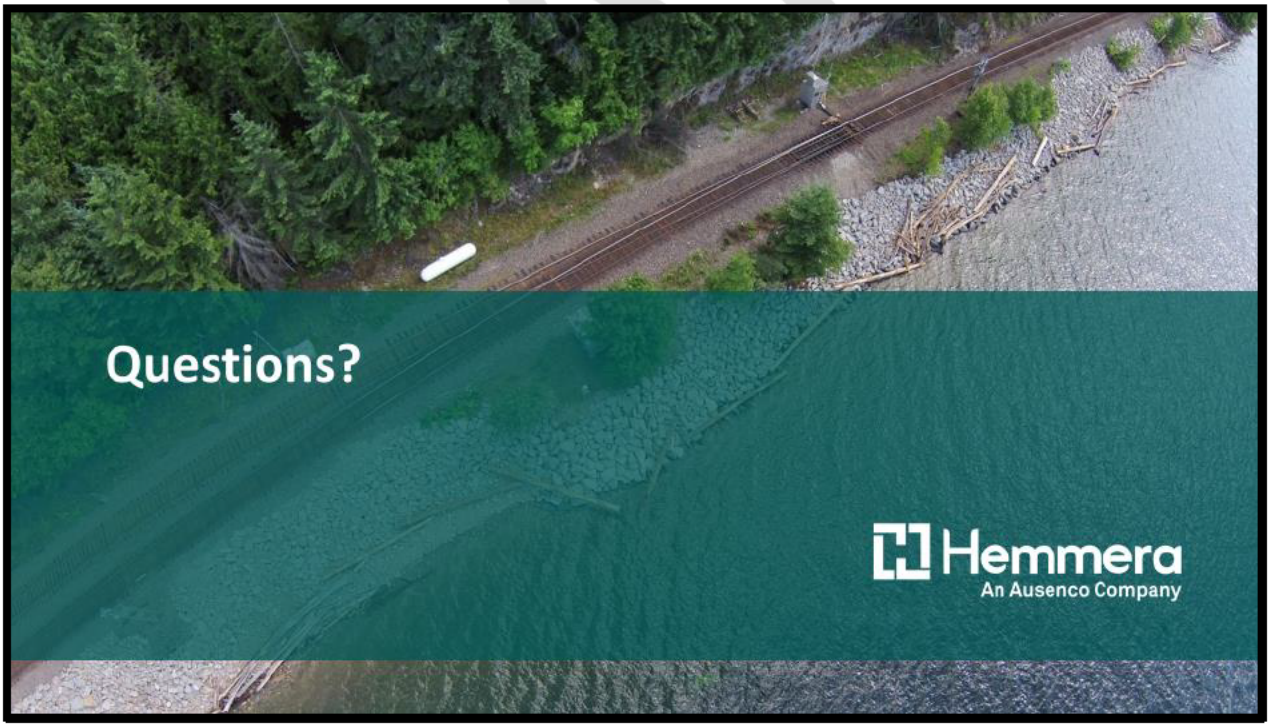
1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

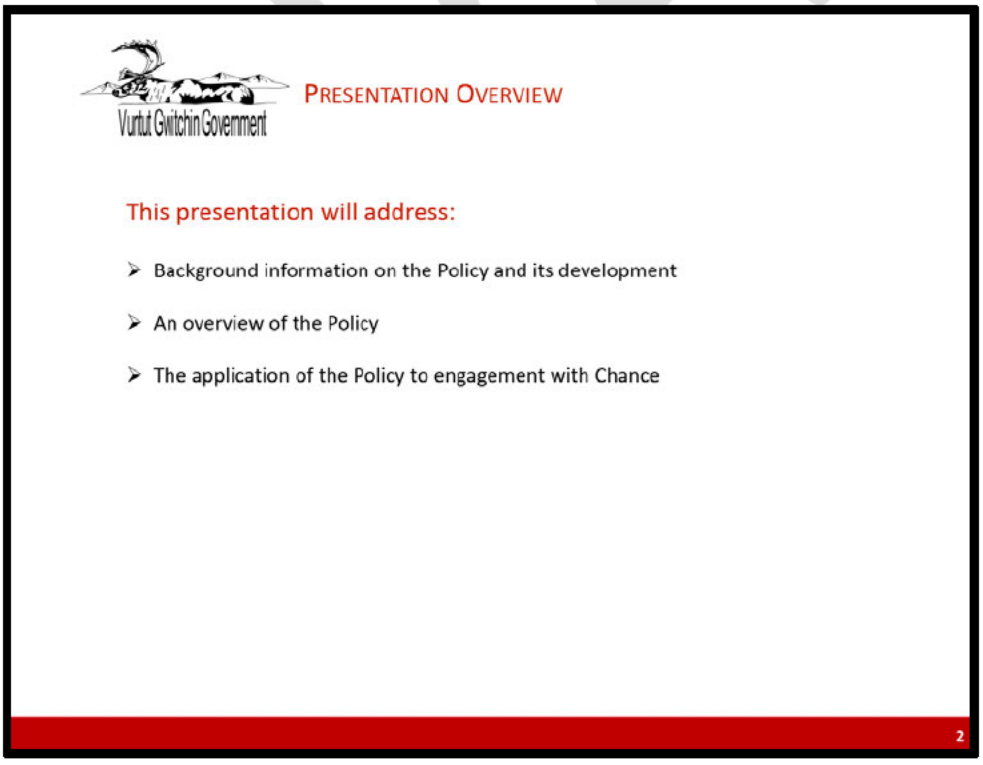
(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,




VUNTUT GWITCHIN GOVERNMENT
OIL AND GAS ENGAGEMENT POLICY:
BACKGROUND AND OVERVIEW
Vuntut Gwitchin Government
This presentation was prepared by the Vuntut Gwitchin Government for discussions with Chance Oil and Gas on December 12, 2018 in the traditional territories of the Kwanlin Dün and Ta'an Kwäch'än


Vuntut Gwitchin Government
PRESENTATION OVERVIEW
This presentation will address:
Background information on the Policy and its development
An overview of the Policy
The application of the Policy to engagement with Chance
2

Vuntut Gwitchin Government

BACKGROUND

The development of the Policy was informed by:

- The principle of sustainable development as enshrined in the VGFN Final Agreement and North Yukon Regional Land Use Plan
  - "'Sustainable Development' means beneficial socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent" [VGFN Final Agreement, Chapter 1].
  - "The core principle that guides the Plan is sustainable development, as defined in the VGFNFA... Sustainable development requires consideration of the economic, social and ecological consequences of land use decisions, and management of lands and resources in an integrated and coordinated manner" [NYRLUP]
- The principles, goals, recommendation and best management practices provided for in the North Yukon Regional Land Use Plan

3

Vuntut Gwitchin Government

BACKGROUND

The development of the Policy was informed by:

- Past experience of engagement activities with proponents and in participating in the YESAB assessment process
  - "The Designated Office is unable to determine if adverse effects to the access to and use of the PCH are or are not significant... development in the region is not intrinsically adverse, but rather that additional information is required to make confident effects predictions and to determine the significance of those adverse effects. The requirement for confidence in predicting effects in this assessment is elevated for two reasons: first, the significant importance for the First Nation and the Inuvialuit way of life that is intrinsically linked to the PCH; and second, the unprecedented scale of the Project within this region" [YESAB DO Report].

4

BACKGROUND

The development of the Policy was informed by:

- Shortcomings in the existing territorial regulatory regime
  - "VGG would like to address our concerns with provisions of the Yukon Oil and Gas Act, R.S.Y. 2002, c. 216 and its associated regulations as it relates to benefits agreements and permit extensions. Additionally, VGG would like to resume the development of resource access roads regulations under the Territorial Lands (Yukon) Act, S.Y. 2003, c. 17" [VGG Letter to Premier Silver, May 10, 2017].
  - "The most recent annual report for the NYRLUP stresses the need for baseline data collection and development of best management practices in order to better understand and predict effects. Industrial development in the region is predicated upon fulfillment of goals for information collection as set out in the NYRLUP and associated annual reports" [YESAB DO Report].

5

BACKGROUND

The development of the Policy was informed by:

- An identified need for public policy that establishes a framework for respectful, meaningful and transparent engagement
  - "It is a condition of this Order that Chance Oil and Gas Limited must, in consultation with each affected First Nation, revise the first nations communications and engagement plan filed under O.I.C. 2016/169 to the satisfaction of the Minister on or before August 1, 2018" [Ministerial Order 2017/37].
  - "[THEREFORE BE IT RESOLVED] That VGG proceed with efforts that lead to constructive engagement with oil and gas industry proponents and government agencies including partnerships in the areas of employment and training, environmental stewardship and business development" [VGFN GA Resolution No. 2017-02].

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Vuntut Gwitchin Government

BACKGROUND

The development of the Policy was informed by:

- International standards and best practices
  - "Indigenous peoples have the right to determine and develop priorities and strategies for the development or use of their lands or territories and other resources... [and to] free and informed consent prior to the approval of any project affecting their lands or territories and other resources, particularly in connection with the development, utilization or exploitation of mineral, water or other resources" [UNDRIP, Article 32].
  - "FPIC is relevant... in relation to development projects encompassing the full project cycle, including but not limited to assessment, planning, implementation, monitoring, evaluation and closure" [UN Permanent Forum on Indigenous Issues, Report of the International Workshop on Methodologies regarding Free, Prior and Informed Consent and Indigenous Peoples].

7

Vuntut Gwitchin Government

BACKGROUND

The development of the Policy was informed by:

- International standards and best practices
  - "Due to the fragility of arctic environments, with high vulnerability to climate change, the high proportions of Indigenous peoples within arctic populations, and increasing resource development pressures, Indigenous-led impact assessment is particularly important... [Indigenous-led impact assessment] is a process that is completed prior to any approvals or consent being provided for a proposed project, which is designed and conducted with meaningful input and an adequate degree of control by Indigenous parties—on their own terms and with their approval. The Indigenous parties are involved in the scoping, data collection, assessment, management planning, and decision-making about a project" [Gwich'in Council International, Impact Assessment in the Arctic: Emerging Practices of Indigenous-Led Review].

8



Overview of the Policy

The main components of the Policy include:

- A clearly defined purpose section
  - "The purpose of this policy is to establish a respectful, transparent and meaningful framework to guide the engagements of the Vuntut Gwitchin Government in relation to Oil and Gas Activities and Oil and Gas Dispositions in a manner that supports and upholds the objective of Sustainable Development" [section 3].
- The establishment and mandating of a committee to facilitate the participation of Citizens in the engagement and decision-making process
  - Membership consists of Standing Committee Chair on Natural Resources, Director of Natural Resources, Elders Representative, Youth Representative and Citizen Representative [section 12].
  - Mandate includes informing and seeking views from Citizens, and assisting and providing recommendations to the Council throughout the Engagement Process [section 11].

9



Overview of the Policy

The main components of the Policy include:

- A process to guide the organizing and carrying out consultations with Citizens regarding Oil and Gas Activities and Oil and Gas Dispositions
  - Director of Natural Resources has primary responsibility for organizing and carrying out any consultation between the Vuntut Gwitchin Government and Citizens regarding Oil and Gas Activities and Oil and Gas Dispositions with the assistance of the Committee as necessary [section 20].
  - Proponents are to coordinate any of its consultation with Citizens by submitting written notice to the Director of Natural Resources that sets out proposed date, location, agenda, description of the purpose of the meeting and any materials to be shared with Citizens [section 21].

10

Overview of the Policy

The main components of the Policy include:

- A three stage process for engagement with Proponents in relation to any Oil and Gas Activity to be completed prior to the Proponent submitting any Proposal to the Board
- Stage 1: Notice Period
  - Sufficient notice of a proposed Oil and Gas Activity must be provided to the Director of Natural Resources at the earliest opportunity [section 24].
  - Director of Natural Resources will refer the notice it receives from the Proponent to the Committee who will review it for sufficiency. The Committee will notify the Proponent in writing of its determination. If notice is not sufficient then more information will be requested. If notice is sufficient then engagement on the Oil and Gas Activity can proceed to Stage 2 [section 25].

11

Overview of the Policy

The main components of the Policy include:

- Stage 2: Cooperation
  - A Cooperation Agreement must be negotiated and entered into following Stage 1 and before proceeding to Stage 3 [section 26].
  - Prior to entering into a Cooperation Agreement, Council must refer the Cooperation Agreement to the Committee. The Council can enter into the Cooperation Agreement if the Committee determines that the Cooperation Agreement adequately addresses items related to compliance with the policy, communications, information sharing and capacity funding [section 27].
  - If a Cooperation Agreement is entered into in relation to an Oil and Gas Activity then the engagement process proceeds to Stage 3. A Cooperation Agreement does not provide free, prior and informed consent to any Oil and Gas Activity.

12

Vuntut Gwitchin Government

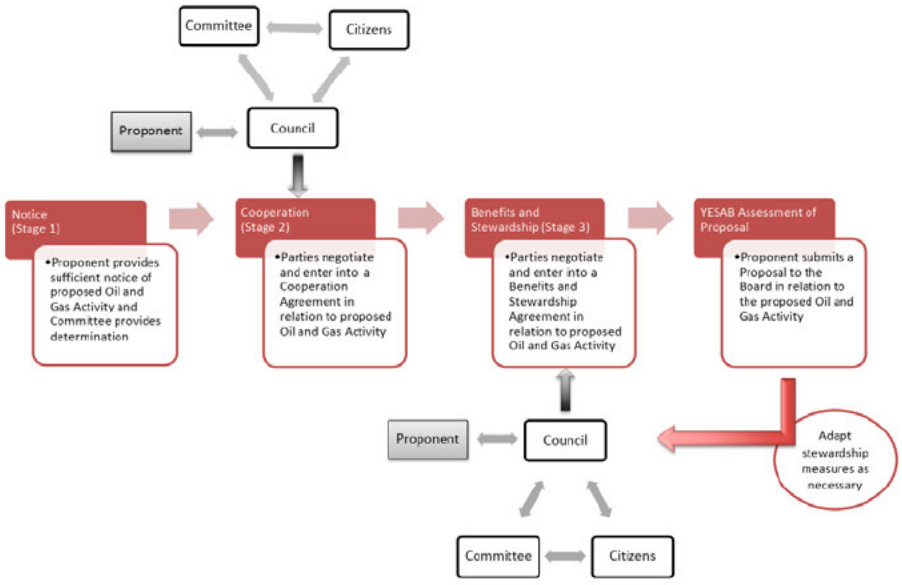
Overview of the Policy

The main components of the Policy include:

- Stage 3: Benefits and Stewardship

  - A Benefits and Stewardship Agreement must be negotiated and entered into following Stage 2 and before proceeding to the Board with a Proposal. It is the mechanism in which the free, prior and informed consent of the Vuntut Gwitchin First Nation is effectively to be provided in relation to any Oil and Gas Activity [section 28].
  - Prior to entering into a Benefits and Stewardship Agreement, Council must refer the Benefits and Stewardship Agreement to the Committee. The Council can enter into the Benefits and Stewardship Agreement if the Committee determines that the Benefits and Stewardship Agreement adequately addresses various items related to economic benefits and environmental stewardship [section 29].
  - Benefits and Stewardship Agreement will be subject to an approval and ratification process deemed adequate by the Committee.

13



14

Application of the Policy to Engagement with Chance

The Policy applies to engagement with Chance:

- Chance review of the draft Policy
- Chance acceptance of the final Policy
  - "Chance will comply with the Policy and any other applicable VGG policies. To the extent that there may be any inconsistency between this Plan and the Policy, the Policy will prevail" [Joint Communication and Engagement Plan]
  - "The Plan, which incorporates the Vuntut Gwitchin Government Oil and Gas Engagement Policy (the "Policy"), sets the framework for all communication and engagement between Chance Oil and Gas Limited ("Chance") and the Vuntut Gwitchin Government ("VGG") moving forward. Chance's commitment to the Plan and Policy is a significant achievement and provides an example for the outside world on how industry ought to approach oil and gas exploration and development in the North within a framework premised on free, prior and informed consent" [VGG June 11, 2018 Letter to Chance]

15

Application of the Policy to Engagement with Chance

The Policy applies to engagement with Chance:

- VGG and Chance engagement is currently in Stage 1 (Notice)
- Chance has shared scenarios for various Oil and Gas Activities at different scales but has not submitted notice of an Oil and Gas Activity it wishes to advance for further consideration under the Policy
- VGG has shared a draft Cooperation Agreement for discussion purposes prior to the completion of Stage 1 (Notice) and in advance of Stage 2 (Cooperation)
- Next steps: Chance to provide written notice of any proposed Oil and Gas Activity to the Director of Natural Resources at the earliest possible opportunity as provided under section 24 of the Policy

16


QUESTIONS AND COMMENTS?
Contact:
Vuntut Gwitchin Government
P.O. Box 94
Old Crow, Yukon
Canada, Y0B 1N0
Tel: (867) 966-3261
Fax: (867) 966-3800
www.vgfn.ca
17

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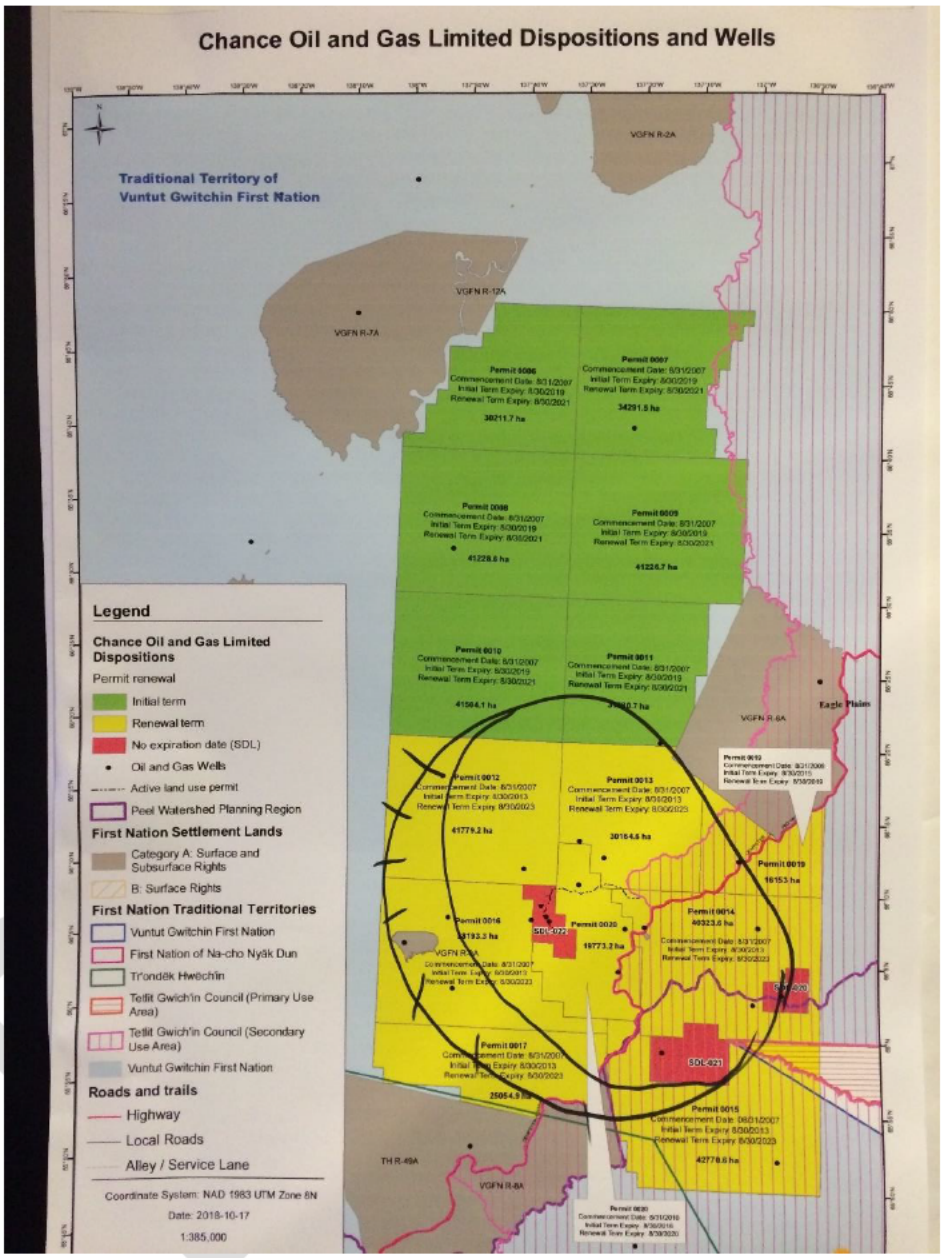
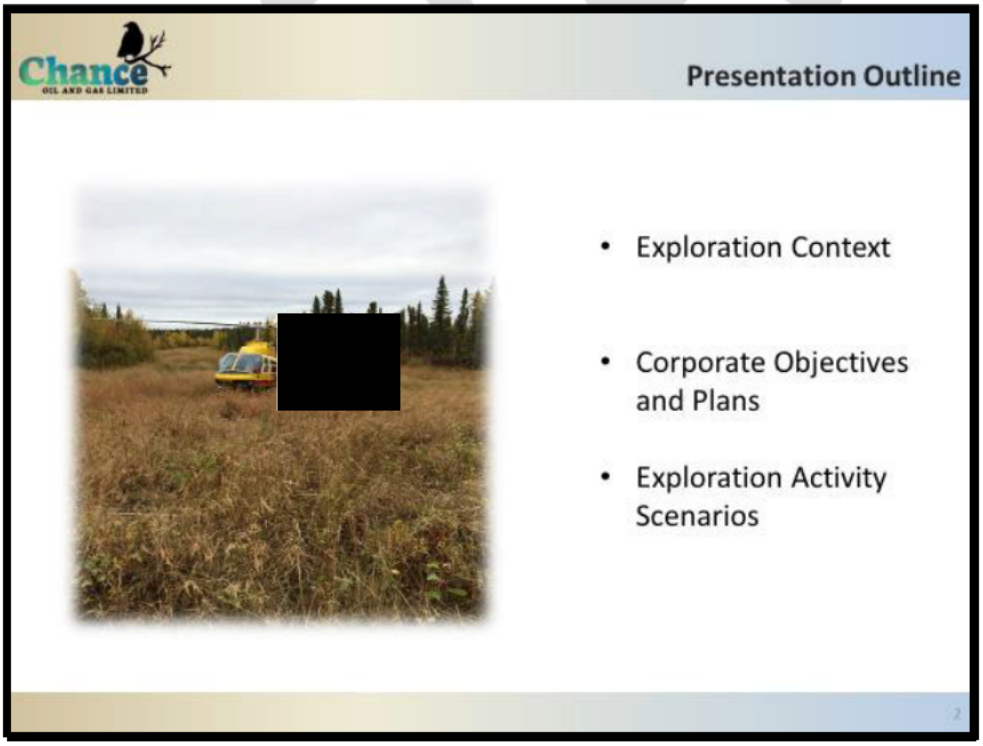
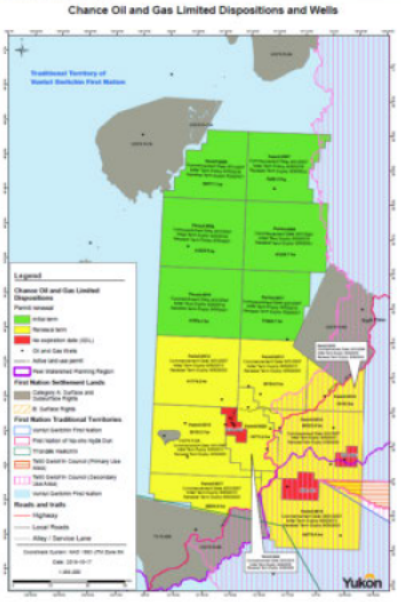
Appendix 3 – Chane All-Party Meeting: Permits map with area of interest highlighted




Chance
OIL AND GAS LIMITED
CONFIDENTIAL
Corporate Presentation
Presentation to the All Parties Meeting
Chance Oil and Gas Limited
February 1st, 2019


Chance
OIL AND GAS LIMITED
Presentation Outline
[redacted]
• Exploration Context
• Corporate Objectives and Plans
• Exploration Activity Scenarios

Land Holdings Eagle Plain, Yukon



- 14 Exploration Permits (0006-0017, 0019-0020 expiring between Aug 30, 2019 and Aug 30, 2023
- 3 Significant Discovery Licenses ("SDL's") with indefinite tenure with discovered oil and natural gas
- Landholdings total about 490,000 hectares
- North Yukon Regional Land Use Plan indicates that this area is suitable for multiuse, including oil and gas industry activities
- Chance surrendered ep. 0005 in 2018 to allow the creation of Ch'ihilii Chik - HPA

3

Infrastructure and Support



- Eagle Plains is an underexplored sedimentary basin
- Discovered resources located at the SDL's is not sufficient to proceed to development
- Oil and gas exploration began in the 1950's and both oil and natural gas have been discovered
- Almost 40 wells have been drilled at Eagle Plains
- Over 10,000 kms. of 2D and about 325 sq. kms. of 3D seismic data has been acquired

4

Land Tenure



- Tenure is the length of time that exploration permits or leases are valid
- Tenure has a large influence on obtaining financing, planning activities and doing the work
- For a remote area like Eagle Plains, longer tenure is better than shorter tenure
- How the legal action against Yukon gets resolved will have an impact on tenure

5

Exploration Activities





- Field work to investigate the geological opportunities
- Acquiring more seismic data (both 2D and 3D)
- Exploration drilling of new wells
- Production testing of any discoveries showing commercial potential
- Construction of seasonal and year-round access trails and roads
- Installing and operating processing facilities connected with production testing

6

Exploration Activities



- Operating the base camp
- Converting wells for injection of water produced with oil and natural gas
- Logistical support for the camp and exploration activities
- Environmental data gathering and monitoring of operations
- No plan to do hydraulic fracturing

Exploration Activities



- Exploration work is the most expensive and most uncertain activity which affects funding commitments
- Exploration activities are unpredictable because results guide the future steps
- Plans are subject to change as priorities change with new information
- Even though Chance has several prospects to evaluate, drilling may find something that could not be predicted before hand that changes the plans
- Flexibility is needed from Assessors, regulators and goods and service providers to accommodate the uncertainties and need to adapt the activity as the work progresses

Objectives and Plans



- Based on current geological understanding, the area of exploration focus includes parts or all of Exploration Permits 0012-0016 and 0019-0020 and the three SDL's
- Acquire more seismic data and drill more wells to evaluate the resource potential
- Discover sufficient oil and natural gas resources to support future development
- Develop discoveries to serve the regional market needs and possibly export markets if the resource base is large enough
- Undertake the exploration program on a small scale over a long period of time to minimize the environmental and social impacts
- Try to operate as continuously as possible to provide steady employment and minimize the high costs of starting up and shutting down

9

Benefits



- Develop local capacity to participate in the projects and displace high cost imported services and equipment
- Diversify the regional economy
- New business, training and employment opportunities
- Reduced GHG's by substituting imported fuel that is shipped thousands of kilometres with Yukon sourced fuel
- Potential to reduce the cost of fuel in the Yukon and surrounding area

10

Project Alternatives



- YESAB assessments are required in order to obtain regulatory approvals to undertake any exploration work
- Depending on the scale and scope of the program, the YESAB assessment could be done by the Designated Office in Dawson or by Executive Committee in Whitehorse
- Two project execution scenarios can be considered: 1) a series of short duration, limited activity projects each with its own YESAB assessment; or 2) one longer duration, but limited scale project over the entire exploration region that undergoes one comprehensive YESAB assessment
- All work is exploration to evaluate the resource potential in order to understand whether the opportunities can eventually be developed commercially

11

Activity Scenarios- Issues to Manage



- YESAB processes are expensive and lengthy
- Lengthy assessment processes grind the tenure clock
- The cost of multiple assessments could hurt the amount of exploration work
- Multiple YESAB assessments of shorter duration, limited scope exploration work means intermittent employment
- Financial and project management are more efficient under a regional YESAB assessment of exploration in a broader area, but still small-scale operation (e.g. a single drilling rig or a single seismic survey)

12


Chance
OIL AND GAS LIMITED
Thank-you
T. Allen, 2013; YOS Report 2015-02
13

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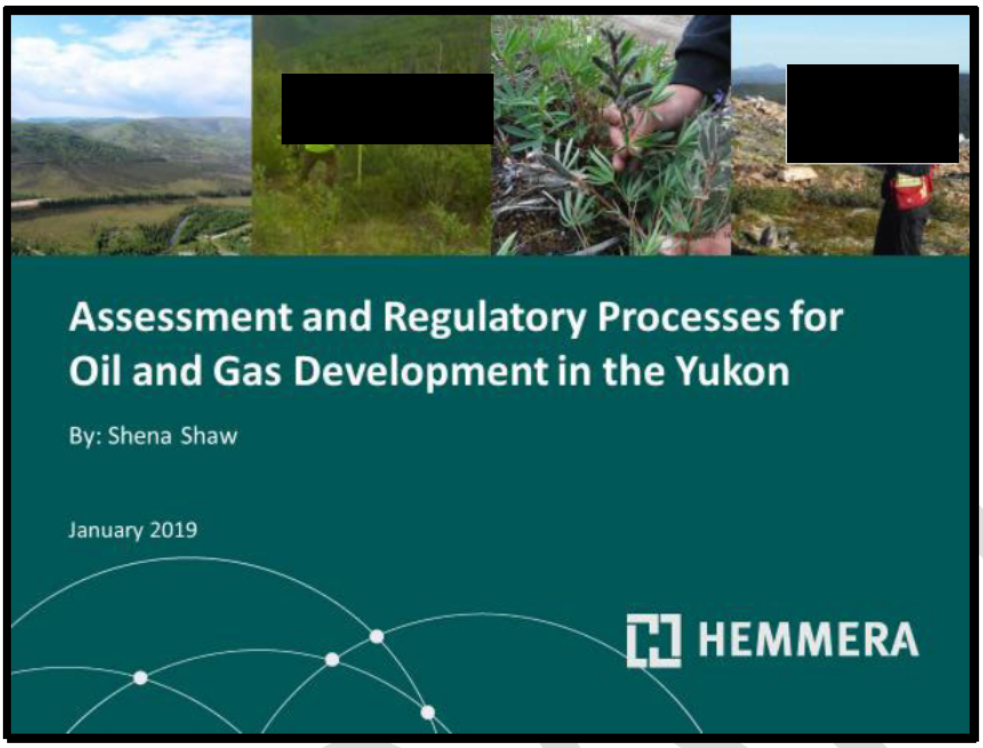
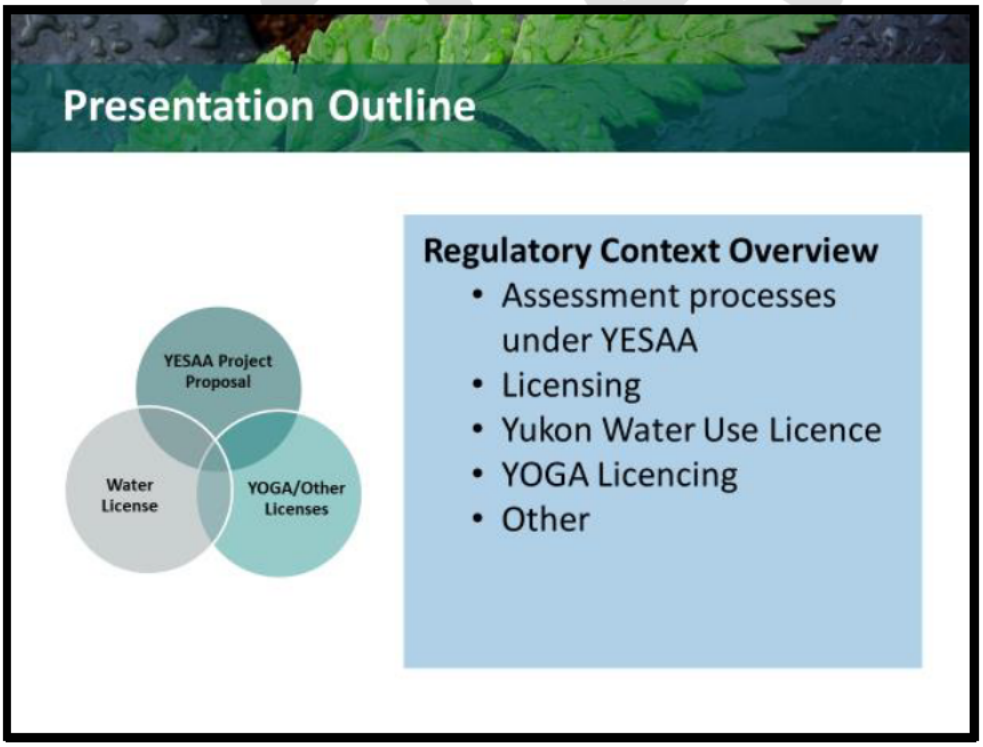
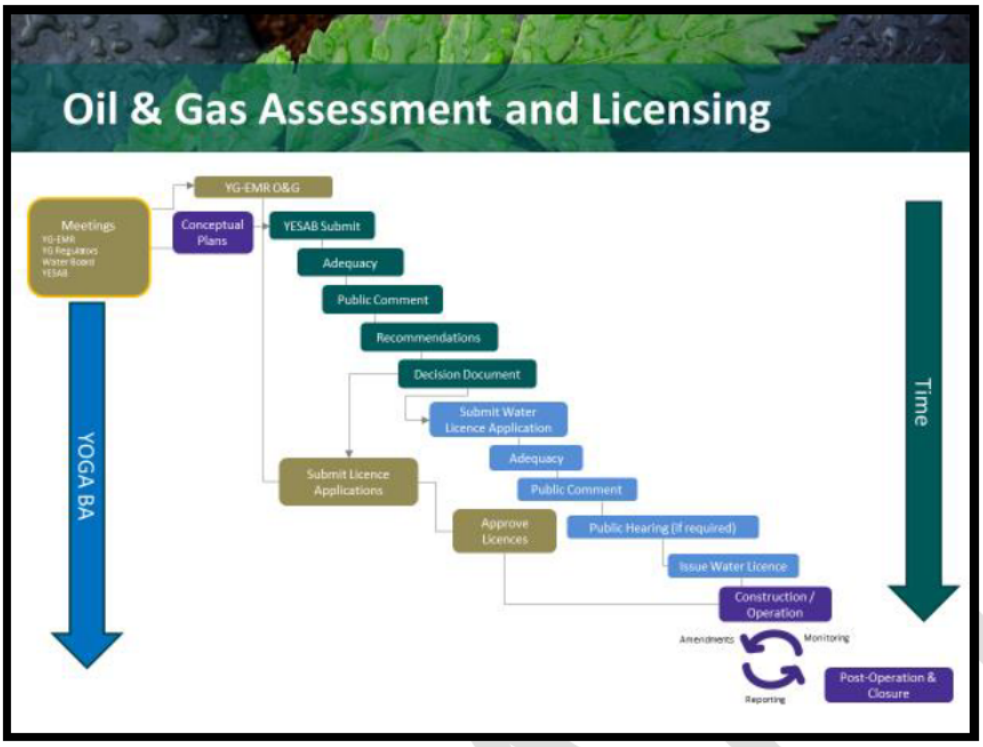
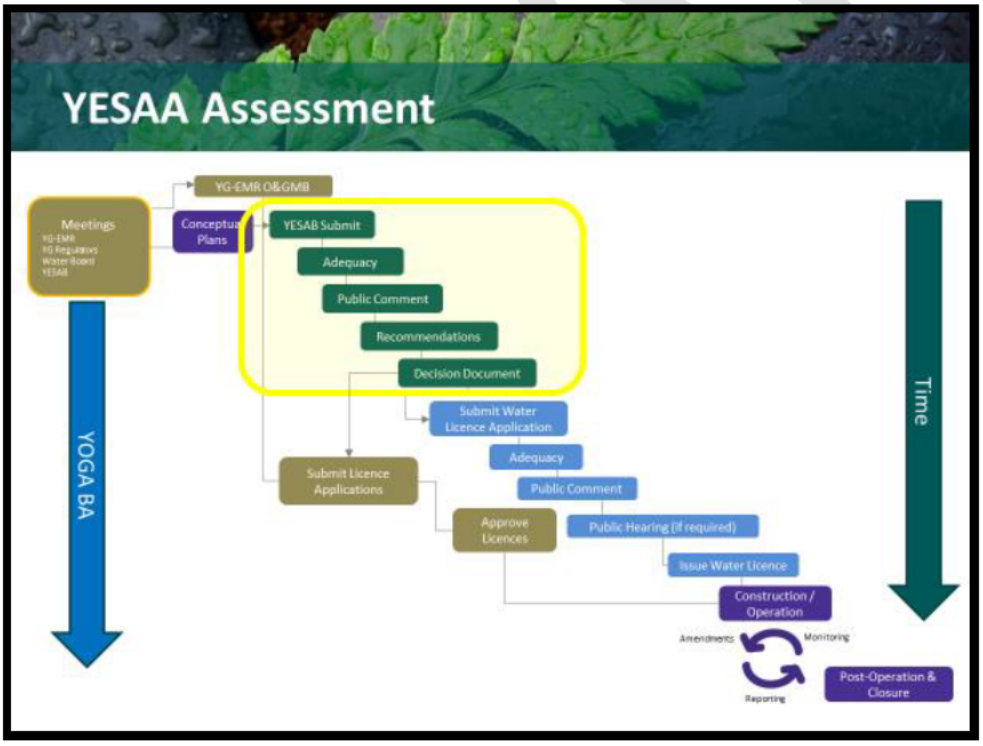

Assessment and Regulatory Processes for Oil and Gas Development in the Yukon
By: Shena Shaw
January 2019
HEMMERA


Presentation Outline
YESAA Project Proposal
Water License
YOGA/Other Licenses
Regulatory Context Overview
• Assessment processes under YESAA
• Licensing
• Yukon Water Use Licence
• YOGA Licencing
• Other


Oil & Gas Assessment and Licensing
YG-EMR O&G
Meetings
YG-EMR
YG Regulators
Water Board
YESAB
Conceptual Plans
YESAB Submit
Adequacy
Public Comment
Recommendations
Decision Document
Submit Water Licence Application
Adequacy
Public Comment
Submit Licence Applications
Approve Licences
Public Hearing (if required)
Issue Water Licence
Construction / Operation
Amendments
Monitoring
Reporting
Post-Operation & Closure
YOGA BA
Time


YESAA Assessment
YG-EMR O&GMB
Meetings
YG-EMR
YG Regulators
Water Board
YESAB
Conceptual Plans
YESAB Submit
Adequacy
Public Comment
Recommendations
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Approve Licences
Public Hearing (if required)
Issue Water Licence
Construction / Operation
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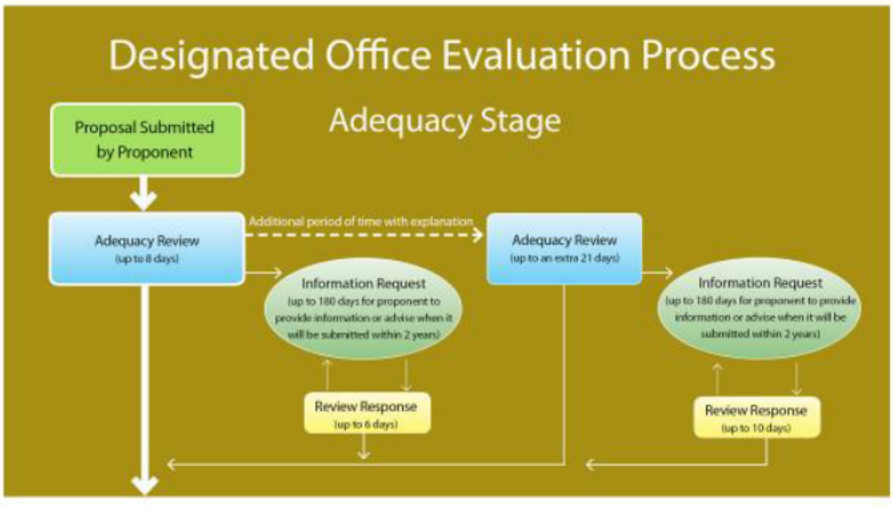
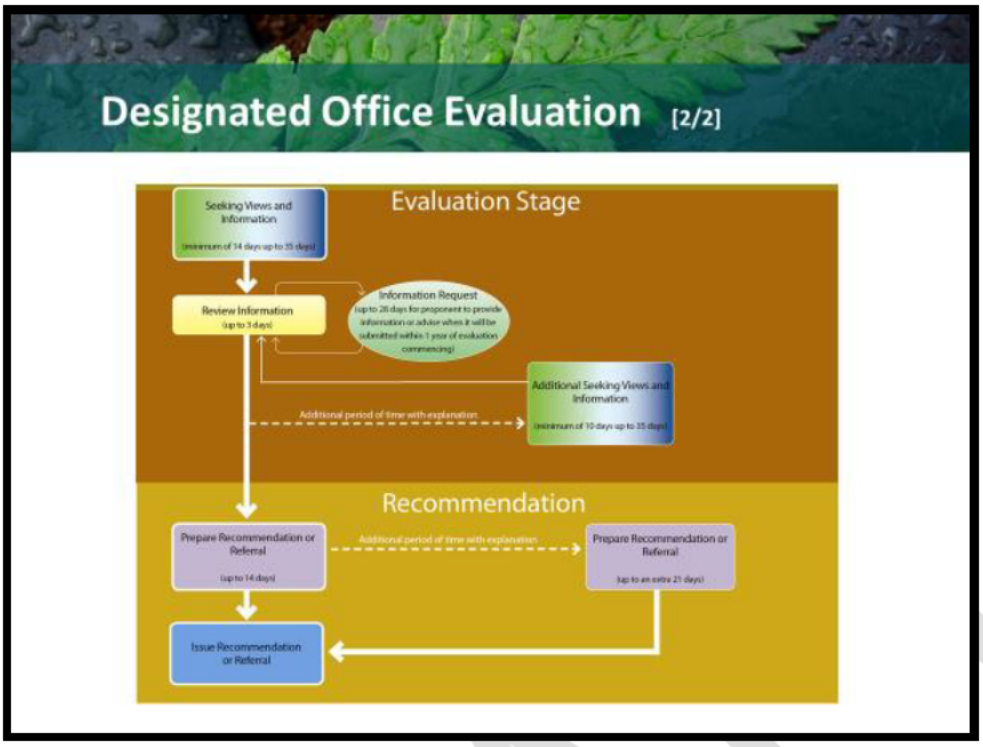
YOGA BA
Time

YESAA Assessment Process

- Assessors look at the potential environmental and socio-economic effects of proposed activities and recommend whether the activities should proceed, proceed with terms and conditions, or not proceed.
- When assessments are complete, recommendations are sent to the relevant Decision Body(s)
  - Designated Office Evaluation
  - Executive Committee Screening
  - Panel of the Board of Review
- Decision Body(s) decide to accept, reject, or vary YESAB's recommendation
- Decision Document issued

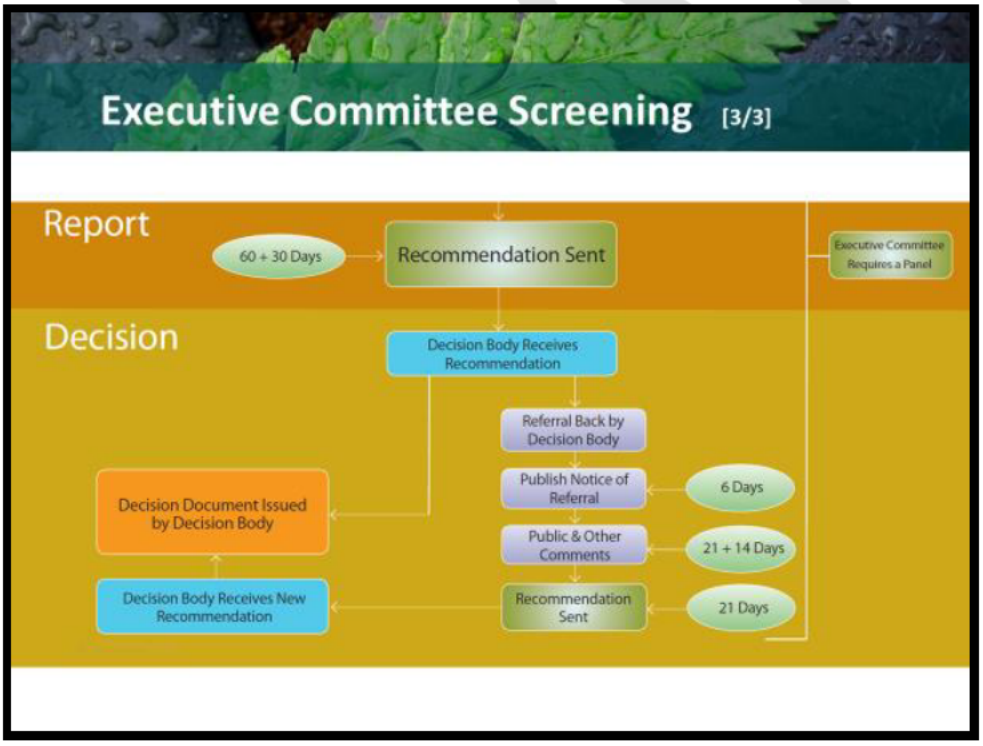
Designated Office Evaluation [1/2]




Designated Office Evaluation [2/2]
Evaluation Stage
Seeking Views and Information
Review Information
Information Request
Additional Seeking Views and Information
Additional period of time with explanation
Recommendation
Prepare Recommendation or Referral
Additional period of time with explanation
Prepare Recommendation or Referral
Issue Recommendation or Referral


Executive Committee Screening [1/3]
Executive Committee Screening Process
Proposal Submitted by Proponent
Adequacy
Proposal Checklist
30 + 30 Days
More Info from Proponent
Adequacy Review
60 + 30 Days


Executive Committee Screening [2/3]
Screening
Publish Notice of Screening
6 Days
Public & Other Comments on Proposal
30+30 Days
21 + 21 Days
More Info from Proponent
Assess Comments & Need for More Information
21 Days
Complete Draft Screening Report
120 + 270 Days
Public & Other Comments on Draft Report
30 + 30 Days
21 Days
More Info from Proponent
Assess Comments Need for More Information
21 Days

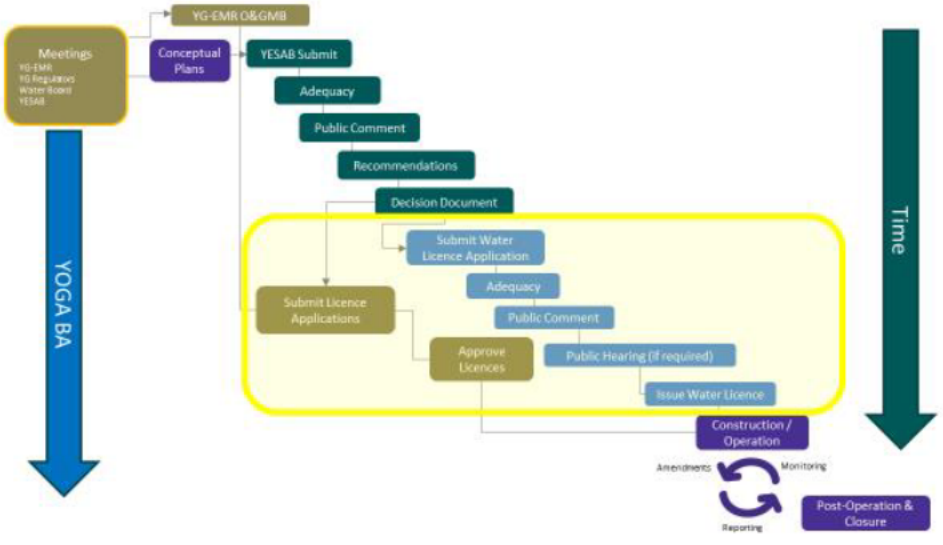

Executive Committee Screening [3/3]
Report
60 + 30 Days
Recommendation Sent
Executive Committee Requires a Panel
Decision
Decision Body Receives Recommendation
Referral Back by Decision Body
Publish Notice of Referral
6 Days
Public & Other Comments
21 + 14 Days
Recommendation Sent
21 Days
Decision Document Issued by Decision Body
Decision Body Receives New Recommendation

YESAA Assessment Process

New: Pre-Submission Engagement (PSE) process

- YESAB approved the PSE and it will come into effect late Fall 2019 (estimated).
- For Executive Committee screenings only.
- Brings parties together to review project requirements in advance of proposal submission.
- Helps identify gaps and issues of concern, define values and baseline information requirements, and ensure a timely and certain screening process.
- "Terms of Reference" style of process

Licensing Process



Yukon Water Use Licence [1/2]

- Use of water or deposit waste into water
- Petroleum exploration/development are "Industrial Undertakings"
- Interim - Oil and Gas Information Package for Applicants (2013)
- Quasi-judicial board supported by Yukon Water Board Secretariat

Yukon Water Use Licence [2/2]

Choice of Type A vs Type B will drive information requirements, process, and timelines

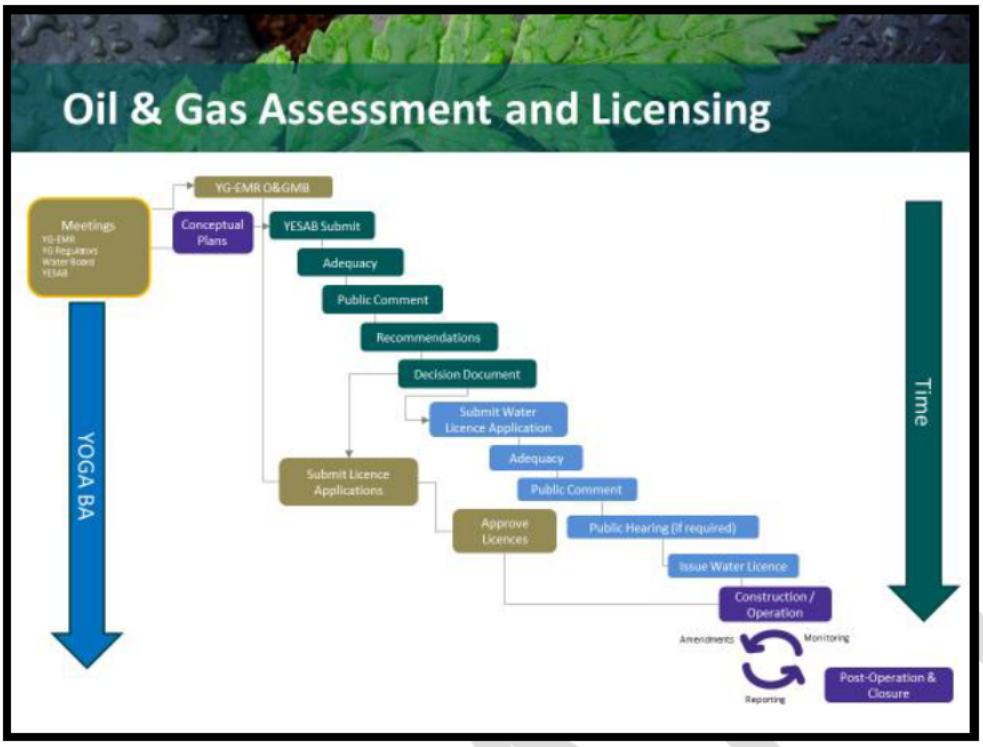
- Hearing required for Type A
- Both require YESAA decision document prior to issuance

Permitting and Licensing

1. Land Use Permit (YG – EMR, Land Management)
2. Well Licence and Well Operation Approval (YG – EMR, Oil and Gas Resources)
3. Permit for Air Emissions (YG – ENV)
4. Temporary Highway Access Permits (YG – HPW, Transportation Branch)
5. Water Licence/Notification of Water Use (YG, Water Board)
6. Dempster Highway Area Authority Authorization

YOGA Well Licence

- First Nation and community consultation prior to application
- Benefits Agreement for projects >$1M/year
- Requires YESAA decision document prior to issuance


Oil & Gas Assessment and Licensing
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Water Board
YESAB
YG-EMR O&GMB
Conceptual Plans
YESAB Submit
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Public Comment
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Issue Water Licence
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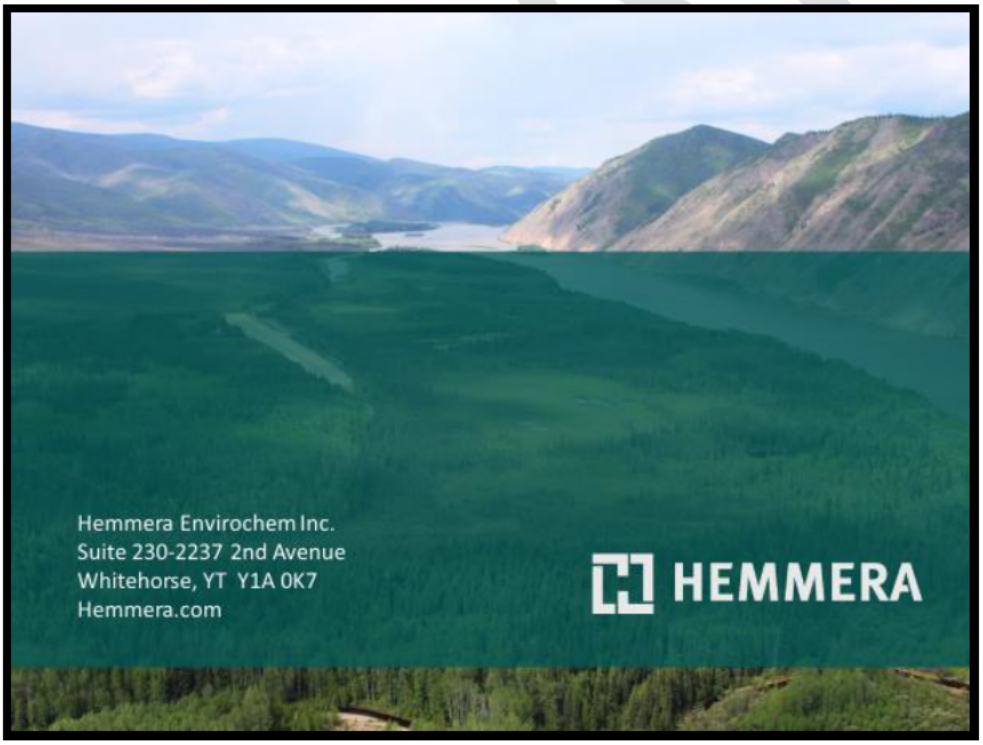
Post-Operation & Closure
Submit Licence Applications
Approve Licences
YOGA BA
Time


Hemmera Envirochem Inc.
Suite 230-2237 2nd Avenue
Whitehorse, YT Y1A 0K7
Hemmera.com
HEMMERA

APPENDIX 2-A-08. June 10, 2019, Meeting Summary

First Nation of Na-cho Nyak Dun and Chance Oil and Gas Limited Meeting

Date: June 10, 2019

Location: Na-cho Nyak Dun Government Building

Attendees:

First Nation of Na-cho Nyak Dun (FNNND):

[redacted] – Acting, Lands and Resources Manager
[redacted] – Land Use Planning
[redacted] – Victoria Gold Liaison
[redacted] – Lands Assistant
[redacted] – Strategic Advisor

Chance Oil and Gas Limited (Chance):

[redacted], President
[redacted], VP Government and Community Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator
[redacted], Board member and Chair of Community Relations Committee

Hemmera:

[redacted], Human Environment Specialist
[redacted], Human Environment Specialist

Introduction: Purpose and Objectives

The purpose of this meeting was for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin. Parties also discussed next steps with YESAB and the process for reviewing Na-cho Nyak Dun Project effects as well as the annual reporting required on the implementation of the Engagement and Communication Plan.

Meeting Objectives:

- Presentation of Draft Project Description
- Discuss Draft Project Description in more detail and provide clarity on any items if needed
- Discuss annual reporting requirement

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Meeting Discussion:

Due to recent staff turn over [redacted] asked Chance to start with a high-level briefing. To help bring those new to the file up to speed.

[redacted] focused on the history of oil and gas exploration in Eagle Plains. Historically the company was called Northern Cross, they looked into old wells already in the region from drilling activities of previous businesses. Up until 1999, mineral resources were managed by Ottawa, then shifted to Yukon Territory. From 2007-2010 exploration permits were issued to Chance. Chance conducted some seismic surveys and drilling and then the fracking moratorium was implemented. [redacted] clarified that the project description that he was introducing and discussing that day – does not involve hydraulic fracturing. Chance provided a brief overview of the All-Party meeting that took place February 1, 2019. Chance has retained Hemmera for support for engagement and consultation activities and to facilitate/manage the YESAB submission.

The Chance presentation began with a general project description. [redacted] described some of the characteristics of old seismic lines. In the past they were 10 metres wide and were straight. Now they are narrow at approximately 2-3 metres. [redacted] clarified that over the ten-year period of the project, it is actually a series of small projects rolling out. This is because each step is based on/informed by discoveries of the step before. Additionally, it is not possible to drill and run a seismic program at the same time. Chance endeavours to have the ability to set up in a wide area and work continuously to, among other things, better attract Yukon businesses and employment.

A FNNND attendee asked where the disposal site for drill cuttings would be and/or if it has been identified. [redacted] stated that is difficult to narrow that down without information on where all the drill sites will be. Chance will need seismic data (for refining locations) and once they know where the drilling will take place they can determine where the sump will be. There are specific properties to make the sump viable.

FNNND asked if the historical discoveries were natural gas or oil. [redacted] stated that drilling in the 1960's found both oil and gas. There are 3 significant discovery locations: Chance, Birch, and Blackie. The Chance site included both oil and gas, Birch was comprised of natural gas (ethane), and Blackie was also natural gas (methane). The area that Chance is focusing their project is approximately 2800km^2. [redacted] informed FNNND of bird surveys that are being conducted at the end of the month. As well as a field program Chance in carrying out to collect rock outcrop samples. [redacted] briefly highlighted [redacted]'s history in the Eagle Plains area.

[redacted] clarified that winter trails would be used for exploration, but that all-season roads would be required for flow testing.

FNNND inquired if Chance would be setting up a Porcupine Caribou working group. [redacted] mentioned that, in the past, a working group did not work well due to several reasons, one of which was poor attendance. Chance has hired Environmental Dynamics Inc. to study wildlife, in particular caribou, but still anticipates that they will be setting up a committee of some kind. Chance will also have a monitoring system that will have people in the field.

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[redacted] explained that while there is water below ground where Chance will be drilling, it is not potable. It is very saline. Mud from drilling

FNNND asked what volume of water does Chance expect to use? [redacted] stated that the camp currently uses 15-20 cubic metres and water used for the drill actually circulates water.

[redacted] stated that the project presented by [redacted] will be submitted to YESAB for an Executive Committee level screening. In 2014, a project was submitted to YESAB as a District Office screening. At that time it was referred to Executive Committee. While there are similarities with the 2014 submission, the project presented by [redacted] is largely being treated as its own project. New consultants have been hired and the level of consultation will be far more intensive. Currently, Chance and FNNND are in the pre-submission consultation phase. In the future, both YESAB and YG will consult with the First Nations. [redacted] explained a proposed timeline for baseline studies and activities/requirements leading up to a YESAB submission end of January 2020. Hemmera is preparing role profiles to facilitate First Nation members to accompany some of the upcoming field surveys. [redacted] also informed FNNND that they intend to run a traditional knowledge study and current use study which will likely be paired with other studies (e.g., wildlife – porcupine caribou).

[redacted] explained that once the proposal is submitted to YESAB, then YESAB performs its own consultation with First Nations and Yukoners. First Nations will be asked if they were satisfied with the consultation done by the proponent. Moving forward, Chance will have a series of meetings in the communities and sometimes those meetings will focus on a specific subject matter (e.g., permafrost, birds, fish). Chance will be meeting with PCMB. [redacted] explained that PCMB meets four times a year, back and forth between communities in NWT and YT.

[redacted] stated that the multiple stages/phases of consultation moving forward through the YESAB process will require lots of effort and time for the First Nation. Usually FNNND has struck an IBA with the proponent, and usually there is no activity on the part of FNNND until an agreement has been arranged. Political discussions may be ahead. Maybe have all the northern leaders (VG, TH, FNNND), makes sense to be a coordinated approach amongst the First Nations and perhaps the creation of a technical group. [redacted] is hoping for the First Nations affected by this project to consider the idea of a singular consultant. [redacted] stated that development has to be sustainable and there has to be benefits. This project is a priority for Chance not FNNND. It is up to the proponent to deal with complications and pay the costs. [redacted] assumed that Chance will open this up to the community, first the First Nation and then the community at large. For FNNND moving forward, capacity support will be key. Is Chance prepared to enter into a formal agreement with FNNND – perhaps not an IBA but an exploration and cooperation agreement.

[redacted] asked if Chance wants to have one person within FNNND as their contact. [redacted] explained that the Engagement and Communication Plan between Chance and FNNND actually asks for contacts to be identified. In the past, Chance's main contact with FNNND had been [redacted]. [redacted] asked for the Engagement and Communication Plan to be sent to her.

[redacted] spoke to an upcoming deadline for a report/summary of the implementation of the Engagement and Communication Plan. The extension of a number of Chance's permits are tied to these reports. Hemmera's suggested approach is to keep this summary/report at a very high level. It will largely be drafted by Hemmera with Chance and FNNND to edit, refine, and finalize collaboratively.

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Hemmera will use it's engagement log to shape the content and the hope is that YG is not expecting a lot of detail.

[redacted] mentioned that YG is organizing Oil & Gas 101s. FNNND was aware of this and had informed YG that the fall would be best. FNNND informed Chance that they meet once a month with YG.

[redacted] stated that he believed it was too early for a community meeting. [redacted] stated that the next step would be to meet with Chief and Council and the information provided in this presentation would shape the briefing note for Chief and Council.

Chance was asked if they would be meeting with the Mayo Renewable Resource Council, and they confirmed that that would be a component of their public engagement.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
FNNND Lands staff to brief FNNND Chief and Council.	FNNND	As soon as practical.
Send original Engagement and Communication Plan, All-Party Summary, YESAB 2014 DO Evaluation Report, and additional background documents to [redacted]	Hemmera	Sent by [redacted] June 11, 2019.
Hemmera will prepare a draft report for Engagement and Communication Plan. Chance and FNNND will review and refine collaboratively.	Hemmera	Will send draft to FNNND and Chance early July

Key Meeting Outcomes

Outcome	Responsible Party	Notes
Present Draft Project Description – discuss in more detail and provide clarity on any items if needed	Chance	
Discuss next steps in YESAB process	Hemmera	
Discuss annual reporting requirement for Engagement and Communication Plan	Hemmera	Hemmera will prepare a draft report. Chance and FNNND will review and refine collaboratively.
Discuss longer-term capacity funding	All Parties	This will be a key agenda item for the next meeting between Chance and FNNND.

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APPENDIX 2-A-09. DFO License Application Notice Letter

Chance Oil and Gas Limited
Suite 1000, 340 – 12th Avenue SW
Calgary, AB T2R 1L5
T: 587.390.4136

June 14, 2019

Na-cho Nyak Dun
101 Future Rd. Box 220
Mayo, Yukon Y0B 1M0

Attention: [redacted] **Acting Lands and Resources Manager**

Dear [redacted]

Re: DFO License Application Notice

The purpose of this letter is to provide notice to the First Nation of Na-cho Nyak Dun (FNNND) of the intention of Environmental Dynamics Inc. (EDI) to submit an Application for a *License to Fish for Scientific, Experimental, Education, or Public Display Purposes, Under Section 52 of the Fishery (General) Regulations.* Chance Oil and Gas Limited (Chance) has contracted EDI to perform fish studies, among other environmental studies, within the project area described in the Draft Project Description delivered to FNNND on June 10, 2019.

The fish studies are scheduled to take place from July 1, 2019 to July 10, 2019 pending approval of the DFO license. Please see attached for EDI's application and list of watersheds and species for the permit.

If any questions should arise regarding the license application or EDI's field work, please contact [redacted] at Hemmera and she will coordinate a reply.

Sincerely,

[redacted]

Vice President Government and Community Relations
867.456.7805
gcharlie@chanceyukon.com

Fisheries and Oceans Canada | Pêches et Océans Canada

APPLICATION FOR A LICENCE TO FISH FOR SCIENTIFIC, EXPERIMENTAL, EDUCATIONAL or PUBLIC DISPLAY PURPOSES, UNDER SECTION 52 OF THE FISHERY (GENERAL) REGULATIONS *(Yukon/Transboundary Rivers Area)*

(Check one, and provide the additional info if required)

☒ New Application

☐ Renewal of previous year's licence — Previous Licence #:

☐ Amendment to a current licence — Current Licence #:

(Check one)

☐ SCIENTIFIC PURPOSES *

☐ EXPERIMENTAL PURPOSES**

☐ EDUCATIONAL PURPOSES***

☐ PUBLIC DISPLAY PURPOSES****

(see footnote for descriptions)

Yes ☐ No ☒ **Do you have an Animal-Use protocol approved by a CCAC-accredited animal care committee?** *(http://www.ccac.ca/en_/standards/guidelines)*

1. Please briefly describe the purpose of your application request. If this is an amendment to a previous license, briefly describe the requested changes to the original license.

The Chance Oil and Gas Project Area covers approximately 2,500 km^2 and includes 1,467 streams. Very little fisheries data exists for the proposed Project Area, with the most recent (limited) sampling occurring in 2001. EDI Environmental Dynamics Inc. proposes to conduct fish sampling on streams from each order throughout the Project Area. Fish sampling will mostly be conducted using electrofishing methods, with beach seining where necessary on 4th or 5th order streams. Electrofishing effort will be approximately 100-300 meters and for a minimum of 400 seconds in order to adequately sample each site. The length of stream sampled will be proportional to the stream width (i.e., narrow creeks will be sampled for longer distance than wide creeks). Sites will be sampled a minimum of 100 m upstream from the nearest confluence. The planned target of sites is 50, with an allowance up to 100.

2. Indicate the desired start and end date for the requested licence/permit. (Licence/permits may only be issued for up to one year.)

Start Date: 2019-07-01 End Date: 2019-10-01

Details (Specify sampling periods, if applicable): *Sampling is intended to begin in mid-July, but may require subsequent sampling.*

3. Applicant Information:

Legal Name of Applicant: [redacted] Date of Birth: 1990-07-24

Organization or School: EDI Environmental Dynamics Inc.

Street Address/Unit#: 2195 Second Avenue City: Whitehorse

Province/Territory: Yukon Postal Code: Y1A 3T8

Phone: [redacted] Fax: Email: [redacted]

Cell:

List individuals that will be assisting with the activity, DOB is required. *(Attach additional page if needed)*

	Legal Name	Date of Birth (YY/MM/DD)		Legal Name	Date of Birth (YY/MM/DD)
1)	[redacted]	[redacted]	6)	[redacted]	[redacted]
2)			7)		
3)			8)		
4)			9)		
5)			10)		

4. SAMPLING PROGRAM - METHODS/LOCATION/SPECIES/DETAILS/OBJECTIVE etc..

Details of where the sampling is to occur, and the gear being used (*Provide detailed information including when, where, and how much sampling will occur)*

Name of River/Stream/Lake/Creek *(use a separate line for each waterbody)* **Watershed codes:** *search http://cmnmaps.ca/fiss_yukon/*	Detail of each sampling method *(ie. #trap nights, electrofishing seconds, # and duration of net sets, mesh size, etc. per sampling site etc. Also specify details of multiple sampling periods if applicable)*
See attached.	

Include species and life stage. Specify planned upper limit of sample size, maximum number and species of specimens that will be retained (if any). (Details not provided in specified fields, to be completed in "Additional Details" below.)

Species *(attach additional page if needed)*	Life stage	# of Fish Sampled	# of Fish Retained	# Estimates of Mortalities	Specify location of all mortalities and/or # retained
Arctic grayling	subadult/adult	200	0	5	
Arctic grayling	juvenile	200	0	10	
Slimy sculpin	subadult/adult	200	15	25	5 Peel w/s, 5 Bell w/s, 5 Whitestone w/s
Round whitefish	subadult/adult	100	0	10	
Lake whitefish	subadult/adult	100	0	10	
Longnose sucker	subadult/adult	100	0	10	

Details (Explain the purpose of retaining mortalities and/or lethal samples):	For the 15 retained slimy sculpin, the purpose is to provide DNA samples (fin clips) for the University of Montana to identify additional potential conservation units (subspecies, species) for a North America wide project. These individuals will ideally be chosen from any incidental mortalities and will only be retained in the event of no incidental mortalities. If there are any incidental mortalities of other species they will also have fin clips submitted to support this initiative.

Additional details (attach additional page if needed).

Include as much detail as possible including your research activities, methods of collection provide details, disposition of the specimens details of regarding release methods and location, and precautions that will be taken to avoid fish mortality. Provide information on handling of non target species if appropriate. etc..

Sites will be chosen to cover the spatial extent of the Project Area to provide a general understanding of fish distribution in different ordered streams. Each stream site will have a Site Card completed as well as fish sampling and in-situ water quality will be taken. Fish sampling will mostly be conducted using electrofishing methods, with beach seining where necessary on 4th or 5th order streams. Electrofishing effort will be approximately 100-300 meters and for a minimum of 400 seconds in order to adequately sample each site. The length of stream sampled will be proportional to the stream width. Sites will be sampled a minimum of 100 m upstream from the nearest confluence. In-situ water quality will be taken at each site, which includes the collection of temperature (degrees Celsius), pH, dissolved oxygen (mg and %), and specific conductivity (µS/cm). All fish captured will be identified to species and enumerated; up to 10 individuals from each species caught will be measured at each site before being returned to the water. Handling and air exposure will be kept to a minimum for all fish.

Footnotes:
* Scientific Purposes includes: Salvage (for fish collection associated with in-stream works etc.); Environmental Impact assessment (pre and/or post development project monitoring); Inventory (species abundance and distribution and/or presence/absence study)
** Experimental Purposes: Research (i.e.. fish collection as part of a experimental procedure, or research to determine how fish populations respond to habitat manipulations)
*** Educational Purposes: Training
**** Public Display Purposes: Samples for display purpose

Applications are to be submitted to:

Attn: Area Licensing Manager

By Mail: 100-419 Range Road
Whitehorse, YT
Y1A 3V1
Fax: (867)393-6738
or
Email: YTLicence@dfo-mpo.gc.ca

PRIVACY NOTICE STATEMENT
The information you provide on this form is collected under the authority of the Fishery General Regulations for the purpose of issuing a licence for scientific, experimental, educational or public display purposes. The information may be used for program planning or management, reporting, audit, administration purposes or disclosed to other government departments or agencies, within other divisions or branches of the institution, with provincial, territorial or foreign government or First Nation organizations as applicable. Failure to provide this personal information may result in your licence being denied. You have the right to the correction of, access to, and protection of, your personal information under the Privacy Act and to file a complaint with the Privacy Commissioner of Canada over DFO's handling of your information. Personal information collected through the processing of your application is described in DFO Personal Information Banks and can be accessed and assessed for accuracy. For more information visit Info Source www.infosource.gc.ca.

5. RELATED LINKS INFORMATION ETC

Collection Period: Sensitive timing periods in aquatic environments in Yukon and transboundary waters can be found at: http://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/index-eng.html. If you plan to sample using instream methods during sensitive periods, we suggest you describe means by which you will mitigate any negative effects.

Transfer or Transplant of Live fish/eggs/milt: Any transfer of live fish into fish habitat and transfer of live fish to a fish rearing facility, requires a permit from the Federal/Provincial/Territorial Introductions and Transfers Committee. Applications and contacts can be found at:
BC - http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/intro-trans/process-processus-eng.html
Yukon – http://www.pac.dfo-mpo.gc.ca/yukon/trans-eng.html

Species At Risk: Research into any species listed in the Species At Risk Act (SARA) requires a permit issued under SARA. Application forms can be found at: http://www.dfo-mpo.gc.ca/species-especes/permits-permis/permits-eng.htm

Canadian Council on Animal Care (CCAC): DFO is a member of the Canadian Council on Animal Care (CCAC) and has committed at the Ministerial level to follow the entire CCAC program in Departmental activities in research, teaching and testing with vertebrate animals. Nearly all universities and colleges in Canada follow this program as well. It is expected that if DFO financial or human resources are involved in the work under this requested licence, or if the applicant is based at an institution having a CCAC-accredited Animal Care Committee, then evidence of an approved Animal Use Protocol (AUP) will be submitted with this application, and CCAC guidelines will be adhered to in any work with live vertebrates. The issuing authority for this licence accepts the CCAC's exemptions for certain animal-use activities as not requiring an approved AUP. More information about the CCAC program is at *www.ccac.ca.*

Note: - Use of carbon dioxide/CO2 (e.g. Alka-Seltzer tablets) to immobilize fish for sampling should not be done without a continuous supply of oxygen, with levels of both gases monitored and regulated.
- Clove-oil products are not regulator-approved in Canada, as a fish anaesthetic.

Aquatic Invasive Species: To prevent the introduction of aquatic invasive species there are a few simple things that can be considered:
a) Before leaving an area: Drain water from boat, trailer and gear, remove all plant parts and mud and.
b) before entering another water body: Wash all your gear including waders with soapy water.
For Further Information:
http://www.dfo-mpo.gc.ca/science/environmental-environnement/ais-eae/index-eng.htm
or
http://www.env.gov.yk.ca/animals-habitat/invasivespecies.php

Fish Sampling Permit for Chance Oil and Gas: Watersheds and Species

Table 1. Watersheds

Name of River/Stream/Lake/Creek	Detail of each sampling method
Chance Creek and tributaries (81809544)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Greaves Creek and tributaries (81809544052517)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
McParlon Creek and tributaries (81840641)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Dalglish Creek and tributaries (210873536)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Enterprise Creek and tributaries (210962555)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Whitestone River tributaries (818; between McParlon and Chance)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Tributary to Eagle River (81517952593396)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Tributary to Eagle River (81517952563022)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Tributary to Eagle River (8151795256302216321)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Tributary to Porcupine River (8151795256302216321)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.

Table 2. Fish Species

Species	Life stage	# of fish sampled	# of fish retained	# estimates of mortalities
Arctic grayling	sub adult/adult	200	0	5
Arctic grayling	juvenile	200	0	10
Slimy sculpin	sub adult/adult	200	0	10
Round whitefish	sub adult/adult	100	0	10
Lake whitefish	sub adult/adult	100	0	10
Longnose sucker	sub adult/adult	100	0	10

APPENDIX 2-A-10. May 5, 2021, Meeting Summary

FIRST NATION OF NA-CHO NYÄK DUN AND CHANCE OIL AND GAS MEETING

Date: May 5, 2021

Location: Microsoft Teams

Attendees:

First Nation of Na-cho Nyäk Dun:

[redacted] Consultant

Chance Oil and Gas Limited:

[redacted], President
[redacted], VP Government and Community Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator

Hemmera:

[redacted], Human Environment Specialist
[redacted], Human Environment Specialist

Purpose and Objectives

The purpose of this meeting was for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin. Chance provided recent information and updates regarding baseline information gathered by consultants (Environmental Dynamics Inc. (EDI), Peer Solutions, Palmer) and Parties discussed next steps with community engagement and consultation schedules for the First Nation of Na-cho Nyäk Dun (FNNND).

Discussion:

The meeting opened with introductions and a welcome.

[redacted] Updates on the Eagle Plains Exploration Project, almost the same project as back in 2019, this presentation will highlight any changes that have happened since. Then we will go over next steps on developing the project proposal and community consultation and engagement schedules and preferences of the FNNND Government.

[redacted]: This presentation will cover what has changed following the 2019 project. We have also undertaken a number of field studies. Work on ecosystem characteristics was performed by EDI. Permafrost processes by Palmer Environmental. Technical design by Peer Solutions who is working on the seismic program.

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EDI had several teams go into the field in 2019 and 2020. They were looking at bird studies, old seismic lines. Those old lines are a result of the technology at the time and the lack of understanding of the geology in the region. During the 50s to mid 80s there was 2D seismic activity. We did 3D seismic. Now, the footprint is much smaller today than 60 years ago. EDI looked at how old seismic lines. If those lines get any sort of use from animals, if they are regenerating, if humans use the area. EDI did fish and aquatic studies. They are trying to find the types of fish present. They obtained porcupine caribou information/data from the board; they have not finished their interpretation. EDI also visited quite a few spots. They are also using lidar which is a laser beam that is reflected off the surface and gives a good image of the landscape. Information useful for accessing sites and land and ecosystem classification. You can get a good snapshot of the area.

Palmer did a study to see where permafrost in the area is active and visited those spots along. Also visiting spots that could make access difficult. They are going back to get geotechnical data. Palmer's work is substantially done, besides what would need to be done following regulation processes. All this information will be available to share with everybody.

We did have a series of presentations in Mayo with Chief and Council, with Tr'ondëk Hwëch'in (TH), with Vuntut Gwitchin (VG), and various Gwich'in communities of the GTC in the NWT. All communities are aware of the proposal. We are trying to manage our land tenures. We are on track to submit to Executive Committee (EXCOM) in the fall, probably October. We will host meetings in the communities and bring consultants. We have started in Old Crow and will be moving to other communities in the next couple of months.

[redacted]: We have a timeline for this project. We want to ensure that we can get into the communities to address any concerns with ecological impacts. We have already informed the communities of the initial project, so this is not new. We have done a significant amount of work. We are excited to bring this baseline information into the community and formally submit this into an EXCOM. We are excited about sustainable development. We heard this is important from communities. We are doing this over the long term., A creative way to address concerns around sustainability. Compared to our Southern oil counterparts, we want to move slowly on drilling.

[redacted]: With the EDI studies, you have done more since the previous community meetings?

[redacted]: Yes, this will be available when we come to the communities with the consultants.

[redacted]: This could be possible in person with the new quarantine rules, we can share this information ahead of time.

[redacted] Start date?

[redacted]: We will cover engagement scheduling later in the meeting. Correction on engagement with FNNND. We met with FNNND technical experts. We did not meet with Chief and Council although they were informed of the meeting. Also, notes from today are being taken and will be sent to you after this meeting. Part of Hemmera's role is creating a record of this meeting to be reviewed and edited by FNNND and Chance.

[redacted]: I'm digging into FNNND files on this. The only thing I'm aware of is the 2019 engagement. Thank you for clarifying. I am in the process now of requesting how FNNND wants to deal with community meetings. A month ago, that they were very sensitive about people coming into Mayo. This is softening. I am trying to get clarification on community meetings.

[redacted]: That's great feedback. This will help inform our engagement activities moving forward. I'll put up the presentation.

[redacted]: This presentation will describe the exploration project proposal. None of this will be development but looking at what could possibly be developed in the future. The project itself is going to occur in an area of 2,400 km that is within the exploration permits Chance holds. This project includes 30 wells and shooting new seismic data. If we have any success on the drilling, it will move to flow testing. Flow testing for natural gas takes up to two months and up to two years if it's oil. It will help us assess potential development. We would dispose of the cuttings in the area. There should not be anything wrong with these cuttings. We are operating in an area of sedimentary rock. It has already been exposed to the elements and are benign. There will be construction of winter trails. If there is success and if it is oil, then we will look at having access year-round. Because it is exploration, we phrased it as "up to 30 wells". This is a program that is meant to be an area wide assessment with 30 wells, exploratory drilling, and 2D and 3D seismic activity. I can't tell you exactly where the well sites will be or what order.

[redacted]: The initial wells would be based on the old seismic data? Then based on those wells, you would do new seismic data?

[redacted]: There is data that we have access to that covers a broader area. That we can use to investigate the area of interest. Our 3D seismic only covers an area of what we need. We need 7x that. We will try the first wells and then see what is around and then go from there. It depends on results as we go. This map [redacted] referred to presentation], outlines the area of interest. It shows the traditional areas and settlements blocks of VG and TH. I'm not totally sure that this map shows the new arrangement between TH and VG. There are 3 significant discovery licences. They are outlined in the yellow: natural gas discoveries between 1960 and 1980. They have oil and natural gas there. Dempster Highway did not exist, getting there was hard. All the discoveries made had value. SDL 021 and 020 overlaps FNNND traditional territory. There are 3 suspended wells at SDL 020 and 1 suspend well at SDL 021.

None of the activity we are talking about will occur on settlement land. Any question?

[redacted]: No.

[redacted]: Exploration drilling would progress on a small scale, such as 1 or 2 wells during operating season. There may be some reasons that we drill in the summer if there is some opportunity for access. 1 drilling rig could give us 3 or 4 wells per year. For assessment purposes, that is close enough to an estimate as we'll get. The drilling locations will be selected on high ground. Which means it is better for permafrost. We will do our best not to be down in the valley bottoms where it is more difficult to operate. We will avoid any ecologically sensitive areas; we will avoid heritage areas. We 've got quite a bit of information covering heritage since 1995. One of the criteria is that we drill away from water. We would likely not even be close. In this area, they are frozen bottom. We are not operating in an area with year-round flowing rivers. There is a whole bunch of regulatory acts that govern our behaviours. Any questions?

[redacted]: Who did the heritage studies?

[redacted]: It was Matrix at that time, now acquired by Stantec.

[redacted]: We worked with an archeologist at Matrix and [redacted], I think, from FNNND and citizens from VG. There is a full report on this. We requested a lot of this information.

[redacted]: Is this documented? It would be good if I could look through that and identify areas of further interests. The Traditional Knowledge would certainty be a factor in that FNNND wants considered.

[redacted]: Yes, we can make this an action item. It is definitely an area that input from FNNND will be critical.

[redacted]: [Going back to the presentation] New drilling techniques can reach a large area with a small footprint on the surface. Eagle Plains has experienced several tectonic related exploration projects. The terrain is a function of tectonic uplift. They tend to dip into peaks and valleys; you get subsurface hill tops of base rock. Oil and gas are less dense than water. Over time, the organic material gets cooked under the pressures of the rock and becomes natural gas.

[Reference to presentation on screen] On the left shows a well drilled in the winter 2019. When you are designing a well, you start with conductor pipe that gets you through to bedrock. This guides the first bit of drilling; the size of the surface hole has to be 25% of the entire depth. It is all designed to handle bit changes, the deeper you go the bigger well diameter. That photograph [reference to presentation on screen] is at our camp, it gives you an idea of what the rig will look like.

[redacted]: We can move right through; I am familiar with this.

[redacted]: The flow testing is longer because there is not much understood of the geology. In the case of natural gas, this test would not be as long as oil. We have given some thought into putting a small-scale distillation project, to sell in the Yukon to avoid trucking. Any questions?

[redacted]: No, you can move along.

[redacted]: There will be some infrastructure related to testing. We must depressurize what is coming up in the well. It gets separated and measured. Any fluids like water will be disposed. Any oil would be sold or trucked to the proper market. Likely this will either be somewhere within the Yukon or a terminal in Vancouver to be shipped away. We will do our best to conserve natural gas. The drill mud is also high pressure. The seismic is an important part of the project. It's very good for imaging. It is much harder to see the lines made today than in the 60s. You can barely see the lines with the seismic work that we did recently.

For the workforce, if we reach peak human employment, we will have an overflow of more than 70 people in the camp. The work rotations will consist of 20 days on and 10 days off, day and night shifts. We can only do one activity / the other (drilling or seismic) with the workforce size. At well sites we will need to have areas for campers for workers to warm up during shifts.

Unsuccessful wells will be abandoned and allowed to regenerate naturally. Mix bury cover sites would be left there to recover. We predict there will be little to no ground water leaching due to thick frozen rock between the area of interest underground and the active layer of permafrost. Mixed bury cover has been used widely in the North Yukon. It is not a new technique. We will follow Alberta's guidelines on this. They

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have the most extensive guidelines. We hope to get screened by executive committee this Fall, to manage the tenure clock we have on the permits.

[redacted]: Not quite sure who is involved in the pre-screening process as far as regulators go. I was involved in YESAB's creation. There should be regulators involved from the start, but we have seen that they often get involved too late. Have you had a chance to work with them/regulators on this?

[redacted]: We have been in contact with [redacted] from Yukon Government. Have met with them several times.

[redacted]: We do rely on them to make these connections. They've been given documents on this already.

[redacted] Sometimes First Nations go off the recommendations of the regulators.

[redacted] For engagement, Hemmera provides support for Chance on all their engagement activities and provides project management for all their project proposal. We do have draft project description. It was shared broadly with First Nations back in 2019. We are adding information to feed in what we learned coming into the Designated Office (DO)project. We are also working on socio-economic components on this project. EDI is the major workforce for the ecological components. We are working on updating the drafted project proposal, compiling all baseline studies, and working on development of those sections. We are mostly at the draft project description phase. We'll be sharing other information with First Nations as well. We have not started drafting the effects assessment yet. We initially engaged with First Nations in 2019. However, that was put on pause. We re-directed efforts to the DO. Now we are starting again and kicking off engagement activities with FN Governments and Citizens. This part of YESAA's requirements of Chance. Regarding completing the project proposal, we have created a tentative engagement schedule that covers now until the Fall. It hits certain themes between now and then. Those themes include summary of project description, concerns, and later we will be discussing mitigations etc. We do understand this a tight timeline. We'll share this memo with you. It's also been shared with YG, VGG, and TH.

[redacted] The FNNND is completely swamped. The memo will help me get others to put some focus on this. Depends on what Mayo and FNNND feel on community meetings. First Nation Government doesn't want to do much until community meetings are held.

[redacted] That is amazing information for us to have to plan these meetings/engagement. Our preference is to do something face to face.

[redacted] So far, it's been going good in Old Crow. We do it in an open setting, like a school gym, where we can space out. We still have to consider the time frame of our permits. We're obligated under the dispositions. We certainty are open to looking at trying to fit in and provide all the necessary information to the community and FNNND citizens. This would include meetings with the Renewable Resource Council. We would like them to be able participate in this discussion. We would like to have a presentation with the Porcupine Caribou Management Board.

[redacted]What about the idea of doing something like today with the Renewable Resource Council (RRC) and FNNND Lands technicians. In zoom meeting, if they are comfortable with zoom meetings. That will give some community representatives an idea of what is going on. Then when we start in person meetings, it can be community driven.

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[redacted]: Since 2019, it has been hard to pin down the First Nation Governments. If you could facilitate that, it could help. I remember there was an Elder from the RRC in Mayo who always comes to our meetings and requests more information. It would be great to answers their questions.

[redacted]: Once I get this engagement memo and I speak with leadership, we can initiate things.

[redacted]: That would be perfect and help us accelerate to the next step. Getting feedback from RRC and FNNND Lands Tech staff will help us develop our proposal and make it better.

[redacted]: We can look at tentative openings and run it by you guys.

Action Items/Next Steps:

- Chance/Hemmera will send baseline information as it becomes available.
- Chance/Hemmera will send updated project description when it is available.
- Hemmera will send 2021 Engagement Schedule Memo
- [redacted] to seek engagement guidance from FNNND Chief and Council
- Hemmera and [redacted] to set up meeting with Mayo Renewable Resource Council and FNNND Lands staff
- Hemmera/Chance to send Matrix Heritage Report

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APPENDIX 2-A-11. Draft *2021 Annual Report on the Implementation First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Engagement and Communication Plan*

DRAFT 2021 ANNUAL REPORT

Implementation of the First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Engagement and Communication Plan

PLEASE NOTE: Chance Oil and Gas Limited has reviewed and approved this report. The First Nation of Na-Cho Nyäk Dun was provided a draft, but has not provided feedback. As Hemmera was unable to secure a signature from the First Nation, the signature boxes were removed from Page 5 and this document retains the DRAFT watermark.

DRAFT

Prepared for:

Yukon Government
Department of Energy, Mines and Resources
Oil and Gas Resources
Box 2703
Whitehorse, YT Y1A 2C6

Prepared by:

Hemmera Envirochem Inc.
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July 30, 2021

1.0 INTRODUCTION

This report demonstrates implementation of the *First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Limited Engagement and Communication Plan* (Plan) (see **Appendix A**) finalized on August 8, 2018. It summarizes discussions held between First Nation of Na-Cho Nyäk Dun (FNNND) and Chance Oil and Gas Limited (Chance) between June 1, 2020 and May 31, 2021. The purpose, objectives, and outcomes of each discussion are described below in order to fulfill the requirements of Ministerial Order (MO) 2018/42 (see **Appendix B**) issued to Chance on August 30, 2018.

2.0 BACKGROUND

The development of communications and engagement plans began with Order in Council (OIC) 2016/169. OIC 2016/169 required Chance to file a First Nations communication and engagement plan with the Minister of Energy, Mines and Resources in order to extend tenure on their northern permits: 0005, 0006, 0007, 0008, 0009, 0010, and 0011. Chance complied with OIC 2016/169 and received their tenure extension.

Chance subsequently received MO 2017/37 when applying for tenure extension on six of eight southern permits: 0012, 0013, 0014, 0015, 0016, and 0017. MO 2017/37 required Chance to revise, in consultation with affected First Nations, the consultation and engagement plan filed under OIC 2016/169. The affected First Nations listed in MO 2017/37 were Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Tetlit Gwich'in Council.

FNNND and Chance collaboratively developed their Plan through a series of in-person meetings and conference calls. Hemmera was retained by Chance in November 2017 to facilitate the development and completion of the communications and engagement plans with the affected First Nations and facilitated all discussions between FNNND and Chance.

Chance and FNNND submitted their finalized Plan to Minister Ranj Pillai on August 28, 2018. To satisfy their obligations under MO 2017/37, Chance filed a total of four communications and engagement plans. All four plans were approved by the Minister and Chance received a five-year tenure extension on the six southern permits.

A condition of the five-year tenure extension, issued via MO 2018/42, required that Chance submit annual reports summarizing actions taken to implement each communications and engagement plan.

See **Appendix C** for a map of Chance's current permits.

3.0 ENGAGEMENT AND COMMUNICATION PLAN IMPLEMENTATION SUMMARY

3.1 Overview

Parties have advanced discussion on Chance's proposed Eagle Plains Exploration Project and Chance's proposed project for Well Maintenance and Extended Flow Testing. The following sections provide separate summaries of engagement activities that occurred for Chance's projects between June 1, 2020 and May 31, 2021.

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3.2 Summary of Engagement – Well Maintenance and Extended Flow Testing Project

Initial notification was sent to FNNND on May 25, 2020. That package included a high-level overview of the project (e.g., project activities, components, goals, outcomes), the regulatory submissions Chance would be making, a brief introduction to Hemmera and its role, as well as a request to discuss any concerns the affected party may have and an offer to arrange a conference call should they so desire. Also included was a 4-page project summary and map of the project location.

Additional communications followed on June 9, June 24, and July 20, 2020. Chance did not receive feedback from FNNND while the project was being refined or when the project proposal was being drafted. A draft of the Project Proposal was shared with FNNND July 24, 2020.

Following additional conversations with the regulator (Government of Yukon), Chance was required to make changes to its project design. On August 7, 2020, FNNND was provided notice that revisions were being made to the project and that additional information would be forthcoming. A revised project proposal was provided, via email, to FNNND on August 28, 2020, along with a cover letter summarizing the revisions and providing a rationale for each.

Chance submitted an initial project proposal to YESAB on September 11, 2020. However, after further consideration, Chance determined that additional changes were required. On November 2, 2020, via email, Chance notified FNNND that it had decided to withdraw its project proposal from YESAB and submit a revised version. In that email Chance stated that once a revised proposal had been drafted, Chance would notify FNNND by sharing a draft and requesting a meeting to discuss the changes further, and Chance stated at that time that after it had the opportunity to discuss those changes with FNNND, the project proposal would be finalized and resubmitted to the Dawson Designated Office.

The revised draft project proposal was provided via email to FNNND on November 19, 2020, and in that email Hemmera indicated that Chance would be submitting the proposal to YESAB the following day. On November 20, 2020, Hemmera informed FNNND that Chance would delay submission until the following week. That same day, a FNNND representative replied indicating the draft was received and being reviewed.

New FNNND staff were assigned the Chance file, and, on November 25, 2020, they requested previous versions of the proposal in order to better understand the project's evolution. On behalf of Chance, Hemmera provided previous version of the proposal and an overview of changes/revisions that had taken place. Hemmera also provided additional context with respect to Chance's larger portfolio and proposed projects and engagement activities.

To allow for additional revisions, Chance's submission to YESAB was delayed until December 24, 2020.

3.3 Summary of Engagement – Eagle Plains Exploration Project

Between June 1, 2020 and May 31, 2021, Chance and FNNND have had only one meeting pertaining to the Eagles Plains Exploration Project.

3.3.1 Meeting Summaries

Date: May 5, 2021

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Location: Microsoft Teams
Attendees: FNNND Consultant, Chance Management, Hemmera

Chance last engaged FNNND on the Eagle Plains Exploration Project in 2019 and the purpose of this meeting was for Chance to re-initiate engagement. Chance presented a high-level overview of exploration activities proposed for the Eagle Plain Basin. The presentation also highlighted any changes in project design that occurred since it had last been shared with FNNND in 2019. The presentation went over the layout of well sites, drilling methods, seismic program, and workforce. Chance also provided recent information and updates regarding baseline information gathered by Chance's consultants (Environmental Dynamics Inc (EDI), Peer Solutions, Palmer), and Parties discussed next steps regarding FNNND's preferences for community engagement and consultation (e.g., schedule, format).

Chance stated that their timeline was aiming for a Fall 2021 submission to Yukon Environmental and Socio-economic Assessment Board (YESAB) and that Chance was working towards getting into the communities in order to learn about, and address, any concerns related to ecological impacts. FNNND asked if more studies had been completed by EDI since Chance had last spoken to the community. Chance confirmed that EDI has conducted additional studies (e.g., fish sampling, linear features study) and that they would be shared with FNNND as they are completed.

Chance and FNNND discussed the proposed seismic program. Chance explained that current seismic data covers a broad area, but has limitations. Chance needs to investigate/target areas of interest and subsequently requires approximately seven times the 3D data that is currently available. Chance confirmed that none of its proposed activities would take place on settlement land. FNNND asked about heritage studies and Chance stated that it had completed a heritage study previously and that at the time Chance has worked with Joella Hogan from FNNND and Vuntut Gwitchin Citizens. Chance committed to sharing a copy of that previous report with FNNND. On the topic of regulations and submission to YESAB, FNNND asked if regulators were involved in the pre-screening. Chance replied that they have been in contact with Derek Fraser from Yukon Government.

Chance and FNNND discussed community engagement strategies. FNNND stated that they are very busy and requested that Chance share its proposed draft engagement schedule. FNNND suggested that Chance meet with the Mayo Renewable Resource Council and that the meeting potentially include FNNND Lands staff. FNNND stated they would speak with leadership to seek direction on engagement preferences moving forward. Chance was to send the revised project description and baseline studies as they become available.

3.3.2 Communication Log

The correspondence between Chance and FNNND is documented in the Engagement Log (see **Appendix D**).

4.0 PLANS FOR ONGOING ENGAGEMENT AND NEXT STEPS

No additional engagement activities are expected for the Well Maintenance and Extended Flow Testing Project while it is undergoing YESAB's review.

FNNND and Chance will continue to hold discussions at regular intervals as Chance develops its project proposal for the Eagle Plains Exploration Project.

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Upcoming engagement activities for the Eagle Plains Exploration Project are expected to involve the following:

- Sharing baseline data
- Meetings between FNNND technical staff and Chance's technical consultants preparing the project proposal for proposed Eagle Plains Exploration Project
- Community engagement events for FNNND citizens

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5.0 APPROVAL OF IMPLEMENTATION SUMMARY

FNNND and Chance have reviewed this report and agree to its contents as an accurate summary of the engagement activities carried out between June 1, 2020 and May 31, 2021.

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APPENDIX A

Na-cho Nyak Dun and Chance Oil and Gas Limited Engagement and Communication Plan

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First Nation of Na-Cho Nyäk Dun
P.O. Box 220
Mayo, Yukon Y0B 1M0
Tel: (867) 996-2265
Fax: (867) 996-2267
E-mail: main@nndfn.com
Website: www.nndfn.com

August 10, 2018

[redacted]

Minister of Energy, Mines and Resources
Government of Yukon
Box 2703
Whitehorse, Yukon, Y1A 2C6

Re: Submission of the First Nation of Na-Cho Nyak Dun and Chance Oil and Gas Limited Engagement and Communications Plan

Dear Minister [redacted]

I am pleased to inform you that the First Nation of Na-Cho Nyak Dun and Chance Oil and Gas Limited (Chance) have concluded our work to develop a framework to facilitate effective and meaningful communications and engagement between ourselves and Chance. The framework captured in the enclosed Engagement and Communications Plan establishes a foundation for a respectful relationship, that we will cooperatively address Na Cho Nyak Dun's capacity and resourcing needs to implement the framework as we continue to work together to ensure the environment is protected and development occurs in a sustainable manner.

Please accept the enclosed Plan for the purposes of Ministerial Order 2017/037. We trust that the Plan will be of satisfaction to the Minister.

I look forward to the next step in the process related to the government to government Consultation regarding the possible renewal or further extension of the oil and gas leases related to this project.

Sincerely,

[redacted]

Chief [redacted]

Encl: *First Nation of Na-cho Nyak Dun and Chance Oil and Gas Limited Engagement and Communication Plan*

CC:
[redacted] Director of Lands and Resources, First Nation of Nacho Nyak Dun
[redacted] Director, Yukon Government
[redacted] Assistant Deputy Minister, Yukon Government
[redacted] President Chance Oil and Gas Ltd.
[redacted] VP Community and Government Relations, Chance Oil and Gas Ltd.
[redacted] Regulatory, Environmental and Community Relations Coordinator, Chance Oil and Gas
[redacted] Senior Project Manager, Hemmera

First Nation of Na-cho Nyak Dun and Chance Oil and Gas Limited Engagement and Communication Plan

1.0 Introduction

Chance Oil and Gas Limited (Chance) is an oil and gas exploration company that holds permits to perform oil and gas exploration activities in the Eagle Plain basin of Yukon Territory, Canada. As part of Chance's exploration program, Chance seeks to develop engagement and communication plans with all the First Nations that are potentially affected by Chance's exploration program activities. Permits 14, 15, 19, and 20 fall within or partially within the First Nation of Na-cho Nyak Dun Traditional Territory and Chance is seeking to engage the First Nation of Na-cho Nyak Dun (FNNND) on its activities within these permits.

2.0 Purpose

This document serves as an Engagement and Communication Plan (Plan) to provide a mutually agreed upon framework to support collaborative and effective engagement and communication between Chance FNNND now and into the future. This Plan incorporates and aligns with FNNND's *Cooperative Engagement Process*.

3.0 Relationship

Chance and FNNND will execute this Plan according to the following principles:

- Transparency and openness;
- Timeliness;
- Integrity;
- Adaptive Management;
- Mutual respect; and
- Working towards trust and understanding of one another.

These principles are adapted from the FNNND *Guiding Principles for Mining Interests* and from Chance's corporate values.

4.0 Key First Nation of Na-cho Nyak Dun and Chance Connections

Engagement and communication between Chance and FNNND will be generally associated with the proposed works and potential effects associated with Chance's oil and gas exploration program and potential opportunities (via training, employment, contracting, and other community investments), as well as any topics or issues identified through engagement and communication associated with Chance's proposed activities. This section of the Plan identifies the key contacts related to these overarching engagement and communication themes. Key representatives involved in engagement and communication are expected to be as follows:

- Chief and Council;
- FNNND Government department officials and advisors;
- FNNND Business Development agencies;
- FNNND Citizens and communities at large; and
- Proponent Management and designated staff and advisors.

The following table lays out the key engagement and communication topics, in no particular order, and associated key contacts for both Chance and FNNND:

Table 1 - Key Engagement and Communication Topics and Leads

Role or Subject Matter	FNNND Key Contact	Chance Key Contact
Project Lead	• Lands & Resources Manager (as described in the FNNND *Cooperative Engagement Process)*	• Vice President of Government and Community Relations
Culture and Community (includes Traditional Knowledge and Traditional Land Use, social, health, and other "human environment" subjects)	• Lands & Resources Manager	• Vice President of Government and Community Relations, Regulatory, Environmental and Community Relations Coordinator
Engineering and Geology	• Lands & Resources Manager	• Chief Executive Officer, President
Environmental	• Lands & Resources Manager	• Vice President of Government and

Role or Subject Matter	FNNND Key Contact	Chance Key Contact
(includes water, aquatic environment, wildlife, plants, and other environmental subjects)		Community Relations, Regulatory, Environmental and Community Relations Coordinator
Opportunities (includes community investment, training, education, contracting, employment, and other business opportunities)	• Lands & Resource Manager	• Chief Executive Officer, President
Agreements and Capacity Funding	• Lands & Resources and Negotiations Teams (as described in the FNNND *Cooperative Engagement Process*)	• Chief Executive Officer, President

5.0 Engagement and Communication Methods

Chance and FNNND will employ the following engagement and communication methods for specific correspondence:

- In person meetings;
- Email;
- Sharing Power Point Presentations (to support in person meetings);
- Sharing reports (as requested and as required) and;
- Telephone correspondence (teleconferences and less formal phone calls).

Engagement and communication methods that support general communication of Chance's activities are as follows:

- Chance newsletters; and
- The website for Chance Oil and Gas Limited.

Engagement and communication meetings will be executed in the following manner:

1. Chance or FNNND will request a meeting in writing to the other party according to the connections iterated in Table 1;
2. The parties to meet will develop the agenda collaboratively;
3. The party requesting the meeting will develop supporting materials (collaboratively, where possible), and share those in advance of the meeting; and
4. The meeting will take place in a mutually agreeable location.

The above general process applies to meetings with subject matter leads (Table 1) as well as meetings with Citizens and communities at large.

Through engagement with FNNND, Chance understands that there are existing communications protocols between FNNND, Tr'ondëk Hwëch'in, and Vuntut Gwitchin First Nation through the Northern Chiefs Accord. In keeping with the relationship principle of mutual respect, Chance will work within these existing communications protocols where applicable and as directed by FNNND.

The following documentation sharing and review protocols support the methods described above:

- Confidentiality of the meeting minutes will be discussed and established in advance of the meeting; i.e. if a meeting is to not be included in the record that will be submitted to regulators and assessors, it is the responsibility of both parties to discuss and agree to this prior to the meeting beginning;
- Meeting minutes taken by Chance will be sent to FNNND within two weeks via email; review and comment on these meeting minutes by FNNND through tracked changes, or some method agreed to by both parties, will be provided via email within 30 days of FNNND receiving the meeting minutes. Should FNNND require more time to review the meeting minutes, FNNND will notify Chance by email within two weeks of receiving the minutes. No response by FNNND to Chance's email providing meeting minutes within the 30 days will be interpreted as general acceptance of the meeting minutes by FNNND;
- Action items and meeting outcomes will be logged during meetings and reviewed by both parties at the end of the meeting to ensure that there is general agreement on the list of actions and parties responsible for those actions. The list of action items and meeting outcomes will be provided with the meeting minutes;
- Chance and FNNND will agree upon and use a file sharing platform to facilitate sharing of large files, such as Power Point presentations and reports; and,
- Should Chance or FNNND employ a third party for records development and management, the third party will follow the process iterated above for recording and providing meeting minutes.

6.0 Records Management

Summarized records of engagement and communication between Chance and FNNND will be kept in a records log. The Chance will ultimately submit the items below to regulators and assessors for review if and when a potential project is assessed in the future:

- Meeting agendas;
- Meeting minutes (finalized versions as described in section **5.0 Engagement and Communication Methods);**
- Invitee/Attendees lists and/or meeting sign-in sheets;
- Records log, which will include summaries of the following:
  - In person meetings;
  - Phone calls and teleconferences;
  - Incoming and outgoing emails between Chance and Chance's representatives and FNNND representatives;
  - Attachments to the above noted incoming and outgoing emails;
- Reports provided to FNNND by Chance and reports provided to Chance by FNNND for review and consideration for engagement and communication purposes; and
- Copies of Power Point presentations delivered by Chance to FNNND for engagement and communication purposes.

To ensure that there is a mutual level of comfort with the records log and materials to be submitted for assessment, Chance and FNNND will collaboratively review and agree to the records log and materials prior to submission to any regulator or assessor.

7.0 Adaptive Management of the Engagement and Communication Plan

Chance and FNNND will review and assess the effectiveness and success of this Plan on at least a 6-month basis. There will be a meeting to check in on the progress made by both parties in implementing the Plan within 3 months of the Plan first being agreed to and implemented, and a schedule for review of the Plan will be developed at that time.

APPENDIX B
Ministerial Order 2018/42

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YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,

(d) oil and gas permit No. 0015,

(e) oil and gas permit No. 0016,

(f) oil and gas permit No. 0017. « *permis visé* »

2 The renewal term of each subject permit is extended by five years (so that it ends on August 30, 2023).

3 The resulting total length of the initial term and the renewal term of a subject permit is 16 years.

MO-OGA-18-07 (ExtPrmt)-E06-F01-FIN

YUKON

CANADA

ARRÊTÉ MINISTÉRIEL 2018/42

LOI SUR LE PÉTROLE ET LE GAZ

Le ministre de l'Énergie, des Mines et des Ressources, conformément à la *Loi sur le pétrole et le gaz*, arrête :

1 La définition suivante s'applique au présent arrêté.

« permis visé » Les permis suivants de pétrole et de gaz détenus par Chance Oil and Gas Limited :

a) permis de pétrole et de gaz nº 0012;

b) permis de pétrole et de gaz nº 0013;

c) permis de pétrole et de gaz nº 0014;

d) permis de pétrole et de gaz nº 0015;

e) permis de pétrole et de gaz nº 0016;

f) permis de pétrole et de gaz nº 0017. "*subject permit*"

2 La durée du renouvellement de chaque permis visé est prolongée de cinq ans, de façon à ce qu'elle se termine le 30 août 2023.

3 La durée totale d'un permis visé, y compris la durée initiale et la durée du renouvellement, est de 16 ans.

2018/42

4(1) In this section

"first nations communications and engagement plan" means the plan filed under O.I.C. 2016/169 and revised in accordance with M.O. 2017/37. *« plan de participation et de communication avec les premières nations »*

(2) It is a condition of this Order that Chance Oil and Gas Limited must file annual reports with the Division Head, in accordance with subsection (3) and to the satisfaction of the Division Head, about the implementation of the first nations communications and engagement plan.

(3) For the purposes of subsection (2), Chance Oil and Gas Limited must file

(a) the first annual report on or before July 31, 2019, in respect of the period beginning on September 1, 2018, and ending on May 31, 2019; and

(b) each subsequent annual report on or before July 31 of each year in respect of the period beginning on June 1 of the preceding year and ending on May 31 of the year in which the report is to be filed.

Dated at Whitehorse, Yukon,
~~Oc~~ August 30th 2018.

4(1) La définition suivante s'applique au présent article.

« plan de participation et de communication avec les premières nations » Le plan déposé en vertu du Décret 2016/169 et révisé en conformité avec l'Arrêté 2017/37. *"first nations communications and engagement plan"*

(2) À titre de condition du présent arrêté, Chance Oil and Gas Limited dépose des rapports annuels auprès du chef de division, en conformité avec le paragraphe (3) et à la satisfaction du chef de division, concernant la mise en œuvre du plan de participation et de communication avec les premières nations.

(3) Pour l'application du paragraphe (2), Chance Oil and Gas Limited dépose :

a) le premier rapport annuel au plus tard le 31 juillet 2019, pour la période débutant le 1er septembre 2018 et se terminant le 31 mai 2019;

b) chaque rapport annuel subséquent, au plus tard le 31 juillet de chaque année pour la période débutant le 1er juin de l'année précédente et se terminant le 31 mai de l'année au cours de laquelle le rapport doit être déposé.

Fait à Whitehorse, au Yukon,
le August 30th 2018.

[redacted]

Minister of Energy, Mines and Resources/Ministre de l'Énergie, des Mines et des Ressources

MO-OGA-18-07 (ExtPrmt)-E06-F01-FIN

APPENDIX C
Map of Chance Dispositions and Wells

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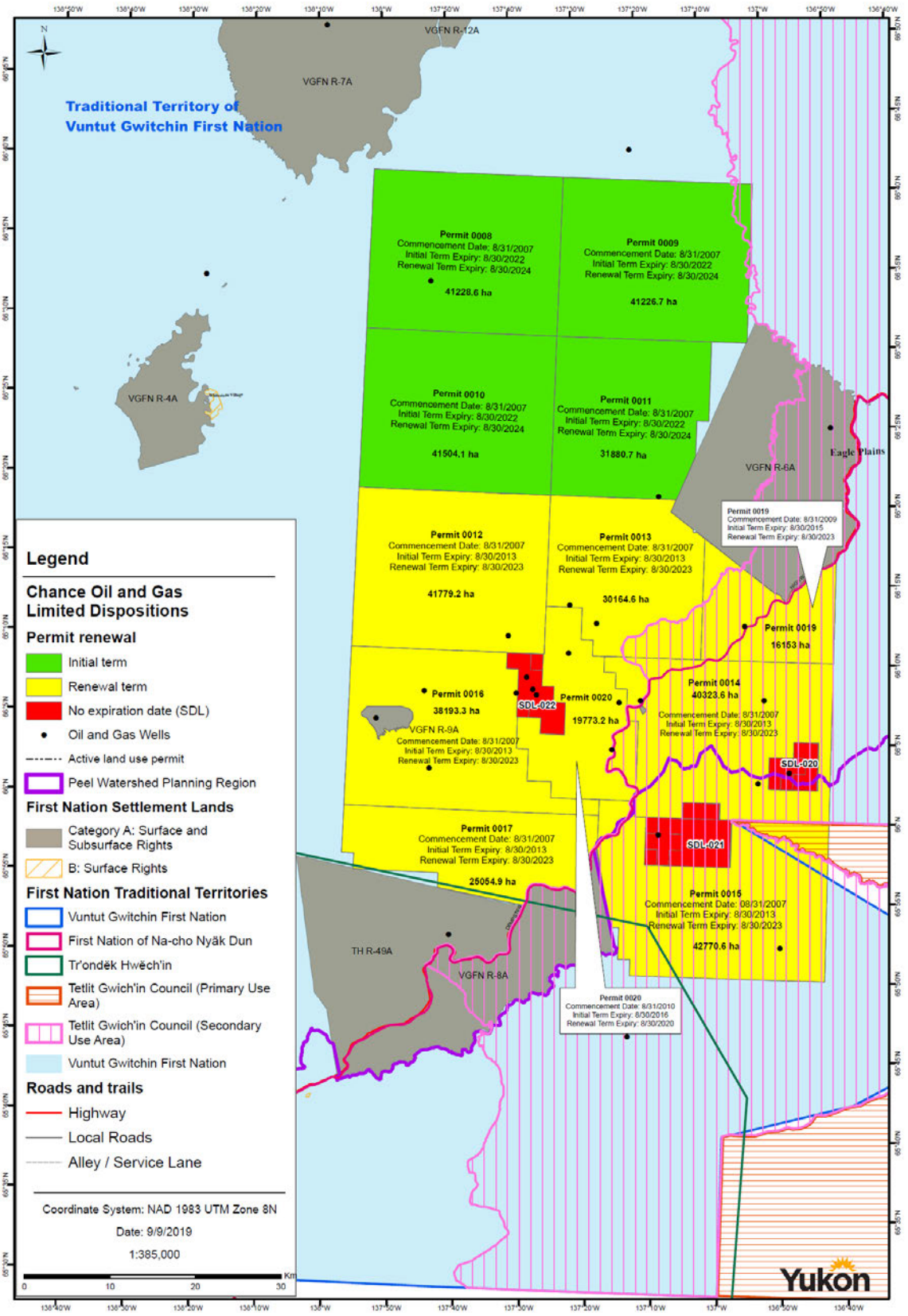
Chance Oil and Gas Limited Dispositions and Wells



APPENDIX D
Engagement Log

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APPENDIX D: Chance Consultation Log

Reference	Date	Contact Type	In / Out	Organization	[redacted]	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00072	January 4, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Meeting agenda
E00131	January 7, 2019	Phone Call	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Engagement/Consultation Meeting Coordination/Planning	FNNND cancelled the meeting with Chance Oil and Gas due to lack of progress made on meeting agenda items.
E00064	January 9, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Flight, hotel details for booking by Chance, per diem, gas and mileage expenses for Vancouver meeting
E00134	January 9, 2019	Phone Call	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	FNNND called [redacted] regarding the logistics of the All-Party Meeting.
E00067	January 10, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Preference of invoice to Chance, or cheque ready from Chance for per diems
E00065	January 11, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Connecting [redacted]
E00135	January 11, 2019	Phone Call	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Chance received a voicemail from FNNND regarding the All-Party Meeting.
E00077	January 11, 2019	Email	Out	Vuntut Gwitchin First Nation Tr'ondëk Hwëch'in First Nation of Na-cho Nyäk Dun Gwich'in Tribal Council Tetlit Gwich'in Council (DGO) YG	[redacted]	Hemmera, Richard Wyman, Greg Charlie, Cindy Dickson	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Attached Draft Working Agenda for All Party Meeting Feb 1. To be finalized
E00137	January 14, 2019	Phone Call	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Chance called FNNND regarding attendance and logistics for the All-Party Meeting.
E00139	January 17, 2019	Phone Call	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	FNNND called Chance regarding logistics for the All-Party Meeting.
E00140	January 17, 2019	Phone Call	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Chance called FNNND regarding the logistics of the All-Party Meeting.
E00020	January 22, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Working on details to get back to [redacted]
E00070	January 22, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Contribution agreement between Chance and FNNND for all party meeting, discussion of Chance's contribution to expenses
E00101	January 22, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Let me know if you need more information
E00052	January 24, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Accommodations secured
E00089	January 24, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Hotel rooms available
E00147	January 24, 2019	Phone Call	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	FNNND called Chance regarding reimbursement for expenses for the All-Party Meeting.
E00080	January 28, 2019	Email	Out	Vuntut Gwitchin First Nation First Nation of Na-cho Nyäk Dun Gwich'in Tribal Council YG	[redacted]	Hemmera, [redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Final All Party Meeting Agenda for Feb 1
E00037	January 29, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Add [redacted] as team rep for NND
E00114	January 30, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Will add [redacted] to printed agenda
E00167	February 15, 2019	Email	Out	Vuntut Gwitchin First Nation First Nation of Na-cho Nyäk Dun Gwich'in Tribal Council YG	[redacted]	Hemmera, [redacted] ff	[redacted]	Engagement/Consultation	Draft summary of Tuesday Feb 5, all-party meeting for review. Feel free to share to teams
E00154	February 18, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Confidentiality Agreement Engagement/Consultation	Asking for Confidentiality Agreement and Capacity Funding update, or whether more information is needed.
E00165	March 26, 2019	Letter	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Tenures/Dispositions/Permits	Request to extend tenure on Exploration Permits 0006-0011 and 0019 at Eagle Plains
E00245	May 8, 2019	Letter	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation	Congratulations from Chance to Chief [redacted] on his re-election to be Chief for another term. Have enjoyed working with Chief [redacted] in the past, and look forward to future work. Chance is advancing plans to continue exploration at Eagle Plains and it would be helpful to meet with Chief, council and key government staff members to update plans and get feedback in accordance with Engagement and Communications Plan.
E00246	May 9, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation	Thank you for recognizing the economic opportunities in our traditional territory. We look forward to creating a solid relationship with industry and creating a template for future generations.
E00243	May 10, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	With election over, asking if possible to meet with Chief and new council next month to provide an update of exploration project status and plans going forward. Possibly June 10, in Mayo, also able to meet with members of Land and Resources Dept to give an update.
E00247	May 14, 2019	Phone Call	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Richard called Simon to follow up email from last week requesting meeting on June 10th. Left a message.
E00249	May 21, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Site Visit/Field Work	Required to consult under geoscience license guideline to inform VGG, NNDFN and Tetlit Gwich'in Council that field work is planned July 10-24, 2019. Will be based out of Eagle Plains Lodge with helicopters. Will be flying to remote outcrop locations through out Eagle Plains Basin to extract rock samples with geological hammer. No mechanical tools will be used.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00276	May 22, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Site Visit/Field Work Engagement/Consultation	Had sent e-mail to [redacted] but as she is no longer with NNDFN, was transferred to [redacted] by front desk, so assuming Josee has taken on responsibilities of [redacted] position. Following up about field work for summer. Working with Hemmera to set up a meeting with NNDFN to provide an update and present Project Description for June 10th. Required to consult under geoscience license guideline to inform VGG, NNDFN and Tetlit Gwich'in Council that field work is planned July 10-24, 2019. Will be based out of Eagle Plains Lodge with helicopters. Will be flying to remote outcrop locations through out Eagle Plains Basin to extract rock samples with geological hammer. No mechanical tools will be used.
E00277	May 23, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Josee is acting in position until further notice and appreciates communication about the project. June 10th marked on calendar. [redacted] can contact Colleen to make arrangements. Let [redacted] know if needing any field works for summer field work.
E00278	May 23, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thank you for your e-mail, will coordinate with [redacted] for June 10th Meeting.
E00454	June 3, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Coordinating the June 10 meeting with Chance. I just want to confirm we have a room available. We will have handouts, so we won't need a projector. Could we arrange transportation to and from the airport for the meeting with you?
E00455	June 3, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Pick up at the airport is not a problem. I booked the Multi purpose room. What time is the meeting going to be at? And do you have posters to put up? Anything else I need to do?
E00456	June 3, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thank you for booking the room and arranging a ride from the airport. We will have a few posters to put up and will have hand out material. Greg, what time did we decide for the meeting?
E00459	June 3, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	The meeting will be 10-12. We're wondering if everyone who is joining us for the meeting would like to get lunch after. Is there a restaurant in town we could all go to or would it be possible to arrange catering?
E00460	June 3, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I could arrange someone to cater. Is there a poster you want me to post around town?
E00461	June 3, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I don't think we need posters around town. We will host a community even later and then need to post posters around town. For lunch, it will be 5 of us from Chance, and then those that attend from FNNND. Do you think the restaurant can accommodate a large group and where is it? Do you think that group would rather go out for lunch or have it catered?
E00471	June 5, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Project Description/Activities	Catering would be best. I lined up a caterer for June 10.
E00265	June 6, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Project Description/Activities	Finalizing agenda and calendar invite for meeting between Chance and First Nation of Na-cho Nyäk Dun the following week
E00293	June 6, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Meeting invitation for June 10, 10-1. This meeting is for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin. Additional agenda items include next steps with YESAB and the process for reviewing Na-cho Nyäk Dun Project Effects as well as the annual reporting required on the implementation of the Engagement and Communication Plan.
E00297	June 6, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thank you, looking forward to meeting on June 10th.
E00319	June 6, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Confirming the orange room is reserved for meeting on June 10.
E00295	June 7, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	Draft Project Description and presentation for meeting attached. Please distribute to those attending the meeting. Will bring paper copies. Please provide an estimate of attendees.
E00420	June 7, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	We have a little portable projector and I'm wondering if you think we should bring it?
E00259	June 11, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Information Sharing Engagement/Consultation	Sending background information following meeting.
E00477	June 13, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Information Sharing	[redacted] - can you please invoice Geoscience for the catering of this meeting. [redacted]
E00269	June 14, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Site Visit/Field Work Engagement/Consultation	Attached details for First Nation's participation in Chance's fieldwork this summer. Still finalizing dates and logistics. Role profiles are in attachment, and aiming to have dates finalized next week. Please give thought to potential participants.
E00478	June 14, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement	[redacted]

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00261	June 17, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation Site Visit/Field Work	Dates set for participation in Field Surveys. Proposing following logistics for First Nation participation: 1) Each FN with territory overlapping project area can have up to two members participate 2)Work will be physically demanding, require hiking steep, rugged terrain and thick bush, requiring average or above-average fitness to participate 3)Limited spots for participants due to helicopter constraints ad availability at Eagle Plains Hotel, so please respond as soon as possible to [redacted] Hemmera) to confirm availability 4) Participants should arrive on start date, but not mandatory to stay for duration of field study 5) all travel, including flights, vehicle travel to Eagle Plains Hotel, ad stay in Hotel must be booked by the First Nation and billed to Chance. Table of Opportunities by date. Purpose of participation will be to observe fieldwork and gain first hand understanding of the research. Deadline for Vegetation Survey # 1 is June 19th.
E00254	June 24, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Fish Information Sharing	Attached notice letter regarding DFO licence application for Environmental Dynamics Inc's fish studies
E00256	June 24, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation	Thank you for information on DFO Application. Please copy [redacted] on any future communication between NND and Chance.
E00257	June 24, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation	Confirming instructions to copy [redacted] going forward.
E00266	June 25, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Information Sharing Engagement/Consultation	Draft Summary of June 10 meeting in Mayo between Chance and First Nation Na-cho Nyäk Dun
E00314	June 27, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Fish Information Sharing	Revisions from EDI for their DFO Application, see Attached
E00483	July 9, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	[redacted] Visit/Field Work	Have you had any interest for participation in the Chance field surveys? Below I've highlighted the surveys there's still time to participate in.
E00485	July 9, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Site Visit/Field Work	I corrected my highlighting below to include all the surveys at the end of July and early August. These are the surveys available to join
E00591	July 15, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	We would like to meet with you and other interested government representatives on Aug 12 in Mayo if that works for you. My colleagues and our Hemmera advisors will be returning from the GA in Old Crow on Aug 10 via Dawson so it might make sense for us to continue our engagement discussions as we advance towards a YESAB submission early in 2020. We would rent a vehicle in Dawson and drive to Mayo for the meeting. Please let us know if this will work.
E00488	July 16, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Hemmera has prepared draft reports on the Implementation of the Communications and Engagement Plan for both VGG and Chance to review. This report summarizes meeting we have had since completing the plan. Please make any desired revisions to the document in tracked changes and send back to me to finalize. Once I have incorporated the changes, I willl send final versions to both parties to sign. Please have revisions in by July 26, then I will finalize, get them signed and submit to Yukon Government for July 31.
E00491	July 24, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	I am following up on 2 items for Chance: the draft Communications and Engagement Plan Implementation Report, and a proposed meeting on August 13 in Mayo. Would FNNND like to provide feedback on the draft report? I'm looking for feedback by Friday. Chance team in Dawson Aug 12 and proposing travel to Mayo Aug 13. Chance would like to discuss project updates and a Cooperation Agreement template. FNNND also mentioned that meeting with Chief and Council might be good. Please let us know.
E00320	July 25, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Following up about meeting on August 12th to discuss the exploration project and related discussions such as cooperation and capacity funding arrangements. Would like to change to August 13th, as there is a conflict on August 12 meeting with TH in Dawson. Are you able to meet with us August 13, in Mayo?
E00321	July 25, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Inquiring why they are not meeting together with the First Nations, instead of separately.
E00322	July 25, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Chance would love to meet collectively with all the affected First Nations, but have not had indications from the various First Nation governments that they wish to continue gathering in All Party meetings. I do feel there is merit in meeting all together where Value Components of the Eagle Plains area are in common. Is it possible to meet with you and your colleagues on August 13 in Mayo? Would be driving from Dawson and returning to Dawson the same day.
E00500	July 25, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Attached are Chance's edits to the Draft Plan Implementation report

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00536	July 30, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Following up on FNNND Comments on Draft Implementation Report. I left a voice mail, and also followed up with Ronaldo yesterday, but have not hear back. Final report is due to YG tomorrow. Hoping you could review and sign off on the content. Please let me know if you would like to provide revisions by noon tomorrow so we revise with your feedback, otherwise I will submit to YG tomorrow at 4 pm.
E00543	July 31, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Hemmera has prepared reports for YG on behalf of Chance on the implementation of the Communications and Engagement Plan that FNNND and Chance completed last summer. It was previously discussed that both FNND and Chance would review this report and sign to demonstrate both parties agree to the report's contents. I have not heard back, and will submit the report to YG as a draft, however we welcome your feedback.
E00544	July 31, 2019	Email	Out	First Nation of Na-cho Nyäk Dun YG	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Attached annual report on the Implementation of the FNNND and Chance Engagement and Communication Plan. This report has been reviewed and signed by Chance, but has not yet been reviewed or signed by FNNND despite our best efforts to send the draft report and follow-up. I will let you know if I receive any feedback.
E00346	August 9, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Great to connect by telephone this morning. Following up to bring awareness to colleagues and advisors at Hemmera of the potential to meet with you and your new council on Aug 13 in Mayo. This will be an opportunity to introduce ourselves to those unfamiliar with Chance and to summarize what our exploration plans are. We are presently in Old Crow attending the GA but travelling to Dawson on Saturday to meet with TH officials. If you are able to arrange to meet with us, we will drive to Mayo Tuesday morning, so could be there about 10 am. We have to be back in Dawson for 3:30pm. Thanks for setting this up on short notice and we look forward to meeting with you and members of your council.
E00388	August 9, 2019	Phone Call	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Meeting Coordination/Planning	Chance called NNDFN about meeting with Council at 10 am on August 13th, 2019. NNDFN said they would organize a group for the meeting and would call back on August 12th to confirm the meeting.
E00390	August 12, 2019	Phone Call	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Chance called FNNND and FNNND confirmed they were unable to meet on August 13 and requested to meet at another time.
E00602	January 28, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Regulatory Process	Chance will be applying to the Yukon Government very shortly to extend the tenure of Exploration Permit 20. Application will be for maximum allowable under the Oil and Gas Act of 5 years. This permit has one suspended well at McParlon A-25 which we hope to use for fluid disposal of any produced water associated with the proposed exploration project. We are at an intermediate stage of discussions with the Manager of Oil and Gas Operations with Yukon to extend the suspended well status on the suspended wells at Eagle Plain. Manager has indicated hat Chance will need to do some physical assessments of the legacy wells to confirm the integrity of the wells before granting an extension. Assessments will require access to 3 suspended wells at SDL M-08, G-08, and J-19 and well as M-59 in order to do the work. A service rig, cement pumping equipment, and wireline services are expected to be used to conduct the assessments. Anticipate taking temperature measurements in wells to evaluate permafrost depth. The program is expended to take 1-2 months. This is a winter operation and will be done during the winter of 2020-2021 and may require Designated Office screening b y YESAB. We will provide more information as soon as we can.
E00646	March 23, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Information Sharing	Chance Oil and Gas (COG) has several initiatives on the go, some of which are time sensitive, and all require engagement with the affected First Nations. The following is a summary of these initiatives: 1.Application to the Yukon Government to get tenure extension on Exploration Permit 0020 which is set to expire on August 30, unless extended. This permit is located mostly in the Traditional Territory of the Vuntut Gwichin, but a portion is in the Secondary Use Area of the Tetlit Gwich'in and in the overlap area with the Na-cho Nyak Dun Traditional Territory. There is a suspended well in this Permit at McParlon A-25 which has ongoing value to COG. 2.There are several suspended wells at the Chance Significant Discovery License (SDL 022) and one at the Blackie SDL (SDL 021) which the Yukon Government requires COG to undertake some maintenance work. This activity will require an impact assessment by the Designated Office (DO) of YESAB in Dawson prior to permissions being granted by Yukon to undertake the work. The plan is to submit to the DO the program in the next month or so with the objective of being able to do the work over approximately a 6 week to two month period in the winter of 2020-2021. This is a regulatory requirement made by the Manager of Oil and Gas Operations with the Yukon Government. Importantly for your knowledge, there is no indication that these suspended wells have any problems, but they are wells that were drilled in the 1960's so the regulator has asked for work to be done in order to be able to continue the suspended status of these wells. 3.Continuing engagement with respect to the multi-well drilling and seismic data acquisition project that has been described to you in the past couple of years. A current map of COG landholdings is attached for your reference. In view of the COVID 19 outbreak, travel and face to face get togethers are not appropriate, if not prohibited, so we will have to make arrangements to exchange information in writing, electronically and by conference call. There is quite a geographic spread for all of us to manage and I look forward to hearing your preferences for engagement. Also, please forward this email to anyone I have missed who is working on the COG file.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00673	May 25, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities DO Project	Chance Oil and Gas Limited is preparing a proposal for well maintenance work in the Eagle Plains. Please see the attached letter meant to initiate engagement and to provide initial project information. Please let me know if you have any issues opening the attachment.
E00675	May 26, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities DO Project Engagement/Consultation	Your message [redacted] Subject: Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with First Nation of Na-cho Nyäk Dun) Sent: Monday, May 25, 2020 2:13:19 PM (UTC-08:00) Pacific Time (US & Canada) was read on Tuesday, May 26, 2020 4:35:24 PM (UTC-08:00) Pacific Time (US & Canada).
E00818	May 26, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Email read receipt
E00682	June 9, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	I hope all is well, just following up from our program description from couple of weeks ago, if you have any question and comments, please contact us. if you would like us to arrange a call with your team, we would be happy to do so and provide you with an overview of the program.
E00796	June 9, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	I hope all is well, just following up from our program description from couple of weeks ago, if you have any question and comments, please contact us. if you would like us to arrange a call with your team, we would be happy to do so and provide you with an overview of the program.
E00797	June 24, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	I wanted to reach out and see if you had any questions about Chance's proposed well maintenance work. I've re-attached our May 25th letter that was sent via email. As [redacted] mentioned below, we'd be more than happy to set up a conference call to provide a brief overview of the project and answer any questions you might have.
E00819	June 25, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Email read receipt
E00710	July 13, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Hemmera has prepared a draft report on implementation of FNNND and Chance Engagement and Communication Plan for FNNND and Chance to review. This report summarizes meetings/correspondance that have occurred between FNNND and Chance since completing the 2019 Annual Report. I have attached the draft as a Word Document, if both FNNND and Chance could make revisions to that document in tracked changes, that would assist me in creating a final version. If there are any issues that arise between parties' revistion, we can address them via e-mail or a quick call. Once revisions have been incorporated and the document is considered final by FNNND and Chance, I will send the final version to both parties to sign. I have also attached, as a pdf, a draft of FNNND and Chance's Engagement Log which functions as Appendix D for the report. Please complete reveiws by Friday, July 24th. Reminder that reports need to be signed and submitted to YG on July 31st.
E00741	July 14, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I'm noticing a discrepancy between an email address we used to have on file for you and one that I've received some read receipts from recently (and that's also on the FNNND website). Is this your correct address? If I don't hear from you today/tomorrow, I'll give you a call to confirm.
E00767	July 20, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Chance Oil and Gas (Chance) is nearing completion of its proposal for well maintenance in the Eagle Plains and hopes to submit to the Yukon Socio-Economic and Environmental Assessment Board within the next two weeks. Chance and Hemmera provided an introductory letter, project summary, and map via email on May 25, 2020 and again on June 24, 2020. Our original correspondence was to Chief [redacted]. However, I may have used an outdated emails address for [redacted] so I've included an updated address as well as the previous one. We value any feedback First Nation of Na-cho Nyäk Dun may have with respect to this proposed project and look forward to working with you during the assessment process.
E00742	July 24, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I wanted to check in and see how your review of the draft engagement report was going? My apologies for not doing this sooner in the week. Despite my typo below, these reports are due to Yukon Government July 31, 2020. Not 2019, there is no time travel involved.
E00766	July 24, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Attached is a draft copy of Chance Oil and Gas (Chance)'s YESAB Project Proposal for the Eagle Plains Well Maintenance Project. In order for Chance to get all its approvals in hand before thw winter season, Chance's application will need to be submitted very shortly after sending this draft to you. At this time, our goal is to submit the Project Proposal middle of next week. As this document has not gone through Hemmera's formatting procedure, it is absent some of the figures and appendices. However, I've attached the Spill Response Plan which will be Appendix B. Chance continues to be committed to engaging with the First Nation of Na-cho Nyäk Dun. Should you wish to discuss the proposed Project in more detail, please don't hesitate to contact Chance or Hemmera.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00743	July 31, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Please see attached for the 2020 Annual Report on the Implementation of the First Nation of Na-Cho Nyäk Dun (FNNND) and Chance Oil and Gas Engagement and Communication Plan. This report has been prepared using meeting agendas and summaries drafted by Hemmera and subsequently reviewed and agreed to by the parties. This report has been reviewd by Chance, but not reviewed by FNNND, despite our best efforts. The signature lines have been removed and the Draft waterark remains. Should FNNND wish to provide edits at a later date, we would be happy to incorporate them and prepare a final report, including signatures, for submission to Yukon Government.
E00745	August 3, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation	My correct email address is: landsmanager@nndfn.com
E00744	August 3, 2020	Email	In	First Nation of Na-cho Nyäk Dun YG	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	We will be reaching out for a potential meeting update with you upon my return after August 18th, 2020.
E00775	August 7, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	This email is intended to give you early notice that Chance Oil and Gas has not yet submitted our Well Maintenance Program Project Proposal to YESAB due to evolving discussions with the regulator. The amendments are being incorporated into the Project Description and effects assessment over the next week or two as we manage vacation absences. Once updated, we will share the updated YESAB submission with you to review. I suggest that a follow up conference call or Microsoft Teams meeting be arranged to address your questions or respond to your comments to the amendments.
E00999	August 21, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities	Email read receipt
E00872	August 27, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	Email read receipt
E00909	August 28, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities	Further to Richard's email dated August 7th (attached), Chance Oil and Gas (Chance) has made a few revisions to their Project Description for the Designated Office Evaluation of their proposed Well Maintenance Program. As a result of those changes, Hemmera has also revised the effects assessment sections of the Project Proposal. Below are the reasons for the revision that have been provided to us by Chance and a brief summary of the amendment itself: 1.Ongoing conversations between Chance and Yukon Government, Oil and Gas Branch (YG) have necessitated changes. While Chance was previously of the impression wells could continue to be suspended, YG is now directing Chance to conduct inspection and maintenance activities for all eight suspended wells and then abandon those wells or bring them into active status (i.e., end the period of well suspension). Chance is now proposing to abandon six wells (i.e., M-59, M-08, J-19, G-08, B-73, and H, 28) and to bring the remaining two wells (i.e., A-25 and E-78) into active status as deep-injection wells. Waste fluid produced during the abandonment of the six wells can then be disposed of via injection into the deep-injection wells. No oil or gas is expected to be produced from the two wells proposed to be activated; they would specifically be used for disposal of waste fluid from activities associated with these maintenance activities. (See sections 2.1.4 and 2.1.5 for further description) 2.At this time, Chance cannot confirm whether it will use the Eagle Plains Hotel or the existing Chance Camp for housing workers over the duration of the Project. The decision to utilize the Eagle Plains Hotel or the Chance Camp will be made when the Project schedule is finalized. It will also have to take into consideration the Hotel's ability to accommodate Chance workers over the full duration of the Project as well as COVID-19 related self-isolation requirements at that time. As a result both options are considered in the effects assessment for the housing of the project workforce. (See sections 2.2 and 2.3 for further description) 3.When the Chance field team were at Eagle Plain early August, they observed that the route used to access M-59 would require realignment of the final portion of Blackie Winter Road. The section of the original route that proceeds north for the final kilometer is not ideal for traffic due to steeper terrain. The steeper route would result in a significant risk to the trucks bearing heavy loads, fuel supply, and other fluid handling shipments. Chance is proposing shifting the final portion of Blackie Winter Road east of the original route in order to attain a much gentler gradient. (See section 2.1.1 and Figure 2-1 for further description) Each of the amendments above are described with additional detail within the attached revised Project Proposal. As previously, not all appendices are complete yet but will be
E00871	August 29, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	Email read receipt
E00903	September 15, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Project Description/Activities	Since my email dated August 28th, Hemmera has been in the final stages of concluding the revised DO Project Proposal for Chance's Well Maintenance program. We have appreciated your feedback and worked to include that into the application. As you know, Chance's timeline for completing this work was tied to compliance with regulations, so in an effort to ensure that the maintenance activities could occur this winter Chance needed to submit the application last week. It was submitted late Friday evening and today Hemmera received confirmation that the project was on the YESAB registry. We acknowledge that you may have future comments on the project as it progresses through the YESAB process. We continue to look forward to hearing your views and are happy to hold additional meetings to discuss and answer any questions you may have. Please see the link to the registry here: Project 2020-0151 Eagle Plains Well Maintenance and Winter Activities

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00857	September 16, 2020	Email	Out	First Nation of Na-cho Nyäk Dun Vuntut Gwitchin First Nation YG	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project Cooperation Agreement	Attached is the most recent agreement we have with signatures from all parties to section 68 of YOGA. Hope this helps with the start of our discussion on the Workover Project. Please feel free to let us know what would be the next steps to begin our discussion.
E00928	September 17, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Benefits/Capacity Agreement DO Project Engagement/Consultation	I am providing a short update to set the stage for discussions to begin as soon as possible regarding a Benefits Agreement among the First Nation of the Nacho Nyak Dun (NND), the Vuntut Gwitchin First Nation (VG), Yukon Government (YG) and Chance Oil and Gas (Chance) in accordance with Section 68 of the Yukon Oil and Gas Act. Hemmera, acting on behalf of Chance, filed a project description with the Designated Office of the Yukon Environmental and Socio-Economic Assessment Board in Dawson last week concerning required work on eight suspended wells operated by Chance at Eagle Plain. The project is small scale and is anticipated to be completed in a two to three-month period during the winter of 2020-2021. The plan is to prepare for and abandon six of these wells and convert two others to be used for disposal of well bore fluids used in the abandonment procedures and/or recovered in the process. The activities are governed by YG oil and gas regulations and are routine oilfield practices. Details are provided in the submission document, but if you have any questions or comments, please feel free to contact me or any of my colleagues. The project area is mostly in the traditional territory of the VG, but one of the wells to be abandoned is located in the overlap area on the east side of the Dempster at Blackie M-59 which is also in Significant Discovery License 021. Although small scale, the project triggers the need for a benefits agreement with the First Nations who are affected by the activities, YG acting on behalf of all Yukoners and the proponent, namely Chance. Please advise who from the NND will be negotiating this Benefits Agreement so arrangements can be made to begin discussions.
E00883	September 18, 2020	Email	Out	Vuntut Gwitchin First Nation YG First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Meeting Coordination/Planning	I just wanted to follow up and hope everyone had a chance to review the last BA agreement. I would suggest that we set up a call sometime soon to discuss on how we want to proceed with section 68 negotiations. As I am away all next week, however I have include[redacted] so they can be available if the parties do agree to discuss next steps. We look forward to your response.
E00955	September 21, 2020	Phone Call	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project	Phone message left
E01001	September 21, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Jobs/Contracts Education and Training	I am sending some information for opportunities to work on the service rig. The attachments are all the forms that need to be completed. There will be a need to have some training prior to being able to complete these forms (H2S Alive, WHMIS, First Aid and TDG).
E00834	November 2, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	After further consideration of the proposed Project (Eagle Plains Well Maintenance and Winter Activities) activities and the requirements of the Yukon Oil and Gas Act, Chance Oil and Gas Ltd. (Chance) has determined that changes are required to the Project submitted to the Dawson Designated Office on September 11, 2020 (Project #2020-0151). As such, Chance has decided to withdraw its Project proposal and will be informing the Yukon Environment and Socio-Economic Assessment Board today, November 2, 2020. Chance intends to incorporate changes into a revised Project proposal. Once the revised proposal has been drafted, Chance will notify you by sharing a draft and requesting a meeting to discuss the changes further. After Chance has discussed those changes with the First Nation of Na-cho Nyäk Dun, the Project proposal will be finalized and resubmitted to the Dawson Designated Office. Chance understands and appreciates that making changes to this Project a second time is requesting additional effort and capacity of the First Nation of Na-cho Nyäk Dun. Chance looks forward to continuing to work with the First Nation of Na-cho Nyäk Dun and will do its best to ease this process.
E00905	November 2, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	After further consideration of the proposed Project (Eagle Plains Well Maintenance and Winter Activities) activities and the requirements of the Yukon Oil and Gas Act, Chance Oil and Gas Ltd. (Chance) has determined that changes are required to the Project submitted to the Dawson Designated Office on September 11, 2020 (Project #2020-0151). As such, Chance has decided to withdraw its Project proposal and will be informing the Yukon Environment and Socio-Economic Assessment Board today, November 2, 2020. Chance intends to incorporate changes into a revised Project proposal. Once the revised proposal has been drafted, Chance will notify you by sharing a draft and requesting a meeting to discuss the changes further. After Chance has discussed those changes with the First Nation of Na-cho Nyäk Dun, the Project proposal will be finalized and resubmitted to the Dawson Designated Office. Chance understands and appreciates that making changes to this Project a second time is requesting additional effort and capacity of the First Nation of Na-cho Nyäk Dun. Chance looks forward to continuing to work with the First Nation of Na-cho Nyäk Dun and will do its best to ease this process.
E00835	November 17, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	We appreciated the[redacted]. I would like to take the time to introduce you to our new FNNND representative: [redacted] will now be the primary FNNND contact person on this project. Please add him (and keep me) on the email distribution list.
E00836	November 18, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	I'll be sure to include[redacted] on all future emails.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00837	November 18, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	I will definitely include Skeeter on all future emails regarding Chance's DO project (Well Maintenance and Winter Activities). Should I also include him on future emails regarding Chance's Executive Committee project (Eagle Plains Exploration)?
E00838	November 18, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Yes please and thank you.
E00890	November 19, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Project Description/Activities	Further to my email dated November 2nd (attached), Chance Oil and Gas (Chance) has revised its Project Proposal (including updated Project Description and Effects Assessment) for Designated Office Evaluation. Below is the key project component that has changed: •Extended Flow Testing: After maintenance activities are complete and depending on wellbore integrity (as confirmed through maintenance activities), Chance proposes to conduct Extended Flow Testing (EFT) on up to three of the wells which have the highest potential for natural gas reserve. The reason for this change is to allow Chance to gather important information about the nature of the natural gas resource accumulation and its productive capability. a.Wells proposed for EFT are M-59, M-08, and J-19 (see PDF attached for Figure 2-1). Please note, Figure 2-1 is currently being updated to reflect this change. b.Revert up to three wells to suspended status (if the EFT results prove to have sufficient resource). c.Abandon three to six wells (the three remaining wells (G-08, B-73, and H-28) will be abandoned and up to additional three wells may be abandoned if wellbore integrity is not confirmed or if EFT results prove insufficient resources). •Timelines: If work cannot be completed this winter season (due to low snow pack, COVID considerations, or permitting delays), Chance will complete the project during the winter of December 2021 to March 2022. Additional detail is within the attached revised Draft Project Proposal. While revisions were made throughout the document, Section 2.1.3 is the substantive addition with respect to EFT. We've attached both a clean version and a version with tracked changes to facilitate your review. Given the very short time frame for winter work, Chance will be submitting the application to YESAB on Friday, November 20th. Hemmera anticipates FNNND requiring additional discussions with Chance to review these changes and look forward to scheduling a meeting where we can discuss these matters further to support your future submissions to the YESAA process.
E01020	November 20, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities Engagement/Consultation	[redacted] I'm reviewing the documents as well as some of the previous work by FNNND. As a recent addition to the FNNND representatives, I'll also be conferring with others at FNNND.
E01021	November 20, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities Engagement/Consultation	I need to amend my email sent yesterday. While Chance would like to submit as soon as possible, the submission will be delayed until mid next week. If the First Nation of Na-cho Nyäk Dun has any immediate concerns, please contact us and we'll make scheduling a meeting a priority.
E01022	November 23, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]		[redacted]	DO Project Project Description/Activities Engagement/Consultation	Let me know if there is anything you need from me.
E00839	November 25, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Further to the notes below, please send me the earlier YESAB submission and a list of changes in the next submission. It would allow me to do a faster review.
E00858	November 25, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	Email read receipt
E00840	November 26, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	Calista Morrison	Hemmera	Skeeter Wright	DO Project Engagement/Consultation Project Description/Activities	I've attached an email Hemmera sent to FNNND June 2019. It includes the draft project description for Chance's Eagle Plains Exploration Project and a presentation that Chance gave to FNNND at that time. This project will go through a YESAB Executive Committee level screening. This is the project I was referring to with respect to including you on any future emails pertaining to Chance's Executive Committee project. However, Chance (and Hemmera) haven't been actively engaging on it on this project this year... We've been focused on Chance's Eagle Plains Well Maintenance Project (or subsequently called Eagle Plains Well Maintenance and Winter Activities) which will be going through the YESAB Designated Office (DO) in Dawson City. That is the proposal we've been engaging with FNNND on for the past few months. It's this project that has changed a couple times and which Chance withdrew from YESAB a couple weeks ago. I've attached a number of emails that "tell the story" and that I hope answer your question: 1.Email with original draft of the DO submission (Eagle Plains Well Maintenance Project). 2.Email fro [redacted] an stating the submission had been delayed because Chance was considering additional changes to the proposed project. 3.Email from myself with revised DO submission, including a high level overview of the changes and Chance's reasons for those changes. a.Note: This was the draft ultimately submitted to YESAB and which Chance then withdrew. 4.Email I sent last week. Contains the current version of Chance's DO submission. The email highlighted the main change (inclusion of Extended Flow Testing). The red-line version that was attached would be the best resource for seeing/reviewing the recent changes.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00841	November 26, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation DO Project Engagement/Consultation Project Description/Activities	I'll review the material and get back to you if I've any questions.
E01002	November 26, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	It's been awhile since I last seen you and worked with you! I think it was the implementation reviews we last where at the table. Anyway, welcome back and look forward working with you and if you would like an update please give me a call anytime.
E01003	November 26, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	It's also been quite a while since I had any contact with Chance (was Northern Cross at that time). I don't remember if I called them or they called me while we were working on Final Agreement chapter 12 implementation.
E00895	December 15, 2020	Email	In	Vuntut Gwitchin First Nation YG First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Meeting Coordination/Planning	As was communicated in numerous emails over the last month from COGL, I wanted to send a follow up email to see if COGL still plans to host a meeting to discuss the revised proposal this Thursday?
E00986	January 1, 2021	Email	Out	Vuntut Gwitchin First Nation First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Benefits/Capacity Agreement DO Project	Please call anytime on my cell or phone if need any information or an update. If you are in Whitehorse please stop by my office and I can provide you with more details and photos of the area we are talking about.Look forward working with you on this project.
E00985	January 11, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Benefits/Capacity Agreement DO Project	Wow, it has certainly been a while since we last spoke. I'm writing about two things. FNNND is also to be involved in the discussions you propose. I[redacted] are the two main FNNND contacts. Your proposed January 14 at 10:30 AM does not work for FNNND. I'll leave it to VGFN to suggest a time/date and see if FNNND can manage their proposed schedule.
E00897	January 19, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	A brief update on Chance's proposed Eagle Plains Well Maintenance and Extended Flow Testing project is provided below: •Project was submitted to the Dawson District Office (DO) December 24, 2020. •Adequacy Review started December 29, 2020 and was extended January 11, 2021. oThe Adequacy Review period was extended for 21 days due to the complexity of the Project. •Dawson DO issued an Information Request on January 15, 2021 Chance is currently working on its response to Information Request 1 which you can find here. Additionally, here is the link to the project's page on the YESAB registry: 2020-0197.
E01065	April 7, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Hemmera is currently resuming work on Chance's Executive Committee project titled Eagle Plains Exploration Program. Seeing as it's been quite some time since Chance and the First Nation of Na-cho Nyäk Dun (FNNND) have discussed this particular project, Chance was hoping to schedule a meeting. Some items that Chance would like to discuss are: •a refresher of the draft project description •update of events since Chance last engaged on the ExCom project •anticipated timeline for submission to YESAB, and •FNNND's preferences/guidance for engagement with its government and its citizens over the coming months. Do you have any availability the week of April 26th – 30th?
E01107	April 7, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I can rearrange my schedule for that week to meet other's needs, except I'm booked for the morning of Thursday April 29.
E01108	April 7, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I sent this to yourself and[redacted] anyone else from FNNND whose schedule we need to consider?
E01109	April 7, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted] on the NND contact list just so she can document information. I'm the functioning NND contact.
E01110	April 7, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I am tied up all day on April 26 and between 10:00 and 12:00 (MT) on April 27. The rest of the week is open though I will be in Ontario and will be 3 hours ahead of Yukon time.
E01111	April 7, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thanks everyone!
E01052	April 8, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	This is[redacted] be in attendance on behalf of the FNNND Lands and Resources department. Thank you for keeping me copied on the communications.
E01090	April 8, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	Meeting Invite: I believe this time slot works for both Chance and[redacted] will update the invite with more details tomorrow or early next week.
E01125	April 8, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I'll be "there" then.
E01126	April 15, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Attached is a draft agenda for the Chance and First Nation of Na-cho Nyäk Dun meeting April 30th. Please let me know if you have any changes you would like me to make. Then I'll finalize the agenda and attach it to the meeting invite.
E01127	April 15, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]. I've no additions to the agenda to suggest.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E01128	April 16, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Does Chance have any additions they'd like to make?
E01129	April 17, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Nothing to add from me.
E01091	April 23, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted],	Meeting Coordination/Planning Engagement/Consultation	Attaching the agenda.
E01057	April 26, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Removing "Placeholder" from the title. Attaching the agenda.
E01094	April 28, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	My apologies. I've just been told I'm to attend a meeting of a number of Chiefs at 10 AM this Friday April 30 for a couple of hours. A draft date/time was not provided to me, I just found out minutes ago. Hopefully, another date/time can be found that works for everyone.
E01095	April 28, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Not a problem! Could you send some dates/times that work for you next week? Then I'll work with Chance to coordinate their attended, and hopefully we can find something that works for everyone!
E01096	April 28, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thanks for your understanding. I'm available: May 3 Monday - all day May 4 Wed - 1 PM onward May 6 Thursday- before 3 PM May 7 Friday - after 1 PM
E01054	April 29, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Meeting Invite: Just moving the appointment to next week. Let me know if you have any issues with this time slot.
E01097	April 29, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I sent along an updated invite. If that date and time happens to not work, just let me know.
E01098	April 29, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thanks for finding a time/date that works.
E01055	May 5, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	On the off chance that there are poor connection issues during our call this afternoon, I wanted to provide a PDF copy of the presentation Richard will be running through. I will still aim to have the PowerPoint up during the call though.
E01056	May 5, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	I'm sending along this meeting invite (in accordance [redacted] email) so that it is in everyone's calendars. A draft agenda for the Chance and NYRRC meeting is below. However, it can definitely be updated if any changes are proposed.DRAFT Agenda Introduction to meeting •Introductions •Review of agenda •Meeting purpose and objectives□ Eagle Plains Exploration Project •Provide overview of Project Description •Discussion and questions□ Next Steps •Timelines •Future meetings/engagement
E01193	May 5, 2021	Meeting - Teleconference		First Nation of Na-cho Nyäk Dun		[redacted]	[redacted]	Engagement/Consultation	The purpose of this meeting was for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin. Chance provided recent information and updates regarding baseline information gathered by consultants (Environmental Dynamics Inc. (EDI), Peer Solutions, Palmer) and Parties discussed next steps with community engagement and consultation schedules for the First Nation of Na-cho Nyäk Dun (FNNND).
E01071	May 13, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning Project Description/Activities	Attached are a couple of items that were discussed during the Chance/FNNND meeting last week. The first is a memo summarizing Chance's draft engagement schedule over the summer/fall. The second is the Heritage report that Chance completed back in 2013.
E01146	May 14, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Engagement/Consultation	I've attached the May 5th Chance / First Nation of Na-cho Nyäk Dun Meeting Summary Draft for Review.
E01147	May 14, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Engagement/Consultation	I'll have a look at it this weekend.
E01159	May 18, 2021	Email	Out	First Nation of Na-cho Nyäk Dun Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Information Sharing Project Description/Activities	We recently received a report and accompanying appendices from Palmer Environmental who worked on permafrost/terrain studies as well as suitability mapping. I've attached the main memo/report from Palmer.
E01172	May 21, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Information Sharing	I wanted to check-in and see if you had any issues with downloading the maps.
E01174	May 21, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Information Sharing	The only minor hassle was that I had to go into town to do it due to my poor off grid internet connection. But that is standard procedure with off grid life and office.
E01198									
E01199									
E01200									
E01201									
E01202									
E01203									

APPENDIX 2-A-12. January 26, 2023, Meeting Summary

Eagle Plains Exploration Project – Reintroduction Meeting Minutes

January 26, 2023

Project No.: 323

DRAFT

Prepared For

Chance Oil and Gas Limited
Vuntut Gwitchin First Nation
Gwitchin Tribal Council
First Nation Na-Cho Nyäk Dun

Prepared By

Two World Consulting
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CONSULTING

Document details

Project Name	Eagle Plains Exploration Project
Document Title	Draft Reintroduction Meeting Minutes
Project No.	323
Date	January 26, 2023

DRAFT

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1. Reintroduction Meeting Details

Table 1 below outlines details of the Reintroduction Meeting.

Table 1: Reintroduction Meeting Details

Topic	Action Description
Date	• January 26, 2023
Time	• 2:00 pm – 5:00 pm
Location	• Fairmont Waterfront, 900 Canada Pl, Vancouver, British Columbia V6C 3L5

Attendees	• Chance Oil and Gas Limited (Chance)
	  • [redacted] (Chairman and CEO)
	  • [redacted] (President)
	  • [redacted] (Regulatory, Environmental and Community Relations Coordinator)
	  • [redacted] (Vice President, joined by telephone)
	• First Nation Na-Cho Nyäk Dun (NND)
	  • Chief [redacted]
	  • [redacted] Implementation & Governance Manager
	• Gwitchin Tribal Council (GTC)
	  • Grand Chief [redacted]
	  • President [redacted], Tetlit Gwitchin Designated Gwitchin Organization
	  • [redacted], External Consultant, Lands and Resources Department, GTC
	  • [redacted]., Gwitchin Development Corporation Chief Executive Officer (CEO)
	  • [redacted], Executive Assistant, GTC
	• Two Worlds Consulting
	  • [redacted] (Facilitator Support)
	  • [redacted] (Facilitator)
	• Vuntut Gwitchin First Nation (VGFN)
	  • Chief [redacted]
	  • [redacted], Intergovernmental Relations Coordinator
	  • [redacted], Executive Director

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2. Reintroduction Meeting Discussion

Chief [redacted] led a welcome prayer.

[redacted] provided a safety share and initiated introductions. [redacted] shared that he is based out of Yellowknife and looks forward to learning and listening from everyone during the meeting. Grand Chief [redacted] said he has been in his role for 2.5 years and noted he has been involved in the mining industry for many years. Grand Chief [redacted] shared how his ancestors followed caribou in the Eagle Plains area. He noted the importance of this area to his people today. Grand Chief [redacted] added that he is interested in understanding more about the Eagle Plains Exploration Project (the Project) and Chance Oil and Gas Limited's (Chance) next steps [redacted] was born and raised in Inuvik and often drives through the Eagle Plains area. She noted interest in learning more about the objectives of today's meeting. Richard said he was born in Treaty Seven Territory and is the founding shareholder of Chance (previously known as Northern Cross (Yukon) Limited) [redacted] shared that the name Chance is taken from the Chance sandstone in the Eagle Plain sedimentary basin where oil was first discovered in Yukon in 1959 [redacted] thanked everyone for joining the meeting and said he looked forward to establishing a collaborative, constructive, and respectful relationship with all the participating First Nations. Willard noted he is a Gwitchin citizen born in Tetlit Territory. [redacted] is currently an Advisor for the Lands and Resources Department at Gwitchin Tribal Council (GTC). [redacted] expressed interest in learning more about the Project and shared he had been in his role for 13 months [redacted] said she is a Yukon Gwitchin member who was raised by her grandfather. She has been with Chance for 10 years and is based in Whitehorse, Yukon. [redacted] shared that he is Red River Métis and the Executive Director of the Vuntut Gwitchin First Nation (VGFN). Chief [redacted] was born and raised in Old Crow and noted a background in oil and gas, self-government agreements, land protection and management, and early negotiations. Chief [redacted] said she was previously the Minister of Environment and had extensive experience dealing with oil and gas licensing and permitting. Chief [redacted] also shared that her intention at today's meeting was to listen and create an open dialogue around intentions [redacted] introduced herself and noted she is the Intergovernmental Relations Coordinator for VGFN. Chief [redacted] introduced himself. [redacted] introduced himself and welcomed everyone to the meeting.

[redacted] reviewed the agenda and asked everyone to share proposed changes or suggestions.

[redacted] noted [redacted] from Chance had joined the meeting via speaker phone.

Chief [redacted] said the proposed agenda topics are not where they need to be. Chief [redacted] shared that the Indigenous Nation attendees had intricate technical knowledge of the Project area. Chief [redacted] noted the Indigenous leaders at today's meeting had an internal briefing prior to this meeting. Chief [redacted] asked [redacted] what her role was during the meeting and if Two Worlds Consulting (TWC) was participating in the Project's Impact Benefit Agreement (IBA) process. [redacted] said TWC is not supporting the Project's IBA process and was recently hired to support the Project's engagement scope of work including meeting facilitation and notetaking. [redacted] added that TWC staff were happy to step out at any time if discussions related to the IBA process

were going to take place. Chief [redacted] noted that Grand Chief [redacted] opening comments highlighted the importance of the Project area to all northern Indigenous Nations. She added that the Project's existing IBAs are maturing, and further discussions related to IBAs will be required.

Chief [redacted] shared community concerns for wells that exist on the Project site and the Yukon's definition of employment and income opportunities in the *Yukon Oil and Gas Act*. Other Project-related concerns shared by Chief [redacted] included impacts to the environment, Treaty and Aboriginal Rights, extent of engagement, how Chance plans to engage going forward, permits with First Nation Na-Cho Nyäk Dun (NND), the vision to push north, the removal of 5 northern permits with respect to hydraulic and conventional methodologies, land, water, fish, and caribou protections, and the Executive Committee stage. Chief [redacted] also noted there are outstanding engagement protocols to establish to sustainably build integrity and trust with Elders and communities. She expressed interest in understanding potential request for land use permits to potentially develop or maintain existing lands including and involvement in related discussions. Chief [redacted] noted the importance of re-establishing relationships with all northern Indigenous Nations and acknowledged the history that exists between meeting attendees. Added that the Project area is used by all northern Indigenous Nations and looks forward to having collective conversations going forward to establish new opportunities and protect their inherent rights. Chief Frost [redacted] Chance to clarify their engagement approach going forward (e.g., when do they want to meet, what information is needed etc.). Chief [redacted] said ethical and responsible partnerships that respect people, and the environment are the foundation to how the northern Indigenous Nations govern themselves. They have lived off the land for generations and Chance will need to communicate differently with their people going forward. Acknowledged that trust and integrity is currently lacking at the community-level. Chief [redacted] said her role as Chief is the voice of the people, to deliver messages on behalf of the people to Chance and advance how Chance can move forward in a respectful manner. Chief [redacted] noted Chance had not signed previous agreements with the northern Indigenous Nations. Stated they are not closed for business but are interested in sustainable opportunities rooted in the laws of the land and that is the laws of the people. Chief [redacted] looked forward to identifying priorities to move this process forward.

[redacted] thanked Chief [redacted] for her comments and said Chance is exploring for natural gas and oil resources in the Project area using permits that have already been awarded. He said Chance is looking to understand how each northern Indigenous Nation wishes to be engaged and the best way to share information. [redacted] said Chance is open to economic and environmental stewardship partnerships. He shared that Chance is proposing to conduct smaller-scale exploration activities over a longer period of time to minimize potential environmental impacts and maximize potential Project-related benefits. [redacted] shared that Yukon Government has mandated Chance to conduct further investigations of existing suspended wells dating back to the 1950s/1960s. He said hydrocarbons have been discovered in some suspended wells. Richard noted Chance hired consultants such as EDI, Palmer, and Ausenco (previously Hemmera) to assess potential Project-related effects to the Eagle Plains Basin and support Chance's Environmental Assessment Application to the Yukon Environmental Socio-economic Assessment Board (YESAB). Richard noted Chance has a lot of information to share with the northern Indigenous Nations and would like to further engage each Indigenous Nation to better understand issues that should be addressed through mitigation and/or prevention measures. He added there are up to 30 new exploration wells to be drilled, up to 1,500 square kilometres of

new 3-D seismic data acquisition and up to 2,000 kms of new 2-D seismic data acquisition. Drilling results will determine long-term natural gas/oil extraction within the existing exploration permit areas. [redacted] added that the exploration activities would take place during the winter seasons over an 8–10-year period depending on results as the program unfolds. The exact drilling locations have not yet been determined. [redacted] noted that no hydraulic fracking would take place because the anticipated drilling will evaluate resource potential in geological formations that are not expected to need hydraulic fracturing. He said the camp is located at KM 325 on Dempster Highway and can accommodate around 75 people [redacted] added that the drilling program will occur sequentially rather than all at once. He also shared that natural gas/oil resources from the Project would support local energy security, economic independence, economic diversification, and a reduction of cumulative greenhouse gas (GHG) emissions by transporting fuel over shorter distances.

[redacted] added he had been involved in the Eagle Plains since 1959 and noted the landscape is unique compared to other northern landscapes because there are no lakes, the terrain supports exploration/extraction equipment, and it will be easier to build roads without significantly damaging the environment.

Grand Chief [redacted] noted that he was recording the meeting for GTC's internal minute keeping and requested permission from all meeting attendees. All meeting attendees agreed to the recording. Grand Chief [redacted] said he struggled with the open-ended agenda and thought it was paternalistic. Expressed interest in more structured agendas to avoid wasting anyone's time and to supporting things moving forward. Grand Chief [redacted] said meetings were had with Chance during the COVID-19 pandemic. He suggested a certain level of transparency, respect, and integrity was required to move forward. Grand Chief [redacted] noted he expects transparency, respect, and integrity from anyone working within their Traditional Territory and said there is water under the bridge in terms of this Project.

[redacted] asked Grand Chief [redacted] if the agenda felt vague. Grand Chief [redacted] responded that the agenda felt a bit vague and shared that GTC agendas included an opening prayer, introduction, meeting content, action items, and next steps. Noted members will quickly share if too much was included in the meeting agenda. Grand Chief [redacted] said he had previously heard what [redacted] shared and preferred meetings with a presentation / opportunity to review maps/leases to understand what is being discussed. Grand Chief [redacted] noted GTC represents four Gwitchin councils, and Chance maps reference one of these councils. Grand Chief [redacted] added that the GTC expects Chance to engage all Gwitchin communities/Indian Band Act councils. Noted GTC will support bringing together the right group of people and expressed interest in visiting the Project's camp. Grand Chief [redacted] shared that the Project is in an area where Gwitchin people harvest caribou. Noted compensation should be the last topic of discussion, and instead discussions should be focused on the management of the land, water, resources, environment, and air. Grand Chief [redacted] suggested Chance simplify future meeting agendas and appreciated the effort to move forward together.

[redacted] said she heard there is an interest in building trust and integrity as well as understanding of historic use in and around the Project. She summarized that historic wells and current and future permitting, involving Elders, inherent rights, employment and economic opportunities, respectful and collaborative relationships, community level engagement timelines, and the

protection of land, water, and air resources are important topics to be discussed at future meetings. Erin asked meeting attendees if she heard them correctly. Grand Chief [redacted] added that the key values mentioned were respect, transparency, accountability, and integrity.

Chief [redacted] shared that it is unfortunate how things have gotten to this point and acknowledged the historical relationship between Chance and northern Indigenous Nations. He noted that he was one of four NND Chiefs to go through this process and felt like little had been accomplished to date. He suggested the northern Indigenous Nations wanted to get to work for their children and future generations. Noted the importance of getting right down to the basic facts. Chief [redacted] added that they need to keep a sharp eye on the issue from a political point of view and bring in politicians as needed and move quickly back to the technical folks. He said it is time to put the politics to the side. Shared the politicians are like the star at the top of a Christmas tree and will let information filter down. Chief [redacted] noted the discussions with Chance had been ongoing over the past 12 years. Emphasized the importance of straightening the politics and focusing on arrangements. Chief [redacted] suggested everyone move forward without going back over the past 12 years of deliberations. Noted NND has not had a large role in the Project to date and that the northern Indigenous Nations will charge hell with a snowball together. Thanked everyone for the opportunity to speak.

[redacted] asked if there was anything else that anyone wanted to add to the discussion. Chief [redacted] reflected on the process and the Project. Noted [redacted] had been involved in the region for a long time. Chief [redacted] said her people are fighting for refuge and noted pristine areas and it's significant to use as the refuges. Chief [redacted] said the previous Project application triggered an Executive Committee review and could not determine if there were any adverse effects to the Porcupine caribou herd because of proposed development in the region. She shared the importance of being more confident in numbers and determinations in the YESAB consultation and engagement process. Chief [redacted] expressed concern for the YESAB process. Specifically, caribou, environment, climate change, assessment planning, monitoring and evaluation, triggers for stopping and advancing work, inherent rights, and the full scope/development of the Project. Expressed interest in a broader agreement with Chance to set the bar higher than the *Yukon Oil and Gas Act* and influence Project triggers and remedies to consider environmental vulnerabilities (e.g., halting project operations). Chief [redacted] acknowledged how fragile the environment is currently, especially around climate change and the pressure of resource development. Added that the northern Indigenous Nations want to participate collaboratively in the Project to ensure it is well managed and not going to create long-term environmental degradation. Suggested this approach will create a degree of control for the Gwitchin people which is important for quantifying significant adverse impacts. Noted the significance of assessment, data, management, and planning work. Chief [redacted] said the northern Indigenous Nations will share their interests/concerns with Chance and will stop the process from advancing if it does consider local Indigenous Knowledge. Noted the importance of listening to Elders and their teachings to inform Project management, planning, and decision-making. Chief [redacted] added the importance of upholding sustainability objectives and expects Chance to work more responsibly.

[redacted] shared interest in having a full dialogue on issues, concerns, and values with the northern Indigenous Nations. Noted the Project's intention is to minimize impacts and hopefully create benefits too. Acknowledged that this exchange is required. [redacted] said he felt like Chance was previously delivering information in a one-way direction and hopes to have more of

[redacted] TWC kindly requests Chief [redacted] review and clarify this sentence to make sure it adequately captures what was being shared.

an exchange. Noted Chance is unable to react without feedback and looks forward to doing whatever it takes to address the concerns identified by the northern Indigenous Nations.

Grand Chief [redacted] acknowledged Gwitchin Treaty rights to harvest, including the rights to access to support their harvesting. Noted these rights come with the responsibility to legally and spiritually be stewards of their Traditional Territory. Shared a story about the late Elder [redacted], who travelled by dogsled in the 1960s in and around the Peel River area. Grand Chief [redacted] said the late Elder [redacted] saw smoke and assumed it was a camp. As he approached the smoke, he realized it was a drill rig. This was a troubling experience because late Elder [redacted] did not know who these people were or what they were doing on the land. This experience laid the groundwork for Gwitchin people to form the Gwitchin Comprehensive Land Claim Agreement (GCLCA) to prevent future incidents like this in their Traditional Territory. Grand Chief [redacted] explained the GCLCA was signed in 1991 and this agreement set a principle that non-Indigenous people, businesses, government, or elected agencies were not able to do anything in our Traditional Territory without speaking with the original inhabitants of the land. Noted this includes having the right to say no and share standards around what they are willing to allow. Grand Chief [redacted] shared porcupine caribou is the main concern for GTC as well as impacts to water, air, and the overall ecosystem (which is very fragile). Grand Chief [redacted] said he was not a fan of the term 'traditional knowledge' because it refers to the past, and Gwitchin Knowledge is current. He noted Gwitchin Knowledge Studies help Gwitchin people develop a record of their knowledge for community use purposes and stated the importance of respecting the intellectual property of such information. Expressed interest in advancing discussions around historic and current use of the land and impacts to Treaty rights and access. Grand Chief [redacted] shared that the Gwitchin standard is high for a good a reason.

[redacted] asked Chief [redacted] what collaboration looks like to her community. Chief [redacted] responded that she is at today's meeting to share the perspectives of her community and the standards they are trying to uphold. Noted these standards were established through their laws and agreements. Chief [redacted] said Chance had heard community feedback for over 20 years. Noted the northern Indigenous Nations are not interested in discussing only monetary compensation or relationships. They want to protect the land, water, air, and caribou. Chief [redacted] said there are outstanding questions to be answered around water, hydrology, and the assessment of oil and gas. These conversations will also include the Yukon Government. Chief [redacted] confirmed she had shared how her community would like to see this process move forward and preferred not to speak to her personal feelings. Chief [redacted] asked [redacted] to clarify what he meant by one-way conversation and lacking information. She said this comment was unclear because there is an established process through YESAB to obtain information. Requested further clarification from Chance. [redacted] said Chance has hired consultants to support their assessment and the Project has an interest from learning from the First Nations. [redacted] said he hears about Section 35 rights and mentioned he is looking to understand what those rights are and how the Project could potentially infringe on those rights. [redacted] added that the Chance had conducted baseline studies and offered to provide this information with the First Nations. Expressed interest in receiving First Nation feedback on what Chance has learned to help guide how they develop and manage the Project until conclusion. [redacted] said Chance is trying to develop a pathway to support conversations that will take place under a cooperation agreement including a terms-of-reference. He noted that previously this process did not go far and explained Chance is following this process because it was how mining companies in the Yukon

had moved forward their proposed projects. [redacted] asked the group to confirm if there is a different way of doing it.

Grand Chief [redacted] said he was surprised by the comment [redacted] made about not understanding legal rights. He said the courts look at collaborative agreements and IBAs to clarify the muddy waters. Grand Chief [redacted] said their rights have evolved over the last 30 years. Stated each Indigenous Nation has the inherent right to self-government in their Traditional Territories. Grand Chief [redacted] said if they seem sensitive it is because Chance is looking to occupy a part of their Traditional Territory and as a sovereign nation, they must review that. Noted it would take another 20 years to get an idea of rights. Grand Chief [redacted] expressed interest in clearly understanding timelines to convey this information back to the community level. Noted the Chiefs are spokespeople that have a responsibility to explain to their people what is being proposed. He said the support of Gwitchin will not be possible if he is unable to explain the Project to his people. Grand Chief [redacted] said he used to this type of back-and-forth dialogue. Noted there is often a desire to hold your cards close to your chest for fear of liability. He suggested Chance create frank and open discussions because that is what matters to the Gwitchin people. Shared that some people in the community may be upset around work being conducted in this area. Grand Chief [redacted] asked Chance if they will stop operations if the caribou migrate to the Project area. He explained that is the baseline of what Gwitchin people will expect and the community will also be interested in understanding what Chance is doing in the area to protect caribou and other species. Grand Chief [redacted] acknowledged some effort had been made to protect caribou. As a leader, Grand Chief [redacted] said he needs to be able to answer these questions from the community.

[redacted] said Chance loves feedback and had information to share. Noted Chance is looking to better understand how the northern Indigenous Nations would like to be engaged and how Chance should proceed after today.

Meeting attendees took a break between 3:50 pm – 4:05 pm.

[redacted] said Chief [redacted] wants the whole life cycle of Eagle Plains examined, and it is difficult for Chance because the Project is currently exploratory and does not go beyond that. Shared that the Project will determine if there is anything worth pursuing. If there something worth pursuing is found, then that is a better time to establish economic partnerships since the nature of the resource to be developed will be better understood [redacted] noted that Chief [redacted] understands this process because of the Victoria Gold project. [redacted] reiterated that the proposed Project is the first stage involving 30 wells to get an idea around what resources are available in the Eagle Plains for everyone. He added that pipelines and other works required after exploration will be considered later. [redacted] said Chance is willing to risk their money and assume that it might not work out, but they really hope that it will. Suggested the northern Indigenous Nations may regret getting into something now if it turns out differently because at this stage there is not enough information to move on. [redacted] said the northern Indigenous Nations can evaluate how the Project goes including how the terrain is treated and improvements needed to protect the environment better. [redacted] said Chance is focused on this first stage (exploration). He said that is hoping the northern Indigenous Nations will help Chance with that. Noted exploration is high risk in terms of very uncertain outcomes related to resource determination and they will not want to participate in that. Suggested involvement beyond exploration will be different, including a payoff for all the northern Indigenous Nations.

[redacted] said the exploration phase will create opportunities for businesses and these opportunities will continue even expand into development if the project proceeds beyond exploration.

Grand Chief [redacted] respectfully said they are not interested in any kind of payoff and said that [redacted] comment about payoff was offensive. [redacted] responded that he meant there would be an opportunity to be a full partner in the Project. Grand Chief [redacted] said they have different expectations and are interested in being full partners now. Expressed interest in understanding the nature of the operation and how and understood the long period of time between initial investment. Grand Chief [redacted] shared GTC experienced the false prospect of the Mackenzie Valley Pipeline. Shared that he felt the discussion was not getting anywhere productive and suggested Yukon Government attend the next meeting. Grand Chief [redacted] requested the meeting conclude. Chief [redacted] and Chief [redacted] agreed with Grand Chief [redacted] request to stop the meeting. Chief [redacted] added that they had addressed the major points and want further deliberation with Yukon Government present. Chief [redacted] added that the northern Indigenous Nations have an obligation to the Yukon Environmental and Socioeconomic Assessment Board (YESAB) as well and will take this time to reflect. Noted the importance of fully understanding what is involved in exploration, including the end product. Chief [redacted] said they want to know they did everything possible to protect the environment. Stated the Charter is intrinsic to everything they do. It is founded on Gwitchin ways. Chief [redacted] thanked everyone for making space for this conversation to happen and shared her appreciation.

[redacted] thanked everyone and said Chance would work on pulling together a summary of engagement topics and associated timelines. Noted the clock is ticking on land tenures. Chief [redacted] confirmed their awareness of the clock ticking and suggested the northern Indigenous Nations will get back to Chance with their perspectives [redacted] added that [redacted] booked accommodation in Old Crow in March at Porcupine Camp. Expressed that finding accommodation in Old Crow is a challenge.

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3. Reintroduction Meeting Action Items & Next Steps

Table 2 below details action items and next steps identified during the Reintroduction Meeting.

Table 2: Reintroduction Meeting Action Items & Next Steps

Topic	Action Description	Responsible	Estimated Date
Meeting Minutes	• Review and provide comment on Draft Reintroduction Meeting Minutes with Two Worlds Consulting.	All	February 20, 2023
Meeting Minutes	• Incorporate meeting attendees' feedback on the Draft Reintroduction Meeting Minutes and share a finalized version of the minutes with all attendees for their records.	Two Worlds Consulting	March 1, 2023 (or approximately 2 weeks after receiving feedback from meeting participants)
Meeting Agendas	• Create simplified agendas for future meetings.	Chance	Ongoing
Meeting Format	• Utilize visual aids such as presentation slides and maps during future meetings.	Chance	Ongoing
Next Steps	• Share perspectives with Chance.	GTC, NND, VGFN	TBC

APPENDIX 2-A-13. August 3, 2023, Meeting Summary

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Meeting Minutes

Subject	Draft Project Description Meeting
Prepared By	Two Worlds Consulting (TWC)
Groups Involved	Chance Oil and Gas Limited (Chance) First Nation Na-Cho Nyäk Dun (NND) Tr'ondëk Hwëch'in (TH) Environmental Dynamics Inc. (EDI) TWC
Participants	[redacted], Regulatory, Environmental and Community Relations Coordinator (Chance) [redacted], VP Government and Communication Relations (Chance) [redacted], Technical Advisor (TH and NND) [redacted], Regulatory Lead (EDI) [redacted], Senior Fisheries Biologist (EDI) [redacted], Engagement Facilitator (TWC)
Date/Time	August 3, 2023 8:30 AM – 9:30 AM
Copies to	Chance, NND, and TH

Purpose of Meeting

- Chance provided an Eagle Plains Exploration Project (Project) overview to Skeeter.

Topics Discussed

- Chance overview
- Project overview including information on exploration, design changes, baseline studies, regulatory process, schedule, engagement, proposed next steps

Key Issues Raised / Chance Responses to Issues

- Asked about availability of well abandonment service providers (i.e., future availability and anticipated service fees in the future).
    - Chance to inquire about well abandonment service providers (i.e., future availability and anticipated service fees in the future).
- Noted seismic impacts to predator-prey relationships had been a major objection from communities in the past.
- Inquired about outstanding Yukon Government directives.
    - Chance to follow up with Yukon Government about directives and confirm if anything is outstanding and then confirm with Nations when and how directives were or will be addressed.

Actions and Responsible Party

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- Chance to inquire about well abandonment service providers (i.e., future availability and anticipated service fees in the future) – in progress.
- Chance to resend presentation to [redacted] – complete.
- Chance to send [redacted] 2D versus 3D seismic definition – complete.
- Chance to send [redacted] copies of primary socioeconomic baseline data and caribou baseline data – complete; Chance confirmed no socioeconomic baseline data was available to share at this time and that TWC has been engaged to draft the socioeconomic inputs of the draft Project Proposal.
- Chance to share linear features study with [redacted] – complete.
- Chance to check internal records to confirm receipt of [redacted] response to the 2022 Communication and Engagement Plan – in progress.
- Chance to follow up with Yukon Government about directives and confirm if anything is outstanding and then confirm with Nations when and how directives were or will be addressed – in progress.
- Chance to send meeting minutes to [redacted] – complete.
- Chance to send updated Project video to [redacted] – in progress.
- [redacted] to discuss information requests with leaderships from NND and TH and share feedback with Chance – in progress.

Details of Discussion

- [redacted] led a round of introductions.
- [redacted] introduced themselves.
- [redacted] shared he was attending the meeting on behalf of NND and TH. He previously worked as a land claims negotiator for the Yukon Government (YG) and other First Nations. He also worked on the drill floor for an exploration project.
- [redacted] said he is a senior fisheries biologist for the Project.
- [redacted] said she is supporting Chance in navigating regulatory requirements for the Project. This includes working with the Yukon Environmental and Socio-economic Assessment Board (YESAB) and the Project's consultants to submit a Project Proposal.
- [redacted] said the Project is the first oil and gas project going through YESAB. He shared that he was involved in writing the *Yukon Environmental and Socio-economic Assessment Act* (YESAA).
- [redacted] explained that [redacted] (Chance President) and [redacted] (Chance CEO) have been working together in the Eagle Plains area on oil and gas exploration for decades. He said 30 wells were drilled in the Eagle Plains area between 1959-1973. [redacted] shared that Chance has offices in Whitehorse and Calgary, and is a small company of approximately 5 people. [redacted] said oil and natural gas reserves were first discovered in the Eagle Plains area in 1958. Chance has focused on exploration activities to assess oil and gas potential in the Eagle Plains. More seismic and drilling is required to support this work. [redacted] said Chance wants to

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be part of the Yukon energy strategy by providing oil and natural gas to Yukoners and businesses in the territory.

- [redacted] presented the Project's currently permitted area. He noted the Project falls within Gwich'in Tribal Council's (GTC) primary and secondary areas and Vuntut Gwitchin First Nation's primary area. He noted the Project area overlaps with the North Yukon Planning Region and Peel Watershed Planning Region (PWPR). Specifically, land use management zone 4. [redacted] acknowledged that the part of the Project area that overlaps with the PWPR is mostly in NND territory.
- [redacted] presented the proposed Project activities. He noted that Chance originally submitted an application to the Dawson City YESAB Designated Office (DO). The Project was referred by the DO to YESAB's Executive Committee in 2016. The referral was made after the DO determined that it was unable to assess whether the Project will have, or is likely to have, significant adverse environmental and socio-economic effects. Chance has been working on their Project Proposal for 9 years.
- [redacted] shared that Chance has completed seismic exploration across a 2500 sq km area and is proposing to drill up to 30 wells. This does not mean that Chance will necessarily drill 30 wells. The number of wells depends on the results from initial wells drilled. Drilling would be conducted during the winter, using a focused approach of approximately 5 to 7 wells per year. Good results will lead to extended flow testing of successful wells for 2 years.
- [redacted] shared the Project Proposal will include information on progressive reclamation.
- [redacted] presented the seismic program. He noted seismic will sometimes be done in the same location as the drilling.
- [redacted] asked what the difference is between 2D and 3D seismic.
- [redacted] responded that 3D is very dense and provides more detailed data.
- [redacted] asked if Chance would put the blasts closer together.
- [redacted] said the 3D seismic allows Chance to have a more detailed picture of the natural gas and oil reserves underground; similar to cutting a cake open.
- [redacted] followed up to ask if it's more how Chance is using the data that's different rather than the how Chance is obtaining it.
- [redacted] confirmed [redacted] understanding was correct. He noted the same method for 2D and 3D at the ground level. For example, there is a downhill target and both options support directional drilling.
- [redacted] asked if the data was being collected differently.
- [redacted] suggested Chance prepare and send [redacted] a plain language definition of 2D versus 3D seismic to support his discussions with leadership.
- [redacted] reviewed the use of the existing camp and proposed a remote camp. He noted the remote camp will have medical staff on site. He added that Chance is looking to build a winter airstrip to accommodate bigger aircraft to support crew changes, transportation of supplies, and emergency medivac if needed.
- [redacted] asked if Chance has received their water license yet.

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- [redacted] confirmed Chance had not yet received their water licence. He shared the Project will also include a mix-bury-cover sumps and central processing facility. He noted the oil and gas will be sent to an approved site like Taylor, British Columbia for refinement.
- [redacted] said processing on site will create pure crude oil and that used water will be reinjected back to a regulator-approved zone. He added that oil gets trucked offsite. He said Chance will complete extended flow testing of the wells to understand the pressure, flow, and how many barrels per day the wells could yield as well as a reservoir analysis. [redacted] noted this data is just as important as seismic data [redacted] explained this part of the process will help Chance to understand the economic and production value of the oil and gas in the Project area.
- [redacted] said Chance's YESAB 2014 submission indicated that they wanted to build all season roads to the proposed drilling locations. Communities indicated they preferred not to see all season roads. In response, Chance's 2023 Project Proposal is focused on ice roads and 100% winter drilling. He noted camp operations would typically start in November/December and drilling would generally occur between December - March/April.
- [redacted] noted there are a lot of seismic lines in the Eagle Plains.
- [redacted] said the geophone data collection will be in spring and summer when the Porcupine Caribou Herd heads north.
- [redacted] added that seismic technology has changed over time, and noted the widths of rights-of-way are smaller than in the past.
- [redacted] reviewed how the current Project is different than the previously proposed Project, specifically, how Chance is looking to rebuild relationships and collaborate with First Nations, use low impact seismic, complete drilling activities only during the winter season, utilize the existing Project footprint and networks, spread activities across 10 years to minimize annual impacts and support steady employment, and use winter ice roads versus all season roads.
- Jennifer shared that many studies had been conducted since 2018 and are continuing this year, and noted Chance is trying to learn from past engagement and incorporate concerns. Jennifer presented completed baseline studies for terrain/surficial geology, permafrost, water quality and surface flows, fish and fish habitat, vegetation, wildlife (porcupine caribou, moose, American marten, grizzly bear, and birds), and heritage resources.
- [redacted] requested more recent caribou baseline information and primary socioeconomic baseline information.
- [redacted] said mapping has been completed across the whole Project area. That has been really helpful for the effects assessment. He also explained that Environmental Dynamics Inc. had completed a linear features study. They walked old seismic trails to get a feel for walking speed, how far you could see, etc.
- [redacted] said that is good because seismic impacts to predator-prey relationships had been a major objection from communities.
- [redacted] reviewed the regulatory process, and noted the Project was referred to the YESAB Executive Committee in 2016 and Chance is working on their Draft Project Proposal [redacted] said Chance was waiting for regulatory direction from YESAB on the Draft Project Proposal Table of Contents (TOC).

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- [redacted] asked Chance to confirm that they had not gotten the TOC yet from YESAB.
- [redacted] confirmed Chance had not received a TOC from YESAB.
- [redacted] said they had all the information lined up and the First Nations told them not to come and do socioeconomic studies.
- [redacted] said he was not aware of that.
- [redacted] said the First Nations said no to meeting in 2019 and then the pandemic happened.
- [redacted] shared that Chance is hoping to submit an updated Draft Project Proposal on December 15th to YESAB.
- [redacted] said Chance is hoping to build trust in the communities and support their understanding of the Project. He noted the Project no longer includes fracking.
- [redacted] reviewed completed and proposed 2023 engagement activities.
- [redacted] asked [redacted] what NND's engagement preferences are. He asked if NND wants Chance to come to the community to conduct open houses and socioeconomic primary data collection. [redacted] said if NND prefers to defer engagement to Vuntut Gwitchin First Nation, Chance respectfully requests that deferral is made in writing to share with YESAB.
- [redacted] asked what level of involvement TH will have in the Project.
- [redacted] said Chance is legally required to consult all potentially impacted First Nations.
- [redacted] asked if Gwich'in Tribal Council has an interest in the Project and if the Project will impact their secondary use area.
- [redacted] confirmed the Project will impact Gwich'in Tribal Council's secondary use area.
- [redacted] suggested Chance follow the Yukon Oil and Gas Act, land claims, and North Yukon Regional Land Use Plan guidelines.
- [redacted] forwarded Chance's virtual meeting invite with YESAB on August 23, 2023 to [redacted]
- [redacted] asked what happens after the submission of the Project Proposal. He also asked what the referral process means and what are the milestones to accomplish to have an adequate submission.
- [redacted] said Chance is looking to get feedback from YESAB on the regulatory process for the Project. She added that Chance is trying to hit on the requirements and wants to submit a complete Project Proposal. [redacted] said Chance will append the baseline reports to the Project Proposal.
- [redacted] acknowledged YESAB is going through their own changes.
- [redacted] said Chance is open to meeting virtually as needed. Noted the logistical challenges of engaging in-person (e.g., lack of accommodation in Mayo).
- [redacted] asked Chance about three outstanding directives issued by Yukon Government to address old wells. He said the work has not been done and he had heard from the Yukon Government that Chance had yet to respond to the directives.

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- [redacted] said one directive was to complete the consultation reports for the land disposition, and noted this year's reports were being submitted to Yukon Government that day. [redacted] said Chance did not receive responses on those reports for the last 3 years.
- [redacted] said he did respond to a previous consultation report for the land disposition.
- [redacted] confirmed they were meeting with Yukon Government that afternoon.
- [redacted] confirmed the Impact Benefits Agreement had been sent to leadership for signature. He also shared that NND is supporting the well maintenance work getting done as soon as possible.
- [redacted] explained that Chance's camp has a water system that treats water for cooking, bathing, etc. He said First Nations and Yukon Government want Chance to reassess the camp's wastewater management.

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APPENDIX 2-A-14. October 13, 2023, Meeting Summary

Chance Oil and Gas Ltd.
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Meeting Minutes

Subject	Consultation and Capacity
Prepared By	Two Worlds Consulting (TWC)
Groups Involved	Chance Oil & Gas (Chance) TWC The Yukon Government (YG) Canadian Northern Economic Development Agency (CanNor) Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) First Nation of Na-Cho Nyak Dun (FNNND) Tr'ondëk Hwëch'in First Nation (TH) Gwich'in Tribal Council (GTC) Vuntut Gwitchin Government (VGG) Yukon Environmental and Socio-economic Assessment Board (YESAB)
Participants	• [redacted] Executive Committee Manager (YESAB) • [redacted] Aboriginal Relations (YG) • [redacted] Major Projects Director (YG) • [redacted] Major Projects Manager (YG) • [redacted] Geothermal & Petroleum Resources Manager (YG) • [redacted] Regional Environment Manager (CIRNAC) • [redacted] Manager (CIRNAC) • [redacted] Project Officer (CanNor) • [redacted] Project Manager (CanNor) • [redacted], Resources & Governance Consultant (FNNND and TH) • [redacted], Lands & resources coordinator (GTC) • [redacted], Technical Advisor (VGG) • [redacted], Caribou Coordinator (VGG) • [redacted] (Chance) • [redacted] (Chance) • [redacted], Regulatory Lead (Chance) • [redacted], Transboundary Specialist (GTC) • [redacted], [redacted], and [redacted] (TWC)
Date/Time	October 13, 2023 from 10:30am – 12:00pm PST
Copies to	[redacted]

Purpose of Meeting

- Discuss Consultation and Capacity

Topics Discussed

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- YESAB Screening Process
- Consultation Plan
- Transboundary Territory

Key Issues Raised / Chance Responses to Issues

- Inquired about international transboundary lands and if there is a plan to address that.
    - Chance stated they are following the YESAB regulations and there is nothing explicitly about international transboundary consultation requirements.
- Noted the need for Nations to receive capacity funding prior to the submission of proposals.
    - CIRNAC stated that NPFP is flexible and can be arranged to support this

Actions and Responsible Party

- VGG to set up all Nations meeting.
- YG to set up meeting with VGG, TH, FNNND, GTC to discuss Consultation Plan after all Nations meeting.
- VGG, TH, FNNND, GTC to follow up with CIRNAC about capacity funding.
- CIRNAC to follow up about Transboundary with US consultation protocol

Details of Discussion

- [redacted] talked about Chance's project proposal. [redacted] discussed Engagement with Chance and the somewhat revised project description. He clarified that this meeting is about the process moving forward and not the project details, as well as to better understand the Nations feelings. John introduced the idea of making a joint consultation plan process to ultimately look at capacity funding for all Nations to meaningfully participate in further engagement. [redacted] clarified that this meeting is to hear the party's perspectives on consultation and capacity and not to talk about the project or project details.
- [redacted] reiterated that this meeting is for consultation discussions. [redacted] described the screening process for YESAB. He stated that YESAB through the screening process checks to see if the proponent has fulfilled consultation duties with communities and First Nations using the four-point test. He clarified YESAB doesn't need consultation records during the screening period, as this is separate from the records of past consultation leading up to the screening period. [redacted] said he is here to answer any further questions about the screening process as the meeting progresses.
- [redacted] asked for clarification about the project history and new regulatory screening process since the project went from Dawson City Designated Office to the Executive Committee. [redacted] continued that with the newer consultation under the Executive Committee how will this change the screening process since the project is referred from the DO?
- [redacted] clarified this is a referred project and now must update under new regulation. He stated Chance is not submitting a new project rather a revised proposal and consultation record to meet new standards.
- [redacted] asked whose regime Chance was under before compared to now and how that has changed the process.
- [redacted] added that Nations are dealing with a proposal that has not been submitted yet and the consultation record only covers what has happened during the DO days.

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- [redacted] stated that First Nations are providing comments but asked [redacted] if Nations should expect face to face discussions to provide input moving forward.
- [redacted] answered yes, this is a possibility. He said YESAB could include Nations in the screening process if needed and desired.
- [redacted] redirected the conversation onto Aboriginal Relations with Yukon Governments
- [redacted] proposed adding to the meeting agenda more discussions regarding the Yukon government. He stated the Yukon Government is a regulator on this project and decision maker on this project and will make recommendation based on the Department of Economic Developments input. [redacted] further explained that the Yukon will lead a consultation under major projects Yukon, with affected Nations and YG will be relying on the screening process which means Nations need to participate in the screening process to inform how treaty rights are affected and how YESAB are taking those impacts and converting to values ultimately to inform decision making. [redacted] continued that the YESAB approach is to engage early in addition to the ongoing screening. He said this meeting is a good time to understand what the consultation process looks like moving forward. He informed that YESAB will be leaning on the Aboriginal Relations to inform and set up that consultation approach. He clarified the assessment itself will be informed by regulators providing technical expertise.
- [redacted] agreed with [redacted] and explained the process further.
- [redacted] explained that YESAB has a less defined consultation process to let it be led more by participants. She explained that YG has been working on multiyear consultation efforts. She invited a discussion of the components that need to be improved in the engagement process. [redacted] stated that she looks forwards to using consultation tools to better inform a process moving forward.
- [redacted] asked if YG is aware of the transboundary areas and how consultation works with Alaskan transboundary lands. He also asked how YG feels about transboundary lands with America.
- [redacted] answered that YG takes transboundary issues seriously but can't confirm if there is a case to reference where an organized Indigenous group in America had transboundary lands with Canada. [redacted] explained that YG has dealt with transboundary within Canada and Provinces more frequently than National transboundary lands.
- [redacted] asked to hear from other Federal representatives on International transboundary protocol.
- [redacted] answered speaking to the federal approach to consultation and the federal participation in these major projects. [redacted] stated that this project may not require federal decision bodies. She clarified that Canada's engagement and duty to consult relies on what is determined through the YESAB screening process.
- [redacted] stated that the Northern Participant Funding Program (NPFP) is designed to assist First Nations in participating in big projects but is limited to 150,000 dollars per fiscal year. He further explained that NPFP is limited to projects that are for sure to go through the assessment process.
- [redacted] asked [redacted] if Nations can't trigger NPFP funding until the proposal is submitted how can Nations get ready for the assessment, as Nations don't want to be left behind. [redacted] asked, if there was a possibility for capacity funding about 2 months before the proposal is submitted.

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- [redacted] answered that CIRNAC tries to be very flexible with this and are open to discussions before submission if things are moving quickly. Shane continued that CIRNAC is looking to maximize participation and readiness.
- [redacted] asked [redacted] if he would be open to assisting in creating a consultation plan
- [redacted] answered that he would be very open to help with a consultation plan. He clarified that Provincial limiting doesn't limit federal funding.
- [redacted] asked If Canada is not a decision body how are transboundary lands addressed with the US for Federal consultation.
- [redacted] asked, for the federal money that is available, is there any documents on the responsibility of proponents to provide capacity funding or is there federal linkage to proponent obligation.
- [redacted] answered, no, federal funding is not linked to proponent responsibility, rather federal funding is supplementary.
- [redacted] asked what Transboundary lands are in question.
- [redacted] clarified that Gwich'in territory extends into Alaskan transboundary lands. [redacted] asked if there is a plan around addressing this.
- [redacted] asked if this is referencing Porcupine Caribou Herd. [redacted] continued that Chance follows YEASB regulations and is concerned over the international regulations being brought into the equation as Chance is following all required regulations that are known.
- [redacted] answered that there are international transboundary Porcupine Caribou Herd relations that he wants clarification on about if there is existing federal protocol for but he just wanted to raise question not to raise concern.
- [redacted] echoed [redacted] and thanked John for clarifying on importance of concern raised.
- [redacted] reiterated that there is no question about FNNND desire to be very involved but the form that will take on how that participation will look he is not sure on. He stated that FNNND is overlapping with TG and that both First Nations want to be involved but have to sort out the details.
- [redacted] stated that Chance has been working with FNNND for a while now and Chance needs to know what level of consultation is required as previous meetings have been postponed and there is not a clear understanding of what FNNND wants consultation wise. [redacted] wanted to get confirmation about level of consultation desired by FNNND. He stated porcupine caribou is common priority amongst all Nations involved and that is known. [redacted] said that Chance would like to schedule meetings with FNNND and asked if [redacted] could help Chance in a timely matter to get some direction on how and when to consult with FNNND as it has been hard in the past. [redacted] recognized that the type and degree of consultation needs to be sorted out on direction that further consultation will take.
- [redacted] answered that there has been some difficulty lately with new governments in both Nations and all new staff causing delays. [redacted] stated that he is working on trying to facilitate more understanding on needs.
- [redacted] stated that he had a few meetings with Chance regarding the proposal and GTC and Chance have a good working relationship, but this relationship doesn't replace the federal duty to consult, and GTC looks forward to discussing that further when the time comes.

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- [redacted] talked about the how the Old Crow meetings back in May discussing the revised project description were delayed due to floods but the but the Mid September meetings in Old Crow were very productive. [redacted] thought it was a good session. [redacted] shared that the VGG perspective is to get ahead of this and have regular meetings with Greg, to keep in touch. John shared that VGG are in support about the proposal being submitted. [redacted] shared that VGG would like to know what the consultation process looks like so VGG can prepare. [redacted] proposed that VGG works together with the other Nations to be more efficient and share resources and to be coordinated in the consultation process. John asked for a First Nations reps only meeting to get organized and so Nations can be active and not passive in the consultation process.
- [redacted] asked if the current project proposal is the final version of the proposal. [redacted] said that the last timeline heard was mid December for probable submission to YESAB. [redacted] asked if FNNND and TH are currently being consulted on the final or work in progress proposal.
- [redacted] answered that Chance has a description of the project in draft from. [redacted] said that the Nations consultation on the project so far has not just been about ticking off a box about rather what people think about the project. [redacted] said that all Nations are going to see the final proposal when it is submitted. [redacted] stated that Chance is looking at a submission in January and said [redacted] can talk to that more.
- [redacted] said that Nations are currently dealing with the draft proposal currently, but the final will be the one that is focused on moving forward.
- [redacted] asked if it can be confirmed that the proposal can be adjusted.
- [redacted] answered that the proposal can be adjusted until submission.
- [redacted] Presented Chance project updates: [redacted] showed slides. [redacted] thanked everyone for attending. He stated Chance is working to meet all four points under YESAB screening. [redacted] stated nothing has really changed from 2014 to the new project. He continued that minor changes were made to First Nations engagement, like seasonal road. [redacted] informed that between now and January 2024 the goal is to submit proposal early to mid February. He stated Chance is happy to do virtual meetings. [redacted] said Chance doesn't want to be throwing big packages at you, Chance wants to make sure that it can be a meaningful conversation. He stated Chance will be doing a document review and that Two Worlds Consulting was hired to support in this endeavour. He finished by saying the meeting held with YESAB about traditional knowledge was critical and Chance wants to capture that Knowledge and use it to influence the submission.
- [redacted] closed the meeting by discussing possible next steps like an all Nation only meeting and a consultation plan with help of YG. [redacted] stated that it was good to hear about support for consultation and about capacity funding as needs are there. He finished by sharing that it might be a good idea to collapse all nations together to save money.

APPENDIX 2-A-15. Proposed Eagle Plains Exploration Project Engagement and Consultation Update Letter

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Via Mail and Email

November 17, 2023

Chief [redacted] and Council
First Nation of Na-Cho Nyäk Dun
PO Box 220
Mayo, Yukon Y0B 1M0

Dear Chief [redacted] and Council,

RE: Proposed Eagle Plains Exploration Project Engagement and Consultation Update

Chance Oil and Gas Limited (Chance) is in the process of developing a Project Proposal for the proposed Eagle Plains Exploration Project (the proposed Project) for submission to the Yukon Environmental and Socio-economic Board's (YESAB) Executive Committee. The Project Proposal is scheduled to be submitted for assessment in February 2024.

Chance is committed to engaging and consulting with potentially affected First Nations and communities about the proposed Project. It values open communication and receiving feedback, concerns, and questions. Chance will consider and address comments received throughout all stages of the proposed Project.

Chance is committed to meet consultation requirements under sections 3 and 50(3) of the *Yukon Environmental and Socio-economic Assessment Act* (YESAA) and section 14 of the Yukon *Oil and Gas Act* (OGA). Under YOGA, Chance is required to consult with First Nations whose Traditional Territories overlap with oil and gas permitted land during the Government of Yukon's permit extension process.

Chance understands that [redacted] has been employed by First Nation of Na-Cho Nyäk Dun to facilitate engagement between the two parties. On November 14, 2023, Chance received a communication noting that First Nation of Na-Cho Nyäk Dun does not wish to be consulted about the proposed Project or Project Proposal prior to its submission to YESAB's Executive Committee. As such, Chance is requesting written confirmation to this effect.

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Chance
OIL AND GAS LIMITED

If, at any time, First Nation of Na-Cho Nyäk Dun wishes to be consulted regarding the proposed Project or the Project Proposal, please let me know and Chance will follow-up and provide relevant documentation. Until then, Chance will continue to provide Project updates and share important information by email and/or letter to First Nation of Na-Cho Nyäk Dun.

Sincerely,

[redacted]

VP Government and Community Relations
Suite 202, 208 Main Street
Whitehorse, YT Y1A 2A9
Office: 867.456.7805
Cell: 867.3330010

cc: [redacted], Acting Executive Director, First Nation of Na-Cho Nyäk Dun
[redacted] Consultant, First Nation of Na-Cho Nyäk Dun
[redacted], Senior Assessment Officer, YESAB
[redacted] Major Project Manager, Major Projects Yukon, Executive Council Office
[redacted], President, Chance Oil and Gas

APPENDIX 2-A-16. December 20, 2023, Meeting Summary

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Draft Meeting Minutes

Subject	Technical Working Group – Fish and Wildlife
Prepared By	Two Worlds Consulting
Groups Involved	Chance Oil and Gas (Chance) Environmental Dynamics Inc. (EDI) First Nation of Na-cho Nyäk Dun (NND) Porcupine Caribou Management Board (PCMB) Tr'ondëk Hwëch'in (TH) Two Worlds Consulting (TWC) Vuntut Gwitchin First Nation (VGFN) Yukon Government (YG)
Participants	**Chance Oil and Gas (Chance)** • [redacted], Community Engagement and Permitting • [redacted], Vice President Government and Community Relations **Environmental Dynamics Inc. (EDI)** • [redacted], Senior Biologist • [redacted], Senior Biologist • [redacted], Quantitative Ecologist **First Nation of Na-cho Nyäk Dun (NND)** • [redacted], Advisor **Porcupine Caribou Management Board (PCMB)** • [redacted], Executive Director • [redacted], Chair • [redacted], Minute Taker **Tr'ondëk Hwëch'in (TH)** • [redacted], Advisor **Two Worlds Consulting (TWC)** • [redacted], Engagement Facilitator • [redacted], Engagement Support **Vuntut Gwitchin First Nation (VGFN)** • [redacted] Technical Advisor **Yukon Government (YG)** • [redacted], Caribou Specialist
Date/Time	December 20, 2023, 8:00 to 12:00 am MST
Copies to	All groups involved

Purpose of Meeting

- To provide a Project summary and updates; and share results of Environmental Baseline Studies including preliminary potential effects and mitigation to Fish, Wildlife, Porcupine Caribou Herd, Linear Features, and North Yukon Land Use Planning Conformity.
- A question and answer period followed the information sharing.

Topics Discussed

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- Project summary and updates
- Baseline Studies
- Effects Assessments
- Fish and Fish Habitat
- Wildlife and Wildlife Habitat
- Porcupine Caribou Herd

Key Issues Raised / Chance Responses to Issues

- Participants would like more detail about the Project Proposal and requested Chance to include all activities in the Project proposal. / Chance to review.
- Participant inquired about meandering seismic lines and how operators are informed about the design. / Chance confirmed that there is a design in place and that scouting will occur prior to the work, to understand the density of the forest and to optimize line locations.
- Asked if the Project videos are online. / Chance is developing a webpage.
- Requested more information on Chance's interpretation of disturbance. / Chance responded that key disturbance factors include noise, smells, and human movement/presence, and consider how far away caribou are from the well sites. Chance stated that disturbance is dependent on how the caribou are responding. Studies on Zone of influence are mixed, with various analytical methods, and depending on interpretation can range from no avoidance up to 40 kilometres of avoidance. There are many issues with analytical approaches that are scale dependent, and not often considered by those authors.
- The priority is to not disturb the caribou, but further work is needed to determine what is too much disturbance. Participants inquired about mitigations and if there is anything other than seasonality. / Chance responded that there will be mitigations in place, and there will be direct and indirect effects.
- A participant cautioned about using a 1-kilometrer Zone of Influence (ZOI), and believes the literature will reflect larger zones. Shared that he thinks Chance will have a difficulty finding that in the literature. / Chance responded that the primary reason for the buffer was because of sensory disturbance and that in larger ZOI assessments there is not a clear mechanism that is associated with the level of disturbance. Chance is focused on addressing local scale sensory disturbance within the work area, and that linear avoidance is assumed within the literature on ZOI's. The assessment applies a uniform 75% reduction across the 1-kilometre zone, which is a conservative (i.e., likely over-estimate) of the effect throughout the zone.
- PCTC (Porcupine Caribou Technical Committee) advised against doing the ZOI analysis based on low sample size (few caribou interacting with 3D seismic across the range). / Chance said that they could not ignore existing data and conducted the analysis regardless, and in the end did not rely on a 3D ZOI analysis as it was not conclusive.
- Participants expressed concerns about the ability of the Land Use Planning Council to review the Project for a conformity check, compared to the capacity of the North Yukon Commission. / Chance said that there are knowledgeable people on the council who have been there for a while. Shared that the North Yukon Commission no longer exists.
- Inquired about how Chance will be able to privatize a road. / Chance responded that the Chief Operating Officer can make it a private road. Said that that it is more of a safety concern, and that people are not interested in hunting around the drilling area. The company could grant access to subsistence harvesters, but this may create a safety concern for staff on site.
- Expressed concerns about the lack of communication between Chance and the Executive Committee. These conversations are important.

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- A participant shared concerns that their experience on drill projects, drill sites needed a 24-hour supply of water, which was trucked into the site. Unless technology has changed, that is one example of essential road traffic even if there are caribou in the area. Participant asked if the reduction would be sufficient or not. / Chance does not have the details on what is considered essential road traffic right now, but will include that in the Project Description.
- Participant requested an end of season report, to understand if caribou mitigation efforts worked and is concerned that this is not being considered. / Chance is interested in learning how the caribou are impacted, and that Chance will learn over the project lifecycle (10-year program).
- Participants encouraged ongoing in-person discussion outside of the YESAB review, which, through written format, can become hostile.

Actions and Responsible Party

- No actions.

Details of Discussion

[redacted] (Chance) gave a brief Project summary and added that [redacted] (EDI) would lead the presentation. [redacted] emphasized that the Project is a proposed exploration program and reiterated that the proposed submission of their Project Proposal is February 2024. Chance has been conducting virtual and in person engagement meetings. He mentioned First Nation of Na-Cho Nyäk Dun leadership currently does not want to participate in community engagement. Chance will continue to provide Project information and that engagement will continue with the First Nations and residents of communities. Chance will also share technical reports with First Nations. Chance is proposing a 10-year program.

The group shared a round of introductions.

[redacted] (EDI) stated the exploration area is around 2400 square kilometres, with clearing occurring during the winter and that it will be approximately 1500 square kilometres total of 3D seismic spread over 10 years. He added that there will be 2000 square kilometres of 2D seismic. [redacted] (EDI) noted that the Project is looking at up to 5 wells per year, equivalent to 2 hectares, and a maximum of 30 wells total. He stated that winter operations will last about 1 to 3 years in each area. He added that there will be three Project work areas and winter access roads will be created. He noted that there will be spring and summer seismic activities with helicopter support and extended flow testing. He stated that the seismic work is different than what was done in the 1950s.

[redacted] (Chance) added that extended flow testing occurs during the winter months and a well of interest will be flowed for natural gas and oil to a service rig. He shared that Chance will be abandoning 3 or up to 5 wells next winter.

[redacted] (PCMB) asked if the seismic testing will include installing and retrieving geophones, which was done previously.

[redacted] (Chance) said that it is new to Chance and that they use the same equipment from the seismic program in 2013.

[redacted] (PCMB) mentioned that he knew Chance was working on site.

[redacted] (Chance) stated that the geophones will be flown out when the snow and wildlife are gone in the spring. He added that if the caribou are hanging out, they can employ mitigation measures and hold off detonation and data collection until the caribou migrate north.

[redacted] (NND/TH) asked if this includes surface drilling.

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[redacted] (Chance) said that it would involves drilling a 3-to-5-meter hole, and the charge will be put down and repacked.

[redacted] (NND/TH) inquired if it was helicopter access and if Chance would be setting up a portable drill.

[redacted] (Chance) mentioned that the site is accessible by vehicle and that Chance would transport the drilling equipment. He added that Chance can hold off until late spring to detonate and take samples.

[redacted] (NND/TH) inquired if it was restricted access.

[redacted] (Chance) confirmed that it will be restricted access.

[redacted] (PCMB) stated that in 2013 there were caribou around. If caribou are around when Chance conducts work, will they hold off on the seismic activity?

[redacted] Chance) said Chance would hold off on detonation activities, but this needs to be discussed further. Chance will make these decisions as they occur and depending on how many caribou are in the area. [redacted] does not understand what the criteria is for this. In the baseline data being gathered for the technical review, there is the understanding that the caribou will migrate. He noted that Chance will go back to that location after the caribou move through. He stated that it depends on the number of caribou that are migrating in the winter range. Chance won't know until they do the field work and determine caribou movement through wildlife monitoring.

[redacted] PCMB) said that if there are caribou moving through the area, it won't be just one hundred in the Eagle Plains Basin. It will be a lot more caribou than that. This is what the collared data suggests.

[redacted] (EDI) noted that the Project team wants to have a good understanding of caribou movement. He added that protecting the lichen protects the herd. He noted that this is why activities are occurring in the winter to minimize the impacts. Seismic lines don't have to be straight anymore, and it is not the Project that was proposed in the past. This is a different seismic operation and that the key thing is that it will be spread out over 10 years.

[redacted] (EDI) presented the Baseline Studies Completed slide.

[redacted] (EDI) shared that the Project was bumped up to Executive Committee screening, which required Chance to do several studies.

[redacted] (PCMB) inquired about information on the Executive Committee.

[redacted] (EDI) said that it is a higher level of consultation and requirements. The Executive Committee reviews the Project.

[redacted] (Chance) said that they require additional data and baseline studies. The original Project went to the Yukon Environmental and Socioeconomic Assessment Board (YESAB) Dawson office and four out of six concerns came from it. These concerns put the Chance Project into a higher level of screening.

[redacted] (EDI) stated that field studies from 2019 to 2021 included: ecological mapping, linear features, fish, water, birds, and desktop studies that includes Porcupine Caribou Herd (PCH), moose, and martens. Chance wanted to do a linear features study to feed into the Land Use Plan (LUP) conformity check. He noted that the PCH are in the desktop studies because there is so much information available on them. He added that there were concerns about grizzly bears, but Chance doesn't have information on them.

[redacted] (EDI) presented the Effects Assessment Approach slide.

[redacted] (EDI) said there will be an impact on caribou, and we are assessing the significance of the effects. He added that Chance put the Environmental Assessment in the context of the LUP. He noted that there is more disturbance which is included in the Linear Features Study. The constraint maps help to develop scenarios to figure out future impacts. He noted that the spatial

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scale is relevant to the species. He said that exploration programs typically do not trigger an Executive Committee review. He added that this Project is going through the same review as the Casino mine project. He said that there is enough concern that it triggered an Executive Committee screening. There are always questions about the Project. He stated that Chance can't do an impact assessment without confirmed sites, which is why the Project team is using scenarios.

[redacted] (Chance) stated that Chance is taking an ecological perspective. Chance is trying to do the Project in a sustainable way by using constraints mapping and studies. Chance knows where the Project would like to drill. Chance needs to design winter access that considers constraints and previous disturbances. The Project team has described this to the Executive Committee and to communities to understand that Chance is listening and modifying the Project Proposal. They are not drilling year-round, and Chance's approach is unique and hasn't been done in the Arctic.

[redacted] (PCMB) asked for clarification whether the Project team was talking about next steps in the permitting process and if they had stopped talking about drilling.

[redacted] (EDI) said seismic comes first to identify the drill targets.

[redacted] (PCMB) said drilling is part of the exploration program, but we are talking about seismic right now.

[redacted] (Chance) said that Chance will still have to drill but initially they must get the targets and do the seismic. He added that this is what will help us understand what kind of resources are out there.

[redacted] (PCMB) inquired as to whether seismic would give Chance that information.

[redacted] (Chance) responded that no, it won't. He added that once it is put in a controlled environment, seismic will be used to understand of the layers of rock formation, depth of it, and any anomalies. He noted that drill site locations will be determined in the seismic studies.

[redacted] (PCMB) questioned whether Greg believed seismic and drilling to be one and the same. [redacted] (Chance) stated they are indeed different, and that identifying drill targets requires the seismic work.

[redacted] (PCMB) said [redacted] (EDI) said the drill on the slide was unconventional.

[redacted] (VGFN) asked if the last step in the process is flow testing.

[redacted] (Chance) said that that is correct. Geologists have said there is a 10 to 20% success rate, which means that 3 of 30 wells or 6 of 30 wells may be successful. Currently they do not know how successful they will be, but that there is opportunity. He noted that the business plan is focused on local consumption and that the Yukon needs additional energy. He said that Chance needs to understand what kind of gas there is and flow it. He noted that the flow time is up to six weeks. Chance would like to understand what kind of gas there is.

[redacted]NND/TH) mentioned that even if heating oil is locally sourced, it would need to be refined down south and then shipped back up. To be a local supplier, Chance would still have to ship oil south.

[redacted] (Chance) said that oil would need to be shipped south during the flow tests, but that there is technology to be refined at the site, but that's not a part of this Project.

[redacted] (YG) said that natural gas flow testing would occur for 6 weeks to prove the resource and asked Greg how long it would be with oil.

[redacted] (Chance) said it would require two years for flow testing and that Chance would be awaiting recommendations from YESAB. He added that it is longer for oil than gas. He noted that when the pressure comes up, the oil is a heavier liquid. He said that it takes time to understand it.

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[redacted] (YG) inquired about how long it would need to flow for.

[redacted] (Chance) said that the Project is not able to flow test summer months as Chance does not have all season roads. If there are successful wells, then Chance will need to seek a permit for an all-season road.

[redacted]YG) said that he's trying to understand the level of disturbance and if Chance would have to turn off the tap and begin flow tests in the following year.

[redacted](EDI) stated that that is something that Chance will have to include in the Project description.

[redacted](Chance) said that winter activities will only be 4 to 5 months.

[redacted] (VGG) asked if flaring would occur during flow testing.

[redacted](Chance) said that yes that is why flow testing is shorter because it would include a minimum of 3 weeks of flaring.

[redacted] (YG) expressed concern about how the trucks would be staged up to get the oil.

[redacted](Chance) said that Chance could get him the information. There will be heated storage, and will include 400-barrel trucks to keep the crude oil in. He said that the oil will come into a station area and before it gets taken away, there will be separators. He stated that Chance will probably have to reinject produced water back down into the wells.

[redacted] (VGG) stated that there needs to be more details about the Project Proposal and what activities Chance is proposing. For example, what are the activities associated with flow testing so that it can be evaluated. He noted that if the detail is in the Project Proposal to start with it saves everyone time. Chance will review.

[redacted] (EDI) presented the Land Use Plan Context slide.

[redacted] (EDI) said there are differences between how it works. There is the Integrated Management Area Zone 4 and that this is where it is expected that development will occur in the area. This zone has a higher level of protection than other areas. Even though Chance is looking at development in this area, Chance is looking at a high level of environmental protection. He added that it is likely one of the highest levels of protection with protection covering 37% of late winter and 31% of the fall range.

[redacted] (EDI) presented the Low Impact Seismic slide.

[redacted] (EDI) said Chance will use meandering lines to avoid large trees and to make the lines of sight to be less than 70 meters. There will be small narrow mulchers used for the seismic lines (2.5 m), which will help to protect vegetation. There is low ground pressure equipment over at least 20 cm of packed snow/ice. The vegetation will be pushed over, not cut, which means a faster recovery.

[redacted] (YG) asked if that is 20 centimetres of snowpack.

[redacted] (EDI) confirmed that it is 20 centimetres of snowpack.

[redacted] (Chance) Chance wants 20 centimeters of snowpack for winter roads, and in Chance's mitigation section, it says Chance will strive to get 20 centimeters.

[redacted] (VGG) asked if there is a design in place for meandering seismic lines and how Chance will communicate this to the operator.

[redacted] (EDI) said that that is an excellent question and [redacted] is the expert.

[redacted](Chance) said that scouting will be done in advance to understand the density of the forest, determine the location, and design it based on that information. If there are dense trees on the south side, Chance will design it to go around.

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[redacted] (VGG) asked if Chance would design it.

[redacted] (Chance) responded yes, they go out and walk it before they design it. There was helicopter support in the past to scout areas, to avoid mulching and to decide where to mulch. He noted that Chance will get more information about the criteria.

[redacted]. (YG) said they are trying to avoid site lines from certain lengths.

[redacted](VGG) said that it is up to Chance to design meandering seismic lines.

[redacted] (EDI) said that is how it works operationally.

[redacted](YG) said aerial photos could be helpful.

[redacted] (EDI) noted that Chance does not have any high-definition photos.

[redacted] (YG) said that the Yukon Government has some photos.

[redacted] (EDI) presented the Linear Feature Disturbance slide.

[redacted] (EDI) said that there are indicator levels of linear disturbance. He added that cautionary is 0.75 kilometres/square kilometer and the Regional Study Area (RSA) is 1.79 kilometres/square kilometre (unadjusted), and 0.52 kilometres/square kilometres(adjusted). He said that if the 3D lines are removed, it could be down to 0.48 square kilometers. He added that the background isn't presented too much in the LUP. He noted that Chance is utilizing the cautionary level.

[redacted](YG) said this is all the discussion from the LUP process.

[redacted] (EDI) said that there is a lot of theory around it, and that is why Chance did a linear effects study.

[redacted](YG) said that the numbers came from the caribou work. He said that he was not at the table but talked to people, such as [redacted], after the plan was done.

[redacted] EDI) said that information came out of Alberta, for example, different land uses and species in the area such as wolves preying on moose rather than caribou.

[redacted] (YG) asked what Chance meant by vegetation recovery.

[redacted] (EDI) said that they used the tall shrub stage, which was 2 metres instead of 1.5 metres from the LUP.

[redacted] (EDI) added that the old seismic approach was to cut the vegetation down.

[redacted] (EDI) presented the Environmental Constraints Mapping slide.

[redacted] (EDI) said Chance intends to avoid heritage sites, permafrost/terrain sensitive areas, riparian management areas, priority ELC units, caribou habitat, and moose habitat. He added that directional drilling is good to avoid high quality habitat, another mitigation measure.

[redacted] (Chance) said that Chance needs to get surface distance between 1.5 to 2.0 kilometres. He said that the Project team could stay on top of the hill and still drill in the valley.

[redacted] (VGG) asked if the Project videos are online.

[redacted] (Chance) said that Chance is in the process of developing a webpage.

[redacted] (Chance) said that Chance wants to launch the website before the new year and the February 2024 submission.

[redacted] (EDI) presented the Well Site Scenarios slide.

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[redacted] (EDI) said that the well site locations are unknown. He added that Chance develops scenarios within constraints to the range of potential habitat effects. Chance develops scenarios based on Scenario 1 which is developed by the seismic team.

[redacted] EDI) presented the Project Interactions slide.

[redacted] (EDI) said that there will be direct and indirect habitat interactions. Direct being vegetation clearing and indirect such as sensory disturbance. He added that there are areas where the Project team will avoid human activity. He said that there will be an indirect and direct mortality risk, direct being vehicle collisions and indirect will be due to increased predator access. This is what YESAB brought up in the first review. Chance is trying to reach a balance in the assessment.

[redacted] (PCMB) inquired about Chance's interpretation of disturbance.

[redacted] (EDI) responded that key disturbing factors are noise, smells, and human movement/presence. He added that this depends how far away caribou are from the well sites. He noted, based on mixed results in literature using various analytical methods, some possibly erroneously, that disturbances could result in no avoidance and up to ~40 kilometres of avoidance. He said that it is dependent on how the caribou are responding to the disturbance.

[redacted] (NND/TH) asked if there would be something on the ground at whatever distance it is. He asked what mitigation is there. He added that the concern is not to disturb the caribou, but how much is too much disturbance. He asked if there were other mitigations other than seasonality.

[redacted] (EDI) responded that there is a mitigation. He added that Chance calls them direct and indirect effects.

[redacted] (EDI) presented the Porcupine Caribou slide.

[redacted] (EDI) said that the key resource in the LUP is the caribou. He added that the information that Chance presents on the caribou is far more descriptive than in 2013. He noted that it was important to characterize the caribou. He added that Chance must understand the caribou enough to understand interactions with the Project. He said that Chance can't avoid all locations, and that Chance has looked at potential effects on PCH habitat and movement. He said that when looking at mortality it is challenging to quantify. He added that Chance has looked at residual effects, which are effects that are left over after mitigation is applied and that cannot be addressed.

[redacted] (EDI) presented the Porcupine Caribou – Distribution slide.

[redacted] (EDI) identified the PCH-identified life cycle periods or seasons. He added that there are patterns of occurrence from 1970 to 2016, supplied by PCTC. He said that Chance is looking at rut and winter overlap. He added that there is no doubt that Chance will see the caribou and that they will likely show up some time during the 10 year operation, and when they do, they will show up in large numbers.

[redacted] (EDI) shared movement of the PCH after the 2013/2014 seismic program. He said that the PCH moved through the Project area in 2015. He added that there were 13,000 to 14,000 observations through the cameras. He said that it was evident that they had moved through there. He noted that this has not happened ever since. He said that he is unsure where the PCH are now in the winter.

[redacted] (YG) said that the time where it does split, they used winter ranges in Alaska recently. He added that the challenge is that the PCH may go to the same area for two decades and then never go there again. He noted that he has not seen them in the uplands for two decades but that is where they used to be. He said that it is common to see them overlap with the December range.

[redacted] (EDI) said that there could be richer detail to describe. He said that when the PCH do show up it will be a lot.

[redacted] (YG) said that they do not have detailed GPS data prior to 2015. He added that collared data did not start until 2012.

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[redacted] (EDI) added that before, there were different collars.

[redacted] (YG) confirmed that previously, the location was tracked every day versus now, where you can track every minute of their movement. He added that most survey work occurs during the summer periods. He said that they had late winter data to look at distribution.

[redacted] (EDI) presented the Porcupine Caribou – Movement slide.

[redacted] (EDI) stated that in 2015, caribou travelled through a network of 2D seismic lines, winter roads, and a large 3D seismic grid. He said that the PCH will probably show up in abundance based on the work Chance has done.

[redacted] (YG) said this is late winter data. He added that that is when distribution would be done.

[redacted] (EDI) said that this is why the Project went to the Executive Committee. He added that Chance doesn't know enough about the PCH in the winter. He said that in the baseline effects, the Project can compile that data. He shared that a lot of the information was not available to the Chance team. He noted that if Chance misses anything, that this is what Chance is looking for.

[redacted] (EDI) said that caribou occupy the RSA in less than 20% of previous years. He added that rut/late fall and winter seasons are considered the least biologically sensitive periods for the herd. He said that that doesn't mean that the Project team isn't treating them sensitively, caribou are just less sensitive during these times. Winter is the least sensitive period relative to all seasons. He said that protecting calving grounds is key. He added that this herd keeps going back and other caribou herds are quite different. He noted that, the PCH are in good health this time of year and less sensitive than other times of the year. He shared that this information came from the PCTC report.

[redacted] (EDI) said that they are looking at the movement rate of PCH and what will they be exposed to. He said that based on the PCH collared data, it is evident that they move through the area. He added that it is roughly 4 to 5 days in the rut and late fall or 15 to 16 days in the winter.

[redacted] (EDI) said that the analysis consisted of quantifying daily travel times. He added that Chance characterized the seasonal ranges by dividing the seasonal range into around 2500 square kilometres of cells. He said that after that, they compared the different travel rates and residency times. He noted that the Project can say that the RSA is around half in the late fall and there are about ten days less spent in the winter. He shared that overall, caribou are spending less time in the RSA when they are there.

[redacted] (EDI) said that this is why it is important to characterize what the caribou are doing in the area. He added that they seem to be moving through the area quickly.

[redacted] (YG) asked if Chance is characterizing that their residency will be half of when they are going into the area.

[redacted] (EDI) said that we calculated residency times as an average, and that we are making a relative comparison of residency in the RSA versus the broader seasonal ranges using the collar data. He said that when the Project team is making a comparison of residency times, they are seeing this much of a difference.

[redacted] (YG) said that he is unsure if he would base the data on the limited set of examples, but it does give a sense. He added he would be leaning more on to the seasonal range data (SRD). He shared that the residency of SRD is useful. He said that he would be careful saying that about collared data.

[redacted] (EDI) said that there will be a list of uncertainties in the Environmental Assessment.

[redacted] (EDI) said that the standard error is associated with the ranges. He shared that the seasonal range average is not directly comparable to the RSA and that he is not sure if the seasonal range residency time is the best average to use. He said

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that the composition of the eco ranges is different. He added that they wouldn't expect the same amount of residency time in the RSA.

[redacted] (YG) said that there is a lot of data, around 50 years of movement data for the herd. He added that there is only GPS data for a decade, which isn't that much.

[redacted] (EDI) said that the Project team must move through with some level of confidence. He said that the Project talks about reversibility of effects and if it is reversible.

[redacted] (EDI) presented the Porcupine Caribou – Habitat Selection slide.

[redacted] (EDI) shared a recap of the methods and results for PCH. He said that they used a standard approach to developing these models and used a generalized linear mixed model. He added that it was a 1:10 used-available design. He shared that they are looking at interactions with lichens, and plant functional type layers (e.g., light microlichens, conifer, forbs, deciduous shrubs, graminoids, and evergreen shrubs). He said that it included elevation, slops, aspect, and distance to waterbodies. He added that they did random effects on the caribou year and did a 5-fold cross variation of model predictions. He added that they mapped RSF predictions across seasonal ranges.

[redacted] (EDI) said that they used selection ratios to identify the RSF prediction threshold where the proportion of used locations is greater than available. He added that this corresponds to selected habitat by caribou; these predictions considers the partial effects of all habitat covariates (rather than single covariate coefficients). He shared that they were able to identify four habitat ratings: high, moderate, low, and very low. He said that the selection threshold identified the split between high/moderate and low/very low and that the split between high and moderate was based on midpoint value, the same for low and very low.

A participant asked if this is describing the quality of the habitat or the ratio of use.

[redacted] (EDI) said that it is quantifying selection. He added that when Chance maps that, it has been classified as a habitat with high or moderate rating. He shared that it is selection, not use.

[redacted] (EDI) said that the moderate and high ratings are the areas associated with selected habitat. He shared that that corresponds to caribou using the areas more frequently than what would be expected by random chance. He added that the Project team chose the term 'selected' habitat and didn't want to use 'suitable' habitat because all habitats can potentially be suitable and used by caribou. He said that the habitat ratings are associated with higher macrolichen cover.

[redacted] (YG) asked what the Y-axis on the top graph said.

[redacted] (EDI) responded that it is the proportion of locations. He said that both figures show the same information in a different type of way.

[redacted] (EDI) presented the Caribou / Project Interaction – Review slide.

[redacted] (EDI) shared that the RSA overlaps with the PCH seasonal ranges. He added that the caribou occupy the RSA in less than 20% of years (or approximately 1 in 5 years). He shared that rut/late fall and winter seasons are considered the least sensitive periods for the herd. He added that the exposure period of individual caribou is expected to be 1 to 2 weeks. He said that Chance is looking at the assessment of criteria of seasonal habitats and that they were built into the LUP.

[redacted] (EDI) presented the Potential Habitat Effects slide.

[redacted] (EDI) shared that direct habitat effects refers to areas cleared of vegetation. He said that this affects 2% of selected rut/late fall and winter habitats within the RSA. He added that it affects 0.2% of selected rut/late fall and winter habitats at the Eagle Plains ecoregion scale. He said that the 3D seismic may not create a functional loss if lichen persists. He shared that it should not affect the lichen.

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[redacted] (EDI) shared that the indirect habitat effects refer to sensory disturbance. He added that they did a ZOI study that was applied around all disturbances. He said that they assumed a 75% reduced habitat effectiveness within a 1-kilometer ZOI. He shared that it is hard to quantify the area. He said that it means that there is a 75% chance that caribou are less likely to select the area. He added that annually, about 32% of the RSA experiences sensory disturbance and affects 23% of the selected rut/late fall and winter habitats within the RSA. He said that it affects 5% of selected rut/late fall and winter habitats at the Eagle Plains ecoregion scale. He added that it is a temporary effect which is reversed once activity stops.

[redacted] (YG) asked where 1 kilometre came from.

[redacted] (EDI) said that it is based on the permanent disturbance, which was their own zone of disturbance. He added that they looked to find a balance of something that was reasonable. He said that 1 kilometer seemed like a reasonable measure.

[redacted] (YG) said that activities like helicopter work and safety checks, cause greater disturbance than the mulcher. He added that he cautions using the 1-kilometer buffer. He shared that he thinks Chance will have a hard time supporting that in the literature.

[redacted] (EDI) said that the primary reason was to associate the ZOI with sensory disturbance. He said that in assessments where ZOIs were found to be large, there hasn't been a test or link to a clear mechanism that could lead to such large areas of avoidance. He argues that studies with large ZOIs often capture broad changes in a herd's range distribution rather than local effects of a Project. He added that this assessment is focused on local-scale sensory disturbance which covers the work area. He said that, in the literature, ZOIs are most often quantified as linear avoidance up to the ZOI threshold. This causes the average avoidance effect to be about halfway up the sloped line. He shared that, for this assessment, they applied a uniform 75% reduction across the 1-kilometer buffer.

[redacted] (YG) said there is a potential effect for the whole area. He asked how they could get this into more detail. He said they will be looking at it very closely.

[redacted] (EDI) said that they identified a 2- or 4-kilometre ZOI associated with the 2D seismic lines (including winter roads and trails). However, he stated that they identified attraction (rather than avoidance) to the 3D seismic grid. He added that the 2–4-kilometre ZOIs for historical 2D seismic are small in magnitude. Habitat effectiveness is reduced by 20–40% on the footprint itself, but the average reduction across the ZOI is much smaller.

[redacted] (EDI) asked what the sample size for the 3D seismic sample size analysis was.

[redacted] (EDI) said that he will have to circle back.

[redacted] (YG) said that the PCTC advised against doing that analysis.

[redacted] (EDI) said that Chance did not rely on a 3D ZOI analysis.

[redacted] (YG) said that it was raised. He added that it may or may not be the case, but they don't have the data.

[redacted] (EDI) added that it is not conclusive.

[redacted] (YG) said that's perfect.

[redacted] (EDI) said that Chance expects those comments to come up too and that's why the analysis is there.

[redacted] said that when you talk about all this data, so next year when you are doing the seismic, there is no additional effects to the PCH at that location.

[redacted] (EDI) said that there will be a leftover footprint. He added that there is a linear disturbance that brings in predators.

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A participant said that it seems reasonable for seismic activity, but then there is a well being drilled. They said that the ZOI would be much bigger based on that. They said that there is going to be less of an impact.

[redacted]. (EDI) said that the impact could be up to 1 kilometer, but Chance could revisit that and rethink the details of that too.

[redacted] (EDI) shared that it was 1 kilometer impact for everything sticking to sensory disturbance.

[redacted] (NND/TH) said that if the caribou are discouraged from using the ZOI and activity stops, that they came back through. He added that he doesn't know if there is any information on prolonged activity. He said that they are talking about several winters. He said that if there is a prolonged period of disturbance, he hasn't come across the information. He asked if there is any information on permanent discouragement of using the area, even after the mulching disturbance stops.

[redacted] (EDI) said that he would look at caribou near mine sites and the Central Arctic Herd and how they responded. He said that they looked it on a herd basis, but he is unsure if they respond well. He shared that work has been done on caribou response to roads, and other development. He said he cannot think of whether they responded to any well site. He said thinking about the development in Prudhoe Bay, there was work on the caribou's response to the road and pipeline. He added that they had deemed a 300-meter zone. He said that if it is not fenced off, the caribou will move through.

[redacted] (YG) said Heather did the most recent analysis on that, and their role is to do objective PCTC science. He said it is the calving and post calving information that has not been developed in the last 30 years. He added that it was around 5 or 6 kilometers. He said that it was a tundra environment and oil field, in the summer. He shared that there were many differences.

[redacted] (EDI) said that it is hard to make that comparison of linear disturbance in Alberta to Eagle Plains. He shared that a caribou response to a single well site would need a wealth of data. He said that there are forty well sites out there.

[redacted] YG) said a camera on the well site would be good.

[redacted] (EDI) said that if you look at an oil rig and the caribou herd are going through, there is a clear answer to that.

[redacted] (VGG) asked if the linear thresholds Chance talks about, are based on the proposed linear disturbance.

[redacted] (EDI) said that that is why the planning commission did their own effects strategy.

[redacted](VGG) asked if Chance has talked to anyone at the Yukon Government about cumulative effects or linear features.

[redacted] (YG) said one of the linear things that was discussed was that the threshold is 1.5 meters of wooded vegetation. He added that they just don't know.

[redacted] (Chance) said that the last direction that Chance got was from [redacted] office when she was Deputy Minister and that the challenge is that the environmental groups are challenging the Yukon Government because the proponent is responsible to go to First Nations to work with them to get their permission on conformity checks. He asked if the proponents are responsible for making communities understand the effects.

[redacted] EDI) said that at the community level during our meetings, it has not been a topic of discussion.

[redacted] (VGG) said that it's coming up in another process around cumulative effects. He added that he is curious as it sounds like a lot of that work was based on studies from Alberta. He asked what the underpinning of the analysis is and if there is other information that is new to him.

[redacted] (EDI) said that Chance looked at the line of sight, travel speeds, visibility, and different levels of regeneration. He added that the Project team wanted to inform the planning commission.

[redacted](Chance) said that when Chance made the original submission, their understanding was that the Land Use Planning Council was working with them. He stated that they were told that Chance must figure that out and convince any other affected

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parties. He asked how Chance does that work. Chance completed what it was required to do based on what was agreed to. He said that it is basically an EMR (Energy, Mines, and Resources) office that is just trying to figure it out. He shared that Chance is confused on who will oversee the old studies and disturbance that didn't occur from Chance/Northern Cross.

[redacted] (EDI) added that Chance did their own studies of effects. He added that that is how Chance came up with adjusted numbers.

[redacted] (NND/TH) said that he's come across concerns about the Land Use Planning Council not having the background that the commission has. He added that this is a compounding factor. He said that the council doesn't have a knowledge of history that the commission developed under the treaty, and that the council doesn't have the background to consider a project. He said that there are concerns about the council being capable of having a reliable opinion.

[redacted] (Chance) said that Sam is at the council and has a lot of knowledge and has been there for a while. He shared that there is no North Yukon Commission now.

[redacted] (YG) said that he is interested in talking about mitigations. By focusing on if the herd is coming through, it minimizes the issue. What happens when they do come through. It may be important to get information from the PCTC or Mike Suitor from the Yukon Government. If you hear caribou are coming your way and will be there in 3 days, what will the response be to that data.

[redacted] (EDI) said that they will get into that. He added that the monitoring part is an important part of the assessment.

[redacted] (EDI) presented the Potential Movement Effects slide.

[redacted] (EDI) said that there will be local movement effects such as reduced crossing if there is traffic on roads and seismic lines. Effects to seasonal movements or migrations are unlikely. Long distance movements will mostly be in fall and do not overlap with the bulk of Project activities. Short residency times and fast movement rates through the RSA and caribou travel through network of linear features in the RSA.

[redacted] (YG) said that pertaining to the effect of harvesting activities, there are areas where similar work has been done. A similar migrating effect can be seen and that it is possible that it may change a migration pattern. He said that he doesn't want to discount it.

[redacted] (Chance) asked what the probability is of that occurring.

[redacted] (YG) said that he is unsure exactly. He added that in 2015 it almost happened.

[redacted] (Chance) said that it is easy to tell that they go along the Dempster Highway.

[redacted] (YG) said that humans are travelling the same way the PCH like to because it is the easier travel. He added that it is a scenario that could occur, and it shouldn't be discounted.

[redacted] (PCMB) said that if looking at the probability, what's going to be in place with the PCTC, the people, and what is the plan to respond.

[redacted] (EDI) said that Chance will note it. He asked if it is going to stop them from entering the work area. He stated that Chance is assuming a 75% probability. He said that he is not trying to downplay the potential effects, but it is only an exploration project.

[redacted] (YG) said that YG has programs that shut down for 2 to 3 weeks when the herd hits.

[redacted] (EDI) said that that will certainly happen. He said that the Project team can't operate with thousand caribou around us. He added that it will affect their localized movement.

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[redacted] (EDI) presented the Potential Mortality Effects slide.

[redacted] (EDI) said that direct effects are vehicle collisions, but this is low risk on access roads and seismic lines. He said that by restricting the road, it won't be public access. He stated that the indirect effects are predation and hunting. He added that linear features might give more access to humans.

[redacted] (NND/TH) said that the resource road regulation on the Territorial Roads Land Act should give Chance permission to make the road private. He asked how Chance can use it as a private road. He asked if under the Oil and Gas Act they would be able to say it is a private road. He asked if Chance has had that discussion.

[redacted] (Chance) said that the Chief Operating Officer (COO) can make it a private road. He said that it is more of a safety concern, and no one wants to hunt around the drilling area. He added that it is one thing to give the access to an Indigenous harvester, from a safety point of view there is an issue around the work area buffer.

[redacted] (NND/TH) asked if the COO has the capability to give Chance a private road.

[redacted] Chance) confirmed yes and that they have had a COO do it before.

[redacted] (EDI) said that any predator wants easier access. He shared that it would have a temporary effect, limited to annual work areas where activities pack the snow on linear feature. He added that there aren't resident caribou in the Project area compared to other herds. He said that it is hard to conceptualize.

[redacted] (YG) said that he has seen people using the seismic lines. He said that there is no real monitoring of it. He stated that on predation, it is a different scenario. He shared that it is complicated because there are migratory wolves. He added that the question is if the herd has a major decline. He said that it is being anticipated sooner or later but they don't know.

[redacted] (EDI) said that there is uncertainty around mortality effects. He shared that it is more around Indigenous access, but Chance doesn't know how to move around that.

[redacted] (YG) said that the affected harvest on ZOI basically has a double effect.

[redacted] (EDI) said that as soon as the Project increases predation risk, there will be an increased effect. He added that it is important to increase local awareness there.

[redacted] (YG) said that this can be dealt with in the Project Effects Assessment.

[redacted]. (EDI) said that there is no harvest policy other than the Indigenous Rights to Harvest.

[redacted]. (EDI) presented the General Protection Measures slide.

[redacted] (EDI) said there is environmental constraints mapping to reduce habitat loss. Chance will stay out of this area when caribou are coming. There will be a limited annual footprint, reducing sensory disturbance. There will be access management to reduce mortality risk. People will probably use the winter access. He shared that he doubts that individuals will use the 3D seismic access.

[redacted] (YG) agreed that people likely won't use it as well.

[redacted] (EDI) shared that low impact seismic will help to reduce habitat loss and has been developed over the years. He added that there will be a maximum width of 2.5 meters that will retain ground vegetation. There will be speed limits in place to reduce mortality risk. He emphasized the importance of worker awareness, including reporting any sightings. There will be a caribou interaction response plan. He asked if there is an information database that Chance can use to understand weekly migration patterns.

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[redacted] (YG) said that the YG is trying to get a database in place. He shared that the PCTC updates their website and YG does the updates as they can. He said that the YG has a regulatory meeting that often changes things.

[redacted] (EDI) asked if YG will tell them when the caribou are coming.

[redacted] (YG) said that some companies are required to contact YG on a schedule. The other more likely scenario is just paying attention to the herd. He said the Chief of Mine and Land Use provides emails and the YG provides weekly updates after that. He shared that YG has been doing it for 5 years and it is working well.

[redacted] (EDI) said that there is flexibility with the seismic operation and that it will be Chance's bad luck. He added that Chance can't move the seismic and once a drill is spinning, the Project team can't stop.

[redacted] (NND/TH) said that it is possible to stop the drill.

[redacted] Chance) said that when driving, risks of potential impacts are increased. He added that there are speed controls, traffic controls, and the only traffic would be wildlife monitors.

[redacted] (EDI) said anything that is necessary.

[redacted] (NND/TH) said there was a constant of bringing water in with big trucks when he worked at the mine sites.

[redacted] (EDI) said that once the drill is going, it is not stopping.

[redacted] (PCMB) said that a caribou action response plan has potential, and he knows PCMB would be interested. He said it would be great if Chance could get their caribou information from PCMB and PCTC. He added that it would be good to see something established. If Chance is responding to caribou interactions, it would be nice to have a plan established. It would make sense if there was official communication linkage to be notified. These communications could establish a cooperative protocol. He added that this could help PCMB study the herd.

[redacted] (EDI) said that he wouldn't be able to develop that independently.

[redacted] (Chance) said that he agrees with getting the real data.

[redacted] (YG) said there will always be redundancy on this, and YG is trying to figure that out. He added that there are ways to do it. He said that the challenge for using satellites to track is that there could be several thousand caribou that don't have collars.

[redacted] (EDI) said that he agrees that it is only a small portion.

[redacted] (YG) said that there are 110 collars on the caribou.

[redacted] (EDI) said there is a level of warning from local monitors. He added that there will be a balance of reported observations, onsite. He shared that Chance would have to do aerial surveys.

[redacted] (YG) said there is no need for aerial surveys. He added that it can give you a sense of what you are dealing with and that they did that in 2013.

[redacted] (PCMB) said that it makes her think about how PCMB could help. If there are wildlife monitors around, it would be great to get regular updates on what they are observing. She added that if there is a situation where several caribou are coming to the Project area, the PCMB has connections to the Porcupine Caribou communities to get the word out. PCMB can help communicate things to bring show that we are engaged and that communities can be confident that Chance and PMCB are working together and sharing accurate information. PCMB wants the communities to be comfortable with what is happening. She added that there is the opportunity to look at the PCMB and Chance engagement as a very positive thing.

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[redacted] (EDI) said that this could be something to work on. He said that he agrees on collaboration and that aerial surveys during operation will be good. He shared that he thinks that the project can operate safely. He said that a lot of this relies on the observers being there.

[redacted] (NND/TH) said that with an existing drill site, and caribou in the area, Chance won't be able to shut down the drill. He said that the idea being that traffic could be reduced. He doesn't know where the water is coming from for the drill. He said that in past projects, there was a 24-hour supply of water from the water source to the drill site. He said that unless technology has changed, that is one example of traffic that can't be stopped if there are caribou in the area. He asked if the reduction would be sufficient or not.

[redacted] (EDI) shared that Chance doesn't have the details on what is considered essential road traffic right now. He shared that 5 vehicles a day sounds manageable.

[redacted] (YG) said that his issue is that there are no communications occurring with the Executive Committee. He said that it is important to have these conversations. These conversations will greatly increase Indigenous relations.

[redacted] (PCMB) said that the PCMB represents PCMB from the PCMB Agreement parties. She said that the PCMB isn't a decision-making board, but they can provide input to regulatory processes and review processes. She added that the PCMB knows trust is important with communities and when working with groups that are willing to go over and above what is specified in regulatory decisions. When the PCMB knows that there is an interest in building that trust, if anyone is looking at building positive relationships, it must be a collaborative process. There needs to be transparency and a willingness to work together no matter what the information may be. It is important for PCMB to do that and that the PCMB wants to work together. It is reasonable to say Chance can't shut down a well in production if there is a conversation ahead of time. If they know about these concerns in advance, there could be something in place that incorporates Traditional Knowledge that would address the communities' concerns. She shared that when caribou come and you can't shut down the well, the PCMB knows that that is reasonable, and they can support that. The PCMB can help with mitigation around that. She said not to underestimate the trust with PCMB and that the PCMB wants to work with Chance to do a good job of this. She shared that what happens with the Project will last in people's minds.

[redacted] (NND/TH) said that even if the PCMB aren't a decision maker, they are important.

[redacted] (EDI) said that the next step is mitigation. He said that he has seen a change in the approach by Chance. It comes down to the communication aspect and the seismic program is flexible.

[redacted] (YG) said regarding the effects monitoring piece, that looking at developing a couple of well-focused designs would be helpful. He said that if the exploration project is successful, Chance will get towards a development stage and there won't be any data.

[redacted] (EDI) said that to determine if mitigation is successful, Chance will have to do an experimental approach.

[redacted] (NND/TH) said that they do a report at the end of the season, to understand if it worked. He is amazed that this is not being considered.

[redacted] (EDI) said that this is a 10-year program, and it is Chance's opportunity to learn. He added that Chance wants to understand what the caribou do.

[redacted] (YG) said that the collared data is one scale.

[redacted] (EDI) said that it makes sense to put in effects monitoring.

[redacted] (YG) said that he is happy to work with Chance and discuss with PCTC to provide input. It is going to have to be a collaborative approach somehow.

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APPENDIX 2-A-17. Exploration Project Information

NORTHERN CROSS

Exploration Project

- Small size impact: less than 1 square kilometer of total impact if all 20 of the proposed exploration wells are drilled and all are discoveries of oil or natural gas that proceed to extended flow testing, which also includes building up to 87 kilometers of year round access roads
- For perspective, excluding the airfields, the town sites of Mayo and Old Crow each cover an area similar to the maximum impact of the exploration drilling program. Dawson City covers an area that is more than 30 times the size of the area of maximum impact.
- The proposed exploration project is planned to occur within the 325 square kilometer area where 3D seismic data was obtained during the winter of 2013-2014
- This project proposal is exploration related work and is not development. More YESAB screening is expected on any discoveries that become development projects
- Exploration activities have uncertain outcomes.
- How many of the proposed 20 wells actually get drilled depends on results as the drilling program proceeds because many of the planned wells depend on successful outcomes from the initial wells drilled
- If drilling results are discouraging, fewer exploration wells will get drilled
- The most likely outcome is that only a few discoveries will be made and undergo extended flow testing, which means the impact will be much less than the maximum described above.
- Any wells undergoing flow testing provide useful information to be able to design development plans
- Nothing in the proposed exploration project is resource development
- Northern Cross has an excellent track record of environmental protection and minimizing impacts
- Activities are designed to be small scale and extend over a longer time period to create more job and business opportunities for Yukoners and to minimize environmental impacts
- Hydraulic fracturing is not part of the proposed exploration drilling and evaluation program.
- The proposed exploration activities are not in the Peel River Watershed

Partnership Opportunities

- Northern Cross recognizes the important role that First Nations offer in the longer term success of resource exploration and development
- Environmental stewardship (base line studies, monitoring, adaptive management plans, protecting traditional uses)
- Business development opportunities (oil field services, direct investment similar to the VG ownership of Air North, synergies with other VG businesses)

Judicial Review

- Northern Cross has challenged YESAB on grounds of procedural unfairness
- YESAB made a referral to Executive Committee based on reasons that had never been presented to Northern Cross
- Northern Cross was never given the opportunity to address these new concerns
- In the interest of fairness, Northern Cross wants the opportunity to respond to the new issues identified by YESAB in its Evaluation Report of February 8, 2016
- The judicial review is a challenge only against the Government of Canada, who is acting on behalf of YESAB in this court process.
- Northern Cross is NOT challenging any First Nation or any legal rights of First Nations under Umbrella Final Agreements in this Judicial Review
- However, all parties who participated in the YESAB review of the exploration drilling program were served with the court application made by Northern Cross for a Judicial Review in the normal course of the legal process

Caribou protection

- Northern Cross cares deeply about caribou and the environment and manages its activities to minimize or eliminate impacts.
- Northern Cross has a demonstrated track record of environmental protection, including protecting caribou
- Northern Cross has prepared several management plans with the help of professional experts in their fields including recognized experts knowledgeable in the Porcupine Caribou Herd
- The management plans have been reviewed by VG government departments and are designed to be adaptable based on experience gained in the field.
- Northern Cross has proposed forming a Caribou Stakeholder Advisory Board comprised of interested stakeholders to provide guidance in the management of project activities in situations where caribou are present.

APPENDIX 2-A-18. Draft *Yukon First Nation Engagement and Consultation Strategy* – document not available at time of submission.

APPENDIX 2-A-19. Letter from Chance on Communications and Engagement Plan – document not available at time of submission.

APPENDIX 2-A-20. Notification Letter of Tenure Extension Request of the Exploration Permits 0012-117 – document not available at time of submission.

APPENDIX 2-A-21. Draft *First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Limited Engagement and Communication Plan* (Version 1) – document not available at time of submission.

APPENDIX 2-A-22. *First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Limited Engagement and Communication Plan* (Version 2) – document not available at time of submission.

APPENDIX 2-A-23. *Eagle Plains Environmental Studies 2018*

Eagle Plains Environmental Studies 2018

Chance Oil & Gas is conducting environmental studies in summer 2019 to collect data on fish, water, permafrost, vegetation and wildlife to support its proposal to conduct exploration activities in the Eagle Plains project area. Chance welcomes participation of local First Nation citizens and traditional knowledge holders in these programs.

All projects will require varying degrees of hiking in steep, rugged terrain and thick bush under production-oriented work conditions. Participants will require average to above average fitness to participate in the work, depending on the survey.

Chance regrets that opportunities for participation in the field studies are limited due to safety and logistical considerations, and all interested citizens may not be able to participate. The logistics of participation in the studies are still being finalized, however, there will be approximately spots for two participants from each First Nation with Traditional Territory overlapping the project area. Travel to and from Eagle Plains Hotel will need to be coordinated by each First Nation.

In addition to these field programs, Chance will be holding a number of community meetings, to provide an opportunity for First Nation citizens, who cannot participate in the field programs to be able to comment on the proposed program.

Access to all work sites will primarily be by helicopter out of Eagle Plains. A small number of sites will be accessed off the Dempster Highway.

A short description of each survey is provided, below.

Bird Surveys

Bird surveys will follow standard 'point count' methods that involve recording all the birds the observers hear and see from an observation station during a 10-minute survey period. Stations are located 500-1500 m apart and are accessed via hiking. This work is very production oriented in order to meet sample size requirements during the relatively short 'dawn chorus' when birds are singing and requires above average fitness to hike quickly between stations. Total hiking distance of 5-10 km per day through rugged terrain and thick bush will be required. The daily work shift is 2:30 am to noon. Participants should have a set of binoculars to get the most out of the survey, but they are not absolutely required.

Vegetation Surveys

Vegetation surveys are being conducted to verify ecosystem/habitat maps and to survey for rare plants. Work will be split over 2 shifts. The daily shift in round 1 will be from 4am to 3pm, to coordinate helicopter use with bird surveys. The shift during the second round is a more civilized 7am-6pm. The work will consist of 15-45-minute vegetation plots where the surveyors record plant occurrences, site conditions, and wildlife sign and habitat. Successive plots will be accessed by a combination of hiking and heli bumps. Participants will need to hike 3-6 km per day through rugged terrain and thick bush, requiring average fitness. No special gear is required.

Seismic Line Study

The purpose of the seismic line study is to document the degree of vegetation regeneration on old lines from past exploration programs 1950-2000's and to characterize the characteristics of new lines (i.e. from 2014) and how they may affect wildlife. The details of survey methodology are still being developed but will likely consist of ~15 minute vegetation plots at multiple spots along different seismic lines. Successive plots will be accessed by a combination of hiking and heli bumps. Participants will need to hike 3-6 km per day through rugged terrain and thick bush, requiring average fitness. No special gear is required.

Aquatic Surveys

Fish and water surveys are being conducted to improve knowledge of fish distribution and water conditions across the proposed project area. Surveys at each site will include electrofishing, stream site descriptions, and water sampling. Each site will take 45-90-minutes to complete. Access to most sites will be via helicopter with a relatively short walk to the stream (i.e. <300m). However, some sites may require hikes of up to 1km to get into.

Chest waders are required to participate in the fish and water surveys.

Required Field Gear for all projects includes:

- Sturdy hiking boots (second pair for when the first get wet is recommended)
- Rain gear
- Appropriate layers of clothes
- Personal first aid/survival kit
- Bug hat/insect repellent
- Hat
- Backpack or cruisers vest
- Bear spray (*Note that EDI does not permit firearms to be carried in the field or brought to a work site).

APPENDIX 2-A-24. *Project Proposal* (Version 1)

YESAB PROJECT PROPOSAL

Eagle Plains Well Maintenance

Chance Oil and Gas Limited

Prepared for:

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LIST OF ACRONYMS AND ABBREVIATIONS

List of Acronyms	
Acronym	**Definition**
ANWR	Arctic National Wildlife Refuge
BOP	Blowout Preventer
DO	Designated Office
DFO	Fisheries and Oceans Canada
ELC	Ecological and Landscape Classification
FNNND	First Nation of Na-Cho Nyäk Dun
GTC	Gwich'in Gwich'in Tribal Council
HRIA	Heritage Resource Impact Assessment
HROA	Heritage Resource Overview Assessment
LUP	Land Use Permit
mKB	Meters below Kelly bushing
NYLUP	North Yukon Land Use Plan
OGDPR	Yukon Oil and Gas and Drilling Production Regulations
PWLUP	Peel Watershed Land Use Plan

SCVF	Surface casing vent flow
TH	Tr'ondëk Hwëch'in
VC	Valued Component
VGFN	Vuntut Gwitchin First Nation
VRLA	Vegetation Local Assessment Area
VRAA	Vegetation Regional Assessment Area
YESAA	Yukon Environmental and Socio-Economic Act
YESAB	Yukon Environmental and Socio-Economic Assessment Board

1.0 INTRODUCTION

Chance Oil and Gas Limited (Chance) (the "Proponent") is proposing to conduct routine maintenance on eight of its suspended wells near Eagle Plains, Yukon (the "Project"). Government of Yukon, Oil and Gas Branch (the "Regulator"), has notified Chance that well maintenance is required in order to maintain the suspended well status on four of the wells: NCY McParlon A-25, NCY Ehnjuu Choo B-73, NCY East Chance E-78 and NCY West Chance H-28. Wells Canoe River Chance J-19, Socony Mobil WM Blackie No 1 M-59, Socony Mobil WM Chance YT No 1 YT G-08, and Western Minerals Chance YT No 1 M-08 will also undergo maintenance work. A suspended well is considered a well that is not producing and has been safely secured. With a well in suspension, there is potential to restart production later. This differs from well abandonment where the well is permanently shut down, plugged, the well head is removed and is considered safe and secure by regulators (CAPP, 2019). The well maintenance activities will be executed within the confines of the Oil and Gas Drilling and Production Regulations (OGDPR). Well maintenance activities, also known as well workovers, generally include the following activities:

- Pressure testing to confirm integrity of the casing and well head valves;
- Removal of equipment in the well bores such as tubing and plugs;
- Wireline investigations to measure temperatures and cement integrity and to convey any perforating equipment;
- Remedial work such as cement squeezes; and
- Conducting a wellbore integrity analysis to determine possible well abandonment.

To mobilize maintenance equipment and crews to the well sites, the project will require re-establishment of the Chance and Blackie winter roads.

The proposal is being submitted to the Yukon Environmental and Socio-economic Assessment Board (YESAB) for an assessment under the *Yukon Environmental and Socio-economic Act* (YESAA). This is required in order to obtain the necessary permits and authorizations to perform the work.

1.1 Proponent Contact Information

The Proponent has retained Hemmera to prepare and submit the Project Proposal to the Dawson Designated Office (DO).

The Proponent contact information is:

Greg Charlie, Vice President
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The Agent contact information is:

Andrew MacPhail, Project Manager
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The preferred method of communication for the Proponent and Agent is via email. The Agent authorization form has been submitted to the Dawson DO as part of the Project Proposal documents.

1.2 Location

The Project is located 30 to 70 km south of Eagle Plains Hotel, in northeast Yukon (**Figure 1-1**). The exploration wells requiring maintenance are detailed in **Table 2-1** and **Figure 2-1**.

Seven of the wells are located in the upper reaches of the Porcupine River watershed on the west side of the Dempster Highway and one is located in the upper reaches of the Peel River watershed on the east side of the Dempster Highway. The nearest watercourse to the wells located in the Porcupine watershed are McParlon Creek which has two tributaries framing the south and western sides of the Chance Significant Discovery License and Ehnjuu Choo Creek. The watercourse nearest the Blackie M-59 well is Dalgleish Creek which flows into the Ogilvie River. There are no water bodies (i.e., lakes or ponds) in the area of proposed activities.

The Dempster Highway transects the area and provides the all season access to the Blackie winter road, the Chance winter road, and the suspended wells at McParlon A-25 and Ehnjuu Choo B-73 which are located immediately adjacent to the Dempster Highway. The nearest outpost is the Eagle Plains Hotel and Highway Maintenance Base which is located approximately 30 to 70 km north of the locations where the workovers are planned to occur. (**Figure 2-1**).

The latitude and longitude coordinates for the proposed Project are:

NW:	66.20808719	(lat/northing)	-137.6280058	(long/easting)
NE:	66.21832565	(lat/northing)	-136.9320243	(long/easting)
SW:	65.96218433	(lat/northing)	-137.6037058	(long/easting)
SE:	65.97269282	(lat/northing)	-136.9164459	(long/easting)

Figure 1-1 Project Location

1.3 Regional Land Use Plans

The proposed Project is located within the boundaries of the North Yukon Planning Region and Peel Watershed Planning Region and is therefore subject to the North Yukon Land Use Plan and (NYLUP) Peel Watershed Land Use Plan (PWLUP). Locations of proposed Project activities are within Land Management Unit (LMU) 9 of the NYLUP and LMU 7 of the PWLUP. (**Table 1.1**). Both are located within the Eagle Plains basin, with the highest potential for oil and gas development. Details regarding how the Project will meet the requirements of the Northern Land Use Plan and Peel Watershed Land Use Plan is provided in **Section 7.5** and **Table 7.2**.

Table 1.1 Landscape Management Units Overlapping the Project

Landscape Management Unit Number	Landscape Management Unit Name	Integrated Management Area (IMA)
9 (NYLUP)	Eagle Plains	4
7 (PWLUP)	Dalglish Creek	4

1.3.1 First Nations and Indigenous Groups

The proposed Project is located in the following First Nations and Indigenous groups' traditional territories (**Figure 1.1**):

- First Nation of Na-Cho Nyäk Dun (FNNND)
- Tetlit Gwich'in Council (TGC)
- Gwich'in Gwich'in Tribal Council (GTC)
- Vuntut Gwitchin First Nation (VGFN)

Vuntut Gwitchin First Nation (VGFN) and Tetlit Gwich'in Council (TGC) are Gwich'in First Nations that have traditionally used and occupied lands in the Northwest Territories and the Yukon, and are linked by close cultural and linguistic (Athapaskan) traditions. VGFN are based in Old Crow, Yukon, while the TGC are based in Fort McPherson, Northwest Territories. The Gwich'in Tribal Council (GTC) is an Indigenous organization based in Inuvik, Northwest Territories. The GTC holds rights under Section 35 of the Constitution Act, 1982, Treaty 11 and the Gwich'in Comprehensive Land Claim Agreement (GCLCA),– Yukon Transboundary Agreement (YTA). Under the GCLCA, GTC is the body responsible for representing the collective rights of GCLCA participants, including all Tetlit Gwich'in as defined in the YTA. Yukon lands of the TGC are identified in the YTA as the Primary Use Area and the Secondary Use Area lands.

The proposed Project area is immediately north of the Tr'ondëk Hwëch'in First Nation Traditional Territory and Settlement Land. The Tr'ondëk Hwëch'in (TH) are a Yukon First Nation based in Dawson City, Yukon. They are descendants of the Hän-speaking people and are a diverse mix of families descended from Gwich'in, Northern Tutchone, and other language groups. The First Nation of Na-Cho Nyäk Dun (FNNND) are a Yukon First Nation based in Mayo, Yukon. They are also of the Northern Tutchone language and cultural group.

1.3.2 Yukon Environmental and Socio-Economic Assessment Act (YESAA) Triggers

The proposed Project requires an evaluation by a Yukon Environmental and Socio-economic Assessment Board (YESAB) Designated Office (DO) because:

1. The project location is in the Yukon;
2. The *Assessable Activities, Exceptions and Executive Committee Projects Regulations* identifies several triggers for the Project including:
    a. Schedule 1, Part 3, Oil and Natural Gas, Item 2:

    On other than an Indian reserve, drilling, operation, modification, decommissioning or abandonment of, or other activity in relation to, an oil or natural gas well or seismic shot hole, but not including a hole drilled to obtain geological information.

    b. Schedule 1, Part 13, Miscellaneous, Item 13:

    On Crown land or settlement land, levelling, grading, clearing cutting or snow ploughing of a route that provides access to land for the purposes of a geophysical, geological or engineering survey.

3. An authorization by a government agency is required for the activities to be undertaken.

The Project is located near Eagle Plains, Yukon and it is understood that the Dawson Designated Office will carry out the evaluation.

1.4 Permits and Licenses / Regulatory Requirements

Chance currently holds the following licenses and approvals from previous activities at the Site:

- Type B Water Licence (MN12-061-1)

To complete the Project the following approvals are required.

- Air Emission Permit
- Land Use Permits
- Dempster Highway Authorization Permit
- Storage Tank Permit
- Waste Management Permit
- Work within Highway Right-of-Way Permit

1.5 Alternatives

Currently there are no alternatives being considered. The proposed well maintenance work has been directed by the Government of Yukon and is designed in accordance with Part 7 of the OGDPR. Alternative technologies and methods for accessing the well sites are also not feasible. Winter access and work are being proposed in order to reduce and eliminate potential effects to various valued components (e.g., permafrost, vegetation, etc.) and has been designed according to best practices and Government of Yukon standards. Other means of access such as helicopter supported are not feasible during winter and low light conditions for personnel health and safety considerations.

2.0 PROJECT DESCRIPTION

2.1 Project Activities

This section provides an overview of the proposed Well Maintenance Program. There are two main components to the Project that include:

- Routine maintenance of suspended wells (well workover); and
- Re-establishment of the Chance winter road and Blackie winter road.

The well maintenance activities proposed are being conducted in order to satisfy a direct order from Government of Yukon, Oil and Gas Branch. Accessory activities, such as construction and re-establishment of the winter roads, is required to access the suspended well sites and complete the maintenance of each well. A letter outlining the order from the Government of Yukon, Oil and Gas Branch is provided in **Appendix A**. Locations for each of the wells is provided in **Table 2.1** and **Figure 2-1**.

2.2 Well Maintenance

The following section describes the work proposed at each of the wells. Each of the wells is deemed suspended by the *Yukon Oil and Gas and Drilling Production Regulations* (OGDPR) (is not producing and safely secured). Well maintenance is required to continue to meet the OGDPR suspended well status regulations. Well servicing equipment may include a service rig, wireline truck and cementing trucks along with the associated support equipment. All equipment will be mobilized to each of the wells on a sequential basis (one at a time) to complete the required maintenance work (downhole suspension, wellbore fluid replacement, replace substandard equipment). The eight wells that require maintenance include:

- Socony Mobil WM Blackie No 1 M-59 (M-59);
- Western Minerals Chance YT No 1 M-08 (M-08);
- Canoe River Chance YT J-19 (J-19);
- Socony Mobil WM Chance YT No 1 YT G-08 (G-08);
- NCY McParlon A-25 (A-25);
- NCY Ehnjuu Choo B-73 (B-73);
- NCY West Chance H-28 (H-28); and
- NCY East Chance E-78 (E-78).

A detailed description of the planned maintenance activities at each well is summarized in the following sections. A summary of the activities at each well is provided in **Table 2.2**.

Table 2.1: Well Locations

Well Name	Location	
	Latitude	Longitude
Socony Mobil WM Blackie No 1 YT M-59	65° 58’ 54.93.9” N	137° 18’ 58.2” W
Western Minerals Chance YT No 1 M-08	66° 07’ 46.0” N	137° 31’ 27.3” W
Canoe River Chance YT J-19	66° 08’ 31.0” N	137° 32’ 27.0” W
Socony Mobil WM Chance YT No 1 YT G-08	66° 07’ 18.1” N	137° 30’ 50.8” W
NCY McParlon A-25	66° 04’ 10.3” N	137° 18’ 58.2” W
NCY Ehnjuu Choo B-73	66° 12’ 10.3” N	136° 59’ 01.5” W
NCY West Chance H-28	66° 07’ 29.8” N	137° 34’ 05.6” W
East Chance E-78	66° 07’ 18.5” N	137° 14’ 46.8” W

Table 2.2 Summary of well maintenance activities

Well Name	Wellhead Inspection	Pressure Test	Surface Casing Vent Flow	Gas Migration	Temperature Log	Cement Bond Log	Hydraulically isolate formations	Well Bore Fluid Test
Socony Mobil WM Blackie No 1 M-59	-	X	X	X	X	X	X	-
Western Minerals Chance YT No 1 M-08	-	X	X	X	-	X	X	-
Canoe River Chance YT J-19	X	X	X	X	X	X	X	-
Socony Mobil WM Chance YT No 1 YT G-08	X	X	X	X	X	X	X	-
NCY Ehnjuu Choo B-73	X	X	X	X	X	X	X	-
NCY West Chance H-28	X	X	X	X	X	X	X	-
NCY McParlon A-25	X	-	X	X	X	-	-	X
East Chance E-78	X	-	X	X	X	-	-	X

Figure 2-1: Well and winter road locations

2.2.1.1 Legacy Wells

Legacy wells were drilled by other operators from 1959-1968,and are located on Significant Discovery Licenses Blackie (021) and Chance (022).The Legacy wells requiring maintenance include:

- Socony Mobil WM Blackie No 1 YT M-59
- Western Minerals Chance YT No 1 M-08
- Canoe River Chance YT J-19, and
- Socony Mobil WM Chance YT No 1 YT G-08

A pressure test is conducted to ensure the integrity of the wellhead and the existing casing in the wellbore. The well will then undergo surface casing vent flow and gas migration testing. Surface casing vent flow (SCVF) is a condition where fluid or gas is flowing from the surface casing vent assembly. A well that has a leak, or a well integrity problem may exhibit signs of SCVF. Gas migration tests are conducted to determine if the well has a gas migration problem. For the purpose of this test, gas migration can be defined as the movement of gas from a subsurface zone to surface through a barrier that should prevent its movement, whether this barrier is natural (overburden, shale) or artificial (cement sheath, external casing packed, pipe joints etc.). It should be noted that during annual inspections, no SCVF has ever been detected. If there is evidence of surface casing vent flow the well will be logged with a variety of tools (e.g., noise tool, temperature tool, bond log tool) to determine the source of the surface casing vent flow and/or gas migration. The logs will be analyzed and a plan will be formulated to complete a downhole shut off at the source of the surface casing vent flow and/or gas migration.

Once the pressure testing, surface casing vent flow testing and gas migration testing is complete, the service rig, support equipment and wireline will be moved to the wellsite. A blowout preventer (BOP) will be installed on the well. Blowout preventers are specialized pressure-control equipment attached to the wellhead to seal, control and monitor oil and gas wells to prevent the uncontrolled release of crude oil or natural gas while operations are occurring on the well. A temperature log will then be conducted to a depth of 300 meters below Kelly bushing (mKB). The temperature log is interpreted by looking for anomalies, or departures, from the reference gradient. This reference gradient might be the geothermal gradient, a log recorded before production or started, or a log recorded with the well shut in. Most anomalies are related to the entry of fluids into the borehole or fluid exit into the formation. Following the temperature log, a cement bond log will be run. The cement log is a log that uses the variations in amplitude of an acoustic signal travelling down the casing wall between a transmitter and receiver to determine the quality of cement bond on the exterior casing wall. The fundamental principal is that the acoustic signal will be more attenuated in the presence of cement than if the casings were uncemented. The cement log is used to identify sections of the well bore that will need interventions to isolate porous formations from adjacent formations.

To isolate a formation from an adjacent formation, the casing will be perforated at the appropriate depth with a wireline conveyed perforating gun. Tubing will then be used to inject cement through the perforations in sufficient quantity to ensure adjacent formations are isolated from each other, at which point pressure will be applied from surface to force the cement into the perforations. Once the cement has cured, the cement will be pressure tested as per the Yukon Oil and Gas and Drilling Production Regulations. The process is then repeated until all formations are isolated from one another and pressure tested. The isolation operations will begin with the deepest non-isolated formation and progress to the shallowest non-isolated formation. Once all the testing/isolation procedures are complete, the tubing will be pulled from the

well, a new well head assembly will be installed, and the well head will be pressure tested once more. The service rig and all support equipment will then be removed from the site.

Additional activities at M-59 include installation of a wellhead that conforms to the OGDPR regulation. In addition, for G-08 and J-19, the tubing and packer will be removed during the workover following completion of gas migration testing.

2.2.1.2 Modern Wells

The modern wells were drilled by Chance/Northern Cross in 2012-2013. The modern wells requiring maintenance include:

- NCY McParlon A-25
- NCY Ehnjuu Choo B-73
- NCY West Chance H-28, and
- NCY East Chance E-78

A pressure test is conducted to ensure the integrity of the wellhead and the existing casing in the wellbore. The well will then undergo surface casing vent flow and gas migration testing. SCVF is a condition where fluid or gas is flowing from the surface casing vent assembly. A well that has a leak, or a well integrity problem may exhibit signs of SCVF. Gas migration tests are conducted to determine if the well has a gas migration problem. For the purpose of this test, gas migration can be defined as the movement of gas from a subsurface zone to surface through a barrier that should prevent its movement, whether this barrier is natural (overburden, shale) or artificial (cement sheath, external casing packed, pipe joints etc.). It should be noted that during annual inspections, no SCVF has ever been detected on any of the wells. If there is evidence of surface casing vent flow the well will be logged with a variety of tools (e.g., noise tool, temperature tool, bond log tool) to determine the source of the surface casing vent flow and/or gas migration. The logs will be analyzed and a plan will be formulated to complete a downhole shut off at the source of the surface casing vent flow and/or gas migration.

A temperature log will then be conducted to a depth of 300 meters below Kelly bushing (mKB). The temperature log is interpreted by looking for anomalies, or departures, from the reference gradient. This reference gradient might be the geothermal gradient, a log recorded before production or started, or a log recorded with the well shut in. Most anomalies are related to the entry of fluids into the borehole or fluid exit into the formation. Following the temperature log, a cement bond log will be run. The cement log is a log that uses the variations in amplitude of an acoustic signal travelling down the casing wall between a transmitter and receiver to determine of the quality of cement bond on the exterior casing wall. The fundamental principal is that the acoustic signal will be more attenuated in the presence of cement than if the casings were uncemented. The cement log is used to identify sections of the well bore that will need to be hydraulically isolated.

The wellbore fluid will be sampled and tested to determine if the fluid meets the OGDPR regulations. After the wellbore fluid is tested and if necessary, a service rig may be moved in to replace the well fluid to conform to the Yukon Oil and Gas and Drilling Production Regulations 99(a) and 99(b). A wellbore fluid test is a test or series of tests, performed to check that no undesirable reactions occur with a specific fluid. The testing process may include checks for compatibility with other treating fluids, wellbore fluids, reservoir fluids, and the reservoir formation. The removed fluid from the wellbore is anticipated to be recycled and

used in the well to meet OGDPR Part 7 Section 99 requirements. If it can't be recycled the fluid will be transported to and disposed of at a permitted waste disposal site. No other activities are anticipated at these wells.

2.2.1.3 Wellbore Integrity Analysis

To determine if a well will be abandoned, the wellbore integrity will be analyzed to determine the suitability of the well for future use. The wellbore integrity analysis will include:

- Pressure testing of the wellhead and casing;
- Bit and scraper run on tubing to ensure the wellbore is still full drift;
- Analysis of the cement behind the production casing and/or liner casing with a cement bond log tool to determine the cement quality;
- Geological analysis to determine what formations need to be isolated after the cement analysis;
- Sampling of wellbore fluid on the wells (if necessary); and
- Location of the well with respect to the other wells which remain.

The wellbore integrity analysis is required to formulate the final plan for each of the wellbores. The analysis will determine if any the following are required:

- No action;
- Cement squeezes to isolate formations from other formations in accordance with OGDPR Part 7 Section 95(1)(b);
- Casing patches to repair any casing breaches found;
- Cement plugs and/or bridge plugs set to suspend or abandon producing formations in accordance with OGDPR Part 7 Section 97 (1) and Section 97 (2); and
- Surface abandonment in accordance with OGDPR Part 7 Section 96.

Cement squeezes, if required to isolate a formation to satisfy OGDPR Part 7 Section 95(1)(b), will entail perforating an interval close to the formation top and squeezing arctic compatible cement in to the annular space between the production casing and the formation face to create a cement sheath that will isolate the formation from other formations above it in the wellbore. The cement squeeze and remaining plug left in the wellbore will conform to the requirements set out in OGDPR Section 98 (1)(b) and Section 98(2) and location of the remaining cement plug will be located afterwards with the method of setting down on the cement plug with a minimum 90 kN force with the cementing string after 12 hours as set out in OGDPR Section 100(1)(b). Fluid in the wellbore may have to be replaced in a wellbore if it does not meet the requirements of OGDPR Part 7 Section 99.

2.2.1.4 Equipment

Equipment required for well maintenance is described below in **Table 2.3**. Equipment will be stored on site mainly on trucks and flatbed trailers. Some items such as the boiler and cement tanks will be placed on the ground on skids.

Table 2.3: Equipment and Infrastructure components

Quantity	Component	Description
	Re-establishment of Winter Road	
Multiple as needed	Construction Equipment	Challenger cats, D6 cats, snow cats, graders, snow making equipment, water trucks and with drags (small trailer pulled behind truck) will be utilized during the initial phase of the project to prepare the roads and well pads for the operations
	Mobilization and Demobilization for Well Maintenance	
6	8' x 40' mats	These can be wooden or steel mats placed on the ground in an interlocking manner for the service rig and connected equipment to sit on.
1	Skid Service Rig Structure (likely 32-40 wheeled loads)	Components required to service the well, including: • Sub-structure, or base, to which the derrick (i.e., framework to support drilling apparatus) is fixed • Derrick that supports the draw works and handling equipment • Draw works that lifts and lowers the handling equipment in the derrick/mast to run pipe in and out of the hole • Blowout preventers, which are pressure control equipment that can hydraulically shut in a well in the event of unplanned influxes of formation fluids into the wellbore
1	Skid Dog House	Skid mounted unit which contains a generator for supplying power to the rig, an office and change rooms for the crew, and a hydraulic control system to operate the BOP stack remotely
1	Skid Pump	Skid mounted unit which contains a pump to provide hydraulic pumping power to pump fluids in to the wellbore (same as pumps below)
1	Skid Tank	Skid mounted fluid storage tank for the service rig. Can store fluid to be pumped in to the wellbore or store fluid which is pumped out of the wellbore.
1	Skid Boiler	Used extensively in very cold and Arctic climates for preventing equipment and fluids from freezing.
1	Junk Skid	This is skid mounted trailer with an inventory of spare parts and equipment used during the well maintenance work
1	Catwalk and Pipe Racks	These are used for the storage of tubing or tools which is removed from or to be ran in to the wellbore and for picking up / laying down tubing or tools.
1	Enclosed Trailer (chemicals, tools, etc)	Dry storage trailer to keep tools, and chemicals to be used during the operations
5	Baskets of Tools	Tools used in the operation of the service rig
350	Tubing Storage: Joints of 73.0 mm, L-80, 9.67 kg/m tubing (9.5 m average length)	Tubing will be stored on location until required to be run in the hole.
1	Super Single Shack	Skid mounted office and accommodation for wellsite supervisors
3	20 kw Generator / Light towers, miscellaneous equipment	Light towers will be required on the wellsites as the operations will run 24 hours a day

Quantity	Component	Description
2	400 bbl tanks	These are skid mounted cylindrical steel tanks about 10 feet in diameter and stand about 20 feet high used for the storage of fluid
1	Miscellaneous Equipment	Additional equipment brought up on a trailer to be used in the operation of the service rig (example – downhole tools, fan heaters, etc.)
1	Skidded Office/Medic Trailer	Essential personnel trailers which serve as offices. All office trailers will have self-contained sewage storage and sewage will be moved periodically to the sewage lagoon at the Chance camp at Km 324.
1	Fuel Storage	Fuel for use for equipment including service rig, pumps, generators, etc. Bulk fuel will be staged at the Chance camp at Km 324 and daily needs will be distributed via pickup trucks with slip tanks during crew changes.
1	Tank Truck	Used to transport fluid to the service rig during operations (mainly fresh water)
1	Vacuum Truck	Used for removal and transportation of wastewater and sewage from the medic/first aid trailer for disposal.
1	Cement Bulker	Cement storage and mixing for use in wells.
1	Cementing Unit	Unit used top pump cement in to the wellbore during the required cementing operations
1	Cement Bins	Large tanks, normally upright, fully enclosed and pressurized, where cement products are stored. Cement is pneumatically pumped from the tank into the cementing unit.
1	Wireline Unit	Unit to convey tools into the wellbore on wire rope to allow for analysis of the casing integrity, setting of bridge plugs and perforating of the casing
1	Slickline Unit	Unite to convey tools into and out of the wellbore on steel wire to allow for the pulling or setting of bridge plugs in the tubing
1	Pumps	Pumps used to circulate the fluid down the pipe, around and up the annular space between the pipe and the casing to surface.
1	Main Workover Fluid Storage	Location where all the fluid additive materials are stored. Normally these materials are delivered on pallets neatly stacked and shrink wrapped to protect them during the truck journey north.
1	Flare Tank and Flare	Flare used to burn combustible gas from the well. The flare tank is a reservoir to ensure the flare does not starve of combustible gases. Flaring is only planned in the unlikely event the wells that have perforated intervals require depressurization prior to the planned workover operations. The flaring cannot be scheduled in an operation as it may or may not be required depending on the circumstances encountered. The flare stack will be a minimum of 18 metres off the ground.
1	Water Storage and Water Treatment	Water storage tank and treatment containers to provide potable water for the rig crew and personnel.
6-10	1/2 Ton Trucks	Pickup trucks will be used for transportation of work crews, fuel and other supplies between the camp/Eagle Plains Hotel and the wellsites.
	Throughout Project	
1	Cement Bulker (2 -3 times throughout project)	A transport truck to deliver cement to the sites for cementing operations
1	Fuel Tank Bulker (7-8 times throughout project)	A transport truck to deliver fuel (diesel and gasoline) to site to be used for fueling equipment on the sites.

2.2.2 Winter Road Construction

2.2.2.1 Site Access

The Project is accessed via the Dempster Highway. Wells H-28, J-19, M-08, G-08 and H-28 will be accessed by re-establishing the Chance winter road. Wells A-25 and B-73 are located immediately adjacent to the Dempster highway, and already have access with rig matting in place. Well M-59 will be accessed by re-establishing the Blackie winter road. The Blackie winter road is approximately 6.5 km in length and approximately 8-10 m in width. The Chance winter road is approximately 25 km long and 8-10 m in width (**Figure 2.1**). The total surface area of the both the Chance winter road and Blackie winter road is approximately 1,875 m^2. The footprint at each wellsite is anticipated to be approximately 100 m x 100 m (1 Ha) with the wellhead at the centre. Exact dimensions of the well sites are dependent on topography and may not be exact squares but will cover an area approximately 1 Ha (e.g., 125 m x 80 m).

2.2.2.2 Winter Road Construction Methods

Winter road construction will utilize similar techniques as previously applied by Chance in previous assessments (YESAB # 2006-0237, 2006-0285, 2007-0219, 2008-0047 and 2012-0140). Before any winter road construction will proceed, a minimum snow depth of 10 cm will be verified to ensure there is sufficient snow cover to protect the ground surface from tires or tracks of vehicles. To promote snow compaction in the early winter, the Chance winter road and Blackie winter road will be driven with snowmobiles and snowcats in late fall/early winter. Priority will be given to re-establishing the Chance winter road first and the Blackie winter road second. This is because there are four wells to access from the Chance road and no overgrowth limiting access, while there is only one well to access from the Blackie winter road, which is more overgrown and requires the development of a substantial snowpack. This will allow more time for the snowpack to develop at the Blackie winter road. Upon construction, if the snow depth (minimum of 10 cm) is not sufficient in certain areas, additional snow will only be collected from areas where a surplus of snow is available or from areas where there is no potential for disturbance to the surrounding environment. These areas may include depressions where significant amounts of snow have accumulated. Snow will only be removed where 10 cm of base will remain compacted to protect surface vegetation. Alternatively, as done in previous years, additional snow may be removed from the Chance camp laydown area (approximately 13 Ha area). Only clean snow, free of deleterious substances, will be used for winter road re-establishment.

Once the snow depth is adequate (i.e., 10 cm or greater in depth without compaction), vegetation along the routes will be cleared using a bulldozer and mulcher. The bulldozer blade will be raised off the ground such that it does not cut the tops of hummocks, tussocks or high spots. The vegetation removed will be mulched with a track mounted mulcher and distributed on the road. Any trees or large brush encountered will be removed at the ground surface using a mulcher to avoid tearing the surface organic layer thereby reducing the chance of thawing ice-rich mineral soil beneath. The mulch helps keeps the soil in place while protecting the root system of ground-cover plants and natural grasses. The likelihood of large trees or brush is low on the Chance winter as the road was last used in April 2014. Where it is safe and practical, standing live or dead trees along the route that provide wildlife habitat will be saved.

Following vegetation removal, the surface of the road will be constructed using accumulated snow to construct berms on the road margins and filling the space at the roads edge with snow and water trucked from approved sources. A combination of snowcats and bulldozers using drags will be used to push and

compact the snow along the access routes. To ensure the roads ability to safely support the service rig and other heavy loads, all construction activities will be supervised by a qualified geotechnical engineer.

The same methods will be utilized to establish well sites and clear any vegetation surrounding the well site for equipment and site infrastructure.

2.2.2.3 Water Withdrawal

Water for the service rig and winter road icing will be primarily sourced from existing withdrawal locations on the Eagle River, with locations on the Ogilvie River as an alternative source. The Eagle River is preferred due to its closer proximity to Chance's operations, with the Ogilvie River being more convenient for the Socony Mobil WM Blackie No 1 (M-59) and NCY McParlon (A-25) operations. No more than 100 m³ of water will be withdrawn daily. All water withdrawal will be conducted following Department of Fisheries and Oceans (DFO) Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 2020).

2.2.2.4 Maintenance

Maintenance of winter access routes may include low ground pressure vehicles (e.g., snowcats), a road grader equipped with a wing snow plow and some water application. Grading may be required over certain stretches and depressions along the roads filled with snow, to smooth the surface.

In the event that natural snowfall is below the minimum required depth to construct and maintain the winter roads, snow making may be used to make up the shortfall. This is a contingent consideration and could require up to 100 m³ of water per day for a short period of time (a few days to a week). The sources of water include the Eagle River and the Ogilvie River. The water to be used to make snow and ice the winter road(s) will be trucked from the source to the point of use. The actual number of trucks being used will be less since a truck can probably complete 1 to 3 deliveries per day. Generally low snowpack is only an issue during the early part of winter so this provision would only apply on a contingent basis during the months of November, December and January. The timing for making artificial snow will depend on how late in the winter season winter road construction begins. If, for example, in late December there is little or no snowfall or snow accumulation on the ground, snow making could ensure a sufficient snow base to commence winter road construction. Snow can only be made when the ambient temperature drops to zero degrees centigrade.

2.2.2.5 Equipment

Equipment will be required for clearing, grading, water transport, and material transport. Light equipment for personnel, fuel and other supply transport will be required periodically during construction and well maintenance.

It is anticipated that Challenger cats, D6 cats, snow cats, graders, snow making equipment, water trucks and drags will be the primary construction equipment. Pickup trucks will be used for transportation of work crews, fuel and other supplies. Water trucks will be used for transport of water from the Eagle River and the Ogilvie River to the Project. Flatbed trailers would be used to transport equipment and larger supplies.

2.2.3 Access Control

Chance understands that increased winter access into the area is of significant concern to First Nations and Indigenous Groups, local residents, trappers and outfitters. Chance has safety concerns regarding unauthorized users due to the potential for sour gas (H_2S) to be present at some wells, and the use of narrow access routes. Additionally, Chance cannot allow the use of firearms in areas where crews are working to ensure safety of their crew. These access routes will be radio controlled by Chance to ensure authorized personnel gain unobstructed access, but this could be adversely impacted by the presence of unauthorized users. To address concerns related to access (e.g., increased use and ease of access, increased hunting, public safety, and safety of Chance personnel) gates will be placed at the junction of the Blackie and Chance winter roads with the Dempster Highway. The gates will be constructed of heavy materials and located such that there are obstacles on either side as much as possible (e.g., heavy forest) to restrict vehicle access.

2.2.4 Anticipated Road Use

The majority of the traffic volumes include mobilizing the service rig and site infrastructure, the setup of the service rig will take approximately one day to complete at each well site. A total of approximately eleven flatbed truck loads will be required to mobilize equipment into each well site. Once a site is established (i.e., maintenance equipment set up), traffic will include approximately 1-2 pickup trucks (for supplies and personnel), 1 water truck and one fuel truck. The fuel and water trucks will come to the project site approximately every three days or as demand dictates.

All vehicles will be equipped with radio communication and any traffic on the roads will be radio controlled. Unauthorized vehicles will not be allowed on the winter roads and the roads will be restricted from public access.

2.2.5 Reclamation

The Project proposes to re-establish the Blackie winter road to one existing well site (M-59), and the Chance winter road for J-19, M-08, G-08 and H-28. Wells A-25, E-78 and B-73 are located immediately adjacent to the highway, and already have access with rig matting in place and/or pre-existing cleared area as a borrow pit or Chance's Base Camp.

Reclamation activities will aim to return the site as closely as possible to its pre-project condition. These activities are intended to effectively:

- Leave the site clean following project completion;
- Remove all garbage, petroleum products, and equipment; and
- Prevent long-term erosion/slumping and promote successful natural revegetation of disturbed areas.

Given the winter road construction methods employed (i.e. allowing for 10cm of snow cover before building the winter road) it is not anticipated that additional reclamation is required for the winter roads. As discussed in **Section 2.1.3**, access to each of the roads will be restricted during operations and following the completion of the proposed activities. This will ensure that the road can fully melt, without any potential for more disturbance from outside users. It is less harmful to leave the road to melt in the spring.

2.2.6 Camp Facilities

Chance anticipates using the Eagle Plains Hotel for housing workers for the Project. The Eagle Plains Hotel, located at kilometer 371 of the Dempster Highway, has been operating since the late 1970's and provides a variety of services including hotel facilities, accommodations (64 people during peak use), restaurant, lounge, public washroom, laundromat and service garage. The hotel is a recognized tourist destination and provides support services to the Government of Yukon, Department of Highways and Public Works, Eagle Plains Maintenance Camp.

Chance's existing camp, office and storage yard was established in October 2011 and is located at km 325 of the Dempster Highway. It is accessible year-round by vehicle unless the highway is closed due to weather or construction. For this Project, Chance plans to utilize the camp for storing and transporting equipment and supplies needed for operations, but Chance personnel will not stay at the camp, and will instead utilize the Eagle Plains Hotel.

Approximately 7-12 fixed wing flights over the course of the entire project, with up to 2 flights per week, will be required for shift changes. Flights will be privately chartered from Edmonton to Inuvik and then to the Wiley airstrip located at km 389.5 of the Dempster highway or the Chance Camp airstrip, located at km 325 of the Dempster highway.

A small medic/first aid trailer equipped with a heater may be installed at the wellsite being where work over operations are occurring to provide refuge for workers and essential first aid supplies. Sewer facilities and water will be available in the trailer. All wastewater and sewage will be collected in CSA approved tanks and transported offsite for disposal at an approved facility in Fort McPherson.

2.2.7 COVID-19 Safety Considerations

Coronaviruses are a large family of viruses found mostly in animals. In humans, they can cause diseases ranging from the common cold to more severe diseases such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). The disease caused by the new coronavirus has been named COVID-19.

While many of the characteristics of COVID-19 are still unknown, mild to severe illness has been reported for confirmed cases. Common symptoms for COVID-19 are:

- Fever
- Cough
- Sneezing
- Sore throat
- Difficulty breathing

Coronavirus is transmitted via larger liquid droplets when a person coughs or sneezes. The virus can enter through these droplets through the eyes, nose or throat if you are in close contact. The virus is not known to be airborne (e.g., transmitted through the particles floating in the air) and it is not something that comes in through the skin. It can be spread by touch if a person has used their hands to cover their mouth or nose when they cough.

Droplet Contact: Some diseases can be transferred by large infected droplets contacting surfaces of the eye, nose, or mouth. For example, large droplets that may be visible to the naked eye are generated when a person sneezes or coughs. These droplets typically spread only one to two metres and are too large to float in the air (i.e., airborne) and quickly fall to the ground. Influenza and SARS are two examples of diseases capable of being transmitted from droplet contact. Currently, health experts believe that coronavirus can also be transmitted in this way.

Airborne transmission: This occurs when much smaller evaporated droplets or dust particles containing the microorganism float in the air for long periods of time. Currently, health experts believe that coronavirus cannot be transmitted through airborne transmission.

At present, COVID-19 is a public health emergency in Yukon. Guidelines for ensuring public safety have been established by the Chief Medical Officer of Health for Yukon. These guidelines include physical distancing, enhanced cleaning, infectious disease control strategies, and hand hygiene. The state of the pandemic and the responding guidelines are rapidly evolving and will be monitored and followed throughout the duration of the Project.

The camp utilized for Project activities and the Eagle Plains Hotel used for crew housing will follow all guidelines including physical distancing and sanitization procedures to ensure a healthy environment for workers. The Eagle Plains Hotel currently abides to all guidelines established by the Chief Medical Officer of Health for Yukon. Crew members will be provided with up to date information regarding the current state of the pandemic and the procedures in place to address it while they are at camp. A screening procedure conducted prior to a worker's arrival at the Eagle Plains Hotel will include questions related to symptoms, travel, and known interaction with an infected person. Face masks will be worn during air travel to the site. Crew members who fail the pre-screening will not be permitted to travel to site. As per the Yukon Government guidelines, only staff arriving from outside British Columbia, Yukon, Northwest Territories and Nunavut will be required to self-isolate prior to their travel to site. During the duration of construction, daily screening, including temperature checks, will occur and workers will be instructed to monitor and report any symptoms they may develop. In the event that a crew member reports a COVID-19 symptom, they will be isolated until a COVID-19 test result can be confirmed. Confidential documentation of Project information including crew member names, arrivals and departures details, and worker origin will be kept.

2.2.8 Fuel Storage

A draft Spill Response Plan is available in **Appendix B**. The plan will outline the procedures to be followed in the event of a petroleum product spill during all phases of the project. Safety procedures for personnel and proper equipment usage during such operations will be discussed in the plan

Fuel will be stored in portable tanks (i.e., slip tanks) and tanker trucks and will not exceed 8000 litres in aggregate. Fuel storage will only occur during periods necessary for the road construction and well maintenance and will be removed upon completion. All fuel caches will be located a minimum of 60 m from the high water mark of any nearby watercourse. Fuel will be transported in tidy tanks or by tanker truck, as required. A fuel spill contingency plan will be posted at all storage areas and fueling stations.

The fluid additive materials will be stored in the Chance lay down yard located at km 325 of the Dempster Highway. They will be stored in a dry trailer/s in their original packaging. The cement will be transported to site in a bulk trailer and left at the lay down yard. Fluid additive materials will include:

- Potassium Chloride (KCL)
- Fluid Inhibitor
- Cement

2.2.9 Waste Management

All garbage and recyclable materials will be taken off site and disposed of at a licensed disposal facility.

Once all the testing/isolation procedures are complete, the tubing will be pulled from the J-19 and G-08 wells. If it is deemed that it is still usable, it will be stored at Chance's camp and if not, it will be transported to approved disposal facilities in Yukon, Alberta or British Columbia. Cement waste and wastewater will be collected and transported to an approved disposal facility.

2.3 Project Schedule / Temporal Scope of Activities

Construction of the winter roads and well maintenance is anticipated to occur during the winter of 2020/2021. Initial site visits would occur in late November or early December of 2020, timed to meeting the minimum snowpack, to pack the access routes with snowmobiles. Winter road construction is anticipated to occur in late December to February. Well maintenance activities are anticipated to take approximately up to 70 days to complete the work at all eight wells. It is anticipated that well maintenance activities will commence in February and be completed by mid-April.

3.0 SUMMARY OF CONSULTATION

The Proponent recognizes the importance of consulting affected First Nations governments prior to making decisions about the Project.

3.1 Potentially Affected Parties

The Project and all proposed Project activities are located within the traditional territories of the Vuntut Gwitchin First Nation and the First Nation of Na-cho Nyäk Dun, as well as the Tetlit Gwich'in Secondary Use Area of the Gwich'in Settlement Region. The proposed Project is also located to the north of Tr'ondëk Hwëch'in Traditional Territory.

Based on the location of the Project within a First Nation's Traditional Territory and/or the proximity of the Project to a First Nation's Traditional Territory (with the potential for indirect effects), the project team identified the following First Nations as potentially affected parties:

- Vuntut Gwitchin (VG)
- First Nation of Na-Cho Nyäk Dun (FNNND)
- Gwich'in Tribal Council (GTC)
    - Tetlit Gwich'in Council (TGC)
- Tr'ondëk Hwëch'in (TH)

Engagement activities were designed to inform potentially affected parties of the proposed Project, and to provide those parties with a reasonable opportunity to engage the project team, to learn about the proposed Project, and to provide input or feedback. Chance's approach to engagement was guided by existing

engagement and communications plans that Chance has with each of the potentially affected First Nations that are identified above.

3.2 Summary of Engagement Activities

The following sub-sections provide brief summaries of engagement activities with each potentially affected First Nation.

3.2.1 Initiation

Written communication was sent via email to FNNND, GTC (including TGC), and TH in order to initiate engagement. Initial communication packages for these First Nations included a high-level overview of the proposed Project (e.g., project activities, components, goals and outcomes), the regulatory submissions Chance would be making, a brief introduction to Hemmera and it's role, as well as the request to discuss any concerns the affected party may have and the offer to arrange a conference call should they so desire. Also included was a 4-page project summary and map of the Project Location.

A distinct communication package was sent via email to initiate engagement activities with VG. This package was structured in accordance with protocols outlined in the *Vuntut Gwitchin Government Oil and Gas Engagement Policy*. As such, this package included an earlier draft of the Project Description dated May 22, 2020.

3.2.1 Vuntut Gwitchin

Initial notification was sent to VG's Director of Natural Resources on May 25, 2020. VG and Chance organized a conference call July 9, 2020 wherein VG requested a high-level overview of the proposed Project. VG asked Chance questions in order to attain additional information for the First Nation to complete their review of the draft Project Description dated May 22, 2020. To assist Chance in preparing meeting materials for the July 9th meeting, VG provided an agenda and questions ahead of time. On July 10, 2020, VG provided Chance with formal information requirements related to the proposed Project. Themes raised by VG included:

- Requiring additional information on mitigation measures to avoid or minimize potential environmental effects (specifically with respect to Porcupine Caribou)
- Requiring additional information on the regulatory context
- Requiring additional details on well tests (e.g., vary tests between the wells, how would Chance address evidence of gas migration, what would be done with removed fluid) and project components (e.g., what materials would be stored on site, what materials will be incinerated, vehicles planned to be used)
- Requiring additional information on water withdrawal (e.g., sources, volume, schedule)

The additional information requested by VG was drafted and refined during the effects assessment and development of the Project Proposal. However, feedback from VG impacted the development of mitigation measures and contributed to identifying information that was previously inadequate in the earlier draft project description and the project proposal as a whole (e.g., additional information on the regulatory context, additional information on the rationale for maintaining the wells in suspended well status versus abandonment).

Chance responded to VG, in the format requested, on July 22, 2020. This document can be provided upon request.

A draft of the Project Proposal was shared with VG July 22, 2020.

In the coming weeks Chance will be initiating discussions with VG in order to meet requirements under section 68 of *YOGA* (i.e., benefits agreements).

3.2.2 First Nation of Na-cho Nyäk Dun

Initial notification was sent to FNNND May 25, 2020. Additional communications followed June 9th, June 24th, and July 20th. Chance did not receive feedback from FNNND while the Project was being refined and the Project Proposal was being drafted. A draft of the Project Proposal was shared with FNNND July 24, 2020.

Chance looks forward any feedback FNNND may provide in the future and to initiating discussions with FNNND in order to meet requirements under section 68 of *YOGA* (i.e., benefits agreements).

3.2.3 Gwich'in Tribal Council

Initial notification was to GTC and TGC May 25, 2020. On June 12, 2020, GTC provided input from its departments of Lands and Resources, Cultural Heritage, and Economic Development. Themes raised by GTC included:

- High environmental standards in the Peel River watershed and protection of scattered wetlands within the Land Management Unit 7
- Protection of wildlife and wildlife habitats
- Protection of the environment, water quality, and quantity and risks with respect to potential spills
- Protection of cultural heritage resources/values

GTC also requested that Chance share the Project Description and any other materials related to the Project that might be available. Chance was able to send a draft Project Description dated May 22, 2020 to both GTC and TGC, however no other materials (e.g., effects assessments, summaries of mitigation measures, management plans) were available at that time.

GTC's original feedback helped Chance select Valued Components, identify mitigation measures, and identify where additional detail was needed in the Project Description. Chance was able to provide a response to GTC on July 9, 2020.

Chance and GTC organized a conference call for July 22, 2020 where parties were able to further discuss the proposed Project. During this call Chance was able to update GTC on any changes that had been made to the project design since the draft Project Description dated May 22, 2020, and GTC was able to ask Chance follow-up questions about potential project impacts.

A draft of the Project Proposal was shared with GTC/TGC July 24, 2020.GTC also flagged potential services that Gwich'in businesses might be able to offer Chance and inquired as to what employment opportunities would be available as a result of the Project. Chance indicated that it welcomes the opportunity to have further discussions with GTC to identify and facilitate potential economic development opportunities.

Chance will balance these interests with requirements to source specific equipment/professions for the maintenance work and requirements under section 68 of *YOGA* (i.e., benefits agreements with Yukon First Nations).

3.2.4 Tr'ondëk Hwëch'in

Initial notification was sent to TH on May 25, 2020. A conference call was organized between Chance and TH for June 17, 2020. The purpose of that meeting was for Chance to provide an overview of the proposed Project and to provide an opportunity for TH to ask questions and/or provide any feedback with respect to the proposed Project. During the conference, TH requested that Chance ensure that TH is identified as a potentially affected First Nation. Even though Project Activities do not occur in TH Traditional Territory, TH are indirectly affected by activities (e.g., increased traffic, impacts to wildlife in the region). Themes raised by TH included:

- Requiring additional information with potential risks associated with the Project and identified mitigation measures
- Requiring additional information with respect to the Project's potential wildlife management plan and information on how Project Activities would be affected if Porcupine Caribou are in the area (possibly the 40 Mile Caribou Herd and Hart River Caribou Herd as well)

TH also recommended that Chance look in the availability of traffic data in the Project Area and surrounding region. The presence and absence of traffic data in the region could inform what baseline studies Chance may need to conduct for future project proposals.

At the time of Chance and TH's initial call, no other materials (e.g., effects assessments, summaries of mitigation measures, management plans) were available. However, when the draft Project Proposal was completed, a draft was shared TH on July 24, 2020.

3.3 Ongoing Engagement Activities

Chance continues to be committed to engaging with potentially affected First Nations, should they wish to discuss the Project in more detail, and look forward to their involvement throughout the DO evaluation process.

4.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS ASSESSMENT METHODOLOGY

The assessment methodology outlined in this section provides a structured framework that is consistently applied to all valued components. The following guidance documents were considered when developing the Project's effects assessment methodology:

- *Proponent's Guide to Project Proposal Submission to a Designated Office* (YESAB 2010)

This methodology makes use of assessment terms Valued Components (VCs), defined as elements of the environmental and socio-economic systems valued for environmental, scientific, social, aesthetic, or cultural reasons.

The assessment methodology for VCs follows the main steps described below:

- Conduct assessment scoping (i.e., identify VC subcomponents and establish assessment boundaries);
- Establish baseline and existing conditions;
- Identify Project-related interactions and potential effects;
- Apply mitigation measures to address potential effects; and,
- Conduct effects characterization and significance determination.

4.1 Assessment Scope

The scope of the effects assessment focuses the application on the Project activities with the greatest potential to cause significant adverse effects on selected VCs. The VCs selected for this assessment were based on Project relevance and importance to First Nations, government agencies, and stakeholders, as well as previous assessment documents for related oil and gas and winter road projects in Yukon. VCs selected are discussed further in **Section 5.0**.

4.2 Establishing Assessment Boundaries

Assessment boundaries have been identified to define the spatial and temporal extent of the assessment. The spatial assessment boundaries are based on the spatial characteristics of the Project and the VC, and the areas where the Project-VC interactions and effects are expected to occur. Temporal boundaries encompass periods when the Project is expected to affect VCs. The temporal boundaries were determined based on the timing and duration of the Project. The spatial and temporal boundaries for the assessment of the Project are defined in **Table 4-1**.

Table 4.1 Spatial and Temporary Boundary Definition

Boundary	Definition
Spatial Boundaries	The spatial boundaries of the Project Area are outlined in Inset A of Figure 2-1.
Temporal Boundaries	The temporal boundaries for the assessment of the Project covers the construction, operation and maintenance of the winter roads and maintenance of the wells. To include permitting and construction timelines with some contingency, the temporal scope of this assessment is 2 years.

4.3 Establishing Baseline Conditions

The first step in performing an environmental and socio-economic effects assessment is to understand the existing environmental and socio-economic conditions currently present within the assessment area. The existing environmental and socio-economic conditions within the Project Area are based on a number of sources including historic literature, recent technical reports, databases, monitoring programs, government information, and first-hand knowledge. A summary of existing conditions is provided as part of each VC assessment to establish the setting for the assessment of Project-related effects on each VC. The level of detail provided for the existing conditions is sufficient to enable potential Project–VC interactions to be identified and understood.

4.4 Identifying Project-Related Interactions and Potential Effects

A key step in performing the environmental and socio-economic effects assessment is to understand the Project-related activities that are proposed and how those activities are likely to interact with the selected VCs. The intensity of the interaction will result in the potential effect on the VC and will ultimately dictate the mitigation measures implemented to minimize the effect of that interaction. The intensity of the interaction may be “none”, “negligible”, or “potential”. All Project components/activities that will not interact with a VC and will not result in potential effects are not considered further in the assessment. Where a potential interaction is predicted, a potential effect is identified and carried forward in the assessment. Where there is potential for the effect to be significant, mitigation measures are developed.

Consistent with direction provided in *YESAA*, each VC assessment section includes descriptions of mitigation measures of relevance to the particular VC to eliminate, reduce, or control adverse Project-related effects, as well as measures contained in industry codes and standards. The effectiveness of mitigation measures in reducing the potential effect is considered in the effects characterization.

4.5 Effects Characterization and Determination of Significance

For each VC, an effects characterization is performed, which evaluates the potential Project-specific effects with the implementation of the mitigation. Each effect is characterized based on its direction, magnitude, geographic extent, timing, frequency, duration, reversibility, and probability of occurrence. Each VC assessment section provides a description of the relative context for the assessment in terms of the resiliency and sensitivity of the VC. General definitions for these characteristics are presented in **Table 4.2.**

Table 4.2 Residual Effects Characteristics

Residual Effect Characteristic	General Definition	General Rating
Direction	Identifies whether the residual effect will be adverse or positive	• Adverse • Positive
Magnitude	Size or severity of the residual effect relative to the existing condition of the VC, generally measured in terms of the proportion of the VC affected within the Project Area, relative to the range of natural variation (or historic variation in the case of human environment VCs)	• Low • Moderate • High
Geographic Extent	Geographic area where the residual effect is likely to occur	• An area within the Project Area
Timing	Occurrence of the residual effect with respect to a temporal attribute important to the VC (e.g., time of day, season, stage in life cycle, etc.)	• VC-specific
Frequency	How often the residual effect is likely to occur, taking into account VC-specific temporal characteristics	• Infrequent • Frequent • Continuous
Duration	Length of time the residual effect to the VC is likely to persist, taking into account VC-specific temporal characteristics	• Short-term • Long-term • Permanent

Residual Effect Characteristic	General Definition	General Rating
Reversibility	Degree to which the residual effect can be reversed once the causal factors cease; irreversible effects are considered to be permanent	• Fully reversible • Partially reversible • Irreversible
Context	The extent to which the VC has been affected by past and present environmental and socio-economic processes and conditions, and its potential sensitivity to the Project-related residual effect, and its ability to recover from that effect	• Undisturbed • Disturbed • Resilient • Sensitive
Probability of occurrence	Likelihood that the residual effect will occur, taking into account how probable it is that a disturbance will actually be caused by the Project or that a specific mitigation will be successful	• Likely • Unlikely

The significance of effect on the VC will be assessed based on the effects characteristics, and the likelihood of the effect. The likelihood of the effect is in part determined by the scientific certainty relative to the quantification of the effect, scientific certainty relative to the effectiveness of the proposed mitigation, and professional judgement based on prior experience in assessing effects and the known effectiveness of proven mitigation measures. The rationale for the determination of significance is provided for each VC.

5.0 VALUED COMPONENT SCOPING

Valued ecological, social, cultural, and economic components (VC) identified for the Project form the basis of the assessment conducted in **Section 6.0**. These components were selected based on the results of environmental and archaeological field studies, literature reviews, consultation with First Nations, and professional expertise. The valued components are described in **Section 5.1**, along with a rationale for their selection. The assessment in **Section 6.0** focuses on these valued components.

Potential VCs and VC subcomponents were selected based on (1) their value as ecological, social, cultural or economic factors, (2) spatial, temporal, and mechanistic ability to interact with the Project, and (3) technical feasibility of conducting an assessment. Ecological values included consideration of foundational environmental factors or processes, species of conservation concern (e.g., caribou), and more general species or processes that represent biodiversity. Social and cultural values were based primarily on current and historic human use, such as hunting, recreation, and heritage values. Economic values relate to existing or future use of resources to derive monetary benefits. Often potential VC subcomponents can include multiple value types. For example, furbearers have ecological, cultural, and economic values.

VC's and subcomponents were also screened based on their ability to interact with the Project, including the degree of spatial and temporal overlap with the Project and mechanism to be affected by the Project. For example, birds are sometimes included as a VC subcomponent for EAs for some projects because of the numerous species that contribute to biodiversity and diverse habitat associations the group has. However, for this Project the potential to interact with the VC is low because most species have migrated south during the winter when the Project will be active and the project has low potential to affect the few resident birds that are present.

Finally, technical feasibility was considered for selection of VC subcomponents. These criteria relate to technical factors that could affect the effects assessment, such as the availability of baseline data or the level of understanding of how the project could affect the VC subcomponent.

Potential VCs that were considered in the scoping exercise but were NOT carried through for assessment are described in **Section 5.2**. These issues were investigated for potential interactions with the Project and were determined to not require further assessment. **Section 5.2** provides a description of the issues, and a rationale for not including them as valued components. Mitigation measures and best practices are identified for these issues where applicable.

5.1 Valued Components Selected

The VCs selected for assessment are wildlife and wildlife habitat, vegetation and wetlands, and heritage resources. The rationale for selecting these VCs and specific subcomponents within each VC to be assessed are provided below.

5.1.1 Wildlife and Wildlife Habitat

Wildlife and wildlife habitat were selected as a VC because there is a potential for interaction between wildlife and wildlife habitat and Project activities. Wildlife and wildlife habitat are valued as important ecological components, for aesthetic and cultural reasons, and as subsistence food sources. Sensitive species and/or habitats will be given special consideration within this VC. The indicators used to describe and evaluate potential Project-related effects on wildlife and wildlife habitat include habitat, movement and distribution, and mortality or injury.

As a group, ‘wildlife’ encompasses numerous taxa with diverse habitat requirements. Effects assessments for most resource development projects include a suite of species or species groups as subcomponents to represent the diversity encompassed within the wildlife VC. The suite of species and species groups that were considered during VC selection are outlined in **Table 5.1**. Based on the selection process, caribou and moose were selected as VC subcomponents for effects assessment.

Table 5.1: Summary of selection process for wildlife valued components

Potential Subcomponent	Value (Ecological, Social, Economic)	Potential to Interact with Project (Spatial, Temporal, Mechanism)	Evaluation Outcome
Caribou	High. The Porcupine Caribou Herd is highly valued for subsistence hunting, cultural values, and ecological values.	Moderate. The Project occurs within the PCH winter range when caribou may be present; however, caribou do not use the Project area every year. If caribou do occur, the Project have the potential to affect local movements and habitat availability.	Selected as a VC subcomponent.
Moose	Moderate. Moose are valued as a secondary species for subsistence hunting, after caribou.	Moderate. The Project occurs within annual moose range and Project activities could have a localized effect on moose distribution and habitat availability.	Selected as a VC subcomponent.
Furbearers	Moderate. Marten and lynx have high cultural and moderate economic value for trapping, but the area has not been actively trapped for several years.	Low. The Project occurs within marten and lynx ranges, but these species tend to be tolerant or adaptive to low levels of industrial work, as required for this project. The project will not create new access on which snowmobiles cannot already travel.	Not selected as a VC subcomponent, but mitigations are provided
Grizzly Bears	Moderate. Grizzly bears are often a species of conservation concern because they occur at low densities and can be sensitive to human disturbance.	Very Low. Grizzly bears will be denning while the Project is active and the chance of a den occurring near work areas is very low.	Not selected as a VC subcomponent, but mitigations are provided
Wolves	Moderate. Wolves play an important role in large mammal predator-prey relationship in northern ecosystems; however, they generally have low social and economic value.	Low. Wolves occur within the project area but tend to relatively tolerant or adaptive to low levels of industrial work, such as required for this Project.	Not selected as a VC subcomponent; no specific mitigations
Birds	Moderate. Birds are often included as a VC subcomponent in effects assessments because, as a group, it includes numerous species that contribute to biodiversity and have diverse habitat associations.	Very Low. The Project has very low potential because the majority of birds in the area are migratory and will be on their wintering grounds, the timing of work is outside the breeding season, when birds may be sensitive to disturbance, and affects to bird habitat are very limited.	Not selected as a VC subcomponent; no specific mitigations

5.1.2 Vegetation and Wetlands

Vegetation and wetlands were selected as a VC because there is a potential for interactions with Project activities, and because of their role supporting biodiversity and wildlife habitat. Further, they are valued by First Nations and local residents who may use certain species as a subsistence and economic resource. Project activities may disturb, change, or remove vegetated areas, habitat containing traditional and medicinal plants, and ecological communities that may host rare plants or wetlands.

5.1.3 Heritage Resources

Heritage Resources were selected as a VC because of the value of heritage sites and historic resources rests within their context in the land in which they are located and there is potential for interactions with Project activities. Once disturbed or removed, that value cannot be restored. The term “heritage resources” is used here to refer to archaeological resources, historical resources, and paleontological resources collectively (i.e., all are considered to be types of heritage resources). In Yukon, the *Historic Resources Act* (RSY 2002, c.109) and Archaeological Sites Regulation contain legislation that mandates the management and protection of Yukon archaeological, historical, and paleontological resources. This legislation applies to heritage resources on both private and public land that are older than 45 years. Archaeological, historical, and paleontological resources are protected from unpermitted surveys, disturbances, alterations, or excavations.

5.2 Other considerations

Other valued components considered in our report but not included in the effects assessment include fish and fish habitat, permafrost, air quality, fish and wildlife harvesting, community safety and well-being of indigenous people; tourism and aesthetics; economic activity; land use and recreation; traditional land use; health and safety; and site access and traffic.

5.2.1 Fish and Fish Habitat

Fish and fish habitat are recognized as important values in the Eagle Plains area. However, Fish and fish habitat are not included as valued components because they have negligible potential to interact with the Project. No direct effects to fish and fish habitat will occur because access roads do not cross any streams and all well sites and access roads are greater than 200 m from mapped water courses or water bodies. Indirect effects, such as sedimentation or water quality are deemed to be negligible because winter roads have minimal effect on natural drainage patterns and do not expose soil for sediment transfer (i.e., there is no ditching along the winter roads and the duff layer and ground vegetation are protected).

5.2.2 Permafrost

Permafrost was considered as a potential VC for the assessment. However, the timing of the proposed activities (i.e., completed in winter) and the relatively short duration of the Project greatly limit any potential effects on permafrost in the area. Additionally, the methods proposed for winter road construction are designed to reduce ground disturbance by mulching large vegetation (trees) rather than pushing it over with a bulldozer, which could potentially pull up root systems and expose underlying sediments. Winter road construction will leave the surface organic mat (moss and peat) intact and uncompressed, minimizing effects on permafrost. Winter roads actually promote penetration of wintertime cold into the ground due to higher thermal conductivity of ice than adjacent snow, a response that will help counteract any minor reduction in cold penetration below road-edge berms. Excess accumulation or piling of snow will not occur

to avoid potential effects on local ground temperatures. Well maintenance activities will not have the opportunity to adversely affect permafrost. Therefore, permafrost was not considered further in this effects assessment.

5.2.3 Air Quality

Air quality was considered as a potential VC for the assessment. However, given the remoteness of the Project site, the relatively short duration of the Project, the air quality within the Project area will not deteriorate with the installation of the winter roads or well maintenance activities. The Project will involve burning of fossil fuels to operate the equipment to work on the winter roads as well maintenance activities. Emissions from equipment will be relatively low and localized to the areas of active construction and at each well. Additionally, the construction phase of the Project is only projected to last one winter at which point air quality will return to baseline conditions and will not have a lasting effect on local air quality. Therefore, air quality was not considered further in this effects assessment.

5.2.4 Fish and Wildlife Harvesting

Fish and wildlife harvesting were considered as a potential VC given the importance of this activity for both traditional and subsistence purposes. In this context, harvesting includes hunting, fishing, and berry picking. Harvesting is important for First Nations to maintain their connections to their traditional territories and helps to preserve and enhance their culture, identity and values. Since Project activities will be located primarily in previously established well sites and where roads had historically been constructed it is anticipated that the effects to opportunities to practice harvesting caused by the project will be minimal. If Project activities overlap spatially and temporally with Porcupine Caribou Herd migration, there could be potential interactions between Project activities and caribou hunters, specifically human health and safety. Negative effects caused by these interactions will be mitigated by the measures implemented in Section 6.1 – Wildlife and Wildlife Habitat. Therefore, fish and wildlife harvesting were not considered further as a VC in this assessment.

5.2.5 Community Safety and Well-being of Indigenous People

Community Safety and Well-being of Indigenous People was considered as a potential VC in response to the Calls for Justice for Extractive and Development Industries from the National Inquiry into Missing and Murdered Indigenous Women and Girls (MMIWG1b 2019). Resource extraction and development projects can exacerbate issues of violence against Indigenous women and girls (MMIWG1a 2019).This potential VC was not carried forward in the assessment because of the Project's approach to staffing the site; staff will not be spending time in nearby communities or along public roadways during their transit to site and instead will arrive on site via a fixed-wing aircraft directly to the Eagle Plains airstrip.

5.2.6 Tourism and Aesthetics

Tourism and aesthetics were considered as a potential VC due to the Klondike and Dempster Highway's use as a popular tourism route in the territory. Two of the wells are located immediately adjacent to the highway and already have access routes with rig matting in place. These wells will be visible to the public, however tourism and aesthetics were not carried forward in the assessment because the Project activities likely to affect tourism and aesthetics will be limited to the construction period of the winter of 2020/2021 during the tourism off season. Project activities will also be localized to the areas of active construction, and will return to baseline conditions following the end of the construction period.

5.2.7 Economic Activity

Economic activity in the area surrounding the Project site was considered as a potential VC because it was identified as an area of interest for the affected First Nations. The Project has limited interaction with local businesses aside from necessary stops (i.e., fuel stations) by resource delivery drivers during construction and is therefore not considered further in this assessment.

5.2.8 Land Use and Recreation

Land use and recreation were considered as a potential VC given the high volume of traffic along the Dempster Highway and use of the area for land use activities and recreational purposes. The Project is not likely to overlap with land use and recreation activities potentially occurring in the area. Effects will be localized to the areas where roads had previously been built and to previously established well sites and camp facilities. Furthermore, the proposed activities are anticipated to be completed in one winter (December to March). Therefore, it is not expected that Project activities will have lasting interactions with land use and recreation beyond the Project's construction schedule and is therefore not considered further in this assessment.

5.2.9 Traditional Land Use

Traditional Land use was considered as a potential VC for the project. Give the location of the Project, it is not expected that Project activities will have lasting interaction with traditional land use beyond the Project's construction schedule and is therefore not considered further in this assessment. The Project is not likely to overlap with land use and recreation activities potentially occurring in the area. Effects will be localized to the areas where winter roads had previously been built and to previously established well sites and camp facilities. Furthermore, the proposed activities are anticipated to be completed in one winter (December to March).

5.2.10 Site Access and Traffic

Site access and traffic were considered a potential VC for the assessment given the high volume of traffic along the Klondike and Dempster Highway and a potential increased level of access among travellers to the surrounding lands and site area via the winter access road that will be constructed for the Project. Due to the implementation of security measures (included a gated entrance) at the commencement of the winter access roads, this VC was not carried forward to assessment.

6.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS ASSESSMENT

6.1 Wildlife and Wildlife Habitat

6.1.1 Existing Conditions

6.1.1.1 Caribou (Rangifer tarandus)

The Project occurs exclusively within the range of the Porcupine Caribou Herd. The transport of equipment to and from the Project, likely from Alberta or northeastern British Columbia, would travel through several additional caribou herds, including the Forty Mile Herd and the Hart Herd along the Dempster Highway. However, the incremental amount of Project traffic compared to regular highway traffic is small and, as

such, the effects of travel to and from the Project are not included in this assessment. Project equipment would consist of approximately two dozen trucks which would travel to and from the Project area over a 3 to 5 day period.

The Porcupine Caribou Herd is a subpopulation of barren-ground caribou. Barren-ground subpopulations are known for their large aggregations, dramatic population fluctuations, lengthy migrations, and significant cultural and social value to northern Indigenous people and other Canadians (COSEWIC 2016). Barren-ground caribou have been assessed as “Threatened” by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2016). Within Yukon barren-ground caribou are considered “Vulnerable/Apparently Secure” (Yukon Government 2020). Although many barren-ground caribou are declining, the Porcupine Caribou Herd has been increasing at a rate of approximately 4% from 123,000 animals in 2001 to 218,000 in 2017 (Yukon Government 2018).

The Porcupine Caribou Herd’s annual range extends approximately 250,000 km² from Alaska, through Yukon, and into the western edge of Northwest Territories. The herd undertakes long distance migrations across seasonal ranges necessary for key aspects of their life cycle. Seven primary life cycle periods occur for the Porcupine Caribou Herd (**Table 6-1**) (Porcupine Caribou Technical Committee 1993). The timing of this Project (December to mid April) coincides with the *Early, Mid, and Late Winter* season and the *Spring, Spring Migration, and Pre-calving* season of the Porcupine Caribou Herd.

Winter is considered the season of lowest importance to the herd (Porcupine Caribou Technical Committee 1993). The herd is at its most dispersed stage during winter, both in terms of the extent of the range it uses and in terms of group aggregations. Average daily movement distances (2-5 km/day) (Russell and Gunn 2017) are lower than other seasons, except for cows during calving. Winter range use varies from year to year depending on snow depth and condition. In Yukon, during deep snow years, use is concentrated in the Richardson Mountains and the Ogilvie-Hart basins. In low snow years, the Whitestone River and Eagle Plains areas, which contain abundant lichen resources, are used more. Forage, primarily lichens, is generally not limiting during the winter and in shallow to normal snow years the caribou appear to maintain neutral to surplus energy balances. The Porcupine Caribou Herd are relatively tolerant to human activity during the winter (Porcupine Caribou Technical Committee 1993).

During the *Spring, Spring Migration, and Pre-calving* season caribou begin moving north towards the calving grounds. Average daily movement rates increase from approximately 6 km/day at the start of the season to approximately 24 km/day through May. Caribou, especially pregnant cows, typically enter an energy deficit during spring due to reduced forage availability, as they leave the lichen-rich taiga and before forbs have emerged, and higher energy expenditure associated with migration. Spring is rated higher importance than winter, but still relatively low overall, due to lack of association with specific habitats, relatively low threats from predators, and lack of insect harassment (Porcupine Caribou Technical Committee 1993).

No Wildlife Key Areas occur for caribou within the Project area (Environment Yukon 2016a).

Table 6.1: Key life cycle periods for the Porcupine Caribou Herd (from Porcupine Technical Committee, 1993)

Season	Dates	Characteristics	Importance
Early, Mid and Late Winter	Dec 1 to Mar 31	The herd is at its most dispersed at this time across two winter ranges: in Yukon, mostly south of the Porcupine River in boreal taiga and, in Alaska, centred in the Chandalar River/Arctic Village area. Winter range use varies from year to year depending on snow depth and condition. Caribou at this time of year are relatively tolerant to human activity. In shallow to normal snow years animals can gain weight.	4 (Lowest)
Spring, Spring Migration, and Pre-calving	Apr 1 to May 31	Distribution of the herd varies depending on snow melt; migration routes vary from year to year. Pregnant females are typically in energy deficit due to reduced forage once they leave the lichen rich taiga.	3
Calving (cows)	June 1 to 10	Calving occurs on the coastal plain of NE Alaska and, to a lesser degree, NW Yukon. This area offers reduced predators and abundant spring forage; no alternative range is available. Cows are at the lowest point of physical condition and are least tolerant to human disturbance.	1 (Highest)
Post-calving and Movement (cows)	June 11 to 30	As calves develop over the first two weeks of life the cows and calves tend to aggregate into larger groups and increase movement rates to track plant green-up. The post calving period imposes high energetic demands on lactating females and cow/calf groups are relatively intolerant of disturbance. The post-calving range is primarily in Alaska and cows that calved in Yukon tend to move west along the foothills into Arctic National Wildlife Refuge (ANWR). Insect avoidance can affect distribution by the end of June.	1 (Highest)
Calving to Movement (bulls)	June 1 to 30	Bulls, non-pregnant cows, and subadults tend to concentrate east of the calving grounds in the northern Yukon. Animals track the progression of greenup from the coastal plains to the northern foothills, to intermountain regions.	3
Early Summer	July 1-15	Cows continue to require high energy intake for milk production, but insect avoidance also drives distribution. Key areas selected for insect avoidance are the coastal plain adjacent to the Beaufort Sea (mostly cows/calves) and mountains in the Brooks and British Mountains (mostly bulls and cows without calves). Long distance movements during this period are also an insect avoidance behaviour.	2
Mid Summer	July 16 to Aug. 7	Mid summer continues to be a period of high insect harassment. Two areas are consistently used – the northern Richardson Mountains in Yukon and the southern portion of the Brooks Range in Alaska. Females with cows may be in energy deficit.	2
Late Summer and Fall Migration	Aug. 8 to Oct. 7	As insect activity declines the herd disperses widely but mostly stays north of the tree line until the latter part of the period – in Alaska south of the Brooks Range and in Yukon north of the Porcupine River. Animals exhibit high feeding rates and gaining fat for the winter.	3
Rut and Late Fall	Oct 8 to Nov 30	The region where rut occurs has no affinity from year to year; rut occurs wherever the herd happens to be along fall migration. In Yukon distribution can occur from the southern Olgilvie Mountains to the Richardson Mountains.	4 (Lowest)

6.1.1.2 Moose (Alces alces)

Moose occur throughout the Project area and are present in all seasons; however, population levels are poorly known. The Regional Biologist with Environment Yukon has suggested that the density of moose in Eagle Plains is low compared to populations in central and southern Yukon, but relatively high compared to other areas in north Yukon, and may be rising (M. Suitor, pers. comm.). Extensive wildfires within the Eagle Plains area over the last 30 years are currently in shrub-dominated successional stages that offer productive summer and winter forage for moose, which are expected to support higher numbers of moose than later successional black spruce forests. In November 2000 an aerial moose survey was conducted for a study area that mostly overlapped with the project area for this Project (Access Consulting Group and EBA Engineering Consultants Ltd. 2001). That survey observed 30 moose and estimated a total population of 60-90 based on additional tracks seen and a low sight ability factor.

Winter is normally a limiting season for moose. Reduced forage, higher energy expenditures, due to snow and cold, and higher vulnerability to predation all contribute to limit moose fitness during the winter. During winter, moose are primarily associated with shrub-dominated habitats for forage, which include regenerating burns, riparian areas, shrub-carrs, wetlands, stream valleys, and upland deciduous and mixed forest (Suring and Sterne 1998, Environment Yukon 2016b, McCulley et al. 2017). In other areas in Yukon, moose typically use higher elevation area in early winter and move to lower elevations in late winter to avoid deep snow and to utilize habitats such as riparian areas with shrubs for forage (Environment Yukon 2016b). It is unverified if this occurs in the Project area, but winter snow depths often exceed 50 cm in the Eagle Plains area (Russell and Gunn 2017), which is the threshold at which moose tend to exhibit winter movements to seek lower snow packs (Poole and Stuart-Smith 2005).

No Wildlife Key Areas for moose occur within the Project area (Environment Yukon 2016a)

6.1.2 Project Interactions and Potential Effects

Potential effects to VC subcomponents were evaluated based on the degree of spatial and temporal overlap between Project activities and the VC subcomponents and the type of interactions the Project could have on the VC subcomponents. Types of interaction include both direct affects, such as displacing animals due to sensory disturbances, and indirect effects, such as increasing mortality risk from hunters or natural predators. Project activities and interactions could result in effects to wildlife and wildlife habitat during three primary Project stages (**Table 6-2**).

Table 6.2: Potential interactions between Project activities Wildlife and Wildlife Habitat

Activity	Project Interactions	Potential Effects
Winter road construction	• Vegetation Removal • Use of heavy equipment • Human presence	• Sensory disturbance • Localized effects to movement and distribution • Direct and indirect habitat effects
Road travel (along the Dempster and winter roads)	• Vehicle travel	• Sensory disturbance • Localized effects to movement and distribution • Indirect habitat effects • Direct and indirect mortality

Well site maintenance	• Vegetation Removal • Use of heavy equipment • Human presence	• Sensory disturbance • Localized effects to movement and distribution • Mortality or injury

6.1.2.1 Caribou

A detailed assessment of potential effects of oil and gas activities in Eagle Plains on caribou was conducted by Russell and Gunn (2017). This assessment draws from their work, adapting to the limited scope of this well maintenance program.

There is increasing evidence that ungulates, including caribou, tend to respond to human presence and activities in similar manners to how they respond to predators (Frid and Dill 2002). The most common response of caribou is to avoid human activity areas or to exhibit greater vigilance behaviours. Reported response distances of caribou vary widely but are mostly in the magnitude of several hundred metres (e.g., 600 m (Murphy and Curatolo 1987). Caribou may also change their distribution relative to disturbance. In most studies, avoidance of roads is less than 4 km (Vistnes and Nellemann 2001, Cameron et al. 2005), but avoidance of the Dempster Highway varied from 18-30 km over a twenty year period depending on land use and hunting regulations (Johnson and Russell 2014). Responses by caribou to human disturbances vary widely and causal relationships are often poorly understood.

Patterns of avoidance by caribou to human disturbances are often affected by the nature of the human activity, specifically, whether caribou are directly hunted or harassed by humans, and time since disturbance began. Reduced behavioural response and apparent avoidance in distribution patterns (i.e., habituation) appear to be associated with lack of hunting and predation (Lawhead et al. 2006, Haskell and Ballard 2008). This highlights the importance of factoring hunting management into mitigations. However, effects on distribution can occur outside of hunted areas and several years after the disturbance began (Johnson et al. 2019).

Russell and Gunn (2017) frame their assessment in terms of *sensitivity* of the Porcupine Caribou Herd to potential effects and degree of *exposure* to effects. Sensitivity relates to factors such as herd size and trend, seasonal body condition, ecological life history activities, and environmental stressors, like insects. Caribou are generally more sensitive to effects when populations are low and declining, when their body condition is low or they are exposed to other stresses (e.g., insect harassment), and during critical life history periods, notably calving. In the context of the current condition of herd and the timing when the Project could interact with it, the sensitivity of the herd is low:

- The herd is at a historically high population level and showing an increasing trend.
- During winter, when the Project would occur, Porcupine Caribou are typically in good body condition and free of stressors, such as insects.
- The winter period is not associated with a critical life history stage.

Exposure relates to the degree of spatial and temporal overlap between caribou and potential human effects, as well as the mechanisms of effects (e.g., type, magnitude, and duration of effects). In terms of type of effects, the most likely effects of the Project are localized, temporary effects to distribution, which can translate to indirect habitat effects. The only potential source of direct mortality from the Project would

be vehicle collisions, and those can be effectively mitigated. Linear features can indirectly affect the rate of mortality of caribou caused by natural predators and hunters, by increasing ease of travel. However, this Project will avoid creating new linear features by re-establishing existing winter roads. The Project is aiming to have a neutral effect on hunting, to balance mitigating effects to caribou while maintaining indigenous hunting opportunities. Although hunting will not be available from the Blackie and Chance winter roads, the project will not inhibit hunting indigenous hunting opportunities in the broader area that may be accessed from the Dempster Highway.

Russell and Gunn (2017) assessed the potential spatial and temporal overlap between the Porcupine Caribou Herd and a similar, but slightly larger extent, as this Project, using thirty years of telemetry data. Their primary analysis area was a 30 km buffer around the project, based on the maximum distance that caribou avoided the Dempster Highway in another study (Johnson and Russell 2014). Russell and Gunn (2017) found that a collared caribou occurred in the 30 km buffer area during the months of January to April in 15-22% of the years. The average percentage of the herd using the 30 km buffer area ranged from 3% in January to approximately 1% in February to April. Average residency times varied from 9 to 17 days/month during the January to April period. In other words, on average, 98% of the herd's movements during the winter occur outside the 30 km buffer surrounding the Project and, for any animal that does occur in the area, they typically spend a third to half of a month there before moving out of the area.

6.1.2.2 Moose

Moose can be affected by human land use activities, although moose are generally less sensitive than caribou. As outlined below, Project activities could result in four types of effects to moose.

1. Sensory disturbance. Human presence, work activities and vehicle travel/equipment operation will generate noise and other sensory effects that moose may respond to. The most likely response of moose to sensory disturbance is to avoid areas where disturbances are occurring. This could result in localized effects to movement and distribution and indirect habitat effects (Lykkja et al. 2009) (see 2 and 3, below, respectively). When moose are unable to move away from sensory disturbances, it can result in physiological stress responses and behavioural modifications (e.g., increased vigilance). However, these responses are not anticipated to occur for this Project because moose can move away from the work areas to avoid them.
2. Localized effects to movement and distribution. Numerous studies have examined responses of moose to human activities, including roads, industrial activity, and rural residences (Andersen et al. 1996, Burson et al. 2000, Yost and Wright 2001, Lykkja et al. 2009). Most studies found avoidance of human activity areas out to approximately 300 m (EDI Environmental Dynamics Inc. 2017). However, there are also cases where moose appear to choose to be nearer to human activity to avoid natural predators (Muhly et al. 2011). Similar to caribou, responses are greatest when moose are directly harassed or hunted.
3. Indirect habitat effects. A consequence of localized avoidance of human activity areas is that the habitat within the zone of influence is temporarily not used by animals. As per the effects on movement and distribution, the zone of influence for indirect habitat effects is approximately 300 m.
4. Direct and indirect mortality. The Project has the potential to have a direct effect on moose mortality via vehicle collisions (EDI Environmental Dynamics Inc. 2015). However, mitigation measures, below, are expected to effectively eliminate the risk of vehicle collisions. The Project could have an indirect affect on mortality by improving access along the winter roads for human hunters and natural predators.

6.1.3 Mitigation Measures

6.1.3.1 General Mitigation Measures for Wildlife and Wildlife Habitat

- All Project personnel will be required to complete formal orientation and training related to wildlife mitigation measures.
- Work will be scheduled to minimize the spatial extent across which work is concurrently occurring.
- Access to the well sites will utilize existing and historic winter roads to minimize the creation of new linear features.
- Project footprints, notably the widths of winter roads, will be minimized as much as possible. On the Chance Road, the width will not exceed the existing right-of way extent.
- Firearms are not allowed on-site by Project personnel. No hunting or shooting rules will be in effect.
- A no harassment of wildlife policy applies to all personnel. This includes attempts to chase, catch, divert, follow, photograph, feed, or otherwise harass wildlife, whether on foot, in on-road or off-road vehicles, heavy equipment, or aircraft.
- The use of on-road and off-road vehicles, including snowmobiles, will be restricted to essential Project access routes.
- Personal use of unmanned aerial vehicles (UAVs or drones) is prohibited.

6.1.3.2 Road Operations

The following measures are designed to mitigate the risk of vehicle collisions and effects of road use on wildlife movements.

- The maximum speed limit along the Dempster Highway is 90 km/h.
- The maximum speed along winter roads is 30 km/h.
- Wildlife will always have the right-of-way. This requires vehicle operators to stop when wildlife are observed on or beside the road, allowing them to cross safely. If wildlife stays on the road or right-of-way for >5 minutes, drivers may resume travel and pass the animals at <10km/h.
- Special rules apply to caribou.
    - For Caribou within 100 m from the road:
        - Stop as far back as possible;
        - Alert other drivers;
        - Wait until caribou have crossed and moved beyond 500 m from the road or are lost from sight before proceeding;
        - Proceed with caution.
    - For Caribou beyond 100 m from the road:
        - Proceed with caution;
        - Alert other drivers;
        - Watch for direction of movement and change in behaviour.

- When moose and caribou are on a road they will sometimes run down the road away from a vehicle. If this happens, stop and wait at least 5 minutes to allow the animal to move off the road. If the animal remains on the road, drive forward at 10 km/h, then stop again when the animal begins to run away. Wait 2 minutes and repeat this procedure. If the animal still does not leave the road, wait 10 minutes and repeat the procedure, alternating with a 2- and 10-minute stop between driving attempts.
- Drivers are required to use two-way radio communication. The location of any wildlife observed along Project roads is to be communicated to other road users on the radio.
- Drivers will not exit the vehicle to chase, catch, divert, follow, photograph, or otherwise harass wildlife.
- Along winter roads:
    - snow banks will be maintained at heights <1 m to reduce the hinderance to wildlife crossing them;
    - where snow banks exceed 60 cm in height, regular breaks (at least every 500m) will be created to facilitate easier animal crossing and as 'escape routes' off the road.
        - Create matched breaks on either side of the road that animals can use to cross.
        - On corners, create run-outs, in each direction, that are obvious alternative routes for animals to use, instead of following the road.
        - Avoid breaks at seismic lines, which could provide human access.

6.1.3.3 Aircraft Operations

The following measures are designed to mitigate the effects of aircraft use on wildlife:

- Altitudes of greater than 300 m above ground level will be maintained at all times of the year.
- Altitudes of greater than 600 m above ground level will be maintained during sensitive times of the year.
- Areas where caribou have been observed in the past will be avoided.
- Flights paths will be designed to avoid important areas during sensitive times of the year.
- No caribou observed will be flown towards, circled, or harassed.
- If caribou are seen to be in a panic or startled the plane will ascend to a higher elevation.

6.1.3.4 Caribou

The majority of potential effects to caribou will be mitigated via measure for general wildlife, road operations and aircraft operations. Additional measure specific to caribou include:

- Packing of snow will not occur on any linear features that are not essential to Project work.
- Access to linear features off the winter roads will be minimized by avoiding creation of breaks in snow berms at junctions with linear features.
- All sightings of caribou will be reported to the Environmental Monitor.
- If more than a dozen caribou are observed, or if any number of caribou are observed in the same location for longer than a three-day period, a qualified environmental professional (QEP) will be consulted to determine if site-specific mitigations may be warranted.

Due to the variable nature of caribou occurrence and snow conditions from year to year, a pre-operations assessment will be conducted in December, prior to Project initiation, to assess local conditions (specifically including information about caribou occurrence and snow conditions) that could warrant tailored management measures. For example, if telemetry data indicated that several collared caribou were in the Project area, near work areas, additional measures may be put in place to mitigate potential effects.

6.1.4 Effects Characterization and Significance

6.1.4.1 Caribou

With the mitigation measures listed in **Section 6.1.3** applied, it is predicted that Project activities will not result in significant effects to habitat, movement and distribution, and mortality or injury to caribou. Detailed effects assessments are provided for each indicator in Table 6.3, Table 6.4 and Table 6.5 respectively. Key factors that result in this significance determination are:

- Although the timing of the Project does overlap with the potential occurrence of the Porcupine Caribou Herd in the area, the extent of the Project area, including a zone of influence, is a small proportion of the herd's total winter range. If caribou choose to avoid the work areas (i.e., due to sensory disturbance) alternative habitat is available.
- The timing of the Project, during winter, is a season of lowest importance for the ecology of the Porcupine Caribou Herd and a period when the caribou are relatively tolerant of human disturbance (Porcupine Caribou Technical Committee 1993).
- The most likely potential effect to caribou is temporary, localized avoidance of work areas due to sensory disturbance.
- The Project will be re-establishing existing winter access, not creating new access features, and will therefore not result in a change in access for human hunters and natural predators.

Table 6.3: Characterization of potential effects to caribou habitat.

Residual Effect Characteristic	General Definition	Rating
Description of Interaction	The Project will consist of work at 8 well sites plus access via 30.2 km of winter roads. This will result in direct habitat effects due to vegetation clearing along the access routes and well sites. It may also result in indirect habitat effects if caribou choose to avoid areas in proximity to the roads and well sites due to sensory disturbance or perceived predation risk.	
Direction	Effects to habitat will be adverse.	Adverse
Magnitude	The magnitude of effects is low, due to the small extent and narrow width of areas that are affected.	Low
Geographic Extent	Direct habitat will be limited to the footprint of the winter roads and well sites (approximately 60 ha). Indirect effects can extend out to 4000 m, depending on site conditions and variation in caribou behaviour. These extents are small relative to the herd's total winter range.	Low
Timing	The timing of the Project, during winter, is a season of lowest importance for the ecology of the Porcupine Caribou Herd and a period when the caribou are relatively tolerant of human disturbance	Low
Frequency	Direct effects will be continuous, though diminishing in magnitude, as vegetation regenerates. Indirect effects will be continuous when work activities are active.	Continuous

Residual Effect Characteristic	General Definition	Rating
Duration	Direct effects to the road and well site footprints will take years to regenerate (long-term). Indirect effects will cease once work activities are completed (short-term).	Short-term Long-term
Reversibility	The effects to habitat are fully reversible. Indirect effects will cease immediately upon stoppage of work activities. Direct effects along the winter roads will take several years for vegetation to regrow.	Fully reversible
Context	Work for this project will occur on previously disturbed sites. Measures to protect the duff layer and ground vegetation will maximize the resiliency of the site to regenerate to similar habitat.	Existing Disturbed/ Resilient
Probability of occurrence	Based on historic telemetry data it is likely that caribou will encounter areas affected by this Project at some point in the future. The likelihood that caribou will be present during the year the Project is active is moderate (over 24, years collared caribou occurred within 4km of the Project area in 17% of the years).	Likely

Table 6.4: Characterization of potential effects to caribou movement and distribution.

Residual Effect Characteristic	General Definition	Rating
Description of Interaction	The Project will consist of work at 8 well sites plus access via 30.2 km of winter roads. This work will result in sensory disturbance that could cause caribou to avoid the areas. Responses to sensory disturbance are mostly ≤4 km but vary in relation to site conditions and caribou behaviour. Effects are most likely to be expressed as temporary, localized avoidance of work areas. No effects to migration are expected because the extent of the Project area is small relative to the extent of winter range available for caribou to travel through.	
Direction	Effects to movement and distribution could be adverse.	Adverse
Magnitude	The magnitude of effects is low due to the limited consequence if caribou chose to avoid work areas. Alternative habitat is available, and avoidance of the area would not hinder migration or sub-regional movements within the winter range.	Low
Geographic Extent	Responses to sensory disturbance are mostly ≤4 km but vary in relation to site conditions and caribou behaviour. These extents are small relative to the herd's total winter range.	Low
Timing	The timing of the Project, during winter, is a season of lowest importance for the ecology of the Porcupine Caribou Herd and a period when the caribou are relatively tolerant of human disturbance	Low
Frequency	Potential effects to movement will occur daily, corresponding to periods when project activities are active.	Frequent
Duration	Project work will occur on a daily basis, for approximately a 12 h period, over an eight to 12-week work period in mid-January to mid-April.	Short-term
Reversibility	The potential effects to movement are fully reversible. Effects will cease immediately upon cessation of work activities.	Fully reversible
Context	Oil and gas exploration activities have occurred intermittently in the Eagle Plains area over the last 50 years. Responses of caribou have not been studied in detail, but use of the area by caribou has continued, demonstrating general resiliency to exploration activities.	Existing Disturbed/ Resilient

Residual Effect Characteristic	General Definition	Rating
Probability of occurrence	Based on historic telemetry data it is possible, but uncertain, that caribou will occur in the Project area when work is active. Over 25 years, collared caribou occurred within 4km of the Project area in 17% of the years.	Possible

Table 6.5: Characterization of potential effects to caribou mortality and injury.

Residual Effect Characteristic	General Definition	Rating
Description of Interaction	The Project will consist of work at 8 well sites plus access via 30.2 km of winter roads. Road use has the potential to cause direct mortality to caribou via vehicle collisions; however, that risk is negligible after mitigations. The project also has the potential to affect indirect mortality via packing of winter roads that could enhance travel rates by wolves or access to hunters. However, the potential for this effect is reduced by potential avoidance of work areas by both caribou and wolves due to human activity/sensory disturbance and hunter access management for safety.	
Direction	Effects to mortality or injury could be adverse.	Adverse
Magnitude	The magnitude of potential effects of direct mortality is negligible after mitigations. Effects of indirect mortality are estimated to be low due to potential avoidance of the work areas by both caribou and wolves and hunter access management.	Low
Geographic Extent	The winter roads total 30.15 km. This extent is small relative to the herd's total winter range, and the number of caribou that are likely to encounter the road is small.	Low
Timing	The timing of the Project, during winter, coincides with the potential occurrence of the Porcupine Caribou Herd in the area.	Moderate
Frequency	The potential encounter rate between caribou and wolves or hunters along or adjacent to winter roads is unknown, but is likely infrequent, due to factors listed above. Caribou would have the potential to encounter project traffic daily (i.e., frequent), but the risk of mortality is negligible after mitigation.	Infrequent
Duration	Project work will occur on a daily basis, for approximately a 12 h period, over an eight to 12-week work period in mid-January to mid-April.	Short-term
Reversibility	The potential effects to mortality are fully reversible. Potential direct effects will cease immediately upon completion of work activities. Vegetation regeneration will take several years to reach a stage that hinders travel by hunters and natural predators.	Fully reversible
Context	A network of winter roads and seismic lines exists in the area from past exploration. This work will not add new features, but it will clear some regenerating vegetation and temporarily pack snow that could temporarily enhance access by hunters and natural predators.	Existing Disturbed/ Resilient
Probability of occurrence	Based on historic telemetry data it is possible, but uncertain, that caribou will occur in the Project area when work is active. Over 24 years, collared caribou occurred within 4km of the Project area in 17% of the years. If caribou do occur in the area during the year that work occurs, there is low probability that the Project will contribute to indirect mortality.	Unlikely

6.1.4.2 Moose

With the mitigation measures listed in **Section 6.1.3** applied, it is predicted that Project activities will not result in significant effects to habitat, movement and distribution, and mortality or injury to moose. Detailed effects assessments are provided for each indicator in **Table 6-6**, **Table 6-7**, and **Table 6-8** for each indicator, respectively. Key factors that result in this significance determination are:

- Although the timing of the Project does occur during winter, which is a sensitive season for moose, the extent of the Project area, including a zone of influence, is a small proportion of winter range that is available to the species. If moose choose to avoid the work areas (i.e., due to sensory disturbance) alternative habitat is available.
- The most likely potential effect to moose is temporary, localized avoidance of work areas due to sensory disturbance.
- The Project will be reactivating existing winter access, not creating new access features, and will not result in a significant change in access for human hunters and natural predators.

Table 6.6: Characterization of potential effects to moose habitat.

Residual Effect Characteristic	General Definition	Rating
Description of Interaction	The Project will consist of work at 8 well sites plus access via 30.2 km of winter roads. This will result in direct habitat effects due to vegetation clearing along the access routes and well sites. It may also result in indirect habitat effects if moose choose to avoid areas in proximity to the roads and well sites due to sensory disturbance or perceived predation risk.	
Direction	Effects to habitat will initially be adverse but may switch to positive for several years if shrubs regenerate on the winter roads.	Adverse/Positive
Magnitude	The magnitude of effects to habitat is low, due to the small extent and narrow width of areas that are affected.	Low
Geographic Extent	Direct habitat will be limited to the footprint of the winter roads and well sites (approximately 60 ha). Indirect effects to habitat are mostly within 300 m, depending on site conditions and variation in moose behaviour. These extents are small relative to the total winter range available to moose.	Low
Timing	The timing of the Project, during winter, is a sensitive season for moose due to limited forage and higher energetic outputs due to snow and cold temperatures.	Moderate
Frequency	Direct effects will be continuous, though diminishing in magnitude, as vegetation regenerates. Indirect effects will be continuous when work activities are active.	Continuous
Duration	Direct effects to the road and well site footprints will take years to regenerate (long-term). Indirect effects will cease once work activities are completed (short-term).	Short-term Long-term
Reversibility	The effects to habitat are fully reversible. Indirect effects will cease immediately upon stoppage of work activities. Direct effects along the winter roads will take several years for vegetation to regrow.	Fully reversible

Residual Effect Characteristic	General Definition	Rating
Context	Work for this project will occur on previously disturbed sites. Measures to protect the duff layer and ground vegetation will maximize the resiliency of the site to regenerate to similar habitat. The extent of this project, and historic oil and gas disturbances, are small relative to natural disturbances (i.e., fire) that affect moose habitat. Approximately two thirds of the area along the Chance road has burnt in the last 30 years.	Existing Disturbed/ Resilient
Probability of occurrence	Moose are known to use the Project area in winter and some of the moose in the area will encounter the effects the Project has on habitat.	Likely

Table 6.7: Characterization of potential effects to moose movement and distribution.

Residual Effect Characteristic	General Definition	Rating
Description of Interaction	The Project will consist of work at 8 well sites plus access via 30.2 km of winter roads. This work will result in sensory disturbance that could cause moose to avoid the areas. Responses to sensory disturbance are mostly ≤1 km but vary in relation to site conditions and moose behaviour. Effects are most likely to be expressed as temporary, localized avoidance of work areas. Moose do not normally make seasonal movements in the Eagle Plains area.	
Direction	Effects to movement and distribution could be adverse.	Adverse
Magnitude	The magnitude of effects is low due to the limited consequence if moose chose to avoid work areas. Alternative habitat is available, and avoidance of work areas is unlikely to impair within-range movements.	Low
Geographic Extent	Responses to sensory disturbance are mostly ≤300 m but vary in relation to site conditions and moose behaviour. These extents are small relative to the total winter range available in the area.	Low
Timing	The timing of the Project, during winter, is a sensitive season for moose due to limited forage and higher energetic outputs due to snow and cold temperatures.	Moderate
Frequency	Potential effects to movement will occur daily, corresponding to periods when project activities are active.	Frequent
Duration	Project work will occur on a daily basis, for approximately a 12 h period, over an eight to 12-week work period in mid-January to mid-April.	Short-term
Reversibility	The potential effects to movement are fully reversible. Effects will cease immediately upon cessation of work activities.	Fully reversible
Context	Oil and gas exploration activities have occurred intermittently in the Eagle Plains area over the last 50 years. Responses of moose have not been studied in detail, but use of the area by caribou has continued, demonstrating general resiliency to exploration activities. The extent of this project, and historic oil and gas disturbances, are small relative to natural disturbances (i.e., fire that affect moose habitat and distribution).	Existing Disturbed/ Resilient
Probability of occurrence	Moose are known to use the Project area in winter and some of the moose in the area will likely encounter the work areas and be subject to sensory disturbance associated with those areas.	Likely

Table 6.8: Characterization of potential effects to moose mortality or injury.

Residual Effect Characteristic	General Definition	Rating
Description of Interaction	The Project will consist of work at 8 well sites plus access via 30.15 km of winter roads. Road use has the potential to cause direct mortality to moose via vehicle collisions; however, that risk is negligible after mitigations. The project also has the potential to affect indirect mortality via packing of winter roads that could enhance travel rates by wolves or access by hunters. However, the potential for this effect is reduced by potential avoidance of work areas by both moose and wolves due to human activity/sensory disturbance and hunter access management for safety.	
Direction	Effects to mortality or injury could be adverse.	Adverse
Magnitude	The magnitude of potential effects of direct mortality is negligible after mitigations. Effects of indirect mortality are estimated to be low due to potential avoidance of the work areas by both moose and wolves and hunter access management.	Low
Geographic Extent	The winter roads total 30.15 km. This extent is small relative to the herd's total winter range, and the number of moose that are likely to encounter winter roads and well sites is small.	Low
Timing	The timing of the Project, during winter, is a sensitive season for moose due to limited forage and higher energetic outputs due to snow and cold temperatures.	Moderate
Frequency	The potential encounter rate between moose and wolves or hunters along or adjacent to winter roads is unknown, but is likely infrequent, due to factors listed above. Moose would have the potential to encounter project traffic daily (i.e., frequent), but the risk of mortality is negligible after mitigation.	Infrequent
Duration	Project work will occur on a daily basis, for approximately a 12 h period, over an eight to 12-week work period in mid-January to mid-April.	Short-term
Reversibility	The potential effects to mortality are fully reversible. Potential direct effects will cease immediately upon completion of work activities. Vegetation regeneration will take several years to reach a stage that hinders travel by hunters and natural predators.	Fully reversible
Context	A network of winter roads and seismic lines exists in the area from past exploration. This work will not add new features, but it will clear some regenerating vegetation and temporarily pack snow that could temporarily enhance access by hunters and natural predators.	Existing Disturbed/ Resilient
Probability of occurrence	Moose are known to use the Project area in winter and some of the moose in the area will likely encounter the work areas. However, the probability of direct and indirect mortality associated with Project activities is low.	Unlikely

6.2 Vegetation

The Project falls within the Taiga Cordillera Ecozone and Eagle Plains Ecoregion. Descriptions of the ecoregion are drawn from the Ecological Stratification Working Group (1995) and Yukon Ecoregions Working Group (2004). The following sections describe the known baseline information for vegetation and wetlands in these regions, the likely Project interactions and potential effects resulting from Project

activities, mitigation measures to reduce or eliminate those effects, and a summary statement concluding the overall significance of the Project on vegetation and wetlands.

6.2.1 Existing Conditions

The Project falls within the Eagle Plains Ecoregion, a 20,400 km² region in north Yukon between the Richardson and Ogilvie Mountains. Most of the region is low altitude rolling topography, between 300 m and 600 m above sea level (asl), with few scattered peaks to approximately 1,000 m asl, outside the Project area. Most of the watercourses in the ecoregion drain north into the Yukon River via the Whitestone, Porcupine and Eagle rivers. The southeast corner of the region drains east to the Mackenzie River via the Peel, Wind and Ogilvie Rivers. The few lakes that exist in the region are generally oxbow or thermokarst lakes (Yukon Ecoregions Working Group 2004). The Eagle Plains Ecoregion is within the continuous permafrost zone where permafrost can be found up to 200 m thick. Several permafrost produced landforms and processes can be found across the region, including ice-wedge polygons, cryoturbation, solifluction, soil creep and active layer detachment slides on shale (Yukon Ecoregions Working Group 2004).

The Eagle Plains Ecoregion experiences a moderate amount of precipitation, with annual amounts around 400 mm. Most of the precipitation falls as rain throughout the summer months, averaging 50 to 80 mm per month, June through August. Precipitation is lighter through September to April and falls as snow. Average winter temperatures on the Eagle Plains Plateau are around -30°C and -25°C, with extremes as low as -60°C. Winter conditions usually last from October to May. Average summer temperatures are around 13°C, with extremes as high as 30°C. Due to its proximity to the Arctic Circle, this region experiences brief periods of continuous sun above and below the horizon (Yukon Ecoregions Working Group 2004).

The vegetation of the Eagle Plains Ecoregion is primarily boreal forest. The most common climax forest community is black spruce woodland associated with hummocks. Tree growth is often limited by the presence of permafrost in many areas of the Ecoregion, causing open, stunted forests and shrub-dominated communities at tall and low shrub structural stages. Upland black and white spruce forests typically have well-developed shrub communities, including Labrador tea, shrub birch, willow, alder, rose, spiraea and blueberry, with a ground cover of lichen and moss. Moderately well to well drained sites commonly have white spruce or deciduous stands with lichen ground cover. More poorly drained areas with low slope gradients and fine-textured soils are associated with overstory species such as black spruce, shrub birch, Labrador tea, and occasionally tamarack, and often have ground cover dominated by cottongrass tussocks. Deciduous or mixed stands are also often found in areas of recent anthropogenic disturbance, such as old roads, drill sites and gravel pits. Deciduous trees in the Eagle Plains Ecoregion include Alaskan paper birch, balsam poplar, trembling aspen, and willow (Yukon Ecoregions Working Group 2004).

Graminoid and shrubby fens, shrubby bogs and graminoid marshes are scattered throughout the Ecoregion. Several sedge species are dominate in both the graminoid fens and marshes, including narrow-leaf cottongrass, aquatic sedge, northern beaked sedge and mud sedge. Shrub species in fens include leatherleaf and bog rosemary. The ground cover of the shrubby bogs is dominated by sphagnum, sometimes with extensive lichen cover. Shrub species typically include low bush cranberry, bog cranberry, bog rosemary, cloudberry, Labrador tea, shrub birch, willow, black spruce and occasionally tamarack. Riparian forests of white and black spruce are found as narrow strips along most major watercourses in the Ecoregion (Yukon Ecoregions Working Group 2004).

Evidence of forest fires can be observed throughout the Project area, as fires are relatively common. Regenerating burns are dominated by shrubby vegetation, including willow, shrub birch, and alder. Alaskan paper-birch is commonly the first tree species to colonize burn areas. Occasionally, on well-drained sites trembling aspen and balsam poplar may be the first tree species to re-colonize. The extent of old burns can be recognized by the presence of the current black spruce – Alaskan paper birch woodlands (Yukon Ecoregions Working Group 2004).

Ecological and Landscape Classification (ELC) mapping was completed for the Eagle Plains Exploration Project in 2019 and 2020, which encompassed the Project area. The ELC mapping was based on manual delineation and attribution of digital ortho-imagery following the Yukon Ecological and Landscape Classification and Mapping Guidelines, Version 1.0. (Environment Yukon 2016c) and the Standard for Terrestrial Ecosystem Mapping in British Columbia (Resources Inventory Committee 1998). ELC mapping was further informed by extensive field sampling of vegetation communities across a diversity of ecosystems, slope positions, and moisture and nutrient regimes throughout the Eagle Plains Exploration Project.

Vegetation was examined at three scales to assess potential effects of the Project: Vegetation Regional Assessment Area (VRAA), Vegetation Local Assessment Area (VLAA), and the road footprint itself. The VRAA includes vegetation within a 2 km buffer on either side of the Chance and Blackie winter roads, and represents the vegetation communities surrounding the roads to provide context for more localized potential effects. The VLAA includes vegetation within a 100 m buffer on either side of the Chance and Blackie winter roads, and represents the extent where potential direct and indirect Project-related effects could occur. The footprint is the 20 m wide path of the access roads and the well sites where tree and shrub clearing will occur.

The ELC units (ecosites) comprising the VRAA and VLAA are summarized in **Table 6-9** (the footprint is not included because it is such a narrow strip that ELC mapping does not accurately reflect the previous disturbance along it at that fine a scale). Comparison of the VRAA and the VLAA indicates that the relative proportions of ecosites are similar across both study areas. Both areas are dominated by:

- Moist Spruce – Labrador Tea forest (shrub structural stage)
- Moist Spruce – Labrador Tea forest (mature forest structural stage)
- Moist Spruce – Alder – Labrador Tea forest
- Mesic White Spruce – Alaska Paper Birch – Alder

A small number of ecosites occur more frequently in the VLAA than the VRAA. These occur in two circumstances. The first are ecosites associated with prior anthropogenic disturbance along the roads and well sites: Mesic birch-willow, Anthropogenic, and Road. The second group includes sites associated with upper and crest topographic positions, where the existing winter roads were situated: Mesic black spruce – Labrador tea (conifer), Dry spruce – lichen (conifer).

One ecosite that occurs less frequently in the VLAA than in the VRAA is Moist Shrub \ Scrub Birch – Labrador Tea – Willow, which is associated with lower slope and valley bottom positions, which the Project access routes avoid.

Both the Chance and Blackie winter roads have been cleared and used for access in previous years. Their footprints are in early- to mid-seral stages and differ from the surrounding vegetation. Chance Road was last used in 2014, and is currently regenerating to low and tall shrub communities undergoing either normal or stagnated succession. Chance Road is dominated by dense shrub birch, willow, alder, and paper birch, ranging from 25% to 60% cover, and with thick herbaceous vegetation (i.e., graminoids and forbs), ranging from 40% to 75% cover (Photo 1). In burned areas, Chance Road is similar to the surrounding vegetation, while in unburnt areas, the surrounding vegetation consists of taller, more mature black spruce forest. Blackie Road has not been used in several decades and is more successionally advanced – dominated by fairly open (25% cover) black spruce and shrub birch at a tall shrub structural stage (Photo 2).This represents a similar vegetation community but a different structural stage than the surrounding vegetation, which is characterized by taller, mature black spruce forest with willow and paper birch shrub layers. There have been no rare nor invasive plants documented in the VRAA, VLAA, or footprint, although targeted rare and invasive plant surveys have not been conducted in the Project area.

As documented in the ELC mapping, wetlands and watercourses cover 49.9 ha in the RAA and include rivers and black spruce bogs. There are no wetlands nor mapped watercourses within 200 m of the road and well site footprints.



Photo 1. View of a typical section of Chance Road, regenerating to a low shrub vegetation community dominated by deciduous shrubs.



Photo 2. View of a section of Blackie Road, regenerating to a tall shrub vegetation community dominated by black spruce.

Table 6.9: Vegetation communities occurring within the Vegetation Regional Assessment Area and Vegetation Local Assessment Area.

Ecosite Code	Ecosite Name	VRAA		VLAA	
		Area (ha)	Area (%)	Area (ha)	Area (%)
02	Mesic birch-willow	66.6	0%	31.8	5%
04	Mesic White Spruce – Alaska Paper Birch - Alder	1111.0	8%	39.6	7%
05	Mesic Alaska Paper Birch (Deciduous)	654.6	5%	24.7	4%
06	Mesic Black Spruce – Labrador Tea (Conifer)	685.9	5%	40.8	7%
14	Dry Spruce-Lichen (Conifer)	138.9	1%	15.7	3%
15	Dry Aspen-Lichen (Deciduous)	2.3	0%	0.0	0%
16	Dry Spruce-Birch-Lichen (Mixedwood)	173.0	1%	1.6	0%
20	Shrubby Riparian Birch – Willow	8.0	0%	0.0	0%
22	Riparian Spruce – Birch - Willow	15.2	0%	0.0	0%
23	Drainage Shrubby Riparian	195.4	1%	4.6	1%
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	590.3	4%	5.6	1%
33	Moist Spruce – Labrador Tea (shrub stage)	5422.9	40%	227.2	37%
33	Moist Spruce – Labrador Tea (mature forest stage)	1202.1	9%	67.0	11%
34	Moist Spruce – Alder – Labrador Tea	1446.1	11%	70.0	12%

35	Moist Spruce – Scrub birch – Labrador Tea	591.7	4%	23.2	4%
36	Moist Birch – Willow	2.7	0%	0.9	0%
41	Wet Shrub – Tamarack	1.0	0%	0.0	0%
42	Wet Shrub – Black Spruce – Tussock Cottongrass	654.3	5%	25.0	4%
43	Wet Shrub – Black Spruce - Sphagnum	28.2	0%	0.0	0%
44	Wet Shrub – Scrub Birch – Tussock Cottongrass	150.3	1%	0.0	0%
46	Wet Black Spruce – Labrador Tea – Cladonia	228.7	2%	20.5	3%
47	Wet Black Spruce – Tussock Cottongrass - Sphagnum	169.7	1%	0.0	0%
48	Wet Black Spruce – Carex	0.3	0%	0.0	0%
AN	Anthropogenic	18.9	0%	5.2	1%
B1	Bog – Black spruce – Lichen	10.2	0%	0.0	0%
B2	Bog – Black Spruce – Sphagnum	24.4	0%	0.0	0%
ES	Exposed Soil	9.2	0%	1.0	0%
RI	River	15.2	0%	0.0	0%
RZ	Road	21.2	0%	3.5	1%
Total		13,638.5	100%	608.0	100%

6.2.2 Project Interactions and Potential Effects

Re-establishment and construction of the winter roads will result in alteration of up to 60.4 ha of vegetation within the road footprint. The footprint will be cleared of vegetation through mulching and manual felling. The cutters of the mulcher will be raised off the ground to minimize disturbance to hummocks, tussocks, and high spots, but will remove taller shrubs and trees to allow safe vehicle and equipment travel. Mulching will remove shrubs and trees while protecting the moss layer, soil and root systems of low-growing plants.

In addition to the direct loss of vegetation within the road footprint due to clearing, re-establishment, construction and travel within the road footprint may cause potential effects to vegetation by altering underlying soils. These potential effects include soil disturbance, soil compaction, root damage, altered soil moisture regime, and permafrost thaw. Soil disturbance and root damage would most likely be caused by physical interactions from machinery during clearing, while soil compaction, altered soil moisture, and permafrost thaw would most likely be caused by repeated travel of heavy equipment compressing underlying soils, which can lead to altered thermal and hydrological characteristics.

Vegetation clearing within the road footprint could have both direct and indirect potential effects. Potential direct effects including change to earlier successional stage, change of wildlife habitat and forage, loss of primary productivity and carbon sequestration, reduction of biodiversity, and aesthetic impacts. Potential indirect effects, which may extend into the VLAA and are generally attributable to edge effects, include altered light availability, altered temperature regimes, altered wind patterns, increased nutrient availability from cleared and mulched vegetation, altered seed dispersal, changes to vegetation composition and growth such as infiltration of early seral plants, and altered herbivory patterns.

Potential effects to rare plants include disturbance or destruction during construction if rare plants occur within the footprint, and changes to habitat characteristics caused by vegetation removal and edge effects in the VLAA. There are no tracked shrub or tree species occurring within the Eagle Plains Ecoregion, so only rare ground cover plants (e.g., forbs, graminoids, mosses, and lichens) would be at risk of physical disturbance (Yukon Conservation Data Centre 2019). Ensuring a minimum 10 cm snowpack on all areas to be cleared will greatly reduce the potential for physical disturbance or destruction of any rare plants occurring in the footprint.

Potential effects to invasive plants include introduction and spread of invasive plants via equipment or personnel brought in from infested areas.

All of the aforementioned effects have potential to effect wetlands within the footprint or VLAA, often with increased significance due to the sensitivity to wetlands (e.g., more sensitive soils, hydrological regimes, higher biodiversity and wildlife value, wetland-obligate species). However, as there are no wetlands documented within the footprint or VLAA in the ELC mapping, these effects are unlikely.

The construction phase of the Project could also result in degradation of vegetation due to spills (e.g., hydraulic fluid, fuel etc.) along the access roads.

6.2.3 Mitigation Measures

Mitigation measures related to vegetation and wetlands include:

- Existing and historic winter roads will be used as the primary access routes to minimize the amount of vegetation that is cleared.
- Winter roads will consist of packed and frozen snow and ice to maintain ground vegetation and to avoid site disturbance to the underlying duff layer, soil and permafrost. A minimum 10 cm snowpack will be required over all road surfaces.
- The extent of vegetation clearing, notably the widths of winter roads and areas at well sites, will be minimized. On the Chance Road, the width will not exceed the existing right-or way extent. This will minimize the direct loss of vegetation and reduce potential edge effects.
- Shrubby vegetation will be cut as high as possible, normally at least 30 cm above the ground. Where possible, shrubs will be pushed over instead of cut.
- The winter roads are located primarily on crest and upper slope positions which minimizes potential overlap with wetlands and riparian areas. If small wetlands or riparian areas along non-classified drainages are encountered, special efforts will be made to minimize effects by enhancing the thickness of the packed snow/ice base and minimizing the right-of-way width.
- To avoid the spread of invasive plants, equipment will be washed and inspected prior to transport to site.

6.2.4 Effects characterization and Significance Determination

With the mitigation measures listed in **Section 6.2.3** applied, it is predicted that the Project activities will not result in significant effects to vegetation and wetlands. Most of the effects are low to moderate in magnitude and considered unlikely to occur and/or reversible over the long-term.

Loss and Alteration of Vegetation

The loss and alteration of vegetation will be mitigated primarily by using existing and historic access roads to minimize the area to be disturbed, and by limiting use to winter. A maximum of 60.4 ha of vegetation will cleared within the footprint, which represents only 0.44% of the RVAA. Existing and historic winter roads in the area typically support early to mid-seral vegetation at a lower structural stage than the surrounding vegetation. Re-activating previously used roads avoids disturbance to mature forests and surrounding vegetation and the overall change in seral stage is minimized. By limiting activities to winter and maintaining a 10 cm snowpack overlying frozen ground, ground vegetation, along with its root structure and litter layer, will be protected from physical disturbance. Cutting vegetation as high as possible will similarly reduce the total amount of vegetation loss, reduce disturbance to root structure, and increase potential for regrowth from the root mass. This will accelerate regeneration after the winter roads have been decommissioned.

Overall, potential effects of loss and alteration of vegetation are low in magnitude and reversible with regeneration. The loss and alteration of vegetation will be limited to a small area that has been previously disturbed, will only remove trees and shrubs greater than 30 cm tall while leaving ground vegetation intact, and will facilitate regeneration. Potential effects are limited in geographic and temporal extent; they will only occur in the footprint of existing roads during a single winter and will start to regenerate the following spring. With mitigations applied, the potential effects of loss and alteration of vegetation are not considered significant.

Creation of Edge Effects

Creation of edge effects (e.g., light availability, temperature regime, wind patterns, vegetation composition and growth, seed dispersal) will be mitigated by using existing and historic access roads and by limiting use to winter. Using previously disturbed access roads that already experience some edge effects will minimize the creation of new edges and thus reduce overall edge effects. Limiting use to winter and minimizing disturbance to ground vegetation will preserve ground vegetation integrity, which will further reduce the potential effects of forest edges. Potential edge effects will decrease as the footprint regenerates once well maintenance activities are completed.

Overall potential effects of edge creation are low in magnitude and reversible with regeneration. The footprint and VLAA already experiences some edge effects from past disturbance along the proposed routes; the Project may reinforce pre-existing edge effects but will minimize new edge creation. Potential effects are limited in geographic and temporal extent; they will only occur in the footprint and VLAA and will diminish as regeneration progresses. With mitigations applied, the potential effects of edge creation are not considered significant.

Disturbance to Soils

The disturbance to soils will be mitigated by creating a frozen snow and ice surface on existing and historic winter roads which will avoid effects to soils and permafrost. Using previously disturbed access roads will avoid potential effects to undisturbed sites. Re-activating and using access roads during winter while the soil is frozen, and maintaining a 10 cm snowpack, will protect the duff layer, soil surface, and soil structure from disturbance, and minimize potential permafrost thaw.

Overall, potential effects of soil disturbance are low in magnitude and unlikely to occur. Potential effects are limited in geographic and temporal extent; they will only occur in the footprint, and work will only occur in a single winter. With mitigations applied, the potential effects of soil disturbance are not considered significant.

Disturbance to Rare Plants

Disturbance to rare plants will be mitigated by limiting road re-establishment and use to winter, and by minimizing ground disturbance. There are no rare shrub or tree species documented within the Eagle Plains Ecoregion; only rare ground vegetation species have the potential to be affected by the Project. Ground vegetation will be dormant in winter, and protected by a minimum 10 cm snowpack, so any rare plants occurring within the footprint will be protected. Potential changes to habitat characteristics affecting rare plants will be mitigated by minimizing the creation of edge effects and overall vegetation loss and alteration.

Overall potential effects to rare plants are low in magnitude and unlikely to occur. Potential effects are limited in geographic and temporal extent; they may only occur in the footprint and VLAA, and physical disturbance may only occur during road re-establishment and use in a single winter. With mitigations applied, the potential effects to rare plants are not considered significant.

Spread of invasive species

Spread of invasive species will be mitigated by limiting road re-establishment and use to winter and inspecting equipment for cleanliness. Vegetation will be dormant in winter, so potential for seed dispersal from plants within the footprint will be low. Potential introduction of invasive species from off-site will be minimized by inspecting equipment brought on-site for cleanliness, including any dirt wads or old vegetation that may be harbouring seeds.

Overall potential effects of invasive species are moderate in magnitude but unlikely to occur. Potential effects are limited in geographic and temporal extent; they may only occur in the footprint and VLAA, and introduction of plants may only occur during road re-establishment and use in a single winter. With mitigations applied, the potential effects of invasive species are not considered significant.

Alteration of Wetlands

Alteration of wetlands will be mitigated by using existing and historic access roads that follow upland topography such as ridges to avoid wetland areas. Although there are no wetlands or named watercourses documented within the footprint or VLAA, snowpack depth will be increased if small wetlands or riparian areas along non-classified drainages are encountered.

Overall potential effects to wetlands are low in magnitude and unlikely to occur. Potential effects are limited in geographic and temporal extent; they may only occur in the footprint and VLAA, and only during road re-establishment and use in a single winter. With mitigations applied, the potential effects to wetlands are not considered significant.

Degradation of Vegetation or Wetlands Due to Spills

Spills will be mitigated by implementing the Spill Contingency Plan which is currently in development.

Overall potential effects of spills are moderate in magnitude but unlikely to occur. Potential effects are limited in geographic and temporal extent; they can occur only in the footprint, and potential occurrence is limited to a single winter. Potential effects would be short-term and would be at least partially reversible. With mitigations applied, the potential effects of spills are not considered significant.

6.3 Heritage Resources

The human history of the Yukon, from the earliest Indigenous groups to the arrival of fur traders and prospectors in the 19th century and beyond, is preserved in the Yukon's heritage or historic resources.

Historic resources include historic sites, historic objects, and any work or assembly of works of nature or of human endeavour that is of value for its archaeological, palaeontological, pre-historic, historic, scientific, or aesthetic features (*Historic Resources Act*, RSY 2002, c 109).

Historical sites generally date to a time of written history (i.e., in the Yukon, the past 100 to 150 years) and typically contain examples of built heritage or structures (e.g., cabins, caches, graves, and brush camps) (Gotthardt and Thomas 2007). Archaeological sites are older (i.e., typically older than 150 years) and can be found on the surface (i.e., artifacts that have been exposed or were never buried) or buried in the ground (e.g., stone tools and chips, animal bone fragments, and remains of ancient hearths and campfires) (Gotthardt and Thomas 2007).

Archaeological sites and resources are culturally meaningful and connect community members to the past and represent a collective identity. These resources represent ways of knowing and generational knowledge which are passed on through the generations. Every Indigenous group manages their cultural heritage in a unique way, but always with respect for the past and future generations.

6.3.1 Existing Conditions

In 2013, a Historic Resources Overview Assessment (HROA) was conducted by Matrix Research Ltd. for the 2013 Seismic Program at Eagle Plains, on behalf of Northern Cross (Yukon) Limited. The intent of this assessment was to determine the heritage potential within the proposed development area and provide recommendations for heritage management.

The HROA determined that a "significant portion of the study area is considered to have low pre-contact heritage resources potential (Matrix Research 2013)." However, the HROA also identified several areas that are considered to have high heritage resources potential. These areas of high potential are associated with locations along streams and along the upland areas overlooking these tributaries. The HROA recommended that further heritage resources investigations, specifically a Heritage Resource Impact Assessment (HRIA), be conducted within the zones of high heritage resource potential prior to any potentially land-altering development activities (Matrix Research 2013).

An HRIA was then conducted later in 2013 by Matrix Research, in which the identified zones of high potential were further assessed (**Appendix C**). As indicated by a Letter Report dated May 15, 2014, to Northern Cross (Yukon) Limited, Matrix Research concluded that the proposed well sites and access roads do not conflict with any of the areas containing heritage values (**Appendix D**). Matrix Research did however identify areas within the study area containing heritage values, identified in **Appendix D**, as high potential areas to avoid and labeled as 'avoidance areas'. Matrix Research recommended that these areas, "be

avoided by any potential land-altering activities and that if avoidance was not possible further heritage assessment should be conducted prior to any development (Matrix Research 2014)."

6.3.2 Project Interactions and Potential Effects

Results of the 2013 HROA and HRIA, conducted by Matrix Research, indicate that no Project interactions and/or potential effects are anticipated for Heritage Resources. Should the Project development areas/locations be altered and fall outside of the currently assessed area, further Heritage Resource assessment will be undertaken.

6.3.3 Mitigation Measures

The following list describes the mitigation measures the proponent has committed to eliminate, reduce or control potential effects to Heritage Resources caused from Project activities:

- Develop and implement a Project specific Heritage Resources Chance Find Procedure to ensure that the discovery of any unanticipated Heritage Resources is addressed. In the event Heritage Resources are encountered, all development activities in the vicinity of the Heritage Resources will be suspended immediately. In such cases, the Cultural Services Branch, Department of Tourism and Culture, Government of Yukon, the Vuntut Gwitchin First Nation, and First Nation of Na-Cho Nyak Dun will be contacted immediately with information on the heritage remains and nature of the disturbance.
- The Project will avoid any land-altering activities in the avoidance areas identified in the Matrix Research 2014 Letter Report, as to protect Heritage Resources.

6.3.4 Effects characterization and Significance Determination

With the mitigation measures listed in **Section 6.4.3** applied, it is predicted that Project activities will not result in significant effects to Heritage Resources. Should the Project development areas/locations be altered and fall outside of the currently assessed area, or within areas identified as high potential and or avoidance areas, further Heritage Resource assessment should be undertaken in order to determine any potential effects to Heritage Resources.

7.0 SUMMARY OF MITIGATION MEASURES

The following sections describe the mitigation measures the proponent has committed to eliminate, reduce or control potential effects of the Project to the selected values components.

7.1 Wildlife and Wildlife Habitat

7.1.1 General Mitigation Measures for Wildlife and Wildlife Habitat

- All Project personnel will be required to complete formal orientation and training related to wildlife mitigation measures.
- Work will be scheduled to minimize the spatial extent across which work is concurrently occurring.
- Access to the well sites will utilize existing and historic winter roads to minimize the creation of new linear features.

- Project footprints, notably the widths of winter roads, will be minimized as much as possible. On the Chance Road, the width will not exceed the existing right-or way extent.
- Firearms are not allowed on-site by Project personnel.
- A no harassment of wildlife policy applies to all personnel. This includes attempts to chase, catch, divert, follow, photograph, feed, or otherwise harass wildlife, whether on foot, in on-road or off-road vehicles, heavy equipment, or aircraft.
- The use of on-road and off-road vehicles, including snowmobiles, will be restricted to essential Project access routes.
- Personal use of unmanned aerial vehicles (UAVs or drones) is prohibited.

7.1.2 Road Operations

The following measures are designed to mitigate the risk of vehicle collisions and effects of road use on wildlife movements.

- The maximum speed limit along the Dempster Highway is 90 km/h.
- The maximum speed along winter roads is 30 km/h.
- Wildlife will always have the right-of-way. This requires vehicle operators to stop when wildlife are observed on or beside the road, allowing them to cross safely. If wildlife stays on the road or right-of-way for >5 minutes, drivers may resume travel and pass the animals at <10km/h.
- Special rules apply to caribou.
    - For Caribou within 100 m from the road:
        - Stop as far back as possible;
        - Alert other drivers;
        - Wait until caribou have crossed and moved beyond 500 m from the road or are lost from sight before proceeding;
        - Proceed with caution.
    - For Caribou beyond 100 m from the road:
        - Proceed with caution;
        - Alert other drivers;
        - Watch for direction of movement and change in behaviour.
- When moose and caribou are on a road they will sometimes run down the road away from a vehicle. If this happens, stop and wait at least 5 minutes to allow the animal to move off the road. If the animal remains on the road, drive forward at 10 km/h, then stop again when the animal begins to run away. Wait 2 minutes and repeat this procedure. If the animal still does not leave the road, wait 10 minutes and repeat the procedure, alternating with a 2- and 10-minute stop between driving attempts.
- Drivers are required to use two-way radio communication. The location of any wildlife observed along Project roads is to be communicated to other road users on the radio.
- Drivers will not exit the vehicle to chase, catch, divert, follow, photograph, or otherwise harass wildlife.
- Along winter roads:

- snow banks will be maintained at heights <1 m to reduce the hinderance to wildlife crossing them;
- where snow banks exceed 60 cm in height, regular breaks (at least every 500) will be created to facilitate easier animal crossing and as 'escape routes' off the road.
    - Create matched breaks on either side of the road that animals can use to cross.
    - On corners, create run-outs, in each direction, that are obvious alternative routes for animals to use, instead of following the road.
    - Avoid breaks at seismic lines, which could provide human access.

7.1.3 Aircraft Operations

The following measures are designed to mitigate the effects of aircraft use on wildlife:

- Altitudes of greater than 300 m above ground level will be maintained at all times of the year.
- Altitudes of greater than 600 m above ground level will be maintained during sensitive times of the year.
- Areas where caribou have been observed in the past will be avoided.
- Flights paths will be designed to avoid important areas during sensitive times of the year.
- No caribou observed will be flown towards, circled, or harassed.
- If caribou are seen to be in a panic or startled the plane will ascend to a higher elevation.

7.1.4 Caribou

The majority of potential effects to caribou will be mitigated via measure for general wildlife, road operations and aircraft operations. Additional measure specific to caribou include:

- Packing of snow will not occur on any linear features that are not essential to Project work.
- Access to linear features off the winter roads will be minimized by avoiding creation of breaks in snow berms at junctions with linear features.
- All sightings of caribou will be reported to the Environmental Monitor.
- If more than a dozen caribou are observed, or if any number of caribou are observed in the same location for longer than a three-day period, a qualified environmental professional (QEP) will be consulted to determine if site-specific mitigations may be warranted.

Due to the variable nature of caribou occurrence and snow conditions from year to year, a pre-operations assessment will be conducted in December, prior to Project initiation, to assess local conditions (specifically including information about caribou occurrence and snow conditions) that could warrant tailored management measures. For example, if telemetry data indicated that several collared caribou were in the Project area, near work areas, additional measures may be put in place to mitigate potential effects.

7.2 Vegetation and Wetlands

Mitigation measures related to vegetation and wetlands include:

- Existing and historic winter roads will be used as the primary access routes to minimize the amount of vegetation that is cleared.

- Winter roads will consist of packed and frozen snow and ice to maintain ground vegetation and to avoid site disturbance to the underlying duff layer, soil and permafrost. A minimum 10 cm snowpack will be required over all road surfaces.
- The extent of vegetation clearing, notably the widths of winter roads and areas at well sites, will be minimized. On the Chance Road, the width will not exceed the existing right-or way extent. This will minimize the direct loss of vegetation and reduce potential edge effects.
- Shrubby vegetation will be cut as high as possible, normally at least 30 cm above the ground. Where possible, shrubs will be pushed over instead of cut.
- The winter roads are located primarily on crest and upper slope positions which minimizes potential overlap with wetlands and riparian areas. If small wetlands or riparian areas along non-classified drainages are encountered, special efforts will be made to minimize effects by enhancing the thickness of the packed snow/ice base and minimizing the right-of-way width.
- To avoid the spread of invasive plants, equipment will be washed and inspected prior to transport to site.

7.3 Heritage Resources

The following list describes the mitigation measures the proponent has committed to eliminate, reduce or control potential effects to Heritage Resources caused from Project activities:

- Develop and implement a Project specific Heritage Resources Chance Find Procedure to ensure that the discovery of any unanticipated Heritage Resources is addressed. In the event Heritage Resources are encountered, all development activities in the vicinity of the Heritage Resources will be suspended immediately. In such cases, the Cultural Services Branch, Department of Tourism and Culture, Government of Yukon, the Vuntut Gwitchin First Nation, and First Nation of Na-Cho Nyak Dun will be contacted immediately with information on the heritage remains and nature of the disturbance.
- The Project will avoid any land-altering activities in the avoidance areas identified in the Matrix Research 2014 Letter Report, as to protect Heritage Resources.

7.4 Fish and Fish Habitat

The Project has no direct interaction with fish and fish habitat. Potential indirect effects are also limited due to the location of winter roads and well sites at least 200 m from streams and waterbodies. The following measures are designed to further mitigate indirect effects relating to water quality.

- If non-classified drainages are encountered, special efforts will be made to minimize effects to downstream water quality and sedimentation risk. These include:
  - enhancing the thickness of the packed snow/ice base over and adjacent to the drainage area,
  - minimizing the width of the right-of-way through the area, and
  - ensuring that slash from vegetation clearing is removed from the area so it will not be transported downstream during spring run off.
- If any site disturbance occurs during winter road construction or operation (i.e., exposure of organic or mineral soil), the location and extent of the site will be documented during operations and the area will be treated for sediment control and vegetation regeneration the following summer.

- In the event of a hydrocarbon spill, follow measures described in the Spill Contingency Plan, to contain the spill and prevent the spill from affect adjacent water courses.

7.5 Regional Land Use Plans

The proposed Project is located within the boundaries of the North Yukon Planning Region and Peel Watershed Planning Region and is therefore subject to the North Yukon Land Use Plan and (NYLUP) Peel Watershed Land Use Plan (PWLUP). Locations of proposed Project activities are within Land Management Unit (LMU) 9 of the NYLUP and LMU 7 of the PWLUP. (**Table 7.1**). Both are located within the Eagle Plains basin, with the highest potential for oil and gas development. Details regarding how the Project will meet the requirements of the Northern Land Use Plan and Peel Watershed Land Use Plan is provided in **Table 7.2**.

Table 7.1 Landscape Management Units Overlapping the Project

Landscape Management Unit Number	Landscape Management Unit Name	Integrated Management Area (IMA)
9 (NYLUP)	Eagle Plains	4
7 (PWLUP)	Dalglish Creek	4

Table 7.2 Commitments and Mitigations to meet the requirements of the North Yukon Land Use Plan and Peel Watershed Land Use Plan

Topic	Recommendation		Best Management Practices		Commitment/Mitigation
	NYLUP	PWLUP	NYLUP	PWLUP	
Surface Disturbances	• Site closure/remediation plans should be developed and monitored that create significant disturbance. • To provide a benchmark for the monitoring of cumulative effects indicator levels, the status of existing surface disturbances should be documented.	• In the IMA, the amount of surface disturbance should be maintained below the cumulative effects indicator levels recommended in the plan.	• The size, intensity and duration of all surface disturbances should be reduced. • Native endemic plants should be used for active reclamation of disturbed sites	• Reduce size, intensity and duration of human-caused physical surface disturbances (e.g. utilize low impact seismic, winter roads and principle of full reclamation.	• The size, intensity, and duration of human caused physical disturbances will be mitigated primarily by using existing and historic access roads to minimize the area to be disturbed, and by limiting use to winter.
Wildlife Habitat	• Reduce size, intensity and duration of human-caused physical surface disturbances (e.g. utilize low impact seismic, winter roads and enhanced reclamation. • Reduce other human land use impacts such as noise, smell and light. • Avoid or reduce activities in significant wildlife habitats during important biological periods (e.g., utilize timing windows). • Coordinate, manage and minimize new road and trail access.	• In the IMA, the protection of Boreal caribou habitat should be given special consideration in the assessment of potential development. • Ensure adequate wildlife and habitat baseline data collection is completed prior to any development activities.	• Avoid or minimize the creation of new access roads and trails; utilize existing routes unless their use will cause additional long term environmental impacts. • Avoid or minimize the size, extent and duration and level of activities in concentrated seasonal use areas. • Use appropriate operational timing-windows in significant wildlife habitats to minimize activities wherever possible, during periods of wildlife use. • When new access creation is necessary: • Non-permanent winter access routes should be developed and utilized versus all-season access routes. • Gate or otherwise restrict hunting along new access routes. • Where possible, direct new access routes through less significant wildlife habitats.	• Coordinate, manage new road and trail access. ○ To the extent possible, avoiding routing new roads and trails through concentrated seasonal use areas and significant habitats. ○ Avoid using or crossing seasonal migration corridors. • Avoid or reduce activities in significant wildlife habitats during important biological periods (e.g. utilize timing windows). ○ Porcupine Caribou are typically in the region during winter period (December to March). ○ Avoid concentrated woodland caribou use areas. • Reduce other human land-use related disturbances such as noise, odours, light.	• The size, intensity, and duration of human caused physical disturbances will be mitigated primarily by using existing and historic access roads to minimize the area to be disturbed, and by limiting use to winter. • The timing of the Project, during winter, is a season of lowest importance for the ecology of the Porcupine Caribou Herd and a period when the caribou are relatively tolerant of human disturbance (Porcupine Caribou Technical Committee 1993). • Work will be scheduled to minimize the spatial extent across which work is concurrently occurring. • Access to linear features off the winter roads will be minimized by avoiding creation of breaks in snow berms at junctions with linear features. • Packing of snow will not occur on any linear features that are not essential to Project work. • All sightings of caribou will be reported to the Environmental Monitor. • If more than a dozen caribou are observed, or if any number of caribou are observed in the same location for longer than a three-day period, a qualified environmental professional (QEP) will be consulted to determine if site-specific mitigations may be warranted. • The use of on-road and off-road vehicles, including snowmobiles, will be restricted to essential Project access routes. • Personal use of unmanned aerial vehicles (UAVs or drones) is prohibited.
Focal Species Management – Porcupine Caribou Herd (NYLUP)	See recommendations for Wildlife Habitat.		• Avoid or minimize the size, extent, duration and level of activities in concentrated seasonal use areas. • Avoid using or crossing seasonal migration corridors with new access routes.	Not applicable	

Topic	Recommendation		Best Management Practices		Commitment/Mitigation
	NYLUP	PWLUP	NYLUP	PWLUP	

			• Define and implement safe operation distances from the herd.
			• Consider the following seasons when determining appropriate operational timing windows (seasons when Porcupine caribou occupy the region):
			  ○ Spring migration – April 1 to May 31
			  ○ Early summer – July 1 to July 15
			  ○ Mid to late summer – July 16 to August 7
			  ○ Fall migration – August 8 to October 7
			  ○ Rut – October 8 to
			  ○ Winter – December 1 to March 31		

Fish Habitat	• Water withdrawals in sensitive fish over-wintering areas should be prohibited.	• Ensure adequate fish, waterbird, aquatic habitat and water quality baseline data collection is completed prior to any development activities .	• The use of ice roads or winter roads as river/creek crossings is generally considered adequate to mitigate potential impacts to fish and fish stocks.	• Minimize surface and vegetation disturbance in riparian areas.
				• Avoid or minimize indurstrial land use activities in wetlands and riparian areas.
				• Prohibit significant levels of winter in-stream water withdrawals in sensitive over-wintering fishing habitat.
				• Avoid large scale-industrial and/or infrastructure projects within major river corridors.
				• Minimize stream crossings; if stream crossings are required ensure proper bridge and crossing structures are used, and are designed for ease of removal (i.e., temporary structure).
					The Project has no direct interaction with fish and fish habitat. Potential indirect effects are also limited due to the location of winter roads and well sites at least 200 m from streams and waterbodies. The following measures are designed to further mitigate indirect effects relating to water quality and fish habitat.
					• If non-classified drainages are encountered, special efforts will be made to minimize effects to downstream water quality and sedimentation risk. These include:
					  ▫ enhancing the thickness of the packed snow/ice base over and adjacent to the drainage area,
					  ▫ minimizing the width of the right-of-way through the area, and
					  ▫ ensuring that slash from vegetation clearing is removed from the area so it will not be transported downstream during spring run off.

8.0 CONCLUSION

The proposed Project requires an evaluation by a YESAB Designated Office because the *Assessable Activities, Exceptions and Executive Committee Projects Regulations* of YESAA identified three accessible activities:

1. The project location is in the Yukon;
2. The *Assessable Activities, Exceptions and Executive Committee Projects Regulations* identifies several triggers for the Project including:
    a. Schedule 1, Part 3, Oil and Natural Gas, Item 2:

    On other than an Indian reserve, drilling, operation, modification, decommissioning or abandonment of, or other activity in relation to, an oil or natural gas well or seismic shot hole, but not including a hole drilled to obtain geological information.

    b. Schedule 1, Part 13, Miscellaneous, Item 13:

    On Crown land or settlement land, levelling, grading, clearing cutting or snow ploughing of a route that provides access to land for the purposes of a geophysical, geological or engineering survey.

3. An authorization by a government agency is required for the activities to be undertaken.

The proponent understands that the purpose of the YESAB Designated Office evaluation process in Yukon is to inform planning and decision-making by governments to avoid or minimize significant environmental and socio-economic effects while realizing development objectives. The proponent also recognizes that the YESAB Designated Office evaluation process provides an integrated means of identifying, evaluating, and mitigating a proposed project's potential adverse environmental and socio-economic effects. Valued components for the assessment were selected based on the potential for Project activities for this proposal to interact with the identified VC and result in adverse effects. Where effects assessments indicated that adverse effects could occur to a VC, the assessment proposed technically feasible and appropriate mitigation measures to avoid or minimize those effects. With the implementation of the proposed mitigation measures, Project-related residual adverse effects to the selected VCs are likely to be not significant.

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APPENDIX A

Letter from Yukon Government Oil and Gas Branch

APPENDIX B
Spill Contingency Plan

APPENDIX C

Heritage Resource Impact Assessment

APPENDIX D

Letter Report for the Heritage Review of 2014 Proposed Well Sites and Access Roads

APPENDIX 2-A-25. *Spill Response Plan*

1.5.13 Spills

In any incident, the first priority is Life Safety. This includes the protection of the public and the safety of response personnel.

Life Safety will always be the top strategic priority

Public safety actions begin at the source of the release and are undertaken in a coordinated manner by Chance Oil and Gas Limited, the local authority and other responders as needed at the time of the incident.

The types of containment and recovery efforts depend on the type of spill. Containment and recovery response actions focus on minimizing the effects of the spill on the surrounding area.

Clean-up activities will be conducted after containment and recovery actions are completed. Clean-up and disposal of contaminated material and site remediation work will continue until the spill site is returned as nearly as possible to pre-spill conditions and company environmental specialists and the agencies are satisfied.

Chance Oil and Gas Limited is an active member of the Western Canadian Spill Services (WCSS). Chance Oil and Gas Limited is expected to assess the risk that its operation poses to the environment and be prepared to provide effective emergency response capability in the event of a spill.

1.5.13.1 Initial Spill Response Actions

- Follow First On-Scene Strategy (Section 1.2.1).
- Size up considerations for a spill site:
  - Is there a fire or explosion hazard? What is the ignition source?
  - Is there H_2S or other toxin present?
  - Are there any areas deemed hazardous? (Mark with flags).
  - What are the ground and weather conditions? (Snow, gravel, sand etc.)
  - Where is the location of the leak, the type of release and the volume released?
  - How long has the spill been taking place?
  - Is the spill into a watercourse, watershed or a water body?
  - Is the spill contained or migrating? Which direction? How far can it go?
  - If the spill is not contained, determine and prioritize the containment points and methods to be used.
  - What lands will be affected? (Farm, livestock, brush, drinking water, etc.)
  - How is it going to be contained and cleaned up?
  - How to access the spill site, the source of the spill and recovery points?
  - What equipment is required? Is oil spill equipment (oil spill co-op) required?
  - Where can spill responders park so as not to interfere with spill equipment? (Minimize vehicular traffic as much as possible at the spill site.)
  - Are there any residences in the area? Do they have water wells that could be affected?
  - Should the spill site be cordoned off to prevent wildlife / livestock from entering?
- Relay information to internal company contacts, government agencies and if required, landowner, spill response contractors and the designated Public Information Officer.

1.5.13.2 General Control and Containment

- If possible, immediately shut off the source of the spill ensuring your own safety.
- Prioritize and set up containment points
- Where possible, prevent a spill from entering a watercourse.
- Use safest and simplest method to get job done within resource and safety capabilities.
    - Isolate and depressurize (ESDs, manual block valves, manual valve isolation).
    - Plug and patch (e.g. fix faulty valve or hole in drum).
    - Absorb or adsorb (e.g. applying adsorbent pads to oil spill).
    - Transfer (e.g. removing product to waste truck or new container).
    - Containerize (e.g. put leaking drum into over-pack drum).
    - Reposition (e.g. upright or roll and chock leaking container).
    - Others (e.g. hot-tap, vent and burn, flaring).
- Contain the spill – containment is a priority for limiting environmental damage.
- Contain as close to source as safe and practical.
- Avoid excessive walking or driving on the spill area.
- Do not use absorbents on large spills.
- Consider ground disturbance guidelines.
- Determine where bell holes or trenches would be most effective.
- Keep trenches shallow and narrow as possible, to prevent additional clean-up.
- Use practical containment tools and equipment including shovels, dump trucks, sand bags, plastic bags, heavy earth moving equipment, "Plug and Patch", foam, salvage covers, adsorbents, booms, hose, redwood plugs, etc.
- If weirs are installed, they should be able to handle large flow rates and surges.
- Surface run off may have to be diverted from the spill site if wet conditions are present.

1.5.13.3 Recovery of product and/or clean-up of the spill

- Ensure the health and safety of the persons responding to the spill.
- Once containment has been achieved, recovery and clean-up operations begin immediately.
    - Recover as much product and saturated debris as possible.
    - Keep environmental disturbance to a minimum.

1.5.13.4 Land Spills

Land spills will spread outward from the initial spill point toward lower-lying areas. Penetration downward into the soil will also occur at a rate that is dependent on the soil type and the nature of the product spilled. During spills in winter, petroleum will spread under the snow making definition of the extent of the spill area difficult.

- attempt to restrict spills on land to as small an area as possible based on site conditions.
- prevent the spill from entering water bodies or flowing watercourses or flowing into manholes or culverts, within the bounds of safety and practicality.

The method chosen for land containment and recovery is dependent on site conditions and the equipment available. A summary of common options is presented in the following table:

Land Containment Options		
Containment Method	**Technique Description**	**Comments**
Earth or Sand Dike (All seasons)	Earth or sand at or near the site is used to contain spilled material on flat or sloped surfaces. Sandbags filled with soil or sand are used to contain spill.	Sufficient dry earth, gravel or sand must be available to contain spill. Earth may be frozen. Surface disturbance to remove earth or sand may result in erosion, especially on steep slopes. Work crews and/or earth-moving equipment are required to build dike.
Snow or Ice Dike (Winter only)	Snow or ice at or near the site is used to contain spilled material on flat or sloped surfaces.	Sufficient snow or water must be available to contain spill. Snow or ice dike will melt quickly in warm weather. Contaminated snow or ice may need to be removed or stored for treatment. Work crews and/or earth-moving equipment are required to build snow dike. Water spraying equipment may be required to construct ice dike.
Land Containment Options		
Containment Method	**Technique Description**	**Comments**
Sorbent Dike (All seasons)	Sorbent material is used to contain spill.	Useful only in small spills, as purchase of large quantities of sorbent is expensive and impractical. Contaminated sorbent may need to be replaced or squeezed out during incident. Contaminated sorbents must disposed in compliance with government legislation. Sufficient sorbent or sorbent boom, work crews and storage containers or a lined storage area for contaminated sorbents must available to build sorbent dike.
Trench or Sump (All seasons)	A trench or sump is excavated downslope on sloping terrain to limit surface or subsurface spill movement. Work crews and/or earth-moving equipment are required to build trench or sump, as well as plastic or other impermeable sheeting for a trench liner.	Clean topsoil should be removed before trench construction. Frozen soil, bedrock close to the surface or soil type (e.g. sand) may make this option impractical. Surface disturbance to remove earth or sand may result in erosion or further penetration in sandy soil.
Land Recovery Options		
Recovery Method	**Technique Description**	**Comments**
Vacuum Truck	A vacuum truck is used to recover spilled material from a dike or trench in areas accessible by trucks or heavy equipment.	The method depends on site access. Surface disturbance and soil damage may result from movement of the vacuum truck to and from the site. Topsoil may need to be stripped from the site before starting recovery activities.

Land Recovery Options		
Recovery Method	**Technique Description**	**Comments**
Pumping Spilled Material into Storage	A pump is used to recover spilled material from a dike or trench in areas not accessible by vacuum trucks.	Pumps must be safe for use at the spill site and compatible with the product to be pumped. Surface disturbance and soil damage may result from movement of the pump and storage equipment to the site. Skid tanks, tanker trucks, port-a-tanks, fuel bladders, permanent tanks, or a lined excavated area must be available to provide storage for the recovered material. A work crew and power supply for the pump must also be available.

1.5.13.5 Spills into a Watercourse

Petroleum products will spread outward from the origin of the spill, eventually achieving a stable thickness on the water. Spills on rivers, creeks, or streams will flow downstream, contaminating riverbanks and vegetation, affecting wildlife, fish and water users in the area of the spill.

The rate of spill movement will depend on the current speed of the water and the time of year. Current may flow faster in the deepest channels in the river and slower in shallower areas, due to varying volumes of water. Flow in a watercourse will also be faster in the spring, because of snowmelt entering the watercourse from the surrounding area. River currents in summer and fall will be generally slower than in the spring. Wind and wave action will also affect the rate and direction of spill travel.

Spill velocity on a watercourse may be estimated quickly by using a current velocity meter or by timing the movement of a floating object on the watercourse over a set distance.

The following table is used for estimating spill velocity based on a 30 metre (100 foot) distance:

Time Required For Object to Travel 100 meters (seconds)	Surface Current Speed		Boom Angle (degrees)
	(km/hr)	(m/s)	
720	0.5	0.14	60°
360	1.0	0.28	60°
240	1.5	0.42	60°
180	2.0	0.56	45°
143	2.5	0.69	45°
120	3.0	0.83	45°
103	3.5	0.97	15°
90	4.0	1.11	15°
80	4.5	1.25	15°
73	5.0	1.39	15°
60	6.0	1.67	15°

Note: In currents faster than 6.0 km/h, or in excessively turbulent waters, the use of containment booms may be impractical, and other containment or protection methods such as the use of diversion or exclusion booms may be required.

The velocity calculated will be an approximation only, as the watercourse velocity varies at different points across the river, due to changes in river depth and at various points upstream and downstream on the river. In the initial stages of the spill on a watercourse, lighter-end materials will tend to evaporate, especially in warm weather. Other processes that might affect spill behaviour include dispersion of the petroleum into the water, formation of stable oil/water emulsions and stranding or oil along the shoreline.

Containment of a spill on a watercourse should be completed as quickly as possible as the spilled material has the potential to travel a much greater distance and contaminate a larger area than spills on land. The Incident Commander and Incident Command System Operations personnel will implement appropriate containment actions based on the size of the watercourse and current velocity.

Watercourse Containment Options		
Containment Method	**Technique Description**	**Comments**
Containment Boom (Spring to Fall)	A containment boom is placed in the watercourse to prevent migration of the spilled material down-stream of the containment point.	The watercourse must be accessible to allow containment activities. If water is too shallow, or current is too fast, the containment boom may not be effective in containing the oil. Oil spill containment equipment, work and safety boats, and a work crew must be available to conduct this method.
Diversion Boom (Spring to Fall)	Diversion booms are used in large or swift rivers to divert spilled material to calmer water for containment and recovery. May be used in combination with containment boom.	The watercourse must be accessible to allow boom to be deployed. High current speeds or turbulence may make deployment impossible, or may cause deployed boom to fail, releasing spilled material downstream. Oil spill containment equipment, work and safety boats, and a work crew must be available to conduct this method.

Watercourse Containment Options		
Containment Method	**Technique Description**	**Comments**
Sorbent boom (Spring to Fall)	Sorbent booms may be used in narrow, low flow streams or rivers to remove small amounts of surface oil. Chicken wire or containment boom may be used to back up sorbent boom.	The watercourse must be accessible to allow boom to be deployed. Sorbent boom use is only viable in low flow watercourses, as boom is not very sturdy and breaks easily. (Chicken wire or containment boom may be used behind sorbent boom to reinforce sorbent boom and prevent breakage). Sorbent boom also has no skirt allowing large amounts of oil to easily flow under it. Sorbent boom will pick up sheen but not large amounts of oil. Sorbent boom is not very effective in cold weather. Large amounts of sorbent boom are expensive, and must be replaced in the watercourse when saturated. Used sorbent must be stored and disposed of in compliance with government legislation. Sorbent boom, work crew and possibly boats may be required.
Earth or Sand Dike (Spring to Fall)	Dikes are used across very shallow streams and intermittent creeks to contain flowing oil. Dikes can also be used to contain spilled materials along a shoreline.	Sufficient earth or sand is needed to construct the dike. Flowing may be caused if stream or creek is dammed (a containment weir may be used to alleviate this problem – see below) Damage may be caused by evacuation and construction in the watercourse and along the banks. A work crew with shovels, earth-moving equipment, earth or sand, sandbags and/or sheets of metal or wood may be required.
Containment Weir (Spring to Fall)	Containment weirs are physical dams with culverts or pipes constructed in the dam to allow free water movement from a site while containing surface oil.	Containment weirs are used in shallow streams and creeks and are suitable for maintaining a constant water level at the site and preventing flooding. Damage may be caused by excavation and construction in the watercourse and along the banks. A work crew with shovels, earthmoving equipment, earth or sand and piping or culvert material is required.

Watercourse Recovery Options		
Recovery Method	**Technique Description**	**Comments**
Vacuum Truck	A vacuum truck is used to recover free petroleum from water in areas accessible by trucks or heavy equipment.	A vacuum truck and operator are required. Use of this method is subject to site access. Surface disturbance and soil damage may result from movement of the vacuum truck to and from the site. Topsoil may need to be stripped from the site before conducting recovery activities.
Pumping of Spilled Material into Storage	A pump is used to recover free oil from the watercourse in areas not accessible by vacuum trucks.	Pumps must be safe for use at the spill site and be compatible with the product to be pumped. Surface disturbance and soil damage may result from movement of the pump and storage equipment to the site. Technique will generate large volumes of contaminated water that will require storage. Skid tanks, tankers, port-a-tanks, fuel bladders, permanent tanks or a lined excavated area must available to provide storage for the recovered material. A work crew and power supply for the pump must also be available.
Skimmers	Mechanical devices are used to skim oil from water surface or remove oil/water mixture for storage.	Skimmer will need sufficient water depth to float. Weir skimmers work best on thicker layers of oil in flowing water. Will generate large quantities of water/oil mixture. Drum or disc skimmers will pick up thinner layers of oil on slow moving water. Debris and vegetation may clog skimmer making oil pickup difficult. A suction, floating weir, disc or drum skimmer, pump and work crew are required. A secure storage facility (tanker, portable tanks, fuel bladders or excavated, lined storage site) is also required.

1.5.13.6 Spills into Water bodies

In the absence of any current or wind, spills on water bodies such as lakes will spread out in all directions from the site of the spill until a uniform stable thickness is reached. If a wind and/or current is present, the spill will move with the wind or current until it reaches the shoreline.

Wave action in the water body may also affect the spill causing oil-in-water or water-in-oil emulsions to form, making recovery and clean-up efforts more difficult.

Response personnel should attempt to contain the spill to as small an area as possible on the water body near the spill source. Dispersion of the spill over a large area on the water body could cause widespread impacts when the spill reaches the shore. If the spill can be contained on the water body, the spilled material is moved toward shore for recovery.

Containment options for spills on water bodies use a containment boom to surround the spill. See the local Oil Spill Contingency Plan for a discussion of containment booms and for boom configurations used to contain a boom in open water. If the area that may be impinged by the spilled materials is environmentally sensitive, appropriate shoreline protection measures may be implemented as recommended by company Environmental Specialists.

1.5.13.7 Spills into Wetlands or Muskeg

Wetlands are areas with high organic content, which contain large amounts of water in the soil. Wetlands may be continuously covered in water or water levels may fluctuate throughout the year. Muskeg is a land area that contains a high moisture content and is boggy in the summer because of large quantities of peat, moss, or other vegetative material in the soil. In winter, muskeg will freeze making excavation extremely difficult.

Spills in wetlands or muskeg can be some of the most difficult spills to contain, recover and clean up because of limited site access for both manpower and equipment. Because of the sensitive nature of these ecosystems, more damage may be caused by emergency response operations than was caused by the original spill. The Incident Commander may consult with government officials or environmental specialists before conducting emergency response operations in wetlands or muskegs. This will ensure that containment, recovery, and clean-up operations represent the most viable option for the spill, based on the type of product, size of spill and site specific safety, operational or environmental concerns.

If all other options are considered unviable, natural recovery may be approved by environmental protection agencies. Natural recovery uses micro-organisms already present in the ecosystem to degrade the oil. Degradation of the oil may be enhanced by addition of other nutrients required by the micro-organisms, to ensure sufficient levels of these nutrients are present to allow degradation to continue.

Natural recovery may be preferable to recovery and clean-up depending on:

- the amount, type and persistence of the oil
- the location of the site
- the nature and uses of the area
- whether the impacts of various clean-up methods are greater than damage related to the actual spill

Natural recovery should be considered if:

- clean-up activities will cause more harm than leaving the site to recover naturally
- leaving the area to recover naturally will not cause further harm to environmentally sensitive areas

Containment operations for wetland or muskeg spills in winter are similar to those for spills on land or ice. If containment operations are conducted at the site in the summer, a combination of land containment and water containment options will be used as appropriate.

Wetland or Muskeg Containment Options		
Containment Method	**Technique Description**	**Comments**
Containment Boom	A containment boom is placed in wetland to prevent migration of oil into non-contaminated areas.	If water is too shallow, or the current is too fast, the containment boom may not be effective in containing the oil. Oil spill containment equipment, work and safety boats and a work crew must be available to use this method.
Containment Weirs	Containment weirs are physical dams with culverts constructed in the dam to allow free water movement from a site while containing surface oil. Containment weirs are used to maintain a constant water level at spill site for easy oil recovery.	Access to the site by manpower and equipment may be limited. Building of containment weirs may be labour-intensive and time-consuming if done manually. Damage may be caused by excavation and construction in the watercourse and along the banks. A work crew with shovels, earthmoving equipment, earth or sand and piping or culvert material is required to use this method.
Vacuum Truck	Muskeg or wetland areas must be accessible. A vacuum truck can recover from a trench or water surface.	Surface disturbance and soil damage may result from movement of the vacuum truck to and from the site. Topsoil may need to be stripped from the site before undertaking recovery activities.
Pumping of Spilled Material into Storage	A pump is used to recover free oil from wetlands or muskeg.	The wetland or muskeg area must be accessible for equipment. Pumps must be safe for use at the spill site and be compatible with the product to be pumped. The technique will generate large volumes of contaminated water that will require storage. Skid tanks, tanker trucks, port-a-tanks, fuel bladders, permanent tanks or a lined excavated area must be available. A work crew and power supply for the pump must also be available.
Skimmers	Used to skim oil from water surface or remove oil/water mixture for storage. Drum or disc skimmers will pick up thinner layers of oil on slow moving water.	The wetland or muskeg area must be accessible. Skimmer will need sufficient water depth to float. Debris and aquatic vegetation may clog skimmer, making oil pickup difficult. A suction, floating weir, disc or drum skimmer, pump and work crew are required to undertake method. A secure storage facility is also required.

Wetland or Muskeg Containment Options		
Containment Method	**Technique Description**	**Comments**
Fresh Water Flushing	Water is flushed through an area to push oil that is in vegetation or on the water surface toward a collection point for recovery. The method can be used in conjunction with trenches.	The wetland or muskeg area must be accessible for equipment to allow recovery activities to be conducted. The method is not suitable for areas with extensive vegetation or obstructions. Physical damage may be caused to sensitive environmental areas. Pumps, a power supply, hoses, hot or cold water, and a work crew are required. A lined, excavated area or storage tanks may be required to hold water for treatment or testing.

1.5.13.8 Spills on Ice

Spills on ice will tend to spread out from the spill source toward lower-lying areas. Surface depressions, cracks and pockets in the ice will cause the spilled material to pool. A significant volume of some oils can be absorbed into ice.

The presence of oil on or in ice increases solar heating and the rate of melting. Subsequent freezing and melting may eventually cause the oil to migrate throughout the surface of the ice. Openings in the ice may allow the spilled material to migrate into open water or allow the spill to be swept under ice, making response operations more difficult.

The information presented should be used as a guideline only in determining typical load-bearing capacity of ice. The Incident Commander and Incident Command System Operations personnel must determine whether it is safe to work on ice based on actual site conditions.

The ability for ice on a river, stream or lake to support the weight of workers and equipment is determined by effective ice thickness which is based on the thickness of clear ice and presence of white ice.

Clear ice (sometimes called blue ice) is translucent and well compressed with few air pockets. This ice is very strong and has a high load-bearing capacity.

White ice (or snow ice) is very porous, with many air pockets and is much weaker. White ice has approximately half the load-bearing capacity of clear ice. White ice is formed by constant melting and freezing of the top layer of ice due to solar heating or mild temperatures and is normally found on top of clear ice.

Holes should be drilled in the ice at the work site, before starting any on ice operations, to determine the average thickness of white and clear ice.

Effective ice thickness then can be calculated, using the formula in the following table:

Effective Ice Thickness = clear ice thickness + ½ white ice thickness
Example: The spill site has 20 inches of clear ice and 10 inches of white ice 20 inches clear ice + ½ x 10 inches white ice = 25 Effective Ice Thickness
Note: If water lies between layers, use the depth of only the top layer of white ice

Based on the effective ice thickness, a determination can be made as to the stationary and moving loads that may be supported by the ice. Normally less ice is required for continuous movement on the ice than for stationary loads as less pressure is exerted on any one point on the ice during movement.

LOAD-BEARING CAPACITY OF ICE THICKNESS FOR CONTINUOUS TRAVEL [1]		
Permissible Load	**Effective Ice Thickness inches (centimetres)**	
	Lake	**River**
One person on foot	2.0 (5.0)	2.5 (6.3)
Group, in single file	3.2 (8.0)	3.5 (8.8)
Passenger car 4,400 lbs. (2000 kg)	7.1 (17.8)	8.3 (20.8)
Light Truck 5,500 lbs (2500 kg)	7.9 (19.8)	9.1 (22.8)
Medium Truck 7,700 lbs (3500 kg)	10.2 (25.5)	11.8 (29.5)
Heavy Truck 15,000 – 17,500 lbs (6800 – 8000 kg)	13.8 (34.5)	16.1 (40.3)
20,000 lbs (9000 kg)	15.0 (37.5)	17.3 (43.3)
50,000 lbs (23,000 kg)	24.8 (62.0)	28.7 (71.8)
99,000 lbs (45,000 kg)	31.5 (78.8)	36.2 (90.5)
150,000 lbs (68,000 kg)	39.4 (98.5)	45.3 (113.3)
240,000 lbs (109,000 kg)	49.2 (123.0)	56.7 (141.8)

WEIGHT-BEARING CAPACITY FOR STATIONARY LOADS AND WORKING ON ICE		
Permissible Load	**Effective Ice Thickness inches (centimetres)**	
	Lake	**River**
2,200 lbs (1000 kg)	8.0 (20.0)	9.1 (22.8)
4,400 lbs (2000 kg)	12.0 (30.0)	14.0 (35.0)
8,800 lbs (4000 kg)	18.0 (45.0)	21.0 (52.5)
17,600 lbs (8000 kg)	24.0 (60.0)	27.0 (67.5)
50,000 lbs (23,000 kg)	44.0 (110.0)	50.0 (125.0)
99,000 lbs (45,000 kg)	59.0 (147.5)	68.0 (170.0)
150,000 lbs (68,000 kg)	71.0 (177.5)	82.90 (205.0)
240,000 lbs (109,000 kg)	91.0 (227.5)	105.0 (262.5)

Note: These tables are guidelines only for determining the typical load-bearing capacity of ice.

[1] Does not apply to parked loads, or where ice faults are evident.

Temperature may affect the load-bearing capacity of ice on a water body. Air temperatures must remain below the freezing point of water (0°C) for a sufficient period to allow the ice to adequately support a stationary or moving load. Temperature effects are dependent on ice thickness, as follows:

- less than 50 centimetres (20 inches) of ice: temperature must be constant for 3 days
- between 50 and 100 centimetres (20 and 40 inches) of ice: temperature must be constant for 4 days
- over 100 centimetres (40 inches) of ice: temperature must be constant for 5 days

Sudden drops or increases in temperature can also cause thermal stressing or cracking of ice requiring temporary load restrictions for 3 to 5 days following the change. Thawing due to warm temperatures may also significantly affect ice conditions. On-site personnel should take extreme care when evaluating ice conditions during a thaw and limit work on or near ice under these conditions.

Containment and clean-up options for spills on ice are similar to those on land and are summarized in the following tables:

On-Ice Containment Options

Containment Method	Technique Description	Comments
Earth or Sand Dike (All seasons)	Earth or sand at or near the site is used to contain spilled material on flat or sloped surfaces. Sandbags filled with earth or sand are used to contain spill.	Effective ice thickness must be sufficient to support the weight of manpower and equipment required to build dike. Sufficient dry earth, gravel or sand must be available to contain spill. Earth may be frozen. Surface disturbance to remove earth or sand may result in erosion, especially on steep slopes. Earth or sand placed on ice must be removed before spring break-up. Work crews and/or earth-moving equipment are required to build dike.
Snow or Ice Dike (Winter only)	Snow or ice at or near the site is used to contain spilled material on flat or sloped surfaces.	Effective ice thickness must be sufficient to support the weight of manpower and equipment required to build dike. Sufficient snow or water must be available to contain spill. Snow or ice dike may melt quickly in warm weather. Contaminated snow or ice may need to be removed or stored for treatment. Work crews and/or earth-moving equipment is required to build snow dike. Water spraying equipment may be required to construct and maintain an ice dike.

On-Ice Containment Options		
Containment Method	**Technique Description**	**Comments**
Sorbent Dike (All seasons)	Sorbent material is used to contain spill.	Useful only in small spills, as purchase of large quantities of sorbent is expensive and impractical. Contaminated sorbent may need to be replaced or squeezed out during incident. Contaminated sorbents must be disposed of properly to comply with government regulations. Sufficient sorbent or sorbent boom, work crews and storage containers or a lined storage area for contaminated sorbents must be available to build sorbent dike.

On-Ice Cleanup Options		
Clean-up Method	**Technique Description**	**Comments**
Manual Removal by Work Crew and/or Equipment (Winter)	A work crew or earth-moving equipment are used to remove thick oil or contaminated snow and ice.	Effective ice thickness must be sufficient to support the weight of manpower and equipment required. All necessary safety precautions should be undertaken for personnel who work near any open water. Manual removal may be a difficult and time-consuming process. A work crew with hand tools or earth-moving equipment (e.g. backhoe) and operators, as well as ice cutting equipment, may be required. Lined storage area or storage drums are required to store contaminated material before treatment or disposal. Oil present in snow may be skimmed off during spring thaw.
Steaming of Ice Surface	Steam is used to melt ice surface to aid in spill clean-up. The technique may be used in association with other clean-up and recovery techniques.	Effective ice thickness must be sufficient to support the weight of manpower and equipment required. All necessary safety precautions should be undertaken for personnel who work near any open water. A work crew with steaming equipment is required to undertake this method.

On-Ice Cleanup Options		
Clean-up Method	**Technique Description**	**Comments**
Sorbents (Spring to Fall)	The method is used in isolated areas to clean up small amounts of oil.	Clean-up is labour-intensive and time-consuming. Limited access to site may make this method difficult or impossible. Sorbents are not very effective on weathered oil or in cold weather. Sorbents may freeze to the surface. Sorbents must be disposed of properly to comply with government regulations. Sufficient sorbent, work crews and storage containers or a lined storage area for contaminated sorbents must be available.
Snow or ice melting	Snow or ice is removed from the clean-up site and melted in heated tanks to allow spilled material to be skimmed off the surface of the melt water. The technique may be used in association with other clean-up and recovery techniques.	Contaminated snow or ice must be removed from clean-up site and placed in melting tanks. The method may be labour-intensive and time-consuming, as melting is not be very efficient for clean-up of large volumes of petroleum-contaminated ice. In very cold temperatures, sufficient heat may not be available in the tanks to melt ice. A work crew, heating tanks, skimming equipment, transfer vehicles and operators are required. A lined storage facility for storage of contaminated ice or snow before melting may also be required, as well as storage tanks for storing recovered petroleum.

1.5.13.9 Spills Under Ice

Spills of petroleum under ice will spread and will travel under the ice at a velocity that is less than the current speed of the watercourse. The spill will tend to follow the path of the main current flow. The spill product may become trapped in crevices, cracks, pockets, and other irregularities under the ice and may freeze from the underside of the ice anywhere downstream or outward from the original spill. This will make recovery and clean-up operations extremely difficult.

Before conducting any response operations to contain, remove and clean up oil under ice, the Incident Commander should ensure that the response personnel have calculated the effective ice thickness to ensure it will support the weight of personnel and equipment.

For spills under ice, the Incident Commander and response personnel should attempt to determine the location of the spilled material and bring the spill to the surface of the water for containment and recovery. Spill movement under the ice is normally located by drilling holes through the ice using an ice auger downstream of the spill source on a flowing watercourse or outward from the spill source on a non-flowing water body. Alternately, aerial reconnaissance may be used to attempt to locate spilled material in cracks at the surface or under thin ice. Once the spill has been located, containment operations can be conducted to bring the spilled product to the surface.

Containment operations are normally accomplished by constructing slots in the ice. Ice slots allow petroleum products trapped under the ice to rise to the surface for recovery.

The slot is normally constructed at an angle in relation to the shore toward the area of strongest current flow in the river. If the slot is constructed correctly, the spilled material will rise into the slot and flow along it toward the shore for recovery.

The angle of slot construction in relation to the shore depends on the current velocity, similar to a containment boom placed in a flowing river. For higher currents in the river, a shallower angle is used for the ice slot, while a larger angle may be used for lower current flows.

If a slot is constructed at too great an angle to the current, turbulence may occur, sweeping the spilled material under the ice on the downstream side. Plywood or other types of sheeting may be placed on the downstream side of the slot and frozen in place to facilitate containment of the spilled material. The ice slot should be 0.5 to 1.0 metres (1.6 to 3.3 feet) wide, to aid in containment. Ice blocks may be cut using a ditch witch or backhoe if the effective ice thickness is sufficient to allow stationary equipment on the ice. [If ice is too thin for equipment but safe for personnel, crews equipped with chainsaws and proper safety gear can cut the ice.] Ice blocks can be removed to clear the slot or pushed under the ice downstream of the slot if sufficient water depth is available.

Ice blocks are extremely heavy (one cubic foot of ice weighs 24 kilograms (53 pounds). Blocks should be cut to a size that will allow the crews or equipment to remove them easily. To aid in block removal, the ones nearest the shore should be removed first and remaining blocks should be floated toward shore for removal. Plywood or other sheeting can be used upstream of the slot to divert oil into the slot for recovery. Narrow slots may be cut into the ice with a chain saw and sheeting may be wedged into the slots to channel the main current toward the ice slot in a manner similar to a diversion boom in open water.

Under-Ice Containment Options

Containment Method	Technique Description	Comments
Ice Slotting	Ice slots are cut into ice on rivers to collect oil moving under the ice. The technique is best used for rivers with current, as oil will be moved toward slot by current.	Effective ice thickness must be sufficient to support the weight of manpower and equipment required to build slot. All personnel working near any open water must take all required safety precautions. The location of the spill must be confirmed by drilling holes downstream of the spill source before constructing the ice slot. Total containment of spilled petroleum in an ice slot is unlikely, due to material trapped under ice. Snowmobiles, communications gear, and ice augers may be required to determine the location of the spill. Work crews, chain saws and/or a backhoe or ditch witch are required to construct an ice slot. A recovery device such as a heat-traced ice skimmer is required to recover spilled material. Storage tanks or a lined excavated storage area may be required to store recovered oil/water mixture.

1.5.13.10 Spills in Broken Ice

The risk to Life Safety of the personnel attempting spill response in broken ice conditions using existing technology is extreme. Emergency operations in broken ice conditions during spring thaw or winter freeze-up are extremely difficult. When oil is mixed with floating ice or covered by a very thin ice cover, ice interferes with the collection of the oil and could damage containment and recovery equipment. The presence of ice also makes the use of boats difficult.

Before authorizing any spill response operations in broken ice conditions, the Incident Commander and response personnel, along with the appropriate regulatory agencies, will evaluate whether it is safe or feasible to undertake containment and recovery operations and what methods should be used.

Containment options for spills during freeze-up or break-up are similar to those for spills on a river and on ice. If containment operations are determined to be feasible based on site conditions, response personnel will attempt to deflect ice away from the containment site.

Deflection of ice may be achieved using log booms or ice dams. A log boom consists of logs cabled together with chain, anchored upstream of a conventional containment boom. An ice dam is constructed upstream of the oil spill site and containment site, to attempt to divert upstream ice away from a containment site.

Log booms are deployed at an angle away from the containment site. Logs are spaced to allow spilled materials and water to move directly toward the containment site, while diverting the ice toward the opposite shore, allowing the ice to pass around the containment site.

1.5.13.11 Spill Control Point Descriptions

Control points are pre-identified locations on watercourses that allow for the staging and deployment of oil spill containment and recovery equipment in response to oil spills that have occurred upstream of the control point. Control point selection is critical to an effective oil spill response and part of your risk assessment and development of site-specific emergency response plan information.

Each oil spill cooperative conducts control point evaluation for the whole geographic co-op area.

Chance Oil and Gas Limited may decide to provide additional control points in the site-specific sections of this Emergency Response Plan.

An ideal control point should have:

- quick access to the watercourse in all seasons, using clear ground, a road or a trail
- adequate work space to conduct operations and to store required equipment with minimal need for clearing of brush and vegetation
- sufficient space to deploy containment and recovery equipment quickly with minimal effort or obstructions (i.e. trees, rocks, steep banks, etc.) and minimal environmental impact
- boat launch location(s) for boats assisting in containment and recovery operations.

Selection of control points with public access is preferred.

For control points on private property - landowner approval and necessary permits for emergency access should be obtained in advance.

Designated site specific control points need to be reviewed at least annually. Each control point site should be visited periodically to evaluate suitability and to ensure information is accurate and complete. Old unsuitable control points should be removed and new control points added, as a part of revisions to site specific information, as required. Control point listings should include a site description, site diagram, access description, landowner/occupant phone number, site suitability and any other information related to the site.

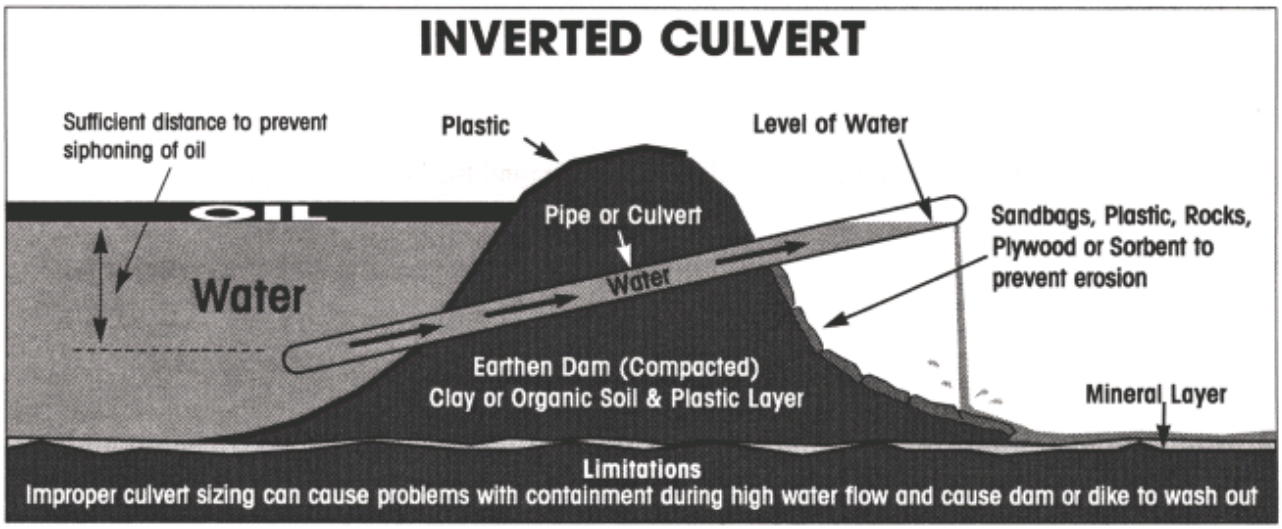
Disposal and Remedial Operations

The proper disposal of contaminated materials as well as site remediation options is outside the scope of this Emergency Response Plan. Site restoration will be determined by consultation among the Incident Commander, company Environmental staff, environmental protection agency personnel and any external environmental consultants that are contracted by Chance Oil and Gas Limited

1.5.13.12 Watercourse Spill Containment and Recovery Techniques

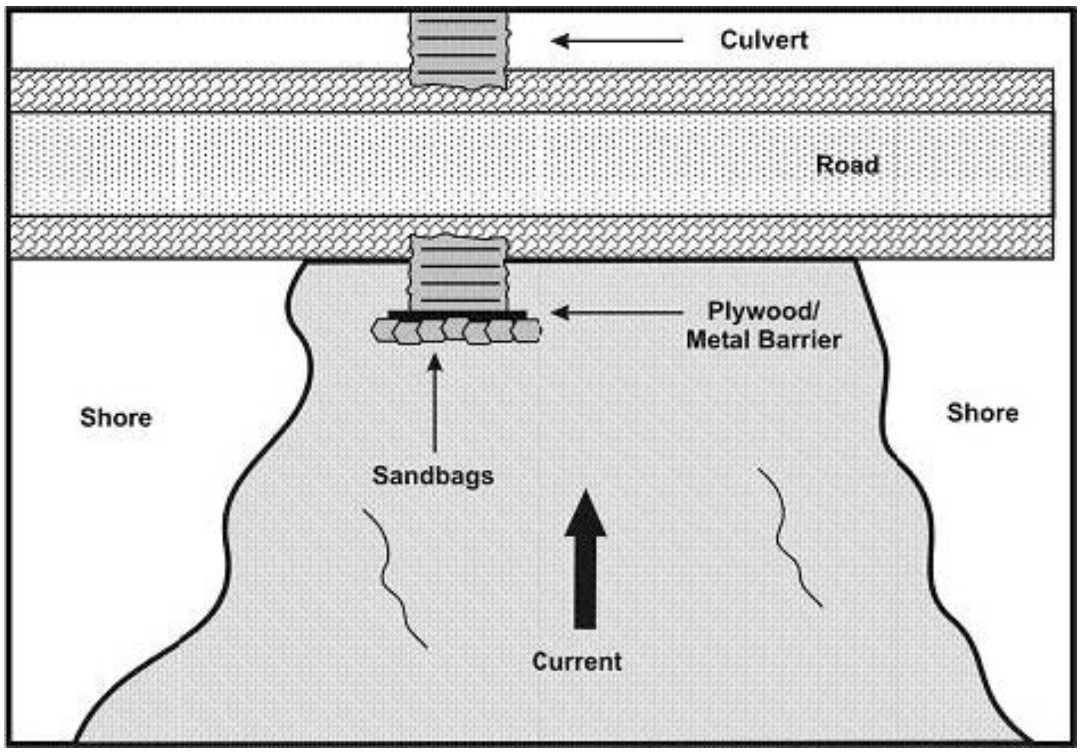
Standing Water

Figure 1: Inverted Culvert Technique



Low Volume Flow

Figure 2: Culvert Blocking



High Volume Flow

Figure 3: Containment Boom

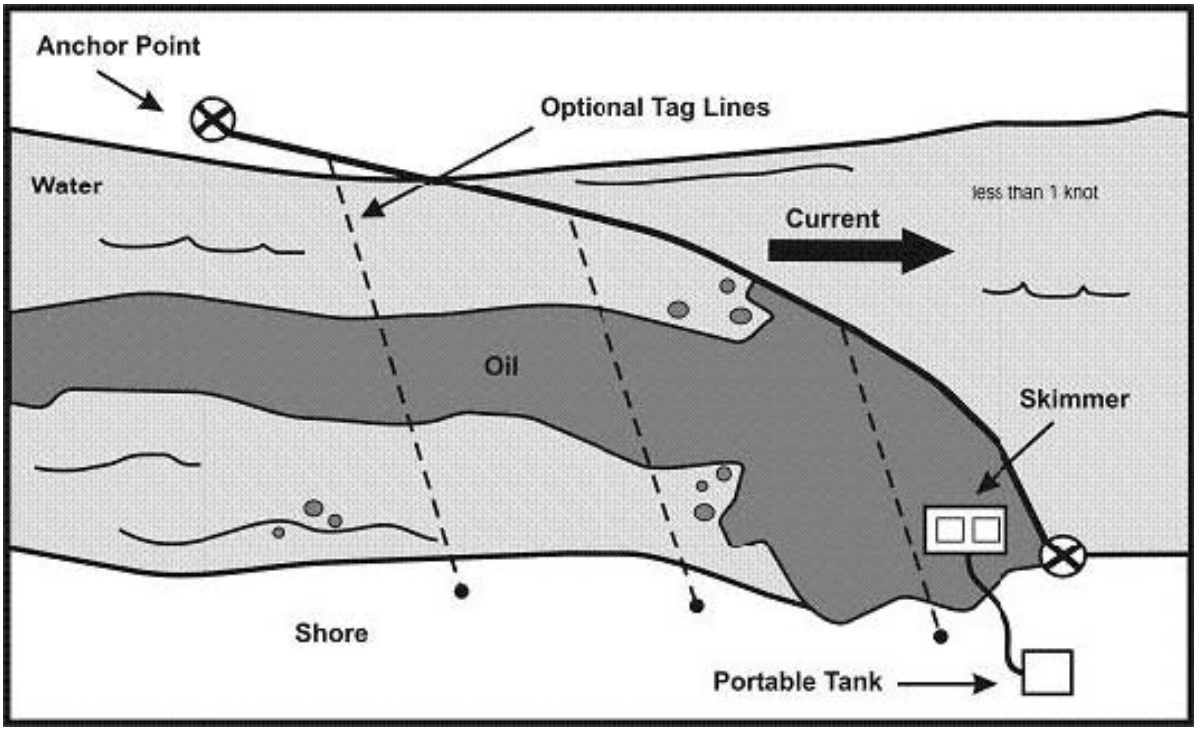


Figure 4: Containment Boom

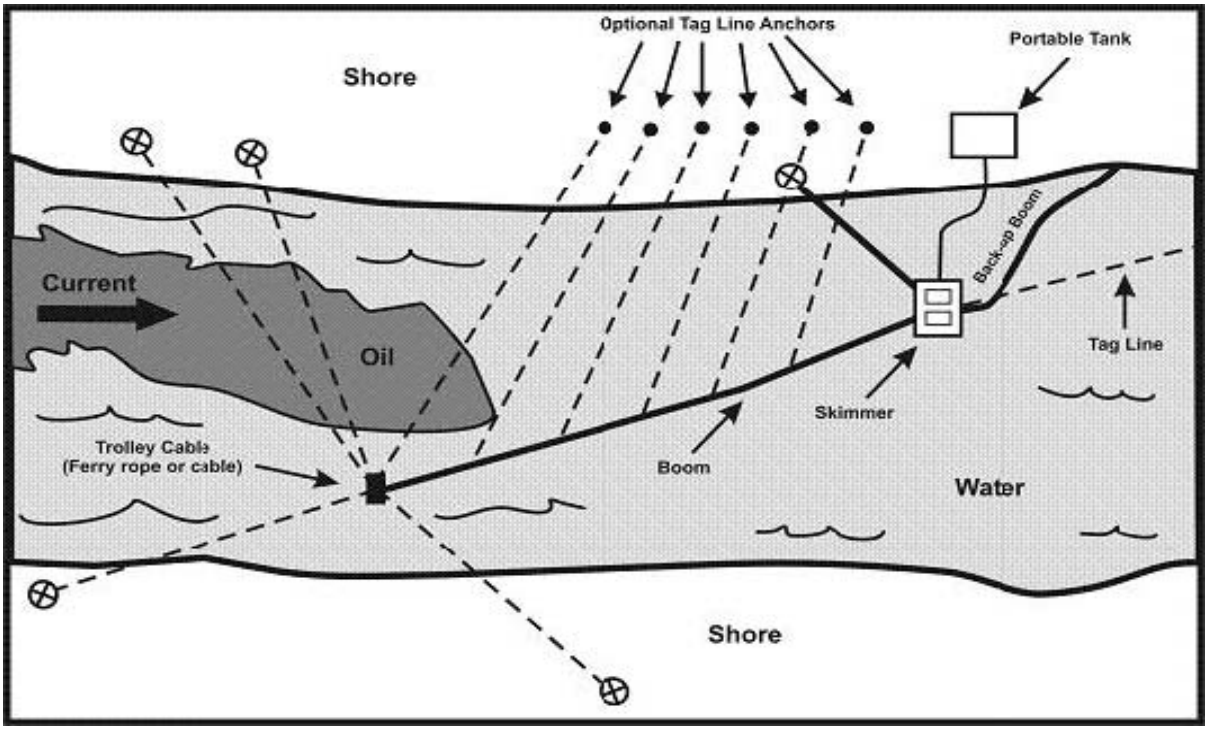


Figure 5: Containment Boom

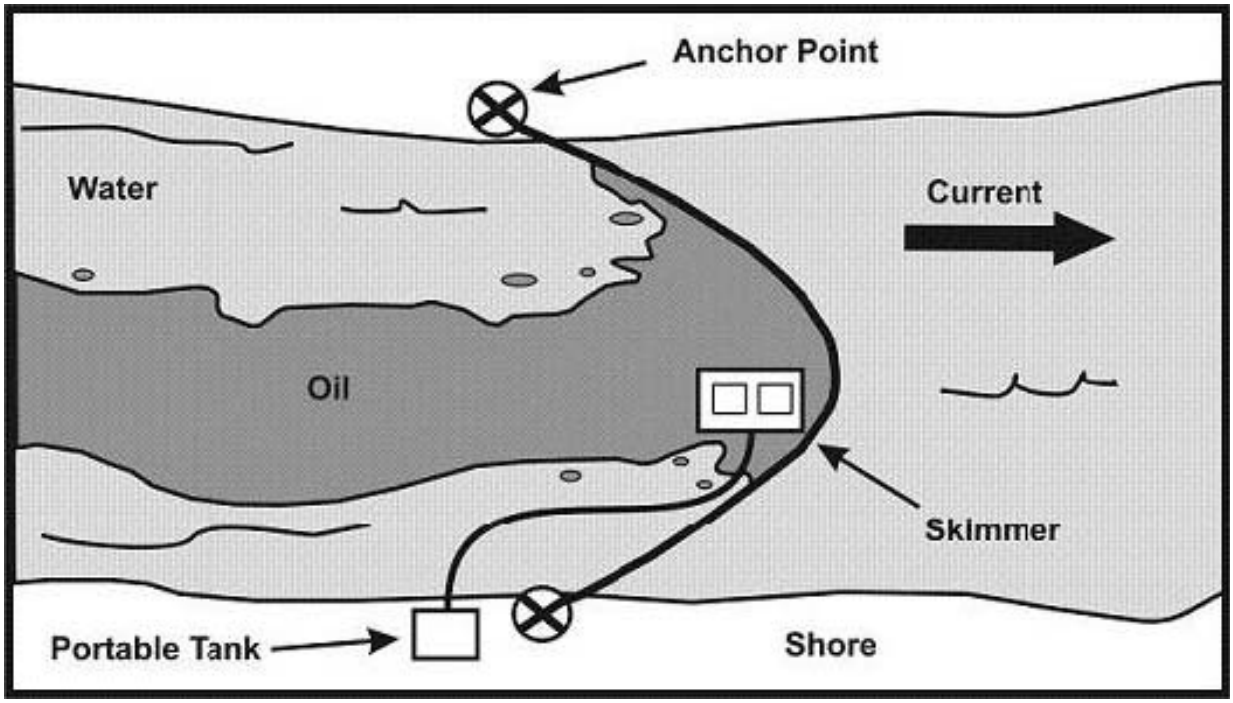


Figure 6: Ice Slotting Strategy

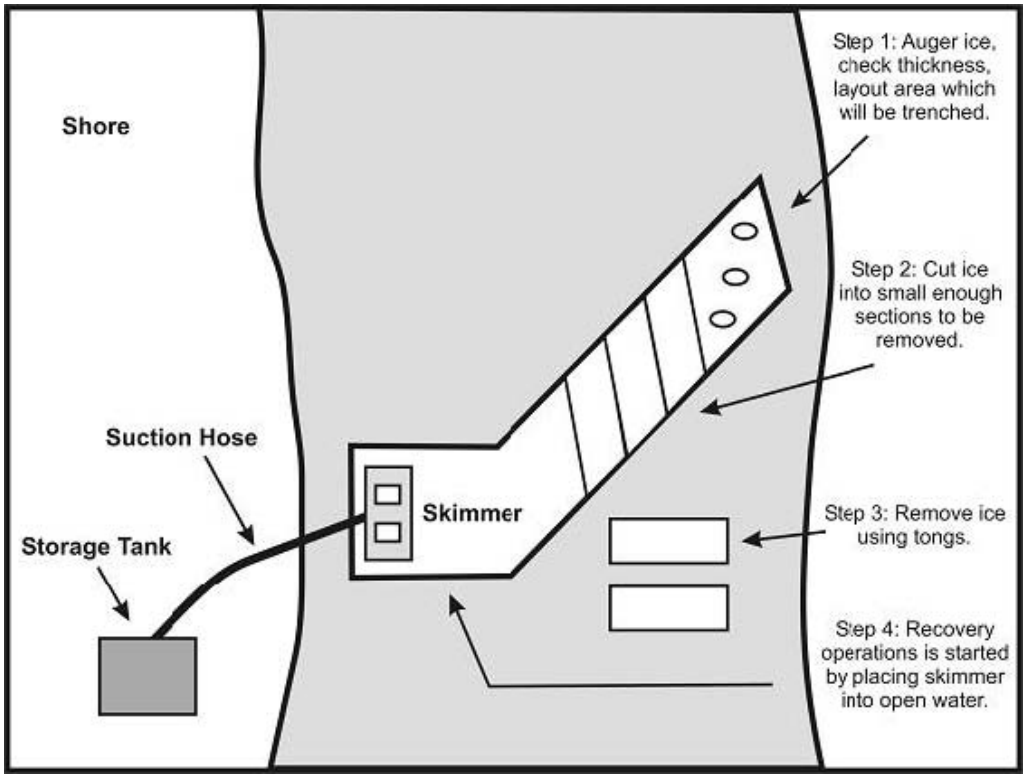
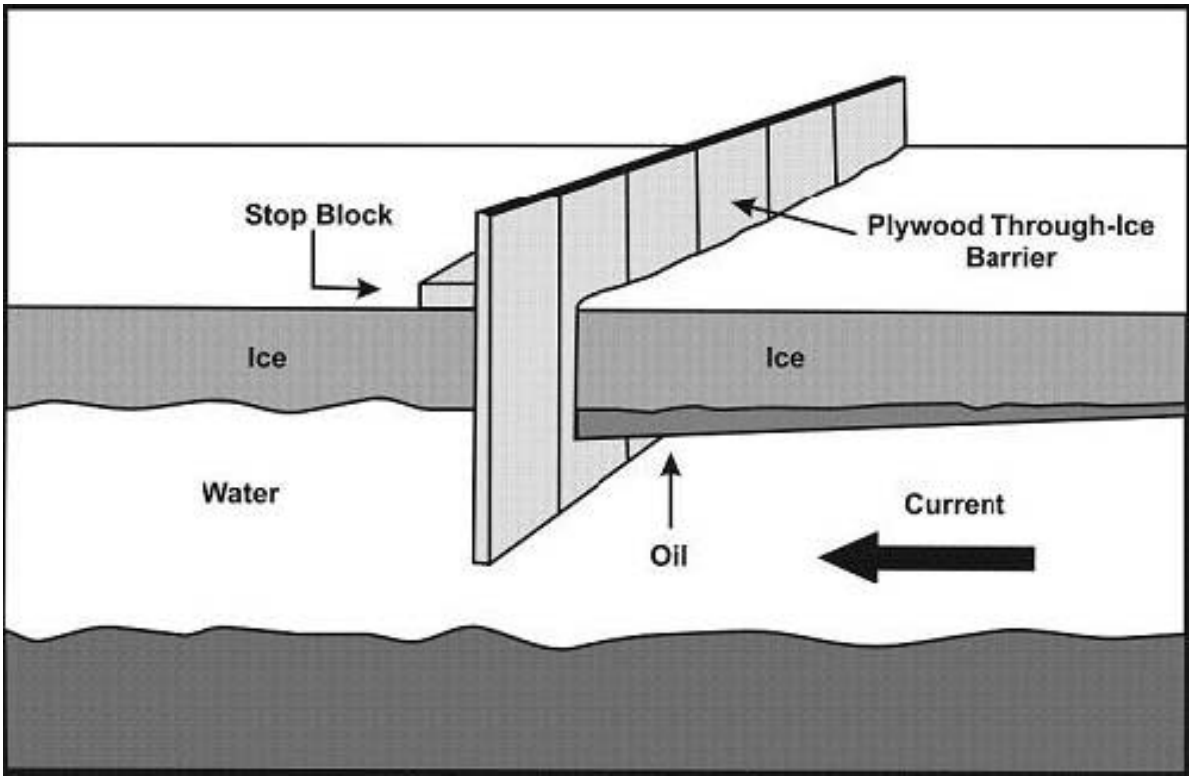


Figure 7: Deflective Board Strategy



APPENDIX 2-A-26. *Chance Eagle Plains Exploration Project: Baseline Information on Terrain Permafrost and Suitability Maps*

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Memorandum

Date: January 22, 2021
Project #: 1903401
File #: 1

To: Richard Wyman, Chance Oil and Gas Limited

From: Robin McKillop, Cory McGregor

cc:

Re: Eagle Plains Oil and Gas Exploration Planning: Surficial Geology/Permafrost and Exploration Development Suitability Mapping

1. Introduction

Palmer is pleased to submit this report to Chance Oil and Gas Limited (Chance) to accompany and explain the interpretive surficial geology/permafrost and exploration development suitability mapping in a priority area of its Eagle Plains property in northern Yukon. Our work provides a basis for Chance to effectively plan upcoming maintenance programs for its abandoned wells and the next phase of its exploration, by distinguishing areas well and poorly suited to road and well pad construction, and mix-bury-cover (MBC) drill cuttings disposal. It also aims to help streamline Chance's exploration permitting process by proactively characterizing the distribution and relative ice content of permafrost in anticipation of related information requests from the Yukon Environmental and Socio-economic Assessment Board (YESAB).

Following provision of important background information (Section 1), we provide an overview of the physical setting (Section 2) and describe the methods used to produce the interpretive mapping and derivative products (Section 3). Key results portrayed by the maps, including the areal distribution of distinct areas and implications for exploration development, are highlighted in Section 4. Recommended follow-up investigations are highlighted in Section 5.

1.1 Background

Chance is interested in expanding its exploration for oil and gas reserves within its property near Eagle Plains. Exploration is planned in phases across a 2,400 km^2 area within its property. To support exploration planning and associated permitting, Chance is seeking insight into the distribution, characteristics, and sensitivity of permafrost terrain within its exploration area as a basis for optimizing initial ground testing and ultimate site selection for its exploration wellpads, access roads and MBC disposal sites. A number of key characteristics are particularly important for assessing site-specific sensitivities to disturbance, including: permafrost extent (laterally) and depth (active layer thickness) with consideration of potential talik (unfrozen) zones; relative ice content (e.g., ice-rich or ice-poor); and past or present instabilities expressed by

thermokarst, gullying, shallow landslides and ice-wedge polygons. Indicators of concentrated and seasonally prolonged shallow groundwater flow, such as slopewash runnels and the margins of existing or recently abandoned water bodies, are also important considerations for site selection and land management as these may increase construction costs and maintenance requirements.

Palmer previously completed surficial geology/permafrost and derivative suitability mapping for a 440 km^2 subset of the Chance Eagle Plains property, located approximately 40 km southwest of Eagle Plains. This study builds on and refines the previous work to complete seamless mapping expanding from the 440 km^2 subset into the surrounding area. In addition, this study takes advantage of the previous reporting by Palmer (2015a), which has been adapted for the current objectives, updated based on limited field observations, and revised where necessary.

1.2 Study Area

The study area is located approximately 20 km southwest of Eagle Plains, and measures approximately 2,400 km^2, inclusive of the 440 km^2 subset mapped in 2015 (Figure 1). The Dempster Highway diagonally crosses the southern half of the study area between kilometres 300 and 347. The northern edge of the study area roughly coincides with the Arctic Circle at 66°30’00” N, while the southern edge is approximately 8 km north of the Peel River valley at 65°55’00” N.

1.3 Objectives

The overall objective of this study is to expand the existing understanding of terrain and permafrost distribution and will ultimately provide Chance with advance knowledge of permafrost sensitivity and development suitability across its 2,400 km^2 Eagle Plains study area. To accomplish this main objective, Palmer completed the following:

- A field reconnaissance program to calibrate the terrain and permafrost characteristics with limited helicopter- and ground-based observations;
- Surficial geology mapping for the study area, including delineation of terrain features through the newly added 1,960 km^2 expansion area and review and refinement of the original 440 km^2 subset;
- Classification of permafrost conditions across the study area, with a focus on describing relative active layer thickness and permafrost ice content; and
- Derivation of an Exploration Development Suitability map with a focus on highlighting regions where constraints related to terrain and permafrost conditions are most likely to affect road routing and design, wellpad siting and layout, and future construction and maintenance activities. The Exploration Development Suitability map also draws attention to areas potentially suitable for MBC disposal of drill cuttings.

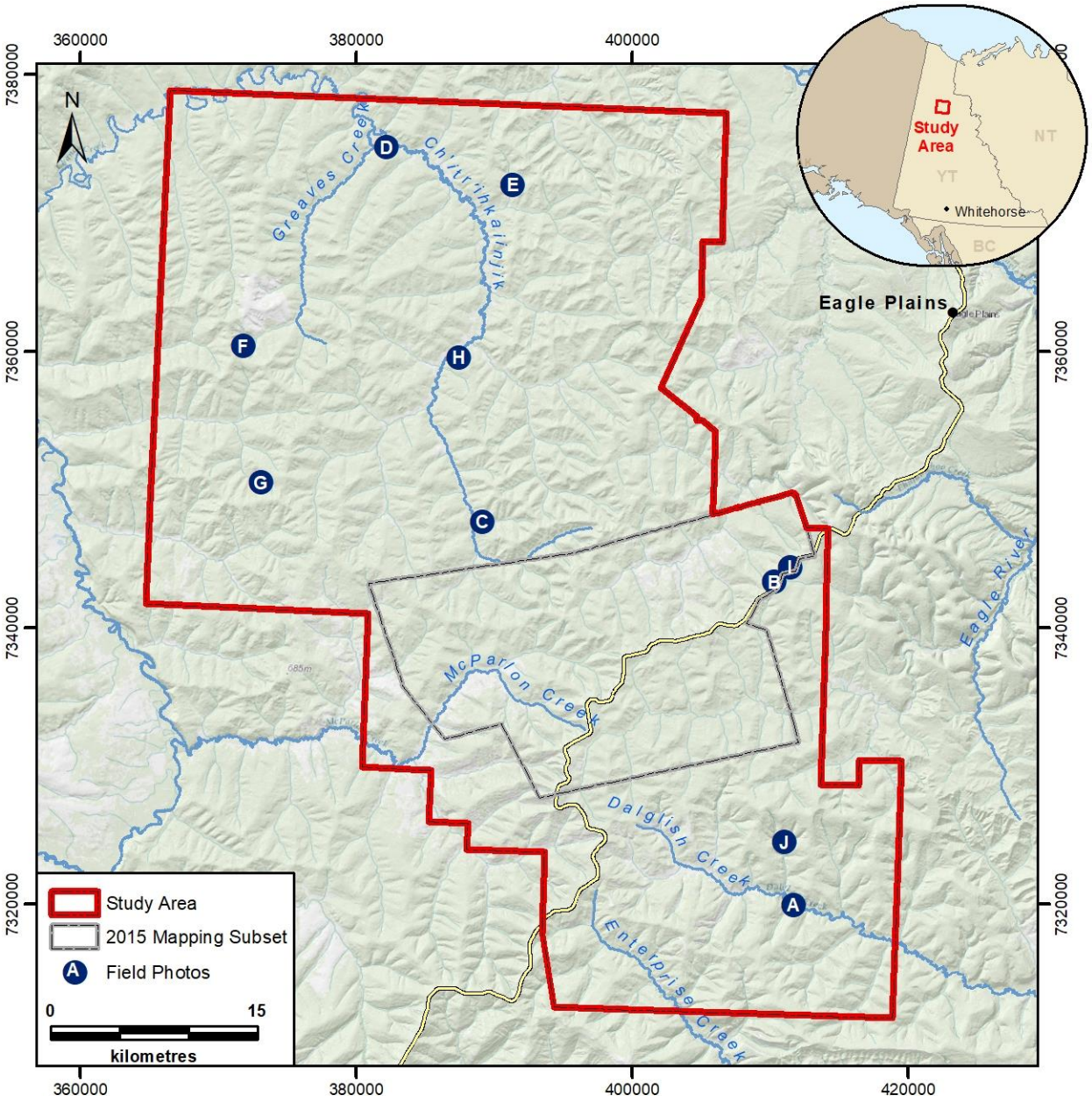

Figure 1. Eagle Plains study area and locations of representative field photos included below.

2. Physical Setting

The study area lies within the Eagle Plains Ecoregion, an area of modest relief in the lowlands between the North Ogilvie and Richardson mountain ranges (Yukon Ecoregions Working Group, 2004). Elevation ranges between 350 m asl at the base of the northernmost river valleys to 750 m asl at high points along the broad ridge system followed by the Dempster Highway. Climate is characterized by prolonged winter conditions which persist up to eight months of the year. Mean annual temperature is near -7.5ºC, with mean July temperatures around 13ºC and mean January temperatures slightly colder on the valley floors (-31ºC) than over higher terrain (-25ºC) due to strong temperature inversions associated with Arctic high pressure.

Annual precipitation is approximately 400 mm, falling mostly as rain during the summer months (Yukon Ecoregions Working Group, 2004). Most surface water drains into the northern-flowing Porcupine River, via major tributaries such as the Eagle River and Whitestone River; in the southeastern corner, Dalglish Creek and Enterprise Creek drain into the Peel River, which flows east to the Mackenzie River.

2.1 Bedrock Geology

The bedrock geology of the study area is dominated by the Upper Cretaceous rocks of the Cody Creek, Burnthill Creek, and Eagle Plain formations (Yukon Geological Survey, 2020). These rocks comprise fine- to medium-grained sedimentary sequences including sandstone, shale, siltstone, bituminous shale, mudstone, and coal. The easternmost edges of the study area intersect the mixed carbonate and clastic rocks of the Hart River and Ford Lake formations.

Differential weathering of these lithologies has contributed to the unique landscape in the study area. Broad ridges are formed by comparatively erosion-resistant sandstone beds. The Dempster Highway and Chance Road generally follow a network of these more resistant ridges. Isolated knolls along the ridge crests are likely remnants of the more competent bedrock in the area.

2.2 Landscape Evolution

Much of Yukon has been repeatedly glaciated during the Pleistocene, causing multiple episodes of erosion and deposition of thick and extensive glacial sediments. Beyond the maximum limit of glaciation, however, surficial deposits generally comprise deeply weathered bedrock and soils on plateaux and slopes, organic-rich soils and peat in depressions, and fluvial silts, sands, and gravels along river valleys (Hughes, 1972). During the last glaciation, the Laurentide Ice Sheet reached its all-time limit occupying the region surrounding the lower Mackenzie River Valley and reaching as far west as parts of the Richardson and Mackenzie Mountains. The study area lies within an unglaciated region to the west of this limit (Duk-Rodkin, 1999), and is generally unaltered by glacial processes. However, Laurentide ice obstructing the Peel River valley and impounding Glacial Lake Hughes diverted meltwater flow northward through the Eagle River valley (Duk-Rodkin and Hughes, 1995). Thus, glacial processes may have had an indirect effect on the study area by lowering the base level of the Eagle River and increasing the rate of incision of its upstream tributaries.

The lack of glacial erosion has resulted in broad, rolling uplands that are typically covered by veneers of relatively fine-grained colluvium or weathered bedrock and commonly bounded by well-drained scarps where more resistant bedrock transitions into fluvially incised, V-shaped valleys. The valley sides are covered by thick, fine-grained colluvium, locally overlain by organics. Thick, fine-grained to gravelly fluvial deposits occupy the valley bottoms. Remnant terraces perched above the floodplains within some of the larger valleys are composed of peat overlying fine sands and silts (Thomas and Rampton, 1982). The lower permeability and valley bottom position of these thicker sediments results in the preservation of ice-rich permafrost, which can introduce challenges for exploration and infrastructure development in these areas.

2.3 Permafrost and Periglacial Processes

Permafrost is ground, including both unconsolidated sediments and bedrock, that remains below 0°C for more than one year. Chance's Eagle Plains property is entirely within the zone of continuous permafrost,

based on property-specific geological and geophysical field data, ground surface expression visible in aerial photography, and regional-scale permafrost mapping compiled by Heginbottom et al. (1995) (Palmer, 2015b).

The depth to permafrost (or active layer thickness) varies spatially at regional and local scales, and temporally with changing seasons. The active layer is generally <1 m thick in the study area, even at its late summer maximum, although it may reach around 2 m in particularly well drained, elevated sites. Active layers may be even thicker, locally reaching bedrock at a depth of 3-4 m, following wildfire (Coates, 2008; Kryotek Arctic Innovation, 2015). At a local scale, active layer thickness primarily depends on elevation, aspect, slope position and shape, soil texture and drainage, snow pack and vegetation cover (Williams and Burn, 1996; Bonnaventure et al., 2012; McKillop et al., 2013). Well drained soils insulated by thick annual snow cover tend to have thicker active layers (deeper permafrost table) than wind-swept, poorly drained areas (shallower permafrost table). In areas of thick, mossy organic cover, permafrost may be encountered at depths as shallow as just a few tens of centimetres even at the end of summer. Active layer thickness increases following snowmelt in spring, and typically peaks in late summer.

Permafrost may or may not contain ice, depending primarily on the material within which it exists and its hydro-geomorphic setting. Most commonly, ice is restricted to the pores or fractures within surficial materials or bedrock, respectively. Such ‘ice-poor’ permafrost is widespread in the study area and most common in areas of exposed or shallow bedrock, along ridges of weathered bedrock, and on relatively well drained colluvial slopes. Where soil textures and drainage conditions permit, thin seams or small lenses of ice may form, representing a more moderate volumetric content of ice. Broad valley bottoms, which have been infilled with mixtures of fine-grained colluvium, fluvial deposits and organic matter, may contain ‘ice-rich’ permafrost. In addition to pore and lens ice, massive bodies of ice may exist within the unconsolidated material. Such bodies grow and shrink in response to changing climatic conditions and ground thermal regime (e.g., organic cover thickness, local drainage conditions). They may form ice wedges, which commonly form geometric networks well expressed at surface by interconnected, linear furrows. Ice-wedge polygons also occur on some gentle slopes, including broad ridge crests and shoulders within portions of the study area.

The sensitivity of permafrost to disturbance depends on a variety of factors, including its temperature, ice content, insulating ground cover (e.g., organics) and the material within which it is held. Relatively warm permafrost (i.e., warmer than -2°C) is more susceptible to thaw due to localized and even minor disturbances to the ground surface, whereas cooler permafrost is able to withstand minor disturbances without appreciable effect. Permafrost that is decoupled from current climatic conditions and only persists in areas of thick, mossy organic cover is more sensitive to disturbance through ground disturbance (e.g., stripping or compaction of organics). Permafrost within fine-grained materials is more likely to contain discrete bodies of ice and, thus, is more sensitive than that within weathered bedrock or coarse-grained colluvium.

Permafrost has a strong influence on soil and drainage conditions, the rates and mechanisms of colluvial (mass movement) processes, and overall hillslope and valley bottom morphology. An appreciation for periglacial processes is important to exploration planning. Permafrost acts as a barrier to water flow, in the absence of any taliks (unfrozen areas bounded by permafrost), so unconsolidated materials within the

active layer commonly become saturated during the summer. On level ground, differential frost heave may occur in the snow-free season, resulting in frost (mud) boils, irregular micro-topography and the formation of earth hummocks. Ice-wedge polygons may form under certain conditions. In areas of ice-rich permafrost, even minor ground disturbances may trigger thermokarst activity (e.g., natural windthrow ripping the surface organic mat and exposing underlying sediments), through which the ground subsides and slumps in response to the melting of buried ice bodies. Thermokarst commonly continues for extended periods of time (i.e., years to decades), once initiated, through a positive feedback cycle between increases in thaw and increases in water ponding. Retrogressive slumping is common along the shores of thaw ponds and along the banks of thermokarst gullies, which incrementally enlarges the area of subsidence.

On slopes, summertime saturation reduces the shear strength of the soil and promotes solifluction, the gradual, downslope creep of material on the permafrost table; or active-layer detachment, the rapid, downslope slide and/or flow of material on the permafrost table. Both processes increase in frequency and magnitude shortly after wildfire (Coates, 2008), mainly due to the loss of rooting strength and insulating organic cover (thaw rate and depth increase). Solifluction is best recognized at surface by conspicuous ‘lobes’ of organics and sediment, defined by a steep, rounded front and a gradual tail. Areas of active solifluction can destabilize roads through irregular settlement and mounding. Certain slopes are commonly prone to active-layer detachments; their histories of landslides are commonly indicated by conspicuous fall line-oriented ‘stripes’ of deciduous trees.

Slopewash is another widespread and important process on slopes underlain by permafrost, through which material is transported downslope through a combination of sheetwash (entrainment in surface runoff) and piping (entrainment in water percolating through the active layer). Shallow ‘runnels’ (also known as ‘water tracks’) are a surface manifestation of slopewash, formed by the repeated and preferential downslope transport of sediments along natural drainage paths. As slopewash runnels deepen, they concentrate and prolong the conveyance of surface runoff and shallow groundwater, resulting in a local depression in the permafrost table (thickening of the active layer). The interception of slopewash runnels by roads necessitates cross-ditching or drainage culvert installation; still, such sites may form ‘icings’ during the winter and spring months, which increase maintenance requirements on road surfaces and embankments.

3. Methods

3.1 Field Reconnaissance

A one-week field reconnaissance program was completed between July 1 to 7, 2019. Weather conditions were generally clear and sunny with brief periods of light rainfall. The program was undertaken with the support of a helicopter and included reconnaissance flights over much of the study area as well as ground-based assessments. The program was completed with a focus on characterizing a diversity of landforms, surficial materials, and permafrost conditions across the study area. Ground-based field observations were made through a series of foot traverses to document changes across the landscape. Field assessment involved examining sediments and visible ice in hand-dug soil pits and natural exposures (e.g., landslide scarps, gullies, stream cut-banks); measuring depth to frost (which may not have represented the true depth to permafrost at the start of the summer); determining material textures, origins, and expressions; and describing geomorphological processes. The program was completed in parallel with an ecological field program undertaken by Environmental Dynamics Inc. (EDI). Where possible, terrain interpretations were

supplemented by opportunistic field observations made and shared by EDI's ecologists as part of their field program.

3.2 Terrain Mapping

Palmer completed surficial geology/permafrost mapping for the 2,400 km^2 study area as a basis for communicating the distribution of distinct ground conditions. The mapping represents the seamless integration of the previously mapped 440 km^2 area (Palmer, 2015a) with the expanded interpretations within the surrounding 1,960 km^2. The 440 km^2 subset was reviewed and standardized for consistency with the surrounding area. Terrain interpretations were completed using a combination of multiple stereo-imagery sources in combination with high-resolution LiDAR-derived elevation data. Aerial photographs were acquired by Chance over the northern and southern regions of the study area, but smoke from wildfires precluded acquisition within the central portion of the study area. Satellite imagery acquired between 2014 and 2019 were overlain onto a digital elevation model to generate pseudo-stereo imagery and were used as a substitute for stereo aerial photographs in this region. Terrain interpretations were refined based on LiDAR-derived elevation data, available across the study area at a resolution of 2 m. Surficial mapping was digitized directly into a geographic information system (GIS) using DAT/EM's Summit 3D mapping software in conjunction with Esri's ArcMap.

Surficial geology/permafrost mapping was completed at a view scale of 1:20,000 using the standardized Yukon surficial geology mapping protocols (Lipovsky and Bond, 2014), which are an adaptation of the *Terrain Classification System for British Columbia* (Howes and Kenk, 1997), with modifications to accommodate project-specific objectives. Terrain polygons were delineated based on internally homogenous combinations of surficial materials, textures, surface expressions, drainage classes, and geomorphological processes. Under this system, up to two surficial materials were identified in each polygon as either a primary or secondary material, or in stratigraphic relation to each other. Relative depth to, and relative ice content of, permafrost were estimated for each map polygon using the terrain characteristics and calibrated based on ground observations made during the field reconnaissance program. Relative depth to permafrost refers to the approximate maximum (end of summer) depth of the permafrost table (active layer thickness) and is an inferred average value for the polygon (Table 1). Relative ice content is an inference of the amount of pore ice, segregated ice, massive ice, and/or excess ice (Table 2). Terrain and permafrost interpretations are limited by the mapped scale, and represent the average conditions within each map unit (polygon). It is possible that ground ice is more or less extensive than its mapped representation due to a necessary generalization of the terrain characteristics or geomorphological processes of the map unit. Polygons have been symbolized based on the primary surficial material. Discrete terrain features and geomorphic processes too small to be mapped as individual polygons, such as thermokarst subsidence and active-layer detachments, have been identified using on-site point and line features. All codes used in the mapping are defined in the legend.

3.3 Exploration Development Suitability

The Exploration Development Suitability maps represent the general suitability of distinct areas for the establishment and maintenance of access roads and wellpads, and for disposal of drill cuttings using MBC techniques. The general characteristics of terrain suitable for wellpads and access roads were assumed to be similar in the study area, so these suitabilities have been considered together.

Table 1. Inferred relative depth to permafrost.

Depth Classification	Definition	Description
Near-surface	Permafrost table located less than 0.4 m from the ground surface.	Permafrost is typically found within or at the base of surface organics. Includes map units overlain by organic blankets and veneers; very poorly to imperfectly drained fluvial fans, terraces, veneers; and inactive floodplains.
Shallow	Permafrost table located between 0.4 and 1.0 m from the ground surface.	Applies to relatively fine-grained and matrix-supported sediments and is considered the typical permafrost depth class through the study area. Includes most imperfectly to moderately well drained deposits, active floodplains and most deposits with mapped ice-wedge polygons or thermokarst subsidence.
Deep	Permafrost table located more than 1 m from the ground surface.	Typically applies to relatively coarse-grained and clast-supported deposits. Includes bedrock and most moderately to well drained colluvium and weathered bedrock along convex ridges and scarps.

Table 2. Inferred relative ice content of permafrost.

Ice Content Classification	Pore Ice	Segregated Ice	Massive Ice	Excess Ice[1]	Description
Ice-rich	Continuous	Extensive	Indicated (Xw), Inferred (Xt), or likely; widespread	Major	Typically includes sediments overlain by organic blankets and veneers; poorly to very poorly drained, mostly inactive fluvial deposits; and map units affected by ice-wedge polygons or thermokarst subsidence.
Ice-moderate	Continuous	Widespread, in seams and lenses	Possible, locally	Moderate	Includes fluvial deposits not previously classified as ice-rich; fine-grained colluvial aprons and blankets; imperfectly to poorly drained matrix-supported colluvial blankets; and map units affected by sheetwash or solifluction.
Ice-poor	Discontinuous to Continuous	Local, mostly in seams	Unlikely, except in isolated areas	None to minor	Applies to most moderately to well drained terrain throughout the rolling uplands and colluvial slopes and is considered the typical ice content class in the study area.

[1] Excess ice refers to the volume of ice that exceeds the total voids (e.g., pore space) that would be present under natural, unfrozen conditions.

The road and wellpad suitability and MBC disposal suitability classifications were derived from the 1:20,000-scale surficial geology interpretations and are specific to (and relative within) the project area. Map units (polygons) were categorized into five road and wellpad suitability classes (ranging from Very High to Very Low) and two MBC disposal suitability classes (Potentially Suitable and Probably Unsuitable) based on terrain characteristics, site drainage, and permafrost conditions, also considering field observations and professional experience in unglaciated Yukon (e.g., McKillop et al., 2013; McKillop et al., 2016). Definitions, explanations and implications of each class are outlined in Section 4.3 in association with the presentation of results. A lower suitability rating does not necessarily mean suitable terrain is not present in the map unit; localized portions of these polygons may be suitable for exploration development or MBC disposal based on site-specific terrain characteristics. Similarly, a higher rating does not necessarily mean the entire polygon is suitable for exploration development or MBC disposal. Field investigations remain warranted to evaluate suitability classifications at a site-specific level.

4. Results and Discussion

4.1 Key Field Observations

Ground observations were made at 103 field reconnaissance sites and supplemented by opportunistic observations and photographs taken along foot traverses and helicopter flights. An overview of representative photograph locations is shown in Figure 1, and examples of common terrain units and processes are presented in Figure 2. Most of the study area consists of gently sloping uplands dissected by stream valleys punctuated by bluffs at the crests of slopes (Photos A to C). Geomorphological processes related to ice-rich permafrost are visible by surface expressions including ice-wedge polygons (Photo D) and thermokarst subsidence (Photo E). Mass movements such as active-layer detachments were observed on gentle to moderate gradients along valley walls (Photo F).

Representative photographs of permafrost conditions and sediments in the study area are presented in Figure 3. Measurements of the active layer thickness at the time of site inspection (July 1 to 7, 2019) are estimated to be slightly thinner than the late summer maximum. In general, depth to frost was less than 1 m throughout the study area. Measurements were generally deeper near active streams and were assumed to be relatively deep on well drained, weathered bedrock ridges where high clast content typically restricted measurements using a frost probe. Permafrost was near-surface (<0.4 m) beneath areas of thick organic cover, such as fluvial terraces and inactive floodplains. Typically, ice content increases toward lower valley positions, and was noticeably higher within inactive floodplains. In one such environment, an eroding stream bank exposed massive ground ice in wedges >2 m high (Photo G). Excess ice was also observed within thick, fine-grained colluvial deposits (Photo H).

Competent bedrock rarely outcrops at surface through most of the study area, but several conspicuous outcrops of sandstone and conglomerate were observed near the Dempster Highway (e.g., Figure 3 Photo I). Most ridge crests appear as weathered bedrock and consist largely of well drained sands and angular clasts (Photo J).


A


B


C


D

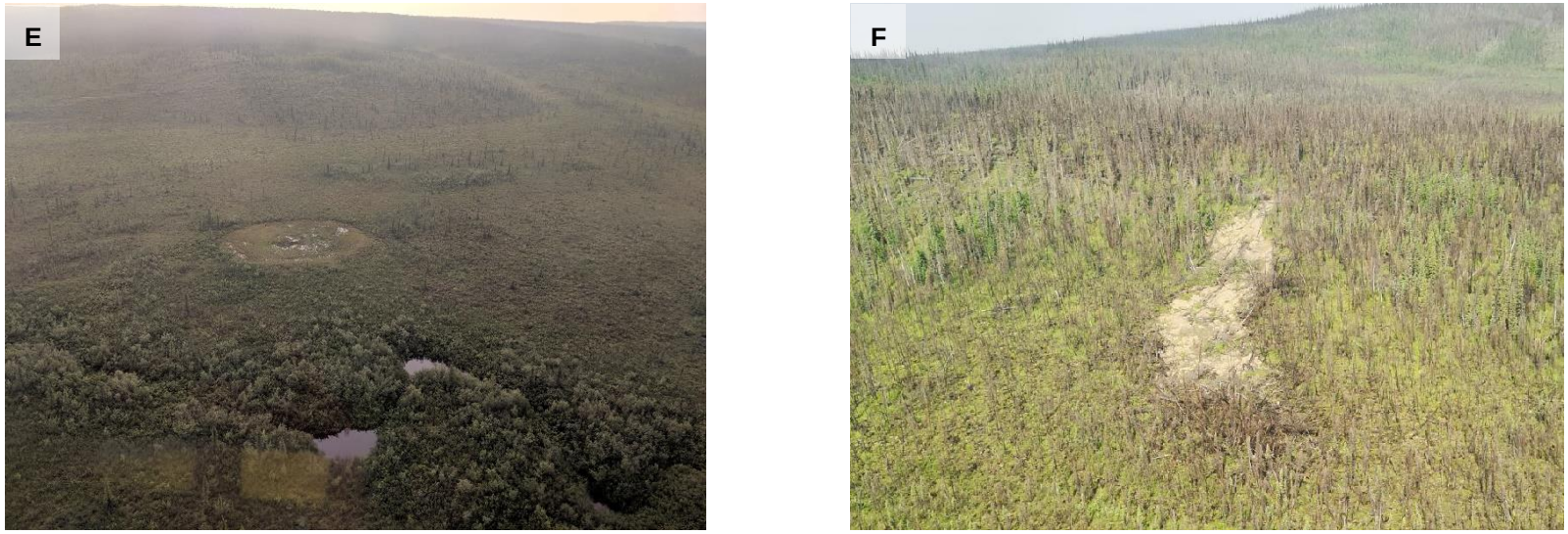

Figure 2. Field photographs representative of common landforms and geomorphological processes within the study area: A) View of the Dalglish creek valley, showing an irregularly meandering channel and several areas of lateral erosion where the creek has cut into the valley walls; B) Convex, mid-slope composed of more-resistant bedrock mantled by a veneer of weathered bedrock and colluvium; C) Gentle fluvial fan exhibiting a triangular- or wedge-shape, transitioning into a modern stream valley (lower right); D) Geometric surface expression of ice-wedge polygons over an inactive region of the floodplain; E) Thermokarst depression in an inactive region of the floodplain; and F) Recent active-layer detachment initiated at the crest of a gentle colluvial slope.



Figure 3. Field photographs representative of typical surficial material characteristics: G) Ice wedge exposed in freshly eroded stream bank (1.9 m-tall person for scale); H) Ice lens within fine-grained, colluvial sediment; I) Outcrop of more-resistant conglomerate exposed in a bluff near the Dempster Highway; J) Sandy, clast-supported veneer of weathered bedrock, typical of deposits found in weathered bedrock bluffs and knolls.

4.2 Surficial Geology and Permafrost

The results of the surficial geology/permafrost mapping are presented in the series of maps shown in **Appendix A**. Most landforms and materials in the study area are interpreted to have originated prior to the last glaciation. Apart from organics, recent fluvial deposits, and areas recently affected by active geomorphological processes, the landscape is dominated by deeply weathered sediments that have developed on slopes and ridges over many millennia.

Colluvial deposits (aprons, veneers, blankets, and mantles of variable thickness) are the most extensive surficial material, located ubiquitously on slopes and ridges and comprising 71.8% of the study area (Table 3). Fluvial deposits comprise 8.4% of the study area and are generally identified along the bottoms of broad valleys, although fans and veneers of fluvial sediments are mapped at confluences and within narrow ravines, respectively. Organic material accumulates on most imperfectly to very poorly drained deposits throughout the study area, but it is only identified in the terrain code when its thickness exceeds about 0.5 m. Organic veneers and blankets are generally mapped in low valley positions near active streams, and comprise 1.6% of the study area. Bedrock within the study area is commonly fissile and deeply weathered, located along ridge tops and convex slope-breaks along the crests of valley walls. Weathered veneers of bedrock cover 17.3% of the study area. Intact bedrock is rare at surface and is limited to exposures in steep scarps lining the broad ridge tops, covering 0.9% of the study area. Areas significantly disturbed by human activity (excluding road networks) have been mapped as anthropogenic landforms, and cover <0.1% of the study area

Table 3. Areal distribution of surficial materials and landforms by primary surface material.

Surficial Material and Landform	Terrain Code	Areal Extent	Areal Percentage
Anthropogenic	A	1.41 km^2	< 0.1%
Organic Veneer	Ov	10.24 km^2	0.4%
Organic Blanket	Ob	28.85 km^2	1.2%
Colluvial Apron	Ca	188.77 km^2	7.9%
Colluvial Veneer	Cv	816.12 km^2	34.0%
Colluvial Blanket	Cb	401.01 km^2	16.7%
Colluvial Mantle of Variable Thickness	Cw	315.50 km^2	13.2%
Weathered Bedrock Veneer	Dv	414.07 km^2	17.3%
Fluvial Plain (active and inactive)	FAp; Fp	111.80 km^2	4.7%
Fluvial Veneer (active)	FAv	49.53 km^2	2.1%
Fluvial Fan (active and inactive)	FAf; Ff	36.29 km^2	1.5%
Fluvial Terrace	Ft	2.87 km^2	0.1%
Bedrock	R	20.47 km^2	0.9%
Total		**2,396.93 km^2**	**100%**

Relative depth to permafrost is estimated to be shallow (0.4-1 m) across the majority of the study area (86.2%), and is found on most broad ridges, colluvial slopes, and around active floodplains (Table 4). Relative depth to permafrost is estimated to be near-surface within poorly drained valley bottoms and beneath organic deposits, comprising 3.6% of the study area. Relative depth to permafrost is estimated to be deep (> 1 m) across 10.2% of the study area and is commonly mapped in association with coarse colluvial or weathered bedrock deposits typically found along convex ridges and bluffs, and bedrock scarps.

Permafrost is estimated to be ice-rich across 12.9% of the study area, and is commonly found below poorly drained, inactive fluvial deposits and below organic cover (Table 4). Ice-rich permafrost may also be found along fine-grained colluvial slopes and even along some ridges where the surface expression of ice-wedge polygons is visible in LiDAR data or aerial imagery. Ice-moderate permafrost comprises 40.8% of the study area, and is commonly found below imperfectly drained fluvial deposits and thick, fine-grained colluvial deposits. Ice-moderate permafrost is also inferred in regions affected by sheetwash or solifluction. Nearly half the study area has been estimated to contain ice-poor permafrost (46.3%), which applies to most moderately to well drained terrain along ridges and upper valley slopes.

Table 4. Area distribution of permafrost conditions by relative depth and relative ice content.

Permafrost Condition Classification		**Estimated Relative Ice Content**			
		Ice-poor	**Ice-moderate**	**Ice-rich**	**Total**
Estimated Relative Depth	**Near-surface (<0.4 m)**	0% *(0 km²)*	0.1% *(2.2 km²)*	3.5% *(84.1 km²)*	**3.6% *(86.3 km²)***
	Shallow (0.4 – 1 m)	37.0% *(885.8 km²)*	39.9% *(955.6 km²)*	9.4% *(224.7 km²)*	**86.2% *(2,066.1 km²)***
	Deep (>1 m)	9.4% *(224.3 km²)*	0.8% *(20.2 km²)*	0% *(0 km²)*	**10.2% *(244.5 km²)***
	Total	**46.3% *(1,110.2 km²)***	**40.8% *(977.9 km²)***	**12.9% *(308.8 km²)***	**100% *(2396.9 km²)***

4.3 Exploration Development Suitability and Associated Implications

The series of Exploration Development Suitability maps is provided in **Appendix B**. The maps combine the results of the road and wellpad suitability classifications with the MBC disposal suitability classifications.

Road and wellpad suitability are presented as a five-class system (Table 5). A total of 17.4% of the study area has been classified as Very High or High suitability. These areas comprise ice-poor, isolated topographic highs and moderately to well drained ridge systems, which form sinuous networks through the landscape. Conversely, lower valley terrain such as floodplains and fine-grained colluvial aprons are generally prone to higher ice contents, and active permafrost and periglacial processes, including active-layer detachments, solifluction, thermokarst, and sheetwash. A total of 54.2% of the study area was classified as Low to Very Low suitability, due to one or more development constraints. The remaining 28.4% of terrain was considered moderately suitable for development and may be reasonable for road and wellpad establishment by employing proactive mitigation measures where necessary.

Table 5. Road and wellpad suitability classification and implications for construction and maintenance.

Road and Wellpad Suitability	Description	Implications for Construction and Maintenance	Percent of Study Area
Very High	Moderately well to well drained, isolated topographic highs with deep or shallow, ice-poor permafrost. Generally considered to be stable terrain, and typically located along wide, rounded ridge crests.	Favourable conditions for access road and wellpad establishment through standard best management practices. Minimal expectation for maintenance requirements.	8.1%
High	Generally, moderately well to well drained areas with deep or shallow, ice-poor permafrost. Typically associated with ridges of weathered bedrock or shallow colluvium over convex topography.	Generally favourable conditions for access road and wellpad establishment through standard best management practices. Low to moderate expectation for maintenance requirements.	9.3%
Moderate	Imperfectly to moderately well drained colluvial slopes with deep to shallow permafrost, commonly with poor to moderate ice content; Convex weathered bedrock bluffs, typically at moderate slope gradients; and fluvial terraces above the influence of modern stream processes.	Generally reasonable conditions for access road and wellpad establishment. Where necessary, employment of mitigations may be to proactively manage natural concentrations of surface runoff and to protect thaw-sensitive permafrost. Moderate expectation for maintenance requirements. Field reconnaissance would help inform route/site selection and mitigation requirements.	28.4%
Low	Poorly to imperfectly drained, thick colluvial slopes with shallow permafrost, commonly with moderate to rich ice content; imperfectly drained fluvial fans and veneers. Regions affected by sheetwash, gully erosion, and ice-wedge polygons are typically included in this category. Surface runoff becomes concentrated.	Generally unfavourable conditions for access road and wellpad establishment, except through mitigations to proactively manage natural concentrations of surface runoff and to protect thaw-sensitive permafrost. Moderate to high expectation for maintenance requirements. Field reconnaissance is necessary to inform route/site selection and mitigation requirements.	32.8%
Very Low	Very poorly to imperfectly drained areas with shallow or near-surface permafrost, commonly with rich to moderate ice content. Includes most floodplains and steep bedrock scarps. Thermokarst subsidence and ice-wedge polygons are common on level to gently sloping ground, and slopes may be subjected to mass movements including solifluction and active-layer detachments.	Unfavourable conditions for access road and wellpad establishment. Any necessary crossings will require comprehensive mitigations to protect thaw-sensitive permafrost and manage surface runoff and compressible, fine grained sediments. Road construction through steep bedrock scarps would require earthworks and potentially localized blasting. Maintenance expectations are high. Field reconnaissance is critical to inform route/site selection and mitigation requirements.	21.4%

Most moderate terrain can be found over mid- to upper-valley slopes and is mantled by imperfectly drained colluvial veneers and convex, moderately sloping weathered bedrock ridge crests. A summary of the implications for construction has been presented in association with typical constraints expected within each class (Table 5). Design, construction and maintenance of exploration infrastructure generally require greater effort and more complex mitigative solutions as road and wellpad suitability decreases.

The MBC disposal suitability serves to highlight ice-poor, gently-sloping, and relatively stable regions of the landscape set back from significant watercourses as potentially suitable for MBC disposal (Table 6). These criteria were generally met along broad ridge systems and isolated knolls. A total of 13.2% of the study area has been classified as potentially suitable for MBC drill cuttings disposal, most commonly in association with areas classified as High or Very High suitability for road and wellpad suitability. Runoff may be variable at the mapped scale such that different areas within a polygon may have less or more interaction with surface water. For example, polygons affected by slopewash may show discrete runnels where runoff is concentrated. As a result, field investigations are suggested to refine the MBC disposal suitability classifications at a site-specific scale which would better determine target areas for cuttings disposal within each map unit (polygon).

Table 6. Mix-bury-cover (MBC) disposal suitability classification.

MBC Disposal Suitability	Description	Percent of Study Area
Potentially Suitable	Generally geomorphologically isolated regions on level or near-level, elevated areas with minimal or no receipt of surface runoff (i.e., 'shedding sites'). Areas are typically located along broad to rounded ridge crests and knolls that are set back from significant watercourses.	13.2%
Probably Unsuitable	Includes moderate to steeply sloping regions; areas with ice-rich permafrost; and areas exhibiting evidence of geomorphological instability such as fluvial erosion, thermokarst subsidence, solifluction, and active-layer detachments.	86.8%

5. Recommendations

Palmer recommends Chance consider a number of logical follow-up initiatives based on the results of this mapping project to help optimize its upcoming multi-year, multi-well drilling program:

- **GIS-based road routing optimization analysis** – To minimize design, construction, maintenance, and rehabilitation costs, project elements and infrastructure should be site to minimize exposure to low Exploration Development Suitability terrain to the extent possible. This may be accomplished through a collaborative GIS-based road routing analysis between Palmer and the Chance project team, whereby effort and cost are attributed to distinct terrain units, and optimized for development.

- **Incorporation of environmental discipline perspectives into suitability** – The Exploration Development Suitability classification was prepared with a focus on terrain and permafrost constraints. Combining this with the perspectives of other environmental disciplines would yield a more robust suitability classification by accounting for additional environmental values (e.g., vegetation, wildlife habitat, First Nations land uses, archaeological resource potential, etc.).
- **Road alignment delineation** – Following determination of an approximate road route at the polygon-scale (two bullets above), more precise delineation of an actual road alignment would help enable avoidance of local terrain and permafrost constraints (e.g., drainage runnels, thermokarst).
- **Targeted field investigations of complex terrain and areas for MBC disposal** – Complete avoidance of terrain with low or very low Exploration Development Suitability may not be feasible given its abundance in lower valley and floodplain positions. Targeted field investigations in these locations would serve to fine-tune the alignment and confirm the interpretations, site conditions, and cost implications. As local permafrost and runoff conditions may show slight variability at the mapped scale, targeted field investigations would also benefit the selection of specific sites for MBC disposal within polygons identified as Potentially Suitable for MBC disposal.
- **Proactive identification of rehabilitation plans** – It may be productive for Chance to proactively identify its planned approaches for site, road, and wellpad rehabilitation following the completion of work, in anticipation of comments by YESAB, First Nations, and other stakeholders. Rehabilitation plans are best tailored to existing ground and runoff conditions.

6. Statement of Limitations

This report has been prepared by Palmer for Chance in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the “Master Service and Supply Agreement”). The report and the information it contains may be used and relied upon only by Client, except (1) as agreed to in writing by Consultant and Client, (2) as required by-law.

The extent of this study was limited to the specific scope of work for which Palmer was retained and is described in this report. Palmer has assumed that the information and data provided by the client or any secondary sources of information are factual and accurate. Palmer accepts no responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or negligent acts from relied-upon data. Judgement has been used by Palmer in interpreting surficial geology, geomorphological processes, and exploration development susceptibility based on desktop analysis and limited field reconnaissance. Interpretations of subsurface conditions have been made based on surface observations and limited subsurface exposures and may not fully capture the variability in the study area or within a given map unit (polygon).

Palmer is not a guarantor of site conditions or potential hazards or risks but warrants only that our work was undertaken and our report prepared in a manner consistent with the level of skill and diligence normally exercised by competent geoscience professionals practicing in Yukon. Our findings, conclusions and recommendations should be evaluated in light of the limited scope of our work.

7. Certification

This memorandum was prepared and reviewed by the undersigned.

Prepared By: DRAFT

Cory McGregor, GIT
Geoscientist

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Appendix A.

Surficial Geology and Permafrost Classification.
Eagle Plains, Yukon

Appendix B.

Exploration Development Suitability.
Eagle Plains, Yukon

APPENDIX 2-A-27. Draft *Project Description* (Version 1)

DRAFT PROJECT DESCRIPTION

Eagle Plains Exploration Project

Prepared for:

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Suite 1000, 340–12th Avenue SW
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Version 1
July 2023

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
2D	two-dimensional
3D	three-dimensional
AER	Alberta Energy Regulator
ARD	acid rock drainage
ATV	all-terrain vehicles
BOPD	barrels of oil per day
Chance	Chance Oil and Gas Ltd.
CPF	Central Processing Facility
CSA	Canadian Standards Association
DFO	Department of Fisheries and Oceans Canada
DHDA	Dempster Highway Development Area
DST	drill stem test
EC	conductivity
EDI	EDI Environmental Dynamics Inc.
EFT	extended flow test
eLMS	Electronic License Management System
ESA	Environmental Site Assessment
GIS	Geographic Information System
GPS	Global Positioning System
GR	gamma ray
HSE	Health, Safety and Environment
IMA	Integrated Management Area
LiDAR	Light Detecting and Ranging
LIS	Low Impact Seismic
LMU	Land Management Unit
LTS	Leaning Tree Stand
MBC	Mix Bury Cover
N	nitrogen
Na	sodium
NE	northeast
NRCAN	Natural Resources Canada
NYRLUP	North Yukon Regional Land Use Plan
NWT	Northwest Territories
OH&S	Occupational Health and Safety
Project	Eagle Plains Exploration Project

Acronym / Abbreviation	Definition
PWRLUP	Peel Watershed Regional Land Use Plan
SAR	sodium adsorption ratio
SCVF	surface casing vent flow
SDS	Safety Data Sheets
SW	southwest
UV	ultraviolet
YESAB	Yukon Environmental and Socio-economic Assessment Board
YOGA	Yukon *Oil and Gas Act*, SY 2019, c.6

SYMBOLS AND UNITS OF MEASURE

Symbol / Unit of Measure	Definition
º	degrees
%	percent
cm	centimetre
“	inch
dS/m	decisiemens per metre
gpm	gallons per minute
ha	hectare
kg	kilogram
km	kilometre
km/km²	kilometres per square kilometre
km²	square kilometre
km/hr	kilometers per hour
kPa	kilopascals
L	litre
lb	pound
m	metre
m²	square metre
m^3	cubic metre
m^3/day	cubic metre per day
mg/L	milligrams per litre
mg/kg	milligrams per kilogram
mm	millimetre
mKB	metres Kelly-Bushing below the surface

1 INTRODUCTION

The proposed Eagle Plains Exploration Project (Project) is located in the Eagle Plains area, between the Ogilvie and Richardson Mountain ranges in the Yukon**.** The Project encompasses a 2,386 square kilometre (km²) area in north-central Yukon, centred approximately 605 kilometres (km) north of Whitehorse and 40 km south and west of the Eagle Plains Hotel, along the Dempster Highway (**Map 1-1**).

Chance Oil and Gas Ltd. (Chance) is the Project Proponent. The Project consists of two phases:

1. Exploration Phase; and
2. Reclamation and Closure Phase.

Within the Exploration Phase, there are three principal components:

1. a seismic exploration program.
2. an oil and gas exploration drilling program; and
3. a drill stem test (DST) and extended flow testing (EFT) at select wells.

1.1 PROJECT LOCATION

The Project is located within the southern part of Eagle Plain Sedimentary Basin in northern Yukon, northeast of Dawson City and southwest of the Yukon/Northwest Territories (NWT) border (**Map 1-1**). The main camp (Chance Camp) is located at km 325 of the Dempster Highway.

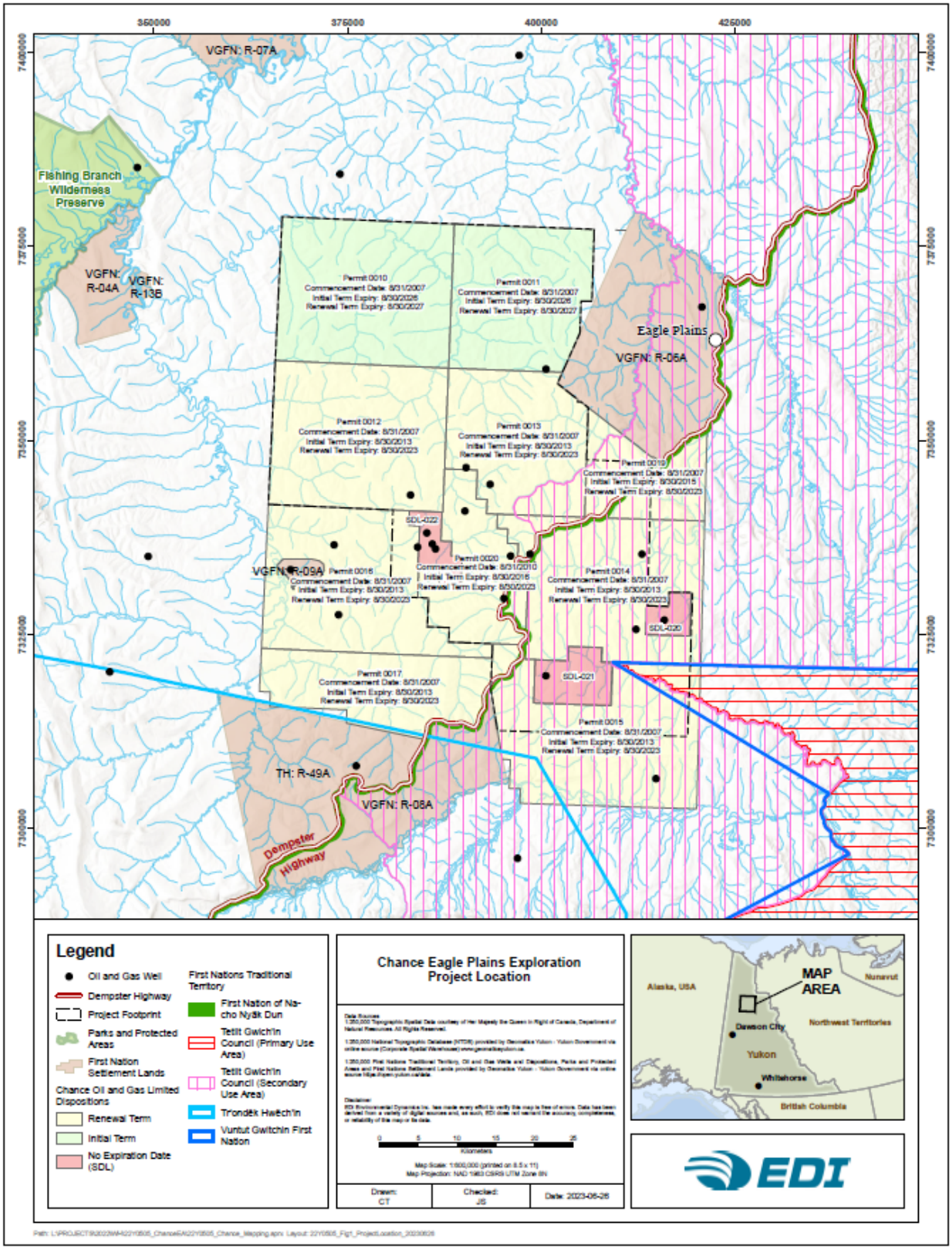
The Project overlaps the Traditional Territories of four First Nations. Most of the Project is within the Traditional Territory of the Vuntut Gwitchin First Nation. The southeastern portion is in an area of overlapping Traditional Territories of the Tetlit Gwich'in Council, Tr'ondëk Hwëchin, the First Nation of Na-Cho Nyäk Dun, and Vuntut Gwitchin First Nation. The Project does not fall within any First Nation Settlement Lands and borders the east and southwest portions of the Vuntut Gwitchin First Nation Settlement Lands.

1.1.1 Exploration History

The Project occurs within the Eagle Plains sedimentary basin, north of the Ogilvie River and west of the Richardson Mountains. The basin contains proven natural gas and oil reserves (Government of Yukon 2019), including 4.6 billion cubic metres (m³) of gas and 3.2 million m³ of oil (Hannigan 2014).

The Project area has had intermittent periods of oil and gas exploration since the 1950s. That activity has established winter roads, seismic lines, and exploratory well sites across parts of the current RSA. Approximately 40 exploration wells have been drilled in the Eagle Plains sedimentary basin. Eight wells are currently being maintained in suspended status, and the remaining wells have been plugged and abandoned. Seismic exploration has included approximately 10,000 km of two-dimensional (2D) lines (mostly before 1985), and about 325 km² of three-dimensional (3D) seismic was conducted in 2013/2014 (Northern Cross (Yukon) Ltd. 2014).

Chance has completed Project-related baseline studies, including surface and groundwater, permafrost, aquatics and fish, vegetation, wildlife, socio-economic, and heritage resources.



Map 1-1. Eagle Plains Exploration Project location.

1.2 DOCUMENT PURPOSE

This document provides an overview of the Project, its location and details about the phases, principal and accessory components, and scheduling. The Draft Project Description outlines a proposed program that will build on past exploration to better define the extent, amount and quality of oil and gas deposits in the area. Under the program, Chance proposes conducting additional 2D and 3D seismic data acquisition programs and drilling up to 30 exploratory wells over ten years. Depending on the drilling program results, EFT, lasting up to two years, may be conducted at wells where crude oil or natural gas are discovered to determine the quantity, quality and extent of the oil and gas deposit(s). The existing winter road network will be expanded to support the seismic, drilling, and flow testing programs. Most of the work and all the new land disturbance will occur in the winter (e.g., seismic line clearing and drilling). Work outside of the winter includes aerial-supported seismic recordings, and EFT may also occur during summer.

The information in this document is conceptual and intended to provide a level of detail supporting discussions on the draft Project Description with potentially affected First Nations, residents of local communities, and stakeholders. Development of this draft document is based on the *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (YESAB 2005), specifically Part 1, Section 5.0 Project Description.

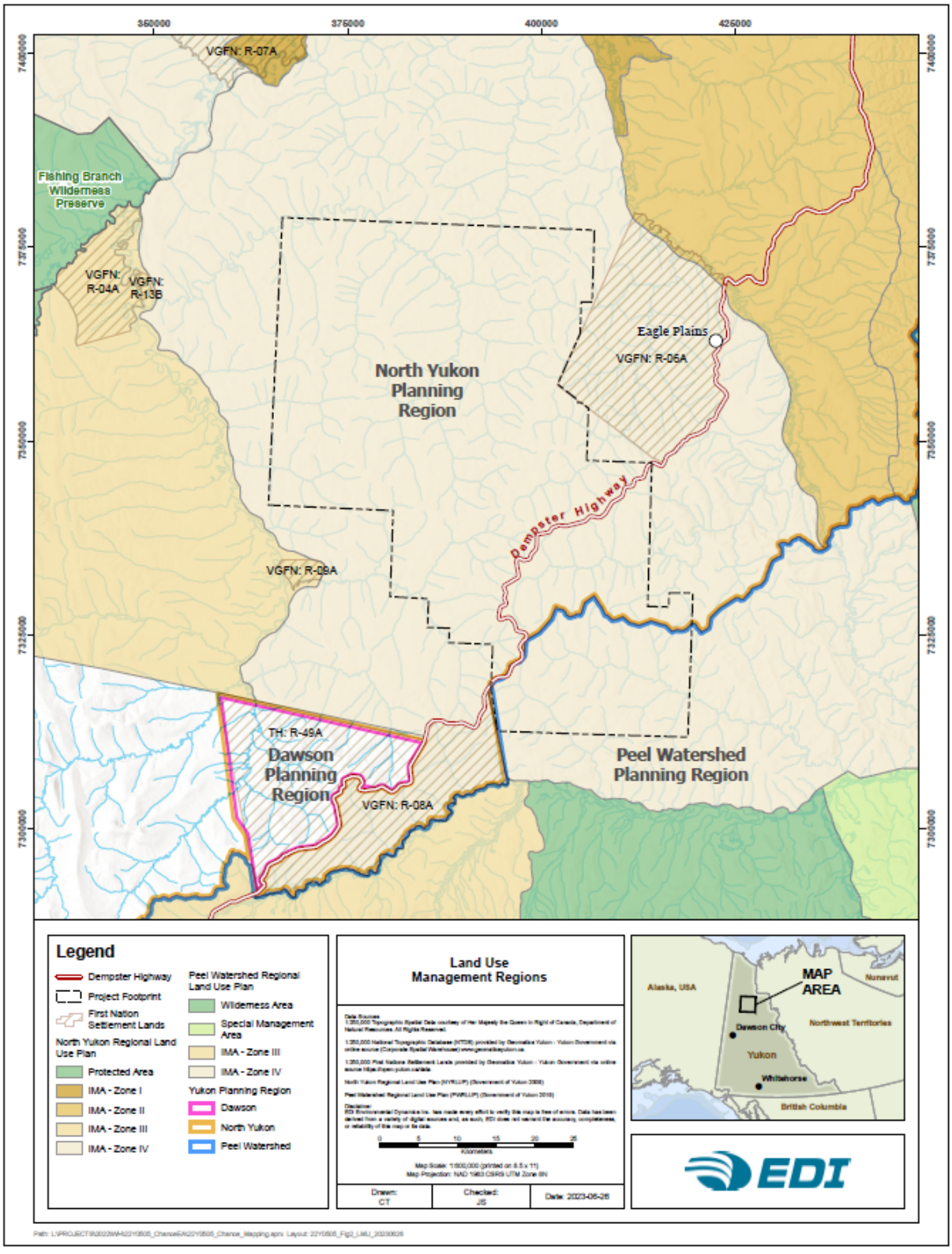
1.3 REGULATORY CONTEXT

The Project is subject to a screening by the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee, as stated in the *Designated Office Evaluation Report* issued on February 9, 2016 (Project Number: 2014-0112). Development of this draft Project Description is based on the *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (YESAB 2005), specifically Part 1, Section 5.0 Project Description. Given that the regulatory framework and process, as developed by YESAB, has changed since the issuance of the Evaluation Report, Chance will collaborate with the Executive Committee on determining the appropriate regulatory process and required project information going forward, including potential environmental and socio-economic effects assessment information.

Detailed Project design and implementation procedures will be developed following Project approvals. Design, methods, or procedural changes will conform to the commitments made by Chance and the terms and conditions stated in Decision Document(s) resulting from the YESAB Executive Committee screening process, once defined. A complete list of required federal and territorial permits, licences, approvals, and assessments will be clarified with the appropriate regulatory agencies as the Project proceeds through the defined permitting and regulatory process.

1.4 RELEVANCE TO LAND USE PLANS

The Project is located within the North Yukon Planning Region and Peel Watershed Planning Region. The Project is, therefore, subject to the approved *North Yukon Regional Land Use Plan* (NYRLUP) (Vuntut Gwitchin Government and Yukon Government 2009) and the *Peel Watershed Regional Land Use Plan* (PWRLUP) (Peel Watershed Planning Commission 2019) (**Map 1-2**).



Map 1-2. Eagle Plains Project and Land Use Planning Units (LMUs).

Each First Nation government has provided input to and approved the Regional Land Use Plan(s) on their Traditional Territory under the respective First Nation Final Agreements.

1.4.1 North Yukon Regional Land Use Plan

The Project lies mainly within the North Yukon Planning Region and is subject to the North Yukon Regional Land Use Plan (NYRLUP). The NYRLUP was created to protect the natural and cultural resources of the region while allowing sustainable economic development opportunities (Vuntut Gwitchin Government and Yukon Government 2009). It provides management direction for using public and settlement lands based on four principles: sustainable development, precautionary principle, conservation, and adaptive management. The NYRLUP divides the Planning Region into 23 Landscape Management Units (LMU), classified into three categories: protected area, integrated management area (IMA), and community area. IMAs are further classified into four zones: Zone 1 (lowest development), Zone II (low development), Zone III (moderate development), and Zone IV (highest development). IMA zones are classified based on the area's sensitivity to landscape disturbance, ecological and cultural values, risk of significant impacts, and level of acceptable change. The RSA is a Zone IV IMA with lower ecological and cultural values in a moderately sensitive biophysical setting. Subsequently, Zone IV IMAs allows for the highest development level to occur.

The NYRLUP encourages results-based management and uses cumulative effects indicators to determine if goals and objectives are met. Results-based management allows for innovation and creativity in land-use strategies and approaches. The two cumulative effects indicators included in the NYRLUP are direct surface disturbance and linear density. The NYRLUP guidelines for Zone IV IMAs are 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density (Vuntut Gwitchin Government and Yukon Government 2009). However, as surface disturbances and linear features reach a level of functional recovery and become part of the continuous landscape, they can be subtracted from the total amount of disturbed area (Vuntut Gwitchin Government and Yukon Government 2009). The NYRLUP suggests using a height of 1.5 m for woody vegetation in forested areas, as vegetation above this height would likely no longer allow for travel or access by humans or wildlife and is, therefore, considered functionally recovered. Activities considered exempt from functional disturbance restrictions are (1) new linear features less than 1.5 m wide; (2) land-use activities that occur on frozen water bodies; (3) winter work with no required clearing of trees; and (4) winter work that uses existing disturbances and linear features.

1.4.2 Peel Watershed Regional Land Use Plan

The southeastern corner of the Project lies within the Peel Watershed Planning Region (PWPR) and is subject to the Peel Watershed Regional Land Use Plan (PWRLUP) (Peel Watershed Planning Commission 2019). Like the NYRLUP, the PWRLUP was established to provide management direction and ensure long-term sustainable development in the Planning Region. The PWRLUP was founded on three main themes: environmental protection, social considerations, and economic development. It follows a similar framework as the NYRLUP. The PWPR is divided into 16 LMUs, each with similar ecological characteristics, planning issues, and management intent. Each LMU is categorized by a land-use designation system. Conservation Areas are managed to protect ecological and cultural resources, while IMAs are 'working' landscapes where new development and surface disturbance may be allowed. IMAs are further classified into Zones, which correspond to the level of allowable development with comparable justification as the NYRLUP. The RSA

is part of LMU 7 (Dalglish Creek), classified as an IMA Zone IV, allowing for the highest level of development.

Like the NYRLUP, the PWRLUP encourages results-based management and uses the same cumulative effects indicators, surface disturbance and linear density to inform decisions. The PWRLUP cautionary and critical indicators are identical to the NYRLUP: 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density. As surface disturbances reach a level of functional recovery and no longer enable travel or access by wildlife and people, they can be subtracted from the total amount of disturbed area. The PWRLUP suggests using a 1.5 m woody vegetation height as a threshold for functional recovery in forested or shrubland areas. In areas dominated by low-growing vegetation, a feature could be considered functionally recovered when covered by native species roughly the same height and composition as the surrounding vegetation. To be considered as "functionally recovered," features must have similar sediment and run-off compared to background levels, roughly match original contours, and have no human-brought materials on the site. Exceptions to the linear density calculation are identical to those outlined in the NYRLUP.

1.5 BASELINE DATA AND MANAGEMENT PLANS

Baseline environmental information and data are required for proposed oil and gas projects submitted to the YESAB Executive Committee for screening under the *Yukon Environmental and Socio-economic Assessment Act, S.C. 2003, c.7* (Government of Canada 2003) (*YESAA*), and applications submitted for other permits and licences. To receive authorization for the Eagle Plains Project to proceed, the Project must be evaluated under *YESAA*.

Environmental baseline reports describing current conditions and outlining specific objectives, as identified in YESAB's *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (YESAB 2005), have been prepared and will be included in the Project proposal submission and following the regulatory process moving forward, once defined. A series of management plans are under development by Chance to provide additional information on infrastructure design and component-specific activities, including follow-up monitoring. These plans will be further developed to include any input from potentially affected First Nations, residents of communities, territorial and federal government departments, and recommendations from the YESAB Executive Committee.

1.6 COLLABORATION WITH FIRST NATIONS AND COMMUNITIES

Chance is committed to developing collaborative working relationships with potentially affected First Nations through the ongoing consultation and engagement process, including the Tetlit Gwich'in Council, Tr'ondëk Hwëchin, the First Nation of Na-Cho Nyäk Dun, and Vuntut Gwitchin First Nation, and residents of nearby communities. The Draft Project Description is one of the multiple opportunities for leadership, individuals, and groups within these communities to share comments, concerns, and recommendations regarding Project activities. Chance will work to incorporate feedback shared on the Project to maximize Project-related benefits for potentially affected First Nations and residents of communities, to address concerns and mitigate potentially adverse effects.

2 PROJECT OVERVIEW

This section provides a summary of the proposed program. Subsections provide additional details on the seismic and exploratory drilling programs, the DST and EFT, accessory Project components, reclamation and closure information, and an overview of Project components and schedule.

The Project area comprises approximately 2,400 km² of oil and gas claims on either side of the Dempster Highway south and west of the Eagle Plains Hotel. The Project and its principal components are exploratory and have been designed to confirm the quality, quantity, and areal extent of any accumulations of hydrocarbons. Hydraulic fracturing is not proposed as part of the Project. Chance intends to conduct Project activities over ten years, primarily during the winter, from winter 2025 to winter 2035.

The Project consists of two phases:

1. Exploration Phase; and
2. Reclamation and Closure Phase.

The key Exploration Phase activities are outlined in **Table 2-1** and the key Reclamation and Closure Phase activities are outlined in **Table 2-2**

Table 2-1. Summary of key Exploration Phase activities.

Project Activity	Key Construction Phase Activity
Engagement	Ongoing engagement with First Nations.
	Ongoing engagement with community residents.
Main Camp	Opening the camp — mobilization of equipment and personnel
	The camp will house the drilling and seismic crew and other support services.
	Construction of the Central Processing Facility (CPF) (once extended flow tests [EFTs] are proposed)
Tree Clearing and Grubbing	Salvage during the winter, before the construction of the winter access roads
Winter Road Construction	Winter roads are required for seismic and well drilling, so will be the first activities of a winter operation.
Seismic Exploration	Access road construction
	Seismic line construction, hazard identification, cutting, surveying, etc.
	Line preparation and drilling
	Data acquisition and recording
Exploration Well site Construction	Well site pads will be constructed using snow, water to freeze the site, a protective liner and rig mats.
Drilling	Up to 30 pads will be constructed and used for exploration drilling over the 10-year life of the Project.
	Remote sump access for drilling mud and rock cutting disposal
	Stripped drilling fluid will be disposed of at deep zone injection wells located at Eagle Plain.
	Completing drill stem tests

Project Activity	Key Construction Phase Activity
	Acid stimulation and completion of wells for testing
Well Testing	Facilities to be installed, as needed, for testing and extended well tests.
	Routine maintenance of facilities, production equipment and well bores, as needed
	Gas is to be flared off, and oil is placed in storage tanks. Recovered formation water (if any) will be disposed of in deep zone injection wells.
Accessory Activities	Winter road construction
	Construction of a winter-use airstrip
	Vehicle traffic related to drilling and construction activities
	Water use permit for lease and winter road construction and waste disposal at the camp
	Baseline data collection and environmental monitoring
	Maintaining and snow-clearing roads and leases
	Water permit use for boilers during winter drilling

Table 2-2. Summary of key Reclamation Phase and Closure Phase activities.

Project Activity	Key Reclamation Phase Activity
Engagement	Ongoing engagement with First Nations.
	Ongoing engagement with community residents.
Seismic Lines	Low impact seismic, narrow construction, stem bending, natural regeneration
Well Suspension	Wells that have successfully undergone EFT will be suspended pending future development approval.
Well Abandonment	Unsuccessful wells and wells not used for disposal will be abandoned when testing or production phases are complete.
	Testing facilities are to be removed from each site.
Mix Bury Cover (MBC) Sump Site Reclamation	The site will be reclaimed as per AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023)
Central Processing Facility	Upon complete field decommissioning activities, the removal of the Central Processing Facility will occur.
Well Site Reclamation	Well site equipment will be removed.
	Area will be allowed to revegetate naturally.
Accessory Activities	Discussions with regulators (as necessary) before reclamation work to determine whether there should be changes to the Plan
	Annual monitoring until vegetation regrowth is deemed satisfactory
	Conduct a Phase 1 Environmental Site Assessment (ESA) for each location.
	Obtain Regulatory Closure approval.

2.1 EXPLORATION

2.1.1 Seismic

Seismic exploration uses a compressional seismic p-wave (like an ultrasound) to remotely image rock layers beneath the surface. The technology measures the reflected energy waves (p-waves), akin to multiple echoes from each rock layer, to identify geological settings where oil and natural gas might be located. This imaging allows geophysicists and geologists to map the subsurface structure of rock formations that could contain hydrocarbons and help pinpoint areas of the greatest potential for drilling a successful well.

Small dynamite charges in shallow holes, called shot holes, are used to create the p-waves that reflect off the various rock layers underground; the reflected p-waves are recorded by very sensitive devices called geophones (that can even detect wind or the footsteps of people passing by). The small dynamite charges within each shot hole force the explosive energy downward through the various rock layers. A seismic detonation of one kilogram (kg) is comparable to the sound of a passing diesel truck and is only 0.5 seconds in duration. The time it takes to receive the reflected sound wave from the detonation tells geophysicists and geologists where the rock layers are, based on where the sound-conducting properties of the rocks change. Very little sound or vibration is perceptible at the surface by anything other than the geophones.

The seismic exploration program will consist of up to 1,500 km² of 3D Low Impact Seismic (LIS) data acquisition and up to 2,000 km of 2D LIS data acquisition. Seismic exploration relies on the geophones placed in a single line (2D) or along multiple, usually parallel, lines (3D). The 2D program may be undertaken as a single program or several smaller programs; the 3D program will be conducted as several programs of 400–700 km² areas. The winter seismic programs will minimize terrain, terrestrial and aquatic environmental effects. The seismic recording will take place in summer to minimize ground disturbance and allow for decreased Health, Safety and Environment (HSE) concerns.

2.1.2 Drilling

The exploratory drilling program consists of up to seven wells, drilled sequentially each year, to a maximum of 30 wells over 10 years. The well locations will be selected based on existing geological and geophysical data, data from previously drilled wells, data from the seismic program, and data from the wells drilled as part of this program.

The exploratory drilling program is planned to begin in winter 2025/2026. Three to five wells may be drilled during the winter, depending on their proximity to the Dempster Highway. Access to initial well sites will be via winter access roads. The well sites will be prepared using winter access methods and rig matting. The winter timing and access location will minimize ground disturbance and potential effects on permafrost and vegetation.

The sequence in which wells are drilled for the exploration program depends on previous drilling success, EFT results, data collected from the seismic exploration program, weather, and road conditions. The ongoing process of interpreting seismic data will allow Chance to understand better the geological setting and size/geometry of potential prospects.

If crude oil or natural gas are discovered in sufficient quantities, Chance will conduct EFT at that well. A maximum of 30 wells may have EFT. The EFT at an individual well can last from several months to several winter seasons, depending on the well and whether the discovery is principally crude oil or natural gas. At a maximum annual drilling rate, with all drilled wells deemed suitable for EFT, 10 wells could be undergoing EFT at any time for this Project.

Once a well has been drilled and tested to determine whether oil and gas reservoirs were encountered, Chance will decide whether to complete the well[1] and conduct EFT or safely and securely abandon the well and reclaim the well site. Once the well completion determination has been made, the drill rig will be removed from the well site and proceed to the next exploratory drilling location.

2.1.2.1 Extended Flow Testing

The EFT provides data on fluid composition, reservoir properties, areal extent, and pressure, both during the EFT and as it builds up following the flow period of the EFT.

If Chance decides to proceed with EFT at a well site, it will be reconfigured to support EFT. A completion, or service rig, will be moved to the site to install the EFT equipment in the well. At the depth where oil or gas has been identified, the cemented in-place steel casing is perforated for fluid to flow out of the geologic formation and into the well.

Some combination of natural gas, crude oil, and formation water (i.e., very deep non-potable groundwater that is usually saline, located in the same rock formation as the oil and gas deposit) are usually extracted during EFT. Fluids produced during EFT will be separated and measured in mobile units on the well pad. Natural gas may be flared but preferentially used as fuel for process heating, mechanical power, and onsite power generation. Formation water will be disposed of by re-injecting it into a compatible and approved geological formation via an existing Eagle Plains well converted to a deep injection well. Existing suspended wells may be converted to deep-injection wells as needed.

2.2 RECLAMATION AND CLOSURE

Progressive reclamation and closure activities are ongoing during the Exploration Phase. This includes the reclamation of winter roads, abandoned well pads, seismic lines, and clearings due to accessory activities. As this Project primarily involves winter activities (except for seismic recording), reclamation will mostly rely on low impact seismic, stem bending, and natural regeneration, intending to minimize ground surface disturbance. A Conceptual Reclamation and Closure Plan will detail reclamation, abandonment, and closure activities.

2.3 ACCESSORY PROJECT COMPONENTS

Additional activities required to support the principal Project components are as follows:

[1] Completion of the well at this stage involves inserting steel pipe, referred to as casing, into the well bore and injecting cement into the annular space between the outside of the casing and the native rock formations to set the casing in place and to prevent any fluids in the rock formation from flowing to surface uncontrolled, and capping the well with a series of valves, referred to as the wellhead, or Christmas Tree.

- Construct a series of Mix Bury Cover (MBC) sumps covering an area of up to approximately 6.4 hectares (ha) to dispose of drill cuttings. These sumps are in an area adjacent to the existing Devon sump (which pre-dates Chance) at km 336 of the Dempster Highway, which has been identified as a suitable location.
- Construct winter access roads.
- Construct an airstrip for seasonal (winter) use on the Chance Winter Road location west of the Dempster Highway.
- Mobilize equipment, supplies, and personnel to the Project and Project area.
- Use the existing Chance Camp at km 325 of the Dempster Highway to house up to 75 workers on a rotational shift basis, and occasionally use the Eagle Plains Hotel,.
- Use a remote fly-in camp near the proposed East Greaves and West Greaves Winter Trails, roughly 40 km from the Chance Camp, to accommodate approximately 25 operations personnel.
- Construct a Central Processing Facility (CPF) at the existing Chance Camp, which will allow Chance to store, further treat/separate fluid produced during EFT and transfer it to trucks for disposal. The additional processing enabled by the CPF will stabilize the crude oil, as required for future truck transport to an appropriate approved crude marketing point.

2.4 SCHEDULE

The Project will enter the YESAB Executive Committee Screening Process by 2024, aiming to have all necessary permitting and approvals by mid-2025. Chance plans to begin exploration activities as early as late 2025, and the Project is planned for up to 10 years. The progress of each component and accessory activity will be scheduled, located, and timed to accommodate factors such as remoteness, weather, seasonal operations, and lack of resourcing, including finding qualified oilfield staff in the region. Certainty around schedule and outcome will be gained as initial data is analyzed from the first few wells that are drilled and had EFT and subsequently from the seismic program. The timing of the three principal Project components and accessory activities is shown in **Table 2-3.**

Exploration activity can start as early as December 2025 and continue for up to 10 years. Scheduling detail is provided for the first three years. The data collected during those initial years will strongly influence future activities' timing, location, and intensity. The schedule only generally accounts for operational interruptions such as severe weather, geological re-interpretation, equipment breakdown or other delays beyond the operator's control.

Chance will engage potentially-affected First Nations and residents of communities throughout the life of the Project.

In summary, Chance will conduct a seismic program staged over five to eight years and drill up to 30 wells over the course of the 10-year Project starting the winter of Project approval. Due to the limitations of the camp and the Eagle Plains Hotel, the exploration work will be undertaken in a logical sequence alternating between drilling and seismic. If a well is successful (i.e., if there is a discovery of crude oil or natural gas in sufficient quantities), Chance will conduct an EFT for up to two years on that particular well.

Table 2-3. Project component and accessory activities timing.

Component	Timing	Details (as needed)
Seismic Exploration Program	except for seismic data recording, the seismic programs will occur during the winter and alternating with the drilling activities due to capacity constraints at the camp.	Subject to this limitation, seismic programs could occur during the 10-year exploration period.
Drilling Exploration Program	alternating with seismic programs initially, starting during the winter months (October through April).	Drilling may be interspersed with accessory activities such as preparing/decommissioning access to well sites, mobilizing/demobilizing equipment, and reclamation activities.
EFT program	timing will depend on the exploration drilling results, primarily the discovery of crude oil or natural gas, and the capacity of the 75-person camp to accommodate the necessary crews.	The EFT will be staggered across the Project area, but it is expected that one or more EFTs will happen in the Project area during the winter operating season.
MBC sumps or pods construction	will occur in every season that drilling is happening, and sumps will be built on an as-needed basis to dispose of drill cuttings	
Airstrip and CPF construction	will likely occur within the first or second winter season.	
Reclamation	will be ongoing throughout the Project's life.	

3 PROJECT DETAILS

Information provided below for each Project component includes its location, key design features, and the results of any relevant investigations to establish site conditions (e.g., seismicity, geotechnical parameters), where applicable. An overview of each Project component and associated activities is described in **Table 3-1.**

The principal Project components in the Exploration Phase are:

1. seismic exploration program.
2. drilling exploration program; and
3. extended flow testing program.

All three components are intended to operate simultaneously, sequentially, or alternatively. The data collected during each program contributes to a more robust characterization of the geological setting in the Project area. A better understanding of the geological setting allows Chance to identify prospects showing potential for oil and gas reserves to accumulate. A combination of existing data and data from seismic exploration, new drilling, and EFT will evaluate these prospects.

The proposed seismic exploration program, consisting of up to 1,500 km² of 3D LIS seismic and up to 2,000 km of 2D LIS seismic, is intended to further identify and map oil and gas prospects where the potential for hydrocarbons to accumulate exists in the Project area. The 3D seismic program will likely be undertaken in a series of smaller areas of 400–700 km² areas and undertaken in a sequential, alternating program with drilling activities. The 2D seismic program could be conducted at once, or as a series of smaller areas connected to a broader program execution strategy.

The exploration drilling program will occur 24 hours per day, seven days per week, once underway, during the winter. When using one drilling rig, Chance will drill one well at a time and up to seven wells per year. Additional wells could be drilled if two rigs are being used. When hydrocarbon resources are discovered (either natural gas or crude oil), Chance will conduct EFT to gather data about the nature of the resource accumulation and its productive capability, which will be used to determine future development plans for each location. EFT timelines vary between wells with a primarily natural gas discovery and wells with a primarily crude oil discovery as follows:

- EFT on wells with a primarily natural gas discovery: maximum of one to two months; and,
- EFT on wells with a primarily crude oil discovery: maximum of two years.

EFT is typically conducted continuously (i.e., 7 days a week, 24 hours a day) until complete; once EFT has begun on a well, pausing or ceasing EFT is logistically challenging and time intensive. Up to 10 wells may be undergoing EFT concurrently, based on the proposed exploration drilling schedule, and up to 30 wells may undergo EFT over the life of the Project, depending on hydrocarbon resource discovery.

The Project does not include hydraulic fracturing.

Table 3-1. Project components and activities overview.

Project Component	Activities

General Project Overview	• Exploration activities for crude oil and natural gas in the Eagle Plains area:
	  ▫ 2D and 3D seismic exploration
	  ▫ Exploration well drilling, flow testing, suspension, decommissioning, and abandonment.
	  ▫ Successful wells will be suspended but may be brought forward in future development project proposals.
	• Use of existing Chance camp to store equipment and supplies and to house personnel:
	  ▫ Water use up to 20 cubic metres per day (m³/day) (for washing, showers, toilets, etc.). Bottled drinking water will be supplied to the camp
	  ▫ Use and maintenance of existing wastewater treatment facilities
	  ▫ 75-person capacity
	• Transport of goods, materials, and personnel to/from the Project area and within the Project area.
	• Project components will occur sequentially at each new well site over the 10-year Project term as follows:
	  ▫ Initial mobilization of equipment to the Project site.
	  ▫ Construction of required infrastructure.
	  ▫ Well site development, drilling, testing, decommissioning, and abandonment.
	  ▫ Progressive reclamation.
	  ▫ Final closure and reclamation.
	• Ongoing engagement with First Nations.
	• Ongoing engagement with local community residents.

Seismic Exploration	• Establishment of seismic line mulching areas:
	  ▫ Up to 1,500 km² of 3D seismic (2.75 m wide source lines, 1.75 m wide receiver lines all mulched)
	  ▫ Up to 2,000 km of 2D seismic (2.75 m wide)
	• Global Positioning System (GPS) Survey of receiver points and source points
	• Low Impact Seismic (LIS) tracked air hammer drilling of seismic shot holes
	• Explosives storage (magazines), transportation, and use (1 kilogram [kg] per source point)
	• Recording with wireless system. Helicopter use for deployment and recovery of recording equipment and conducting data recording.

Drilling Exploration	• Winter establishment of up to 30 well sites, each approximately 1.44 hectares (ha) within the Project area
	  ▫ Site levelling using packed snow or ice and rig matting as required
	• Installation of surface infrastructure on drill sites including:
	  ▫ Drill rig
	  ▫ Mud tanks, pumps, and mud mixing and separation systems
	  ▫ Power generators
	  ▫ Boilers
	  ▫ Flare tanks and flare stack
	  ▫ Blowout preventer accumulator system
	  ▫ Fuel storage

Project Component	Activities
	▫ Cement mixing and storage ▫ Storage bins for rock cuttings removed from the drilling mud ▫ Trailers for offices, first aid, rig crew sleeping quarters, water storage and treatment, sewage storage, and food waste incinerator. • Drilling wells up to 2,500 m deep ▫ Wells drilled sequentially, one to two wells at a time, up to seven wells per year ▫ Use of low-toxicity, water-based mud system ▫ Use of an average of 15 cubic metres (m^3) and up to a maximum of 100 m^3 of water per operating day for drilling ▫ Disposal of drill cuttings into individual Mix Bury Cover (MBC) sumps or pods approximately 300 m^3 over an area of 800 square metres (m^2) (estimated volume of drill cuttings for one well) ▫ Disposal of approximately 200 m^3 of drilling mud in MBC • Drill Stem Tests (DST): one or more on each well at depths where formations with the potential to produce crude oil or natural gas were encountered. ▫ Potential acid stimulation using approximately 5–10 m^3 of a weak concentration of hydrochloric acid (10-20 percent [%]) ▫ Production and separation of fluids recovered from the well during the DST(s). ▫ Flaring natural gas, separation of crude oil and any produced formation water. • Disposal of formation water, saline fluids, liquid faction of drilling fluids and rig wash underground in deep-injection wells converted from existing suspended wells or wells drilled as part of this Project.
Extended Flow Testing (EFT)	• Installation of surface and subsurface equipment and facilities to enable EFT including: ▫ Casing of entire wellbore and perforation of the casing at zones of interest ▫ Packer, tubing, and downhole measurement gauges ▫ Wellhead valve assembly ▫ Flare tank and flare stack ▫ Separator vessel, treating vessel, and storage tanks ▫ Appropriate artificial lift systems (e.g., pumps) ▫ Heaters ▫ Dehydrators ▫ Flow lines ▫ Metering equipment ▫ Portable generators • Conduct EFTs on up to 30 wells ▫ May be completed within a few weeks at a predominantly natural gas bearing zone or may require up to 2 years for a predominantly crude oil-bearing zone. ▫ Separation of natural gas, crude oil, and formation water ▫ Production of crude oil and transportation of produced crude oil from the site to markets. ▫ Using natural gas on site for process heating, storage tanks and other vessels used, fueling artificial lifting to assist crude oil production, or compression of natural gas to be used in other areas of the operation such as fuel to heat the camp. ▫ Flaring natural gas during EFT if unable to use on site.

Project Component	Activities
	• Disposal of formation water, saline fluids, liquid faction of drilling fluids and rig wash underground in deep-injection wells converted from existing suspended wells or wells drilled as part of this Project.
Well Maintenance (Workovers)	• Suspended wells are inspected annually, and active wells are subject to servicing on an as-needed basis to address operational issues that interrupt the EFT, requiring mobilization and installation of a service rig to the well site to remedy the problem. • Maintenance activities include: ▫ Wellhead Inspection Pressure Test of surface wellhead valves ▫ Surface Casing Vent Flow test ▫ Gas Migration test ▫ Repair or replace pumping equipment ▫ Clear blockages to fluid flow that can develop during EFT ▫ Replace worn-out downhole equipment ▫ Set up EFT in other formations within the same wellbore ▫ Suspend or abandon wells after EFT
Access Roads	• Construction of winter trail access for exploratory well drilling, DST, EFT, and seismic program access and execution. • Clearing woody vegetation along identified route above the surface of the snow. • Minimum of 10 centimetres (cm) of packed snow accumulation, packing snow and, in some sections, spreading water to create ice on the ground surface. • 8–10 m wide with wider pullouts of 16–20 m spaced every 5 kms to allow for passing traffic. • The total length of winter access roads per season will vary based on locations identified for exploration drilling each winter; new well sites will be accessed using existing/previously used routes as much as possible to minimize new clearing and linear disturbance. ▫ Each season, a maximum of 125 km of new (previously uncleared or used more than ten years ago) winter access roads will be created. ▫ Approximately 15% of the roads will be built on previously disturbed ground (old roads, cutlines, etc.) ▫ A maximum of 200 km of winter access roads (new winter access + previously cleared winter access) will be active each season. • Clearing of vegetation.
Mix Bury Cover (MBC) Construction and Operation	• Construction of MBC sump approximately 6.4 ha total in area to dispose of drill cuttings and drilling by-products. ▫ The sump will be excavated as disposal volume is required to minimize potential permafrost exposure (possibly in narrow compartments oriented east-west to maximize shading). ▫ Each MBC “pod” will be 800 m^2 and contain the drill cuttings from one well; only one pod at a time will be active/excavated. ▫ A typical well produces up to 300 m^3 of drill cuttings for disposal; development of the MBC would parallel the rate of exploration drilling (i.e., typically 1,500 m^3 of drill cuttings for disposal each year) • Removal and stockpile of organic cover material and silts for use in reclamation.
Central Processing Facility (CPF)	• Construction of CPF adjacent to the camp, which would include: ▫ Multi-stage and multi-phase separators ▫ Heat treatment

Project Component	Activities
	▫ Vapour and gas collection system for flares or to provide fuel for camp use ▫ Processing of crude oil to stabilize and meet specifications for truck transport ▫ Storage of approximately 3,180 m³ of crude oil ▫ Storage of approximately 119 m³ of formation water • Fuel storage facility ▫ 151,000 L diesel fuel ▫ 24,000 L propane • Storage and use of chemicals and reagents: ▫ Hydrochloric acid (10% to 20% concentration) ▫ Methanol ▫ Additives to prevent corrosion of oilfield processing and handling equipment ▫ Demulsifiers to be used in treating fluids to better separate oil from formation water • Bulk explosive compound to store dynamite for seismic exploration.
Airstrip	• Construction of an airstrip approximately 1,500 m long located at about km 4 along the Chance winter road from the Dempster Highway intersection • Airstrip use throughout the Project life, approximately two flights per week. • Aviation fuel storage
Water Use	• Use of up to 300 m³ of water per day (or per permitted limits) for making snow to build winter trails, ice roads and temporary well sites, not exceeding 10% of the instantaneous flow from the following extraction points: ▫ Year-round extraction from the Eagle River, Ogilvie River, and Whitestone River. ▫ Seasonal extraction from Glacier Creek and Fly Camp. • Use up to 20 m³ of water daily (for washing, showers, toilets, etc.); bottled drinking water will be supplied to the camp. • Construction of a water reservoir at the camp for water storage and use during low water periods.
Transportation	• Use Dempster Highway, North Klondike Highway, and Alaska Highway to access Project site. • Approximate offsite traffic on public roads between the site and supply points is estimated to be: ▫ 7–10 water trucks and up to 3 fuel trucks per week. ▫ 8–9 lightweight service vehicles per week as needed. • Onsite traffic on Proponent-controlled roads is estimated to be: ▫ Fuel and water deliveries at a rate of 5-8 trucks per week. ▫ Lightweight service vehicles daily to transport personnel and gear from camp to well sites.
Camp and Workforce	• Up to 75 people on-site during all Project components. • Continued use of existing 75-person Chance Camp, located at km 325 of the Dempster Highway. ▫ Existing waste management and disposal facilities. ▫ Existing wastewater treatment infrastructure. • Use Eagle Plains Hotel to accommodate personnel overflow for short periods, if required.

Project Component	Activities

Reclamation and Closure	• Progressive abandonment and reclamation of unsuccessful wells.
	  ▫ Installation of cement plugs across all porous/permeable zones within the wellbore, across the base of each casing section and including an overlapping portion below the surface casing with the base of the surface casing.
	  ▫ Cutting a surface portion of well casing(s) off at least 1 m below ground level and welding steel plates to cap the casing.
	• Progressive decommissioning and reclamation of access routes when they are no longer necessary.
	• Well suspension or abandonment at the end of Project.
	• Decommissioning and reclamation of the MBC sump area and airstrip at the end of the Project.

3.1 SEISMIC EXPLORATION PROGRAM

3.1.1 Seismic Data and Drill Locations

Seismic uses a compressional seismic p-wave (like an ultrasound) to remotely image layers of rock beneath the surface. The technology measures the reflected energy waves to identify geological settings where oil and natural gas might be deposited. This imaging allows geophysicists and geologists to map the subsurface structure of rock formations that could potentially contain hydrocarbons. The placement and orientation of these layers help to pinpoint the area with the greatest potential to drill a successful well.

Source points use small dynamite charges in shallow holes to create the p-waves that reflect off the various rock layers underground like an echo to be recorded by highly sensitive recording devices called geophones. The detonations used to create the seismic wave are contained within the hole to force the energy downward through the various rock strata. A seismic detonation of 1 kg creates a dull thud that can be heard only near the hole. It is comparable to a passing diesel truck for ½ second duration. As the energy bounces back to the surface, the geophones detect the seismic waves and record the data **Figure 3-1.** The time it takes to receive the sound wave from the detonation tells geophysicists and geologists where the rock properties change, helping to find the oil and gas deposits. Very little reflected energy is perceptible at the surface by anything other than the highly sensitive geophones.

Once all source points have been detonated in sequence, the data are processed and analyzed. The interpretation of the seismic data can give geophysicists detailed cross-sections (2D seismic lines) and multi-dimensional graphics (3D seismic programs) of the sub-surface area. This information is combined with previously known information about the rock types within the area and their properties, such as hardness, density and porosity, to support drilling locations for wells. The decision to drill wells or acquire additional seismic is determined by the amount and quality of the data available (**Figure 3-2**).

Decisions to drill wells or acquire additional seismic data is an ongoing process to define the resource potential in a particular geological formation or geographic region and is a combination of geological and geophysical efforts. The process includes ongoing seismic acquisition and geological evaluation as the wells are drilled and production capabilities are examined.

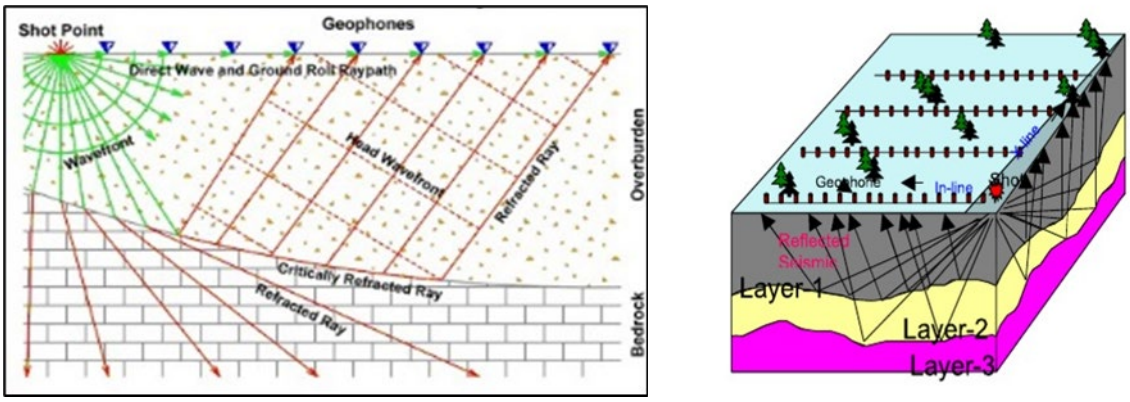


Figure 3-1. A graphic example of the reflection seismic exploration data collection process.

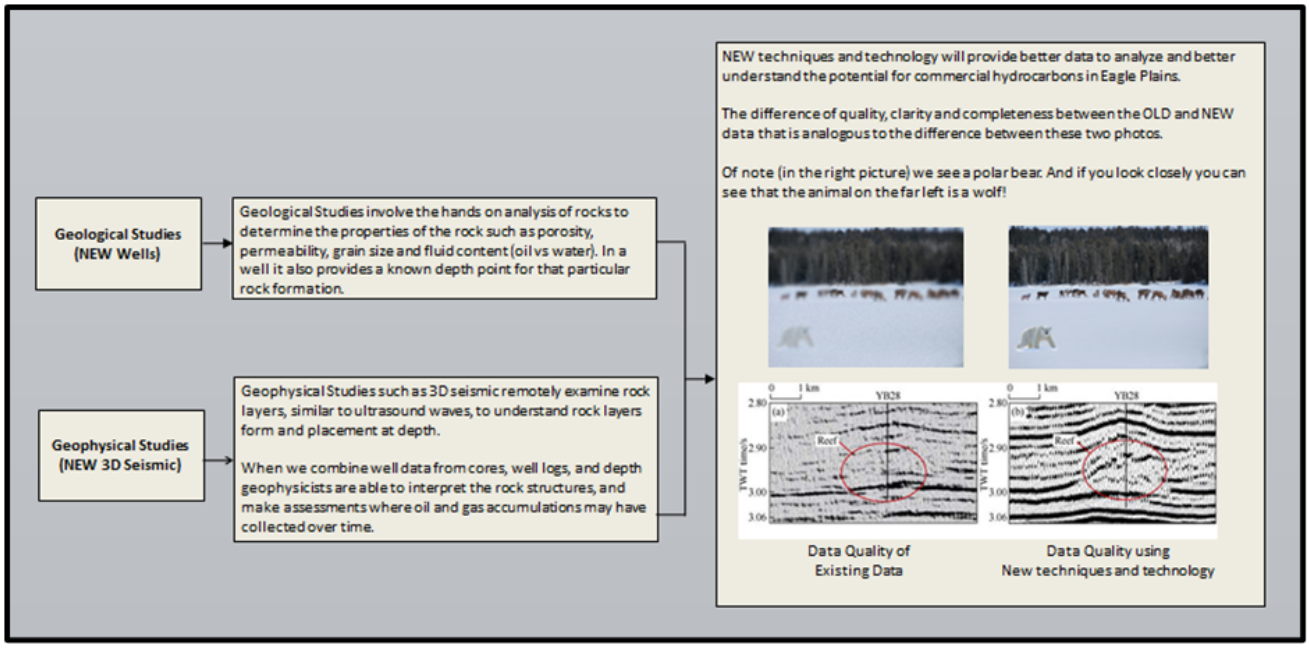


Figure 3-2. Example geological and geophysical studies.

3.1.1.1 Seismic Data

Seismic data is required in the Eagle Plains Basin to understand the area's complex geology. Modern seismic techniques will provide high-quality information about the geology of Eagle Plains while minimizing environmental effects. The proposed area for seismic exploration consists of about 1,500 km² of new 3D and 2,000 km of new 2D reflection seismic exploration within Chance's exploration permit area. **Map 3-1** illustrates the extent of the exploration area. However, the location of each annual seismic program, whether 2D or 3D, will be determined by analyzing the exploration drilling results and how seismic may help determine the knowledge of the basin. Low Impact Seismic 2D programs can be used to determine the extent or edge of a prospect, and LIS 3D will show more detail.

Depending on available accommodations, personnel, and equipment, the seismic data will likely be acquired in several discrete programs of approximately 400–700 km² areas. Year-round operations will enable resource allocation by completing line preparation during the winter and conducting the recording activities during the summer using heli-portable operations. Lines will be prepared in winter when snow is present, and the ground is frozen. Winter ground preparation will protect the active layer and underlying permafrost and preserve saplings and small shrubs. Year-round operations will enable larger portions of the seismic program to be completed with reduced disruption within the Project area.

For LIS 3D, a design is created by a professional 3D designer. For the Eagle Plains area, receiver lines will have an east/west orientation, and source lines will be oriented north/south. The spacing between points is determined by the level of data resolution required to image the shallowest rock formation of interest. It is estimated to vary between 40 and 50 m since the geology at Eagle Plains dips from the northeast (NE) to the southwest (SW). For a given layer of rock, it will be physically shallower in the NE part of the basin and deeper in the SW. The receiver lines will be mulched with the narrowest mulch head size (1.75 m wide), allowing for safe travel by foot, snowmobile or ATV and will run roughly parallel to other meandering receiver lines spaced approximately 200 m apart. The north-south source lines will be mulched (2.5 m wide) to allow access for the tracked drills that make the shot holes. The source lines run roughly parallel to other meandering source lines approximately 300 m apart. For LIS 2D, the geophones and sources are located within the same meandering, about 2.5 m wide, line.

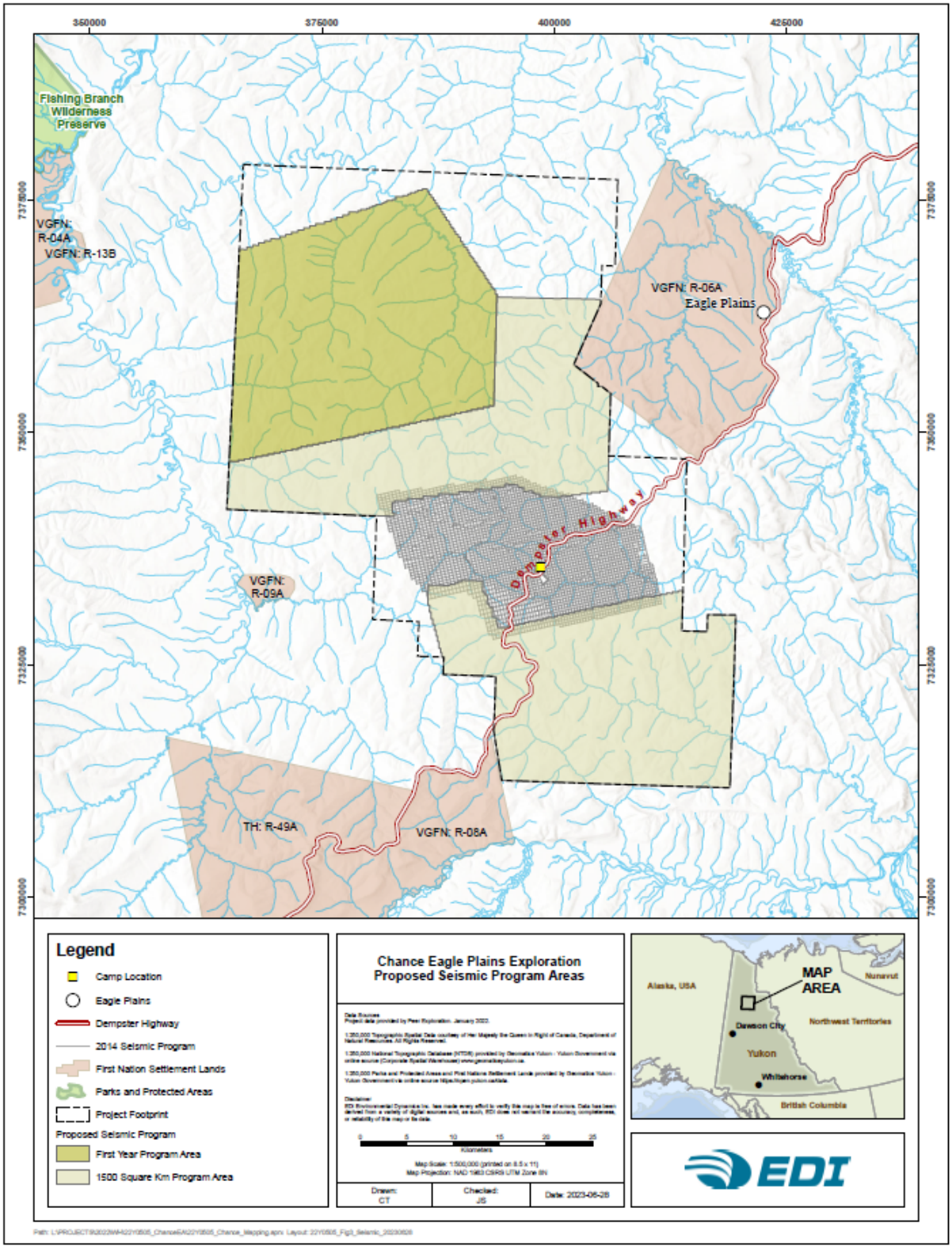
During the recording process, each source point is detonated separately upon the initiation of a radio signal directed by the field operator called a “shooter”. The shooter is positioned at least 30 m from the active station and can survey the surrounding environment to observe detonation safety. The source point that will be detonated is in the source “swath” area and provides a center point for the recording patch. A recording “patch” is the area of live (active) geophones that are closest to the source point swath area (within 3,000 m). Upon detonation of the source point within the swath, the geophones in the recording patch collect the data. For the Eagle Plains area, the patch size is comprised of 16 lines containing 140 geophones each (**Figure 3-3**). The patch ensures that far offset distances are greater than the depth of target formation; therefore, the data will encompass areas large enough to prevent gaps in the data. The patch is moved digitally and physically as the shooter travels from east to west and then north to south. Geophones are continually picked up from the recorded area and moved to the next area ahead of the recording patch.

As seismic program data will be acquired over several years, naturally occurring fires are likely in the area. Several fires have occurred in the Eagle Plains basin, and approximately 60% of the Project area has been burned. The most recent wildfire occurred in 2017, burning 294 km² within Chance’s exploration permits 0010 and 0012 (**Map 3-2**).

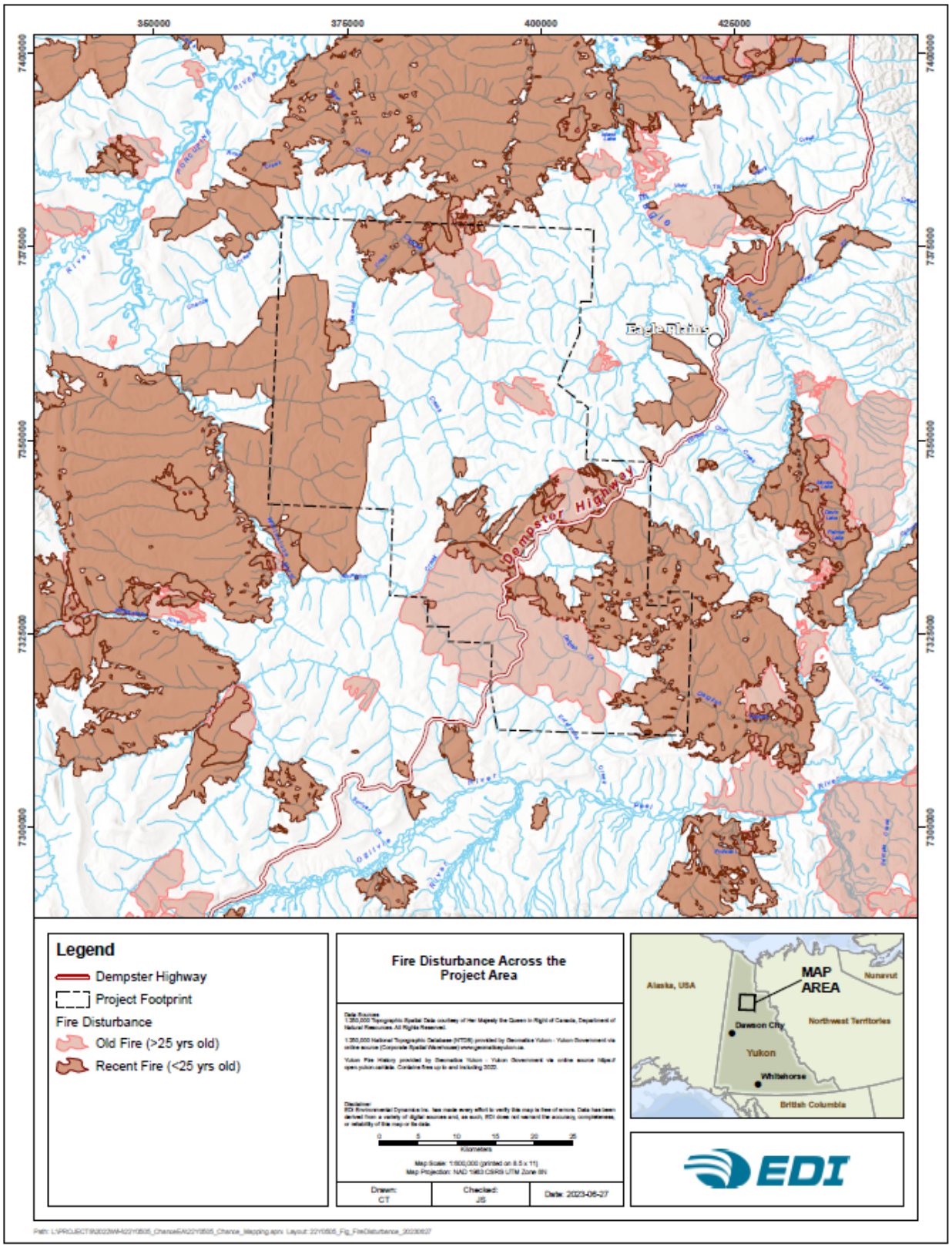
Each year that a seismic program with be conducted, an analysis of mitigation strategies is undertaken, and appropriate strategies are implemented to reduce the environmental effects in the area. One example is using existing burn areas rather than clearing new vegetation where possible. The proposed first-year seismic program was designed considering the existing open meadow and burn areas. Lines traversing these areas will not disturb live vegetation and should not be regarded as a functional disturbance. Regrowth in these areas will also be monitored to gauge the natural regeneration conditions in the area. Previous LIS seismic line disturbances will continue to be, analyzed to ensure that current methods of line

preparation provide optimal conditions for regrowth in the Eagle Plains area. Ecological, permafrost and historical data have been extensively gathered and incorporated into the operations plan.

Seismic operations are planned for year-round operations in the year that they are to be conducted, based on length of time required to conduct each component of the program and the limited personnel, equipment, and accommodations available in the Eagle Plains area. The line preparation (access trail construction, line cutting, surveying, and drilling) will be conducted during the winter months (December through April) under frozen ground conditions and recording would then follow in the summer months (July through September) (**Figure 3-3**).



Map 3-1. Proposed seismic program area in the Eagle Plains Project Area.



Map 3-2. Forest fire burn areas in Eagle Plains.

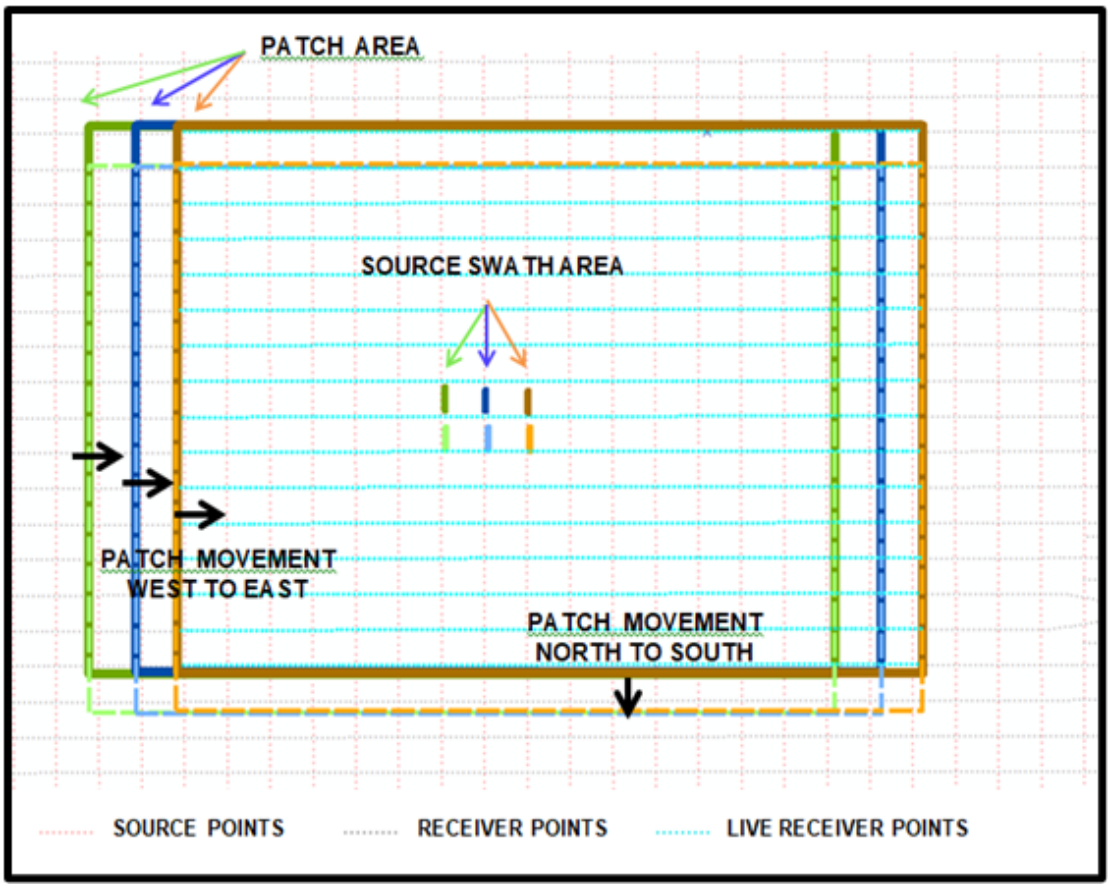


Figure 3-3. Proposed seismic patch size and movement throughout the Program area.

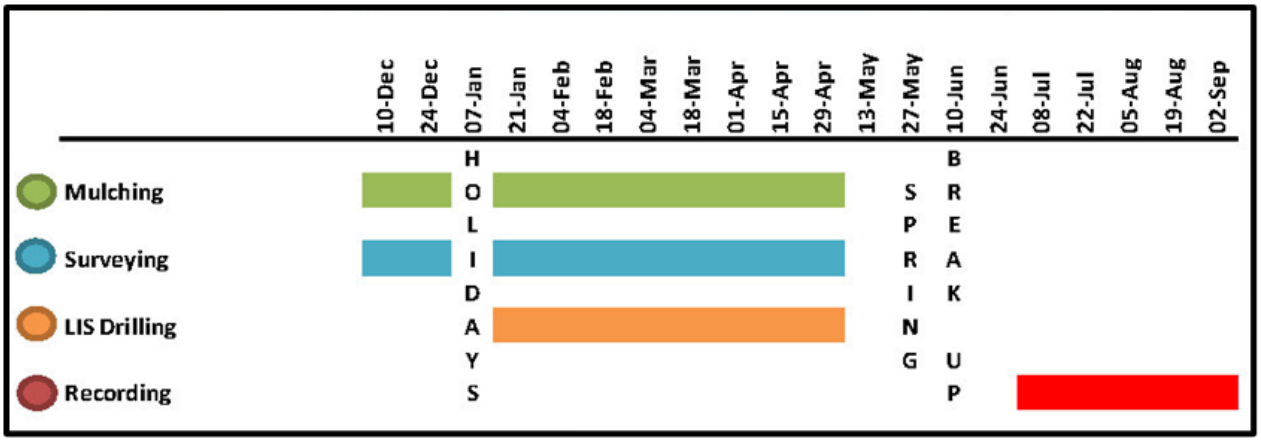


Figure 3-4. Proposed year-round schedule in Eagle Plains.

3.1.1.2 Seismic Line Construction

The historical seismic data in the Eagle Plains area consists of “Legacy” 2D seismic lines and the “Modern” LIS 3D seismic program conducted in 2013–2014. The methods used to construct the Legacy 2D lines included 6–10 m wide lines in straight (linear) patterns that cross the landscape. These lines are visible today mainly due to the use of bulldozers to remove over/understory — clearing methods and wider lines that are not required in modern LIS practices. Modern LIS line construction methods use narrow line widths that meander and create non-linear line disturbances. Bulldozers are no longer used in seismic line construction; smaller and narrower mulchers are now used to support the preservation of the active layer and reduced vegetation removal.

Line preparation will use the LIS methods, reducing the landscape footprint. This technique creates meandering source and receiver lines that limit the line of sight to less than 70 m, which minimizes any predator (e.g., wolf) line of sight for prey. The LIS method also ensures that the line can avoid removing larger timber that shelters under canopy vegetation by adjusting the meander of the line to avoid larger trees and mature vegetation.

3.1.1.3 Constraint and Sensitive Habitat Identification and Mitigation

Before line preparation, a detailed line-by-line spatial analysis (area examination) is performed using a combination of air photos, Light Detecting and Ranging (LiDAR), field scout information, Geographic Information System (GIS) information, First Nation cultural inputs and heritage studies, permafrost studies and flora and fauna assessments. Existing disturbances, burn areas, and natural open areas will be used rather than create new cutting where possible. Topography, natural drainage, and runoff patterns will be considered when developing the seismic design to prevent impediments to water flow. All lines will have offsets to protect sensitive habitats. Streams and rivers will be avoided except for crossings at access points. Doglegs will be used where lines intersect major access routes to reduce visibility and use as access.

Planning the seismic, winter access, and well pad sites considered water, landscape, landform (e.g., permafrost), vegetation and habitat sensitivities to disturbance. A “Constraints Map” exercise was conducted to identify especially sensitive or high quality environmental and heritage values where project work should be avoided. Constraints include areas that are sensitive for environmental, cultural, or safety reasons. In seismic exploration, the term “constraints” is often referred to as “hazards”. Examples of environmental values in Eagle Plains include permafrost areas, high-value wildlife habitat, wetlands, riparian areas, and heritage sites. Management measures applied with the constraints map include complete avoidance of project development/activities within the mapped areas and a range of other types of mitigations where avoidance is not possible — examples include rig matting, winter work, LIS, etc.

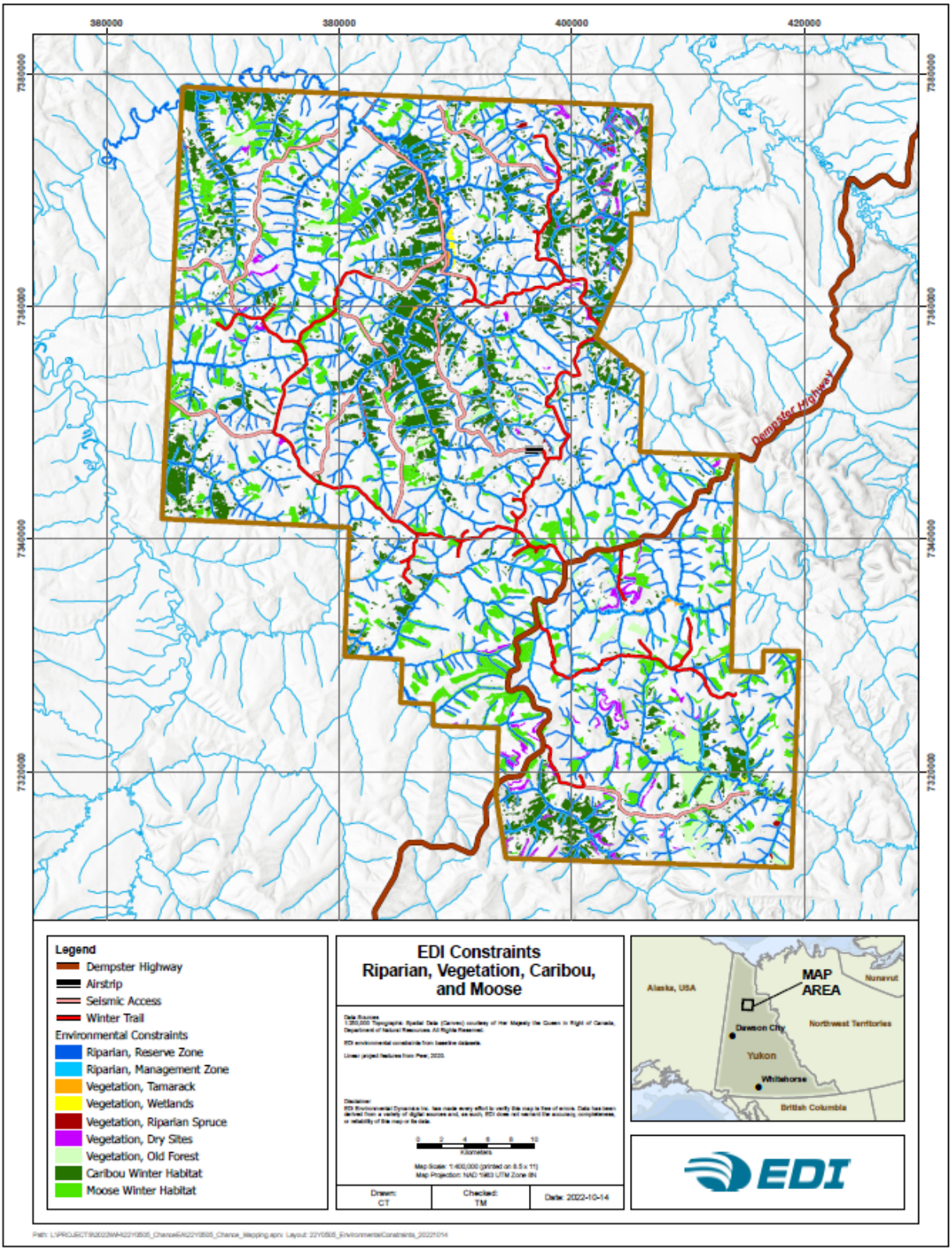
Developing and applying a constraints map for environmental and heritage sites is especially useful when certain project features cannot be preplanned (i.e., mapped), which is the case for multiple features in the Eagle Plains Project. Since Chance cannot plan exactly where Project features will occur as exploration proceeds, identifying high value areas where Project features cannot occur is a good approach to mitigating potential effects.

Details of the constraints mapping approach will be provided in the environmental assessment portion of the Project Description. Several important landscape and ecological features were considered, but the key features built into the constraints map (**Map 3-3**) included the following:

- Surface water and fish were considered by creating no-disturbance buffers in riparian areas to higher order streams where fish are likely present in the summer.
- Vegetation was considered by identifying sensitive Ecological Landscape Classification units including dry sites, riparian spruce sites, tamarack sites, and unique wetland sites.
- Moose habitat included high-rated forage sites.
- Heritage sites and high heritage potential identified by the Yukon Government, First Nations, or site-specific surveys.
- Caribou high value forage habitat.

The avoidance priority considering all constraints is as follows:

1. Heritage sites;
2. Permafrost/terrain sensitive areas;
3. Riparian management areas;
4. Priority ELC units;
5. Caribou habitat; and,
6. Moose habitat.



Map 3-3. Constraints Riparian, Vegetation, Caribou, and Moose.

Pre-flagging may be conducted to identify Pand mark line locations containing riparian areas, difficult terrain, hazards or constraints, historical/archeological areas, animal features and facilities. This is done by personnel on the ground marking the line locations and areas of concern for the mulchers and chainsaw operators to follow or avoid. These areas will be added to the Project map and used to plan each area's activities strategically. Decisions can be made to delay progress in certain areas due to wildlife presence or to employ different equipment that would be better suited to the terrain in that area. In addition, geofences can be created to monitor activities near “Hot Spots” which are areas of concern that personnel must avoid. Handheld GPS units support accurate line placement and automatically notify management when the mechanical equipment approaches a “Hot Spot” or stations encroach on any buffered zones or areas. Personnel trained to monitor the production crew’s location based on the GIS data gathered during the pre-flagging stage to ensure designated equipment and personnel in the area are safe.

3.1.1.4 Line Preparation — Cutting

A combination of mulchers and operators with chainsaws will prepare source and receiver lines that will be closely monitored and quality controlled. Mulchers (**Photo 3-1)** are equipped with GPS units with seismic line data to allow the operator to follow a pre-planned course. Mulcher operators have detailed information on the area’s pre-identified hazards or constraints, culturally sensitive locations, flora and fauna setbacks, and course derivations, and the operator takes care when approaching these areas of concern. Lines will be doglegged (or bent) at locations crossing any major access trails and open clearings to reduce the visual identification of access points into the program area. Meandering line construction chooses the path of least resistance and avoids timber larger than 20 to 30 cm in diameter (**Photo 3-2** and **Photo 3-3**). This technique reduces the line of sight down line to less than 70 m. Studies conducted on the 2014 3D seismic program found that the average off-line sight line was 46 m due to the region's sparse tree density and large burn areas.

Source lines will be mulched to 2.5 m wide (**Photo 3-2**) to accommodate tracked LIS drill vehicles, and receiver lines will be 1.75 m wide (**Photo 3-3**) to accommodate snowmobiles, ATVs and personnel. A minimum of 10 cm of packed snow will be left online to mitigate possible damage to vegetation or permafrost. Riparian areas and lines containing pokers or leaners will be hand cleared with chainsaws.

The seismic line preparation will be done using rough mulching: a technique that removes the branches but leaves the tree's stem intact. This technique is useful in leaving evenly distributed coarse, woody debris allowing for more rapid decomposition of the fallen timber while enabling the new vegetation to propagate through the mulch (**Photo 3-4**). The mulcher heads are set to high blade, leaving the active layer undisturbed and soil or permafrost unaffected. The mulch also protects the root system of young timber from heat, cold, drought and erosion. Rough mulching makes lines narrower, creating more natural lines with weakly defined cut-width edges.

The Eagle Plains Basin has few watercourses of substantial size. Most watercourses are intermittent and have little or no year-round fish-bearing potential as they freeze to the bottom in winter. The most notable watercourses are Chance Creek and Greaves Creek (in the North), McParlon Creek (Central) and Dalglish and Enterprise Creeks (in the South). The Whitestone River is west of and outside of the Project area.

Since creeks in the program area freeze to the bottom in winter, no “major” watercourse crossings will be required. A major watercourse crossing is any stream or river that will not freeze to the bottom or the water flow is too great to sustain a snow fill crossing. Crossings are categorized as mechanical (equipment crossing) or foot crossing. The mechanical crossings (**Figure 3-5)** will be constructed using snow fills and may require a water truck to make snow and freeze in the crossing. Water crossings are first packed with clean snow pushed from the creek surface to the crossing location. This prevents woody debris from contaminating the creek during spring melt. The snow is then hardened using a water truck to form ice to strengthen crossing integrity with the weight of the equipment. Snow fills in both creeks and drainage areas will preserve the integrity of the banks for adequate water flow and run-off. All crossings will be removed before spring break-up to allow obstruction-free drainage. All snow fills will be constructed following the Department of Fisheries and Oceans (DFO) *Code of Practice: Ice Bridges and Snow Fills* (September 2022) (Government of Canada 2022).

Riparian areas are also examined and added to the program map. Since riparian areas provide key resources for wildlife and bank stability, mechanical equipment is restricted to a 55 m setback from the bank edge. This setback protects vegetation disturbance in the area and makes sure source holes terminate at a safe distance to avoid flowing holes (**Figure 3-6)**.



Photo 3-1. A 2.5 m wide mulcher.



Photo 3-2. A 2014 3D source 2.5 m wide line in the Project Area.



Photo 3-3. A 2014 3D receiver 1.75 m wide line.



Photo 3-4. 2019 photo showing 2014 3D source line construction and deadfall from wildfire.
Note: minimal disturbance to the active layer and minimal mulch produced.

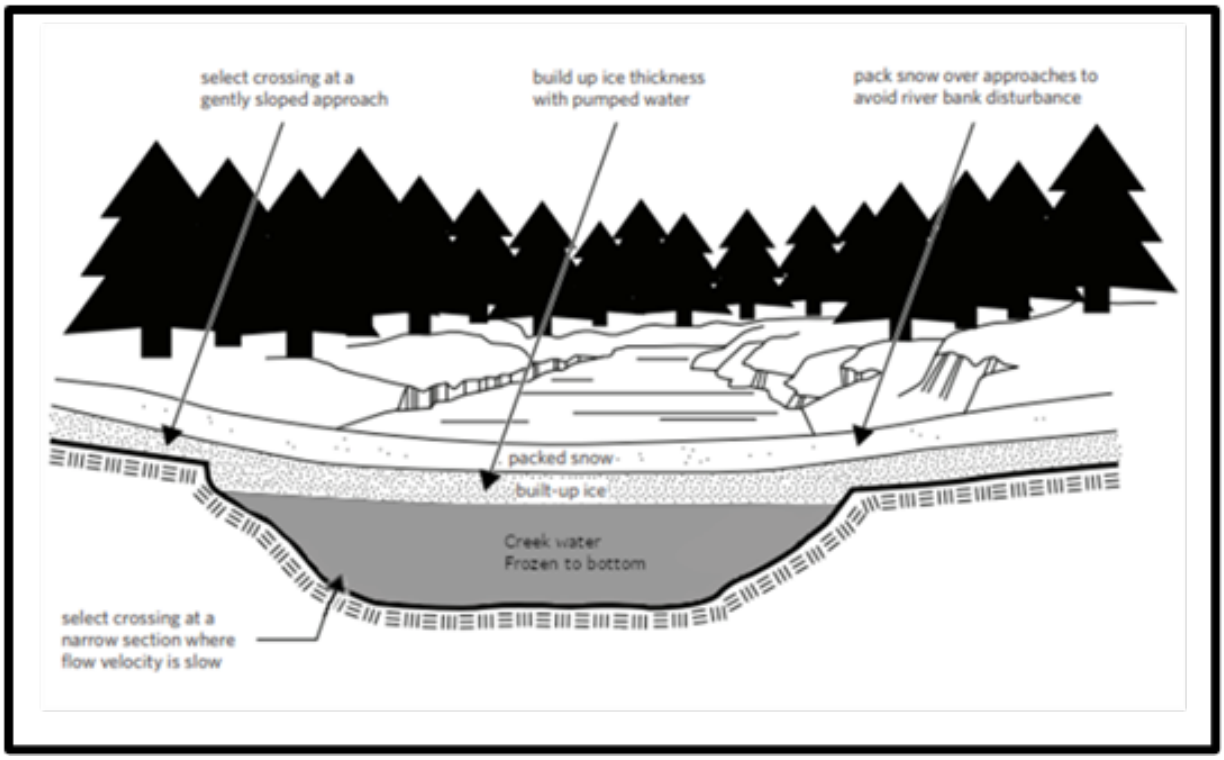


Figure 3-5. Typical creek crossing in Eagle Plains. Creeks are crossed at a 90-degree angle to banks to preserve bank stability.

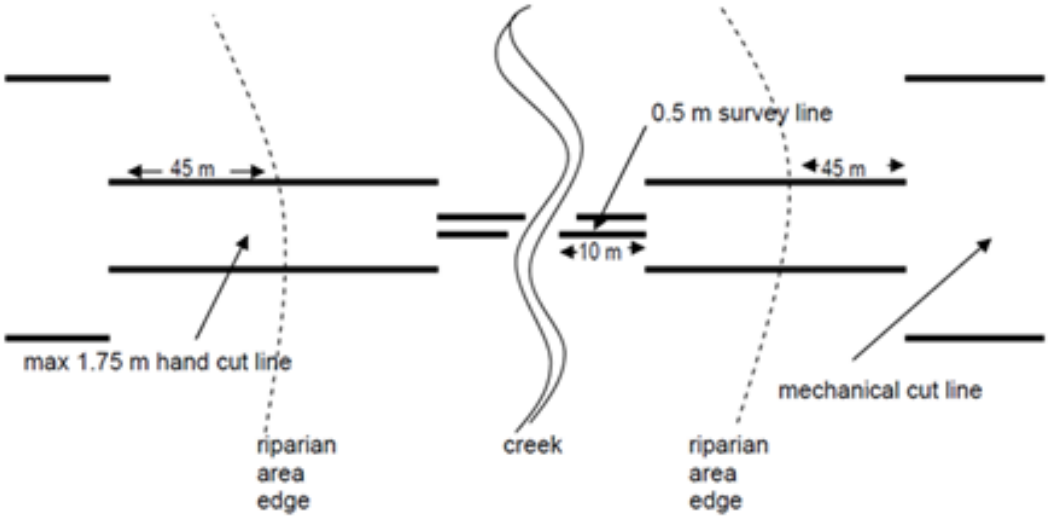


Figure 3-6. Riparian area diagram with cutting and mechanical equipment setbacks.

3.1.1.5 Line Preparation — Surveying

Once there are a sufficient number of source and receiver lines cut to allow the next stage of the seismic program to occur, surveyors then travel the source lines using all-terrain vehicles (ATVs) and snowmobiles to survey and mark each drill location of the source holes; and on receiver lines they mark the receiver points where the recording crew will place the wireless geophones.

Surveyors also add to the hazard/sensitive site assessment map as they record their GPS data. These data include:

- riparian areas;
- difficult terrain;
- historical/archeological areas;
- animal sites/features;
- facilities;
- hazard identification;
- proper line placement;
- movement around thick bush;
- refining cutting requirements; and,
- flag all hazards or constraints and riparian areas.

3.1.1.6 Line Preparation — Drilling

Once source points are surveyed, narrow-tracked LIS drills (**Photo 3-5)** are deployed to drill a 10 cm diameter, 6 m deep hole at each location. For the proposed seismic programs in Eagle Plains, the source points will be spaced along the source lines at approximately a 50 m interval.

No water was required to drill the source holes during the 2014 seismic program, and cuttings were easily reloaded into the hole chamber after the dynamite was placed at the bottom of the hole. Source holes are loaded with 1 kg of dynamite to be later detonated by the recording crew (this is called pre-loading). As

provincial/territorial and federal legislation requires, each source point is plugged with drill cuttings (soil, rocks, etc.) brought up to the surface from the drill stem). An industry-approved plug is inserted into the hole at a minimum depth of 30 cm below the surface and then filled to the surface with more drill cuttings.

Peer and the industry's explosive providers are aware of the regulations under the federal *Transportation of Dangerous Goods Act, S.C. 1992, c. 34* (Government of Canada 1992) and strictly adhere to those regulations. Explosives will only be transported in approved magazines and by individuals trained in transporting dangerous goods. Natural Resources Canada (NRCAN) regulates and controls all aspects of explosive possession and transportation through magazine licenses which are renewed annually. The new Electronic License Management System (eLMS) allows up-to-date management of all explosive purchases, transport, and incidents to ensure explosives are tracked and safely stored. The two types of magazines that will be used to store explosives are as follows:

Maxam Type 9 Magazines (Photo 3-6):

- There are two compartments — dynamite and detonator.
- Type 9 magazines are lined with 7/8" Armortex (Bullet Proofing and Blast Resistant). Dimensions are 58" wide x 144" long x 66" high.
- Doors are high security and built as per NRCAN Regulations and issued a Federal Tag #.
- There will be two different sizes of skidded Type 9 magazines which will store up to 3,000 kg of explosives and 5,000 detonators, depending on packaging. There are also wheeled Type 9 magazines built to the same specifications but with reduced capacities.
- Construction from the outer skin to inside is:
  - ¼" steel plate;
  - 7/8" Armortex; and,
  - ¼" plywood interior.
- Weight is 7,500 pounds (lbs).
- These magazines are transported by either small custom-built tandem axle trailers, tandem axle recovery/tow truck with a flat bed or any truck trailer unit such as a low boy.

Maxam Type 4 Magazines:

- Single-compartment magazine;
- Various sizes — 8' wide x 12' long x 7' high with a capacity 7,500 kg;
- High-security door construction as per NRCAN Regulations and issued a Federal Tag #;
- Construction from the outer skin to inside is:
  - ¼" steel plate;
  - 3" gravel;
  - ¾" plywood interior.
- Weigh 18,000 lbs; and,
- These magazines are transported with either a tandem axle recovery/tow truck with a flat bed or any truck unit such as a low boy.



Photo 3-5. Narrow Low Impact Seismic (LIS) drills.



Photo 3-6. Explosives magazine storage (Maxam Type 9).

3.1.1.7 Data Acquisition — Recording

Recording the seismic program consists of two stages: laying out and picking up equipment on the receiver lines; and detonation at each source hole.

Geophone "Lay-out"/ "Pick-up" — Line crew members place the geophones (**Photo 3-7**) and associated equipment at each receiver point location. Using a long line and heli-bags, a helicopter will place and retrieve recording equipment along the receiver lines at predetermined intervals. Recording personnel will access the equipment in the heli-bags and place a series of geophones approximately every 40 m along the receiver lines. The recording crew will be using a cable-less recording system. Cableless recording systems are ideal for gathering seismic data because they reduce the constraints on geophone placement, eliminate downtime for cable repair, and reduce the number of crew members required to deploy the equipment. Once in place, the geophones record the seismic waves created by the charges detonating on the source lines. Once the section of geophones is recorded, personnel and a helicopter return to retrieve the equipment and any debris used to mark the surveyed receiver locations. The geophones are returned to the staging site, downloaded, cleared and deployed back to the program to be laid out again to record the next section of line.



Photo 3-7. Example of a geophone.

Source Point Detonations — This stage begins after the first section of geophones has been laid out on the receiver lines. Specially trained personnel called "shooters" traverse the source lines on foot, via ATV or snowmobiles, to each source point. The shooter examines the area around the source point for any possible hazards, constraints, or wildlife and inspects the condition of the leads. They connect the detonation device to the leads and signal to the Observer (located at the staging site) that the charge is safe to detonate. The shooter stands clear of the source hole (approximately 30 m) but remains within

viewing distance to watch the area remains clear. A specific radio signal initiates the detonation, and the shooter returns to the hole to remove the detonation device, the leads, and any flagging or markers in the area. The shooter then proceeds to the next source point and repeats this procedure.

Once the program is complete, a crew may be deployed to clean up any remaining material used online for the seismic program. The garbage is returned to a staging point and discarded in an approved bin to be transported to a waste facility. The crew also reports issues that may require further reclamation to be immediately addressed.

During the recording stage, the equipment on the source and receiver lines is accessed by foot, ATV or snowmobile or by helicopter. The helicopter will be based out of the Chance Camp at km 325, and the use of the helicopter will be minimized as much as possible. Where possible, the helicopters will be sourced from local operators familiar with the environment and the Flying in Caribou Country guidance document (Government of Yukon 2010); however, specialized long-lining operators will be required outside Yukon for the recording operation. The addition of helipads will also be required for safety and medevac reasons but will be selected in naturally open and sparsely treed areas.

Staging sites will store some or all of the following equipment throughout the seismic program. All equipment is moved to the next staging site as the equipment is required in the next area of the program:

- Trucks (1/2, 3/4, and 1 ton);
- ATV and snowmobiles;
- Trailers (flat decks and covered);
- Double-walled fuel tanks (diesel 145,228 L, Gas 83,825 L and Jet-A 35,000 L) The fuel will be contained at the main camp in double-walled tanks and transported to the staging sites in a 2,000 L tank trailer for use during operational activities in each area.
- Helicopter & fuel tanker;
- Picker trucks (1-ton trucks with equipment);
- Recording bags;
- Garbage bins to temporarily store garbage before incineration;
- Magazine;
- Survey and drill supplies;
- Canvas tents;
- Medivac unit;
- LIS drill units;
- Seacan for storage and tools;
- Snow cats;
- Water truck;
- Battery truck; and
- Mulchers.

3.1.1.8 Program Access and Remote Camp

Access Trails & Road Crossings — Access routes will be created in strategic corridors to maximize HSE Occupational Health and Safety (OH&S) requirements and to minimize environmental effects. Proposed access trails will be developed using a combination of existing trails, historical seismic lines, or on new cut lines. All access trails will be developed and used to minimize disturbances to the soil, permafrost and vegetation. Where possible, trails will be positioned to follow the shortest and flattest routes, sharing existing linear features or open and burned areas. Construction will follow minimum disturbance techniques, such as mulcher high-blading, to keep the active layer intact. Most trails will be frozen-in or allowed to freeze up naturally.

The width of the access trails will be a maximum width of 6 m wide and will also have a minimum of 10 cm of packed snow. Proposed access is classified as “Winter Trails” and “Seismic Access”. The Winter trails are primary access routes and are expected to be used for seismic, drilling operations and potentially EFT activities with an upgrade to year-round access status. They must be 8 m wide to accommodate two-way traffic and large trailers. Seismic access is only required to be 6 m wide as these trails are only needed for the seismic programs and will be less used. There are potentially 120 km of new “Winter Trail” access and 158 km of new “Seismic Access” to be prepared.

Few new crossings will be required off the Dempster Highway as less seismic is proposed. The areas of the seismic program that encroach on the highway will be managed in two ways. The source and receiver lines will terminate 10 m from the Dempster Highway. Access to the source and receiver lines will be via access trails (connecting the source and receiver lines with the Dempster Highway). The width of access trails will be kept to a minimum while allowing safe access. Access trails will also be doglegged 30 m back from the highway (per the Department of Highways and Public Works guidelines for a 90-degree entry to the highway) (**Figure 3-7**). This will allow personnel an unobstructed view of the traffic on the highway so that safe entry from the access trail to the highway can be made. It also creates an obstructed view from the Dempster Highway users, which will assist in minimizing aesthetic concerns and use as access.

To the extent possible, the intention of the Dempster Highway Development Area (DHDA) will be a primary consideration during line placement of seismic lines near the highway. Travellers also use the Dempster Highway to gain access to the remote regions of the North Yukon and NWT. Chance understands that tourism is an important industry for the area. Since most seismic activity will be conducted during the winter and in remote areas, the effects on tourism are expected to be minimal.

Winter Seismic Transportation — During winter seismic operations, approximately 30 one-ton or ½-ton 4x4 trucks will transport personnel to and from the Chance Camp to their specific job site location daily. It will include mobilization/demobilization and crew transport to and from the main Chance Camp. Using a remote camp will reduce vehicular travel on all roads, including the Dempster Highway, as the proposed remote camp locations are 40 km closer to the seismic program area than the Chance Camp. This will reduce the environmental effects on the roads and surrounding areas and limit the likelihood of accidents or incidents due to travel.

The vehicles will primarily be travelling on the Chance and Blackie roads and other proposed winter access trails, as well as a small section of the Dempster Highway. Any use of the Dempster Highway will occur during specific times of the day as crews will be transported to and from their work site at daybreak, and sundown. Although the proposed project will increase traffic along the Dempster Highway, it is not anticipated to substantially affect users of adjacent Settlement Lands and traditional uses of the area. During the winter, a low number of vehicles (40 to 50 per day) travel the Dempster Highway; therefore, it is anticipated the added traffic for the seismic program will not interfere with regular highway users.

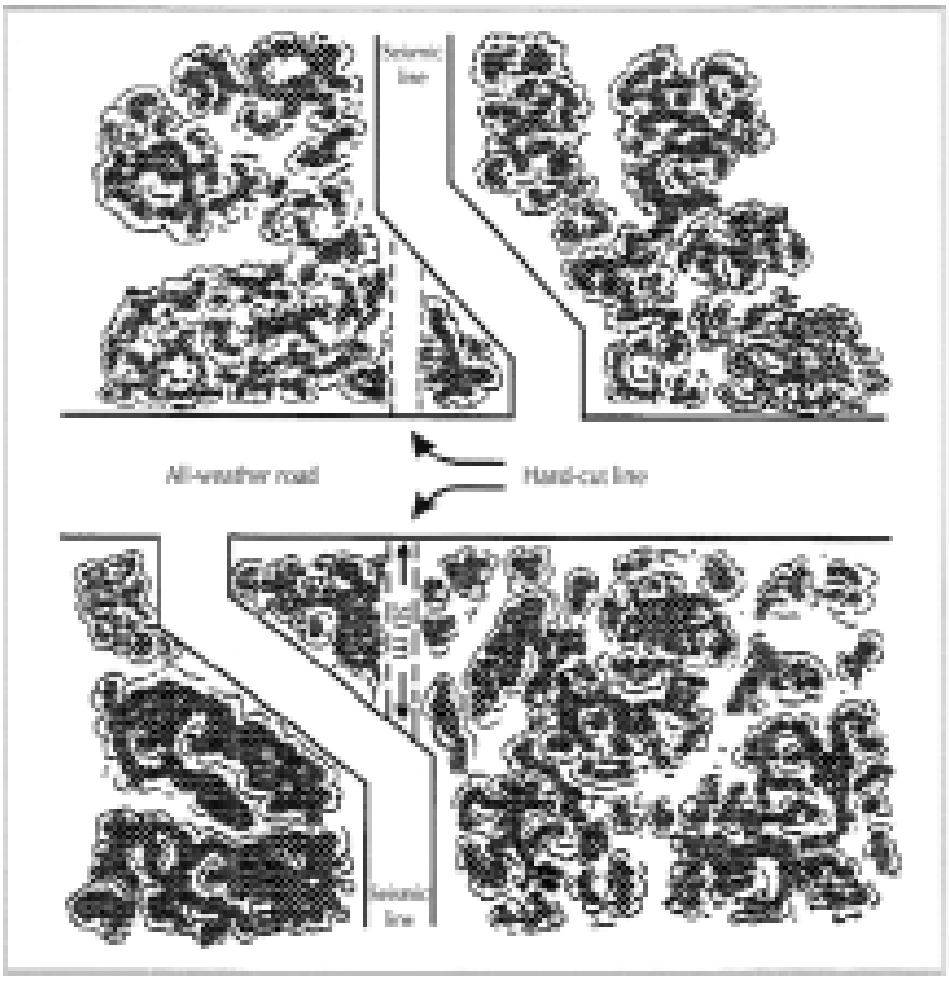


Figure 3-7. "Dogleg" seismic line at access points to limit visibility.

Source: (Yukon Energy Mines and Resources 2006)

Signs stating "Seismic Activity" will be erected in areas where the program is near the Dempster Highway. To avoid possible crew encounters, these signs promote awareness by regular users of the area where the workers are present. The potential for vehicular and hunting conflict will likely be minimal due to the remoteness of the seismic programs; however, crews working on the seismic program are mandated to wear brightly coloured safety vests and hard hats to improve visibility. Seismic crews must also give the right-of-way to all traffic and users of the area. Considering other Dempster Highway users, signage will be posted in communities (i.e., Dawson, Stewart Crossing, Carmacks and Inuvik) one month before the project starts to notify potential highway users that additional traffic may be encountered. Additionally, the Yukon Department of Highways and Public Works will be notified. With these measures, it is anticipated that potential effects on other highway users will be reduced or eliminated.

Summer Seismic Transportation — The summer operations will be limited to seismic recording. Two helicopters (Bell 412 type, capacity of 13 people) will transport workers to and from the program area. This will consist of approximately three trips in the morning and three trips returning to camp in the evening. The recording equipment will be deployed via A-Star type helicopter and long line. Aerial access protects the active layer and underlying permafrost, preserving saplings and small shrubs along the access routes as vehicular traffic will be limited. As caribou are not usually present in the Eagle Plains area during the summer, it is unlikely that they would be affected by the activity in the area. The proposition of year-round activities will also enable larger seismic program areas to be completed in one year, reducing the number of seismic programs needed to acquire the desired dataset.

3.2 DRILLING EXPLORATION PROGRAM

Chance may establish up to 30 well sites during the 10-year Project life, each approximately 1.44 ha. Total approximate disturbance due to well sites throughout the Project is anticipated to be a maximum of 43.2 ha if all 30 wells are drilled.

Initial drilling results will inform subsequent areas of investigation and well site locations. Chance will continue interpreting seismic and exploratory drilling data throughout the Project to understand better the geological setting, size, location, and geometry of potential prospects.

3.2.1 Well Site Locations

Well sites will be preferentially located on heights of land, and will consider the following:

- Avoidance of areas with challenging permafrost conditions.
- Avoidance of ecologically sensitive areas such as riparian corridors (i.e., within 45 m of a perennial watercourse), wetlands, steep slopes, old forest, sensitive wildlife habitat and permafrost features.
- Avoidance of areas with identified or potential heritage values (noted as “avoidance areas”) in Heritage Resource Overview Assessment and Heritage Resource Impact Assessment studies conducted for lands within the Project area (Matrix Research Ltd. 2008, 2013, 2014, Bennett 2022, 2023).
- Requirements from the Yukon *Oil and Gas Act*, RSY 2002, c.6 (*YOGA*) (Government of Yukon 2002) and the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004).

3.2.1.1 Pre-Drilling Preparation

The first exploratory wells will be drilled in the winter of Year 1. Pre-drilling preparation will require preparation of winter roads to the selected well sites, and preparation of the well sites. Winter road and well site preparation require a minimum of 10 centimetres (cm) of packed snow cover (including the highest hummocks) to prevent damaging the surface vegetation (Stanley Associates Engineering Ltd. and Sentar Consultants Ltd. 1993). At least 30 cm of snowfall is required to produce 10 cm of compacted snow (Stanley Associates Engineering Ltd. and Sentar Consultants Ltd. 1993). Snow packing via snowmobile or snowcat earlier in the season (potentially as early as November or December) is usually undertaken to facilitate freezing in the winter trail and well site locations and assist with full construction before drilling operations. Based on historical trends (i.e., when 10 cm of packed snow accumulation has been achieved in past

years), actual construction of the winter roads could occur as early as December or as late as mid-to-late January. Additional details are provided in **section 4.3.1**.

3.2.1.2 Preparing Winter Well Sites

Well site set-up typically requires approximately five days, during which 15 to 20 truckloads are required to mobilize the drill rig and other equipment/materials/infrastructure. Once established, well sites will be approximately 1.44 ha for single well pads and up to 2.5 ha for multiple well pads and will contain the drill rig, flare stack, rig trailers, and office trailers. There will also be trailers to provide sleeping capacity for key personnel required to stay at the rig full-time.

Vegetation clearing at each well site will be minimized as much as possible; well sites will be levelled by packing snow at the site and then icing to form a level pad, or, if not enough snow is available, using water to freeze well pads or making snow artificially. An impermeable liner will be laid on the pad, followed by interlocking wooden rig mats, where required. Rig mats are approximately 16 feet by 8 feet and may be used to cover the entire well site, the area around the drilling rig, or both.

Matting is used at well sites in northern locations to provide insulation and protection to the underlying snow and ground surface, distribute the weight of equipment, and minimize ground disturbance while using the site. Matting will be used when, a) the ground is uneven and leveling the well site with snow and ice is not possible or b) the ground may not be competent enough to support the heavy rig loads and the dynamic loading that is typical of a drilling operation. At winter well sites constructed without densified fill material as the base of the pad, equipment will always remain on matted surfaces in case of early thaw conditions.

3.2.1.3 Well Site Surface Infrastructure

Figure 3-15 illustrates the general layout of equipment, storage, and structures at a proposed well site. The planned 1.44 ha (120 m × 120 m) area is designed to accommodate the drilling operation and associated setback distances from surrounding vegetation, a separation between pieces of equipment, and personnel working and sleeping quarters. It should be sufficient to accommodate the well completion and EFT equipment. As presented in past assessments, Chance plans to use a drill rig with similar capabilities to Chance Rig #1. The drilling rig will be capable of drilling to depths of up to 2,500 m (vertically). The final area of each well site may not be square since the area will depend on topographical constraints.

The rig layout depicted is for a winter drilling operation (distinguished by the number of boilers onsite). Boilers are used extensively in very cold climates to prevent equipment and drilling fluids from freezing.

Table 3-2 describes the drill rig components identified in **Figure 3-8**. Well sites are defined as industrial areas and are therefore restricted entry areas; only appropriately trained, authorized personnel wearing all required personal protective equipment (coveralls, steel-toed boots, hard hat, gloves, and safety glasses) are allowed access. **Photo 3-8** shows a typical example of a Chance rig and is shown at night. **Photo 3-9** shows a typical Chance rig set up at the end of a constructed winter access road.

Table 3-2. Well site components shown in Figure 15 general layout of a well site.

Component	Description
Boilers	Used extensively in very cold climates to prevent equipment and drilling fluids from freezing.
Cement	Cement storage and mixing for use in wells to secure casing and seal off porous and permeable formations to prevent fluid inflow.
Medic, Offices, and Sleeping Trailer	Essential personnel trailers which serve as offices or sleeping quarters and include a multi-room sleeper for some of the personnel at the drilling location.
Flare Tank and Flare	Flare used to incinerate combustible fluids from the well. The flare tank is a reservoir to ensure the flare does not starve of combustible fluids.
Fuel Storage	Fuel used at the site for equipment including drill rig, pumps, light towers, accommodation trailers, boilers, generators, etc.
Garbage and Incinerator	Storage area for waste and incinerator to dispose of food waste.
General Storage	Storage and laydown area for equipment needed onsite.
Mud Tanks	Tanks where drilling mud is stored (drilling mud is a viscous fluid mixture, water based for this operation, used in oil and gas drilling operations to lubricate/cool the drill bit, to carry rock cuttings to the surface and to provide hydrostatic pressure within the drill hole to prevent fluid inflow from porous and permeable rock formations). The tanks are usually upright, fully enclosed, and pressurized, storing bulk materials for drilling mud. Section 31 of the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004) under *Yukon Oil and Gas Act*, SY 2019, c.6 (*YOGA*) (Government of Yukon 2002) stipulates that the "combined capacity of the drilling fluid tanks of every fluid system must not be less than the greater of 120 m^3 and 50% excess of the volume of the wellbore." Cement materials both prior to and after mixing are stored in similar tanks.
Main Mud Storage	Location where all the drilling mud materials are stored. Normally these materials are delivered on pallets stacked and shrink wrapped to protect them during transport and storage.
Drill Pipe Storage	Racks in which drill pipe is stored until required to be run in the hole.
Mud Mixing	Tank in which drilling mud products are first mixed with water to facilitate further mixing with drilling mud already mixed and in use. Products such as bentonite clay, for example, require a caustic soda solution to facilitate good mixing and preserve good flow characteristics
Mud Pumps	Pumps used to circulate the drilling mud down the drill pipe, around the drill bit, and up the annular space between the drill pipe and the open hole or casing to surface.
Return Mud Separator	The area where the return mud separator, known as a shale shaker, separates rock cuttings from the drilling mud. The rock cuttings are then centrifuged to separate residual liquid from the cuttings so the cuttings can be disposed in a Mix Bury Cover (MBC) sump. The centrifuge is also used at the end of the drilling operation to recover water for use in the next well and the spent mud is also disposed of in the MBC sump.
Drill Structure	Components required to drill the well, include: • Sub-structure, or base, on which the derrick is fixed. • Derrick that supports the draw works and top drive which hold drill pipe before it is run into or retrieved from the well and the equipment used to rotate the drill pipe during the drilling operation.

Component	Description
	• Top drive that is a mechanical, electrically powered linking device that attaches to the pipe in the hole and rotates it when drilling while simultaneously pumping drilling mud through the drill pipe and out of the drill bit at the bottom end. • Draw works that lifts and lowers the travelling block in the derrick/mast to run pipe in and out of the hole. • Blowout preventers are a series of closing valves that can hydraulically shut in a well in the event of unplanned influxes of formation fluids into the wellbore and prevent blowouts.
Water Storage and Water Treatment	Water storage tank and treatment containers to provide potable water for the rig crew and personnel.

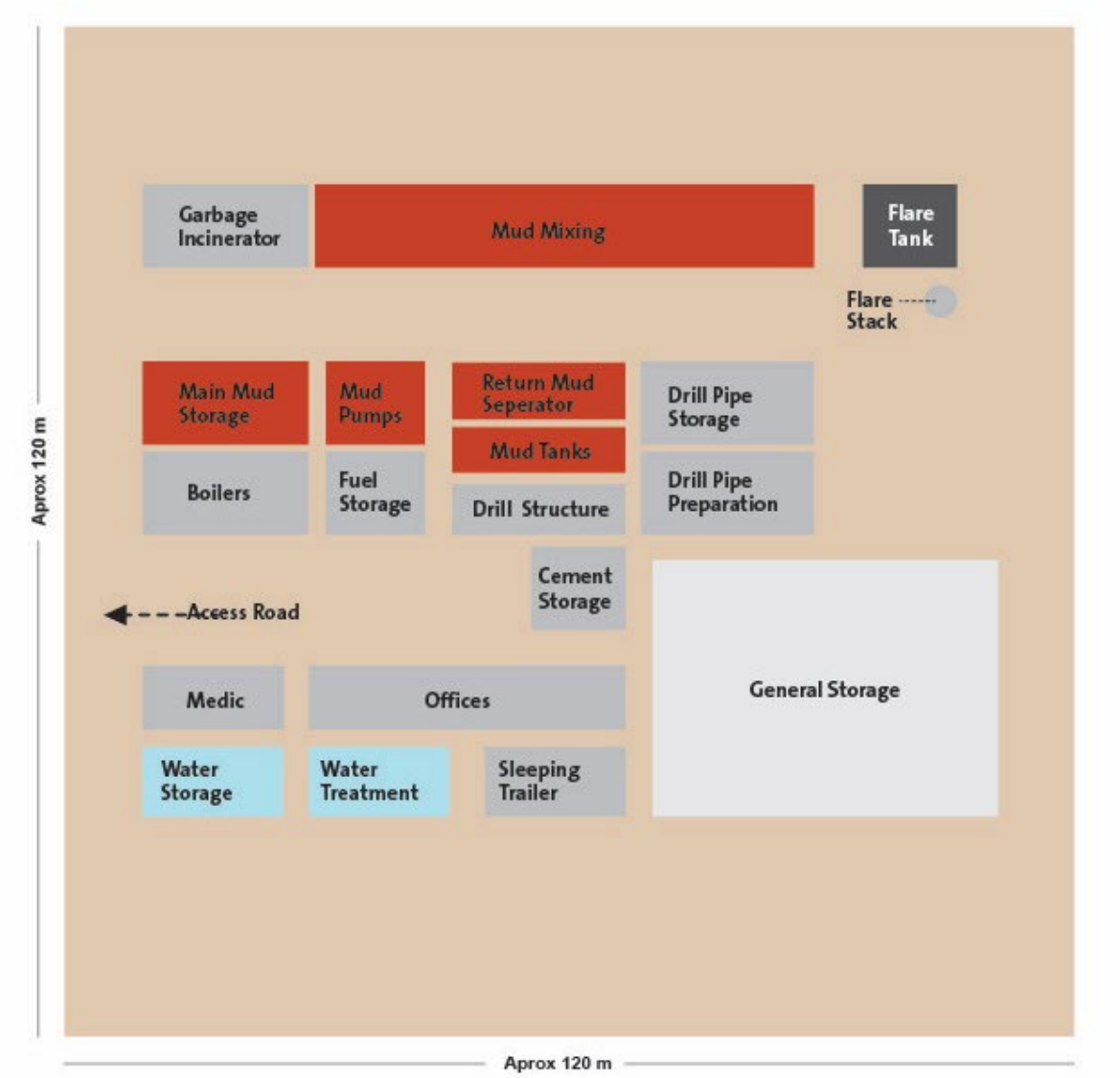


Figure 3-8. General layout of a well site.



Photo 3-8. Example of typical Chance rig at night.



Photo 3-9. Example of typical Chance rig at end of constructed winter access road.

3.2.1.4 Drilling Operations

Eagle Plains well sites and well design will incorporate the following key features to enhance efficiency, reduce waste, and minimize general effects on the surrounding environment.

- The rig will use sufficient casing pipe to reach the projected total depth of up to approximately 2,500 m (vertical depth). For reference, the well casing program will typically comprise the following elements:
  - Conductor of 13-3/8-inch diameter to approximately 25 m below ground level, cemented to surface.
  - Surface casing of 9-5/8-inch diameter to approximately 25% of the planned, measured depth of the well below ground level, cemented to surface.
  - Production or intermediate casing of 7-inch diameter either to total depth or within Yukon's Oil and Gas Drilling and Production Regulations requirement of not more than 25% of open hole remaining uncased at any time (Oil and Gas Drilling and Production Regulations Section 55-(1) (c) (i)) (Government of Yukon, 2004). This casing will also be cemented to surface.
  - 4-1/2-inch liner to a depth of 2,500 m, cemented with a minimum 100 m overlap into the previous casing.
- The nominal diameter of the various casing strings (all selected to meet industry standard dimensions) will reduce the size of the hole drilled and of drill cuttings generated as the well is deepened. For example, a 3,500 m exploratory well typically produces 400–500 metric tons of cuttings. Less than 150 metric tons will be produced for the typical exploratory well depth of 2,500 m proposed at Eagle Plains.
- A water-based mud system will be developed and managed by a specialized service contractor with comprehensive knowledge of the Alberta Energy Regulator (AER) *Directive 050 Drilling Waste Management* (AER 2023) requirements as they pertain to the Yukon jurisdiction regulations.
- All requirements in Sections 26 to 65 of the Yukon *Oil and Gas Drilling and Production Regulations* (Government of Yukon, 2004) (covering well design, casing design, groundwater protection, mud products, blowout prevention and choke/kill systems, fire detection and gas detection systems, safety of personnel, mitigation of operations effects, and more) will be either met or exceeded in the design, selection, and deployment of materials.
- Proposed drilling design planned operations procedures, relevant health, safety, and environment plans; oil spill contingency plans; and emergency response plans will be provided to the regulator for review at least six months before planned mobilization to site. Any perceived or identified deficiencies will be discussed and addressed with the Yukon regulator to confirm what is required before operations.
- Chance will enforce compliance on all third-party service suppliers to ensure that (1) their health, safety, and environment management systems address regulatory requirements in personnel training and skill development; (2) personal protective equipment provided to workers meets Canadian Standards Association (CSA) and international safety standards; and (3) supervisors are knowledgeable about operational standards related to health, safety, and environment. Chance company representatives will perform periodic inspections and audits during mobilization and operations.

- All wells will be drilled initially as “keepers” to facilitate EFT or to become early producers if the Project progresses to full development. The only wells likely to be abandoned would be unsuccessful (dry) wells with no potential to be used as water or natural gas disposal wells.
- Well sites will be designed and constructed with purpose-built collection berms to recover and contain for disposal any fluid not otherwise contained by the operation’s process control. During well site/well pad construction, an impermeable layer will be laid to prevent seepage into the ground below the fill material pad.
- Rig drilling, cementing, or DSTs fluids will be contained and recovered until disposal following regulations.

Drilling contractors must provide training and have operational procedures certified by a recognized professional or regulatory body in blowout prevention and well control. Crews undergo simulated safety drills at each shift on a 2-shift, 24-hour work rotation. During these safety drills, the response and efficiency of drill crews are evaluated. The equipment is also evaluated, and deficiencies are corrected immediately following the drills. Drill crew and well supervisor well control/blowout prevention/hydrogen sulphide certificates are normally inspected by a visiting inspector to confirm compliance when operating.

3.2.1.5 Drilling Mud

Drilling mud is a viscous, heavy liquid used in drilling oil and gas wells to lubricate and cool the drill bit, to carry the rock cuttings out of the drill hole and back to the surface where the cuttings are separated from the mud, and the mud is recycled for reuse in the drilling operation. The drilling mud system currently under consideration for the Project is a low-toxicity water-based drilling system; Chance is assessing systems and suppliers based on several factors, including ease of disposal at the end of its use.

The main function of drilling mud is to over-balance the well pressure to ensure that the pressure in the wellbore is higher than the pressures expected to be encountered from the various geological formations as the drill bit penetrates them. The drilling mud prevents formation fluids from entering the wellbore. It keeps the drill cuttings in fluid suspension when drilling is paused or the drilling assembly is cycled in and out of the hole for bit changes, well logging, DST work, or any other downhole activity. Drilling mud is selected to provide operational efficiency, minimize formation damage, reduce corrosion, and minimize the environmental effects of handling and disposal.

Project operations will minimize the volume of drill cuttings and drilling waste generated by drilling smaller-diameter holes. Drilling waste is composed of rock chips and cuttings. The drilling fluid returned to the surface is sent through a shale shaker to separate rock cuttings, and the drilling mud is returned to the well to continue drilling. The recovered cuttings are put through a centrifuge, where the drill cuttings are further separated from any residual water before being disposed of in an MBC sump. At the end of the drilling operation, the mud slurry is run through the centrifuge to separate the water for future use in the next well. Recovered mud is disposed of in the MBC sump.

3.2.1.6 Cement Plugs and Permafrost

When mixed with water and begin to set, typical oilfield cements produce heat, known as the heat of hydration. This heat can thaw the permafrost adjacent to the wellbore. Permafrost cements are a specific mixture of typical oilfield cement (Portland Cements) with additives such as gypsum (calcium sulphate) to

eliminate the heat of hydration. Calcium and sulphate are naturally occurring molecules at Eagle Plain and are environmentally benign. Use of permafrost cements will minimize the risk of permafrost degradation.

Permafrost cement usually is only used for the surface casing installed to isolate the wellbore from the rock formations and protect permafrost. Chance plans to install surface casing to a depth of 400 m at minimum.

3.2.1.7 Drill Stem Testing (DST)

Depending on the analysis of rock cuttings, measurements made of drilling fluids during the drilling operation, the well log results, and any core samples taken, it may be desirable to test prospective zones before drilling deeper or running casing. In these cases, a DST is commonly done. Drill stem tests are conducted through a special string of drill pipe that includes two packers, which are devices that, when inflated, serve to isolate the zone (the geological formation) of interest from the rest of the well and are set in place just above and below the zone undergoing DST. A special annular pressure-operated valve is placed inside the drill pipe near the zone to be tested. This valve is opened, and in a controlled manner, fluids in the formation are allowed to flow into the drill pipe and up to the surface for separation, measurement, and sampling.

At the surface, the drill pipe is connected through a series of valves allowing the operator to control the flow of fluids from the well and direct them through a pipe system, called flowlines, to the separator and the separator for measurement and sampling.

Figure 3-18 shows the DST process on the surface. Surface flow lines carry the fluids to a test separator. The separator splits the fluid mixture into component elements, which could combine crude oil, natural gas, and formation water. Each fluid stream is measured by flow meters to confirm the volume, pressure, temperature, and rate of flow. From the separator, the crude oil stream would be directed into a holding tank, the natural gas to the choke manifold on the derrick, and then sent to the flare stack or another pre-determined place (e.g., burned for heat, power generation or mechanical power). The separated formation water would be collected and hauled away for disposal; in an existing deep injection well located in the Eagle Plain area.

The exploration wells may encounter several hydrocarbon-bearing zones that could be evaluated by conducting a DST (or DSTs). Before DSTs are conducted, a well site-specific plan and DST procedures will be developed by Chance. Plans for all DSTs will be based on well results and will be discussed with the Oil and Gas Resources branch of the Yukon Department of Energy, Mines and Resources.

A well site-specific plan will be specific to the formation to be tested and the existing wellbore conditions. This plan will protect the safety of personnel, equipment, and the environment and provide for handling any fluids that may be recovered. Enform *IRP 4 Well Testing and Fluid Handling - An Industry Recommended Practice* guidelines (Enform Canada 2015) are one of the sources that will be referenced in preparing the plan. The formal project proposal will include a sample plan with information on how the plan will be assembled.

Flaring of gases during DST is a widely applied activity. The process, however, can only be undertaken in compliance with *YOGA Oil and Gas Drilling and Production Regulations* section 128 (Government of Yukon 2004), which is provided below for reference. Additionally, DST guidelines outlined in Enform *IRP 4 Well*

Testing and Fluid Handling – An Industry Recommended Practice (Enform Canada 2015) are intended to ensure that safe work procedures are in place and to "minimize the probability of either the mechanical or human systems failing during a test, as well as establishing minimum health, safety and operating standards". In addition, they are "designed to allow flexibility and must be used in conjunction with competent technical judgment".

As required, the flare line must be positioned downstream of the derrick's choke manifold, designed to prevent fluid accumulation within the line, and installed and anchored as specified by regulation. Gas encountered during DST is circulated through a degasser system to separate it from the drilling mud, rendering the mud safe to pump back into the wellbore. Larger volumes of gas may be control-burned through the flare stack according to the flare permit issued by the Oil and Gas branch of the Yukon Government.

An example of a typical well site flare process layout is illustrated in **Figure 3-9**, a typical flare stack and gas/vapour recovery flowsheet is illustrated in **Figure 3-10** and a typical portable flare stack is shown in **Figure 3-11**. Normally the flare line from the choke manifold is connected to the flare stack inlet to permit the direction of the gas to the flare for total control. The flare stack will be a minimum of 18 m high and a maximum 30 m high depending on surface conditions to assist in air dispersal of combustion end products and mitigate effects on permafrost.

Following the regulated spacing requirements, the flare stack will be positioned on the well site. If flaring is necessary, the flare will be higher than the surrounding vegetation or trees (as required by the *Oil and Gas Drilling and Production Regulations* [Government of Yukon, 2004]). Noise from flaring typically only occurs when very large volumes of high-pressure natural gas are being flared. During DST, flaring would only occur for a maximum of one day at the end of a drilling program for one well.

YOGA Oil and Gas Drilling & Production Regulations Part 9 (Government of Yukon 2004) specifies these parameters.: The flare stack will meet the requirements as follows:

> *128. Flare requirements*
>
> *Unless otherwise approved or directed by the Chief Operations Officer, any gas that is flared will be discharged from a flare stack that:*
>
> *(a) is at least*
>
> *(i) 50 metres from any well, treater, separator, compressor, crude oil storage tank or any other unprotected source of ignitable vapours*
>
> *(ii) 80 metres from any right-of-way, easement, road, public utility, building, installation, works, place of public concourse or any reservation for national defence, except only when there may exist special circumstances that, in the opinion of the Chief Operations Officer, justify the positioning of the stack at a greater or lesser distance*
>
> *(b) is adequately anchored and suitably protected against freezing*
>
> *(c) is designed to ensure flame stability and efficient combustion*
>
> *(d) is of sufficient height and diameter to ensure*
>
> *(i) that the average concentrations of hydrogen sulphide and sulphur dioxide in the ambient air do not exceed limits specified under the Occupational Health and Safety Act*

(ii) that vegetation combustion is prevented by maintaining an area free of vegetation and combustible debris around the base of the flare stack or the end of the flare line to the following minimum distances:

(A) 10 metres or 1.5 times the stack height, whichever is greater, in cultivated areas

(B) 30 metres or 2.5 times the stack height, whichever is greater, in forested areas

(C) 1.5 times the stack height, in any other area

(iii) that a minimum stack height of 2.5 times the height of the highest third-party building located within a distance equal to 5 times the height of the building is maintained

(iv) that any heat generated around the base of the stack does not exceed the manufacturer's specifications for any equipment situated there, to a maximum of 4.73 kW/m²

(e) has a sufficient exit velocity and is provided with guards or other features to prevent extinction of the flame.

(f) if the gas flow is intermittent, is provided with an ignition device to ensure continuous ignition of any gases.

To minimize potential deposition of residual chemicals produced via flaring on vegetation and soil, the site design will include an appropriate spacing between the flare stack and vegetation. Vegetation and soil adjacent to and downwind (prevalent) of each flare stack will be sampled before an activity that could result in gas production to provide a baseline of identified substances of concern at the site. Samples will then be taken during flaring for comparison with the baseline to monitor potential deposition. Visual monitoring will occur throughout flaring to observe nearby vegetation's safety and protection.

A typical operational sequence of DST is:

1. Wellbore is drilled to a depth of interest.
2. Well is logged using various diagnostic tools, and depth intervals for testing are selected.
3. Test equipment is connected to the end of a drill string and run into the well bore. The test equipment generally consists of two packers set above and below the geological formation being tested to isolate the formation to be tested from the rest of the wellbore. Inside the drill pipe between the packers, an annular pressure-controlled downhole valve to open and close at the beginning and end of the DST, respectively, and pressure gauges to measure the bottom flowing and shut-in pressures.
4. A cushion of fluid may be contained in the drill pipe to initially provide back pressure on the formation being tested, which may be required to control initial flow rates out of the formation, into the drill pipe, and up to the surface.
5. Once the test string is positioned at the zone to be tested, the packers are set, and the downhole valve is opened to allow formation fluids to flow into the drill string.
6. Fluids produced during the test are carried from the wellhead to a test separator as described above, where any natural gas, crude oil or formation water are separated for individual measurement, sample collection for further laboratory analyses, and either flared (natural gas), recovered for eventual disposal at a terminal in NEBC (crude oil) or disposed of (formation water) into one of the disposal wells designated by Chance.

7. Initially, the valve is opened and the well flows relatively quickly to clean up the wells (normally, this period may be a few hours). Following this period, flow is temporarily shut in the downhole, and a pressure buildup is recorded (with the initial shut-in period lasting 2 or 3 times the initial flow period).
8. The test zone is then flowed at constant or variable rates by opening the valve located in the packer and allowing formation fluids into the drill pipe and flow up to the surface. Each constant flow period is normally followed by a shut-in period to record how long it takes for the pressure to build back up inside the well.

- Before concluding the series of test rates, bottom hole and surface samples are collected. Samples are taken of all fluids for analysis (both Pressure Volume Temperature samples under the flowing reservoir pressure, temperature conditions and atmospheric samples to check for “base sediments and water characteristics of the produced fluid”).

After the DST, the tools are closed, packers unset (removed) and any samples within the drill pipe are reverse circulated to surface. A normal DST takes a few hours, not including the time required to prepare the tools, run pipe to depth and do the reversed process on completion.

Well log results, sample analysis and DST results are used to decide whether to abandon or insert casing into the well, pending further evaluation. To abandon the well, cement plugs are inserted using an open-ended drill pipe across all porous/permeable zones and the base of each casing string. At the surface, the well casing(s) are cut off 1 m below ground level and steel plates are welded across the top of the casing. A well sign is erected and the well site re-contoured and re-vegetated, all pursuant to the relevant *YOGA Oil and Gas Drilling and Production Regulations (Government of Yukon 2004).*

At least one DST per successful well will be conducted unless several zones require testing. If more than one prospective/productive formation is encountered in a well and is separate from other formations, DSTs will be conducted on those separate formations independently of each other. Sometimes, a DST may be re-done if there is a mis-run, or if the DSTs were not done in a steady sequence. The order in which DSTs are conducted will depend on where the zones of interest are found in relation to the various casing strings that could be set as the well is being drilled.

All well testing will be performed with the guidance of AER *Directive 034: Gas Well Testing, Theory and Practice* (Alberta Energy Regulator 1979) and in consultation with the Oil and Gas branch of the Yukon Government. Chance will follow related legislation, such as the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004). Part 5 of this regulation provides detail on well evaluation and testing requirements.

Specific details of past drilling experiences can be found on the Yukon Oil and Gas Online Information Site: (http://maps.gov.yk.ca/imf.jsp?site=OilandGas_wells). Chance’s comprehensive casing designs and rig and blow-out prevention system conform to *YOGA* and the *Oil and Gas Drilling and Production Regulations* (Sections 33-61 (Government of Yukon 2004). Additional details of Chance’s system configuration are confidential as per Section 176 (4) of the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004).

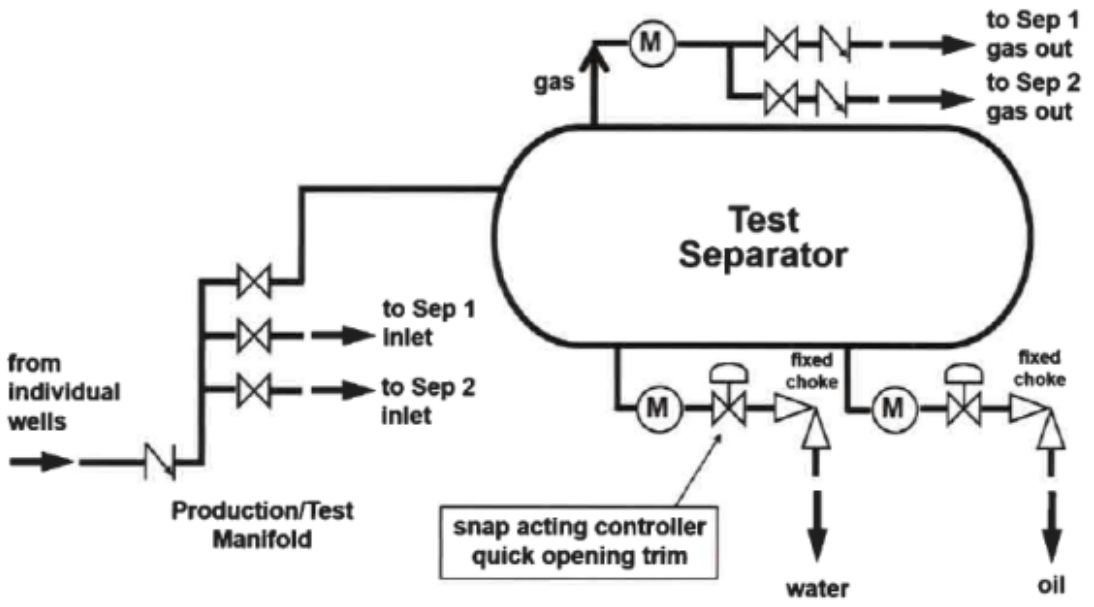


Figure 3-9. Drill Stem Test (DST) process diagram from well head through the test separator.

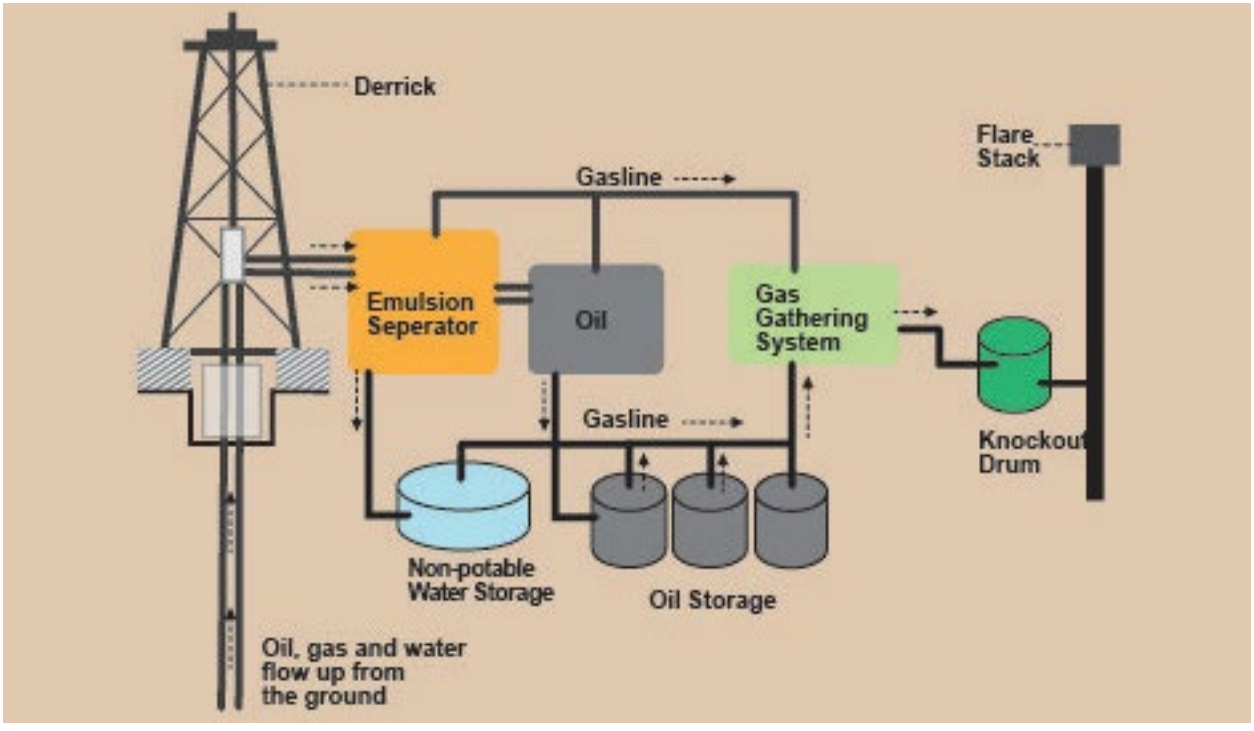


Figure 3-10. Typical flare stack and gas/vapour recovery flowsheet.

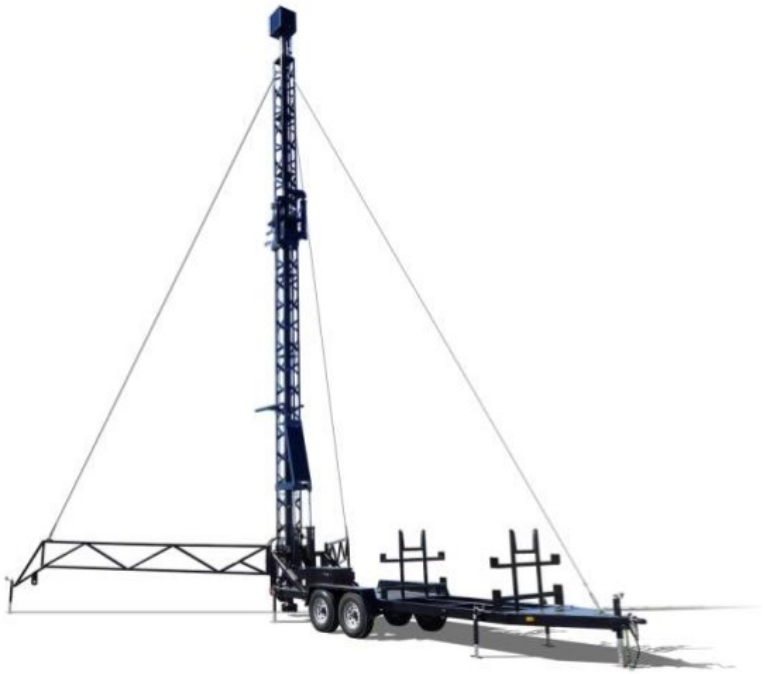


Figure 3-11. Typical flare stack unit on a portable rig.

3.2.1.8 Further Testing Details

Swabbing — Swabbing is usually conducted to help initiate fluid flow from the formation into the well and flow to the surface. Wells will only be swabbed if the well is drilled, cased, and a potential reservoir has been:

- identified;
- perforated;
- testing reveals that reservoir pressure is insufficient to flow liquids to the surface without swabbing; and/or,
- if well stimulation results in wellbore liquids that prevent flow to the surface.

Swabbing reduces in-well bore pressure that otherwise prevents a potentially productive formation from flowing to the surface naturally.

Acid Stimulation — Eagle Plains' previous oil and gas exploration activities indicate that small-volume acid stimulation treatments effectively remove scale and other impedances to allow or improve fluid flow into the wellbore. Acid stimulation entails pumping discrete amounts of hydrochloric acid at varying depths.

The acid is trucked to location in specially sealed tanks in compliance with regulations under the federal *Transportation of Dangerous Goods Act, S.C. 1992, c. 34* (Government of Canada 1992) and transferred to the cement pumping unit for pumping downhole. Treatment batches of 10 to 25 barrels (approximately 1.6 to 4.0 m^3) are pumped at controlled pressure until complete. The weak acid serves to dissolve scale

(calcium carbonate) or cement. The chemical reaction of the hydrochloric acid with carbonates forms non-toxic and pH-neutral calcium chloride salt and water as by-products.

The application of acid is for a new well and not used for an existing one that has been in operation for some time. Acid cleans up a newly drilled well to improve initial flow rates. It is also used as a remedial tool to improve production where there is evidence of flow impairment. For an exploration project, this improves production in a setting where little prior information or data exists and is therefore undertaken on a trial basis.

The product's Safety Data Sheets (SDS) describe the toxicity limits for oilfield hydrochloric acid. Oilfield concentrations are normally 10%, 15%, or 20% hydrochloric acid. In winter, if acid is spilled, like water, it would freeze and can be recovered from the surface snow or a thin soil layer.

3.2.1.9 Drilling By-Products Disposal

Eagle Plains is a sedimentary basin, and drill cuttings will consist of sandstone, shale, and carbonate rock none of which are significantly sulphide-bearing. Drill cuttings from wells drilled in 2012 were examined by Chance geologists; based on this examination and previous exploration / geological work in the area, the potential for acid rock drainage (ARD) from drill cuttings was determined to be remote to non-existent.

Naturally occurring radioactivity will be measured by gamma ray (GR) or spectral gamma ray wireline logs, a regulatory requirement in the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004). Gamma ray is a radioactivity detection device (similar to a Geiger Counter) that detects radioactive Uranium, Thorium or Potassium isotopes in the rock formations drilled. No abnormal detections have been made other than that attributed to natural rock formation radioactivity. Therefore, radioactivity appears absent or undetectable in the fluid of the Eagle Plains sedimentary formations.

The Oil and Gas branch of the Yukon Government has adopted the AER *Directive 050: Drilling Waste Management* (Alberta Energy Regulator 2023) procedures for the disposal of drilling wastes within the Yukon. Chance will manage the operation following the MBC requirements of the Directive for the remote sump locations.

Solid Drill Cuttings — Drill cuttings are a direct by-product of the drill bit grinding through rock. Cuttings are brought to surface with the drilling mud and separated via shale shakers and centrifuges, as described in **section 4.3.2**.

“Stripping” is running the drilling mud through centrifuges as it returns to the surface to separate the water from any solids suspended in the fluid stream. Cuttings are separated during stripping and stored separately on the well site until they can be disposed of. The fluid is then either recycled back into the mud system in the drilling operation or retained for use in future drilling locations.

Close attention to the dryness of the cuttings moving across the shale shakers and collected in the shale bins are required for the following reasons:

- Less total weight in the cuttings equals less cost associated with future handling of the drill cuttings.

- In the winter, handling and moving dry cuttings is easier as they do not freeze and create large blocks of material.
- Recycling more fluid separated from the cuttings reduced the need for additional make-up drilling fluid.

Drill cuttings will be removed from the well sites for disposal at the MBC, as described in **section 4.3.3**.

Drilling Mud — Chance is proposing to use water-based drilling fluid systems. After drilling a few wells using recycled drilling fluids, the mud system may need to be partially or fully reconstituted (disposal of the current fluid and mixing fresh water and new drilling fluid products). This ensures the drilling fluid is fresh and capable of drilling through the different rock types found in the proposed wells and is performing to meet operational needs. Chance has successfully re-used drilling fluid systems across multiple wells to reduce the overall need for make-up water and the total fluid volume for disposal at Eagle Plains.

The proposed drilling system and the site conditions present at the drilling locations and in the Eagle Plains general area have directly influenced the disposal options for waste drill fluid. Accordingly, the following conditions were established for the selection of the drilling mud system:

- Low-toxicity mud system confirmed through laboratory analysis;
- Meets operational requirements (maintain formation stability, hole cleaning and well control, etc.); and,
- Suitable for disposal via the MBC disposal process at a nearby location.

Any drill fluid selected must satisfy Section 32 "*Approved Drilling Fluid*" of *YOGA*'s *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004). The type and chemistry of the drilling fluid is described further in this section.

Injection Well — AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023) covers the disposal of drilling fluid. Drill cuttings will be mixed with the required amount of soil following AER *Directive 050 Drilling Waste Management* and disposed of in the MBC sump. Drilling fluid will be stripped back to the clear portion and disposed of in one of the injection wells.

Disposal requires further injectivity and suitability investigations. This cannot occur until the wells are re-entered and ready for the investigation trials. Chance candidate wells could be one or more of the following suspended well(s): Chance J-19, Chance M-08, Chance G-08, Blackie M-59, McParlane A-25 and Chance E-78 all of which are located within the Chance licence areas. Any well that is not a preferred EFT or future production candidate could be an injection well if strategically located near a usable well or wells and if it exhibits the required characteristics for injecting fluids. For this exploration project, the priority wells for disposal are A-25 and E-7, however others could be part of the disposal mix depending on the outcome of well maintenance assessment activities.

The *YOGA Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004) require that any produced water not be disposed of at the surface unless its quality and/or salinity is equal to or greater than the quality limits set out in producing field facility licence.

Any plans or intention to dispose of produced water from reservoir fluids separation must be submitted to the regulatory authority and must meet the environmental standards as well the oilfield waste disposal standards and limits (reference *YOGA Oil and Gas Drilling and Production Regulations* Sections 122. 123. 124, 130 and 165) (Government of Yukon 2004). Produced water disposal is only authorized when the operator demonstrates legislation requirements have been met and that good oilfield and reservoir management practices are satisfied.

Once their disposal suitability is established, the following liquid materials (treated with bactericide) and their volumes may be disposed of:

- Produced water per well (water cut 20% to 60% for 200 barrels of oil per day (BOPD)) = approximately 40 to 120 barrels water/day but dependant on field conditions;
- Workover fluids: Maximum 7" casing volume full = 276 barrels;
- Rig wash: hose flowing at five gallons per minute (gpm) water for one hour = ±seven barrels per day in summer;
- Saline fluids (completion brines) same as workover fluids = 276 barrels; and
- Liquid fraction of drilling fluids = approximately 200 m^3 at end of Project.

The zone must have an impermeable barrier above it to prevent migration of the injected fluid and be deeper than 750 m. The rock's Permeability and porosity must permit fluid pumping at low surface pressure and well below formation breakdown pressure. Testing must determine injection fluid compatibility between the rock and native reservoir before injection. The injection pressure and rate are measured, indicating the porosity and permeability of the formation and reservoir used for injection.

Disposal of highly saline-produced water at surface disposal sites may be greatly restricted in quality and quantity. To support best reservoir management practices, the re-injection of produced formation water back downhole may sometimes be required.

3.2.2 Extended Flow Testing

As noted above, well testing will be performed following the guidance of AER *Directive 034: Gas Well Testing, Theory and Practice* (Alberta Energy Regulator 1979) and in consultation with the Oil and Gas branch of the Yukon Government. Chance will also follow related legislation, such as the Yukon *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004). Part 5 of this regulation provides detail on well evaluation and testing requirements.

Petroleum or natural gas reserves identified through DST are expected to undergo EFT to gather important information about the nature of the resource accumulation and its productive capability. Duration of EFTs at each well where petroleum or natural gas is identified may occur during successive winters for up to two years. The information obtained from EFTs is critical to determining the future development plan for each discovery. The planned wells are exploratory; any flow testing will be contingent on identifying formations potentially containing hydrocarbons. Part 8, Section 103 (1) of the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004) requires:

> *"The Licensee of a well shall obtain sufficient well tests, formation flow tests, wireline logs, analyses, surveys, conventional cores, cuttings and samples during the drilling of the well to ensure that a comprehensive geological and reservoir evaluation can be made."*

EFTs will be undertaken if preliminary results from DST are encouraging, and the following criteria have been met:

- The well is drilled and cased;
- A potential reservoir is:
  - Identified;
  - DST has been conducted; and,
  - Test analysis of the DST concludes sufficient hydrocarbons present to proceed to further evaluation of the hydrocarbon bearing formation.

Table 3-3 outlines the sequence of activities in developing the well site areas.

The same regulatory constraints apply to fluids produced by EFT as to recovery by any other means.

EFT operates on a similar principal as DST. The main difference is that EFTs are undertaken after the well has been cased. In an EFT however, the drilling rig would be removed to drill another well while the drilled well is prepared for testing. As each well is drilled and drill stem tested to evaluate its candidacy for extended testing, it is left in a safe, secure state for further testing after removing the drilling rig. Mobilizing a service rig to complete the work may become necessary before turning the well to extended testing. A well service rig has very similar capabilities and equipment to a drilling rig except that it generally has fewer modules and is lighter equipment. If a service rig is required, it would be incremental equipment to the drilling rig.

Table 3-3. Sequence of well development activities.

<table>
<tr><th colspan="3">The sequence of Well Development Activities</th></tr>
<tr><td colspan="3">1. Develop winter access trail to well site</td></tr>
<tr><td colspan="3">2. Develop well site (approximately 1.44 ha in area)</td></tr>
<tr><td colspan="3">3. Install surface infrastructure for drilling and testing exploratory well on well site</td></tr>
<tr><td colspan="3">4. Drill well</td></tr>
<tr><td colspan="3">5. Transport and dispose of drill cuttings in MBC sump via winter access trail</td></tr>
<tr><td colspan="3">6. Well logging and core sampling prior to conducting Drill Stem Tests (DSTs)</td></tr>
<tr><td colspan="3">7. Conduct DSTs to determine whether Extended Flow Testing (EFT) should be conducted</td></tr>
<tr><td colspan="3">8. Move drill rig to next well site area</td></tr>
<tr><td rowspan="2">If DSTs not successful
(i.e., no petroleum products were encountered in the well)</td><td colspan="2">If DST is successful (i.e., Natural Gas or Crude Oil is encountered)

Successful wells will be suspended as an intermediate step to cover timing differences between finishing the DST and undertaking EFT.</td></tr>
<tr><td>Primarily Natural Gas Discovery</td><td>Primarily Crude Oil Discovery</td></tr>
<tr><td>Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).
Or</td><td>Complete well (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).</td><td>Complete well (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).</td></tr>
</table>

The sequence of Well Development Activities		
Suspend well to become an alternative location for deep zone injection (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).		
Remove all surface infrastructure.	Install required surface facilities (separator vessel, heaters, dehydrators, stock tanks, flow lines, metering equipment, portable generators, and flare stack).	Install required surface facilities (separator vessel, heaters, dehydrators, stock tanks, flow lines, metering equipment, portable generators, and flare stack).
Remediate well site area.	Conduct EFT over period of 1 – 2 months	Conduct EFT over period up to 2 years
Recontour well site area and revegetate disturbed areas to natural conditions.	Measure natural gas and water from wells.	• Measure, store, and process crude oil, natural gas, and water from wells. • Transport crude oil from EFT to central processing facility, then to acceptable market.
Recontour access roads and revegetate disturbed areas to natural conditions.	Conduct maintenance on well as required (work over).	Conduct maintenance on well as required (work over).
	Once EFT is, complete either: • Decommission and abandon well or • suspend well pending future use (e.g., develop further project proposal to bring into production)	Once EFT is complete, either: • Decommission and abandon well or • suspend well pending future use (e.g., develop further project proposal to bring into production)
	Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).	Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).
	Remove all surface infrastructure.	Remove all surface infrastructure.
	Remediate well site area and allow to regenerate naturally	Remediate well site area and allow to regenerate naturally

To allow the zone of interest to flow into the wellbore, the casing is perforated which is a routine procedure achieved by either using a wireline from surface or attached to the end of the production tubing from the surface to the zone of interest. In this case, the well is first completed with a packer attached to a tubing string and have downhole gauges to record flowing temperatures and pressures in real time. The surface would have the necessary “Christmas Tree” wellhead equipment and be flow line connected to the test separator through a choke manifold. Well fluids (gas, oil and water) would then be handled similarly.

Several wells at different locations could undergo EFT simultaneously, depending on drilling success/DST outcomes.

Extended flow testing is normally performed by specialists who provide the equipment, supervise the EFT operation, administer the safety protocols, and have the required certifications to perform the associated tasks. Extended flow testing however would be handled in the same fashion as production operations and still be conducted by trained professional operators under the direct supervision of a Production Superintendent.

EFTs will require installing surface and subsurface equipment and facilities at each well site to measure, process and store produced fluids. There is the potential to undertake more than one EFT per well if more than one zone is suitable for testing. The specific details of this equipment is subject to the nature of the discovery and could include:

- Casing of entire wellbore and perforate casing at zone of interest;
- Packer, tubing and downhole gauges;
- Wellhead valving assembly;
- Flare systems;
- Separator vessel;
- Treater to do additional separation of the produced fluids;
- Storage tanks;
- Appropriate artificial lift systems;
- Heaters;
- Dehydrators;
- Flow lines;
- Metering equipment; and,
- Portable generators.

Chance anticipates a delay (e.g., the following winter season) between completing DST, completing the well/removing the drill rig, and commencing EFT to allow time to design the flow test, secure the equipment and operating personnel, ship the equipment to site, install the equipment, and commence the operations. This program would include ancillary services to set up and perform the EFT (e.g., service rig). EFT will be undertaken on a maximum of 30 wells drilled during the exploration well drilling program. EFT may require up to a month to complete for a predominantly natural gas well or up to 2 years for a predominately crude oil well. Chance anticipates that up to 10 wells may undergo EFT simultaneously (based on the planned drilling schedule).

Fluids produced during EFT will be some combination of natural gas, crude oil and possibly formation water, which will be separated, measured, processed, used, sold, or disposed of as follows:

- Natural gas could be flared for short periods of time but would be preferentially used for process heating, fuel for mechanical power or possibly onsite power generation. Heaters are used to provide heat to vessels treating the produced fluids or keeping stored fluids warm; they can include heating an intermediate fluid such as glycol at the heater and circulating the glycol in a network of raised or insulated pipes (to prevent thawing ground surface) to the places where heat is required. The mechanical or power generators would likely be small engines fuelled with natural gas and sized according to the location's needs.
- Crude oil produced during the EFT would be preferentially stored temporarily for potential future shipment to market. This will require some processing at the well site or the CPF to

stabilize the crude oil for truck transport to a suitable, approved crude oil marketing point (i.e., terminal).
- Formation water produced with crude oil or natural gas will be separated from the hydrocarbon streams and disposed of via existing deep injection wells at Eagle Plains.

EFTs involve the flowing of a well or wells under human supervision, while wells flow unimpeded for the duration required for the test. In a multi-well producing field, for example, a maximum of three persons can manage the production operator tasks of a field with 50 or more producing wells (double that number when working a 24-hour day). Field production operators visit each well at least once daily unless there is a need for remedial work. They record flowing well pressures, ensure fluid pumps operate properly, have enough fuel to continue operating and visually inspect the facility for anything unusual.

Chance plans to use up to three operators to manage the EFT wells in any 12-hour cycle. A second set of up to three will form the cross-shift for a total number of six operators.

3.3 ACCESSORY PROJECT COMPONENTS

The following activities are required to support the principal exploration drilling and EFT:

- building and maintenance of winter access roads;
- other project facilities (i.e., remote camps and fuel storage);
- some surface facilities (e.g., flare stacks, flow lines, storage, processing, injections);
- airstrip construction and operations (estimated two fixed-wing aircraft flights per week); and,
- water use for drilling and camp needs, and for short periods to make snow and freeze in access trails.

Chance Camp at km 325 will be the main accommodation facility for the exploration program. During drilling operations, there will be some accommodation for essential staff in a mobile camp at the well location. This mobile camp will be occupied 24 hours per day, 7 days per week, to house essential personnel (rig supervisors, medic, geologist, etc.).

3.3.1 Well Maintenance

Any well completed for EFT, or not completed for EFT and suspended, may require maintenance during the 10-year term of the Project. Well maintenance is required on any suspended well before abandonment, conversion to an active well, or annually if it remains suspended. Well-maintenance equipment may include a service rig, wireline truck, cement trucks, and associated support equipment. Under the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004), a well is deemed suspended when it is safely secured, but not producing oil or natural gas.

Well maintenance activities, also known as workovers, generally include the following:

- pressure testing to confirm integrity of the casing and well head valves;
- removal of equipment in the well bores such as tubing and plugs;
- wireline investigations to measure temperatures and cement integrity and convey any perforating equipment;
- remedial work such as cement squeezes; and,

- wellbore integrity assessment.

3.3.1.1 Pressure Test and Surface Casing Vent Flow Test and Gas Migration Test

A pressure test will be conducted at each well to evaluate the integrity of the wellhead and the existing wellbore casing. The well (or Legacy well) will then be tested for surface casing vent flow (SCVF) and gas migration. Chance reports that no SCVF has ever been detected in existing suspended wells during annual inspections. If SCVF is identified, the well will be inspected and test results logged using various tools (e.g., noise tool, temperature tool, bond log tool) to determine the source of the SCVF and/or gas migration. The logs will be analyzed, and a plan will be formulated to complete a downhole shut-off at the source of the SCVF or gas migration if required. This is only done for significant vent flow events or when abandoning a well. Non-significant vent flows are normally left until end-of-life for newly producing or suspended wells. Depending on the status of the well (e.g., cased or completed with perforations) and the nature of the problem, the equipment needed to fix the problem will involve some combination of a service rig, wireline services and possibly cementing services.

3.3.1.2 Temperature Log and Cement Bond Log

Once SCVF and gas migration testing is complete, the service rig, support equipment, and wireline will be moved to the well site. A temperature log will be recorded from the surface to 300 m Kelly-Bushing below the surface (mKB) to identify anomalies or departures from the reference gradient. Most anomalies are related to fluids entering the formation through the borehole or fluid exit. If there is no anomaly, this work will be a good measure of the depth and thickness of permafrost.

A cement bond log will be run after the analysis of the temperature log. The cement log uses the variations in the amplitude of an acoustic signal travelling down the casing wall between a transmitter and receiver to determine the quality of a cement bond on the exterior casing wall. The acoustic signal will be more attenuated in the presence of cement than if the casings were uncemented. The cement log is used to identify sections of the well bore that will need intervention to isolate porous formations from adjacent formations.

3.3.2 Access Roads

Winter roads will be used for the exploration program. There will be no permanent roads within the exploration stage of the project. Temporary drilling pads created from snow on cleared but undisturbed ground will be used and will only exist during winter. **Figure 3-12** below shows the maximum potential winter road network to the exploration sites. Each winter road's number, location and length will be determined as the exploration program develops. As the program unfolds, the access road network's ultimate size will depend on drilling results (success). If drilling results are discouraging, the road network may be less than shown.

This project's proposed winter road construction method will be a compaction of the natural snow cover. Water may be needed in some areas to reinforce the packed snow. Some snow may be hauled to low areas or areas that are wind-blown. The natural vegetation cover will be preserved and remain undisturbed as much as possible. Compacted snow roads are appropriate to serve low ground pressure geotechnical field programs or winter roads with low traffic volumes. This method will suit this exploration program, as the expected traffic on this road will be the transport of a drilling rig with anticipated one to two moves (this

number could be up to 5 depending on the time needed to drill and evaluate a given well) per season, and a small number of support vehicles.

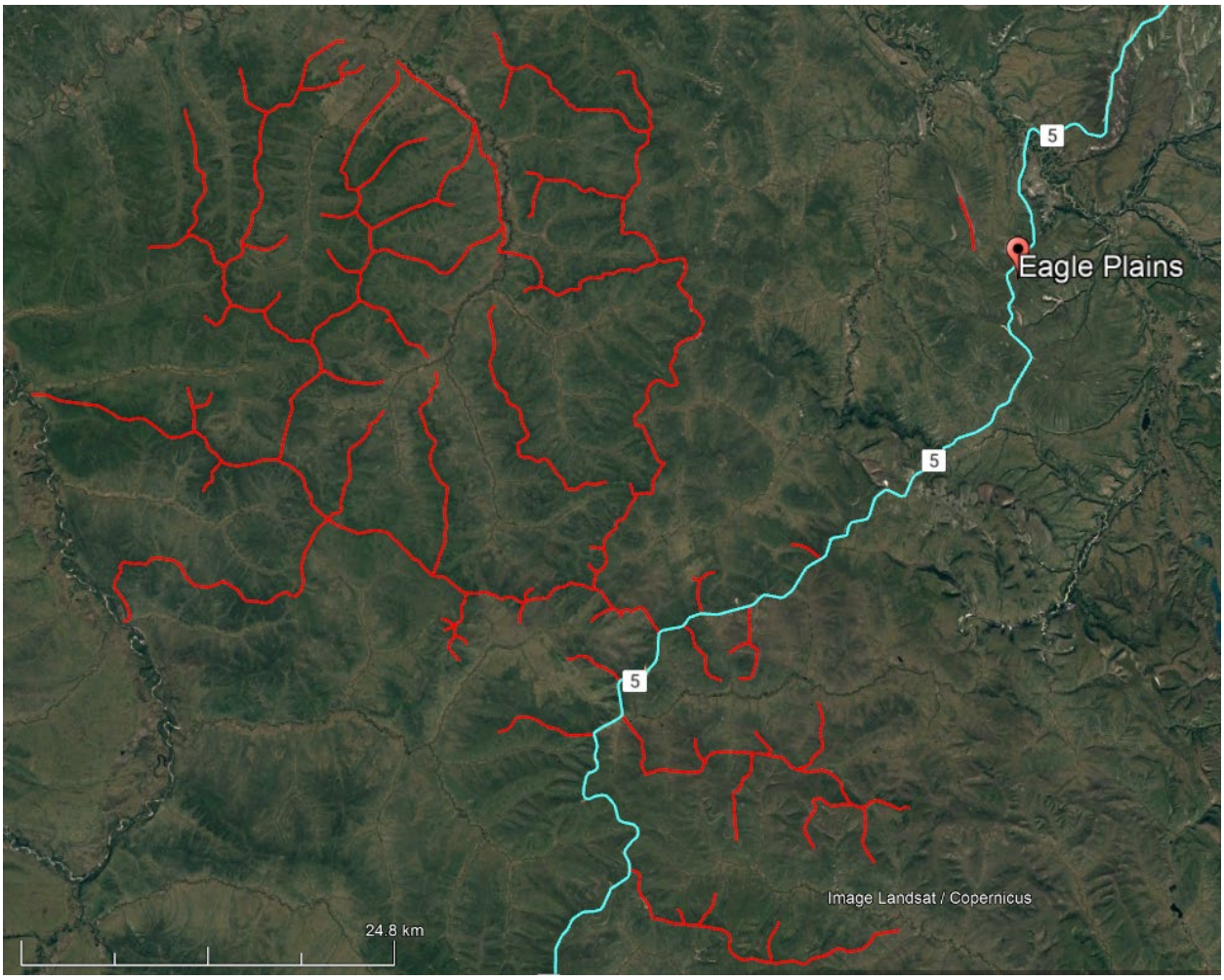


Figure 3-12. Conceptual winter road network.

3.3.2.1 Routing Rationale for the Winter Roads

The routing of a winter road needs to consider the following criteria (discussed in detail below):

- road geometry, such as grades and curves to suit the intended vehicles;
- number and width of water crossings;
- avoidance of unfavorable terrain;
- avoidance of selected areas determined by historical resources, vegetation, wildlife habitat, etc.; and,
- sensitivity of permafrost terrain to the construction of a winter road.

Road geometry — Ideally, for vehicle safety and operations, the maximum gradients on the road should be 6% or less, with only short sections up to 10%. The routing developed for this Project generally falls within this range, although route adjustments will likely be undertaken in the field if these desirable gradients are met.

Number and width of water crossings — Selecting routes that minimize the number and width of water crossings reduces the complexity of the winter road construction and the uncertainty or risk during operation. For this Project, there is only one wide crossing, and all crossings are expected to be completely frozen during the operating season.

Avoidance of unfavorable terrain — Chance has undertaken terrain mapping of the area. The route is located on bedrock, weathered bedrock and colluvial sediment where possible.

Sensitivity of permafrost terrain to constructing a winter road — Chance has undertaken permafrost mapping in combination with terrain mapping. The route, where possible, is generally located on ice-poor to ice-moderate permafrost. Ice-rich permafrost is sensitive to the activities associated with the construction and operation of winter roads and should be avoided to the extent possible. Specific mitigation to preserve permafrost will be undertaken in situations where it must be crossed.

The development of the routing for the potential winter road network has considered these criteria. The potential routes have been selected to minimize the effect of unfavorable terrain and thaw sensitive permafrost terrain while balancing the need to access sites.

3.3.2.2 Construction Considerations and Operating Season

The winter road will not be constructed until the ground is sufficiently frozen and has adequate snow cover to limit disturbance to the ground and vegetation.

Winter road construction will commence when the depth of snow cover is approximately 10 cm and sufficient to cover low-lying vegetation thereby minimizing effects to the ground. The winter road will be constructed with dozers supplemented with steel frame drags. Other equipment may be required to haul snow as necessary.

The winter road widths will be dependent on the size of vehicles to be used each season. Single-lane winter road for smaller lighter equipment and very low traffic volumes will be as narrow as 5 m. Wider two-lane winter roads, approximately 9 to 10 m in width, will be constructed for larger equipment and greater numbers of vehicles.

Closing a winter road is based on observed depletion of snow cover and current and forecasted weather. Once the insulating snow softens and disappears and the daily air temperatures rise above 0°C for a few days, the winter road will be operated only at night, and eventually closed before the ground thaws. Diligent and ongoing observations of the conditions and the forecasts will be undertaken to ensure that equipment is moved off site and the winter roads are closed appropriately.

The general operating season for a winter road in this area is estimated to be from the end of January to the end of March. Still, it could last longer depending on the timing of opening and the end of winter.

3.3.2.3 Mix Bury Cover (MBC) Sump Access Road

Chance also proposes constructing a 400 m long, 6 m wide winter road to the proposed MBC sump area. This road will be built as early in the operating season as possible (soon after mid-January as snow and weather permit) and will take approximately two weeks to complete. It will be reopened each winter season that drilling occurs. The proposed route follows an existing access trail; no major clearing will be required. The proposed route includes no watercourse crossings and is 800 m from the nearest surface water body.

3.3.2.4 Access Road Maintenance

Maintenance of winter access routes may include low-ground-pressure vehicles, a road grader equipped with a wing snow plough, some water application, and use of matting where required. Grading may be required over certain stretches of the route, and depressions along the roads will be filled with snow to smooth the surface. If required, water will be withdrawn from approved water sources using adequately sized intakes and screened to prevent debris blockage and fish mortality; refer to Interim *Code of Practice: End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater* (Government of Canada 2020).

3.3.3 Mix Bury Cover (MBC) Sump

As described and detailed in AER *Directive 050 Drilling Waste Management* Section 13 (Alberta Energy Regulator 2023), and accepted in the Yukon, MBC is a method of disposing of drilling waste (both drill cuttings and drilling mud) by which the by-products and spent mud are mixed with a local receiving soil at a specific mix ratio, deposited into a sump area, and then covered with clean subsoil.

A typical MBC sump design consists of three distinct layers:

- A clean subsoil layer 1 to 1.5 m deep on top of the drill cuttings and soil mix; this layer acts as an insulator between the subsoil/drill cutting mix and the vegetative layer to ensure that, after final reclamation, the site is returned to its original state.
- The subsoil/drill cutting mix layer is where the receiving subsoil is mixed at a specified mix ratio with the disposed of material (e.g., drill cuttings, spent drilling mud, etc.).
- Clay-rich material exceeding 1 m depth below the drill cuttings and soil mix, or alternative impermeable liner, acts as a hydraulic isolator.
- The identified MBC sump location will be investigated for suitability via drill cores to confirm the following conditions are present and at what depth:
- Sump soil has appropriate deposits of clay-rich soils.
- Appropriate clay-rich material of 1 m is beyond the horizontal and vertical dimensions of the sump to ensure hydraulic containment.
- There is an absence of hydraulic defects or ways for fluid to leak out of sump.
- A composite sample, made up of five subsamples, is required for every 3,000 m³ proposed to be used for MBC.

Before Chance begins exploratory drilling, a test sample of the drilling fluid will be analyzed and compared against the receiving soils at the proposed MBC site to estimate the soil/waste mix ratio to ensure the final soil composition complies with AER Directive 050 Drilling Waste Management Section 3 (Alberta Energy Regulator 2023). While an MBC sump is actively being used, Chance will monitor and inspect the site to evaluate sump integrity, volumes of material involved, and if further work is needed to the sump location.

For the proposed Project, drill cuttings will be transported to and disposed of at the identified MBC sump site, while drill fluids will be reused until the end of the Project or the end of the season. Chance plans to construct a new MBC sump (see **Figure 22**). The Devon sump location has not been used by Chance to dispose of drill cuttings or drilling fluid, and there are no plans to do so. The preferred MBC location for this Project is an adjacent, previously undisturbed area of approximately 63,910 m².

Figure 3-13 shows the proposed area with several 800 m² MBC pods representing an estimated area required to dispose of 300 m³ of drill cuttings, approximately one well's worth. The additional area is to accommodate spacing between MBCs for truck access and to stockpile excavated material. Typical operational practice is to have only one MBC pod open at a time to minimize potential permafrost exposure to ambient air temperature.

As per the AER directive, sampling drill waste will undergo the following sampling procedures:

- During drilling, the environmental monitor will be onsite to conduct sampling in compliance with AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023) to ensure that drilling waste is compliant and accurate records are being kept, and to respond to any spills.
- The environmental monitor will take soil samples at the MBC site before use for MBC and after closure and reclamation.

If drilling by-products do not meet AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023), the disposal materials will be transported to an appropriately permitted facility for disposal. Chance has previously used permitted facilities that can accept specified waste in Whitehorse and northeast BC.

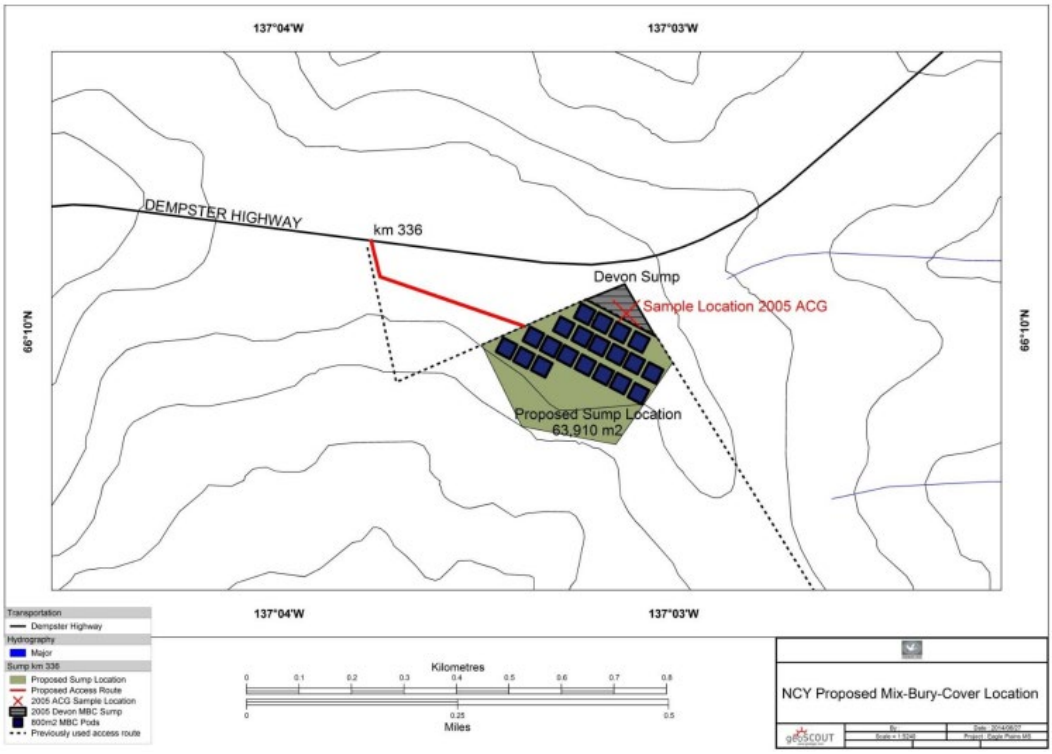


Figure 3-13. General location and plan of the proposed Mix Bury Cover (MBC) sump.

3.3.4 Central Processing Facility (CPF)

The Chance Camp's Central Processing Facility (CPF) will be located at the southernmost end of the camp area, furthest from other camp structures and personnel. The CPF will comprise multi-stage and multi-phase separators, heater treaters (to remove any remaining emulsified formation water and residual natural gas still in solution), a vapour and gas collection system, and a possible central power generation facility to charge all discrete well batteries. Trucks will transport fluid produced during EFT or (occasionally) DST from exploration wells for further processing at the CPF. Separated water will be further treated to remove any hydrocarbons, scale, anaerobic bacteria, and other colloidal or suspended solids ready for disposal in a nearby deep injection well.

Crude oil produced during the EFT would be preferentially stored temporarily for future shipment to market. This may require some processing at the well site or the CPF to stabilize the crude oil for truck transport to a suitable, approved crude oil marketing point (i.e., terminal). The volume (stored in up to five surface tanks in full compliance with Yukon and Canadian standards and regulations) also ensures safe crude stabilization before loading onto southbound trucks. In terms of maintenance, the only treatments appearing necessary at this stage of design are fluid separation (to separate oil from gas and water into three distinct streams), heat treating the crude to remove water remnants from the separated crude, and gas dehydration to make the gas useable as a fuel.

3.3.5 Airstrip

Chance will construct an airstrip along the existing Chance winter trail approximately 4 km off the Dempster Highway. The airstrip will be about 1,500 m long and part of the road network west of the Dempster Highway. This airstrip will be used only during the winter when the surface can be levelled using winter road construction techniques. If sufficient air traffic support is required, Chance may upgrade the airstrip to year-round usage. Until the Chance Road airstrip becomes serviceable each winter or at the end of the winter season operations when trail conditions deteriorate, Chance will continue to use the Dempster Highway adjacent to the camp as a periodic airstrip.

At the beginning of an operating season, the 800-m stretch of the Dempster Highway adjacent to the camp will be used as an airstrip similar to previous periods. Once the Chance winter road airstrip is built, flights will move to that location.

3.3.6 Transportation

For most of the exploration program, Chance will attempt to limit traffic on the winter access roads to authorized personnel. Traffic will include approximately eight to nine light-weight service trucks daily (for supplies and personnel), one to two water trucks, and one fuel truck as frequently as operations dictate. The fuel and water trucks will come to the Project site approximately three times per week or as demand dictates, and there will be occasional transport of drill cuttings from the well sites to the sump location. Air traffic is estimated at two flights in/out per week (normal arrival times between 10:30 a.m. and 12:00 p.m.).

Most traffic volume on winter access roads will be related to mobilizing the drill rig and constructing the site infrastructure. Well site set-up will take approximately five days, including 15 to 20 loads, to mobilize the drill rig. Winter roads will be restricted from public access for safety reasons. Chance's contractors will be transporting crews between the camp and the well site using company vehicles; all vehicles will be equipped

with radio communication and, particularly during busy times (i.e., setup and demobilization), traffic will be radio controlled. For safety reasons, any personnel accessing the areas (i.e., winter roads) must notify the appropriate staff (i.e., security personnel or managers/supervisors) when they leave the Dempster Highway and arrive at the well sites. Chance staff hired as wildlife monitors and security personnel will monitor access to the winter roads.

A typical description of road traffic during the prime operating periods (January 1 to April 15; May 1 to December 1) is presented in **Table 3-4**, and road users will follow the schedule as indicated previously in **Table 2-3** and **Table 3-3.**

Table 3-4. Typical road traffic during operating windows.

	Activity Description	Peak Traffic	Normal Traffic
1	Early Season Mobilization (Winter)	High	Light /High
2	Rig Mobilization (Winter)	High	Light /High
3	Drilling (Winter)	Light/High	Light
4	Access Road Construction (Winter)	Light/High	Light
5	Extended Flow Testing (Winter)	Light/High	Light

Notes:

1. High: 20–40 vehicles per 24-hour day
2. Light: less than 20 vehicles per 24-hour day

Chance expects vehicle volumes on the winter access roads during exploration drilling activities will range between medium and light traffic volumes. Minimal additional traffic is expected to and from the site, except for the trips by the water truck and fuel truck, which will be on-demand, transportation of other supplies as needed and possibly transport crude oil produced during EFT to an acceptable market off-site.

Trucking a stabilized crude oil cargo in specially constructed transporting tanks presents the same risk as transporting the diesel fuel required and used in Yukon. The process of loading and dispatching trucks at regular intervals will be planned and handled by professionals who will also maintain constant communication and GPS tracking of trucks as they travel down the Dempster Highway and on other connecting routes to their destination.

Chance has practised Journey Management on its previous exploration drilling work at Eagle Plains. In this instance, any unit transporting materials to Chance's Camp at km 325 will be called and tracked periodically by the dispatcher. The exact location when reaching certain pre-determined checkpoints will be relayed to the Chance Camp Management and Logistics Coordinator; this will ensure road safety for the truck driver and other road users and the safety of the vital cargo. It also provides critical planning information for receiving staff to plan for offloading its cargo and possibly loading backhauls.

The journey distance is 1,029 km from Eagle Plains to Skagway. The journey duration is approximately 17.5 hours driving at an average speed 59 km/hr. Other options exist, including truck delivery to terminals in Fort Nelson and Fort St. John, BC, or Grand Prairie, Alberta. The driving times will vary depending on which of these options is used, but the management procedures will remain the same.

Chance and its trucking contractor(s) will develop a *Transportation Alert and Emergency Response Plan* to manage potential risks and provide a clear chain of communication and action in the event of an accident while in transit on Yukon roads and highways. The plan will address any other Provincial routes. All reputable trucking contractors versed with transporting flammable liquids and petroleum products generally are mandated to follow the *Transportation of Dangerous Goods Act* (Government of Canada 1992). Ensuring the truck is safety-checked and the drivers are qualified and adhere to their company's safety policies are the key to preventing an incident or accident. Tracking the drivers to check on transit speed on a real-time basis means the truck's progress is never neglected and the driver is on notice to observe all road traffic rules at all times.

All incidents affecting Chance's trucking contractor are reported to Chance Operations Management and form part of Chance's safety statistics. Every incident is investigated, and the causes for each occurrence are closely analyzed and discussed with the truck owner. Should any trucking contractor exhibit an undue number of close calls/near misses or a series of incidents with the same causes, they would be removed from the contract without delay and replaced with a more competent and safety-minded contractor.

3.3.7 Workforce and Accommodations

Workforce requirements will vary over the life of the Project and will ultimately be limited by the existing camp capacity. During past drilling and seismic exploration programs undertaken between 2012 and 2014, Chance had no more than 75 to 80 people on-site at any time. During drilling, Chance operated on a 24-hour clock with a 20-day-on and 10-day-off crew rotation cycle, meaning that one-third of the crew was off duty at any point. Chance operated on a 12-hour clock for the seismic exploration program and cycled the various services as the program unfolded with limited crew changes, mostly connected with the camp catering operation.

Chance's existing camp (Chance Camp), office, and storage yard was established in October 2011 and is located at km 325 of the Dempster Highway. It is accessible year-round unless the highway is closed due to weather or construction. For this Project, Chance plans to use the camp for storing and transporting equipment and supplies needed for operations and personnel accommodations. The Chance Camp is the Project's main accommodation facility, and it can house up to 75 people in trailers and kitchen, sanitary and potable water treating facilities. Camp waste management consists of an incinerator for burning non-toxic and food waste and a secure storage area for other forms of waste. All non-incinerated waste will be transported to an appropriate municipal waste facility for disposal.

Due to the remoteness of some well sites, a remote camp (fly-in) would be established near the proposed East Greaves and West Greaves Winter Trails, roughly 40 km from the Chance Camp, to accommodate approximately 25 personnel. It would be used as an operations camp with full services, including food, fuel, sleeper trailers, bathrooms, water storage, and project management and HSE offices. The fly camp is necessary for operations planned in the winter months as the cold temperatures approaching -50°C, nearly 24-hour darkness and the potential of "white out" snow storms pose a real threat to crew member safety.

In addition, a mobile camp will be established at each active well. This will be a trailer that accommodates sleeping and a small medical/first aid trailer equipped with heat, power, water, and sewer service that may be installed at the well site during workover operations to provide essential first aid supplies and refuge for

workers. All wastewater and sewage will be collected in tanks approved by the CSA and transported off-site for disposal at an approved facility in Fort McPherson.

Chance aims to offer training, employment and contracts to its First Nation/Yukon partners as identified in sec. 68 of *YOGA* (Government of Yukon 2002). During its last drilling/seismic program, Chance successfully hired a workforce from the communities from Old Crow, Fort McPherson, Dawson, Whitehorse, and Inuvik.

3.3.8 Project Water Use

Water for the drill rig, winter road construction and the camp operation will be primarily sourced from existing withdrawal locations on the Eagle River, with locations on the Ogilvie River and Whitestone River as an alternative source. Licensed allowances will determine water usage. All water withdrawals will follow the DFO's *Interim Code of Practice: End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater* (Government of Canada 2020).

If natural snowfall is below the minimum required depth to construct and maintain the winter roads, snowmaking equipment may be used to make up the shortfall. This is a contingent consideration and could require up to 300 m³ of water per day for a short period (a few days to a week) in the early winter. The sources of water include the Eagle River and the Ogilvie River. The water used to make snow and ice for the winter road(s) will be trucked from the source to the point of use, with each truck expected to complete between one and three deliveries per day.

Potable water for the Project will be sourced from the Eagle River, Ogilvie River and potentially the Whitestone River at a maximum rate of 20 m³/day, as described in Water Licence MN12-061 and treated at the Chance Camp using a combination of ultraviolet (UV) treatment, chlorination, and filtration. Wastewater disposal at the Camp consists of a wastewater treatment plant, holding lagoon, and exfiltration system.

3.3.9 Fuel Storage

Operation of the camp will require diesel and propane for power, heating and cooking. Diesel will be stored on-site in 15,000 L Enviro Tanks. There will be four to six tanks at the camp and one to two at the rig site. The tanks are bulk fuel, double-walled storage tanks with built-in secondary containment. The drilling rig, boilers, and any light towers at the rig site will have their own built-in fuel storage tanks.

Propane will be used to fuel the furnaces, hot water tanks, and the kitchen at the camp and at the rig sites and will be stored in 1,500 L propane bullet tanks. There will be six at the camp and one to two at the rig camp.

3.4 RECLAMATION AND CLOSURE

3.4.1 Seismic Lines

In addition to the low impact seismic methodology, with reduced line width and meandering paths, a remediation plan involving access deterrence will be used. Although nominal, standing timber will be gently pushed across lines to create a Leaning Tree Stand (LTS) using a "Stem Bending" method to decrease

these sight lines. Although not expected to be required to a great extent in the Eagle Plains area, this technique is highly effective in reducing access and enabling sufficient cover for vegetation regeneration.

3.4.2 Mix Bury Cover (MBC) Sump Site Reclamation

The standard AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023) of action prescribes the following closure and reclamation actions for MBC sumps:

- Upon completion of the Project, remote disposal locations will be covered with a minimum of 1.0 m of capping material and contoured to meet background topography.
- A Phase 1 Environmental Site Assessment (ESA) will be completed for each well and corresponding remote MBC location to identify any potential areas of environmental concern.
- If the Phase 1 ESA triggers a Phase 2 ESA, soil samples will be collected and analyzed at an accredited laboratory.
- If contamination is identified, a Remediation Action Plan will be prepared and upon approval, the remedial program will be completed. Once all contamination is addressed either in the Phase 1 ESA, Phase 2 ESA, or Remediation, a surface program including soil and vegetation will be conducted.
- Once vegetation is established, a Detailed Site Assessment; comparing soil lithology and vegetation onsite to offsite) will be completed.

The stockpiled vegetative layer and soil will be re-applied to the MBC sump area on top of the capping materials and after contouring has been completed.

Environmental monitors will follow the testing requirements in accordance with AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023):

1. Receiving soil
    a. Electrical conductivity and sodium adsorption ratio
2. Waste (solids or total waste)
    a. pH, electrical conductivity, sodium adsorption ratio, sodium (Na)
    b. nitrogen (N), if additives/products added to the drilling mud/waste system contain any amount of N or if N content was unknown
    c. metals, if concentrations exceeding limits were added to the drilling mud system or if the metal content of additives/products is not known
    d. hydrocarbons, if a hydrocarbon flag was encountered
    e. toxicity, if toxicity data are unknown for any of the mud additives/products used in the drilling mud system or if concentrations used exceeded pass threshold for luminescent bacteria toxicity test
3. Waste/soil mix (post-disposal)
    a. conductivity (EC), sodium adsorption ratio (SAR), and Na, if drilling waste EC >10 decisiemens per metre (dS/m) or Na >3000 milligrams per litre (mg/L) (saturated paste extract or filtrate from oversaturated waste)
    b. metals, if concentrations in drilling waste exceed concentrations listed
    c. hydrocarbons, if concentrations in the drilling waste exceed concentrations

d. N, if the nitrogen concentration in the drilling waste (wet weight) is ≥6 milligrams per kilogram (mg/kg) for disposals in coarse soil or ≥120 mg/kg for disposals in fine soil.

The first task on any well site is constructing the well pad or preparing the surface on which matting can be safely placed. The next step is to lay the mats on the 10 cm of packed snow, moving snow as needed to create a flat surface. The final process, before deploying the drilling equipment, is a professional geotechnical check on the stability of the surface and its resultant ability to support the maximum anticipated loads with a suitable safety factor. Finally, the geotechnical engineer will provide a signed/stamped report attesting to the stability and strength of the facility for the work contemplated.

3.4.3 Well Abandonment

As mentioned, the 30 proposed wells are part of an exploration program to help determine the region's oil and gas resource potential. Depending on the outcome of results, a given well may be tested and additional plans developed to bring it into production or decommissioning and abandonment if determined to be unproductive. As the Operator, Chance will always be responsible for all wells deemed its property. This responsibility can never be delegated to any other party unless and until such time Chance relinquishes ownership according to *YOGA* and its regulations (Government of Yukon 2002, 2004).

The standard AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023) of action prescribes the following closure and reclamation actions for well sites:

- A Phase 1 ESA will be completed for each well location to identify any potential areas of environmental concern.
- If the Phase 1 ESA triggers a Phase 2 ESA, soil samples will be collected and analyzed at an accredited laboratory.
- If contamination is identified, a Remediation Action Plan will be prepared and upon approval, the remedial program will be completed. Once all contamination is addressed in the Phase 1 ESA, Phase 2 ESA, or Remediation, a surface program will be conducted, including soil and vegetation.
- Once vegetation is established, a Detailed Site Assessment; comparing soil lithology and vegetation onsite to offsite) will be completed.

Wells required for further operational uses such as producing wells, water or gas injector wells will be maintained in a suspended state and can be converted for use in the future. The *Oil and Gas Drilling and Production Regulations* under *YOGA* (Government of Yukon 2004) have specific actions required from an operator to maintain a well in a suspended state; key among these actions is to periodically conduct inspections to ensure that the integrity of the well is intact. While a well is in suspended status, the regulator requires a sum of money to be placed on deposit to cover the cost of abandonment and remediation of the site. Once abandoned, the status becomes permanent, and re-entering such a well would not be possible.

The normal stages before decommissioning/abandonment of a well are as follows:

- The well is first determined to be unusable.
- The perforations are first cemented by placing a cement plug below and above them and squeezing cement into the formations to isolate them within the wellbore permanently. A

mechanical shut-off device called a bridge plug may also be wireline set above the cement plug to add protection or isolation.

- A second cement plug would be set higher in the production casing and below the estimated permafrost maximum depth. This plug is normally set on top of a bridge plug to ensure it does not leak down in the casing. The plug is also "felt" with a drill bit to confirm its existence and hardness.
- The casing at the surface is cut 1 m below the original ground and buried under the soil to remediate the location entirely. The soil will be left to achieve a frozen state naturally, and permafrost is expected to establish within it at the same depth as the surrounding area.
- The lease is remediated by removing all equipment and infrastructure to restore the location to its original status. The surface location is left to be revegetated naturally.

When appropriate, a decommissioning/abandonment plan for the well sites will be developed to comply with Part 7 of the *Oil and Gas Drilling and Production Regulations* (Sections 95, 96, 97, 99) (Government of Yukon 2004). Wells would require final well abandonment according to the *YOGA Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004).

During winter work, sampling can be accomplished from the surface snow deposits around the well site. Chance has selected well site dimensions to ensure a sizable perimeter for containing liquid or solid waste from the Project. The well site will be lined to contain potentially released fluids. An outline procedure prepared by Chance in compliance with the *YOGA Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004) is presented as follows:

- Seal off all perforations in the casings not already sealed with cement squeezes.
- Pressure test the casings to 7,000 kilopascals (kPa) to confirm isolated and sealed formations.
- Cut off the wellhead and casings to 1 m below ground level and weld/install plates to cover each casing string at the surface.
- Install well identification marker visible above ground level.
- Bury the cut casings to complete the abandonment.

If the entire Project had to be suspended but not completed, the infrastructure would be preserved and maintained until the Project resumes. If it is decided to terminate the Project, the infrastructure will be decommissioned. While operations are suspended, Chance would ensure access from the Dempster Highway would be barricaded and visually inspected periodically.

3.4.4 Winter Roads and Winter Well Sites

Reclamation activities will aim to enable sites to revegetate naturally as quickly as possible throughout the life of the Project. Well site and winter road reclamation activities will be designed to meet the following objectives:

- Leave the site uncontaminated following the completion of Project activities.
- Remove all garbage, petroleum products, and equipment.
- Prevent long-term erosion or slumping and promote successful natural revegetation of disturbed areas.

Given the winter road construction methods that will be employed (i.e., packing snow to a minimum thickness of 10 cm), no additional reclamation is anticipated to be required for the winter roads. Proposed Project activities will take place during winter, and the winter access roads and well site pads will be constructed using snow and ice to minimize damage to the vegetative layer or compaction/scarification of the organic soil layer. The proposed measures to promote successful natural revegetation are as follows:

- Complete removal of equipment, matting, materials and debris from well sites.
- Leaving the well sites and winter roads in such a condition that water ponding, slumping or soil erosion are unlikely outcomes – if (unplanned) soil disturbance takes place, the surface would be contoured to minimize erosion (depending on the area disturbed), roughened, and covered in a layer of mulch or cut vegetation.
- No stockpiles of snow or ice will be left at the well sites or along the winter roads, to minimize melt-related effects on vegetation.
- Existing shrub-stage vegetation will be pushed over, or cut as high as possible, during winter road construction.
- Trees and shrubs will be cleared but ground vegetation will be left intact and protected via minimum 6” packed snow or rig mats. Where trees and large shrubs exist, they will be hand cut and piled to form brush piles that will inhibit human travel and provide ongoing soil/non-woody vegetation protection post-melt.

Access to winter roads will be restricted during and after operations. Restricting access will ensure that the road can fully melt in spring, thus reducing the potential for additional disturbance from outside users and reducing risk to Chance employees and the public.

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APPENDIX 2-A-28. *First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Limited Engagement and Communication Plan* (Version 2)

DRAFT 2021 ANNUAL REPORT

Implementation of the First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Engagement and Communication Plan

PLEASE NOTE: Chance Oil and Gas Limited has reviewed and approved this report. The First Nation of Na-Cho Nyäk Dun was provided a draft, but has not provided feedback. As Hemmera was unable to secure a signature from the First Nation, the signature boxes were removed from Page 5 and this document retains the DRAFT watermark.

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July 30, 2021

1.0 INTRODUCTION

This report demonstrates implementation of the *First Nation of Na-Cho Nyäk Dun and Chance Oil and Gas Limited Engagement and Communication Plan* (Plan) (see **Appendix A**) finalized on August 8, 2018. It summarizes discussions held between First Nation of Na-Cho Nyäk Dun (FNNND) and Chance Oil and Gas Limited (Chance) between June 1, 2020 and May 31, 2021. The purpose, objectives, and outcomes of each discussion are described below in order to fulfill the requirements of Ministerial Order (MO) 2018/42 (see **Appendix B**) issued to Chance on August 30, 2018.

2.0 BACKGROUND

The development of communications and engagement plans began with Order in Council (OIC) 2016/169. OIC 2016/169 required Chance to file a First Nations communication and engagement plan with the Minister of Energy, Mines and Resources in order to extend tenure on their northern permits: 0005, 0006, 0007, 0008, 0009, 0010, and 0011. Chance complied with OIC 2016/169 and received their tenure extension.

Chance subsequently received MO 2017/37 when applying for tenure extension on six of eight southern permits: 0012, 0013, 0014, 0015, 0016, and 0017. MO 2017/37 required Chance to revise, in consultation with affected First Nations, the consultation and engagement plan filed under OIC 2016/169. The affected First Nations listed in MO 2017/37 were Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Tetlit Gwich'in Council.

FNNND and Chance collaboratively developed their Plan through a series of in-person meetings and conference calls. Hemmera was retained by Chance in November 2017 to facilitate the development and completion of the communications and engagement plans with the affected First Nations and facilitated all discussions between FNNND and Chance.

Chance and FNNND submitted their finalized Plan to Minister Ranj Pillai on August 28, 2018. To satisfy their obligations under MO 2017/37, Chance filed a total of four communications and engagement plans. All four plans were approved by the Minister and Chance received a five-year tenure extension on the six southern permits.

A condition of the five-year tenure extension, issued via MO 2018/42, required that Chance submit annual reports summarizing actions taken to implement each communications and engagement plan.

See **Appendix C** for a map of Chance's current permits.

3.0 ENGAGEMENT AND COMMUNICATION PLAN IMPLEMENTATION SUMMARY

3.1 Overview

Parties have advanced discussion on Chance's proposed Eagle Plains Exploration Project and Chance's proposed project for Well Maintenance and Extended Flow Testing. The following sections provide separate summaries of engagement activities that occurred for Chance's projects between June 1, 2020 and May 31, 2021.

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3.2 Summary of Engagement – Well Maintenance and Extended Flow Testing Project

Initial notification was sent to FNNND on May 25, 2020. That package included a high-level overview of the project (e.g., project activities, components, goals, outcomes), the regulatory submissions Chance would be making, a brief introduction to Hemmera and its role, as well as a request to discuss any concerns the affected party may have and an offer to arrange a conference call should they so desire. Also included was a 4-page project summary and map of the project location.

Additional communications followed on June 9, June 24, and July 20, 2020. Chance did not receive feedback from FNNND while the project was being refined or when the project proposal was being drafted. A draft of the Project Proposal was shared with FNNND July 24, 2020.

Following additional conversations with the regulator (Government of Yukon), Chance was required to make changes to its project design. On August 7, 2020, FNNND was provided notice that revisions were being made to the project and that additional information would be forthcoming. A revised project proposal was provided, via email, to FNNND on August 28, 2020, along with a cover letter summarizing the revisions and providing a rationale for each.

Chance submitted an initial project proposal to YESAB on September 11, 2020. However, after further consideration, Chance determined that additional changes were required. On November 2, 2020, via email, Chance notified FNNND that it had decided to withdraw its project proposal from YESAB and submit a revised version. In that email Chance stated that once a revised proposal had been drafted, Chance would notify FNNND by sharing a draft and requesting a meeting to discuss the changes further, and Chance stated at that time that after it had the opportunity to discuss those changes with FNNND, the project proposal would be finalized and resubmitted to the Dawson Designated Office.

The revised draft project proposal was provided via email to FNNND on November 19, 2020, and in that email Hemmera indicated that Chance would be submitting the proposal to YESAB the following day. On November 20, 2020, Hemmera informed FNNND that Chance would delay submission until the following week. That same day, a FNNND representative replied indicating the draft was received and being reviewed.

New FNNND staff were assigned the Chance file, and, on November 25, 2020, they requested previous versions of the proposal in order to better understand the project's evolution. On behalf of Chance, Hemmera provided previous version of the proposal and an overview of changes/revisions that had taken place. Hemmera also provided additional context with respect to Chance's larger portfolio and proposed projects and engagement activities.

To allow for additional revisions, Chance's submission to YESAB was delayed until December 24, 2020.

3.3 Summary of Engagement – Eagle Plains Exploration Project

Between June 1, 2020 and May 31, 2021, Chance and FNNND have had only one meeting pertaining to the Eagles Plains Exploration Project.

3.3.1 Meeting Summaries

Date: May 5, 2021

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Location: Microsoft Teams
Attendees: FNNND Consultant, Chance Management, Hemmera

Chance last engaged FNNND on the Eagle Plains Exploration Project in 2019 and the purpose of this meeting was for Chance to re-initiate engagement. Chance presented a high-level overview of exploration activities proposed for the Eagle Plain Basin. The presentation also highlighted any changes in project design that occurred since it had last been shared with FNNND in 2019. The presentation went over the layout of well sites, drilling methods, seismic program, and workforce. Chance also provided recent information and updates regarding baseline information gathered by Chance's consultants (Environmental Dynamics Inc (EDI), Peer Solutions, Palmer), and Parties discussed next steps regarding FNNND's preferences for community engagement and consultation (e.g., schedule, format).

Chance stated that their timeline was aiming for a Fall 2021 submission to Yukon Environmental and Socio-economic Assessment Board (YESAB) and that Chance was working towards getting into the communities in order to learn about, and address, any concerns related to ecological impacts. FNNND asked if more studies had been completed by EDI since Chance had last spoken to the community. Chance confirmed that EDI has conducted additional studies (e.g., fish sampling, linear features study) and that they would be shared with FNNND as they are completed.

Chance and FNNND discussed the proposed seismic program. Chance explained that current seismic data covers a broad area, but has limitations. Chance needs to investigate/target areas of interest and subsequently requires approximately seven times the 3D data that is currently available. Chance confirmed that none of its proposed activities would take place on settlement land. FNNND asked about heritage studies and Chance stated that it had completed a heritage study previously and that at the time Chance has worked with Joella Hogan from FNNND and Vuntut Gwitchin Citizens. Chance committed to sharing a copy of that previous report with FNNND. On the topic of regulations and submission to YESAB, FNNND asked if regulators were involved in the pre-screening. Chance replied that they have been in contact with Derek Fraser from Yukon Government.

Chance and FNNND discussed community engagement strategies. FNNND stated that they are very busy and requested that Chance share its proposed draft engagement schedule. FNNND suggested that Chance meet with the Mayo Renewable Resource Council and that the meeting potentially include FNNND Lands staff. FNNND stated they would speak with leadership to seek direction on engagement preferences moving forward. Chance was to send the revised project description and baseline studies as they become available.

3.3.2 Communication Log

The correspondence between Chance and FNNND is documented in the Engagement Log (see **Appendix D**).

4.0 PLANS FOR ONGOING ENGAGEMENT AND NEXT STEPS

No additional engagement activities are expected for the Well Maintenance and Extended Flow Testing Project while it is undergoing YESAB's review.

FNNND and Chance will continue to hold discussions at regular intervals as Chance develops its project proposal for the Eagle Plains Exploration Project.

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Upcoming engagement activities for the Eagle Plains Exploration Project are expected to involve the following:

- Sharing baseline data
- Meetings between FNNND technical staff and Chance's technical consultants preparing the project proposal for proposed Eagle Plains Exploration Project
- Community engagement events for FNNND citizens

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5.0 APPROVAL OF IMPLEMENTATION SUMMARY

FNNND and Chance have reviewed this report and agree to its contents as an accurate summary of the engagement activities carried out between June 1, 2020 and May 31, 2021.

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APPENDIX A

Na-cho Nyak Dun and Chance Oil and Gas Limited Engagement and Communication Plan

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First Nation of Na-Cho Nyäk Dun
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Tel: (867) 996-2265
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August 10, 2018

[redacted]

Minister of Energy, Mines and Resources
Government of Yukon
Box 2703
Whitehorse, Yukon, Y1A 2C6

Re: Submission of the First Nation of Na-Cho Nyak Dun and Chance Oil and Gas Limited Engagement and Communications Plan

Dear Minister [redacted]

I am pleased to inform you that the First Nation of Na-Cho Nyak Dun and Chance Oil and Gas Limited (Chance) have concluded our work to develop a framework to facilitate effective and meaningful communications and engagement between ourselves and Chance. The framework captured in the enclosed Engagement and Communications Plan establishes a foundation for a respectful relationship, that we will cooperatively address Na Cho Nyak Dun's capacity and resourcing needs to implement the framework as we continue to work together to ensure the environment is protected and development occurs in a sustainable manner.

Please accept the enclosed Plan for the purposes of Ministerial Order 2017/037. We trust that the Plan will be of satisfaction to the Minister.

I look forward to the next step in the process related to the government to government Consultation regarding the possible renewal or further extension of the oil and gas leases related to this project.

Sincerely,

[redacted]

Chief [redacted]

Encl: *First Nation of Na-cho Nyak Dun and Chance Oil and Gas Limited Engagement and Communication Plan*

CC:
[redacted] Director of Lands and Resources, First Nation of Nacho Nyak Dun
[redacted] Director, Yukon Government
[redacted] Assistant Deputy Minister, Yukon Government
[redacted] President Chance Oil and Gas Ltd.
[redacted] VP Community and Government Relations, Chance Oil and Gas Ltd.
[redacted] Regulatory, Environmental and Community Relations Coordinator, Chance Oil and Gas
[redacted] Senior Project Manager, Hemmera

First Nation of Na-cho Nyak Dun and Chance Oil and Gas Limited Engagement and Communication Plan

1.0 Introduction

Chance Oil and Gas Limited (Chance) is an oil and gas exploration company that holds permits to perform oil and gas exploration activities in the Eagle Plain basin of Yukon Territory, Canada. As part of Chance's exploration program, Chance seeks to develop engagement and communication plans with all the First Nations that are potentially affected by Chance's exploration program activities. Permits 14, 15, 19, and 20 fall within or partially within the First Nation of Na-cho Nyak Dun Traditional Territory and Chance is seeking to engage the First Nation of Na-cho Nyak Dun (FNNND) on its activities within these permits.

2.0 Purpose

This document serves as an Engagement and Communication Plan (Plan) to provide a mutually agreed upon framework to support collaborative and effective engagement and communication between Chance FNNND now and into the future. This Plan incorporates and aligns with FNNND's *Cooperative Engagement Process*.

3.0 Relationship

Chance and FNNND will execute this Plan according to the following principles:

- Transparency and openness;
- Timeliness;
- Integrity;
- Adaptive Management;
- Mutual respect; and
- Working towards trust and understanding of one another.

These principles are adapted from the FNNND *Guiding Principles for Mining Interests* and from Chance's corporate values.

4.0 Key First Nation of Na-cho Nyak Dun and Chance Connections

Engagement and communication between Chance and FNNND will be generally associated with the proposed works and potential effects associated with Chance's oil and gas exploration program and potential opportunities (via training, employment, contracting, and other community investments), as well as any topics or issues identified through engagement and communication associated with Chance's proposed activities. This section of the Plan identifies the key contacts related to these overarching engagement and communication themes. Key representatives involved in engagement and communication are expected to be as follows:

- Chief and Council;
- FNNND Government department officials and advisors;
- FNNND Business Development agencies;
- FNNND Citizens and communities at large; and
- Proponent Management and designated staff and advisors.

The following table lays out the key engagement and communication topics, in no particular order, and associated key contacts for both Chance and FNNND:

Table 1 - Key Engagement and Communication Topics and Leads

Role or Subject Matter	FNNND Key Contact	Chance Key Contact
Project Lead	• Lands & Resources Manager (as described in the FNNND *Cooperative Engagement Process)*	• Vice President of Government and Community Relations
Culture and Community (includes Traditional Knowledge and Traditional Land Use, social, health, and other "human environment" subjects)	• Lands & Resources Manager	• Vice President of Government and Community Relations, Regulatory, Environmental and Community Relations Coordinator
Engineering and Geology	• Lands & Resources Manager	• Chief Executive Officer, President
Environmental	• Lands & Resources Manager	• Vice President of Government and

Role or Subject Matter	FNNND Key Contact	Chance Key Contact
(includes water, aquatic environment, wildlife, plants, and other environmental subjects)		Community Relations, Regulatory, Environmental and Community Relations Coordinator
Opportunities (includes community investment, training, education, contracting, employment, and other business opportunities)	• Lands & Resource Manager	• Chief Executive Officer, President
Agreements and Capacity Funding	• Lands & Resources and Negotiations Teams (as described in the FNNND *Cooperative Engagement Process*)	• Chief Executive Officer, President

5.0 Engagement and Communication Methods

Chance and FNNND will employ the following engagement and communication methods for specific correspondence:

- In person meetings;
- Email;
- Sharing Power Point Presentations (to support in person meetings);
- Sharing reports (as requested and as required) and;
- Telephone correspondence (teleconferences and less formal phone calls).

Engagement and communication methods that support general communication of Chance's activities are as follows:

- Chance newsletters; and
- The website for Chance Oil and Gas Limited.

Engagement and communication meetings will be executed in the following manner:

1. Chance or FNNND will request a meeting in writing to the other party according to the connections iterated in Table 1;
2. The parties to meet will develop the agenda collaboratively;
3. The party requesting the meeting will develop supporting materials (collaboratively, where possible), and share those in advance of the meeting; and
4. The meeting will take place in a mutually agreeable location.

The above general process applies to meetings with subject matter leads (Table 1) as well as meetings with Citizens and communities at large.

Through engagement with FNNND, Chance understands that there are existing communications protocols between FNNND, Tr'ondëk Hwëch'in, and Vuntut Gwitchin First Nation through the Northern Chiefs Accord. In keeping with the relationship principle of mutual respect, Chance will work within these existing communications protocols where applicable and as directed by FNNND.

The following documentation sharing and review protocols support the methods described above:

- Confidentiality of the meeting minutes will be discussed and established in advance of the meeting; i.e. if a meeting is to not be included in the record that will be submitted to regulators and assessors, it is the responsibility of both parties to discuss and agree to this prior to the meeting beginning;
- Meeting minutes taken by Chance will be sent to FNNND within two weeks via email; review and comment on these meeting minutes by FNNND through tracked changes, or some method agreed to by both parties, will be provided via email within 30 days of FNNND receiving the meeting minutes. Should FNNND require more time to review the meeting minutes, FNNND will notify Chance by email within two weeks of receiving the minutes. No response by FNNND to Chance's email providing meeting minutes within the 30 days will be interpreted as general acceptance of the meeting minutes by FNNND;
- Action items and meeting outcomes will be logged during meetings and reviewed by both parties at the end of the meeting to ensure that there is general agreement on the list of actions and parties responsible for those actions. The list of action items and meeting outcomes will be provided with the meeting minutes;
- Chance and FNNND will agree upon and use a file sharing platform to facilitate sharing of large files, such as Power Point presentations and reports; and,
- Should Chance or FNNND employ a third party for records development and management, the third party will follow the process iterated above for recording and providing meeting minutes.

6.0 Records Management

Summarized records of engagement and communication between Chance and FNNND will be kept in a records log. The Chance will ultimately submit the items below to regulators and assessors for review if and when a potential project is assessed in the future:

- Meeting agendas;
- Meeting minutes (finalized versions as described in section **5.0 Engagement and Communication Methods);**
- Invitee/Attendees lists and/or meeting sign-in sheets;
- Records log, which will include summaries of the following:
  - In person meetings;
  - Phone calls and teleconferences;
  - Incoming and outgoing emails between Chance and Chance's representatives and FNNND representatives;
  - Attachments to the above noted incoming and outgoing emails;
- Reports provided to FNNND by Chance and reports provided to Chance by FNNND for review and consideration for engagement and communication purposes; and
- Copies of Power Point presentations delivered by Chance to FNNND for engagement and communication purposes.

To ensure that there is a mutual level of comfort with the records log and materials to be submitted for assessment, Chance and FNNND will collaboratively review and agree to the records log and materials prior to submission to any regulator or assessor.

7.0 Adaptive Management of the Engagement and Communication Plan

Chance and FNNND will review and assess the effectiveness and success of this Plan on at least a 6-month basis. There will be a meeting to check in on the progress made by both parties in implementing the Plan within 3 months of the Plan first being agreed to and implemented, and a schedule for review of the Plan will be developed at that time.

APPENDIX B
Ministerial Order 2018/42

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YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,

(d) oil and gas permit No. 0015,

(e) oil and gas permit No. 0016,

(f) oil and gas permit No. 0017. « *permis visé* »

2 The renewal term of each subject permit is extended by five years (so that it ends on August 30, 2023).

3 The resulting total length of the initial term and the renewal term of a subject permit is 16 years.

MO-OGA-18-07 (ExtPrmt)-E06-F01-FIN

YUKON

CANADA

ARRÊTÉ MINISTÉRIEL 2018/42

LOI SUR LE PÉTROLE ET LE GAZ

Le ministre de l'Énergie, des Mines et des Ressources, conformément à la *Loi sur le pétrole et le gaz*, arrête :

1 La définition suivante s'applique au présent arrêté.

« permis visé » Les permis suivants de pétrole et de gaz détenus par Chance Oil and Gas Limited :

a) permis de pétrole et de gaz nº 0012;

b) permis de pétrole et de gaz nº 0013;

c) permis de pétrole et de gaz nº 0014;

d) permis de pétrole et de gaz nº 0015;

e) permis de pétrole et de gaz nº 0016;

f) permis de pétrole et de gaz nº 0017. "*subject permit*"

2 La durée du renouvellement de chaque permis visé est prolongée de cinq ans, de façon à ce qu'elle se termine le 30 août 2023.

3 La durée totale d'un permis visé, y compris la durée initiale et la durée du renouvellement, est de 16 ans.

2018/42

4(1) In this section

"first nations communications and engagement plan" means the plan filed under O.I.C. 2016/169 and revised in accordance with M.O. 2017/37. *« plan de participation et de communication avec les premières nations »*

(2) It is a condition of this Order that Chance Oil and Gas Limited must file annual reports with the Division Head, in accordance with subsection (3) and to the satisfaction of the Division Head, about the implementation of the first nations communications and engagement plan.

(3) For the purposes of subsection (2), Chance Oil and Gas Limited must file

(a) the first annual report on or before July 31, 2019, in respect of the period beginning on September 1, 2018, and ending on May 31, 2019; and

(b) each subsequent annual report on or before July 31 of each year in respect of the period beginning on June 1 of the preceding year and ending on May 31 of the year in which the report is to be filed.

Dated at Whitehorse, Yukon,
~~Oc~~ August 30th 2018.

4(1) La définition suivante s'applique au présent article.

« plan de participation et de communication avec les premières nations » Le plan déposé en vertu du Décret 2016/169 et révisé en conformité avec l'Arrêté 2017/37. *"first nations communications and engagement plan"*

(2) À titre de condition du présent arrêté, Chance Oil and Gas Limited dépose des rapports annuels auprès du chef de division, en conformité avec le paragraphe (3) et à la satisfaction du chef de division, concernant la mise en œuvre du plan de participation et de communication avec les premières nations.

(3) Pour l'application du paragraphe (2), Chance Oil and Gas Limited dépose :

a) le premier rapport annuel au plus tard le 31 juillet 2019, pour la période débutant le 1er septembre 2018 et se terminant le 31 mai 2019;

b) chaque rapport annuel subséquent, au plus tard le 31 juillet de chaque année pour la période débutant le 1er juin de l'année précédente et se terminant le 31 mai de l'année au cours de laquelle le rapport doit être déposé.

Fait à Whitehorse, au Yukon,
le August 30th 2018.

[redacted]

Minister of Energy, Mines and Resources/Ministre de l'Énergie, des Mines et des Ressources

MO-OGA-18-07 (ExtPrmt)-E06-F01-FIN

APPENDIX C
Map of Chance Dispositions and Wells

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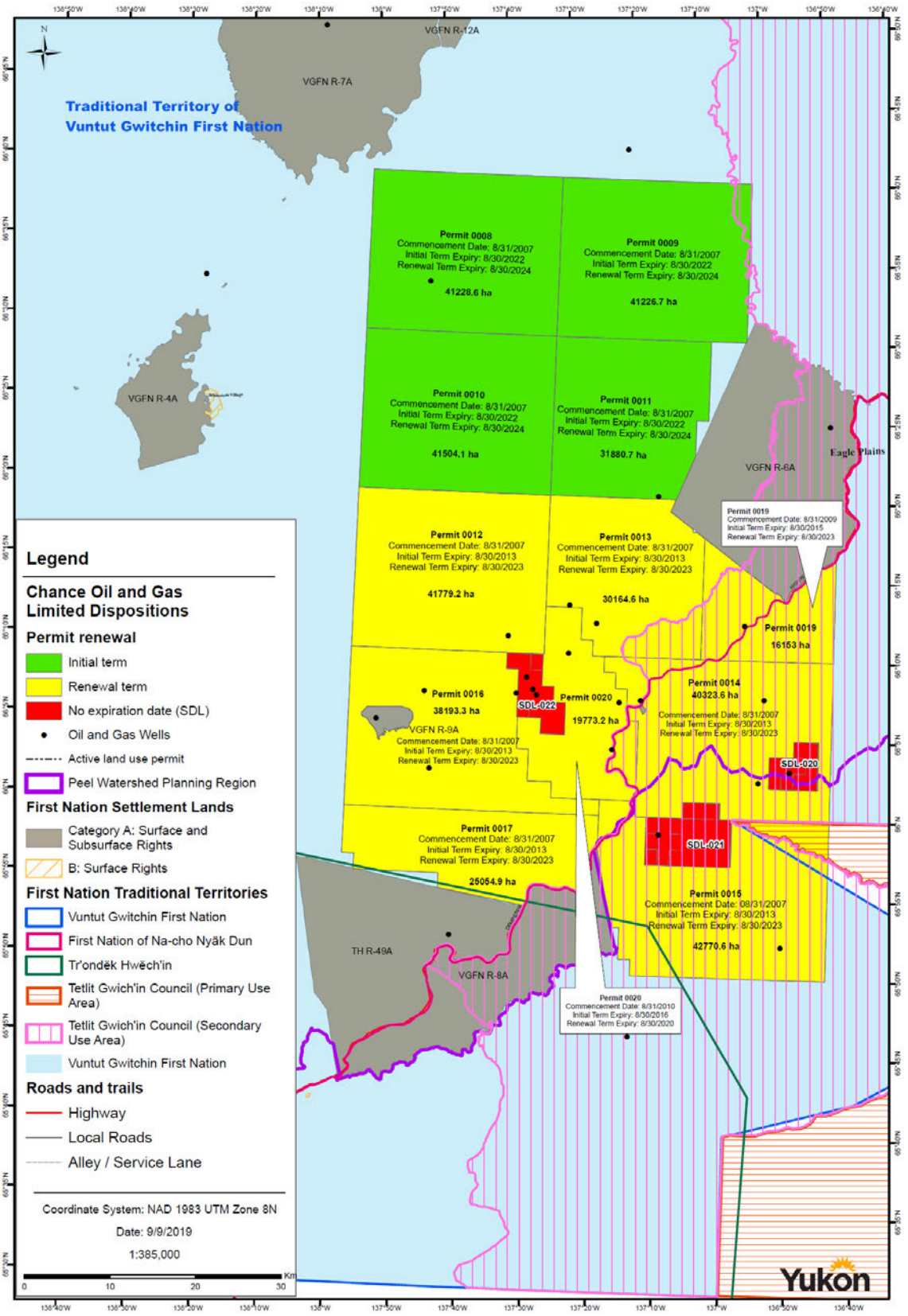
Chance Oil and Gas Limited Dispositions and Wells



APPENDIX D
Engagement Log

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APPENDIX D: Chance Consultation Log

Reference	Date	Contact Type	In / Out	Organization	[redacted]	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00072	January 4, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Meeting agenda
E00131	January 7, 2019	Phone Call	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Engagement/Consultation Meeting Coordination/Planning	FNNND cancelled the meeting with Chance Oil and Gas due to lack of progress made on meeting agenda items.
E00064	January 9, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Flight, hotel details for booking by Chance, per diem, gas and mileage expenses for Vancouver meeting
E00134	January 9, 2019	Phone Call	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	FNNND called [redacted] regarding the logistics of the All-Party Meeting.
E00067	January 10, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Preference of invoice to Chance, or cheque ready from Chance for per diems
E00065	January 11, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Connecting [redacted]
E00135	January 11, 2019	Phone Call	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Chance received a voicemail from FNNND regarding the All-Party Meeting.
E00077	January 11, 2019	Email	Out	Vuntut Gwitchin First Nation Tr'ondëk Hwëch'in First Nation of Na-cho Nyäk Dun Gwich'in Tribal Council Tetlit Gwich'in Council (DGO) YG	[redacted]	Hemmera, Richard Wyman, Greg Charlie, Cindy Dickson	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Attached Draft Working Agenda for All Party Meeting Feb 1. To be finalized
E00137	January 14, 2019	Phone Call	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Chance called FNNND regarding attendance and logistics for the All-Party Meeting.
E00139	January 17, 2019	Phone Call	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	FNNND called Chance regarding logistics for the All-Party Meeting.
E00140	January 17, 2019	Phone Call	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Chance called FNNND regarding the logistics of the All-Party Meeting.
E00020	January 22, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Working on details to get back to [redacted]
E00070	January 22, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Contribution agreement between Chance and FNNND for all party meeting, discussion of Chance's contribution to expenses
E00101	January 22, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Let me know if you need more information
E00052	January 24, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Accommodations secured
E00089	January 24, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Hotel rooms available
E00147	January 24, 2019	Phone Call	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	FNNND called Chance regarding reimbursement for expenses for the All-Party Meeting.
E00080	January 28, 2019	Email	Out	Vuntut Gwitchin First Nation First Nation of Na-cho Nyäk Dun Gwich'in Tribal Council YG	[redacted]	Hemmera, [redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Final All Party Meeting Agenda for Feb 1
E00037	January 29, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Add [redacted] as team rep for NND
E00114	January 30, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	Hemmera	[redacted]	Meeting Coordination/Planning	Will add [redacted] to printed agenda
E00167	February 15, 2019	Email	Out	Vuntut Gwitchin First Nation First Nation of Na-cho Nyäk Dun Gwich'in Tribal Council YG	[redacted]	Hemmera, [redacted] ff	[redacted]	Engagement/Consultation	Draft summary of Tuesday Feb 5, all-party meeting for review. Feel free to share to teams
E00154	February 18, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Confidentiality Agreement Engagement/Consultation	Asking for Confidentiality Agreement and Capacity Funding update, or whether more information is needed.
E00165	March 26, 2019	Letter	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Tenures/Dispositions/Permits	Request to extend tenure on Exploration Permits 0006-0011 and 0019 at Eagle Plains
E00245	May 8, 2019	Letter	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation	Congratulations from Chance to Chief [redacted] on his re-election to be Chief for another term. Have enjoyed working with Chief [redacted] in the past, and look forward to future work. Chance is advancing plans to continue exploration at Eagle Plains and it would be helpful to meet with Chief, council and key government staff members to update plans and get feedback in accordance with Engagement and Communications Plan.
E00246	May 9, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation	Thank you for recognizing the economic opportunities in our traditional territory. We look forward to creating a solid relationship with industry and creating a template for future generations.
E00243	May 10, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	With election over, asking if possible to meet with Chief and new council next month to provide an update of exploration project status and plans going forward. Possibly June 10, in Mayo, also able to meet with members of Land and Resources Dept to give an update.
E00247	May 14, 2019	Phone Call	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Richard called Simon to follow up email from last week requesting meeting on June 10th. Left a message.
E00249	May 21, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Site Visit/Field Work	Required to consult under geoscience license guideline to inform VGG, NNDFN and Tetlit Gwich'in Council that field work is planned July 10-24, 2019. Will be based out of Eagle Plains Lodge with helicopters. Will be flying to remote outcrop locations through out Eagle Plains Basin to extract rock samples with geological hammer. No mechanical tools will be used.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00276	May 22, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Site Visit/Field Work Engagement/Consultation	Had sent e-mail to [redacted] but as she is no longer with NNDFN, was transferred to [redacted] by front desk, so assuming Josee has taken on responsibilities of [redacted] position. Following up about field work for summer. Working with Hemmera to set up a meeting with NNDFN to provide an update and present Project Description for June 10th. Required to consult under geoscience license guideline to inform VGG, NNDFN and Tetlit Gwich'in Council that field work is planned July 10-24, 2019. Will be based out of Eagle Plains Lodge with helicopters. Will be flying to remote outcrop locations through out Eagle Plains Basin to extract rock samples with geological hammer. No mechanical tools will be used.
E00277	May 23, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Josee is acting in position until further notice and appreciates communication about the project. June 10th marked on calendar. [redacted] can contact Colleen to make arrangements. Let [redacted] know if needing any field works for summer field work.
E00278	May 23, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thank you for your e-mail, will coordinate with [redacted] for June 10th Meeting.
E00454	June 3, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Coordinating the June 10 meeting with Chance. I just want to confirm we have a room available. We will have handouts, so we won't need a projector. Could we arrange transportation to and from the airport for the meeting with you?
E00455	June 3, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Pick up at the airport is not a problem. I booked the Multi purpose room. What time is the meeting going to be at? And do you have posters to put up? Anything else I need to do?
E00456	June 3, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thank you for booking the room and arranging a ride from the airport. We will have a few posters to put up and will have hand out material. Greg, what time did we decide for the meeting?
E00459	June 3, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	The meeting will be 10-12. We're wondering if everyone who is joining us for the meeting would like to get lunch after. Is there a restaurant in town we could all go to or would it be possible to arrange catering?
E00460	June 3, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I could arrange someone to cater. Is there a poster you want me to post around town?
E00461	June 3, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I don't think we need posters around town. We will host a community even later and then need to post posters around town. For lunch, it will be 5 of us from Chance, and then those that attend from FNNND. Do you think the restaurant can accommodate a large group and where is it? Do you think that group would rather go out for lunch or have it catered?
E00471	June 5, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Project Description/Activities	Catering would be best. I lined up a caterer for June 10.
E00265	June 6, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Project Description/Activities	Finalizing agenda and calendar invite for meeting between Chance and First Nation of Na-cho Nyäk Dun the following week
E00293	June 6, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Meeting invitation for June 10, 10-1. This meeting is for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin. Additional agenda items include next steps with YESAB and the process for reviewing Na-cho Nyäk Dun Project Effects as well as the annual reporting required on the implementation of the Engagement and Communication Plan.
E00297	June 6, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thank you, looking forward to meeting on June 10th.
E00319	June 6, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Confirming the orange room is reserved for meeting on June 10.
E00295	June 7, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	Draft Project Description and presentation for meeting attached. Please distribute to those attending the meeting. Will bring paper copies. Please provide an estimate of attendees.
E00420	June 7, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	We have a little portable projector and I'm wondering if you think we should bring it?
E00259	June 11, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Information Sharing Engagement/Consultation	Sending background information following meeting.
E00477	June 13, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Information Sharing	[redacted] - can you please invoice Geoscience for the catering of this meeting. [redacted]
E00269	June 14, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Site Visit/Field Work Engagement/Consultation	Attached details for First Nation's participation in Chance's fieldwork this summer. Still finalizing dates and logistics. Role profiles are in attachment, and aiming to have dates finalized next week. Please give thought to potential participants.
E00478	June 14, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement	[redacted]

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00261	June 17, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation Site Visit/Field Work	Dates set for participation in Field Surveys. Proposing following logistics for First Nation participation: 1) Each FN with territory overlapping project area can have up to two members participate 2)Work will be physically demanding, require hiking steep, rugged terrain and thick bush, requiring average or above-average fitness to participate 3)Limited spots for participants due to helicopter constraints ad availability at Eagle Plains Hotel, so please respond as soon as possible to [redacted] Hemmera) to confirm availability 4) Participants should arrive on start date, but not mandatory to stay for duration of field study 5) all travel, including flights, vehicle travel to Eagle Plains Hotel, ad stay in Hotel must be booked by the First Nation and billed to Chance. Table of Opportunities by date. Purpose of participation will be to observe fieldwork and gain first hand understanding of the research. Deadline for Vegetation Survey # 1 is June 19th.
E00254	June 24, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Fish Information Sharing	Attached notice letter regarding DFO licence application for Environmental Dynamics Inc's fish studies
E00256	June 24, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation	Thank you for information on DFO Application. Please copy [redacted] on any future communication between NND and Chance.
E00257	June 24, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation	Confirming instructions to copy [redacted] going forward.
E00266	June 25, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Information Sharing Engagement/Consultation	Draft Summary of June 10 meeting in Mayo between Chance and First Nation Na-cho Nyäk Dun
E00314	June 27, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Fish Information Sharing	Revisions from EDI for their DFO Application, see Attached
E00483	July 9, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	[redacted] Visit/Field Work	Have you had any interest for participation in the Chance field surveys? Below I've highlighted the surveys there's still time to participate in.
E00485	July 9, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Site Visit/Field Work	I corrected my highlighting below to include all the surveys at the end of July and early August. These are the surveys available to join
E00591	July 15, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	We would like to meet with you and other interested government representatives on Aug 12 in Mayo if that works for you. My colleagues and our Hemmera advisors will be returning from the GA in Old Crow on Aug 10 via Dawson so it might make sense for us to continue our engagement discussions as we advance towards a YESAB submission early in 2020. We would rent a vehicle in Dawson and drive to Mayo for the meeting. Please let us know if this will work.
E00488	July 16, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Hemmera has prepared draft reports on the Implementation of the Communications and Engagement Plan for both VGG and Chance to review. This report summarizes meeting we have had since completing the plan. Please make any desired revisions to the document in tracked changes and send back to me to finalize. Once I have incorporated the changes, I willl send final versions to both parties to sign. Please have revisions in by July 26, then I will finalize, get them signed and submit to Yukon Government for July 31.
E00491	July 24, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	I am following up on 2 items for Chance: the draft Communications and Engagement Plan Implementation Report, and a proposed meeting on August 13 in Mayo. Would FNNND like to provide feedback on the draft report? I'm looking for feedback by Friday. Chance team in Dawson Aug 12 and proposing travel to Mayo Aug 13. Chance would like to discuss project updates and a Cooperation Agreement template. FNNND also mentioned that meeting with Chief and Council might be good. Please let us know.
E00320	July 25, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Following up about meeting on August 12th to discuss the exploration project and related discussions such as cooperation and capacity funding arrangements. Would like to change to August 13th, as there is a conflict on August 12 meeting with TH in Dawson. Are you able to meet with us August 13, in Mayo?
E00321	July 25, 2019	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Inquiring why they are not meeting together with the First Nations, instead of separately.
E00322	July 25, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Chance would love to meet collectively with all the affected First Nations, but have not had indications from the various First Nation governments that they wish to continue gathering in All Party meetings. I do feel there is merit in meeting all together where Value Components of the Eagle Plains area are in common. Is it possible to meet with you and your colleagues on August 13 in Mayo? Would be driving from Dawson and returning to Dawson the same day.
E00500	July 25, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Attached are Chance's edits to the Draft Plan Implementation report

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00536	July 30, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Following up on FNNND Comments on Draft Implementation Report. I left a voice mail, and also followed up with Ronaldo yesterday, but have not hear back. Final report is due to YG tomorrow. Hoping you could review and sign off on the content. Please let me know if you would like to provide revisions by noon tomorrow so we revise with your feedback, otherwise I will submit to YG tomorrow at 4 pm.
E00543	July 31, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Hemmera has prepared reports for YG on behalf of Chance on the implementation of the Communications and Engagement Plan that FNNND and Chance completed last summer. It was previously discussed that both FNND and Chance would review this report and sign to demonstrate both parties agree to the report's contents. I have not heard back, and will submit the report to YG as a draft, however we welcome your feedback.
E00544	July 31, 2019	Email	Out	First Nation of Na-cho Nyäk Dun YG	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Attached annual report on the Implementation of the FNNND and Chance Engagement and Communication Plan. This report has been reviewed and signed by Chance, but has not yet been reviewed or signed by FNNND despite our best efforts to send the draft report and follow-up. I will let you know if I receive any feedback.
E00346	August 9, 2019	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Great to connect by telephone this morning. Following up to bring awareness to colleagues and advisors at Hemmera of the potential to meet with you and your new council on Aug 13 in Mayo. This will be an opportunity to introduce ourselves to those unfamiliar with Chance and to summarize what our exploration plans are. We are presently in Old Crow attending the GA but travelling to Dawson on Saturday to meet with TH officials. If you are able to arrange to meet with us, we will drive to Mayo Tuesday morning, so could be there about 10 am. We have to be back in Dawson for 3:30pm. Thanks for setting this up on short notice and we look forward to meeting with you and members of your council.
E00388	August 9, 2019	Phone Call	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Meeting Coordination/Planning	Chance called NNDFN about meeting with Council at 10 am on August 13th, 2019. NNDFN said they would organize a group for the meeting and would call back on August 12th to confirm the meeting.
E00390	August 12, 2019	Phone Call	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Chance called FNNND and FNNND confirmed they were unable to meet on August 13 and requested to meet at another time.
E00602	January 28, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Regulatory Process	Chance will be applying to the Yukon Government very shortly to extend the tenure of Exploration Permit 20. Application will be for maximum allowable under the Oil and Gas Act of 5 years. This permit has one suspended well at McParlon A-25 which we hope to use for fluid disposal of any produced water associated with the proposed exploration project. We are at an intermediate stage of discussions with the Manager of Oil and Gas Operations with Yukon to extend the suspended well status on the suspended wells at Eagle Plain. Manager has indicated hat Chance will need to do some physical assessments of the legacy wells to confirm the integrity of the wells before granting an extension. Assessments will require access to 3 suspended wells at SDL M-08, G-08, and J-19 and well as M-59 in order to do the work. A service rig, cement pumping equipment, and wireline services are expected to be used to conduct the assessments. Anticipate taking temperature measurements in wells to evaluate permafrost depth. The program is expended to take 1-2 months. This is a winter operation and will be done during the winter of 2020-2021 and may require Designated Office screening b y YESAB. We will provide more information as soon as we can.
E00646	March 23, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Information Sharing	Chance Oil and Gas (COG) has several initiatives on the go, some of which are time sensitive, and all require engagement with the affected First Nations. The following is a summary of these initiatives: 1.Application to the Yukon Government to get tenure extension on Exploration Permit 0020 which is set to expire on August 30, unless extended. This permit is located mostly in the Traditional Territory of the Vuntut Gwichin, but a portion is in the Secondary Use Area of the Tetlit Gwich'in and in the overlap area with the Na-cho Nyak Dun Traditional Territory. There is a suspended well in this Permit at McParlon A-25 which has ongoing value to COG. 2.There are several suspended wells at the Chance Significant Discovery License (SDL 022) and one at the Blackie SDL (SDL 021) which the Yukon Government requires COG to undertake some maintenance work. This activity will require an impact assessment by the Designated Office (DO) of YESAB in Dawson prior to permissions being granted by Yukon to undertake the work. The plan is to submit to the DO the program in the next month or so with the objective of being able to do the work over approximately a 6 week to two month period in the winter of 2020-2021. This is a regulatory requirement made by the Manager of Oil and Gas Operations with the Yukon Government. Importantly for your knowledge, there is no indication that these suspended wells have any problems, but they are wells that were drilled in the 1960's so the regulator has asked for work to be done in order to be able to continue the suspended status of these wells. 3.Continuing engagement with respect to the multi-well drilling and seismic data acquisition project that has been described to you in the past couple of years. A current map of COG landholdings is attached for your reference. In view of the COVID 19 outbreak, travel and face to face get togethers are not appropriate, if not prohibited, so we will have to make arrangements to exchange information in writing, electronically and by conference call. There is quite a geographic spread for all of us to manage and I look forward to hearing your preferences for engagement. Also, please forward this email to anyone I have missed who is working on the COG file.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00673	May 25, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities DO Project	Chance Oil and Gas Limited is preparing a proposal for well maintenance work in the Eagle Plains. Please see the attached letter meant to initiate engagement and to provide initial project information. Please let me know if you have any issues opening the attachment.
E00675	May 26, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities DO Project Engagement/Consultation	Your message [redacted] Subject: Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with First Nation of Na-cho Nyäk Dun) Sent: Monday, May 25, 2020 2:13:19 PM (UTC-08:00) Pacific Time (US & Canada) was read on Tuesday, May 26, 2020 4:35:24 PM (UTC-08:00) Pacific Time (US & Canada).
E00818	May 26, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Email read receipt
E00682	June 9, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	I hope all is well, just following up from our program description from couple of weeks ago, if you have any question and comments, please contact us. if you would like us to arrange a call with your team, we would be happy to do so and provide you with an overview of the program.
E00796	June 9, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	I hope all is well, just following up from our program description from couple of weeks ago, if you have any question and comments, please contact us. if you would like us to arrange a call with your team, we would be happy to do so and provide you with an overview of the program.
E00797	June 24, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	I wanted to reach out and see if you had any questions about Chance's proposed well maintenance work. I've re-attached our May 25th letter that was sent via email. As [redacted] mentioned below, we'd be more than happy to set up a conference call to provide a brief overview of the project and answer any questions you might have.
E00819	June 25, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Email read receipt
E00710	July 13, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Hemmera has prepared a draft report on implementation of FNNND and Chance Engagement and Communication Plan for FNNND and Chance to review. This report summarizes meetings/correspondance that have occurred between FNNND and Chance since completing the 2019 Annual Report. I have attached the draft as a Word Document, if both FNNND and Chance could make revisions to that document in tracked changes, that would assist me in creating a final version. If there are any issues that arise between parties' revistion, we can address them via e-mail or a quick call. Once revisions have been incorporated and the document is considered final by FNNND and Chance, I will send the final version to both parties to sign. I have also attached, as a pdf, a draft of FNNND and Chance's Engagement Log which functions as Appendix D for the report. Please complete reveiws by Friday, July 24th. Reminder that reports need to be signed and submitted to YG on July 31st.
E00741	July 14, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I'm noticing a discrepancy between an email address we used to have on file for you and one that I've received some read receipts from recently (and that's also on the FNNND website). Is this your correct address? If I don't hear from you today/tomorrow, I'll give you a call to confirm.
E00767	July 20, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Chance Oil and Gas (Chance) is nearing completion of its proposal for well maintenance in the Eagle Plains and hopes to submit to the Yukon Socio-Economic and Environmental Assessment Board within the next two weeks. Chance and Hemmera provided an introductory letter, project summary, and map via email on May 25, 2020 and again on June 24, 2020. Our original correspondence was to Chief [redacted]. However, I may have used an outdated emails address for [redacted] so I've included an updated address as well as the previous one. We value any feedback First Nation of Na-cho Nyäk Dun may have with respect to this proposed project and look forward to working with you during the assessment process.
E00742	July 24, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I wanted to check in and see how your review of the draft engagement report was going? My apologies for not doing this sooner in the week. Despite my typo below, these reports are due to Yukon Government July 31, 2020. Not 2019, there is no time travel involved.
E00766	July 24, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Attached is a draft copy of Chance Oil and Gas (Chance)'s YESAB Project Proposal for the Eagle Plains Well Maintenance Project. In order for Chance to get all its approvals in hand before thw winter season, Chance's application will need to be submitted very shortly after sending this draft to you. At this time, our goal is to submit the Project Proposal middle of next week. As this document has not gone through Hemmera's formatting procedure, it is absent some of the figures and appendices. However, I've attached the Spill Response Plan which will be Appendix B. Chance continues to be committed to engaging with the First Nation of Na-cho Nyäk Dun. Should you wish to discuss the proposed Project in more detail, please don't hesitate to contact Chance or Hemmera.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00743	July 31, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Please see attached for the 2020 Annual Report on the Implementation of the First Nation of Na-Cho Nyäk Dun (FNNND) and Chance Oil and Gas Engagement and Communication Plan. This report has been prepared using meeting agendas and summaries drafted by Hemmera and subsequently reviewed and agreed to by the parties. This report has been reviewd by Chance, but not reviewed by FNNND, despite our best efforts. The signature lines have been removed and the Draft waterark remains. Should FNNND wish to provide edits at a later date, we would be happy to incorporate them and prepare a final report, including signatures, for submission to Yukon Government.
E00745	August 3, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation	My correct email address is: landsmanager@nndfn.com
E00744	August 3, 2020	Email	In	First Nation of Na-cho Nyäk Dun YG	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	We will be reaching out for a potential meeting update with you upon my return after August 18th, 2020.
E00775	August 7, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	This email is intended to give you early notice that Chance Oil and Gas has not yet submitted our Well Maintenance Program Project Proposal to YESAB due to evolving discussions with the regulator. The amendments are being incorporated into the Project Description and effects assessment over the next week or two as we manage vacation absences. Once updated, we will share the updated YESAB submission with you to review. I suggest that a follow up conference call or Microsoft Teams meeting be arranged to address your questions or respond to your comments to the amendments.
E00999	August 21, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities	Email read receipt
E00872	August 27, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	Email read receipt
E00909	August 28, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities	Further to Richard's email dated August 7th (attached), Chance Oil and Gas (Chance) has made a few revisions to their Project Description for the Designated Office Evaluation of their proposed Well Maintenance Program. As a result of those changes, Hemmera has also revised the effects assessment sections of the Project Proposal. Below are the reasons for the revision that have been provided to us by Chance and a brief summary of the amendment itself: 1.Ongoing conversations between Chance and Yukon Government, Oil and Gas Branch (YG) have necessitated changes. While Chance was previously of the impression wells could continue to be suspended, YG is now directing Chance to conduct inspection and maintenance activities for all eight suspended wells and then abandon those wells or bring them into active status (i.e., end the period of well suspension). Chance is now proposing to abandon six wells (i.e., M-59, M-08, J-19, G-08, B-73, and H, 28) and to bring the remaining two wells (i.e., A-25 and E-78) into active status as deep-injection wells. Waste fluid produced during the abandonment of the six wells can then be disposed of via injection into the deep-injection wells. No oil or gas is expected to be produced from the two wells proposed to be activated; they would specifically be used for disposal of waste fluid from activities associated with these maintenance activities. (See sections 2.1.4 and 2.1.5 for further description) 2.At this time, Chance cannot confirm whether it will use the Eagle Plains Hotel or the existing Chance Camp for housing workers over the duration of the Project. The decision to utilize the Eagle Plains Hotel or the Chance Camp will be made when the Project schedule is finalized. It will also have to take into consideration the Hotel's ability to accommodate Chance workers over the full duration of the Project as well as COVID-19 related self-isolation requirements at that time. As a result both options are considered in the effects assessment for the housing of the project workforce. (See sections 2.2 and 2.3 for further description) 3.When the Chance field team were at Eagle Plain early August, they observed that the route used to access M-59 would require realignment of the final portion of Blackie Winter Road. The section of the original route that proceeds north for the final kilometer is not ideal for traffic due to steeper terrain. The steeper route would result in a significant risk to the trucks bearing heavy loads, fuel supply, and other fluid handling shipments. Chance is proposing shifting the final portion of Blackie Winter Road east of the original route in order to attain a much gentler gradient. (See section 2.1.1 and Figure 2-1 for further description) Each of the amendments above are described with additional detail within the attached revised Project Proposal. As previously, not all appendices are complete yet but will be
E00871	August 29, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	Email read receipt
E00903	September 15, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Project Description/Activities	Since my email dated August 28th, Hemmera has been in the final stages of concluding the revised DO Project Proposal for Chance's Well Maintenance program. We have appreciated your feedback and worked to include that into the application. As you know, Chance's timeline for completing this work was tied to compliance with regulations, so in an effort to ensure that the maintenance activities could occur this winter Chance needed to submit the application last week. It was submitted late Friday evening and today Hemmera received confirmation that the project was on the YESAB registry. We acknowledge that you may have future comments on the project as it progresses through the YESAB process. We continue to look forward to hearing your views and are happy to hold additional meetings to discuss and answer any questions you may have. Please see the link to the registry here: Project 2020-0151 Eagle Plains Well Maintenance and Winter Activities

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E00857	September 16, 2020	Email	Out	First Nation of Na-cho Nyäk Dun Vuntut Gwitchin First Nation YG	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project Cooperation Agreement	Attached is the most recent agreement we have with signatures from all parties to section 68 of YOGA. Hope this helps with the start of our discussion on the Workover Project. Please feel free to let us know what would be the next steps to begin our discussion.
E00928	September 17, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Benefits/Capacity Agreement DO Project Engagement/Consultation	I am providing a short update to set the stage for discussions to begin as soon as possible regarding a Benefits Agreement among the First Nation of the Nacho Nyak Dun (NND), the Vuntut Gwitchin First Nation (VG), Yukon Government (YG) and Chance Oil and Gas (Chance) in accordance with Section 68 of the Yukon Oil and Gas Act. Hemmera, acting on behalf of Chance, filed a project description with the Designated Office of the Yukon Environmental and Socio-Economic Assessment Board in Dawson last week concerning required work on eight suspended wells operated by Chance at Eagle Plain. The project is small scale and is anticipated to be completed in a two to three-month period during the winter of 2020-2021. The plan is to prepare for and abandon six of these wells and convert two others to be used for disposal of well bore fluids used in the abandonment procedures and/or recovered in the process. The activities are governed by YG oil and gas regulations and are routine oilfield practices. Details are provided in the submission document, but if you have any questions or comments, please feel free to contact me or any of my colleagues. The project area is mostly in the traditional territory of the VG, but one of the wells to be abandoned is located in the overlap area on the east side of the Dempster at Blackie M-59 which is also in Significant Discovery License 021. Although small scale, the project triggers the need for a benefits agreement with the First Nations who are affected by the activities, YG acting on behalf of all Yukoners and the proponent, namely Chance. Please advise who from the NND will be negotiating this Benefits Agreement so arrangements can be made to begin discussions.
E00883	September 18, 2020	Email	Out	Vuntut Gwitchin First Nation YG First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Meeting Coordination/Planning	I just wanted to follow up and hope everyone had a chance to review the last BA agreement. I would suggest that we set up a call sometime soon to discuss on how we want to proceed with section 68 negotiations. As I am away all next week, however I have include[redacted] so they can be available if the parties do agree to discuss next steps. We look forward to your response.
E00955	September 21, 2020	Phone Call	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project	Phone message left
E01001	September 21, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Jobs/Contracts Education and Training	I am sending some information for opportunities to work on the service rig. The attachments are all the forms that need to be completed. There will be a need to have some training prior to being able to complete these forms (H2S Alive, WHMIS, First Aid and TDG).
E00834	November 2, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	After further consideration of the proposed Project (Eagle Plains Well Maintenance and Winter Activities) activities and the requirements of the Yukon Oil and Gas Act, Chance Oil and Gas Ltd. (Chance) has determined that changes are required to the Project submitted to the Dawson Designated Office on September 11, 2020 (Project #2020-0151). As such, Chance has decided to withdraw its Project proposal and will be informing the Yukon Environment and Socio-Economic Assessment Board today, November 2, 2020. Chance intends to incorporate changes into a revised Project proposal. Once the revised proposal has been drafted, Chance will notify you by sharing a draft and requesting a meeting to discuss the changes further. After Chance has discussed those changes with the First Nation of Na-cho Nyäk Dun, the Project proposal will be finalized and resubmitted to the Dawson Designated Office. Chance understands and appreciates that making changes to this Project a second time is requesting additional effort and capacity of the First Nation of Na-cho Nyäk Dun. Chance looks forward to continuing to work with the First Nation of Na-cho Nyäk Dun and will do its best to ease this process.
E00905	November 2, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	After further consideration of the proposed Project (Eagle Plains Well Maintenance and Winter Activities) activities and the requirements of the Yukon Oil and Gas Act, Chance Oil and Gas Ltd. (Chance) has determined that changes are required to the Project submitted to the Dawson Designated Office on September 11, 2020 (Project #2020-0151). As such, Chance has decided to withdraw its Project proposal and will be informing the Yukon Environment and Socio-Economic Assessment Board today, November 2, 2020. Chance intends to incorporate changes into a revised Project proposal. Once the revised proposal has been drafted, Chance will notify you by sharing a draft and requesting a meeting to discuss the changes further. After Chance has discussed those changes with the First Nation of Na-cho Nyäk Dun, the Project proposal will be finalized and resubmitted to the Dawson Designated Office. Chance understands and appreciates that making changes to this Project a second time is requesting additional effort and capacity of the First Nation of Na-cho Nyäk Dun. Chance looks forward to continuing to work with the First Nation of Na-cho Nyäk Dun and will do its best to ease this process.
E00835	November 17, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	We appreciated the[redacted]. I would like to take the time to introduce you to our new FNNND representative: [redacted] will now be the primary FNNND contact person on this project. Please add him (and keep me) on the email distribution list.
E00836	November 18, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	I'll be sure to include[redacted] on all future emails.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00837	November 18, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	I will definitely include Skeeter on all future emails regarding Chance's DO project (Well Maintenance and Winter Activities). Should I also include him on future emails regarding Chance's Executive Committee project (Eagle Plains Exploration)?
E00838	November 18, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Yes please and thank you.
E00890	November 19, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Project Description/Activities	Further to my email dated November 2nd (attached), Chance Oil and Gas (Chance) has revised its Project Proposal (including updated Project Description and Effects Assessment) for Designated Office Evaluation. Below is the key project component that has changed: •Extended Flow Testing: After maintenance activities are complete and depending on wellbore integrity (as confirmed through maintenance activities), Chance proposes to conduct Extended Flow Testing (EFT) on up to three of the wells which have the highest potential for natural gas reserve. The reason for this change is to allow Chance to gather important information about the nature of the natural gas resource accumulation and its productive capability. a.Wells proposed for EFT are M-59, M-08, and J-19 (see PDF attached for Figure 2-1). Please note, Figure 2-1 is currently being updated to reflect this change. b.Revert up to three wells to suspended status (if the EFT results prove to have sufficient resource). c.Abandon three to six wells (the three remaining wells (G-08, B-73, and H-28) will be abandoned and up to additional three wells may be abandoned if wellbore integrity is not confirmed or if EFT results prove insufficient resources). •Timelines: If work cannot be completed this winter season (due to low snow pack, COVID considerations, or permitting delays), Chance will complete the project during the winter of December 2021 to March 2022. Additional detail is within the attached revised Draft Project Proposal. While revisions were made throughout the document, Section 2.1.3 is the substantive addition with respect to EFT. We've attached both a clean version and a version with tracked changes to facilitate your review. Given the very short time frame for winter work, Chance will be submitting the application to YESAB on Friday, November 20th. Hemmera anticipates FNNND requiring additional discussions with Chance to review these changes and look forward to scheduling a meeting where we can discuss these matters further to support your future submissions to the YESAA process.
E01020	November 20, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities Engagement/Consultation	[redacted] I'm reviewing the documents as well as some of the previous work by FNNND. As a recent addition to the FNNND representatives, I'll also be conferring with others at FNNND.
E01021	November 20, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities Engagement/Consultation	I need to amend my email sent yesterday. While Chance would like to submit as soon as possible, the submission will be delayed until mid next week. If the First Nation of Na-cho Nyäk Dun has any immediate concerns, please contact us and we'll make scheduling a meeting a priority.
E01022	November 23, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]		[redacted]	DO Project Project Description/Activities Engagement/Consultation	Let me know if there is anything you need from me.
E00839	November 25, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Further to the notes below, please send me the earlier YESAB submission and a list of changes in the next submission. It would allow me to do a faster review.
E00858	November 25, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	Email read receipt
E00840	November 26, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	Calista Morrison	Hemmera	Skeeter Wright	DO Project Engagement/Consultation Project Description/Activities	I've attached an email Hemmera sent to FNNND June 2019. It includes the draft project description for Chance's Eagle Plains Exploration Project and a presentation that Chance gave to FNNND at that time. This project will go through a YESAB Executive Committee level screening. This is the project I was referring to with respect to including you on any future emails pertaining to Chance's Executive Committee project. However, Chance (and Hemmera) haven't been actively engaging on it on this project this year... We've been focused on Chance's Eagle Plains Well Maintenance Project (or subsequently called Eagle Plains Well Maintenance and Winter Activities) which will be going through the YESAB Designated Office (DO) in Dawson City. That is the proposal we've been engaging with FNNND on for the past few months. It's this project that has changed a couple times and which Chance withdrew from YESAB a couple weeks ago. I've attached a number of emails that "tell the story" and that I hope answer your question: 1.Email with original draft of the DO submission (Eagle Plains Well Maintenance Project). 2.Email fro [redacted] an stating the submission had been delayed because Chance was considering additional changes to the proposed project. 3.Email from myself with revised DO submission, including a high level overview of the changes and Chance's reasons for those changes. a.Note: This was the draft ultimately submitted to YESAB and which Chance then withdrew. 4.Email I sent last week. Contains the current version of Chance's DO submission. The email highlighted the main change (inclusion of Extended Flow Testing). The red-line version that was attached would be the best resource for seeing/reviewing the recent changes.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00841	November 26, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation DO Project Engagement/Consultation Project Description/Activities	I'll review the material and get back to you if I've any questions.
E01002	November 26, 2020	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	It's been awhile since I last seen you and worked with you! I think it was the implementation reviews we last where at the table. Anyway, welcome back and look forward working with you and if you would like an update please give me a call anytime.
E01003	November 26, 2020	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	It's also been quite a while since I had any contact with Chance (was Northern Cross at that time). I don't remember if I called them or they called me while we were working on Final Agreement chapter 12 implementation.
E00895	December 15, 2020	Email	In	Vuntut Gwitchin First Nation YG First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Meeting Coordination/Planning	As was communicated in numerous emails over the last month from COGL, I wanted to send a follow up email to see if COGL still plans to host a meeting to discuss the revised proposal this Thursday?
E00986	January 1, 2021	Email	Out	Vuntut Gwitchin First Nation First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Benefits/Capacity Agreement DO Project	Please call anytime on my cell or phone if need any information or an update. If you are in Whitehorse please stop by my office and I can provide you with more details and photos of the area we are talking about.Look forward working with you on this project.
E00985	January 11, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Benefits/Capacity Agreement DO Project	Wow, it has certainly been a while since we last spoke. I'm writing about two things. FNNND is also to be involved in the discussions you propose. I[redacted] are the two main FNNND contacts. Your proposed January 14 at 10:30 AM does not work for FNNND. I'll leave it to VGFN to suggest a time/date and see if FNNND can manage their proposed schedule.
E00897	January 19, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	A brief update on Chance's proposed Eagle Plains Well Maintenance and Extended Flow Testing project is provided below: •Project was submitted to the Dawson District Office (DO) December 24, 2020. •Adequacy Review started December 29, 2020 and was extended January 11, 2021. oThe Adequacy Review period was extended for 21 days due to the complexity of the Project. •Dawson DO issued an Information Request on January 15, 2021 Chance is currently working on its response to Information Request 1 which you can find here. Additionally, here is the link to the project's page on the YESAB registry: 2020-0197.
E01065	April 7, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Hemmera is currently resuming work on Chance's Executive Committee project titled Eagle Plains Exploration Program. Seeing as it's been quite some time since Chance and the First Nation of Na-cho Nyäk Dun (FNNND) have discussed this particular project, Chance was hoping to schedule a meeting. Some items that Chance would like to discuss are: •a refresher of the draft project description •update of events since Chance last engaged on the ExCom project •anticipated timeline for submission to YESAB, and •FNNND's preferences/guidance for engagement with its government and its citizens over the coming months. Do you have any availability the week of April 26th – 30th?
E01107	April 7, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I can rearrange my schedule for that week to meet other's needs, except I'm booked for the morning of Thursday April 29.
E01108	April 7, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I sent this to yourself and[redacted] anyone else from FNNND whose schedule we need to consider?
E01109	April 7, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted] on the NND contact list just so she can document information. I'm the functioning NND contact.
E01110	April 7, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I am tied up all day on April 26 and between 10:00 and 12:00 (MT) on April 27. The rest of the week is open though I will be in Ontario and will be 3 hours ahead of Yukon time.
E01111	April 7, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thanks everyone!
E01052	April 8, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	This is[redacted] be in attendance on behalf of the FNNND Lands and Resources department. Thank you for keeping me copied on the communications.
E01090	April 8, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	Meeting Invite: I believe this time slot works for both Chance and[redacted] will update the invite with more details tomorrow or early next week.
E01125	April 8, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I'll be "there" then.
E01126	April 15, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Attached is a draft agenda for the Chance and First Nation of Na-cho Nyäk Dun meeting April 30th. Please let me know if you have any changes you would like me to make. Then I'll finalize the agenda and attach it to the meeting invite.
E01127	April 15, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]. I've no additions to the agenda to suggest.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E01128	April 16, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Does Chance have any additions they'd like to make?
E01129	April 17, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Nothing to add from me.
E01091	April 23, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted],	Meeting Coordination/Planning Engagement/Consultation	Attaching the agenda.
E01057	April 26, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Removing "Placeholder" from the title. Attaching the agenda.
E01094	April 28, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	My apologies. I've just been told I'm to attend a meeting of a number of Chiefs at 10 AM this Friday April 30 for a couple of hours. A draft date/time was not provided to me, I just found out minutes ago. Hopefully, another date/time can be found that works for everyone.
E01095	April 28, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Not a problem! Could you send some dates/times that work for you next week? Then I'll work with Chance to coordinate their attended, and hopefully we can find something that works for everyone!
E01096	April 28, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thanks for your understanding. I'm available: May 3 Monday - all day May 4 Wed - 1 PM onward May 6 Thursday- before 3 PM May 7 Friday - after 1 PM
E01054	April 29, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Meeting Invite: Just moving the appointment to next week. Let me know if you have any issues with this time slot.
E01097	April 29, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I sent along an updated invite. If that date and time happens to not work, just let me know.
E01098	April 29, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thanks for finding a time/date that works.
E01055	May 5, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	On the off chance that there are poor connection issues during our call this afternoon, I wanted to provide a PDF copy of the presentation Richard will be running through. I will still aim to have the PowerPoint up during the call though.
E01056	May 5, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	I'm sending along this meeting invite (in accordance [redacted] email) so that it is in everyone's calendars. A draft agenda for the Chance and NYRRC meeting is below. However, it can definitely be updated if any changes are proposed.DRAFT Agenda Introduction to meeting •Introductions •Review of agenda •Meeting purpose and objectives□ Eagle Plains Exploration Project •Provide overview of Project Description •Discussion and questions□ Next Steps •Timelines •Future meetings/engagement
E01193	May 5, 2021	Meeting - Teleconference		First Nation of Na-cho Nyäk Dun		[redacted]	[redacted]	Engagement/Consultation	The purpose of this meeting was for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin. Chance provided recent information and updates regarding baseline information gathered by consultants (Environmental Dynamics Inc. (EDI), Peer Solutions, Palmer) and Parties discussed next steps with community engagement and consultation schedules for the First Nation of Na-cho Nyäk Dun (FNNND).
E01071	May 13, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning Project Description/Activities	Attached are a couple of items that were discussed during the Chance/FNNND meeting last week. The first is a memo summarizing Chance's draft engagement schedule over the summer/fall. The second is the Heritage report that Chance completed back in 2013.
E01146	May 14, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Engagement/Consultation	I've attached the May 5th Chance / First Nation of Na-cho Nyäk Dun Meeting Summary Draft for Review.
E01147	May 14, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Project Description/Activities Engagement/Consultation	I'll have a look at it this weekend.
E01159	May 18, 2021	Email	Out	First Nation of Na-cho Nyäk Dun Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Information Sharing Project Description/Activities	We recently received a report and accompanying appendices from Palmer Environmental who worked on permafrost/terrain studies as well as suitability mapping. I've attached the main memo/report from Palmer.
E01172	May 21, 2021	Email	Out	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Information Sharing	I wanted to check-in and see if you had any issues with downloading the maps.
E01174	May 21, 2021	Email	In	First Nation of Na-cho Nyäk Dun	[redacted]	[redacted]	[redacted]	Information Sharing	The only minor hassle was that I had to go into town to do it due to my poor off grid internet connection. But that is standard procedure with off grid life and office.
E01198									
E01199									
E01200									
E01201									
E01202									
E01203									

APPENDIX 2-A-29. *Chance Oil and Gas, Eagle Plains Project: Wildlife Baseline Studies*

Chance Oil and Gas, Eagle Plains Project: Wildlife Baseline Studies



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EXECUTIVE SUMMARY

The Eagle Plains Project (the Project) is an oil and gas exploration program in north-central Yukon, approximately 605 km north of Whitehorse along the Dempster Highway. Chance Oil and Gas Ltd. intends to conduct exploratory activities over a 10-year period to confirm the quality, quantity, and areal extent of hydrocarbons. Project activities will include seismic exploration and exploratory wells supported by an expanded winter road network.

The Project's Regional Study Area (RSA) is approximately 2,400 km² and is spatially bounded by the Peel River and Ogilvie River to the south and the northern reaches of Chance Creek to the north. The Project is within the Eagle Plains ecoregion, an intermontane basin underlain by sedimentary rock. The regional land cover comprises subarctic coniferous forest with mixed forest and arctic/alpine tundra while also lying within a continuous permafrost zone.

For the Project to proceed, it must be evaluated under the *Yukon Environment and Socio-Economic Assessment Act*, which requires baseline wildlife information. As such, wildlife baseline studies were conducted to provide information about birds, American marten, grizzly bear, moose, and caribou to meet the information requirements to support a project proposal to the Yukon Environmental and Socio-economic Assessment Board. The following subsections provide an executive summary of each baseline study completed for the Project.

Birds

The purpose of the birds baseline study was to document the potential occurrence, relative abundance, and habitat associations of birds across the Project's RSA. This study consisted of a combination of a desktop assessment and field surveys. The desktop assessment included identifying ecosystem units across the RSA using predictive ecosystem mapping, collecting, and cleaning historic bird survey data in the broader area, and developing a comprehensive list of bird species with the potential for occurrence based on range and habitat requirements. Two types of field surveys were conducted, each targeted at broad habitat associations in the Project area: point count surveys (transects for terrestrial habitats) and wetland/pond surveys. The survey design followed a targeted, stratified habitat design to provide representative survey coverage across the range of habitat types that occur in the RSA. Point count stations were established along walking transects for efficient survey implementation, and sites were selected using a targeted, stratified habitat design. Ecosystem units for predictive ecosystem mapping were reclassified with field data to produce 32 ecosystem units that captured site-specific differences in vegetation. An average of 23 survey stations were located in each ecosystem unit, with a minimum of eight stations in uncommon habitats. Field surveys were conducted during the 2019 breeding season (June 25 to 30) by two experienced biologists.

To better explain broad patterns of habitat occupation by species of birds in the RSA, the initial 32 ecosystem units were consolidated into ten broad avian habitat types: Herb, Deciduous/Mixed Shrub, Tall Shrub – Black Spruce, Deciduous/Mixed Forest, Spruce Forest, Riparian/Wetland Deciduous Shrub, Riparian Coniferous Shrub, Riparian Spruce Forest, Open Water, and a classification ("Unknown") for distant (>100 m) or flyover observations that prevented associating birds with habitat.

Based on range and habitat, 128 bird species potentially occur in or adjacent to the RSA. Forty-eight bird species were recorded in adjacent areas during North American Breeding Bird Surveys. Possible species include eight listed either under the federal *Species at Risk Act* or identified in the Yukon *Wildlife Act*, and 67 are considered a priority and management concern under the federal *Bird Conservation Region 4 Plan*. Species listed in the *Species at Risk Act* include (with those in bold observed in the RSA): Horned Grebe (*Podiceps auritus*), Peregrine Falcon (*Falco peregrinus*), Short-eared Owl (*Asio flammeus*), **Red-necked Phalarope** (*Phalaropus lobatus*), **Common Nighthawk** (*Chordeiles minor*), **Olive-sided Flycatcher** (*Contopus cooperi*), Bank Swallow (*Riparia riparia*), and **Rusty Blackbird** (*Euphagus carolinus*).

During field surveys, nine hundred and seventy-nine birds from 53 species were observed in the RSA. Point counts identified 743 birds of 42 species, and wetland surveys identified 231 birds of 37 species. Five Swainson's Hawk (*Buteo swainsoni*) were also identified as incidental observations. Patterns of species relative abundance and richness (number of species) varied among the different habitat types. These patterns were consistent with regional habitat and known bird range-use and habitat requirements. Average relative abundance and species richness were greatest in Spruce Forest, Deciduous and Mixed Shrub, and Riparian/Wetland Deciduous Shrub habitats; and lowest in Herb and Tall Shrub – Black Spruce habitats. These patterns were generally related to the structural complexity and productivity of these different habitat types. However, the number of unique species in a given habitat did not depend on structural complexity. Many unique species were found in the Herb and Open Water habitats.

The general patterns of bird occurrence and habitat associations observed in this study are consistent with the limited information available for birds in the area.

Marten

Marten were selected as a Valued Component for the Project due to their value as a furbearer to the Vuntut Gwitchin First Nation and as an indicator species for mature and old forest values. Marten are a good species for assessing potential effects on habitat because they are more closely associated with habitat (mature forest) than many other species of medium-sized carnivore. However, little is known about basic marten ecology in northern boreal forest and taiga ecosystems. The RSA is located entirely within the Eagle Plains Ecoregion, where tree growth is limited by the presence of permafrost and short cool summers that limit the structural development of forests. The most common climax forest community is black spruce woodlands with open canopies and relatively small trees. The size and number of mature forest structures that marten use, such as large trees, snags, and coarse woody debris is much smaller than in forests used by marten in more southern latitudes. Therefore, indices of marten habitat suitability were evaluated in a relative context in this northern setting.

A habitat suitability index model was developed for marten to examine the amount, quality, and habitat distribution for the species in the RSA. Habitat was assigned a suitability ranking of High, Moderate, Low, or Nil/Very Low, relative to the range of habitat quality across the RSA. The rating categories correspond to qualitative predictions of the relative suitability of the habitat for supporting five life requisites of marten: reproduction, thermal cover, escape cover, foraging, and dispersal. High-quality habitat supports all five life requisites. Moderate-quality habitat supports escape cover, foraging, and dispersal. Low-quality habitat only

supports limited foraging and dispersal. Nil/Very Low-quality habitat does not contribute significantly to any life requisites; however, herb/shrub structural stages and stunted disclimax forest areas likely function as permeable barriers and allow intra-territorial movements within marten home ranges. Key habitat associations include selection for mature/old conifer structural stages and avoidance of herb/shrub structural stages (mostly resulting from fire), natural openings, wetlands, and stunted black spruce stands. The model also accounts for avoiding anthropogenic linear features, with greater rating reductions for wider linear features. The model uses two types of source information to provide a spatially explicit quantification of marten habitat across the RSA: vegetation mapping (Ecological and Landscape Classification mapping) and human disturbance, including the Dempster Highway, winter roads, and two types of seismic lines.

The model indicates a patchwork of High (16%), Moderate (23%), and Low (60%) quality marten habitats across the RSA. High-quality marten habitat is associated with mesic, spruce-dominant ecosites in mature to old structural stages. Concentrations of High-quality habitat include the southern portion of the study area, in the Enterprise and Dalglish Creeks watersheds, a band running east-west, north of the Dempster Highway, and the western portion of the northern half of the RSA. Moderate-quality habitat is associated with wetter and/or younger ecosystem units than High-quality habitat and is widespread across the RSA. High and Moderate quality habitat is also concentrated in narrow strips of mature/old riparian forests along some of the major watercourses in the RSA, including Chance and Greaves Creeks in the northwest and McParlon Creek west of the Dempster Highway. Low-quality habitat is associated with regenerating burns, wetlands, and stunted, open, black spruce areas. Concentrations of Low-quality habitat include recent burns on both sides of the Dempster Highway and wetlands and open, stunted spruce areas in valley bottoms in the lower reaches of the Chance watershed in the northwestern portion of the RSA. Nil/Very Low habitat constitutes only 1% of the RSA.

Linear features had a relatively minor effect on overall quality, amount, and distribution of potential habitat for marten in the RSA. This was due to the narrow width of linear features and small overall extent they comprise relative to the overall RSA. Though existing linear features result in reduced habitat quality at the site-level, their effects on habitat supply for marten at the home range scale are very limited.

Grizzly Bear

Grizzly bears (*Ursus arctos horribilis*) were selected as a Valued Component for the Project due to their conservation status and social, cultural, and economic value. Grizzly bears are Special Concern on Schedule 1 of the federal *Species at Risk Act*. The grizzly bear section provides baseline information about population trends, distribution, sources of mortality, diet, and habitat selection within the RSA. This section draws from multiple sources, including published and unpublished literature, personal communications with biologists, and traditional knowledge where available. Few studies on grizzly bears have been conducted in the Project area. Literature from surrounding regions was consulted when local information was not available.

Grizzly bear densities are thought to be low throughout the RSA. The most current grizzly bear population estimate for the broader Eagle Plains Ecoregion (which encompasses the RSA) is 184 individuals, based on expert opinion of grizzly bear habitat capacity from the 1980s. Little is known about seasonal grizzly bear distribution and movements within the RSA and surrounding areas. However, the Richardson and Ogilvie

Mountains (north and south of the RSA, respectively) are thought to have higher grizzly bear densities than the comparatively flat Eagle Plains Ecoregion. Grizzly bears congregate at the Fishing Branch River (20 km west of the RSA) in the fall to feed on spawning salmon. Grizzly bears may also follow the spring and fall migration of the Porcupine caribou herd to take advantage of the seasonal abundance of caribou as a food source.

Key threats to grizzly bear populations in the Yukon are human-wildlife conflict and harvest mortality. Licenced grizzly bear harvest rates are low in the RSA relative to other parts of the Yukon. Annual grizzly bear harvest in Game Management Zone 1 (which encompasses the RSA) has historically varied from zero to three bears per year. Other potential sources of grizzly bear mortality in the RSA include the defence of life and property kills, collisions with vehicles, and predation from other bears or large carnivores.

Seasonal grizzly bear diets reflect the phenological progression of key food resources such as herbaceous plants, roots, ungulate calves, berries, and fish. Terrestrial wildlife are likely an important food source for grizzly bears in northern Yukon, particularly barren-ground caribou (*Rangifer tarandus groenlandicus*) and arctic ground squirrels (*Spermophilus parryii*). The distribution of available food strongly influences habitat selection by grizzly bears during spring, summer, and fall seasons and the supply of suitable den sites in winter. Grizzly bears in the RSA may select habitats with abundant herbaceous vegetation, roots, or berries, such as riparian valleys and slopes. Grizzly bears may also travel to nearby mountain ranges to feed on ground squirrels, particularly in fall, as berry availability declines. Grizzly bears may follow caribou during spring and fall as they migrate to and from their calving grounds, targeting calves or opportunistically preying on adults.

Grizzly bears in northern Yukon hibernate in winter from approximately October to May. They prefer to den in mountainous regions; however, in areas with relatively flat topography (such as the RSA), grizzly bars will select small topographic features such as hills, steep riparian banks, or lakesides to excavate their dens. Grizzly bears in the taiga of northern Yukon have large home range sizes (females: 442–750 km^2, males: 760–1,250 km^2). They travel long distances to find suitable winter denning habitats in the mountains.

Moose

Moose (*Alces alces*) were selected as a Valued Component for the project's environmental assessment due to their value as a game species and their cultural values to local First Nations. The purpose of the moose study was to summarize existing baseline information for moose and develop a habitat model for the species within the Eagle Plains RSA. The habitat model quantifies the suitability, amount, and distribution of potential habitat for moose in the RSA. This information can be used to assess the Project's potential effects on moose and develop measures to mitigate effects if required.

There is limited incidental knowledge about moose population levels, distribution and habitat use within the Eagle Plain RSA. Formal population surveys of moose have not been conducted, but local knowledge suggests that, while moose densities in Eagle Plains are relatively low compared to areas in southern Yukon, they are relatively high compared to other areas in North Yukon. Information from two historical aerial surveys examining the distribution of moose (and other large mammals) indicates that moose occur across the RSA throughout the year, consistent with the relatively low elevation, subdued topography, and moderate

snowpacks that occur in the area. Several large, regenerating burns and smaller extents of riparian and wetland shrublands offer shrubby browse that moose depend on during winter.

The habitat model was developed specifically for the winter season because winter is the most limiting season for moose — forage is most limited, and energetic demands are greatest due to cold temperatures and the extra effort required to travel through snow. The model explicitly focussed on forage availability, which was believed to be the most significant factor affecting habitat selection in winter. During winter, moose feed almost exclusively on the stems and branches of certain shrubs. Vegetation surveys in the area found that several species of willows (*Salix spp.*) were the most abundant potential forage species and the species with the most frequent evidence of browsing by moose.

The habitat model included three variables, ecosystem type, structural stage, and fire disturbance status, all from recent vegetation mapping (Ecological and Landscape Classification mapping) conducted in the RSA. Habitat suitability ratings were developed for each combination of ecosystem type, structural stage, and fire disturbance based on the observed or potential abundance of willow. The highest-rated areas included natural shrublands, regenerating burns in riparian areas, and small extents of deciduous and mixed-wood ecosystems on mesic and moist sites. Moderate-rated areas were predominantly regenerating burns on mesic to wet sites. Low-rated sites were mostly undisturbed stands of open, stunted spruce on mesic to wet sites, ranging from tall shrub to old forest structural stages. Differentiating ratings between Moderate and Low areas was often difficult. Many burned and unburned sites had an average willow cover less than 15%, with high variation in cover among sites in the same ecosystem units. Generally, 7% willow cover was used as the threshold to differentiate between Moderate and Low sites. This is a relatively low value of willow cover but using a higher threshold would have resulted in large areas of regenerating burn being classified the same (Low) as undisturbed areas.

The habitat model indicates that High-suitability moose winter habitat is quite limited across the RSA, and Moderate habitat is widespread: High (12%), Moderate (43%), Low (44%), and Nil/Very Low (1%). Due to the scattered occurrence of High-suitability habitat across the RSA, some moose are expected to occur across the RSA in winter. However, local densities are likely to vary with the portions of Low and Moderate suitability habitats that form the matrix of habitat at a larger scale. This pattern of having extensive areas in Moderate suitability winter habitat is different than occurs in other parts of Yukon, especially in more mountainous regions, where suitable winter habitat (i.e., High and Moderate) are often constrained by elevation and broad vegetation patterns to a relatively small proportion of the landscape (e.g., <25%). In Eagle Plains, a substantial amount of winter forage occurs within large areas with relatively low willow cover (i.e., the Moderate suitability areas).

Caribou

The Porcupine Caribou Herd (PCH) is a subpopulation of barren-ground caribou (*Rangifer tarandus*), known for large population aggregations, dramatic population fluctuations, lengthy migrations, and significant cultural and social value to northern Indigenous peoples. Within the North Yukon Land Use Plan, the PCH is considered "the most significant and culturally important wildlife resource in the planning region." The PCH has been assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada, but the

subspecies is not listed on Schedule 1 of the federal *Species at Risk Act*. Within Yukon, barren-ground caribou are considered Vulnerable/Apparently Secure.

The specific objectives of this study were to:

- summarize existing information about the ecology of the PCH,

and, use telemetry data and analysis outputs from the Porcupine Caribou Technical Committee to:

- quantify the degree of seasonal range overlap by the PCH with the Eagle Plains Oil and Gas Exploration Project RSA during late fall and winter, when seasonal range use overlaps the RSA.
- quantify habitat use patterns and selection by the PCH during late fall and winter.
- quantify movement rates and residency periods of the PCH during late fall and winter.
- quantify potential effects of exiting linear features on the occurrence and movements of the PCH.

There is a long history of co-management of the PCH among indigenous, state, territorial and federal governments in Canada and the United States. In Canada, management initiatives are led by the Porcupine Caribou Management Board with technical support from the Porcupine Caribou Technical Committee. The Porcupine Caribou Technical Committee leads most monitoring and research work on the PCH, including population and demographic monitoring, seasonal movement monitoring (via GPS telemetry tracking), caribou body condition monitoring, habitat and human disturbance assessments, and annual snow surveys. The portion of the PCH annual range that occurs within Yukon is protected by a network of parks, special management areas, conservation areas, wilderness areas, protected areas, ecological preserves, habitat protection areas, and Integrated Management Area zones within the North Yukon Regional Land Use Plan and the Peel Watershed Regional Land Use Plan. In total, 54% of the annual range of the PCH within Yukon falls within some type of protected area where industrial activity is prohibited, 36% of the annual range occurs within regional land use plan Integrated Management Area zones where development is limited, and 9% of the annual range is not covered by any land management zonation.

Although most barren-ground caribou subpopulations are declining, the PCH numbers have increased over the last two decades. Since the first survey in 1972, the PCH has had two periods of population growth, with an interceding decline. The last successful population survey in 2017 estimated a record high of 218,457 caribou.

Like most barren-ground caribou subpopulations, the PCH has a large annual range and makes long-distance migrations, hundreds or thousands of kilometres, among different seasonal ranges. After calving on the north slope and Arctic coastal plains, the PCH typically splits in two, with portions of the herd moving southwest in Alaska and southeast in Yukon. Animals in the Yukon typically follow a clockwise movement through the seasonal ranges from the calving grounds on the north slope, to the British Mountains in summer, to the Richardson Mountains in late summer, dispersing widely and variably across northern Yukon (as far south as the Ogilvie Mountains) in fall and winter, before returning north to the coastal plains in spring. The PCH has historically overlapped the RSA in the rut/late fall and winter periods. However, the RSA overlaps a small

portion of those ranges — 6.0% of the late fall range and 6.5% of the winter range, and the RSA does not overlap with the most frequently used portions of those ranges.

Habitat selection by the PCH for late fall and winter was estimated using resource selection functions using GPS collar data from 2012 to 2021 for 164 caribou in late fall and 172 caribou in winter. Spatial habitat data included a set of plant functional type layers (light macrolichens, graminoids, forbs, evergreen shrubs, deciduous shrubs, and conifer trees), elevation, aspect, slope, terrain ruggedness, and distance to waterbodies >1 ha. PCH caribou tended to select and avoid similar resources in both late fall and winter. Key covariates in models for both seasons that were statistically significant (i.e., $P < 0.05$) included macrolichen cover (positive coefficient), conifer tree cover (negative coefficient), slope percent (negative coefficient), elevation (variable in fall and winter), and aspect (greater selection for south- and west-facing). Coefficients associated with lichen cover were of the greatest magnitude, suggesting that the selection of lichen is the primary driver of habitat selection in late fall, especially in winter. The resource selection function models were used to derive habitat quality maps with four ratings (Very Low, Low, Moderate, and High), which were determined by assessing selection ratios across resource selection function predictions. The distribution and proportion of selected habitat (Moderate and High) was then examined within the RSA and broader seasonal ranges. The proportion of selected habitat was equivalent between the RSA (0.404) and the broader range during late fall (0.415 ± 0.025) but was less in the RSA (0.265) than the broader range during winter (0.411 ± 0.026). Selected habitat, especially areas of High quality, were mostly dependent on the amount and distribution of macrolichen cover.

The potential for linear features (i.e., the Dempster Highway, winter roads, 2D seismic and 3D seismic) to mediate the base habitat model via avoidance of those features was assessed using a zone of influence (ZOI) framework. Although ZOIs were determined for some features, confidence in the outcomes was low because (i) the magnitude of the ZOI effects were weak (i.e., including the ZOI effects in the habitat models had little effects on the habitat predictions); (ii) the ZOI distance estimates were sensitive to the data and analytical methods used; (iii) the pattern of ZOI effects were not consistent with other studies and basic understanding of the PCH ecology. Developing ZOIs for assessment and management purposes will integrate results from other studies adapted to the Eagle Plains setting and the ecology of the PCH.

To better understand factors affecting PCH caribou movement, two analyses were conducted: (1) a comparison of daily movement rates and residency times of caribou in the Project RSA relative to the broader landscape, and (2) a delineation of movement paths to assess broad-scale movement patterns and the potential for caribou to interact with the Project. The PCH typically exhibits movements of several kilometres per day in late fall and winter. Late fall daily movements (8.7 km/day in the RSA) were substantially greater than during winter (4.4 km/day), and caribou tended to occupy portions of the landscape for shorter periods during late fall than during winter. Caribou residency times in both seasons were two-fold greater in the broader landscape than within the Project RSA, suggesting that, on average, the RSA is used as more of a transitory area than other portions of the seasonal ranges. There were relatively few collared caribou that travelled through the RSA during late fall. However, in the fall of 2015, 14 collared caribou made clear, directed movements along the height of land parallel to the Dempster Highway, from the northeast to the southwest. Most caribou appeared to avoid crossing the Dempster Highway while travelling through the Eagle Plains

region, but all animals eventually crossed the highway farther south, in the Ogilvie Mountains. The movements through Eagle Plains crossed numerous 2D seismic lines, winter roads and a large 3D seismic grid within the RSA.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
2D	Two Dimensional
3D	Three Dimensional
AIC	Akaike's Information Criterion
asl	above sea level
BBMM	Brownian Bridge Movement Model
BC	British Columbia
BCR	Bird Conservation Region
BMU	Bear Management Unit
°C	degrees Celsius
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWCS	Canadian Wetland Classification System
CWD	Coarse Woody Debris
CWS	Canadian Wildlife Service
DBH	Diameter at Breast Height
DEM	Digital Elevation Model
DLP	Defence of Life and Property Kill
ELC	Ecosystem and Landscape Classification
GAM	Generalized Additive Modelling
GIS	Geographic Information System
GMS	Game Management Subzone
GMZ	Game Management Zone
GPS	Global Positioning System
ha	hectares
HSI	Habitat Suitability Index
HMP	Harvest Management Plan
IMA	Integrated Management Area
IPCB	International Porcupine Caribou Board
km	kilometers
km^2	square kilometers
LF	Linear Feature
LIS	Low Impact Seismic
m	meter
mm	millimeter
NABBS	North American Breeding Bird Survey
NND	Na-cho Nyäk Dun
NWT	Northwest Territories
NYLUP	North Yukon Land Use Plan

PCH	Porcupine Caribou Herd
PCMB	Porcupine Caribou Management Board
PCTC	Porcupine Caribou Technical Committee
PEM	Predictive Ecosystem Mapping
PFT	Plant Functional Type
PWLUP	Peel Watershed Land Use Plan
RISC	Resources Information Standards Committee
RSA	Regional Study Area
RSF	Resource Selection Function
SARA	*Species at Risk Act*
the Project	the Eagle Plains Project (proposed by Chance Oil and Gas Ltd.)
TGC	Tetlit Gwich'in Council
THFN	Tr'ondëk Hwëchin First Nation
TRI	Terrain Ruggedness Index
VC	Valued Component
VGFN	Vuntut Gwitchin First Nation
YESAA	*Yukon Environmental and Socio-Economic Assessment Act*
YESAB	Yukon Environmental and Socio-Economic Assessment Board
ZOI	Zone of Influence

1 INTRODUCTION

Baseline wildlife information and data are required for proposed oil and gas projects submitted to the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee for screening under the *Yukon Environment and Socio-Economic Assessment Act* (YESAA), as well as applications submitted for an Industrial Licence and Type A Water Licence from the Yukon Water Board, among other permits and licences. To receive authorization for the Eagle Plains Project to proceed, the Project must be evaluated under YESAA. Specific wildlife objectives, as identified in YESAB's Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions (2005), are to:

- describe the abundance and distribution characteristics of major wildlife species within the project area and vicinity;
- describe the habitat classifications used in the project area and any implications concerning the distribution and abundance of habitat types that may influence the project;
- provide a map showing the spatial arrangement of habitats of special interest, if applicable;
- identify and describe the transportation corridor and critical, key, and sensitive habitats;
- identify any species listed on the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and Species at Risk lists;
- describe any special management requirements due to vulnerability, threatened, or endangered status; and,
- identify and describe any ongoing studies and monitoring programs concerning wildlife in the project area and vicinity.

1.1 PROJECT OVERVIEW

The Eagle Plains Project (the Project) encompasses a 2,386 km² area in north-central Yukon, centred approximately 605 km north of Whitehorse and 40 km south and west of Eagle Plains hotel, along the Dempster Highway. The Project occurs within the Eagle Plains sedimentary basin, north of the Ogilvie River and west of the Richardson Mountains. The basin contains proven natural gas and oil reserves (Peel Watershed Planning Commission 2019), including 4.6 billion m³ of gas and 3.2 million m³ of oil (Hannigan 2014).

The Regional Study Area (RSA) has had intermittent periods of oil and gas exploration since the 1950s. That activity has established winter roads, seismic lines, and exploratory well sites across parts of the current RSA. Approximately 40 exploration wells have been drilled in the Eagle Plains sedimentary basin. Eight (8) wells are currently being maintained in suspended status, and the remaining wells have been plugged and abandoned. Seismic exploration has included approximately 10,000 km of two-dimensional (2D) lines (mostly before 1985), and about 325 km² of three-dimensional (3D) seismic was conducted in 2013/2014 (Northern Cross (Yukon) Ltd. 2014).

The current exploration program will build on past exploration to better define the extent, amount and quality of oil and gas deposits in the area. Under the current program, Chance Oil and Gas Ltd. proposes conducting additional 2D and 3D seismic data acquisition programs over large extents of the RSA and drilling up to 30 exploratory wells. Depending on the drilling program results, extended flow testing lasting up to two years may be conducted at wells where crude oil and/or natural gas are discovered to determine the quantity, quality and extent of the oil and gas deposit(s). The existing winter road network will be expanded to support the seismic, drilling, and flow testing programs. Most work is expected to be conducted in the winter (e.g., seismic line clearing and drilling); however, seismic recordings and extended flow testing may also occur during summer or year-round.

1.2 STUDY AREA

The Eagle Plains Project Regional Study Area (RSA; Map 1-1) is 2,386 km² (238,566 ha), centred in the Eagle Plains Ecoregion in north Yukon. The area consists of subdued topography of rolling hills and sloping plains. The Dempster Highway crosses the RSA along the local height of land. From there, the area drains into the Porcupine River watershed to the north (via Chance Creek) and west (via McParlon Creek and the Whitestone River) and into the Peel River watershed to the southeast (via Dalglish Creek).

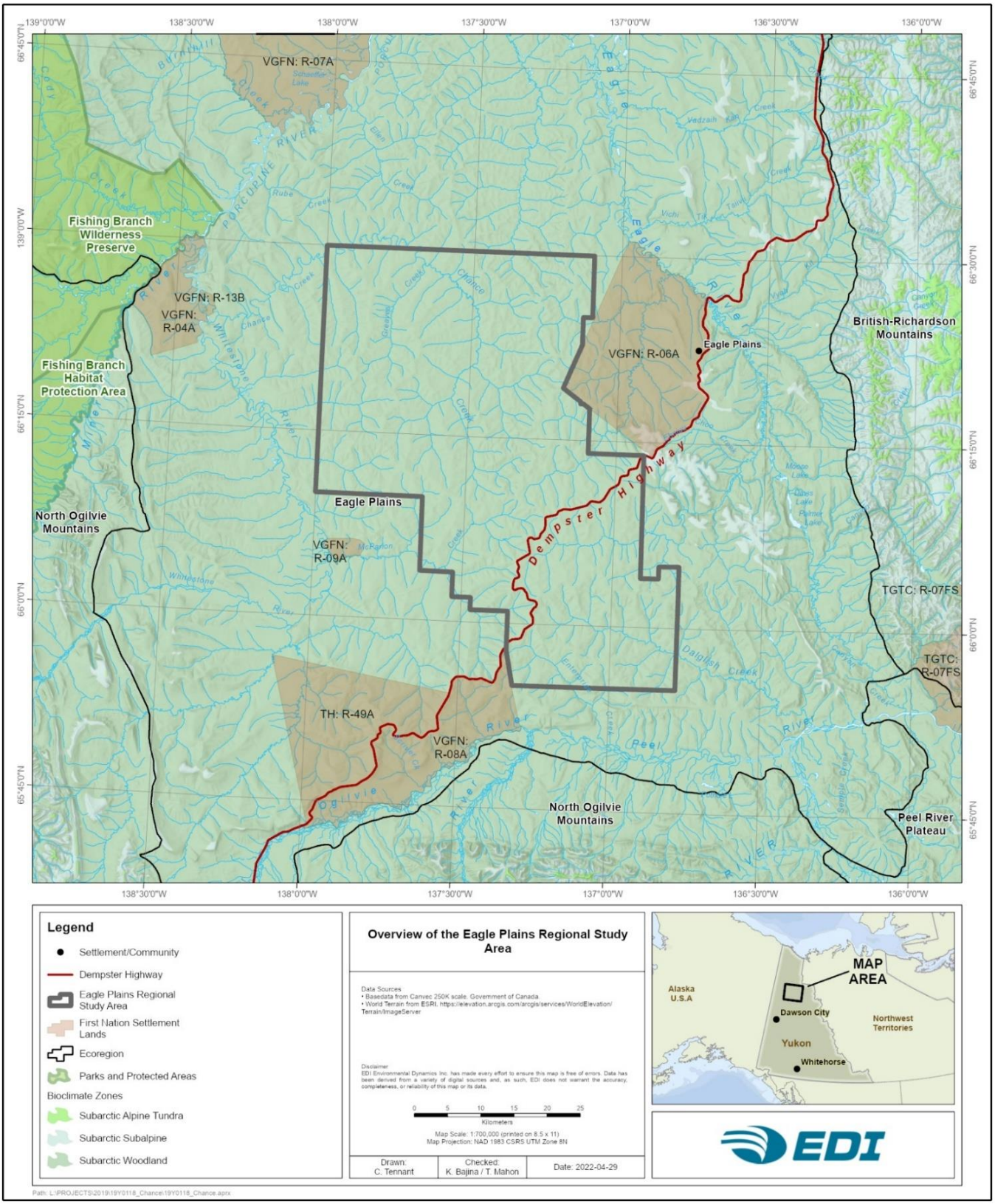
The RSA overlaps four First Nation Traditional Territories. Most of the RSA is within the Vuntut Gwitchin First Nation (VGFN) Traditional Territory. The southeastern portion is in an area of overlapping Traditional Territories of VGFN, the Tetlit Gwich'in Council (TGC), the First Nation of Na-cho Nyäk Dun (NND), and Tr'ondëk Hwëchin First Nation (THFN). Although the RSA is outside any First Nation Settlement Lands, it adjoins VGFN Settlement Lands on parts of its east and southwest borders.

Development in the RSA and the surrounding Eagle Plains is low. The Dempster Highway is the main vehicle access corridor, running from approximately Dawson City, Yukon in the southwest to Inuvik, Northwest Territories (NWT) to the northeast and transiting the RSA along the way. Several winter access roads also branch off the Dempster Highway. A network of seismic lines (Photo 1-1) from historical exploration are found in the RSA. The Eagle Plains settlement is located on the Dempster Highway, approximately 30 km east of the RSA boundary and consists of the Eagle Plains Hotel and the Government of Yukon's Highway Maintenance camp.

The Project is within the North Yukon Planning Region and Peel Watershed Planning Region. Therefore, it is subject to the North Yukon Land Use Plan (NYLUP) and Peel Watershed Land Use Plan (PWLUP). The project falls within the Integrated Management Area (IMA) Zone IV of both plans, a zone with lower ecological and cultural values and the highest permissible development of the four IMA zones.



Photo 1-1. Seismic lines from historical exploration activities within the Regional Study Area.



Map 1-1. Overview of the Eagle Plains Regional Study Area.

1.3 ECOLOGICAL OVERVIEW

The Project falls within the Eagle Plains Ecoregion (Map 1-1), a 20,400 km² region in north Yukon between the Richardson and Ogilvie Mountains. The ecoregion consists of low-altitude rolling topography between 300 m and 600 m above sea level (masl), with few scattered peaks above and around 1,000 masl (Ecological Stratification Working Group 1995).

The Eagle Plains Ecoregion experiences moderate precipitation, with annual amounts around 400 mm. Most precipitation falls as rain throughout the summer, averaging 50 to 80 mm per month, from June through August. Precipitation is lighter through September to April and falls as snow, with average winter snowpacks of 80 cm peaking in April. The climate in this region is strongly affected by its latitude, with extended winter conditions that usually last from October through to early May. There is a substantial variation in seasonal temperatures in the Eagle Plains, with cool short summers and long cold winters. Average winter temperatures are between −30°C and −25°C, with extremes as low as −60°C. Average summer temperatures are around 13°C, with extremes as high as 30°C. Due to the northern latitude, this region experiences brief periods of continuous sun above and below the horizon in summer and winter, respectively.

Most of the Ecoregion, including the northeast portion of the RSA, drains north into the Yukon River via the Whitestone, Porcupine and Eagle rivers. That part of the RSA includes the headwaters of the Eagle River and several other tributaries of the Porcupine River, along with the Chance and McParlon Creek subdrainages of the Whitestone River. The southeast corner of the Ecoregion drains east to the Mackenzie River via the Peel, Wind and Ogilvie Rivers. Dalglish and Enterprise creeks flow directly into the Peel River. The few lakes in the Ecoregion are generally oxbow or thermokarst lakes (Yukon Ecoregions Working Group 2004a). Several wetland complexes are found to be associated with larger creeks in the RSA.

The Eagle Plains Ecoregion is dominated by the Crysolic soils that occupy much of the northern third of Canada, characterized by near-surface permafrost. Turbic Cryosols predominate, exhibiting patterned ground formations and hummocks, and are often associated with open stands of black spruce (*Picea mariana*), tamarack (*Larix laricina*) and birch (*Betula* spp.). The active permafrost layer in these ecosystems generally ranges between 20 cm and 90 cm below the surface. The active layer depth is generally deeper under hummocks and shallower under inter-hummock areas (Yukon Ecoregions Working Group 2004a).

The RSA is entirely within the Subarctic Bioclimate Zone (Environment Yukon 2014a). Vegetation in the RSA is characterized by open-canopy, spruce-dominated habitats where permafrost generally limits tree growth and results in stunted, disclimax vegetation communities (Environment Yukon 2016a). Hummocky, black spruce and white spruce (*Picea glauca*) woodlands with well-developed shrub communities are common in upland areas, with white spruce and ground lichens increasing in abundance in well-drained sites. Areas with low slope gradients and fine-textured soils often have ground cover dominated by cottongrass tussocks beneath a shrub layer of birch, black spruce, Labrador tea (*Rhododendron groenlandicum*), and occasionally tamarack (Yukon Ecoregions Working Group 2004a).

Evidence of forest fires can be observed throughout the RSA (Photo 1-2 and Photo 1-3). Alaskan paper-birch (*Betula neoalaskana*) is often the first tree species to colonize burn areas, and the extent of old burns is generally

correlated with young black spruce – Alaskan paper birch woodlands (Yukon Ecoregions Working Group 2004a). Fires increase the depth of the active permafrost layer, causing slope failures and changes in ecosystem moisture regimes.



Photo 1-2. Example of a regenerating moist forest stand after a fire within the RSA.



Photo 1-3. Example of a recently burnt area of the RSA.

2 BIRDS

2.1 PURPOSE AND OBJECTIVES

This section documents the occurrence, relative abundance, and habitat associations of birds occurring or likely occurring in the RSA. It includes a desktop assessment to collect and summarize existing information about birds; and field surveys to document the occurrence, relative abundance, and habitat associations of birds within the RSA. Field surveys were recommended by the regulator responsible for migratory birds (Environment and Climate Change Canada — Canadian Wildlife Service [CWS]) because no systematic bird surveys have been previously conducted in the Project area. Surveys in adjacent areas were limited and mainly were road-based surveys, which had limited or no coverage of particular habitat types. Two field survey types were used to provide representative coverage of broad avian habitat types and associated avian communities: (1) point count surveys and (2) pond and wetland surveys.

2.2 BIRD HABITAT OVERVIEW

The Project falls within Bird Conservation Region 4 (BCR 4), the Northwestern Interior Forest (Environment Canada 2013a). BCR 4 is home to 211 regularly occurring bird species, including 31 waterfowl species, 19 water bird species, 23 shorebird species, and 138 land bird species (Environment Canada 2013a). Most species are breeding season migrants, few are year-round residents. The Project is also within ~30 km of two other bird conservation regions: region 3 (BCR 3), the Arctic Plains and Mountains, and region 6 (BCR 6), the Boreal Taiga Plains. BCR 3 habitats are influenced by a short growing season and continuous permafrost; upland habitats range from heavily vegetated heath communities to sparse cryptobiotic crusts, lichens, and moss; in the southern end, dwarfed spruce trees are often found in restricted patches (Environment Canada 2013b). BCR 6 is primarily characterized by gently rolling or undulating landscapes, vegetation dominated by the boreal forest and interspersed with wetlands and several major river systems (Environment Canada 2013c). In total, BCR 3 has 159 species of birds, while BCR 6 has 288. This current study did not find species uniquely associated with either of these two conservation regions.

The RSA has three predominant bird habitat types: black spruce upland, willow and scrub birch shrubland, and scrub fens and bogs. Upland forests provide potential breeding habitat for resident Northern Goshawk (*Accipiter gentilis*), Spruce Grouse (*Canachites canadensis*), Northern Hawk Owl (*Surnia ulula*), American Three-toed Woodpecker (*Picoides dorsalis*), Canada Jay (*Perisoreus canadensis*), Boreal Chickadee (*Poecile hudsonicus*), White-winged Crossbill (*Loxia leucoptera*), and Common Redpoll (*Acanthis flammea*) (Frisch 1987, YEWG 2004, Environment Canada 2013). Migrants that breed in upland forests include Swainson's Thrush (*Catharus ustulatus*), Gray-cheeked Thrush (*Catharus minimus*), Varied Thrush (*Ixoreus naevius*), Bohemian Waxwing (*Bombycilla garrulus*), Yellow Warbler (*Setophaga petechia*), Yellow-rumped Warbler (*Setophaga coronata*), American Tree Sparrow (*Spizelloides arborea*), and Dark-eyed Junco (*Junco hyemalis*) (Frisch 1987, YEWG 2004). American Kestrel (*Falco sparverius*), Say's Phoebe (*Sayornis saya*), American Robin (*Turdus migratorius*), Orange-crowned Warbler (*Leiothlypis celata*), and Chipping Sparrow (*Spizella passerina*), as well as other species of thrush, warbler,

and sparrow, can be found in more open forests with a well-developed shrub layer, or shrublands with tall shrub and dwarfed spruce (Frisch 1987, YEWG 2004). A frequently occurring species in the Eagle Plains ecoregion, though rare elsewhere in Yukon, is Swainson's Hawk (*Buteo swainsoni*). This species is associated with isolated stands of productive white spruce for nesting habitat, mostly found in narrow riparian strips surrounded by open bogs and shrublands where they regularly forage.

Aquatic habitats for birds consist of open bodies of water (e.g., ponds, lakes), wetlands (mostly bogs and fens) and riparian zones dominated by sedges and shrubs. Open water bodies are limited in the RSA and are thus potentially inhabited by relatively few Tundra Swan (*Cygnus columbianus*), Greater White-fronted Goose (*Anser albifrons*), Canada Goose (*Branta canadensis*), American Wigeon (*Mareca americana*), Green-winged Teal (*Anas crecca*), and Bufflehead (*Bucephala albeola*) (Frisch 1987, YEWG 2004, Environment Canada 2013). Shorebirds such as Lesser Yellowlegs (*Tringa flavipes*), Solitary Sandpiper (*Tringa solitaria*), and Wilson's Snipe (*Gallinago delicata*) remain along the water's edge and in riparian zones consisting of coniferous and deciduous vegetation. Riparian zones also provide potential breeding habitat for Willow Ptarmigan (*Lagopus lagopus*), Alder Flycatcher (*Empidonax alnorum*), Yellow Warbler, Wilson's Warbler (*Cardellina pusilla*), American Tree Sparrow, and Lincoln's Sparrow (*Melospiza lincolnii*) (Frisch 1987, YEWG 2004). Spotted Sandpiper (*Actitis macularius*), Herring and Short-billed Gulls (*Larus argentatus* and *L. brachyrhynchus*), Belted Kingfisher (*Megaceryle alcyon*), Bank Swallows (*Riparia riparia*), and Cliff Swallows (*Petrochelidon pyrrhonota*) can be found along rivers (Frisch 1987, YEWG 2004).

Alpine/subalpine areas are absent from the RSA. Species that inhabit the alpine/subalpine in other parts of the ecoregion include Golden Eagle (*Aquila chrysaetos*), Rock Ptarmigan (*Lagopus muta*), Horned Lark (*Eremophila alpestris*), American Pipit (*Anthus rubescens*), Gray-crowned Rosy Finch (*Leucosticte tephrocotis*), Upland Sandpiper (*Bartramia longicauda*), and Townsend's Solitaire (*Myadestes townsendi*) (Frisch 1987, YEWG 2004).

The Project RSA does not include cliffs or bluffs that could be used by cliff-nesting raptors, such as Golden Eagle, Peregrine Falcon (*Falco peregrinus*) or Gyrfalcon (*Falco rusticolus*). These species' nearest suitable nesting cliffs are along the Porcupine River and Eagle River (Hayes and Mossop 1978).

Data on birds in the Project area are currently limited. The first evaluation of bird occurrences in Eagle Plains was *Birds by the Dempster* (Frisch 1987). Birds of the Yukon Territory (Sinclair et al. 2003) provided a more detailed description of species occurrences, habitat, and relative abundances. More recently, a general account of birds within the region was presented by Environment and Climate Change Canada in their report, *Bird Conservation Strategy for Bird Conservation Region 4 in Canada: Northwestern Interior Forest* (Environment Canada 2013a). The North American Breeding Bird Survey (NABBS) is the best local data source. Two NABBS routes along the Dempster Highway (routes 78 and 79) are close to the Project.

2.3 METHODS

This study consisted of two components: a desktop assessment to collect and summarize existing information about birds relevant to the Project area and field surveys to document the occurrence, relative abundance, and habitat associations of birds across the Project RSA. This approach, field survey design, and methods details

were discussed with CWS representatives during the project planning stage. The methods used considered specific recommendations provided by CWS representatives and a broader set of recommendations in *A Framework for the Scientific Assessment of Potential Project Impacts on Birds* (Hanson et al. 2009). The methods selected and reporting herein also comply with the the ten key considerations identified in the DRAFT updated guidelines *Canadian Wildlife Service Guidance Regarding Information Needed to Support Assessment of Project Effects on Birds* (ECCC-CWS 2022).

2.3.1 DESKTOP ASSESSMENT

A list of bird species that had the potential to occur in the Project RSA was developed from a combination of historical occurrence data in adjacent areas, a territorial field guide, and a national bird conservation assessment.

Historical data were gathered from the NABBS database for two routes (routes 78 and 79) that run along the Dempster Highway in the Eagle Plains region (Pardieck et al. 2019). The NABBS is a long-term, large-scale monitoring program that began in 1966 to track trends in avifauna. It consists of annual (one day a year) standardized roadside surveys, during the peak breeding season, by skilled observers making 50 stops spaced 0.8 km apart, along 39.4 km long routes. Observers record the number of bird species heard from any distance or seen within a 0.4 km radius of each stop during a three-minute observation period. These data are then compiled and made freely available to analyze trends in relative abundance and species composition. From 2014 to 2018, NABBS identified 48 species along Eagle Plains' two routes (above) (Pardieck et al. 2019).

General information about bird species occurrences was obtained from *Birds by the Dempster* (Frisch 1987), *Birds of Yukon* (Sinclair et al. 2003), and the Federal conservation assessment, *Bird Conservation Strategy for Bird Conservation Region 4 in Canada: Northwestern Interior Forest* (Environment Canada 2013a). These sources ranked species as 'Likely' or 'Possible' in the RSA based on habitat requirements, range boundaries, and occurrence information. Likely species were those whose range overlapped with the RSA, and suitable habitat occurred in the RSA. Possible species included (1) those with suitable habitat in the RSA, but whose range was on the edge of the RSA, and (2) those whose range overlapped with the RSA, but for which the availability of suitable habitat was in question.

2.3.1.1 Conservation Status

The conservation status of bird species was identified based on the most recent recommendations by COSEWIC (COSEWIC 2018) and current lists in the *Species at Risk Act* (SARA) registry (i.e., the most recent amendment, Environment and Climate Change Canada 2019) and BCR 4 plan. The SARA registry groups species into one of three schedules:

- Schedule 1 — the official list of species at risk in Canada includes species that are either Extirpated, Endangered, Threatened or of Special Concern;
- Schedule 2 — species designated as Endangered or Threatened, but that have yet to be re-assessed by COSEWIC under the revised criteria; and,

- Schedule 3 — species designated as Special Concern but have yet to be re-assessed by COSEWIC under the revised criteria.

Birds that fall under conservation categories of Special Concern or higher were identified. All bird species of conservation concern, identified through the designation and ranking processes described above, were evaluated against their species conservation status assessment found in the national bird conservation strategy for BCR 4 (Environment Canada 2013a). The BCR 4 strategy outlines conservation planning and priorities to support the implementation of migratory bird conservation programs. The BCR species assessment considered population size, population trend, regional abundances and densities, and species and habitat threats to designate species warranting "Concern and Stewardship at the Regional, National, or Continental level". Stewardship species are based on "having a large proportion of their world population within BCR 4". Species managed by Environment Yukon under the Yukon *Wildlife Act* were also noted.

2.3.2 HABITAT STRATIFICATION

A broad avian habitat classification system was developed to provide representative survey coverage across the RSA. A habitat stratification approach was applied to site selection for all survey sites before field surveys. Avian habitat types were initially developed using Predictive Ecosystem Mapping (PEM), later verified with Ecological and Landscape Classification (ELC) mapping for habitat-related analyses. Two key components of the initial PEM mapping to define avian habitat types were: ecosystem units and structural stage, described below.

2.3.2.1 Ecosystem Units (Ecosites)

The North Yukon PEM was used to classify 16 ecosystem units in the Project RSA. However, the PEM model was unsatisfactory when assessing ecosite predictions in the field because of its low accuracy. The PEM ecosite codes were used to guide each survey location, but adjustments were made to the classifications according to the dominant vegetation. These changes were supplemented with detailed notes and descriptions of plant and tree species (i.e., lichen cover, percent shrubs, tree height and canopy closure), as well as photographs, with the intent of reclassification.

The purpose of reclassifying PEM ecosystem units was to describe site-specific vegetation at a finer resolution and, ultimately, develop more accurate associations between species of birds and habitat in the Project RSA. A detailed review was conducted of all point count and wetland survey forms, including a review of notes on species of vegetation and structural stage (Table 2-1) and analyzing each survey station's photographs. Deciduous and coniferous (i.e., primarily black spruce) vegetation were distinguished based on their relative densities at ecosites previously classified as mixed wood. Patterns of bird occupation were then analyzed to determine whether deciduous and mixed vegetation warranted separate ecosite codes. Shrub-stage and mature-stage spruce stands were differentiated based on tree height and the degree of canopy closure. Separating these two structurally distinct stands yields two ecological communities with different bird assemblages, e.g., species requiring mature trees for nest cavities, such as owls and woodpeckers, are unlikely to be found in shrub-stage forests. These new ecosites were summarized along with their previous PEM codes

and descriptions of key vegetation characteristics. In total, 32 distinct ecosystem units were developed from the PEM model (Table 2-2).

Table 2-1. Structural and successional stages of vegetation associated with ecosystem units in the Eagle Plains Project Regional Study Area.[1]

Code	Structural Stage	Description
1	Non-vegetated	Very recent disturbance and no vegetation (or <5% vegetation).
2a	Sparse	Initial stages of primary and secondary succession with 5–10% vegetation cover maintained by environmental conditions.
2b	Cryptogram (Bryoid-dominated)	Bryophyte-dominated community maintained by environmental conditions.
3a	Herb (Forb-dominated)	Early successional stage of herbaceous communities maintained by environmental conditions or disturbance. Includes non-graminoid herbs and ferns.
3b	Herb (Graminoid-dominated)	Early successional stage of herbaceous communities maintained by environmental conditions or disturbance. Includes grasses, sedges, reeds, and rushes.
3c	Herb (Aquatic)	Early successional stage of herbaceous communities maintained by environmental conditions or disturbance. Dominated by floating or submerged plants.
4a	Tall Shrub	Early successional stage of forest or shrub communities dominated by shrub layer vegetation > 2 m tall.
4b	Low Shrub	Early successional stage of forest or shrub communities dominated by shrub layer vegetation <2 m tall.
5	Pole/Sapling	Trees >2 m tall and typically densely stocked. Vertical structure and layering not yet evident.
6	Young Forest	Forest canopy with distinct layers and somewhat open stand.
7	Mature Forest	Mature trees and well-developed understories at canopy openings.
8	Old Forest	Old and structurally complex stands composed mainly of shade-tolerant and regenerating tree species.

[1] Modified from Environment Yukon 2017.

Table 2-2. Modified predictive ecosystem mapping ecosites relative to original ecosites in the Eagle Plains Project Regional Study Area.

Modified PEM	PEM	*N*[1]	Vegetation Description
211-D	211	7	Wet deciduous shrub; predominantly willow and scrub birch. Structural stage 4b.
211-SB	211, 213	3	Wet black spruce shrub (peat bog). Structural stages 4a–6.
211-SB-ML	211, 213	2	Wet black spruce shrub with moderate lichen cover. Structural stages 4a–6.
213-tp	213	2	Wet black spruce dominant forest; tall and productive stands. Structural stages 6 and 8.
221	221	1	Moist mixed shrub; black spruce and deciduous (scrub birch and willow). Structural stage 4b.

Modified PEM	PEM	*N*[1]	Vegetation Description
221-D	221	12	Moist deciduous shrub; predominantly scrub birch and willow. Structural stages 4a–b.
221-SB	221, 223	18	Moist black spruce shrub. Structural stages 4a-6.
221-SB-LL	221, 223	3	Moist black spruce shrub with low lichen cover. Structural stage 4a.
221-SB-ML	223	2	Moist black spruce shrub with moderate lichen cover. Structural stage 6.
221-SB-HL	221	1	Moist black spruce shrub with high lichen cover. Structural stage 4a.
222	222	6	Moist mixed forest; spruce and deciduous (birch and/or alder). Structural stages 5-8.
222-D	222	1	Moist deciduous forest; birch dominant. Structural stage 6.
223-tp	222, 223	4	Moist black spruce forest; sometimes mixed with white spruce. Structural stages 6-7.
223-LL-tp	223	2	Moist black spruce forest; sometimes mixed with white spruce; low lichen cover. Structural stages 6-7.
230	230	1	Mesic herb with <15% shrub cover. Structural stages 2b and 4b.
231-D	231	4	Mesic deciduous shrub; predominantly willow and scrub birch. Structural stages 4a–b.
231-D-ML	231	1	Mesic deciduous shrub; predominantly willow and scrub birch; moderate lichen cover. Structural stage 4a.
231-SB	231, 233	7	Mesic black spruce shrub. Structural stages 4a–6.
231-SB-HL	233	3	Mesic black spruce shrub with high lichen cover. Structural stages 4a–6.
232	232	3	Mesic mixed forest; black spruce and deciduous (paper birch and/or trembling aspen). Structural stages 5–6.
232-D	232	3	Mesic deciduous forest; predominantly paper birch and willow. Structural stages 5–6.
233-tp	233	5	Mesic black spruce forest sometimes mixed with white spruce; tall and productive stands. Structural stages 6-7.
233-LL-tp	233	1	Mesic black spruce forest with some black spruce shrubs; low lichen cover; tall and productive stands. Structural stages 4b, 6–7.
233-HL-tp	233	1	Mesic black spruce forest; high lichen cover; tall and productive stands. Structural stage 6.
310	310	4	Riparian herb with little to no shrub cover. Structural stages 3b–c.
311-D	311	22	Riparian deciduous shrub; predominantly scrub birch and willow. Structural stages 4a-b.
311-SB	311, 313	4	Riparian black spruce shrub. Structural stages 4a–6.
311-SB-T	311	4	Riparian black spruce and tamarack shrub. Structural stages 4a–6.
313	313	11	Riparian spruce forest; mix of black and white spruce, as well as hybrids. Structural stages 6–8.
400	400	4	Wetland herb. Structural stage 3b.
401-D	401	1	Wetland deciduous shrub; predominantly scrub birch and willow. Structural stage 4b.
500	500	17	Open water.

[1] Sample size, the number of survey stations (point count or pond) within each modified PEM ecosite.

2.3.2.2 Bird Habitat Types

Once ecosystem units were reclassified, they were grouped according to vegetation and structural stage similarities. Mixed and deciduous vegetation, while ecologically distinct, did not differ in their use by birds; therefore, they were grouped in a single category. Ultimately, 32 ecosystem units were consolidated into ten broad avian habitat types: Herb, Deciduous/Mixed Shrub, Tall Shrub – Black Spruce, Deciduous/Mixed Forest, Spruce Forest, Riparian/Wetland Deciduous Shrub, Riparian Coniferous Shrub, Riparian Spruce Forest, Open Water, and a classification ('Unknown') for distant (>100 m) or flyover observations that prevented associating birds with habitat (Table 2-3). As a post hoc exercise, ELC ecosite types were assigned to broad habitat types based on the spatial overlap with survey sites with the ELC map and verified using field-based habitat descriptions (Table 2-3). For a complete list of ELC codes, names, and descriptions, see Attachment Table 1 in Section 2.6.1 (Attachment 2-A).

Table 2-3. Avian habitat types developed by grouping modified Predictive Ecosystem Mapping ecosites, based on their similarities in vegetation and structural stages, in the Eagle Plains Project Regional Study Area. *A posteriori* classified ELC ecosites are provided for each habitat type.

Avian Habitat Type	Modified PEM Ecosite	ELC Ecosite[1]	Structural Stages	*N*[2]	Vegetation Description
Herb	230, 310, 400	31, 33, 42, B2	2b, 3b, 3c, 4b	9	Herb dominant sites found along crests and upper slopes, riparian zones, and wetlands; <20% shrub cover.
Deciduous and Mixed Shrub	211-D, 221, 221-D, 231-D, 231-D-ML	06, 22, 23, 31, 33, 34, 35, 42, B2	4a-b	24	Predominantly scrub birch and/or willow vegetation, sometimes with a mix of black spruce; lichen cover possible.
Tall Shrub – Black Spruce	211-SB, 211-SB-ML, 221-SB, 221-SB-LL, 221-SB-ML, 221-SB-HL, 231-SB, 231-SB-HL	05, 06, 14, 20, 23, 33, 34, 42	2b, 4a-b, 6	35	Tall shrub/dwarfed black spruce dominated area often with low to high lichen cover.
Deciduous and Mixed Forest	222, 222-D, 232, 232-D	04, 05, 06, 33, 34	5, 6, 7, 8	13	Birch dominant forest or mix of spruce and deciduous (e.g., birch, aspen, and alder) stands.
Spruce Forest	213-tp, 223-tp, 223-LL-tp, 233-tp, 233-LL-tp, 233-HL-tp	05, 33, 42, B1	6, 7, 8	14	Black spruce dominant forest, sometimes mixed with white spruce, and often with low to high lichen cover. Ranges from intermediate height stands with open canopy to tall and closed canopy forest.
Riparian/Wetland Deciduous Shrub	311-D, 401-D	20, 23, 31, 33, 35, 42, 43, 44	2b, 3b, 4a-b	23	Predominantly scrub birch and willow shrub along riparian zones and wetlands.
Riparian Coniferous Shrub	311-SB, 311-SB-T	22, 33, 35, 42, 43, B1	2b, 4a-b, 6	8	Black spruce and tamarack dominant riparian shrub.
Riparian Spruce Forest	313	22, 23, 31, 35, 42, 43, B2	6, 7, 8	11	Dominated by mix of black and white spruce, as well as spruce hybrids.
Open Water	500	LA, PD	1	17	Non-vegetated open water.
Unknown	UNK	UNK	UNK	74	Unknown habitat due to distant observations (>100 m) or flyovers.

[1] Broad ELC polygons within which survey stations were located.

[2] Sample size, the number of survey stations (point count or pond) within each habitat group.

2.3.3 OCCURRENCE AND DISTRIBUTION SURVEYS

Two experienced bird biologists conducted field surveys in the Project RSA between June 25 to 30, 2019. Each biologist had more than 15 years of experience conducting point count surveys and could reliably identify all bird species by sight and vocalizations that had the potential to occur. All surveys employed a targeted, stratified habitat design to provide sampling across all broad avian habitat types.

2.3.3.1 Breeding Bird Point Count Surveys

'Point count' surveys were conducted in terrestrial habitats following standardized survey methods (Ralph et al. 1995, Resources Inventory Committee 1999a, Matsuoka et al. 2014). Point count stations were visited along walking transects to facilitate efficient survey productivity (i.e., versus individual point counts spaced more widely, which would have resulted in longer travel time and a lower number of survey stations). Point count survey stations were established within a Geographic Information System (GIS) using guided site selection to provide coverage across all avian habitat types and broad spatial coverage across the RSA (Map 2-1). Random site selection approaches were explored but ultimately not used because of challenges associated with safety (steep terrain), logistics (access), and reduced sample sizes (i.e., randomization resulted in much smaller sample sizes due to greater travel times to transect starting stations and between stations). Site selection targeted a minimum of four stations in each habitat type. The location of existing and proposed development features was also considered to ensure the surveys covered those areas. Stations were spaced approximately 500 m apart, with a minimum spacing of 400 m, to avoid counting the same birds from multiple stations. Point count locations were chosen in two ways to associate bird occurrences with habitat types: (1) locating stations within one PEM polygon, at least 100 m from the polygon edge; and (2) locating the station on the boundary between two PEM polygons where the location of birds in different habitat types could be reliably determined (e.g., on the transition between shrubland and forest type). Each point count station was surveyed once to maximize the number of sampled sites.

Survey methods followed standard point count survey methodologies (Ralph et al. 1995, Resources Inventory Committee 1999a, Matsuoka et al. 2014). Surveys used a 10-minute detection period and an unlimited recording distance. Biologists conducted surveys during the dawn chorus (i.e., a half-hour before dawn to ~8:30) when territorial singing rates are highest. Upon arriving at the predetermined survey station location, surveyors evaluated the station location and, where appropriate, revised the location by up to 50 m to aid in accurately plotting bird locations in their associated habitat types. Once on station, surveyors waited two minutes to allow any birds disturbed by the surveyor's arrival to settle and resume their activities. Once the official observation period began, surveyors recorded all birds detected (visual or auditory) during the 10-minute detection period by plotting their locations on a point count map form and recording the standardized four-letter species name abbreviation, time of detection, sex, age, number, behaviour, and the habitat type in which they occurred (i.e., ecosystem unit and structural stage). Surveyors assigned birds estimated to be >100 m distant at a distance of 101 m due to the high uncertainty of estimates at those distances. Following the surveys, a bearing and distance were measured on the point count map from the

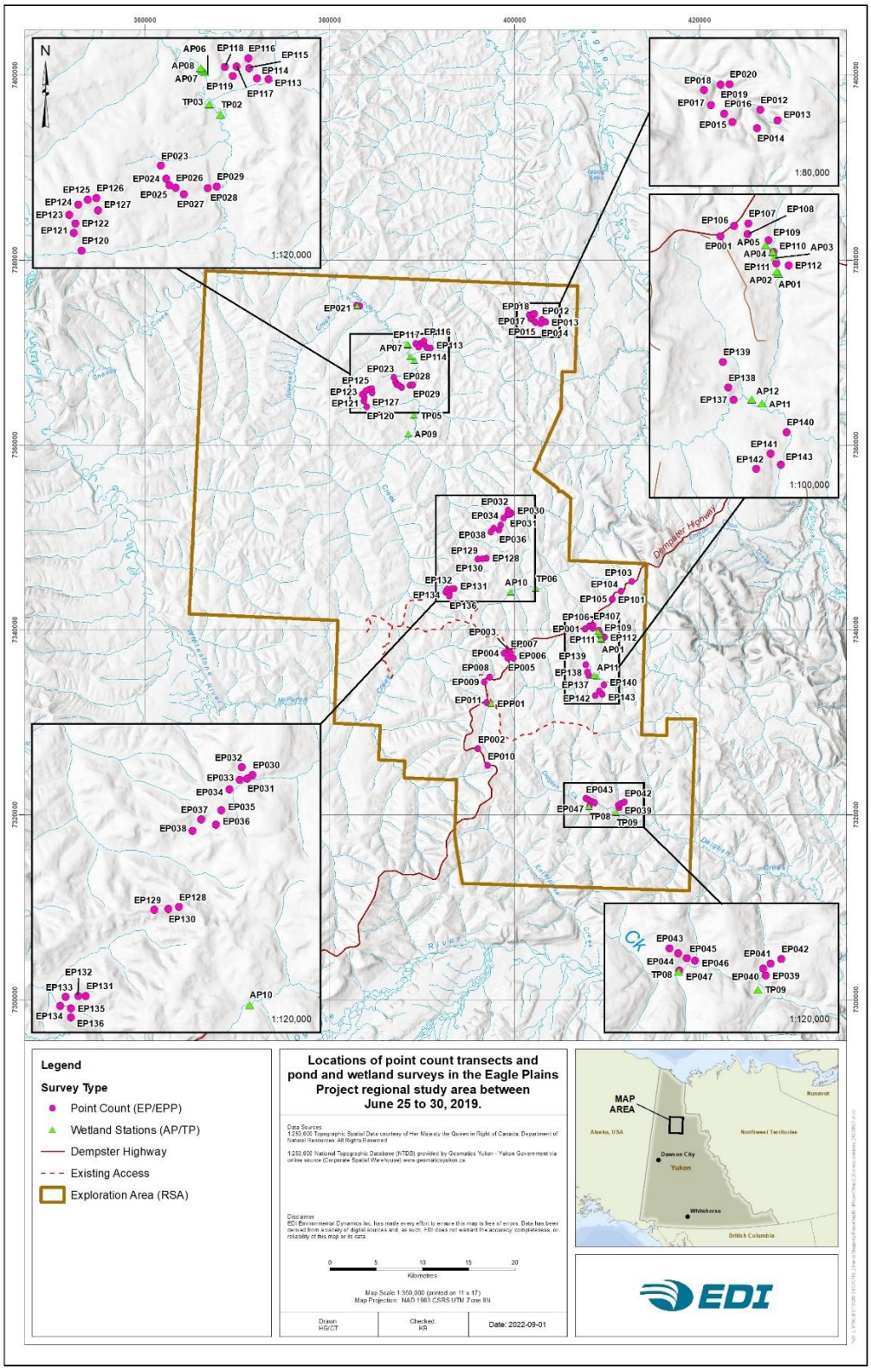
station location for each bird observation (<100 m) used to calculate coordinates for each observation. A total of 91 point count stations were surveyed over six days.

2.3.3.2 Pond and Wetland Surveys

For wetland surveys, protocols were adapted from the BC RISC Standards *Inventory Methods for Waterfowl and Allied Species* (Resources Inventory Committee 1999b). Before surveys, ponds and open water wetlands within 3 km of existing or proposed project development were identified using the PEM map. Shoreline surveys were conducted at 19 unique ponds, and observations were made from stations along the shoreline using binoculars and scopes. The number of stations varied from one to five, depending on the size and shape of the ponds. Approximately half of a pond's total perimeter was traversed along a section of shoreline parallel to the longest axis of the feature to provide complete visual coverage of the waterbody. Surveyors approached waterbodies covertly and began surveys behind screening vegetation to avoid flushing birds from the ponds before they were tallied. Ground-based surveys were thought to provide a census of birds present at each pond. However, a few birds obscured by shoreline vegetation may not have been counted. Biologists recorded the following information for each pond for all detected birds: species, sex, age, number, and habitat associations.

2.3.3.3 Cliff-nesting Raptors Habitat Assessment

Cliff-nesting raptors, including Peregrine Falcon, Gyrfalcon, and Golden Eagle, are relatively common in parts of North Yukon with suitable cliffs, such as the Ogilvie Mountains, south of Eagle Plains. Nesting occurrences of these species are not known in the Eagle Plains area. Due to the subdued topography of the Eagle Plains area, suitable nesting cliffs are likely to be uncommon or non-existent. We systematically assessed the potential for suitable nesting cliffs across the study area by mapping areas with a slope >30 degrees (the lowest gradient in which EDI Environmental Dynamics Inc. (EDI) staff have found cliff nests in other parts of the Yukon). This mapping exercise did not identify any suitable cliffs in the area. Therefore, targeted field surveys for this species group were not conducted.



Map 2-1. Locations of point count transects and pond and wetland surveys in the Eagle Plains Project Regional Study Area between June 25 to 30, 2019.

2.4 RESULTS AND DISCUSSION

2.4.1 DESKTOP ASSESSMENT

Based on range and habitat requirements, 128 species can occur in the Eagle Plains Project RSA. This includes 99 'Likely' species (52 confirmed by surveys and incidental observations presented in this report) and 29 'Possible' species. These 'Possible' species included Common Nighthawk (*Chordeiles minor*) observed once in the RSA during these surveys. Despite the confirmed occurrence, the species is still considered 'Possible' because it is outside its regular range, and none were observed during NABBS between 2014 and 2018 (i.e., the single observation during these surveys could have been an extralimital record). A summary of these potential species and conservation statuses, ordered by species groups, is provided in Table 2-4. A more detailed discussion of the species identified within the Project RSA is provided in Section 2.4.2. For an exhaustive list of all potential bird species, see Attachment Table 2 in Section 2.6.2 (Attachment 2-B).

The NABBS database is a valuable information source for the occurrence and distribution of bird species in the region because they are a recent and systematic survey. Of the two survey routes near the Project area (i.e., routes 78 and 79), route 79 was surveyed annually between 2014 and 2018, and route 78 was surveyed in each of those years except 2016. In total, observers who participated in these surveys identified 1,945 birds from 48 species (Table 2-4). Though these data are useful in identifying species common to the region, road-side surveys introduce bias in estimating species occurrences and relative abundances, especially when extrapolating to off-road areas (Sólymos et al. 2020). This may explain why 'Possible' species (e.g., Harlequin Duck [*Histrionicus histrionicus*], Surfbird [*Calidris virgata*], and Golden-crowned Sparrow [*Zonotrichia atricapilla*]) were recorded on the NABBS routes but not within the RSA, and why 18 species confirmed during surveys within the RSA (e.g., Red-necked Phalarope [*Phalaropus lobatus*], Great Gray Owl [*Strix nebulosa*], and American Three-toed Woodpecker), were not detected over five years of road-side surveys.

Overall, species occurrence and relative abundance patterns differed among years in both NABBS routes. The total number of detections decreased from 2014 to 2018, and this pattern was consistent for most bird species. This may partly correspond to the survey effort. The number of species identified and the number of birds detected were similar between route 78 (920 counts from 34 species) and route 79 (1,025 counts from 39 species) during the five-year period. No species-specific trends were evident in the data.

The NABBS data also included three species (six detections) federally designated as Special Concern: Short-eared Owl (*Asio flammeus*; one occurrence in both 2015 and 2016, and two occurrences in 2018), Rusty Blackbird (*Euphagus carolinus*; one occurrence in 2015), and Olive-sided Flycatcher (*Contopus cooperi*; one occurrence in 2018).

Table 2-4. Total number of potential (likely and possible) bird species in the Eagle Plains Project Regional Study Area, June 2019, grouped by higher-order classification. North American Breeding Bird Survey (2014–2018) confirmed species and counts are provided.

Order	Likely	Possible	Likely + Possible (Total)	NABBS Confirmed (2014–2018)[1]
Grebes – Podicipediformes	2	0	2	0
Loons – Gaviiformes	3	0	3	0
Waterfowl – Anseriformes	17	7	24	6 (24)
Shorebirds – Charadriiformes	12	9	21	3 (13)
Grouse – Galliformes	2	4	6	2 (2)
Diurnal Birds of Prey – Accipitriformes	9	0	9	4 (5)
Falcons – Falconiformes	4	0	4	1 (1)
Owls – Strigiformes	5	0	5	2 (6)
Rails – Gruiformes	1	0	1	0
Kingfishers – Coraciiformes	1	0	1	0
Nightjars – Caprimulgiformes	0	1	1	0
Woodpeckers – Piciformes	2	1	3	0
Songbirds – Passeriformes	41	7	48	30 (1,894)
Jays, Crows and Allies	2	0	2	2 (59)
Blackbirds	1	0	1	1 (1)
Thrushes and Allies	6	1	7	6 (381)
Shrikes and Vireos	1	0	1	0
Flycatchers and Allies	4	0	4	2 (2)
Swallows	3	1	4	0
Sparrows, Finches and Allies	11	3	14	10 (1,204)
Chickadees, Nuthatches and Wrens	2	1	3	0
Warblers	8	1	9	8 (245)
Others	3	0	3	1 (2)
Totals	**99**	**29**	**128**	**48 (1,945)**
SARA Schedule 1	**7**	**1**	**8**	**3**
BCR 4 Priority	**51**	**12**	**63**	**20**

[1] Count of individual bird observations for each group in brackets.

2.4.2 OCCURRENCE AND RELATIVE ABUNDANCE

A total of 974 birds from 52 species were detected during the breeding bird surveys (i.e., point count transects and wetland/pond surveys). One raptor species not included in these counts—Swainson's Hawk—was identified, incidentally, on four separate occasions between June and August 2019, totalling five individuals. These additional observations bring the number of total detections to 979 birds from 53 species.

Songbirds (*Passeriformes*) were the most diverse and abundant group of birds, while falcons (*Falconiformes*), owls (*Strigiformes*), and nightjars (*Caprimulgiformes*) were the least diverse and abundant (Table 2-5). Proportionally, more waterfowl and shorebirds were identified during wetland/pond surveys, and more songbirds and raptors were identified during point count transects. More birds were counted during point count transects (743 versus 231), but a similar number of species were identified during point counts transects and wetland/pond surveys (42 in point counts and 37 in wetlands; Table 2-5).

Table 2-5. Total counts and species of birds observed during point count transects and wetland/pond surveys in the Eagle Plains Project Regional Study Area, June 2019, grouped by higher-order classification.

Order	Point Count Transects		Wetland/Pond Surveys		Combined	
	Count	No. Species	Count	No. Species	Count	No. Species
Waterfowl – Anseriformes	3	2	99	7*	102	7
Shorebirds – Charadriiformes	18	4	38	7*	56	7
Diurnal Birds of Prey – Accipitriformes	2	2	0	0	2	2
Falcons – Falconiformes	1	1	0	0	1	1
Owls – Strigiformes	1	1	1	1*	2	1
Nightjars – Caprimulgiformes	1	1	0	0	1	1
Woodpeckers – Piciformes	3	1	0	0	3	1
Songbirds – Passeriformes	714	30	93	22*	807	32
Jays, Crows and Allies	52	2	6	1*	58	2
Blackbirds	3	1	16	1*	19	1
Thrushes and Allies	155	5	12	3*	167	5
Flycatchers and Allies	16	3	3	2*	19	3
Swallows	0	0	3	1	3	1
Sparrows, Finches and Allies	340	10	33	8*	373	10
Chickadees, Nuthatches and Wrens	9	2	0	0	9	2
Warblers	139	7	16	5*	155	7
Others	0	0	4	1	4	1
Totals	743	42	231	37*	**974**	**52**

* Number of species from wetland/pond surveys were not all unique from those in point count transects.

2.4.3 SPECIES AND HABITAT ASSOCIATIONS

Analyses of the association between bird species and habitat type controlled for survey effort (i.e., average counts per point count station). The average number of birds (i.e., relative abundance) and the average number of species varied considerably among survey stations and the different avian habitat types (Figure 2-1; Table 2-6). The average relative abundance was greatest in Open Water, Deciduous and Mixed Shrub, Riparian/Wetland Deciduous Shrub, and Spruce Forest habitats; it was lowest in Riparian Spruce Forest, Herb, and Tall Shrub – Black Spruce habitats. Among habitat types, the proportion of (average) detections to the (average) number of species was consistent, with a higher relative abundance being associated with a greater number of species. In general, this pattern was related to the structural complexity and productivity of the various habitat types. For example, Herb habitat is less structurally complex and consists exclusively of graminoid ground cover; it had the fewest species (but had a relatively high number of unique species; see Figure 2-2). In contrast, Spruce Forest habitat can be structurally complex due to variations in canopy cover, understory, and ground cover, and older stands may contain a variety of forest structures that provide habitat for a variety of bird species and life requisites including nesting (e.g., Yellow-rumped Warbler), perching (e.g., Olive-sided Flycatcher), and insect foraging (either on the ground [e.g., Gray-cheeked Thrush] or on live/dead trees [e.g., American Three-toed Woodpecker]). Consequently, Spruce Forest had the greatest species richness of all avian habitat types. The exception to the general association between relative abundance and species richness was Open Water habitat, which had the highest relative abundance but one of the lowest average number of species.

The number of species (i.e., species richness) and the number of unique species (i.e., species exclusive to a habitat type) were summarized for each avian habitat type. Unequal survey effort across habitat types could bias such comparisons of species totals across habitat types; however, it does provide a useful approach to examine general patterns of bird occurrence and assemblages within and across habitat types. Spruce Forest, Riparian/Wetland Deciduous Shrub, and Deciduous and Mixed Shrub habitat types had the greatest species richness, while Herb and Open Water habitat types had the least species richness (Figure 2-2). Patterns of species richness may, in part, be due to the distribution of survey stations in each habitat type, especially in Herb habitat (only nine stations). The Open Water habitat also had low species richness despite surveys at 17 survey stations. This may reflect the limited availability of waterbodies and wetlands in the broader region (i.e., relatively few water-associated bird species occur because the habitat is so limited and dispersed).

No clear association was found between species richness and the number of unique species. For example, Open Water was one of the least species-rich habitat types but had the most unique species. This is not surprising because Open Water is a unique habitat compared to the other terrestrial habitats, and a different complement of bird species occurs there. Other habitat types with many species (e.g., 21 species in Deciduous and Mixed Shrub) had no species unique to those habitats. Likely, riparian habitat types did not have unique species because species that occupy riparian habitat often have broad, rather than specific, requirements. For example, Rusty Blackbird and Lesser Yellowlegs were found in Riparian Coniferous Shrub, Riparian/Wetland Deciduous Shrub, and Herb habitat types.

Patterns of bird occurrences were analyzed in terms of species-specific detection rates (Table 2-6). Songbird species had the highest detection rates overall because these species consistently occupied several different habitat types. Only 15 species occupied a single habitat, and the remaining 47 species occupied multiple habitats (most frequently two or three habitats; Figure 2-3). Species that occupied four or more habitat types were exclusively songbirds and had the highest detection rates. This included species groups such as thrushes, sparrows, and their respective allies. Only 10 species occurred in six or more habitats: Canada Jay, American Robin, Gray-cheeked Thrush, Swainson's Thrush, Common Redpoll, Fox Sparrow (*Passerella iliaca*), White-crowned Sparrow (*Zonotrichia leucophrys*), American Tree Sparrow, Lincoln's Sparrow, and Yellow Warbler. Overall, species with high detection rates included a combination of habitat specialists and habitat generalists. Waterfowl and obligatory wetland species (e.g., Red-necked Phalarope), which were restricted to Open Water habitat, had high detection rates in that habitat (Table 2-6).

In contrast, thrushes (e.g., Gray-cheeked Thrush) and warblers (e.g., Yellow Warbler), which occupied several different habitat types, had high detection rates in many of the habitats they occupied (Table 2-6). The five species with the highest overall (average) detection rates (i.e., across all 110 survey stations in the RSA) were Canada Jay, Swainson's Thrush, Lincoln's Sparrow, White-crowned Sparrow and Yellow-rumped Warbler. For a general overview of bird species assemblages within each habitat type, ordered by highest to lowest detection rates, see Table 2-7. General patterns of frequency and use of habitat types by species in the RSA are consistent with expectations and correspond to patterns reported in other studies (Schieck and Song 2006, Mahon et al. 2016).

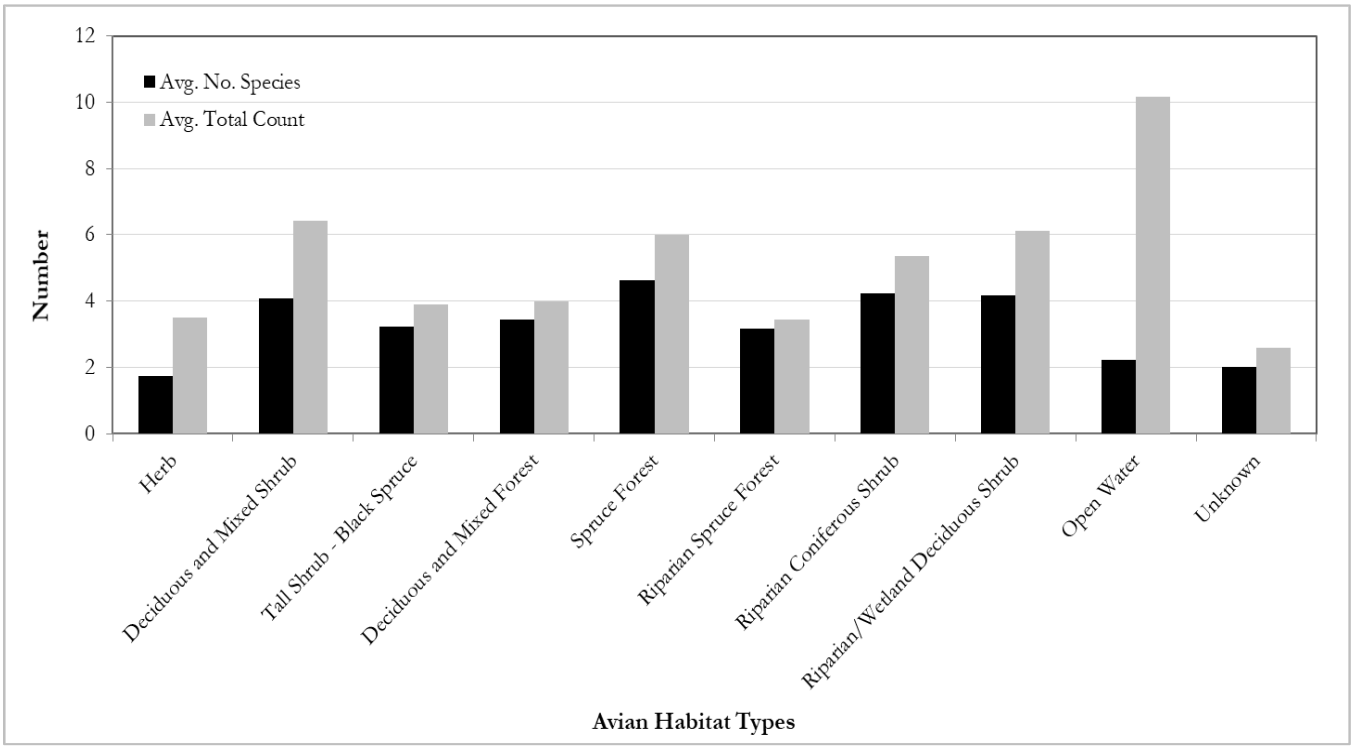


Figure 2-1. The average number of species and average total counts of birds observed among the avian habitat types in the Eagle Plains Project Regional Study Area, June 2019.

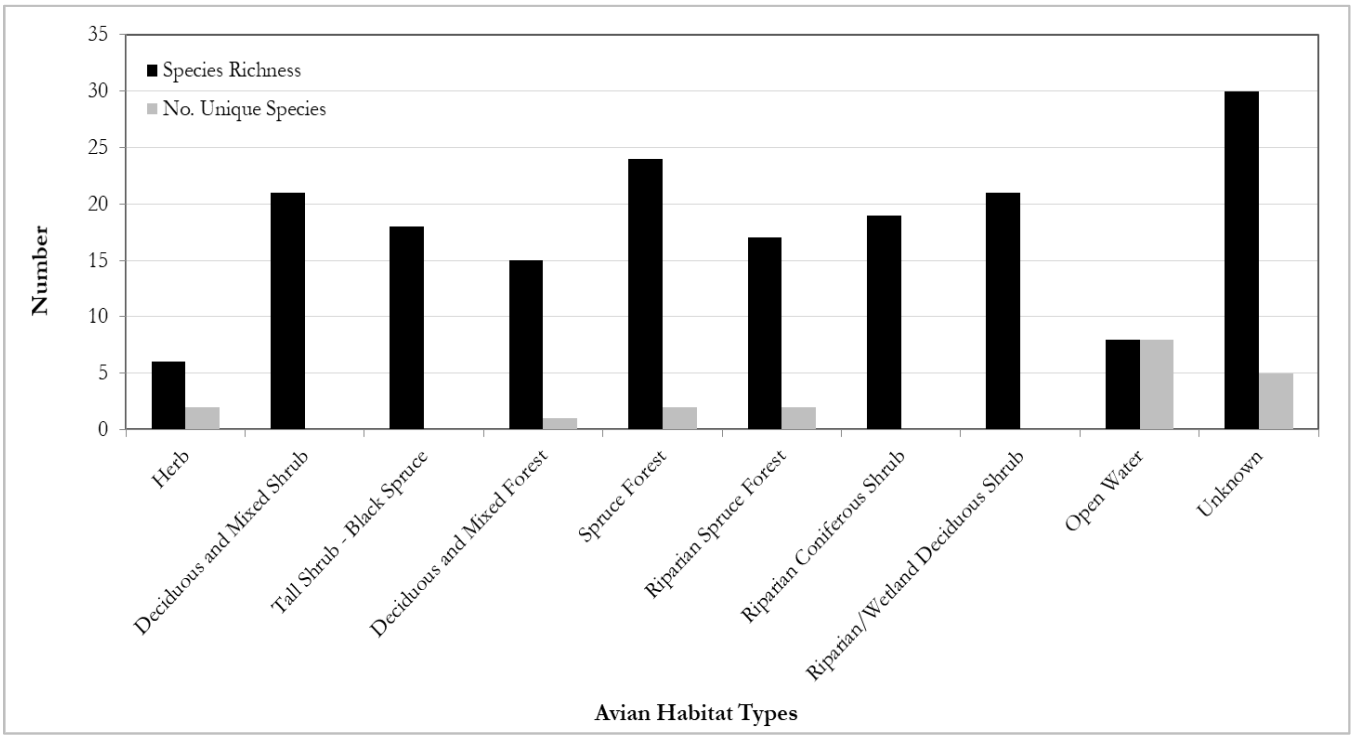


Figure 2-2. Species richness and number of unique birds observed among the avian habitat types in the Eagle Plains Project Regional Study Area, June 2019.

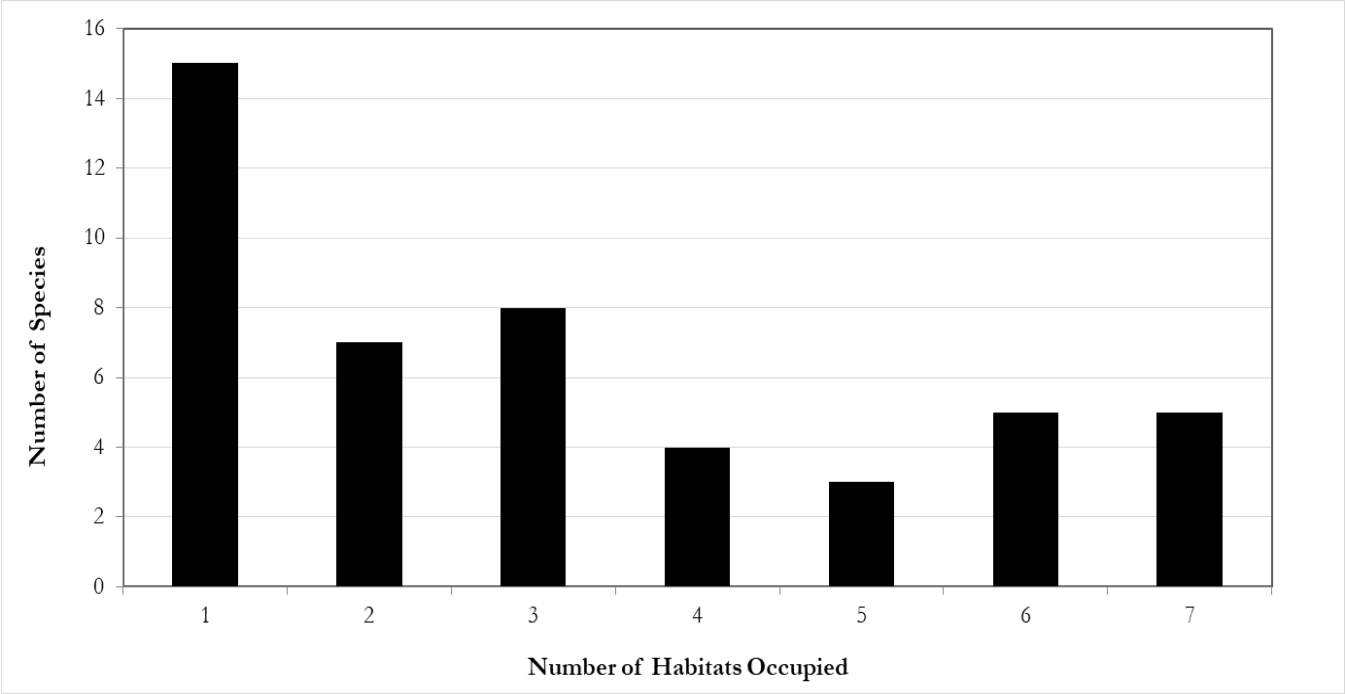


Figure 2-3. Frequency distribution of the number of habitats occupied by bird species in the Eagle Plains Project Regional Study Area, June 2019.

Table 2-6. Average detection rates (birds per survey station) for 52 bird species across 10 avian habitat types in the Eagle Plains Project Regional Study Area, June 2019.[1]

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
Waterfowl													
American Wigeon	*Mareca americana*									1.29		0.20	22
Mallard	*Anas platyrhynchos*									0.29		0.05	5
Northern Shoveler	*Spatula clypeata*									0.65		0.10	11
Northern Pintail	*Anas acuta*									0.47		0.07	8
American Green-winged Teal	*Anas crecca*									2.47		0.38	42
Lesser Scaup	*Aythya affinis*									0.41		0.06	7
Bufflehead	*Bucephala albeola*									0.41		0.06	7
Shorebirds													
Red-necked Phalarope	*Phalaropus lobatus*									0.88		0.14	15
Spotted Sandpiper	*Actitis macularius*	0.22										0.02	2
Solitary Sandpiper	*Tringa solitaria*							0.13	0.13		0.01	0.05	5
Lesser Yellowlegs	*Tringa flavipes*	1.44						0.13	0.09		0.01	0.15	17
Baird's Sandpiper	*Calidris bairdii*										0.03	0.02	2

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
Least Sandpiper	*Calidris minutilla*	0.22										0.02	2
Wilson's Snipe	*Gallinago delicata*	0.22	0.04						0.09		0.11	0.12	13
Diurnal Birds of Prey													
Northern Harrier	*Circus hudsonius*										0.01	0.01	1
Red-tailed Hawk	*Buteo jamaicensis*										0.01	0.01	1
Falcons													
Merlin	*Falco columbarius*				0.08							0.01	1
Owls													
Great Gray Owl	*Strix nebulosa*				0.08	0.07						0.02	2
Nightjars													
Common Nighthawk	*Chordeiles minor*						0.09					0.01	1
Woodpeckers													
American Three-toed Woodpecker	*Picoides dorsalis*					0.14		0.13				0.03	3
Songbirds — Jays, Crows and Allies													
Canada Jay	*Perisoreus canadensis*		0.38	0.57	0.69	0.79	0.18	0.25	0.09		0.01	0.51	56
Common Raven	*Corvus corax*										0.03	0.02	2

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
Songbirds — Blackbirds													
Rusty Blackbird	*Euphagus carolinus*	0.78						0.25	0.39		0.01	0.17	19
Songbirds — Thrushes and Allies													
American Robin	*Turdus migratorius*		0.13	0.20	0.31	0.21		0.50	0.13		0.03	0.24	26
Gray-cheeked Thrush	*Catharus minimus*		0.46	0.43		0.14	0.27	0.25	0.04		0.16	0.42	46
Swainson's Thrush	*Catharus ustulatus*		0.25	0.31	0.85	0.79	0.36	0.13	0.09		0.55	0.79	87
Hermit Thrush	*Catharus guttatus*						0.09					0.01	1
Varied Thrush	*Ixoreus naevius*				0.08	0.14					0.05	0.06	7
Songbirds — Flycatcher and Allies													
Olive-sided Flycatcher	*Contopus cooperi*		0.08			0.07	0.09	0.13			0.01	0.05	6
Yellow-bellied Flycatcher	*Empidonax flaviventris*		0.13	0.03				0.13				0.05	5
Alder Flycatcher	*Empidonax alnorum*		0.17			0.07		0.13	0.09			0.07	8
Songbirds — Swallows													
Tree Swallow	*Tachycineta bicolor*										0.04	0.03	3
Songbirds — Sparrows, Finches and Allies													
Pine Grosbeak	*Pinicola enucleator*			0.03		0.14		0.13			0.01	0.05	5

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
American Tree Sparrow	*Spizelloides arborea*		0.54	0.09	0.08	0.07	0.09	0.13	0.39		0.04	0.29	32
Chipping Sparrow	*Spizella passerina*			0.14		0.14					0.04	0.09	10
Savannah Sparrow	*Passerculus sandwichensis*	0.22	0.25					0.13	0.70		0.01	0.24	26
Fox Sparrow	*Passerella iliaca*		0.38	0.09		0.21	0.09	0.38	0.35		0.08	0.30	33
Lincoln's Sparrow	*Melospiza lincolnii*		0.92	0.17	0.08	0.36	0.18	1.50	1.09		0.03	0.68	75
White-crowned Sparrow	*Zonotrichia leucophrys*		1.08	0.29		0.14	0.09	0.63	0.52		0.24	0.67	74
Dark-eyed Junco	*Junco hyemalis*		0.08	0.37	0.15	0.07			0.09		0.08	0.24	26
White-winged Crossbill	*Loxia leucoptera*			0.23		0.36					0.43	0.41	45
Common Redpoll	*Acanthis flammea*		0.25	0.20	0.08	0.07	0.36		0.26		0.30	0.43	47
Songbirds — Chickadees, Nuthatches and Wrens													
Boreal Chickadee	*Poecile hudsonicus*		0.04	0.06		0.21	0.09					0.06	7
Red-breasted Nuthatch	*Sitta canadensis*				0.08		0.09					0.02	2
Songbirds — Warblers													
Ruby-crowned Kinglet	*Corthylio calendula*			0.11	0.23	0.29	0.18		0.04		0.07	0.17	19
Northern Waterthrush	*Parkesia noveboracensis*		0.21				0.36		0.57		0.01	0.21	23
Orange-crowned Warbler	*Leiothlypis celata*		0.25		0.31			0.13			0.03	0.12	13

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
Yellow Warbler	*Setophaga petechia*		0.17	0.03	0.38	0.14	0.55	0.25	0.57		0.03	0.32	35
Blackpoll Warbler	*Setophaga striata*					0.07						0.01	1
Yellow-rumped Warbler	*Setophaga coronata*		0.25	0.51	0.46	0.79			0.17		0.04	0.44	48
Wilson's Warbler	*Cardellina pusilla*		0.38				0.09		0.26			0.15	16
Songbirds — Others													
Bohemian Waxwing	*Bombycilla garrulus*					0.29						0.04	4
Total Habitat Detections		28	154	135	51	81	36	43	141	117	188	-	**974**

[1] Brackets in column headings indicate the number of survey stations in each avian habitat type. Birds are ordered taxonomically, first by species group then by species. Shaded cells indicate five most abundant species in each habitat (some have up to eight shaded cells due to equivalent detection rates).

Table 2-7. Bird associations for the 10 primary avian habitat types within the Eagle Plains Regional Study Area, June 2019.[1]

Herb (9)[2]	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)
Lesser Yellowlegs - 1.44	White-crowned Sparrow - 1.08	Canada Jay - 0.57	Swainson's Thrush - 0.85	Canada Jay - 0.79
Rusty Blackbird - 0.78	Lincoln's Sparrow - 0.92	Yellow-rumped Warbler - 0.51	Canada Jay - 0.69	Swainson's Thrush - 0.79
Spotted Sandpiper - 0.22	American Tree Sparrow - 0.54	Gray-cheeked Thrush - 0.43	Yellow-rumped Warbler - 0.46	Yellow-rumped Warbler - 0.79
Least Sandpiper - 0.22	Gray-cheeked Thrush - 0.46	Dark-eyed Junco - 0.37	Yellow Warbler - 0.38	Lincoln's Sparrow - 0.36
Wilson's Snipe - 0.22	Canada Jay - 0.38	Swainson's Thrush - 0.31	American Robin - 0.31	White-winged Crossbill - 0.36
Savannah Sparrow - 0.22	Fox Sparrow - 0.38	White-crowned Sparrow - 0.29	Orange-crowned Warbler - 0.31	Bohemian Waxwing - 0.29
	Wilson's Warbler - 0.38	White-winged Crossbill - 0.23	Ruby-crowned Kinglet - 0.23	Ruby-crowned Kinglet - 0.29
	Swainson's Thrush - 0.25	American Robin - 0.20	Dark-eyed Junco - 0.15	American Robin - 0.21
	Orange-crowned Warbler - 0.25	Common Redpoll - 0.20	Merlin - 0.08	Fox Sparrow - 0.21
	Yellow-rumped Warbler - 0.25	Lincoln's Sparrow - 0.17	Great Gray Owl - 0.08	Boreal Chickadee - 0.21
	Savannah Sparrow - 0.25	Chipping Sparrow - 0.14	Varied Thrush - 0.08	American Three-toed Woodpecker - 0.14
	Common Redpoll - 0.25	Ruby-crowned Kinglet - 0.11	American Tree Sparrow - 0.08	Gray-cheeked Thrush - 0.14
	Northern Waterthrush - 0.21	American Tree Sparrow - 0.09	Lincoln's Sparrow - 0.08	Varied Thrush - 0.14
	Alder Flycatcher - 0.17	Fox Sparrow - 0.09	Common Redpoll - 0.08	Pine Grosbeak - 0.14
	Yellow Warbler - 0.17	Boreal Chickadee - 0.06	Red-breasted Nuthatch - 0.08	Chipping Sparrow - 0.14
	American Robin - 0.13	Yellow-bellied Flycatcher - 0.03		White-crowned Sparrow - 0.14
	Yellow-bellied Flycatcher - 0.13	Pine Grosbeak - 0.03		Yellow Warbler - 0.14
	Olive-sided Flycatcher - 0.08	Yellow Warbler - 0.03		Great Gray Owl - 0.07
	Dark-eyed Junco - 0.08			Olive-sided Flycatcher - 0.07
	Wilson's Snipe - 0.04			Alder Flycatcher - 0.07
	Boreal Chickadee - 0.04			American Tree Sparrow - 0.07
				Dark-eyed Junco - 0.07
				Common Redpoll - 0.07
				Blackpoll Warbler - 0.07

Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)
Yellow Warbler - 0.55	Lincoln's Sparrow - 1.50	Lincoln's Sparrow - 1.09	American Green-winged Teal - 2.47
Swainson's Thrush - 0.36	White-crowned Sparrow - 0.63	Savannah Sparrow - 0.70	American Wigeon - 1.29
Common Redpoll - 0.36	American Robin - 0.50	Northern Waterthrush - 0.57	Red-necked Phalarope - 0.88
Northern Waterthrush - 0.36	Fox Sparrow - 0.38	Yellow Warbler - 0.57	Northern Shoveler - 0.65
Gray-cheeked Thrush - 0.27	Canada Jay- 0.25	White-crowned Sparrow - 0.52	Northern Pintail - 0.47
Canada Jay - 0.18	Rusty Blackbird - 0.25	Rusty Blackbird - 0.39	Lesser Scaup - 0.41
Lincoln's Sparrow - 0.18	Gray-cheeked Thrush - 0.25	American Tree Sparrow - 0.39	Bufflehead - 0.41
Ruby-crowned Kinglet - 0.18	Yellow Warbler - 0.25	Fox Sparrow - 0.35	Mallard - 0.29
Common Nighthawk - 0.09	Solitary Sandpiper - 0.13	Common Redpoll - 0.26	
Hermit Thrush - 0.09	Lesser Yellowlegs - 0.13	Wilson's Warbler - 0.26	
Olive-sided Flycatcher - 0.09	American Three-toed Woodpecker - 0.13	Yellow-rumped Warbler - 0.17	
American Tree Sparrow - 0.09	Swainson's Thrush - 0.13	Solitary Sandpiper - 0.13	
Fox Sparrow - 0.09	Olive-sided Flycatcher - 0.13	American Robin - 0.13	
White-crowned Sparrow - 0.09	Yellow-bellied Flycatcher - 0.13	Lesser Yellowlegs - 0.09	
Boreal Chickadee - 0.09	Alder Flycatcher - 0.13	Wilson's Snipe - 0.09	
Red-breasted Nuthatch - 0.09	Pine Grosbeak - 0.13	Canada Jay - 0.09	
Wilson's Warbler - 0.09	American Tree Sparrow - 0.13	Swainson's Thrush - 0.09	
	Savannah Sparrow - 0.13	Alder Flycatcher - 0.09	
	Orange-crowned Warbler - 0.13	Dark-eyed Junco - 0.09	
		Gray-cheeked Thrush - 0.04	
		Ruby-crowned Kinglet - 0.04	

[1] Birds listed in descending order of average detection rate (values after the bird names) in each avian habitat type.

[2] Values in the column headings indicate the number of samples per habitat type.

2.4.4 SPECIES OF CONSERVATION CONCERN

Four species observed in the Project RSA (Red-necked Phalarope, Common Nighthawk, Olive-sided Flycatcher, and Rusty Blackbird) were federally listed as either Special Concern or Threatened (Table 2-8). These species are either of regional, national, or continental concern, and two are designated with regional stewardship in BCR 4. The conservation statuses of all potential bird species in the Project area are listed in Attachment Table 2 in Section 2.6.2 (Attachment 2-B). Of those species, three additional species of Conservation Concern are likely to occur in the Project RSA, including Horned Grebe (*Podiceps auritus)*, Short-eared Owl, and Bank Swallow (Table 2-8). Two cliff-nesting raptors listed as 'specially protected' species under the Yukon *Wildlife Act*, Peregrine Falcon and Gyrfalcon, can occur in the broader region but are unlikely to occur in the Project RSA because of a lack of appropriate cliffs. Another 'specially protected' species, Trumpeter Swan (*Cygnus buccinator*; not listed below), is exclusive to southern Yukon and Alaska during the breeding season and, thus, is unlikely to occur in the Project RSA.

Table 2-8. The conservation status and counts of bird species in the Eagle Plains Project RSA.

Species Common Name	COSEWIC[4]	SARA[5]	BCR 4 Priority[6]	Yukon *Wildlife Act*	RSA Count	NABBS Count (2014–2018)
Horned Grebe[1]	SC (Apr 2009)	1 – SC	R – stewardship N/C – concern	No	0	0
Red-necked Phalarope	SC (Nov 2014)	1 – SC	N/C – concern	No	15	0
Peregrine Falcon[2]	NAR (Nov 2017)	–	R – stewardship N/C – concern	Yes	0	0
Gyrfalcon[2]	NAR (Apr 1987)	–	–	Yes	0	0
Short-eared Owl[1]	T (May 2021)	1 – SC	N/C – concern	No	0	4
Common Nighthawk[3]	SC (Apr 2018)	1 – T	N/C – concern	No	1	0
Olive-sided Flycatcher	SC (Apr 2018)	1 – T	R – stewardship R/N/C – concern	No	6	1
Bank Swallow[1]	T (May 2013)	1 – T	–	No	0	0
Rusty Blackbird	SC (Apr 2017)	1 – SC	R – stewardship R/N/C – concern	No	19	1
			Totals		**41**	**6**

[1] Species that are 'Likely' to occur in the Eagle Plains Project RSA.

[2] Cliff-nesting raptors that are 'Likely' to occur in the broader region, but do not have suitable habitat in the Eagle Plains Project RSA.

[3] A species that is 'Possible' in the Eagle Plains Project RSA because of its range limits. One occurrence was observed but status remains uncertain.

[4] Most recent COSEWIC assessments; E = Endangered, NAR = Not at Risk, SC = Special Concern, T = Threatened.

[5] SARA statuses from the latest amended list in May 2023 (Legislative Services Branch 2023); Schedule 1 codes equivalent to COSEWIC.

[6] Priorities, concerns, and stewardships from BCR 4 2013 report; C = Continental, N = National, R = Regional.

2.4.5 ADEQUACY OF ONE YEAR OF SURVEYS

The official guidance provided by the Canadian Wildlife Service for avian baseline studies usually is to conduct at least two years of field surveys (Hanson et al. 2009), and the DRAFT 2022 guidelines emphasize a statistical review of the power to detect changes (ECCC-CWS 2022). Repeat surveys account for annual variation in patterns of bird occurrences and distribution and imperfect detectability associated with bird survey methods. During our initial consultation with CWS we proposed conducting a single year of surveys, dependent on the outcome of the surveys. CWS indicated that they always prefer to see multiple years of data collected. However, they may not raise objections to the Project Proposal if significant avian conservation concerns or information uncertainties do not occur. In our opinion, the one year of multi-species field surveys that we conducted, in combination with the desktop assessment, provides sufficient baseline information about bird species to proceed with the Project Proposal.

2.5 SUMMARY

The purpose of this study was to document the potential occurrence, relative abundance, and habitat associations of birds across the Project's RSA. This study consisted of a combination of a desktop assessment and field surveys. The information presented in this report was collected by Professional Biologists and qualified environmental practitioners, following generally accepted scientific survey designs and methods. The field survey design used a targeted, stratified habitat design to provide a representative sample across the RSA.

Based on range and habitat, 128 species potentially occur in or adjacent to the RSA. Forty-eight (48) were recorded from the North American Breeding Bird Survey data in adjacent areas. Possible species include eight listed under the SARA or identified in the Yukon *Wildlife Act*, and 67 are considered a priority and management concern under the federal Bird Conservation Region 4 Plan. Birds listed under the SARA observed during surveys included Red-necked Phalarope, Common Nighthawk, Olive-sided Flycatcher, and Rusty Blackbird.

Field surveys observed 53 species in the RSA. Point counts identified 42 species, and wetland surveys identified 37 species. Swainson's Hawk was identified via incidental sightings and is an interesting species. It has a disjunct breeding range in North Yukon separated by several hundred kilometres from their primary range to the south. Patterns of species relative abundance and richness (number of species) varied among the different habitat types. Average relative abundance and species richness were the greatest in Spruce Forest, Deciduous and Mixed Shrub, Riparian/Wetland Deciduous Shrub habitats, and lowest in Herb and Tall Shrub – Black Spruce habitats. These patterns were generally related to the structural complexity and productivity of these different habitat types. However, the number of unique species in each habitat did not depend on structural complexity. Many unique species were found in the Herb and Open Water habitats. General patterns of bird occurrence and habitat associations in the RSA are consistent with expectations and correspond with the limited existing information about birds in the area.

2.6 BIRD SECTION ATTACHMENTS

2.6.1 ATTACHMENT 2–A — ECOLOGICAL AND LANDSCAPE CLASSIFICATION ECOSYSTEM UNITS

Ecological and Landscape Classification (ELC) Ecosystem Units (Ecosites)

Codes, names, and descriptions of ecosites assigned *a posteriori* to habitat groups in the Project RSA are listed below.

Attachment Table 1. Ecological Landscape Classification ecosystem units developed for the Eagle Plains Project Regional Study Area.

Code	Name	Description and typical situation
10	Sparsely Vegetated	Vegetative cover <10%.
11	Dry Herb	Area dominated with herbaceous vegetation with very low shrub cover (<5%).
12	Dry Lichen	*Cladonia* sp. (i.e., caribou forage species) dominated areas with very low shrub cover (<5%) typically on south facing slopes.
13	Dry Mix Shrub	Dry shrub dominated areas with very low *Cladonia* sp. (i.e., caribou forage species) cover (<10%); disclimax community.
14	Dry Shrub/ Spruce – Lichen	Dry areas with spruce cover >5% and *Cladonia* sp. (i.e., caribou forage species) cover >10%.
15	Dry Shrub/ Aspen – Lichen	Dry areas with aspen cover >5% and *Cladonia* sp. (i.e., caribou forage species) cover >10%.
16	Dry Spruce – Birch – Lichen	Dry areas with either white spruce, black spruce, and/or Alaskan paper birch cover; spruce, scrub birch, and *Cladonia* sp. (i.e., caribou forage species) cover >10%.
17	Dry Aspen	Dry areas with aspen dominant canopy and very low *Cladonia* (i.e., caribou forage species) cover (<5%).
01	Mesic Herb	Area dominated by herbaceous vegetation with very low shrub cover (<5%); neither disclimax nor successional pathway known. No distinct mottles or seepage present; some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
02	Mesic Birch – Willow	Area has a history of anthropogenic disturbance; regeneration is dominated by either Alaskan paper birch and/or willow species. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
03	Mesic White Spruce – Alaskan Paper Birch – Alder	Area dominated by Alaskan paper birch with mixed-wood understory (i.e., white spruce and alder). Usually found along upper slope to crest positions on gentle to moderate slopes. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
04	Mesic Black Spruce – Alaskan Paper Birch	Area dominated by black spruce and Alaskan paper birch with >30% shrub cover; mid-slope position. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
05	Mesic Alaskan Paper Birch	Area dominated by Alaskan paper birch stands with > 30% shrub cover; mid- to upper-slope position. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
06	Mesic Black Spruce – Labrador Tea	Area dominated by black spruce with Labrador tea shrub layer; level or mid- to upper-slope position on gentle slopes. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).

Code	Name	Description and typical situation
20	Shrubby Riparian Birch – Willow	Shrubby riparian area dominated by scrub birch, tea-leaved willow, or diamond leaved willow and bog cranberry; disclimax community.
21	Riparian White Spruce – Prickly Rose	Treed riparian zone dominated by white spruce with a mixture of shrub species; rose usually present.
22	Riparian Spruce – Birch – Willow	Treed riparian zone dominated by white and black spruce, possibly some Alaskan paper birch, and a mixture of shrub species such as scrub birch and willow.
30	Moist Herb	Area dominated with herbaceous vegetation with very low shrub cover (<5%) on gentle to moderate slopes. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths; some ice crystals can be observed in frozen layer.
31	Moist Shrub/ Scrub Birch – Labrador Tea – Willow	Area dominated by scrub birch and Labrador tea with <10% spruce cover; shrub layer has tea-leaved willow. Typically found at level or mid- to upper-slope position on gentle slopes. Successional pathway unknown but considered a shrub disclimax site. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present; some ice crystals can be observed in frozen layer.
32	Moist Shrub/ Spruce – Scrub Birch – Labrador Tea	Area dominated by >10% spruce cover, <5% willow cover, and >15% lowbush cranberry. Typically found at mid to upper slope position on gentle slopes; disclimax community. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths; some ice crystals can be observed in frozen layer.
33	Moist Spruce – Labrador Tea	Area dominated by >15% spruce tree cover. Presence of *Cladonia* sp. (i.e., caribou forage species). Typically found at level or upper-slope position on gentle slopes. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths due to frost boils; some ice crystals can be observed in frozen layer.
34	Moist Spruce – Alder – Labrador Tea	Area dominated by >15% spruce tree cover; alder and *Cladonia* sp. (i.e., caribou forage species) present. Typically found at mid-slope position on gentle slopes. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths due to frost boils; some ice crystals can be observed in frozen layer.
35	Moist Spruce – Scrub Birch – Labrador Tea	Area dominated by <15% spruce tree cover with *Cladonia* sp. (i.e., caribou forage species) present. Typically found at level or gentle slopes. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths due to frost boils; some ice crystals can be observed in frozen layer.
36	Moist Birch – Willow	Area dominated by willow and birch trees, often associated with old anthropogenic disturbances; successional pathway unknown. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths due to frost boils; some ice crystals can be observed in frozen layer.
40	Wet Herb	Area dominated with herbaceous vegetation with very low shrub cover (<5%) on level to lower-slope positions. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
41	Wet Shrub – Tamarack	Area with >5% tamarack; low presence of *Cladonia* sp. (i.e., caribou forage species) and high presence of *Sphagnum* sp. or glow moss. Scrub birch and Labrador tea present. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
42	Wet Shrub – Black Spruce – Tussock Cottongrass	Area dominated by >5% black spruce and >10% tussock cottongrass. Labrador tea, scrub birch, *Sphagnum* sp. and *Cladonia* sp. (i.e., caribou forage species) present. Typically found on level ground but also from toe to mid-slope positions; disclimax community. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.

Code	Name	Description and typical situation
43	Wet Shrub – Black Spruce – Sphagnum	Area dominated by >5% black spruce, <10% tussock cottongrass, and >25% *Sphagnum* sp.; disclimax community. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
44	Wet Shrub – Scrub Birch – Tussock Cottongrass	Area dominated by <5% black spruce, >10% scrub birch, and >30% tussock cottongrass; disclimax community. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
45	Wet Shrub – Scrub Birch – Graminoid	Burned area composed of <5% black spruce; dominant shrub is scrub birch, while dominant graminoid is either spruce muskeg sedge or bluejoint reedgrass; disclimax community. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
46	Wet Black Spruce – Labrador Tea – Cladonia	Area with >15% black spruce, >20% *Cladonia* sp. (i.e., caribou forage species), and <5% tussock cottongrass. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
47	Wet Black Spruce – Tussock Cottongrass – Sphagnum	Area with >15% Labrador tea and <10% *Cladonia* sp. (i.e., caribou forage species). Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
48	Wet Black Spruce – Carex	Area dominated by either a spruce muskeg sedge or bluejoint reedgrass herbaceous layer; shrub layer is a mixture of Labrador tea, scrub birch, and willow species with >30% cover. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
B1	Bog – Black Spruce – Lichen	Treed or shrubby peatland ecosystem unit with poor nutrient regime within the rooting zone. Stunted black spruce with <50% *Sphagnum* sp. and >10% *Cladonia* sp. (i.e., caribou forage species) ground cover.
B2	Bog – Black Spruce – Sphagnum	Treed or shrubby peatland ecosystem unit with poor nutrient regime within the rooting zone. Stunted black spruce with >50% *Sphagnum* sp. ground cover.
F	Fen	Treed, shrubby, or graminoid peatland ecosystem unit where groundwater inflow maintains relatively high mineral content within the rooting zone. Graminoid fen has >20% *Sphagnum* sp. or moss cover.
M	Marsh	Shallowly flooded mineral wetland ecosystem dominated by emergent vegetation. Area dominated by graminoids and has less than 10% Sphagnum or moss cover.
S	Swamp	Treed or shrubby mineral wetland ecosystem unit with a flowing or fluctuating, semi-permanent, near-surface water table.
W	Shallow Water	Shallow water ecological communities dominated by rooted, water submerged, and floating aquatic plants.
AN	Anthropogenic	An area of anthropogenic disturbance not included in other definitions (e.g., areas cleared for camps).
ES	Exposed Soil	Any area of exposed soil not included in other definitions. Includes areas of recent disturbance (e.g., terrain slides) and human-made disturbances where vegetation cover is <5%.
Fa	Flood Active Channel	Ecological communities scoured by river floodwaters for prolonged periods. Usually dominated by annuals or herbs that can re-sprout from underground structures.
LA	Lake	A body of water >2 m deep or large enough to be classified as a lake (>8 ha).
PD	Pond	A small body of water greater than 2 m deep, but not large enough to be classified as a lake (<8 ha).

Code	Name	Description and typical situation
Rc	Rock Cliff	Ecological communities of vertical rocky sites commonly with some bryophyte cover (rock crusts); small pockets of soils may support vascular vegetation. Also used to map non-vegetated cliffs.
RI	River	A watercourse formed when water flows between continuous, definable banks. The flow may be intermittent or perennial.
Ro	Rock Outcrop	Bluffs and knobs of solid rock with limited soil development and high cover of exposed rock; drought tolerant cryptogams often prominent.
Rt	Rock Talus	Active and inactive talus (i.e., large rocks) and scree (i.e., smaller rocks and more soil); small pockets of soils may support some vascular plants.
RZ	Road	An area cleared and compacted for the purpose of transporting goods and services by vehicle.

2.6.2 ATTACHMENT 2–B — LIST OF ALL POTENTIAL BIRD SPECIES AND THEIR CONSERVATION STATUSES

All bird species with the potential to occur in the Project area:

Names, federal conservation statuses (SARA, COSEWIC), BCR 4 priority, territorial status (i.e., species highlighted by Environment Yukon and those considered of conservation concern in the Yukon Conservation Data Centre track list), and indication of occurrence in the Project RSA for all 128 bird species, are listed below:

Attachment Table 2. List of species with the potential to occur in the Eagle Plains Project Regional Study Area.

Species Common Name[1]	Documented in RSA[2]	COSEWIC[3]	SARA[4]	Environment Yukon (YCDC Track List)[5]	BCR 4 Priority Species[6]
Horned Grebe [L]		SC (Apr 2009)	1 – SC	*	R – stewardship N/C – concern
Red-necked Grebe [L]					R – stewardship
Red-throated Loon [L]					
Pacific Loon [L]					R – stewardship N/C – concern
Common Loon [L]					C – stewardship N/C – concern
American Wigeon [L]	✓				R – stewardship R/N/C – concern
Mallard [L]	✓				R – stewardship N/C – concern
Blue-winged Teal [P]					N/C – concern
Northern Shoveler [L]	✓				R – stewardship
Northern Pintail [L]	✓				R – stewardship N/C – concern
Green-winged Teal [L]	✓				R – stewardship
Canvasback [L]					R – stewardship N/C – concern
Ring-necked Duck [P]					
Greater Scaup [L]					
Lesser Scaup [L]	✓				R – stewardship R/N/C – concern
Harlequin Duck [P]				✓	R – stewardship
Surf Scoter [L]					R – stewardship N/C – concern
White-winged Scoter [L]					R – stewardship N/C – concern
Long-tailed Duck [L]					N/C – concern
Bufflehead [L]	✓				R – stewardship
Common Goldeneye [L]					N/C – concern
Barrow's Goldeneye [L]					R – stewardship

Species Common Name[1]	Documented in RSA[2]	COSEWIC[3]	SARA[4]	Environment Yukon (YCDC Track List)[5]	BCR 4 Priority Species[6]
Red-breasted Merganser [L]					
Greater White-fronted Goose [L]					C – stewardship
Snow Goose [P]				✓	
Brant [P]				✓	
Cackling Goose [P]					
Canada Goose [L]					
Tundra Swan [P]				✓	R – stewardship
Ruffed Grouse [P]					
Spruce Grouse [L]					
Sharp-tailed Grouse [P]				✓	
Willow Ptarmigan [L]					
Rock Ptarmigan [P]					
White-tailed Ptarmigan [P]					R – stewardship
Bald Eagle [L]					
Golden Eagle [L]					R – stewardship
Osprey [L]				✓	
Northern Harrier [L]	✓				
Sharp-shinned Hawk [L]					
Northern Goshawk [L]					R – stewardship
Swainson's Hawk [L]	✓			✓	N/C – concern
Red-tailed Hawk [L]	✓				
Rough-legged Hawk [L]					
Gyrfalcon [L]					
Peregrine Falcon [L]		NAR (Nov 2017)		✓*	R – stewardship N/C – concern
American Kestrel [L]				✓	R – stewardship
Merlin [L]	✓				
Great Horned Owl [L]					
Northern Hawk Owl [L]					R – stewardship
Great Gray Owl [L]	✓				R – stewardship
Short-eared Owl [L]		T (May 2021)	1 – SC	✓*	N/C – concern
Boreal Owl [L]					R – stewardship
American Golden-Plover [P]					N/C – concern
Semipalmated Plover [L]					N/C – concern
Wandering Tattler [P]				✓	R – stewardship
Whimbrel [P]				✓	N/C – concern
Surfbird [P]				✓	R – stewardship N/C – concern
Long-billed Dowitcher [P]					
Red-necked Phalarope [L]	✓	SC (Nov 2014)	1 – SC	*	N/C – concern

Species Common Name[1]	Documented in RSA[2]	COSEWIC[3]	SARA[4]	Environment Yukon (YCDC Track List)[5]	BCR 4 Priority Species[6]
Spotted Sandpiper [L]	✓				R – stewardship
Solitary Sandpiper [L]	✓				R – stewardship N/C – concern
Lesser Yellowlegs [L]	✓				R – stewardship R/N/C – concern
Upland Sandpiper [L]					N/C – concern
Baird's Sandpiper [L]	✓				
Least Sandpiper [L]	✓				
Pectoral Sandpiper [P]					
Semipalmated Sandpiper [P]					
Wilson's Snipe [L]	✓				N/C – concern
Long-tailed Jaeger [P]					
Bonaparte's Gull [P]					R/C – stewardship N/C – concern
Short-billed Gull [L]					R – stewardship
Herring Gull [L]					N/C – concern
Arctic Tern [L]					N/C – concern
Sandhill Crane [L]				✓	
Belted Kingfisher [L]					
Common Nighthawk [P]	✓	SC (Apr 2018)	1 – T	✓*	N/C – concern
Hairy Woodpecker [P]					
American Three-toed Woodpecker [L]	✓				R – stewardship
Northern Flicker [L]					
Olive-sided Flycatcher [L]	✓	SC (Apr 2018)	1 – T	*	R – stewardship R/N/C – concern
Yellow-bellied Flycatcher [L]	✓				
Alder Flycatcher [L]	✓				C – stewardship
Say's Phoebe [L]					
Northern Shrike [L]					R – stewardship
Canada Jay [L]	✓				C – stewardship
Common Raven [L]	✓				
Horned Lark [L]					
Tree Swallow [L]	✓				
Violet-green Swallow [L]					
Bank Swallow [L]		T (May 2013)	1 – T	✓*	
Cliff Swallow [P]					
Boreal Chickadee [L]	✓				R/C – stewardship
Gray-headed Chickadee [P]				✓	R – stewardship
Red-breasted Nuthatch [L]	✓				
American Dipper [P]					

Species Common Name[1]	Documented in RSA[2]	COSEWIC[3]	SARA[4]	Environment Yukon (YCDC Track List)[5]	BCR 4 Priority Species[6]
Ruby-crowned Kinglet [L]	✓				
Northern Waterthrush [L]	✓				
Orange-crowned Warbler [L]	✓				
Yellow Warbler [L]	✓				
Blackpoll Warbler [L]	✓				R – stewardship
Palm Warbler [P]					
Yellow-rumped Warbler [L]	✓				
Townsend's Warbler [L]					R – stewardship
Wilson's Warbler [L]	✓				R – stewardship
American Robin [L]	✓				
Townsend's Solitaire [L]					
Gray-cheeked Thrush [L]	✓				
Swainson's Thrush [L]	✓				
Hermit Thrush [L]	✓				
Varied Thrush [L]	✓				R – stewardship
American Pipit [L]					
Bohemian Waxwing [L]	✓				R/C – stewardship
Lapland Longspur [L]					
Snow Bunting [P]					
Pine Grosbeak [L]	✓				R/C – stewardship
American Tree Sparrow [L]	✓				
Chipping Sparrow [L]	✓				
Savannah Sparrow [L]	✓				
Fox Sparrow [L]	✓				
Lincoln's Sparrow [L]	✓				
Harris's Sparrow [P]		SC (Apr 2017)			
White-crowned Sparrow [L]	✓				R – stewardship
Golden-crowned Sparrow [P]					R – stewardship
Dark-eyed Junco [L]	✓				
Rusty Blackbird [L]	✓	SC (Apr 2017)	1 – SC	✓*	R – stewardship R/N/C – concern
White-winged Crossbill [L]	✓				C – stewardship
Common Redpoll [L]	✓				

[1] Species identified as either 'Likely' (L) or 'Possible' (P) in the Project RSA.

[2] (✓) species observed during surveys or as incidental observations.

[3] Most recent COSEWIC assessments; E = Endangered, NAR = Not at Risk, SC = Special Concern, T = Threatened.

[4] SARA statuses from 2023; Schedule 1 codes equivalent to COSEWIC.

[5] (✓) Yukon Conservation Data Centre 2019 track list species; (*) species at risk highlighted by Environment Yukon

[6] Priorities, concerns, and stewardships from BCR 4 2013 report; C = Continental, N = National, R = Regional.

3 MARTEN

3.1 PURPOSE AND OBJECTIVES

American marten (*Martes americana*; hereafter marten) were selected as a Valued Component (VC) for the Project due to their value as a furbearer, as well as their relevance as an indicator species for mature and old forest values (Buskirk and Ruggiero 1994, Suffice et al. 2017). The VGFN have a community trapline within the RSA and value marten as a furbearer for its economic value, social values associated with trapping, and environmental values as a component of the regional wildlife community.

This section provides a summary of marten ecology in the subarctic taiga. That information is used to develop a habitat model to quantify the quality, amount, and distribution of potential marten habitat across the RSA. A Habitat Suitability Index (HSI) model was developed using relevant environmental data in a GIS to quantify the amount of marten habitat into relative quality categories (i.e., High, Moderate, Low, and Nil/Very Low).

3.2 TRAPPING

According to trapping records, marten were the most heavily trapped species in the two group trapping concessions that overlap the RSA between 2012 and 2018 (Figure 3-1,). Between 2012 and 2018, 715 marten were reported from the two concessions (i.e., 401, 402) overlapping the RSA. The number of marten reported varied widely among the trapping seasons: the greatest harvest was 240 marten reported in 2015 compared to the lowest harvest of 0 marten the following year. Unfortunately, trapping records from 2019 onwards were unavailable for those concessions.

Trapping mortality in marten is biased towards males and juveniles, and harvests that include a high proportion of adult females indicate potential overharvesting (Strickland and Douglas 1987, Hodgman et al. 1994, Fortin and Cantin 2005). Exhaustive trapping removes resident adult marten from the population and allows juveniles to establish home ranges in vacant areas, thus lowering the overall age of the population. Juveniles have lower reproductive output relative to adults; therefore, this change in age structure can lower population fecundity and growth rates (Archibald and Jessup 1984, Fortin and Cantin 2005). Without knowledge of the age and sex structure of harvested marten, it is not possible to assess the sustainability of trapping in the RSA.

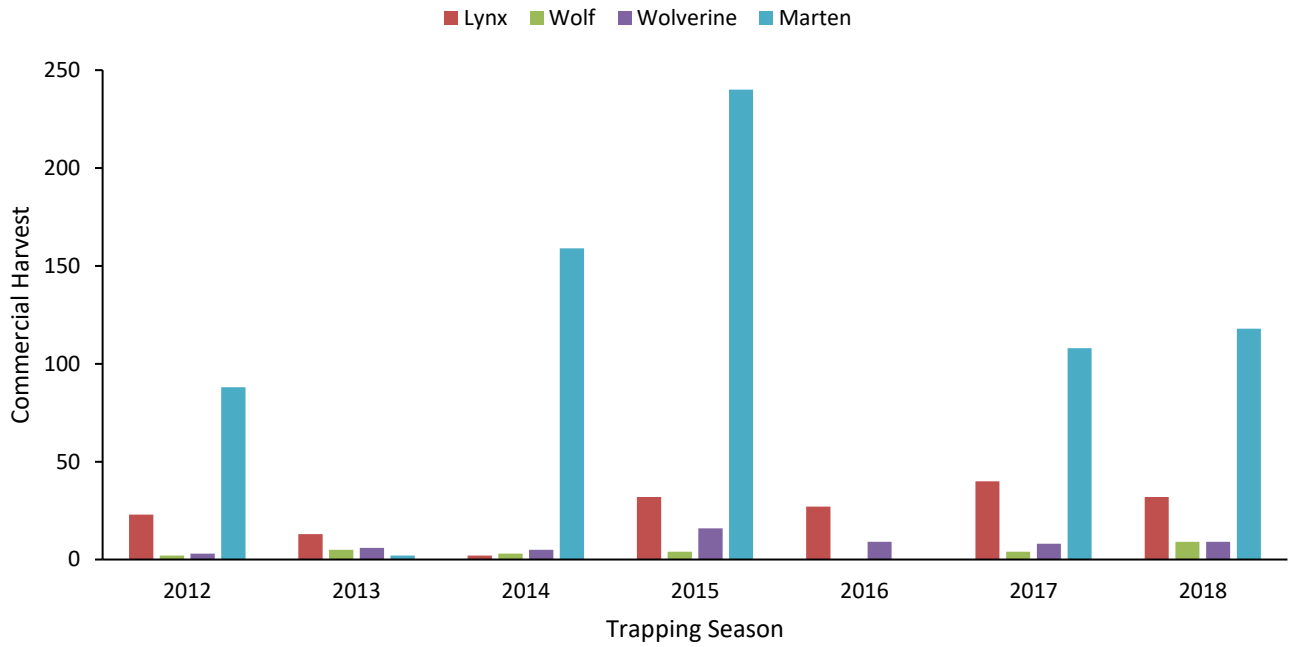
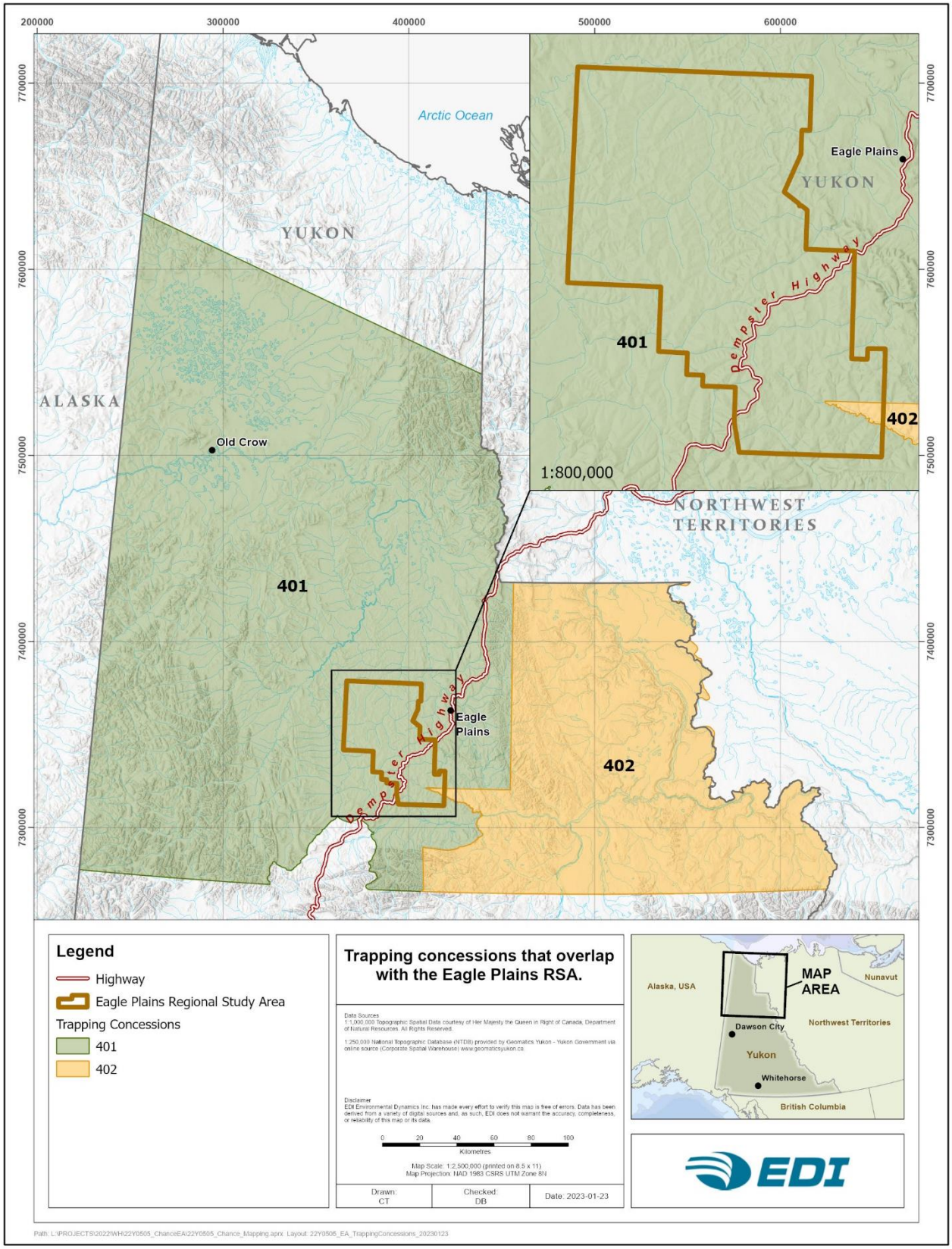


Figure 3-1. Commercial harvest returns for group trapping concessions overlapping the RSA for which records were available.



Map 3-1. Trapping concessions that overlap with the Eagle Plains RSA.

3.3 GENERAL HABITAT ECOLOGY OF MARTEN

The RSA occurs in the boreal taiga, at the northern limit of marten range (Buskirk and Ruggiero 1994, Yukon Ecoregions Working Group 2004a). While marten occur over a contiguous range across northern North America from Labrador to Alaska (Snyder and Bissonette 1987, Buskirk and Ruggiero 1994, Drew 1995, Paragi et al. 1996), little is known about their basic ecology in northern boreal forest and taiga ecosystems (Latour et al. 1994). In more productive forests to the south, marten are often associated with mature forest structures, such as large trees, snags, and coarse woody debris (CWD; Buskirk and Ruggiero 1994, Thompson et al. 2012). However, there is some evidence that in northern boreal forests, marten exploit structural stages with short, stunted trees that are sparsely distributed (Latour et al. 1994, Paragi et al. 1996). Marten in the Alaskan taiga selected habitat types with the greatest amount of CWD and the greatest abundance of vole, rather than canopy cover (Paragi et al. 1996). Across the Yukon forest-to-tundra ecotone, marten preferred open taiga areas rather than boreal forest, and were positively associated with small mammal (i.e., taiga vole [*Microtus xanthognatus*], and red-backed vole [*Myodes* spp.]) biomass (Pretzlaw 2006). Therefore, occurrence and habitat selection patterns for marten in northern boreal and taiga ecosystems can differ from those described elsewhere in North America (Pretzlaw 2006).

During 2015 and 2016, EDI performed snow tracking surveys to quantify the presence and distribution of furbearers and ungulates south of Dawson, Yukon (EDI Environmental Dynamics Inc. 2017). Snow tracking transects covered various habitat types, including 49% shrub, 13% coniferous, 10% herbs, 8% exposed land, 7% frozen rivers, and 13% other classes (i.e., broadleaf, mixedwood, rock/rubble, wetland). Marten tracks occurred in shrubland 51% of the time, coniferous forest 15% of the time, and herb sites 10% of the time. These results indicate that marten occurred across all major vegetated habitat types approximately in proportion to their availability on the landscape (EDI Environmental Dynamics Inc. 2017).

Home ranges of marten in the taiga are larger than in other regions of North America (Latour et al. 1994). In the Mackenzie Valley, NWT, mean home range sizes of adult males were 1,420 ha, and those of adult females were 680 ha. Overall, mean home range size of adult marten was 1,110 ha (Latour et al. 1994). In contrast, the average size of a marten home range in British Columbia (BC) is 525 ha for males and 316 ha for females, and in Ontario, the size of a typical marten home range is between 390 and 660 ha (Lofroth 1993, Manlick et al. 2017a). Marten density in the taiga (the carrying capacity) is likely limited by the availability of arboreal cavities for natal denning, subnivean CWD sites and underground shelters, small mammal abundance, predation, and intraguild competition (Brainerd et al. 1995). The estimated minimum density of marten was 0.0016/ha in the Mackenzie Valley, NWT (Latour et al. 1994), and 0.0025/ha in the Alaskan taiga (Paragi et al. 1996). The estimated fall density of resident adults in the northern boreal region of the Yukon was 0.006/ha (Archibald and Jessup 1984).

3.3.1 FORAGING

Marten habitat selection in the Eagle Plains Ecoregion may depend largely on prey distribution and availability (Paragi et al. 1996). Taiga vole are the prey most selected by marten in the Alaskan taiga, likely due to their larger size (mean weight = 54 g) relative to red-backed vole (mean weight = 20 g; Paragi et al. 1996). Potential

and confirmed mammalian prey in the taiga includes snowshoe hare (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*), red-backed vole, taiga vole, lemmings (*Lemmus* spp., *Dicrostonyx* spp.), and to a lesser extent, deer mice (*Peromyscus maniculatus*) (Paragi et al. 1996). Non-migratory grouse, including willow ptarmigan and spruce grouse, are available year-round and are likely prey for marten in the taiga (Paragi et al. 1996). However, marten are dietary generalists and their diet fluctuates seasonally with the breeding cycles of small mammal prey, bird migration and nesting periods, and fruiting periods of understory plants (Ben-David et al. 1997, Carlson et al. 2014, Twining et al. 2019).

In northern latitudes, marten foraging and population dynamics are influenced by fluctuations in the abundance of small mammal prey (Zielinski 2000). Multiple scat analyses in the NWT and Alaska found that small rodents, including vole and lemming, were the most important diet item for marten (Buskirk and Ruggiero 1994). Small rodents in northern regions undergo relatively large periodic fluctuations in population size (Krebs 1996). Marten populations are likely tightly coupled with these small mammal population cycles due to the relatively low diversity of mammalian prey species in the Eagle Plains Ecoregion (Yukon Ecoregions Working Group 2004a, Roth et al. 2007). Marten abundance and fecundity are correlated with temporal variability in the abundance of preferred prey, likely due to nutritionally demanding processes associated with reproduction and juvenile recruitment (Carlson et al. 2014, Flynn and Schumacher 2016).

Previous research has shown berries to be most important for marten diet during the summer and fall (July–November) when fruit availability is greatest (Baker 1992, Schaumann and Heinken 2002, Twining et al. 2019). Further, there is recent evidence that *Vaccinium* fruit are also an important winter food item for marten in coastal areas where they remain accessible year-round (Banner et al. 2014, Eriksson et al. 2019). Similarly, common juniper (*Juniperus communis*) berries are an important winter food item for marten in other regions (Hargis and McCullough 1984). Therefore, marten in the RSA likely consume fruit from several species of shrub depending on habitat and season, including blueberry and lowbush cranberry in upland woodlands, and crowberry (*Empetrum nigrum*), lingonberry, cloudberry (*Rubus chamaemorus*), and bog cranberry (*Vaccinium oxycoccos*) in lowland black spruce-shrub sites (Yukon Ecoregions Working Group 2004a).

The diet of marten in interior regions of North America is typically dominated by species of voles associated with structurally complex forests (Thompson and Colgan 1994, Poole et al. 2004, Eriksson et al. 2019). Habitat structures normally associated with old forests, including stumps, snags, and large pieces of downed wood, provide subnivean access to small mammal prey in areas with deep snow (Zielinski et al. 1983, Baker 1992, Delheimer et al. 2019). However, within the Yukon, red-backed voles are present across all vegetation types and appear to be more abundant in subalpine shrub habitats than lower elevation boreal forests (Pretzlaw 2006, EDI Environmental Dynamics Inc. 2017). Taiga vole are restricted to the taiga and avoid forest cover (Pretzlaw 2006). Taiga vole in Alaska appear to select post-fire structural stages and are found in black spruce forests, birch forests, forest-grassland edge, and grasslands (Wolff and Lidicker Jr. 1980). Provided there is sufficient understory shrub cover, habitat used for foraging is probably directly associated with increased prey availability regardless of forest age or structural stage (Keim et al. 2011, Vigeant-Langlois and Desrochers 2011).

3.3.2 COVER

Across much of their distribution, marten select home ranges with old or late-mature forests and avoid recently cut forests (Chapin et al. 1998, Bridger et al. 2017, Suffice et al. 2017). Older forests contain complex woody structures, including mature trees, stumps, snags, and large pieces of CWD that marten require to meet many life history requirements, including thermal cover and escape cover from predators (Zielinski et al. 1983, Mowat 2006a, Andruskiw et al. 2008). Shrub cover can also be an important factor influencing marten habitat quality, as marten use understory shrubs as cover from aerial predators such as Northern Goshawk (*Accipiter gentilis*; Poole et al. 2004, Zielinski et al. 2005, Slauson et al. 2007).

Important habitat features typically associated with old forests, including stumps, snags, and large pieces of downed wood, provide subnivean access to winter denning in areas with deep snow (Zielinski et al. 1983, Baker 1992, Delheimer et al. 2019). A winter den is a structure that may be used repeatedly for resting for prolonged periods (Birks et al. 2005). Natal dens are used for parturition and kit rearing during the breeding season, and may be used as resting sites in other seasons (Birks et al. 2005). A scarcity of tree cavities leads marten to use denning sites that provide suboptimal thermal cover and escape from predators (Birks et al. 2005). Marten dens may be found in tree branches, bird nests, rock crevices, underground burrows, occupied houses, nest boxes, or barns (Birks et al. 2005). Therefore, marten may use a range of below or above-ground structures for winter denning in the RSA, regardless of forest age or structural stage.

3.3.2.1 Thermal Cover

In winter, marten possess limited energy reserves and must reduce energetic costs by seeking insulated resting sites (Spencer 1987, Buskirk et al. 1989, Brainerd et al. 1995). Marten are shown to be more dependent on subnivean resting sites at more northern latitudes (Brainerd et al. 1995). Marten's choice of resting above or below snow cover depends on the ambient air temperature relative to the temperature in a microenvironment; in other words, marten are more likely to rest wherever is warmest (Buskirk et al. 1989). In Scandinavia, marten seek underground or subnivean resting sites instead of arboreal sites when the ambient air temperature is very low (Brainerd et al. 1995). Any subnivean spaces not entirely surrounded by snow are suitable; however, CWD is best in terms of thermal properties (Buskirk et al. 1989). Therefore, thermal cover generally increases with increased coniferous cover and associated CWD. Rock provides some protection from digging predators; however, rock provides poor insulation than wood, and rock dens may contain organic bedding for insulation (Buskirk et al. 1989, Birks et al. 2005).

3.3.2.2 Escape Cover

As a mesocarnivore, pressure from competition and predation can play an important role in the population dynamics of marten populations (Kiseleva 2012, Manlick et al. 2017b). Aside from marten, wolf (*Canis lupus*), red fox (*Vulpes vulpes*), lynx (*Lynx canadensis*), and wolverine (*Gulo gulo*) are the primary mammalian predators in the Eagle Plains Ecoregion. Marten likely select habitat with sufficient escape cover (e.g., medium-sized coniferous trees and CWD) to avoid risk of intraguild predation by these species (Slauson et al. 2007, Eriksson

et al. 2019). Furthermore, marten within the Eagle Plains Ecoregion compete with least weasel (*Mustela nivalis*), lynx, and red fox for shared small mammal prey (Slough and Jung 2007).

Marten in North America select home ranges that contain vertical forest or understory shrub cover where they perceive lower risk of predation from aerial predators as well as larger carnivores that, depending on the system they occupy, includes mustelid, canid, and felid species (Slauson et al., 2007; Eriksson et al., 2019). Red fox are the most generalist and widespread carnivore in the northern boreal-tundra ecotone, and may limit marten populations through intraguild predation (Lindström et al. 1995, Birks et al. 2005, Pretzlaw 2006). Therefore, fox predation may force marten to remain arboreal and den above ground (Birks et al. 2005). Aerial predators include Northern Goshawk and Great Horned Owl (*Bubo virginianus*), both of which are predators of marten in other regions and occur year-round in forests in the Yukon (Bull and Heater 2001, Doyle and Smith 2001, Sinclair et al. 2003). Golden Eagle also occur in northern Yukon during the breeding season and may be predators of marten. However, marten may perceive a lower risk of predation in open woodlands and shrublands of the Eagle Plains due to the absence of several predators of marten in more southern biomes, including bobcat (*Lynx rufus*) and coyote (*Canis latrans*; Thompson and Colgan 1994, Bull and Heater 2000, Moriarty et al. 2016).

3.3.3 REPRODUCTION

Natal dens are used for the parturition and rearing of neonates and are critical for recruitment and population viability (Buskirk and Ruggiero 1994). Across North America, most natal dens are found in structurally complex sites (Buskirk and Ruggiero 1994). Marten prefer arboreal cavities for parturition and rearing neonates due to the shelter they provide from terrestrial predators, including red fox (Spencer 1987, Brainerd et al. 1995). Marten kits are very vulnerable to fox predation when kits move out of arboreal dens (Brainerd et al. 1995). However, scarcity of arboreal cavities may force marten to use alternative structures for natal denning (Birks et al. 2005). For example, arboreal cavities are rarely used as resting sites in Finland and northern Russia (Brainerd et al. 1995). In the NWT, an adult female marten denned and produced young within a 21-year-old burn (Latour et al. 1994). Therefore, a better understanding of habitat selection by adult female marten in the taiga is needed (Paragi et al. 1996).

3.3.4 DISPERSAL

North American marten are sensitive to forest fragmentation and are found across landscapes with greater amounts of contiguous forest (Thompson et al. 2012). Previous studies show that 5 km of nonforested habitat between forest patches is an effective barrier to dispersal for marten (Buskirk and Ruggiero 1994). Timber harvesting and extensive road networks increase the density of forest edges and generally reduce habitat connectivity for species such as marten adapted to forest interiors (Robitaille and Aubry 2000, Mowat 2006b). However, marten use narrow strips of forest and abandoned roads as movement corridors between more suitable patches of mature forest (Potvin and Bertrand 2004, Breault et al. 2021).

Furthermore, there is evidence that in regions with sparse forest cover, marten may be adapted to meet certain resource requirements in nonforested habitats. For example, in Scotland, forest habitat is limited and pine

marten (*Martes martes*) consistently use matrix habitats, including scrub and tussock grassland, to meet life history requirements (Caryl et al. 2012). Intensively managed forests in Scotland lack resources such as den sites and important prey (e.g., short-tailed field vole [*Microtus agrestis*]), abundant in grasslands long thought to be impermeable to marten movement or at best suboptimal marten habitat (Caryl et al. 2012).

Cold temperatures and high seasonality result in different patterns of habitat use among marten in North America (Zielinski et al. 1983). Marten habitat selection was investigated in the Alaskan taiga in a landscape composed of mature coniferous forests of black spruce and larch (*Larix laricina*) from 5–20 cm diameter at breast height (DBH) 100–115 years post-fire, as well as dense, young forests 30 years post-fire, and tall shrub and pole sapling forests with some moss and herb structural stages 10 years post-fire (Paragi et al. 1996). Marten abundance, hunting intensity (based on snow-tracking), and CWD density were the greatest in 10-year burns relative to 30-year burns and mature forests (Paragi et al. 1996).

However, this study found that juveniles were more common in recent burns than in mature stands, and recent burns were likely used only by nonbreeding marten (Paragi et al. 1996). Non-transient marten used coniferous forest more often than transient adult and juvenile marten, which were more likely to use scrub habitat (Paragi et al. 1996). For natal denning, resources are limited in herb and shrub structural stages and prey populations are unpredictable relative to mature forests (Paragi et al. 1996). Therefore, post-fire clearings may be only suitable for dispersing juveniles and transient adult marten (Paragi et al. 1996). Herb and shrub structural stages may function as population sinks for immature and transient marten dispersing from contiguous mature forest (Paragi et al. 1996). Previous HSI models for marten in the taiga have ranked nonforested habitats, including post-fire clearing and shrubland as low-suitability habitat (EDI Environmental Dynamics Inc. 2018). However, habitat requirements of breeding marten in the taiga are not well-understood (Paragi et al. 1996).

3.3.5 DISTURBANCE

3.3.5.1 Fire

Marten are dietary generalists and are not limited to prey associated with mature/old forest structural stages (Baker 1992, Paragi et al. 1996, Poole et al. 2004). Marten in the Alaskan taiga use snags and windthrown trees as winter cover in recent burns before coniferous regeneration occurs (Paragi et al. 1996). Trappers in Alaska view fire as beneficial to furbearer populations. Rodent prey, including red-backed vole, tundra vole (*Microtus oeconomus*), meadow vole (*Microtus drummondii*), and taiga vole, are abundant in dense herbaceous vegetation growth following recent fires (Stephenson 1984). Extensive use of post-fire clearings occurred by marten 1– 3 years post-fire. High population abundance occurs within 3–10 years post-burn, with activity centred in unburned inclusions and burn edges (Stephenson 1984).

In the Alaskan taiga, marten abundance, frequency of investigations, hunting intensity, and CWD density were greatest in 10-year burns relative to older burns and mature forest (Paragi et al. 1996). Subnivean access based on tracks was greatest in 10-year burns relative to mature forests and 30-year burns (Paragi et al. 1996). Small mammal biomass and diversity were greatest in the 10-year burn. This structural stage provided a more stable

prey base due to greater diversity of rodents and more stable populations of red-backed vole (Paragi et al. 1996). Young forests 30 years post-fire had the least stable small mammal populations and lacked taiga voles, the prey most selected by marten in this study (Paragi et al. 1996). The suitability of post-fire clearings for marten may be low at first and increase 6–10 years post-fire as ground cover recovers and small mammals occupy the habitat (Paragi et al. 1996). Suitability begins to decrease 15–20 years post-fire and reaches minimum suitability 25–30 years post-fire when CWD has fully decayed and young forests establish. These forests lack near-ground structures for subnivean foraging, escape cover, denning, and resting sites (Paragi et al. 1996).

Adult marten in the NWT were more likely to have home ranges in unburned stands than burned stands (Latour et al. 1994). Unburned forests were open, 90-year-old black spruce-herb, or black spruce-bog forests with average tree height from 5–10 m, and average DBH from 4–14 cm (Latour et al. 1994). Burned stands were characterized by regeneration of open to sparse deciduous vegetation (40% bare ground), a primarily willow shrub layer, and a birch/balsam fir canopy (Latour et al. 1994). Wet areas were characterized by moss, lichen, and Labrador-tea in the understory with sparse, stunted black spruce in the tree layer (Latour et al. 1994). Long-term use by adult marten within home ranges indicated greater use of unburned forests relative to burned forests (Latour et al. 1994). In burns, most snags remained standing and deadfall lay directly on the ground; therefore, burns did not provide access to subnivean spaces, and hunting was mostly on the surface of snow with little protection from predation (Latour et al. 1994). However, an adult female marten with a home range partially within a burn, denned and produced young within the 21-year-old burn (Latour et al. 1994). Furthermore, home ranges of 1 adult and 1 juvenile tracked for 14 and 15 months were entirely within the burns (Latour et al. 1994). Using post-fire structural stages by breeding marten in the taiga is not well understood and should be explored in future studies (Paragi et al. 1996).

3.3.5.2 Roads

The Dempster Highway runs roughly southwest to northeast through the southern half of the RSA. The RSA includes numerous winter roads (15 m average width) from previous exploration activities dating back to the 1960s. Project activities will be accessed via existing and new winter roads. Generally, marten avoid open areas and areas of high human disturbance, including roads (Hargis et al. 1999, Potvin et al. 2000). Marten in North America generally avoid roads due to increased predation risk and lower availability of preferred prey; however, predation risk is assumed to be low in the RSA because primary predators of adult marten are absent or at low density in the Eagle Plains Ecoregion (Yukon Ecoregions Working Group 2004a, Moriarty et al. 2011, 2015, Joyce 2018). Therefore, marten may perceive a lower risk of predation along roads within the RSA due to the absence of several predators of marten in more southern biomes (Bull and Heater 2001, Mowat 2006a, Thompson et al. 2012). Further, abandoned roads (5 m average width) may provide easier pathways for marten movement than undisturbed forest and greater cover from aerial predators than openings (Breault et al. 2021). However, extensive road networks may fragment woodland and shrubland, reducing habitat connectivity and limiting marten dispersal (Caryl et al. 2012).

3.3.5.3 Seismic Lines

The RSA contains numerous 2D seismic lines (range = 5–8 m wide, mean = 5.4 m wide) from previous exploration activities dating back to the 1960s. Most 2D exploration occurred between 1961 and 1984, with new 2D exploration in 2001 incorporating Low Impact Seismic (LIS) techniques(Access Consulting Group and EBA Engineering Consultants Ltd. 2001, GEOTIR 2014). Approximately 2,200 km of new 3D LIS exploration (1.5–3 m wide) was conducted in a 32,500 ha area between November 2013 and April 2014 (GEOTIR 2014). This new 3D exploration is located near the RSA's centre, north and south of the Dempster Highway. The entire RSA, including legacy and contemporary seismic lines, was assessed as a linear feature study. There were signs of normal and magnified succession on 2D and 3D seismic lines. Among 2D lines, 89% had growth >1.5 m height and were considered fully recovered, and 22% of 2D lines made in the 1950s and 1960s showed magnified succession. All 3D lines were made in 2014 and showed normal succession.

In the northern boreal forest (i.e., southwest NWT, northeast BC, and northwest Alberta), marten use of seismic lines is strongly influenced by line width and state of regeneration (Tigner et al. 2015). In this study, forests were open black spruce bogs in lowlands, and upland white spruce-aspen with dense shrubs. Remote wildlife cameras were used to quantify marten use of seismic lines relative to adjacent interior forests. Marten were detected in open lines >3 m wide up to 90% less than forest interiors, but were detected in open lines <2 m wide or lines >6 m with at least partially recovery roughly equally to forest interiors (Tigner et al. 2015). Use of seismic lines is thought to be driven by the perceived risk of predation; marten avoid open habitats but use disturbed habitats following sufficient recovery of overhead and lateral cover (Tigner et al. 2015).

3.3.6 HABITAT SUMMARY

In more productive forests to the south, marten are often associated with mature forest structures, such as large trees, snags, and CWD (Buskirk and Ruggiero 1994, Thompson et al. 2012). Marten select habitats with structural complexity which provides subnivean access to small mammal prey, thermal cover, escape cover from predators, as well as natal denning sites (Spencer et al. 1983, Buskirk and Ruggiero 1994, Latour et al. 1994, Paragi et al. 1996). Within the Subarctic Bioclimate Region, characterized by stunted, open canopy spruce-dominated habitats, tree growth is often limited by the presence of permafrost resulting in disclimax vegetation communities with tall and low shrub structural stages. Therefore, patterns of habitat selection of marten in the RSA may differ from those in southern biomes (Pretzlaw 2006).

Habitat quality in the RSA should be evaluated within the context of reduced availability of old forest structures and lack of contiguous, coniferous forests in the Eagle Plains Ecoregion. Marten select habitat types with the most large pieces of downed wood and the largest standing live and dead trees available at the landscape scale (Zielinski et al. 1983, Baker 1992, Delheimer et al. 2019). Trees, snags, and CWD >30 cm in diameter are associated with older structural stages within the RSA. These structures would be considered too small to provide thermal cover and support natal denning requirements for marten elsewhere in North America (Buskirk et al. 1989, Delheimer et al. 2019). However, these structures are likely large enough to provide thermal cover and support natal denning requirements for marten in the northern context of the RSA (Spencer 1987, Brainerd et al. 1995).

3.4 METHODS

An HSI model was used to estimate habitat quality across the RSA (U.S. Fish and Wildlife Service 1980). An HSI model, also referred to as a knowledge-based habitat suitability model (Clarke 2012), is a common method for assessing habitat quality for wildlife species, and a method adapted for use in environmental impact assessments (U.S. Fish and Wildlife Service 1980). Habitat is defined as the particular place occupied by a specific population within a community and usually characterized by the dominant plant form or physical characteristics (U.S. Fish and Wildlife Service 1980). Each species requires habitat to supply space, food, cover, water, and other requirements for survival (U.S. Fish and Wildlife Service 1980). Suitability is defined as the habitat's ability, in its current structural stage, to provide the life requisites of the species (Resources Inventory Committee 1999c).

3.4.1 HABITAT SUITABILITY MODELLING

HSI modelling uses spatial datasets such as land cover, disturbance history, and topography. It ranks available habitats according to their ability to support a selected species. The habitat rankings can be based on various sources, including ecological survey data, local knowledge, expert knowledge, and traditional knowledge. HSI models can be based on suitability ratings for one habitat variable or the combination of ratings for multiple variables to quantify the quality, amount and distribution of potential habitat for the species (Dijak and Rittenhouse 2009).

3.4.1.1 Rating Scheme

Habitat ranking schemes reflect knowledge of the species' habitat use and ecology (Resources Inventory Committee 1999). A 4-class system was chosen to rank habitat suitability in this study because there is an intermediate level of knowledge of habitat quality for marten in the taiga (Resources Inventory Committee 1999, EDI Environmental Dynamics Inc. 2018). Thus, habitat was assigned a suitability ranking of High (H), Moderate (M), Low (L), or Nil/Very Low (N/VL) relative to the range of habitat quality across the RSA. Using a mathematical equation, the HSI score was produced by combining suitability ratings for several specific habitat variables (e.g., vegetation community type) into one final HSI score.

The developed habitat model produced HSI scores ranging from 0 to 1. Scores were used rather than classes to combine scores and adjustments from multiple variables into a final HSI score. Scores were categorized into four qualitative categories: High (>0.75 to 1.0), Moderate (>0.50 to 0.75), Low (>0.25 to 0.50), Nil/Very Low (>0.0 to 0.25; Resources Inventory Committee 1999). The rating categories correspond to qualitative predictions of the relative suitability of the habitat for supporting five life requisites of marten: reproduction, thermal cover, escape cover, foraging, and dispersal. High-quality habitat supports all five life requisites. Moderate-quality habitat supports escape cover, foraging, and dispersal. Low-quality habitat only supports limited foraging and dispersal. Nil/Very Low-quality habitat does not contribute significantly to any life requisites; however, herb and shrub structural stages and stunted disclimax forest areas likely function as permeable barriers and allow intra-territorial movements within marten home ranges (Caryl et al. 2012). Habitat conditions and suitability interpretations for each rating class are provided in Table 3-1.

Table 3-1. Description of habitat rating classes used in the marten HSI model.

HSI Score	Habitat Rating	Description
>0.75 to 1.0	High	Suitable (optimal). Provides conditions for natal denning (large live conifer trees, large snags, large CWD), thermal cover (medium/large-sized elevated CWD subnivean), escape cover, foraging, and dispersal.
>0.50 to 0.75	Moderate	Suitable (suboptimal). Provides conditions for escape cover (small/medium-sized live or dead conifer trees, and/or small CWD, and/or dense shrub cover), foraging, and dispersal.
>0.25 to 0.50	Low	Limited Suitability. Provides conditions for foraging (i.e., any size or species of tree that would support prey species and CWD large enough for subnivean access; grass and/or horsetails for hare, voles, birds, and/or berries for prey or marten), and dispersal (i.e., some herb or sparse deciduous/shrub cover).
>0.0 to 0.25	Nil/Very Low	Unsuitable. Non-vegetated areas, such as alpine, water, or highways, that do not provide conditions to support any life requisites for marten. Non-vegetated areas may be used for intra-territorial movements.

3.4.1.2 Habitat Variables

Habitat variables were identified as potentially important for describing marten habitat (Table 3-2). Variables were evaluated for inclusion based on the strength of relationships found in other studies, the ecological relevance to marten in the Eagle Plains Ecoregion, and the availability of the variable in GIS databases for the RSA. Based on these criteria, ELC and Linear Feature (LF) data were included in marten habitat modelling.

Distance to riparian areas was considered for inclusion in the model. Riparian areas are important foraging habitat for marten in North America (Spencer et al. 1983, Ben-David et al. 1997), and elder members of the VGFN observed good marten habitat in the area where the Blackstone and Peel rivers meet (Sherry and Vuntut Gwitchin First Nation 1999, p. 140). Riparian areas generally have greater prey availability relative to the surrounding landscape due to higher densities of prey and greater volumes of CWD, which increase access to subnivean spaces (Buskirk et al. 1989). ELC data accurately represent increased habitat quality in mature/old riparian forests found as narrow strips along most major watercourses in the RSA, including Chance Creek in the northwest and Dalglish Creek in the southeast. Therefore, a variable for distance to riparian was redundant with the ELC mapping and was not included in the model.

The history of fire disturbance has influenced marten distribution and was considered for inclusion in the model. However, the nature of the relationship between fire history and patterns of use by marten is unclear for the taiga biome. Recent burns and post-fire clearings are generally considered suboptimal habitat. They are used mainly by nonbreeding and dispersing juvenile marten (Paragi et al. 1996). In the NWT, adult martens were likelier to locate home ranges in unburned stands than burned ones (Latour et al. 1994). However, recent burns may provide foraging opportunities not present in older burns or mature forests (Paragi et al. 1996). Furthermore, fire history was explicitly accounted for in the structural stage of the ELC mapping. Therefore,

a separate variable for fire history was determined to be redundant with ELC mapping and was not included in the model.

Elevation was considered as a variable for inclusion in the model. Marten generally occur at higher elevations than similarly-sized mesocarnivores, due to adaptations for travelling over snowpack and hunting in subnivean spaces (Grinnell et al. 1937, Zielinski et al. 2005, 2017). However, elevation within the rolling topography of the RSA does not vary substantially (range = 343–752 m asl) and was likely not a significant driver of marten distribution. Therefore, elevation was not included as a variable in the model.

Table 3-2. Summary of habitat variables commonly associated with marten habitat quality from published literature relevant to the Regional Study Area.

Variable	Included in model?	Rationale
Ecosite (ELC)	Yes	Marten select conifer-dominated stands with dense shrub cover.
Structural Stage (ELC)	Yes	Marten select mature/old forests with complex structure.
Distance to Riparian	No	Most ecosites defined by permafrost rather than riparian. ELC data more accurately represent increased habitat quality in mature/old riparian forests than distance to riparian.
Linear Features	Yes	Generally, marten avoid linear features due to increased predation risk. It is included as a habitat modifier/downgrade to adjacent habitat.
Fire History	No	Different patterns of use by marten depending on study. Fire may affect habitat quality positively or negatively, dependent on ecosite and time since disturbance. Fire history was explicitly accounted for in the structural stage of the ELC mapping. Therefore, it would be redundant to include it in the model.
Elevation	No	Range in elevation within RSA (343–752 m asl) is not enough to affect marten distribution.

Ecological and Landscape Classification

ELC mapping refers to an integrated approach to mapping and classifying land units according to their ecological similarity (Environment Yukon 2016a). As part of another study in the RSA (EDI Environmental Dynamics Inc 2021), field plots were used to establish preliminary classification units and site/soil conditions across various ecological communities. The vegetation association organization and ecosite and coding system follows the Yukon ELC Mapping Guidelines (Environment Yukon 2016a). Non-forested and sparsely/non-vegetated ecosystem were assigned to group/realm following *Biogeoclimatic Ecosystem Classification of Non-forested Ecosystems in British Columbia* (BC MFLNRORD and BC MOE 2010, Mackenzie 2012), and anthropogenic units were classified following *Standards for Terrestrial Ecosystem Mapping in British Columbia* (Resources Inventory Committee 1998a). Wetland sites were classified according to the Canadian Wetland Classification System for class, form, subform, type and subtype.

The remaining ecosites were coded with a two-digit number that indicates, by its number series, a certain range of soil moisture conditions: 10s are dry sites, 00s are mesic sites, 20s are riparian sites, 30s are moist

sites, and 40s are wet sites. Ecosite names reflect plant species that are important indicators of the vegetation found within the ecosite (e.g., 33 – Moist Spruce – Labrador Tea).

Biologists delineated ELC polygons in a GIS based on discernible differences among vegetation, topography, terrain, soils, gradients, and patterns (relationship patterns between ecosystem units, polygon shape and orientation). Three or fewer ecosystem units (i.e., ecosites) were entered per polygon. Each ecosite had an associated structural stage modifier (e.g., pole sapling) and decile, representing the percent area of the polygon in each ecosite (i.e., all deciles sum to 100%).

A subsample (n = 97) of ELC field plots were used to describe habitat suitability rankings for marten within the context of the Eagle Plains Ecoregion. Field plots were identified as High (n = 10), Moderate/high (n = 21), Moderate (n = 20), Moderate/low (n = 44), and Low (n = 2). No field plots were in Nil/Very Low habitat suitability. ELC ecosites and structural stages were used to generalize habitat rankings from field plots to ELC GIS data (Table 3-3).

Every combination of ecosite and structural stage was assigned an initial HSI score of High (HSI >0.67 to 1.0), Moderate (HSI >0.33 to 0.67), Low (HSI >0 to 0.33), or Nil/Very Low (HSI = 0). Only ecosites and structural stages represented in the RSA were included in habitat modelling. All non-vegetated ecosites (AN, ES, Fa, LA, PD, RI, RZ) were ranked as Nil/Very Low (0.0). Vegetated ecosites in the non-vegetated structural stage (1) were ranked as Nil/Very Low (0.0). Ecosite 10 (sparsely vegetated) was ranked as Nil/Very Low (0.0) regardless of structural stage. All other vegetated ecosites with Sparse/cryptogram (2/2a) or Herb/graminoid-dominated (3/3b) structural stage were all ranked as Low quality (0.1). Vegetated ecosites in Low shrub (4b) structural stage were ranked as Low quality (0.33) and ranks increased with structural stage to a maximum of 1.0 (High quality) for conifer/mixedwood ecosites, and a maximum of 0.67 (Moderate quality) for deciduous/shrub ecosites, and 0.33 (Low quality) for wetland (bog, marsh, fen) ecosites.

Linear Features

Linear features (LF) were surveyed in the RSA as a companion study for the exploration project proposal (EDI Environmental Dynamics Inc., unpublished study). LFs were classified as 2D, 3D, winter roads (any trails or limited use roads with an obviously curving path), and the Dempster Highway. A subsample (n = 64) of field plots from the LF surveys were used to investigate habitat suitability for marten on-line and off-line. Determining the relative level of impact of various types of LFs established empirical evidence for modelling.

No linear features contained high suitability habitat; the average difference between off-line and on-line habitat suitability rankings across all types of LFs was 0.81 (SD = 0.79, range = 0–3, n = 64). All 2D lines (average width = 5.4 m, n = 27) were moderate-low habitat suitability on-line, and when compared to off-line habitat, the average difference in suitability ranking was 0.85 (off – on), (SD = 0.82, range = 0–2). 3D lines (width range = 1.75–5 m, n = 27) were mostly moderate-low habitat suitability (n = 24), and the average difference between off-line and on-line suitability was 0.63 (SD = 0.69, range = 0–2). The average difference among winter roads (average width = 5 m, n = 8) was 0.88 (SD = 0.64, range = 0–2). Along the Dempster Highway (average width = 15 m, n = 2), the average difference was 2.5 (SD = 0.71, range = 2–3). The average difference in HSI between off-line and on-line field plots was scaled to a score from 0–1 for downgrading:

- Dempster Hwy (30.0 m wide) = (2.5*0.25) = 0.625
- Winter Roads and 2D lines (10.0 m wide) = (0.87*0.25) = 0.218
- 3D lines (10.0 m wide) = (0.63*0.25) = 0.158

2D and 3D lines were mapped using a 10 m width due to limitations of the spatial scale of modelling (10 m raster). The 2D lines are wider than 3D lines and thus have a greater local effect on marten habitat suitability. The difference in effect between 2D and 3D lines on marten habitat was accounted for by applying a greater value for downgrading 2D lines (–0.218) compared to 3D lines (–0.158).

Table 3-3. HSI ratings for marten habitat quality in the Eagle Plains RSA based on an assessment of ELC field plots.

Ecosite Name	Ecosite Code	Structural Stage											
		Non-vegetated	Sparse / cryptogram	Sparse (5–10% cover)	Herb	Graminoid dominated	Low shrub	Shrub	Tall shrub	Pole sapling	Young Forest	Mature Forest	Old Forest
		1	2	2a	3	3b	4b	4	4a	5	6	7	8
Mesic Birch - Willow	2	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Mesic White Spruce – Alaska Paper Birch - Alder	3	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Mesic Black Spruce – Alaska Paper Birch (mixedwood)	4	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Mesic Alaska Paper Birch (Deciduous)	5	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Mesic Black Spruce – Labrador Tea (Conifer)	6	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Sparsely Vegetated	10	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dry Spruce-Lichen (Conifer)	14	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Dry Aspen-Lichen (Deciduous)	15	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Dry Spruce-Birch-Lichen (mixedwood)	16	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Dry Aspen (Deciduous)	17	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Shrubby Riparian Birch – Willow	20	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Riparian White Spruce – Prickly Rose	21	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Riparian Spruce – Birch - Willow	22	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Drainage Shrubby Riparian	23	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60

Ecosite Name	Ecosite Code	Structural Stage											
		Non-vegetated	Sparse / cryptogram	Sparse (5–10% cover)	Herb	Graminoid dominated	Low shrub	Shrub	Tall shrub	Pole sapling	Young Forest	Mature Forest	Old Forest
		1	2	2a	3	3b	4b	4	4a	5	6	7	8
Moist Shrub \ Scrub Birch – Labrador Tea – Willow	31	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Moist Spruce – Labrador Tea	33	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Moist Spruce – Alder – Labrador Tea	34	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Moist Spruce – Scrub birch – Labrador Tea	35	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Moist Birch – Willow	36	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Tamarack	41	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Black Spruce – Tussock Cottongrass	42	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Black Spruce - Sphagnum	43	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Scrub Birch – Tussock Cottongrass	44	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Scrub Birch - Graminoid	45	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Black Spruce – Labrador Tea – Cladonia	46	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Wet Black Spruce – Tussock Cottongrass - Sphagnum	47	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Wet Black Spruce – Carex	48	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Anthropogenic	AN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bog – Black spruce – Lichen	B1	0.00	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25	0.25

Ecosite Name	Ecosite Code	Structural Stage											
		Non-vegetated	Sparse / cryptogram	Sparse (5–10% cover)	Herb	Graminoid dominated	Low shrub	Shrub	Tall shrub	Pole sapling	Young Forest	Mature Forest	Old Forest
		1	2	2a	3	3b	4b	4	4a	5	6	7	8
Bog – Black Spruce – Sphagnum	B2	0.00	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Exposed Soil	ES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fen	F	0.00	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Flood Active Channel	Fa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake	LA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marsh	M	0.00	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Pond	PD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
River	RI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Road	RZ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.4.1.3 Model Structure

Each ELC polygon contains up to three ecosites with deciles indicating percent cover relative to the total area of the polygon. A weighted average HSI score was calculated for each polygon using the following equation:

$$ELC_r = \frac{\sum_{i=1}^{n} d_i h_i}{\sum_{i=1}^{n} d_i}$$

where ELC_r is the initial weighted average, d_i is the decile value, and h_i is the HSI score for each ecosite. HSI polygons were converted to a 10x10 m resolution raster, and linear feature adjustments were applied to the initial HSI scores for each cell:

$$HSI = ELC_r - LF_r$$

where LF_r is the LF adjustment.

3.5 RESULTS AND DISCUSSION

The model indicated a patchwork of High, Moderate, and Low-quality marten habitat, across the RSA (Table 3-4; Map 3-1). High-quality marten habitat is associated with mesic, spruce-dominant ecosites in mature to late structural stages. It includes some of the most common ecosystem units in the RSA, including Moist Spruce – Labrador Tea (33), Moist Spruce – Alder – Labrador Tea (34), and Mesic Black Spruce – Alaska Paper Birch (04; Figure 3-1). Concentrations of High-quality habitat include Enterprise and Dalglish Creeks watersheds in the south, a band running east-west north of the Dempster Highway, and the western part of the northern half of the RSA. Moderate-quality habitat is associated with wetter or younger ecosystem units than High-quality habitat and is widespread across the RSA. High and Moderate-quality habitat is also concentrated in narrow strips of mature/old riparian forests along some of the major watercourses in the RSA, including Chance and Greaves Creeks in the northwest and McParlon Creek west of the Dempster Highway.

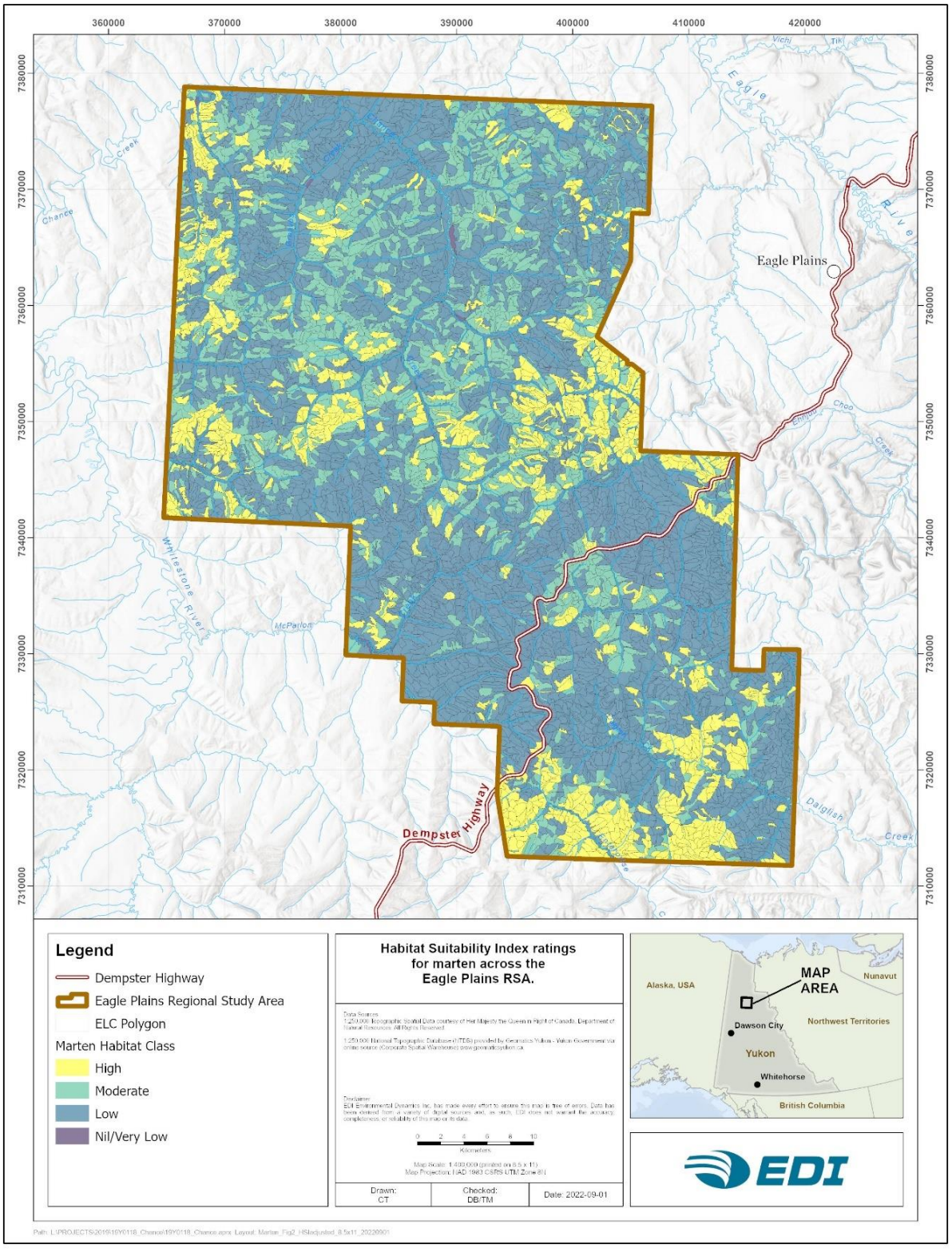
There is extensive Low-quality habitat, represented by vegetation communities in tall and low shrub structural stages found throughout the RSA (Figure 3-1). These habitats generally lack mature forest structures, such as large trees, snags, and CWD, which marten require for subnivean foraging, escape/thermal cover, and denning (Buskirk and Ruggiero 1994, Thompson et al. 2012). Low-quality habitat was associated with shrubby wetlands and stunted black spruce sites in low valley bottoms in the Chance watershed in the northwestern portion of the RSA and regenerating fire-disturbed areas on both sides of the Dempster Highway in the southern part. Completely non-vegetated areas are rare in the RSA; thus, there is almost no Nil/Very Low-quality habitat (Table 3-4; Map 3-1).

Linear features had a relatively minor effect on the overall quality, amount, and distribution of potential habitat for marten. The effect of linear features on habitat suitability for marten is mainly limited to site-level effects (Map 3-2). This effect was due to the narrow width of linear features (Moriarty et al. 2016, 2017) and their small extent relative to the overall RSA. Though existing linear features reduce habitat quality at the site level,

their effects are negligible to habitat supply at the home range scale for marten (Table 3-4). The Dempster Highway was likely the only linear feature in the RSA that could limit the movement of marten. Marten avoid crossing open areas due to increased predation risk relative to areas that provide escape cover (Slauson et al. 2017). However, the highway likely functions as a barrier, not an obstacle or constraint to their movement (Beyer et al. 2016). Therefore, it is likely that marten can and will cross the highway, so the potential barrier limits to their movement likely do not affect habitat availability at the home range scale.

Table 3-4. Relative availability of marten habitat in the Eagle Plains RSA.

Habitat Rating	HSI Scores	Area (ha)	Area (%)
High	>0.75 to 1.0	38,049.63	15.94
Moderate	>0.50 to 0.75	55,202.05	23.12
Low	>0.25 to 0.50	142,484.78	59.68
Nil/Very Low	>0.0 to 0.25	3,015.79	1.26
Total		238,752.25	100



Map 3-2. Habitat Suitability Index model ratings for marten across the Eagle Plains RSA.

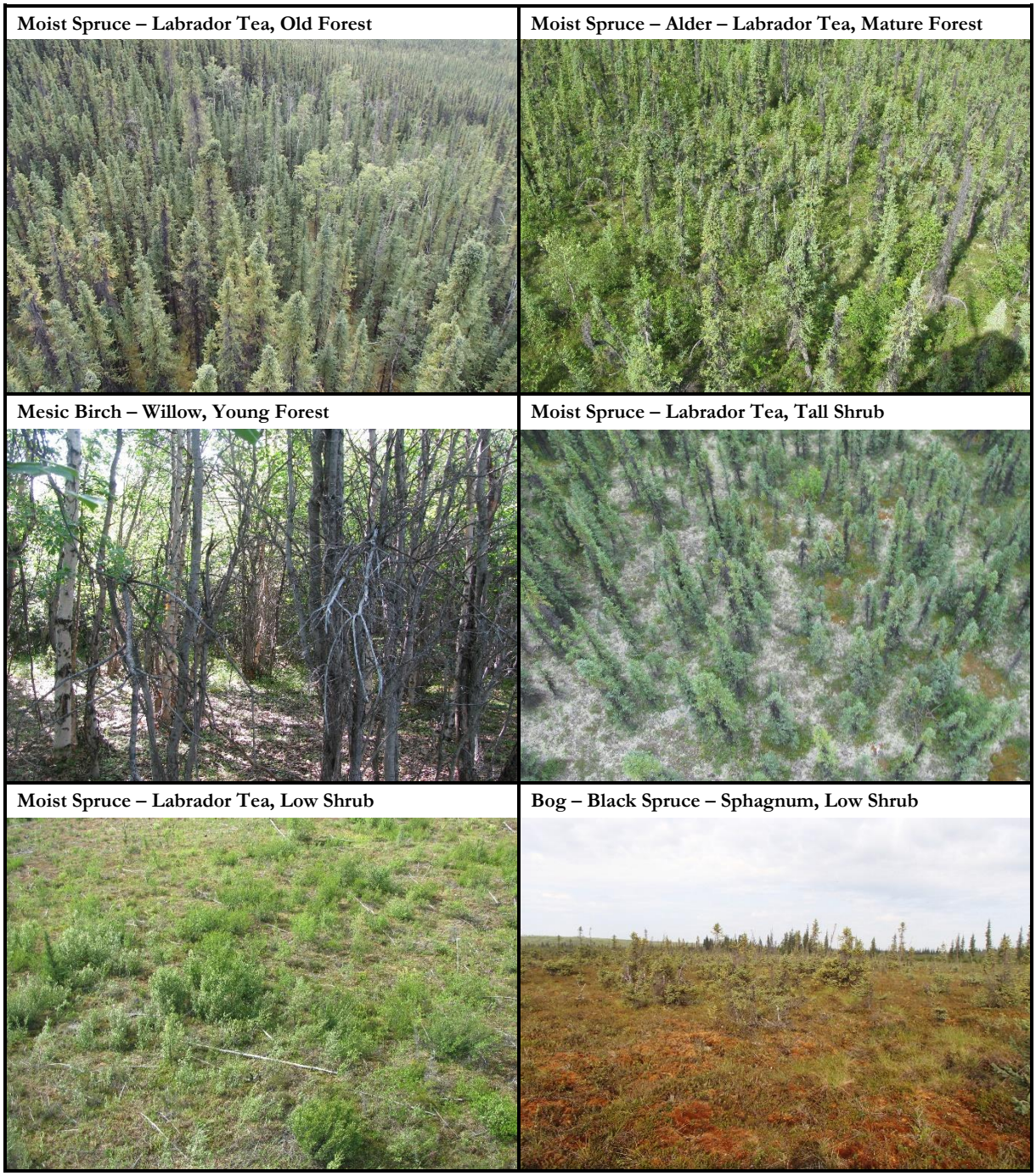
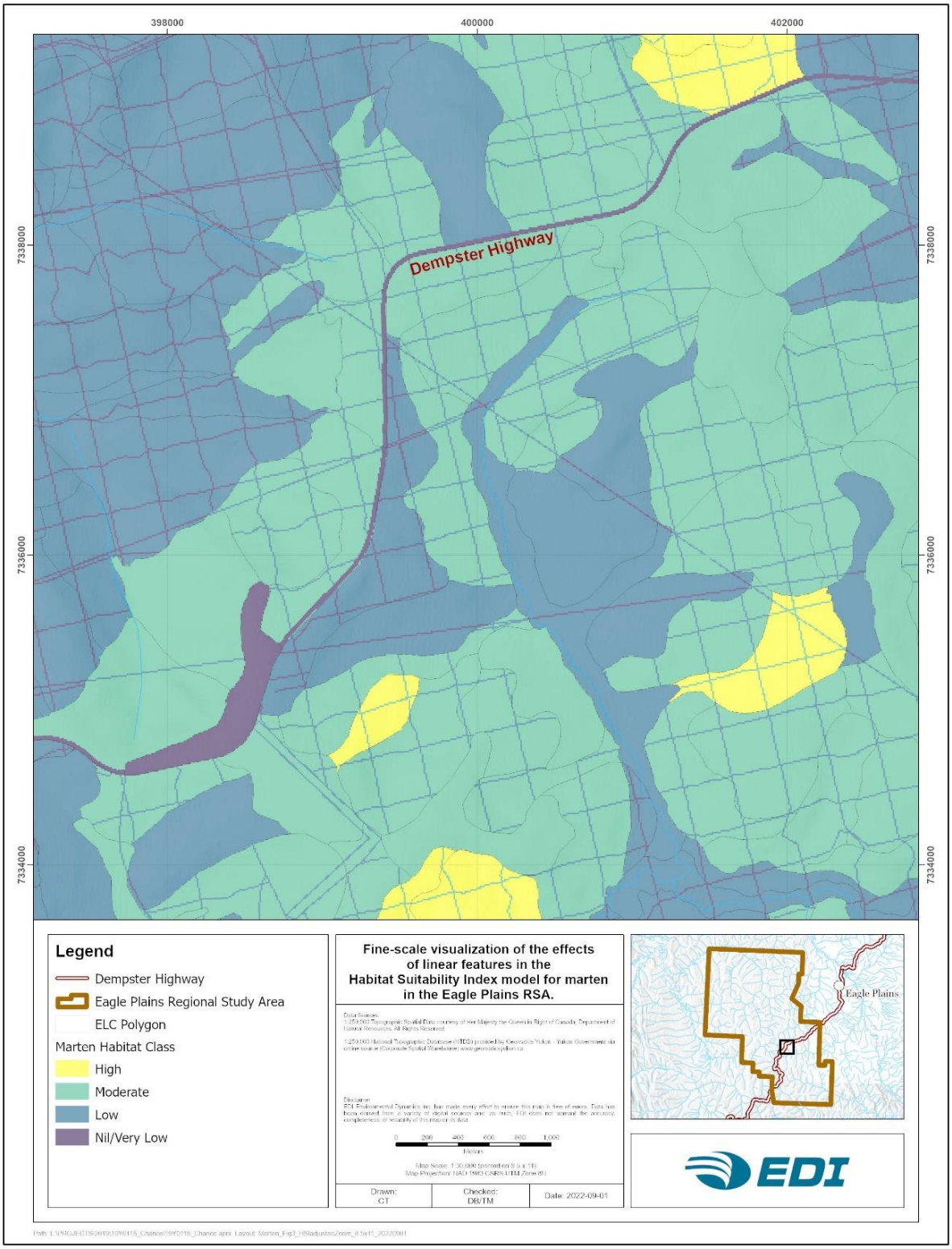


Figure 3-2. Examples of High (top row), Moderate (middle row), and Low (bottom row) quality marten habitat in the Eagle Plains RSA.



Map 3-3. Fine-scale visualization of the effects of linear features in the Habitat Suitability Index model for marten in the Eagle Plains RSA.

3.5.1 MODEL VERIFICATION AND CONFIDENCE

The frequency of use of habitat by marten in the RSA is expected to correlate to the ordinal habitat classes used in the model. However, independent marten occurrence data were not available to test that expectation. The overall confidence in the model is moderate based on moderate knowledge of marten in northern ecosystems and the lack of local field verification.

3.6 SUMMARY

The quality, amount, and distribution of potential habitat for marten were quantified across the RSA using a Habitat Suitability Index model. Ecosite and vegetation structural stages were used to assign areas an initial HSI score, which was then modified based on the presumed adverse effects of linear features on marten habitat. The HSI model indicates a patchwork of High (16%), Moderate (23%), and Low (60%) quality marten habitat across the RSA. High-quality marten habitat occurred in relatively large areas of contiguous mature/old spruce forests and narrow strips of mature/old riparian forests along major watercourses. The RSA contains extensive Low-quality habitat, associated with vegetation communities in tall and low shrub structural stages, including regenerating burns and open, stunted black spruce forest. Non-vegetated areas that constitute Nil/Very Low habitat are a minor component of the RSA. Linear features reduce habitat quality at the site level, but their effects on habitat supply at the scale of a marten's home range are limited.

4 GRIZZLY BEAR

4.1 PURPOSE AND OBJECTIVES

Grizzly bears (*Ursus arctos horribilis*) were selected as a VC for the Project due to their conservation status and social, cultural, and economic value. Grizzly bear have been assessed as a species of Special Concern in Canada, indicating their populations are at risk of becoming threatened if not adequately managed (COSEWIC 2007). Grizzly bears have cultural significance for Indigenous people of Yukon, some of which have traditional uses for their fur, fat, and meat (Benson 2014, Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a). In addition, grizzly bears are managed as a Big Game species in Yukon (Government of Yukon 2002) and harvested by Yukon residents and non-residents (i.e., outfitting operations) throughout much of the territory. Grizzly bear are considered an iconic Yukon species and the opportunity to view grizzly bears attracts tourists from around the world (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a).

This section summarizes the current state of knowledge about grizzly bear ecology in the Project and broader areas, including population trends, distribution, habitat selection, diet, and sources of mortality. This report emphasizes grizzly bear ecology specific to the Taiga Cordillera Ecozone where the Project is located. The behavioural ecology and population characteristics of grizzly bears in the taiga are likely distinct from bears inhabiting coastal, boreal, and arctic barren-ground ecosystems, given substantial variation in habitat and food availability across these regions (Mowat and Heard 2006, Mowat et al. 2013). This report draws from multiple sources, including published and unpublished literature, personal communications with biologists, and traditional knowledge where available. Few studies on grizzly bears have been conducted in the region and the broader Taiga Cordillera. Thus, literature from surrounding regions was consulted when local information was unavailable.

4.2 POPULATION STATUS AND DISTRIBUTION

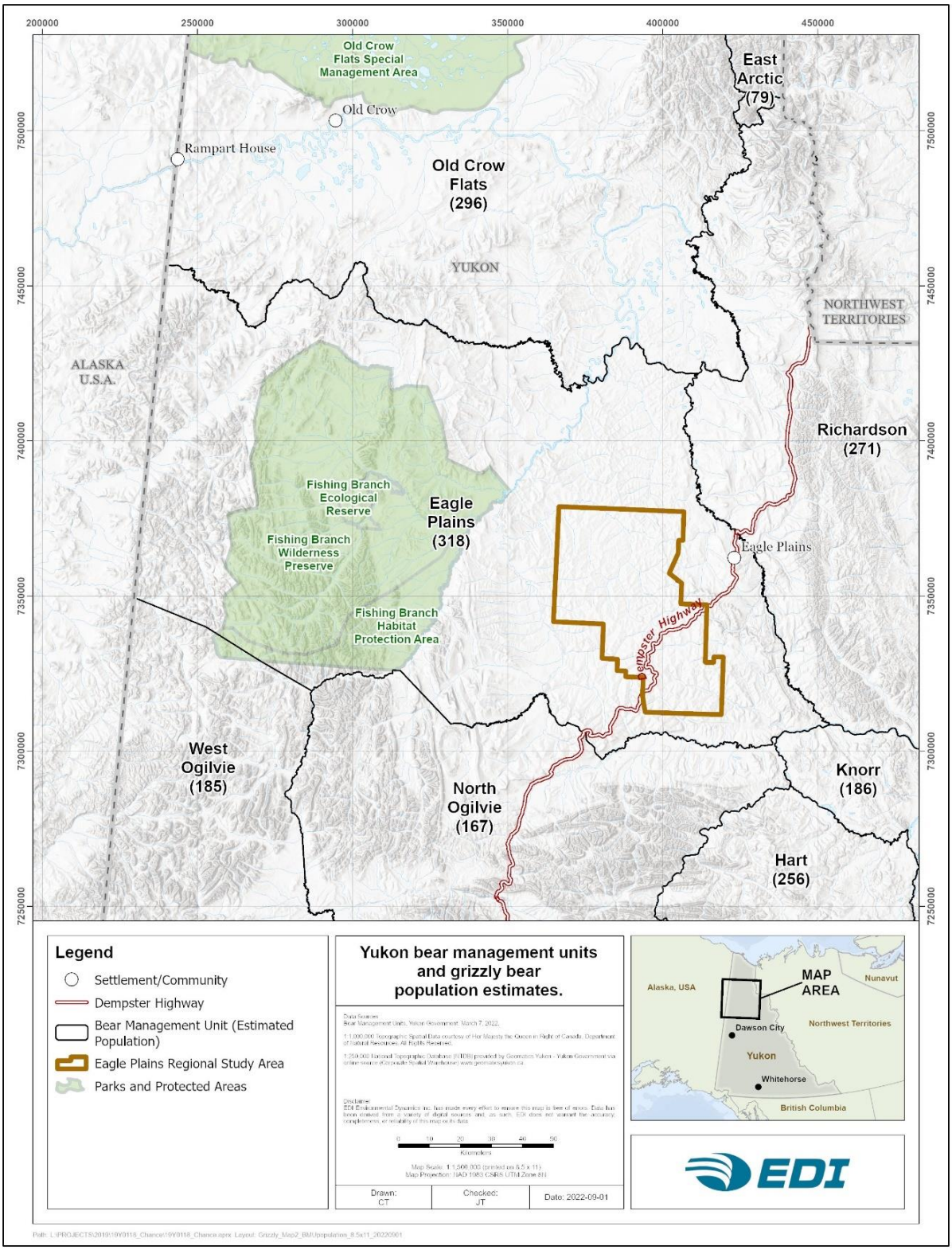
4.2.1 POPULATION

Yukon's grizzly bear population is estimated at 6,000 to 7,000 individuals, comprising approximately 25% of Canada's total grizzly bear population (COSEWIC 2007). The Yukon population estimate was derived from expert-opinion-based estimates of grizzly bear densities in each Yukon Ecoregion, using habitat information and local knowledge collected in the 1980s (Smith and Osmond-Jones 1990, Yukon Grizzly Bear Conservation and Management Plan Working Group 2019b). The exceptions are the Southern Lakes Region and Yukon North Slope, where more recent estimates are available from population assessments using genetic mark-recapture methods (Yukon Fish and Wildlife Branch 2016, 2017). The RSA is located within the Eagle Plains Ecoregion, which has a grizzly bear population estimate of 184 individuals (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019b).

Yukon's grizzly bear populations are managed within bear management units (BMU), generally delineated by outfitting concession boundaries. The Inuvialuit Settlement Region is an exception, where grizzly bears are managed under a separate co-management agreement (WMAC [NS] and WMAC [NWT] 1998). Population estimates for each BMU were derived from the original expert-based Ecoregion estimates (except the Southern Lakes Region and North Slope). Population estimates for BMUs range from 43 to 503 bears; with variation attributed to differences in habitat quality and the sizes of BMUs.

The Eagle Plains BMU, which encompasses the RSA, has a population estimate of 318 bears (Map 4-1). However, the population estimate for the Eagle Plains BMU includes Ni'iinli Njik (Fishing Branch) Territorial Park, which likely has much higher grizzly bear densities than the RSA due to abundant salmon and winter denning habitat (Vuntut Gwitchin Government and Environment Yukon 2010). Grizzly bear densities are considered low throughout the RSA, although limited information is available (Pongracz and Suitor, pers. comm., 2022). Population densities for the adjacent Richardson Mountains are estimated at approximately 23 bears per 1,000 km^2 (Clarkson et al. 1993), but grizzly bears are more abundant in the mountains than the taiga plains that characterize the RSA (Benson 2014).

Grizzly bear population trends in Yukon are primarily tracked through harvest monitoring. The Yukon population is stable (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a). There is minimal data on population trends within the Eagle Plains BMU, given low grizzly bear harvest rates (refer to Section 3.1), but traditional knowledge provides some insight. Gwich'in knowledge holders suggest that grizzly bears in the Gwitch'in Settlement Area have a generally stable population (Benson 2014). However, elders noted that grizzly bears have declined in some areas from 1940 to the early 2000s due to increased hunting pressure, the opening of the Dempster Highway, increased use of snow machines, and a general northward range shift towards the Inuvialuit Settlement Region.



Map 4-1. Yukon bear management units and grizzly bear population estimates.

4.2.2 DISTRIBUTION

Grizzly bears occur throughout the Yukon, ranging from the BC/Yukon border to the Arctic coast. They are generalist omnivores that may live in various habitat types (Mowat et al. 2013), and they occur in all Ecoregions within Yukon.

In northern Yukon, seasonal grizzly bear distribution generally tracks the availability of key food resources such as berries, fish, ungulate calves, and ground squirrels (MacHutchon and Wellwood 2003). Very little information exists about grizzly bear distribution within the RSA. The Whitestone River adjacent to the RSA (Map 1-1) is an area of higher grizzly bear concentration in the region (Pongracz and Suitor, pers. comm., 2022). During the fall, grizzly bears congregate in Ni'iinli Njik (Fishing Branch) Territorial Park, approximately 20 km west of the RSA, to feed on spawning salmon in the Fishing Branch River (Vuntut Gwitchin Government and Environment Yukon 2010).

In and adjacent to the Gwitch'in Settlement Region, grizzly bears are more common in the Richardson Mountains, the Ogilvie Mountains, and the barren arctic coast than in the flat, low-elevation taiga that overlaps the RSA (Benson 2014). These distributional patterns are attributed to a lack of ground squirrels and other key food sources in the moist, hummocky spruce forest that characterizes much of the RSA.

4.2.3 CONSERVATION STATUS AND THREATS

COSEWIC has assessed grizzly bears as a species of Special Concern (COSEWIC 2007). The Western Canadian grizzly bear population is listed under Schedule 1 of the SARA, which requires measures to prevent grizzly bears from becoming Threatened or Endangered. Within Yukon, grizzly bears are not currently considered a species of conservation concern (Yukon Conservation Data Centre 2019), although a conservation plan was developed for grizzly bears in 2019 to promote healthy and viable grizzly bear populations into the future (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a).

The greatest threats to the Canadian grizzly bear population are considered to be 1) human-caused mortality, including illegal and legal hunting, conflict kills, and railway or road mortalities, and 2) habitat loss and fragmentation (COSEWIC 2007). Members of the VGFN had observed in the late 1990s that Grizzly bears did not come near to the Dempster highway but were concerned with the old garbage dump areas along the highway possibly attracting bears (Sherry and Vuntut Gwitchin First Nation 1999, p. 286, 289). Key threats to grizzly bear populations in the Yukon are human-wildlife conflict and harvest mortality, although habitat loss and climate-related changes to food availability may also be significant (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a). Northern grizzly bear populations cannot sustain high mortality rates due to their low reproductive rates and low densities (Nagy et al. 1983). Sources of mortality in the RSA and surrounding region are discussed in detail in Section 4.4.

4.3 MORTALITY AND HARVEST

Grizzly bears are managed as a big game species in Yukon (Government of Yukon 2002), and harvest is permitted in most parts of the territory outside of National Parks, including resident, non-resident, and subsistence harvest. The overall mortality management system is based on estimated total sustainable mortality rates of ≤ 2% of the female population, ≤ 6% of the male population, and ≤ 4% of the total population (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a). Total allowable mortality rates account for mortality from harvest, and other sources, including vehicle collisions and defence of life and property (DLP) kills (i.e., conflict kills).

Yukon grizzly bear harvest is managed within BMUs, although harvest rates are often reported at the scale of Game Management Subzones (GMS) or broader Game Management Zones (GMZ). The bag limit is one grizzly bear every three years in open subzones, and hunters must report all bear kills (Government of Yukon 2021). The RSA is located within GMZ 1, with the lowest licenced grizzly bear harvest rates in the Yukon. Between 1980 and 2014, the annual grizzly bear harvest in GMZ 1 varied from zero to three bears (Milligan 2018). More specifically, within the Eagle Plains BMU (Map 4-1), only two grizzly bears were harvested from 1995 to the present (Pongracz and Suitor, pers. comm., 2022). The Eagle Plains BMU does not overlap any outfitter concessions (i.e., no non-resident harvest), so reported harvest rates are attributed to licenced resident harvest.

Other sources of grizzly bear mortality include DLP kills, collisions with vehicles, and predation from other bears or large carnivores. Grizzly bear mortality rates in the Eagle Plains BMU are low relative to other BMUs in the territory, with an annual average mortality density of < 0.1 bears per 1,000 km², based on records from 2005 to 2016 (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019b). Mortality rates tend to be higher in southern Yukon, where both the human population and road densities are comparatively high, with mortality densities up to 0.6 bears per 1,000 km² in some BMUs (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019b). However, these rates do not account for unreported human-caused mortality (e.g., unreported DLP kills) or natural sources of mortality. Reported DLP kills accounted for an average of 11 grizzly bear mortalities per year in Yukon from 1980 to 2016. DLP mortality rates are very low within the Eagle Plains BMU; from 1995 to 2021, only one grizzly bear DLP kill was reported (Pongracz and Suitor, pers. comm., 2022).

The correlation between road density and grizzly bear mortality has been well documented in other parts of western North America (McLellan 1990, Mace et al. 1996, Boulanger and Stenhouse 2014, Proctor et al. 2019). Most historical grizzly bear mortalities in central BC and Alberta were related to human activity and occurred within 500 m of a road (Ciarniello et al. 2004, Boulanger and Stenhouse 2014). In BC, grizzly bear mortality rates are known to increase in areas where road densities exceed 0.6 km/km² (Lamb et al. 2018). Mortalities were caused by higher rates of legal harvest, poaching, and conflict kills near roads, in addition to direct mortalities from road collisions. Roadside hunting of grizzly bears is currently permitted in Yukon, although this is under review in some local areas (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a).

Grizzly bear mortalities from vehicle collisions are rare in Yukon. Fifteen grizzly bear mortalities resulted from collisions with vehicles from 2003 to 2014 on all Yukon Highways (EDI Environmental Dynamics Inc. 2015). Collisions tended to occur in spring and summer when grizzly bears were foraging on roadside vegetation. Most collisions occurred on the Alaska Highway (60%), which has higher traffic volumes than other roads in the territory. The only major road in the RSA is the Dempster Highway, which has comparatively low traffic volumes and is unpaved. From 2003 to 2014, only one bear collision was reported on the Dempster Highway near Dawson City. The bear species was unidentified.

Predation is a source of mortality for grizzly bears, but predation rates are generally unknown in the Yukon. Male grizzly bears occasionally prey on females and cubs on the North Slope (Clarkson and Liepins 1994). Wolves in packs have also been known to kill grizzly bears in northern Yukon (Benson 2014).

4.4 REGIONAL HABITAT ECOLOGY AND DIET

The distribution of available forage strongly influences habitat selection by grizzly bears during spring, summer, and fall seasons (Nielsen et al. 2010, Milakovic et al. 2012) and the supply of suitable den sites in winter (Smereka et al. 2017). Security and thermal cover are also important (McLellan 1990). However, they are generally selected with nearby foraging habitats (Milakovic et al. 2012).

Much of the available information on seasonal grizzly bear habitat selection and diet comes from the interior mountains and coastal regions of western North America (e.g., Hamilton 1978, McCormick 1999, McLellan and Hovey 2001, Ciarniello et al. 2007, Maraj 2007, Nielsen et al. 2010, Milakovic et al. 2012, McClelland et al. 2020). However, the ecological characteristics of these populations may differ substantially from that of grizzly bears in northern Yukon. At a finer spatial scale, grizzly bear ecology within the RSA differs from grizzly bears elsewhere in northern Yukon, such as the Yukon North Slope or the nearby Ogilvie and Richardson Mountains (Pongracz and Suitor, pers. comm., 2022), but very little information exists about grizzly bears within the RSA. Literature and traditional knowledge from similar ecosystems in northern Yukon have been summarized to the extent possible, including the Taiga Cordillera and adjacent Taiga Plains Ecozones. When information specific to the region was unavailable, literature from other parts of the Yukon or western North America was consulted.

4.4.1 SEASONAL DIET

Grizzly bears have broad omnivorous diets, including plants, fish, terrestrial wildlife, and insects (MacHutchon and Wellwood 2003, Ciarniello and River 2018). Grizzly bear diets differ among regions due to variations in food availability across local climates (Mowat and Heard 2006, McLellan 2011, Coogan et al. 2014). Individual grizzly bear diets are also highly variable and dependent on seasonal and annual availability of food items within their home ranges (MacHutchon and Wellwood 2003, McClelland et al. 2020).

Seasonal grizzly bear diets generally reflect the phenological progression of key food resources such as herbaceous plants, ungulate calves, berries, and fish (Hamer and Herrero 1987, MacHutchon and Wellwood 2003, McClelland et al. 2020). Vegetation is a major component of grizzly bear diet in northern Yukon; for

example, vegetation comprised more than 30% of grizzly bear diet in the Richardson Mountains (Koizumi 2012). During spring, important plant foods for grizzly bears in the Taiga Cordillera include the roots of alpine hedysarum (*Hedysarum alpinum*), sedges (*Carex* spp.), grasses, horsetail (*Equisetum spp.),* and berries leftover from winter such as kinnikinnik (*Arctostaphalos uva-ursi*), bearberry (*Arctostaphalos rubra* or *A. alpina*), and crowberry (MacHutchon 2000, MacHutchon and Wellwood 2003). In summer and early fall, grizzly bear diet in northern Yukon includes a variety of berries such as blueberry (*Vaccinium uliginosum*), soapberry (*Shepherdia canadensis*), crowberry, bearberry, kinnikinnik, cranberry (*Vaccinium vitis-idaea*), and cloudberry (MacHutchon 2000, MacHutchon and Wellwood 2003). When berries are unavailable, grizzly bears may forage on herbaceous vegetation such as sedges, grasses, and horsetails. As berry availability declines in late fall, grizzly bears may dig for alpine hedysarum more frequently (MacHutchon and Wellwood 2003).

In northern Yukon, grizzly bear diets incorporate a relatively high proportion of terrestrial wildlife, comprising up to 70% of their diet (Mowat and Heard 2006, Koizumi 2012). Mammals are likely an important food source throughout the spring, summer, and fall whenever they are available, including caribou (*Rangifer tarandus*), moose (*Alces alces*), arctic ground squirrels (*Spermophilus parryii*), and small rodents (MacHutchon 2000, MacHutchon and Wellwood 2003, Koizumi 2012). Arctic ground squirrels are an important food source, and grizzly bears may spend increasing effort pursuing them as berry availability declines in late fall (MacHutchon and Wellwood 2003). Arctic ground squirrels tend to select slopes with well-drained soils and avoid wet, flat, or hummocky terrain (Barker and Derocher 2010), which characterizes much of the RSA. Thus, grizzly bears with home ranges that overlap the RSA may rely heavily on other food sources (e.g., alpine hedysarum or ungulates). Traditional knowledge suggests that bears may travel to the nearby Richardson Mountains to forage on ground squirrels in fall (Benson 2014).

Ungulates may be a particularly important food source in spring, when grizzly bears in northern Yukon and Alaska prey on caribou and moose calves (Boertje et al. 1988, MacHutchon 2000, MacHutchon and Wellwood 2003). Barren-ground caribou (*Rangifer tarandus groenlandicus*) are a focal food source for grizzly bears in northern Yukon during caribou calving and seasonal migration periods (MacHutchon and Wellwood 2003). Grizzly bears may follow caribou as they migrate to and from their calving grounds (Reynolds and Garner 1987, Benson 2014), targeting calves or opportunistically preying on adults (MacHutchon and Wellwood 2003). Northern grizzly bear populations that prey on caribou during calving or migration have higher reproductive rates and population densities than those that do not overlap caribou range (Reynolds and Garner 1987). Grizzly bear diet has not been studied within the RSA, and there is no scientific data on the relative importance of caribou as a food source. However, the Porcupine caribou herd migrates through the RSA en route to calving grounds on the arctic coastal plain and again during their return to winter range in the Richardson and Ogilvie mountains (Russell et al. 1993, Ryder et al. 2007). Grizzly bears within the RSA likely use caribou during spring and fall migration.

Salmon, trout, and char are important seasonal foods for grizzly bears (Mowat and Heard 2006, Adams et al. 2017). During fall, grizzly bears congregate at the Fishing Branch River in Ni'iinlii Njik Territorial Park to feed on chum salmon (*Oncorhynchus keta*) (Vuntut Gwitchin Government and Environment Yukon 2010). Grizzly bears on the north slope are also known to feed on Dolly Varden trout (*Salvelinus malma*) (MacHutchon and Wellwood 2003). Baseline fish inventories for the Project found that salmon and trout were absent within the

RSA (EDI Environmental Dynamics Inc. 2022a). Arctic grayling (*Thymallus arcticus*) were the most common fish species, although longnose sucker (*Catostomus catostomus*) and round whitefish (*Prosopium cylindraceum*) were also present. Grizzly bear in the Richardson Mountains have been observed feeding on arctic grayling (Benson 2014), and whitefish and sucker are known food sources in the central Canadian arctic (Gau et al. 2002, Barker 2011).

4.4.2 FORAGING HABITAT

The availability, abundance, and distribution of important grizzly bear forage directly influence grizzly bear abundance and distribution during the growing season (McLoughlin et al. 2002a, Nielsen et al. 2017, McClelland et al. 2020). Grizzly bear populations in the subarctic and arctic are generally considered limited by food (McLoughlin et al. 2002a). Grizzly bears may balance the selection of high-quality food patches with avoidance of landscape features associated with high mortality risk, such as areas with dense human developments and roads (Nielsen et al. 2010, Proctor et al. 2017). However, given the relatively low harvest rates and low levels of human development in the RSA, it is likely that grizzly bear habitat selection is driven by food availability.

The literature on grizzly bear foraging habitat selection in the mountains, boreal forest, and coastal regions of western North America is extensive (e.g., Hamilton 1978, McCormick 1999, McLellan and Hovey 2001, Ciarniello et al. 2007, Maraj 2007, Nielsen et al. 2010, Milakovic et al. 2012, McClelland et al. 2020), but far less is known about habitat use in northern ecosystems. Studies in northern Yukon, Alaska, and NWT have focused mainly on arctic barren-ground grizzly bears (Phillips 1987, MacHutchon 1996, Gau 1998, McLoughlin et al. 2002a, Barker 2011), leaving a substantial knowledge gap about grizzly bear ecology in the Taiga Cordillera (particularly non-mountainous areas such as the Eagle Plains Ecoregion).

Grizzly bear distribution was clumped in the Richardson Mountains rather than uniform; bear densities were comparatively high in habitats with abundant food such as riparian valleys and low in flat tundra plains (Clarkson et al. 1993). Local traditional knowledge suggests that mountains are better grizzly bear habitat than taiga or barren-ground plains due to the abundance of berries and ground squirrels, and the earlier snowmelt on windblown and south-facing slopes in spring (Benson 2014). Grizzly bears in northern Yukon have large home range sizes (up to 1,250 km^2) and travel long distances to reach suitable foraging habitat (MacHutchon 2000). Thus, grizzly bears in the RSA may travel to the Richardson or Ogilvie Mountains for seasonal forage. This is consistent with the knowledge that grizzly bears have low densities in the RSA, and their behaviour is characterized by seasonal movements through the area (Pongracz and Suitor, pers. comm., 2022).

In the central Canadian arctic, barren-ground grizzly bears selected eskers, shrubby riparian zones, and tussock tundra throughout the spring, summer, and fall, corresponding with the spatial and temporal availability of food (Phillips 1987, McLoughlin et al. 2002a). Esker slopes support a relatively high abundance of berry-producing shrubs and arctic ground squirrels (Gau 1998, Barker and Derocher 2010, Barker 2011), whereas riparian zones and tussock tundra may provide herbaceous forage such as horsetails, sedges, and cotton grasses (*Eriophorum* spp.) (Gau 1998, Gau et al. 2002). Barren-ground grizzly bears also selected habitat with abundant lichen, which may attract caribou (McLoughlin et al. 2002a). During the Porcupine caribou

migration on the Yukon north slope, grizzly bears travelled along river channels or selected hillsides with long sight-lines, presumably to increase their chances of detecting caribou (MacHutchon 2001).

4.4.3 COVER (SECURITY AND THERMAL HABITAT)

Security habitat includes areas of dense vegetation that provide visual screening from other grizzly bears or humans (Mace and Waller 1997). Security cover may be particularly important for sub-adult male bears and sows with cubs to avoid adult males defending their territories or killing cubs to bring females into estrus (LeFranc et al. 1987, McLellan 2005). Female grizzly bears may select lower-quality foraging habitat if it provides high security values or spatial separation from potentially aggressive male bears (Pearson 1975, McLellan and Shackleton 1988). For example, female grizzly bears in the arctic are thought to occupy the Mackenzie Delta to avoid male bears in adjacent mountain ranges (Benson 2014).

Thermal cover includes habitat that provides relief from the elements, such as solar exposure or extreme weather. Cover from heat and solar exposure is provided by various habitats such as open water (e.g., rivers, streams, lakes), permanent snow patches, steep north aspects, and mature forest patches with high canopy closure (Pearson 1975, LeFranc et al. 1987). Grizzly bears may also select forests with high canopy closure for day beds to seek shelter from heavy rains (Pearson 1975, Munro et al. 2006). The importance of thermal cover for grizzly bears in the Taiga Cordillera has not been studied.

4.4.4 WINTER DENNING HABITAT

Grizzly bears in northern Yukon hibernate in winter from approximately October to May (Nagy et al. 1983, MacHutchon 2000), although the timing for den entry and emergence depends on annual weather patterns. Grizzly bears will enter their dens as late as mid-November and emerge as early as March if the weather is warm (Benson 2014).

No records exist of grizzly bears dens within the RSA, although grizzly bears are known to den in the mountains of Ni'iinli Njik (Fishing Branch) Territorial Park, approximately 20 km west of the RSA (Pongracz and Suitor, pers. comm., 2022). Grizzly bears in the arctic and subarctic typically excavate their dens in locations with suitable soil, such as sand, gravel, or glacier-deposited rock (MacHutchon 2000, Smereka et al. 2017). Grizzly bears in Vuntut National Park in northern Yukon preferentially select den sites in the mountainous regions of the park and avoid denning in Old Crow Flats, which is characterized by flat topography, large wetland complexes, and spruce forests (MacHutchon 2000). Denning within Old Crow Flats is likely limited to dry, steep riverbank slopes (MacHutchon 2000). Grizzly bears throughout the Gwitch'in Settlement Area are known to prefer denning in the mountains; however, in areas with flat topography (such as the RSA), grizzly bears will select small topographical features such as hills, steep riparian banks, or lakesides to excavate their dens (Benson 2014). Grizzly bears in northern Yukon have large home ranges (Section 4.5.5) and may travel long distances to reach winter den sites (up to 65 km; Craighead 1976). Thus, some grizzly bears with home ranges overlapping the RSA may travel to nearby mountain ranges (Richardson Mountains, Ogilvie Mountains, or Ni'iinli Njik Territorial Park) to hibernate.

In arctic barren-ground ecosystems, grizzly bears select river banks, lakesides, or eskers with silty or sandy soil for denning (Harding 1976, Mueller 1995) and avoid open spruce forest (Smereka et al. 2017). Grizzly bears prefer to excavate their dens on steep south-facing slopes with abundant shrub cover in the arctic (Mueller 1995, McLoughlin et al. 2002b) and the boreal forest of southern Yukon (Libal et al. 2012). The root structures of tall shrubs such as willow (*Salix* spp) and dwarf birch (*Betula glandulosa*) may provide support to the ceilings of excavated grizzly bear dens (McLoughlin et al. 2002b).

4.4.5 HOME RANGE AND SEASONAL MOVEMENTS

Grizzly bear home range sizes are variable and have an inverse relationship with food availability (Nagy and Haroldson 1990, McLoughlin et al. 2000). Thus, grizzly bear home ranges in productive coastal or interior mountain habitats of BC are typically smaller and have greater overlap than those in less productive boreal, taiga, or arctic barren-ground ecosystems (McLoughlin et al. 2000, Edwards et al. 2009, Hamilton et al. 2018). Additionally, the size of individual home ranges may vary annually in response to fluctuations in the quality and abundance of food (McLoughlin et al. 2000). The largest recorded grizzly bear home range sizes in North America were in the central Canadian Arctic, where mean home range sizes for female and male bears were 2,100 km² and 7,245 km², respectively (McLoughlin et al. 2003).

No data on grizzly bear home range sizes within the RSA are available, but studies conducted in other parts of the Taiga Cordillera provide some insight. Grizzly bear home range sizes in the Old Crow flats of Vuntut National Park were estimated at 650 – 750 km² for females and 1,150 – 1,250 km² for males (MacHutchon 2000). In the Richardson Mountains north of the RSA, female grizzly bears had mean annual home ranges of 442 km² and males had home ranges of 760 km² (Koizumi 2012). The smaller home ranges in the Richardson Mountains may be attributed to more food resources, such as berries and ground squirrels relative to the taiga plains (Benson 2014).

Grizzly bears have low fidelity to home ranges in unproductive arctic ecosystems, where food distribution is spatially and temporally heterogenous, and grizzly bear population densities are low (Edwards et al. 2009). Under these conditions, it is beneficial for grizzly bears to adjust the size and location of their home ranges to maximize forage availability. For example, in northern Yukon and Alaska, grizzly bears may travel long distances to follow the seasonal migration of barren-ground caribou (Reynolds and Garner 1987, MacHutchon 2001). Grizzly bears in northern Yukon are also thought to travel long distances to find suitable winter denning habitat in the mountains (Benson 2014).

4.5 SUMMARY

Available data suggest that a low density of grizzly bears are distributed throughout the RSA. Rates of recorded harvest mortality are low within the Eagle Plains BMU, but other sources of mortality are largely unknown and unrecorded. Grizzly bear diet in the RSA and surrounding region predominantly consists of vegetation (berries, roots, and herbaceous plants) and terrestrial wildlife, including caribou, moose, and arctic ground squirrels. Grizzly bears may rely heavily on caribou (particularly calves) during the seasonal migration of the Porcupine caribou herd through the region. Habitat quality in the RSA is generally poor compared to the adjacent mountain ranges, where berries and ground squirrels are more abundant. Lastly, grizzly bears in the RSA may excavate their winter dens in riverbanks, lakesides, and hills where suitable soil can be found, or they may travel to nearby mountain ranges to den on steep south-facing slopes. Most of the information presented in this review was based on scientific studies.

5 MOOSE

5.1 PURPOSE AND OBJECTIVES

Moose (*Alces alces*) were selected as a VC for the Project due to their importance as a managed game species, and their cultural values to First Nations living in the Yukon. Winter, and especially the late winter season, is often a difficult time for moose due to the limited availability of forage and increased energetic demands to move through crusted or deep snow. A winter habitat suitability map was developed for moose in the RSA to identify high-suitability winter forage habitat areas. The map quantifies the winter forage habitat in each habitat class (high, moderate, low/nil/very low) within the RSA.

This section summarizes information and data on moose use and ecology in the subarctic taiga that was used to develop habitat suitability mapping to quantify the suitability, amount, and distribution of potential habitat for moose in the RSA.

5.2 GENERAL HABITAT ECOLOGY OF MOOSE

5.2.1 EXISTING INFORMATION

There is limited knowledge of moose within the RSA. In 2001, Anderson Resources Ltd submitted a project application and a mitigation plan for an Eagle Plains 2001–2003 Seismic Survey Program (Access Consulting Group and EBA Engineering Consultants Ltd. 2001). This report describes moose knowledge of the area as being limited and incidental. The authors reviewed the existing data and had discussions with local wildlife biologists and other resource users about winter usage patterns by moose in the general vicinity of the Eagle Plains project area. At that time, moose were only superficially studied in the Eagle Plains Area (Access Consulting Group and EBA Engineering Consultants Ltd. 2001).

The 2001 project application report stated that an approximate moose density of about 0.05 moose/km² was estimated for the project area based on general habitat assessment. The application also provided the following information:

> "*Within the project area, moose are not commercially exploited and there are no outfitting concessions. There is limited off-road access and the moose population density within the project area is known to be low, hence the subsistence harvest is minor. YTG Renewable Resources harvest data show that, in the last twenty years, only 13 moose have been harvested in the Dempster Corridor subzones (Game Management Zone 1-55 and 1-56).*
>
> *Anderson conducted a post-rut moose survey in early November of 2000, to augment the currently very limited knowledge regarding moose populations in the project area. The survey was conducted to provide baseline information on the level of range usage by moose within the project area. During the course of the 2-day survey, 30 moose were observed and an additional 64 sets of tracks were encountered. In general, moose were more frequently associated with the higher elevations (between 400 m and 700 m above sea level), but were widely dispersed throughout all of project*

area's drainages. From the survey results, an overall population of approximately 60-90 moose was estimated (Access Consulting Group and EBA Engineering Consultants Ltd. 2001)."

These observations of greater moose abundance at higher elevations are consistent with observations from VGFN elders around the same time (Sherry and Vuntut Gwitchin First Nation 1999, p. 7). They discussed that Eagle Plains was an important moose range, but that some animal populations had changed their land use after the Dempster highway was built and there was low density near the highway (Sherry and Vuntut Gwitchin First Nation 1999, p. 287, 299).

In 2001, an aerial survey was completed from June 18–22 within the 2001 project area. During that survey, 19 moose were incidentally observed, with most observations noted in the South Eagle River and Dalglish Creek area. A general point of interest was that moose calving was expected in several drainages, but was particularly noteworthy in the South Eagle River (Access Consulting Group and EBA Engineering Consultants Ltd. 2001).

In 2013 Environment Yukon conducted an 'Eagle Plains Mammal Occupancy Aerial Survey' from March 19 to March 24, 2013 (Environment Yukon, unpublished data). The survey aimed to assess the occurrence and distribution of large mammals within the broader Eagle Plains Ecoregion. Over the 6 survey days, 64 moose were observed, including cow and calf observations. The data indicated that moose were widely distributed within the Eagle Plains area, but the area was not comprehensively surveyed, and formal analyses/reporting were not included with the data.

From October 2014 through August 2016, Yukon Environment deployed 37 (2014) to 48 (2015) pairs of remote cameras in the Eagle Plains area (Burden 2016). The objective was to assess the use of linear features by medium to large mammals (wolves, caribou, and moose) by comparing the use of wildlife on and off seismic lines by placing cameras at random locations on seismic lines, and camera locations off seismic lines. The report is a data summary with no statistical analysis, and the results are non-standardized (e.g., lacking a catch per unit effort reporting metric). Regardless, there was some information collected for moose relevant to this study. Over the two years of study, moose encounters were infrequent and varied slightly among years (0.33 moose/100 camera days in 2014–2015, 0.43 moose/100 camera days in 2015–2016). Moose were found in the study area throughout the year but were observed more often from May through November (spring through fall). No statistical analyses or apparent trends were used to determine moose associations with linear disturbances.

EDI did not complete other population or distribution surveys for moose as part of the current baseline studies. Efforts focused on developing a winter habitat model to quantify habitat suitability, amount, and distribution across the RSA.

5.2.2 HABITAT ECOLOGY OF MOOSE

Moose are one of the most widely distributed ungulates and range from the Arctic coasts of North America, Europe, and Asia down to the southern limits of the boreal forest and farther south where suitable montane biomes are located exist. In the Yukon, moose densities generally range between 100 and 250 moose for every 1,000 km^2 of suitable moose habitat (Environment Yukon 2016b). The Regional Biologist has indicated that,

based on his observations, moose densities in Eagle Plains are relatively low compared to some parts of the southern Yukon, but that moose densities in Eagle Plains are high compared to other parts of North Yukon (Mike Suitor, pers comm).

Moose make seasonal movements to various habitats such as calving, summer, rutting, and winter habitats. These seasonal movements may range from a few to many kilometres (Clarke et al. 2017, Government of Yukon 2022). Changing environmental conditions can affect the quality, quantity, distribution, and accessibility of cover and forage over a landscape. Key habitat requirements are rarely distributed evenly over space or time, so moose move to access various resources as availability changes. Periodic disturbances, such as wildfire and vegetation clearing change the abundance and availability of moose cover and forage. Moose are generally not evenly distributed across the landscape; they concentrate in particular habitats offering higher forage opportunities(Government of Yukon 2022). Moose with access to large quantities of forage are known to travel less than those in areas where forage is less abundant (McCulley et al. 2017). There is a wide variation in home range sizes for moose across the boreal forest and between seasons (Phillips et al. 1973, Addison et al. 1980, Clarke et al. 2017, McCulley et al. 2017). Moose that frequent the Old Crow Flats wetland complexes in northern Yukon are known to spend summer months within this area and then migrate 250 km to spend the winter within the Alaska Arctic National Wildlife Refuge (McCulley et al. 2017).

Moose habitat selection patterns vary among populations, individuals, seasons, and sexes (Clarke et al. 2017, McLeod and Clarke 2017). Furthermore, habitat use by moose can differ depending on the type of land cover and the availability of resources in a particular area. In northern Yukon, moose appear to frequent narrow strips of forest along the rivers (Photo 5-1), and VGFN elders have observed good moose habitat just south of the RSA along the Blackstone and Ogilvie rivers and the wetlands of the Blackstone Uplands (Sherry and Vuntut Gwitchin First Nation 1999, p. 303). In the south, moose frequent the treeline in the subalpine shrub zone. Moose in the Yukon also tend to concentrate in recent burns and along waterways with interconnecting ponds, marshes and meandering streams (Government of Yukon 2022).

Moose inhabit numerous stand-cover types and structural stages. Conifer stands are generally used primarily as cover to moderate extremes of cold, wind, heat, deep snow, and security from predators (Timmermann and McNicol 1988, McCulley et al. 2017). Early seral areas are usually shrub-dominated and used by moose because shrub species comprise more than 60% of a moose's annual diet (Renecker and Schwartz 2007). During the spring and summer, moose forage primarily on the leaves of woody plants, aquatic plants, and forbs. During winter, the diet shifts to highly lignified woody stems, resulting in higher ruminating times (Renecker and Hudson 1986). Plant form and twig diameter have also been shown to affect digestion rates, influencing moose winter foraging (Vivas et al. 1991). Some preferred moose forage species include:

- Willows (*Salix* spp.)
- Red-osier dogwood (*Cornus sericea*)
- Saskatoon serviceberry (*Amelanchier alnifolia*)
- Highbush cranberry (*Viburnum edule*)
- Mountain ash (*Sorbus sitchensis*)
- Scrub birch (*Betula glandulosa / nana*)

- Trembling aspen (*Populus tremuloides*)
- Lodgepole pine (*Pinus contorta*)
- Paper birch (*Betula papyrifera*)

These browse species may be used preferentially due to their height and growth form (Baker 1990, Van Ballenberghe et al. 1989). The palatability of shrub species can also vary from region to region. Soopolallie (*Shepherdia canadensis*) was recorded as an important forage species for moose on the Kenai Peninsula, Alaska (Edwards 1940) but appears to be unpalatable in other parts of the boreal forest (Rolley and Keith 1980). In northeast Alberta, the preferred browse species was Saskatoon serviceberry; even in areas where it was uncommon, the species was still heavily used when it was present (Nowlin 1978). In the Peace-Athabasca Delta, moose feed primarily on willow, red-osier dogwood, paper birch and balsam poplar. In one study done in the taiga region ranging from northwestern Manitoba to Great Slave Lake NWT, winter moose diet was mainly composed of *Betula papyrifera* bark (Thomas 1990). Risenhoover (1989) found that willows accounted for more than 94% of the winter moose diet in Denali National Park and Preserve.

Within the RSA, willows and scrub birch are the dominant browse species available for moose. Willows often form the predominant diet in other northern areas. Willows are well adapted to wetter soils and are commonly found in wetland and riparian habitats (Photo 5-2). Willows are also an early successional species and are often abundant in early seral habitats resulting from forest fires and human-disturbed areas (e.g., seismic lines, cutblocks, and road rights-of-way). Moose have been reported selecting previously burned habitats and areas within 100 m of streams and waterbodies, presumably due to the abundant forage (Wasser et al. 2011). In habitats with low availability of twigs and leaves, moose sometimes use a foraging technique called 'bark-stripping' where long, linear strips of bark are peeled from certain trees, such as aspen (LeResche and Davis 1973, Miquelle and Van Ballenberghe 1989). However, the bark is usually a relatively small component of moose diets (Miquelle and Van Ballenberghe 1989). It is unlikely to be a significant food source in Eagle Plains due to the dominance of spruce, whose bark is non-palatable.

Across Canada, heavily used areas by moose include wetlands, floodplains of major rivers, riparian areas, regenerating cut blocks and burns, and avalanche chutes. Their preferred habitat types include recent burns, logged areas, lake and river shores, willow and alder swamps and other wetland areas MacCracken et al. 1997). Food (including forage quality) and climate are considered important aspects of habitat for moose (Franzmann 1981). Analyses of moose range commonly stress the abundance, production, and use of woody shrubs as important characteristics when describing moose habitat requirements (LeResche and Davis 1973; Jung et al. 2009).

In Labrador, moose can be observed more often in riparian areas and hardwood stands and less often in string bogs, open conifer-lichen stands, barren hilltops than expected based on the availability of those habitat types during the winter (Jung et al. 2009). Riparian areas are often high suitability habitats for moose in winter due to the availability of high-quality forage species such as willows. Willows and birch found within the riparian shrub communities are often adjacent to a strip of closed-canopy conifer-dominated forest that provides thermal cover and snow interception. The combination of shrub communities and closed-canopy mature riparian forests offer a highly suitable habitat mosaic for moose (Jung et al. 2009).

During the winter, moose are influenced by snow depth, snow density and hardness. Moose movements begin to be impeded at snow depths of 70 cm, and moose strongly avoid areas with >100 cm of snow. Moose generally winter in areas where snow depths are less than 70 cm (Coady 1974, Franzmann 1981). In mountainous areas, where snow accumulation can vary substantially, this can result in strong patterns of seasonal range use, with moose avoiding mid an upper elevation where snow accumulation is higher. For example, in the Pelly-Macmillan River area (Central Yukon), moose concentrated along the major river valleys during late winter, where the combination of shallower snow under mature forest canopies and dense willows in wetland areas provided moose with optimal habitat (O'Donoghue 2005). However, snow is not expected to strongly influence the distribution or habitat selection in the RSA in most years. This is due to the relatively modest elevation range within the RSA. The average maximum snow depths of approximately 80 cm are just on the edge of the range that moose avoid (EDI Environmental Dynamics Inc. 2021). Over much of the winter, snow depths are less than 70 cm.

Predation is recognized as a major factor affecting the dynamic of moose populations (Gasaway et al. 1992, Ballard and Van Ballenberghe 2007). In general, prey species select security habitats at multiple scales based on various factors that can affect their perceived predation risk. Perceived security is also a dynamic factor that varies over time and is dependent on the density and behaviour of predators, including humans. Moose population growth and density in Yukon are thought to be limited by wolves (Hayes et al. 2003). Consequently, moose may avoid habitats that increase the potential for wolf encounters. However, predator avoidance may be a more prominent factor in habitat selection at the landscape scale than within a home range (Dussault et al. 2005). Habitat types with taller and denser vegetation likely provide some protection from wolves during winter. Habitat types that provide cover from predators may also contain taller trees that intercept snow, reducing snow depth and reducing the energy required to move.

At a minimum, security habitat should conceal a moose from predators. It can be assumed the security habitat for moose can be provided by any forest stand of adequate density with trees and shrubs taller than 2 m. Security cover for moose is most critical during spring calving when cow moose seek out islands and gravel bars on river floodplains for calving. At calving time, cow moose and calves can find secure habitat in dense deciduous or mixedwood stands, or tall shrubs with canopy cover >50% (MacCracken et al. 1997). During winter, deep, and persistent snow has been shown to have a greater impact on the physical condition of moose and thus increasing its risk of predation. Within one study (Dickie et al. 2020), moose seem to select riparian areas to facilitate movement instead of selecting them only for foraging opportunities. In the RSA, most wildlife trails were observed adjacent to riparian areas.



Photo 5-1. A moose observed adjacent to a narrow treed riparian area in the RSA (Photo provided by Palmer Environmental 2019).



Photo 5-2. Shrubby riparian area, on the edge of a burn, where willows have been browsed by moose.

5.2.3 DISTURBANCE

5.2.3.1 Fire

Burns are often a major factor affecting the distribution and abundance of moose across the boreal forest, with densities peaking 20 to 25 years after fire (LeResche 1974). Studies have shown that moose populations are often denser in burned areas where browse is of higher quality and greater abundance than adjacent, unburned areas (Gasaway et al. 1989). Moose have been reported selecting previously burned habitats that are 10–30 years old (Maier et al. 2005) and less than 40 years old (Wasser et al. 2011). Overall, fire creates favourable forage conditions for moose when regenerating shrubs are available for browse.

Several large wildfires have affected the RSA, occurring between 1959 and 2018. Areas that were affected by fire, and are still regenerating, were labelled with a fire disturbance code in the ELC vegetation maps. For older burn areas, the adjacent non-burned area was compared to the burn area to see if there was a noticeable difference in vegetation. Areas that did not have a noticeable difference were not characterized as fire disturbed as they were considered regenerated. The appropriate structural stage was assigned to reflect the stage of regeneration.

The post-fire successional pathways for many of the ecosystem units in the RSA were the same or very similar, making the differentiation of ecosystem units based on revegetation difficult. For example, almost all ecosystem units regenerate initially with deciduous shrubs (willow and scrub birch) and a mix of spruce and deciduous trees (primarily paper birch), and, as succession progresses, the prominence of spruce increases and deciduous shrubs and trees decreases. Often the post-fire succession also varied within an ecosystem unit depending on several factors, including the number and frequency of fires, the intensity of the fire, and the amount of permafrost present before and after the fire. Field observations suggest that hot fires likely melted a larger portion of the permafrost, permanently altering the moisture regime of the affected area; therefore, site moisture regimes are altered, and some sites do not return to the same ecosystem unit that had been established before the fire. From a moose habitat perspective, the result is that, except for some ecosystem units in riparian areas, the abundance of browse species is affected more by regeneration status and structural stage than ecosystem unit type.

The current structural stage for some of the more recent fire-disturbed areas was difficult to determine due to the range in age and variety of the imagery. To be consistent, the mappers assigned a shrub structural stage to all fire disturbed areas unless there was strong evidence suggestion another structural stage (i.e., a plot stating it was graminoid dominant, Photo 5-3).



Photo 5-3. Recent burn in a graminoid structural stage. Generally, regenerating shrubs become available as browse to moose about 10 years after fire disturbance.

5.2.3.2 Linear Features

Linear features are the primary type of anthropogenic disturbance in the Project area. However, there are many uncertainties regarding the extent, impacts, and recovery status of linear features in the area. Linear features include narrow, linear clearings on the landscape, typically used for transportation and seismic exploration activities. The Project area has numerous 2D seismic lines (e.g., Photo 5-4) and winter roads from previous exploration activities dating back to the 1960s. The majority of 2D exploration occurred between 1961 and 1984. Some 2D exploration occurred in 2001 that incorporated LIS techniques (Access Consulting Group and EBA Engineering Consultants Ltd. 2001, GEOTIR 2014). More recently, approximately 2,200 km of 3D low-impact seismic (LIS) exploration was conducted in a 325 km² area between November 2013 and April 2014 (GEOTIR 2014). This 3D exploration grid is near the centre of the Project area, spanning north and south of the Dempster Highway.

Linear features can affect predation risk on moose. Facilitated predation operates by increasing the spatiotemporal overlap and interactions between wolves and prey species (Serrouya et al. 2016, Dickie et al. 2020). The magnitude and extent of such overlap are dependent on the extent and use of linear features across the contiguous woodland habitat. Linear features may enhance predation rates by increasing predator abundance via travel corridors and, ultimately, by optimizing hunting efficiency (Serrouya et al. 2016, Dickie et al. 2017, DeMars and Boutin 2018). The degree to which facilitated predation operates and affects prey species is context dependent. The primary features possibly associated with facilitated predation in the Project area are winter roads/trails, 2D and 3D seismic lines, and the Dempster Highway. In winter, clearing and compaction of snow on linear features by plowing or snowmobiles can elevate predator movements (Keim et al. 2019b), further exacerbating predation risk.

The Dempster Highway runs roughly southwest to northeast through the southern half of the RSA. The RSA includes numerous winter roads (15 m average width) from previous exploration activities dating back to the 1960s. The Project will be accessed via existing and new winter roads. Moose have been shown to avoid human development and activity, but response varies by season, sex, and population. Reduced use by moose has been documented near roads (Rolley and Keith 1980).

Moose use of seismic lines is variable. In a study completed in northern Alberta by Dickie et al. (2020), moose selected to be closer to riparian areas and avoided being closer to linear features. Another study demonstrated that seismic lines could increase encounter rates between prey and predator by facilitating predator movement (McKenzie et al. 2012). Moose, wolves and even people tend to move faster on linear features since these features create a path with less visual and physical resistance to movement but in some cases the ease of movement can increase the risk of prey species encountering a predator. Dickie et al. (2020) noted that moose had tendency to move faster while on linear features which could support the theory that moose perceive LFs as a risk to wolf encounters.

Many uncertainties surrounding the ecological impacts and recovery potentials for linear features, particularly of 2D and 3D seismic lines, in the taiga ecosystem that characterizes Eagle Plains. EDI completed a linear feature study. The purpose of that study was to systematically describe and quantify the current conditions of linear features across the RSA by providing a baseline inventory and assessing the successional and functional status of linear features. Six types of successional pathways were defined on linear features in the Eagle Plains area (Table 5-1; after Simpson 2008).

Most sites surveyed (79%) were undergoing normal succession, and that vegetation was either in a low shrub (56.1%) or tall shrub (29.0%) structural stage along the linear features sampled. Almost all 3D plots were at a low shrub structural stage (67% less than 1 m), while 2D plots and winter roads were distributed more evenly through low shrub, tall shrub, and forested structural stages (21% greater than 4 m and 5% greater than 8 m). The analyses suggested that 2D seismic lines regenerate to a more shrub-dominated community relative to pre-disturbance conditions, 3D seismic lines had lower woody cover than off-line plots after five years of regeneration, and fire has the potential to increase shrub and tree growth on linear disturbances. Sightlines along linear features decreased substantially as the height of vegetation increased, and ease of travel along linear features decreased with the amount of woody cover. Fire played an important role in shaping functional recovery by increasing the amount of woody cover and the structural stage of vegetation.

Under normal succession, 2D seismic lines had 12% to 19% greater mean shrub cover than the corresponding off-line sites in burnt and unburnt conditions, respectively. In unburnt conditions, 2D seismic lines had considerably shorter and sparser trees than paired off-line plots, but in burnt conditions, the 2D lines showed denser trees. Burn status appeared to influence some successional classes. Magnified succession was more common at burnt sites (19 burnt versus 5 unburnt), while stagnated succession was more common at unburnt sites (3 burnt versus 7 unburnt). Sites on a normal successional trajectory did not appear to have any relationship to burnt status, while other successional classes were too uncommon to draw any conclusions.

Studies focusing on the use of linear features by moose are limited. However, Keim et al. (2019a) found that moose used 3D seismic lines the least and used well-defined 2D seismic lines and pipelines the most.



Photo 5-4. Example of a low shrub 2D seismic line within the RSA.

Table 5-1. Descriptions of successional classes documented in the RSA (Simpson 2008).

Successional Class	Description
Normal succession	Similar to adjacent forest, but at an earlier seral stage. E.g., young trees that may be surrounded by early successional shrub and forb or graminoid species. Disturbance is likely only the removal of trees and shrubs, with little to no disturbance to soil or permafrost.
Magnified succession	Increased moisture and nutrient availability due to soil disturbance. Often new seral species due to removal of original trees and shrubs. Resulting vegetation is likely shrub or deciduous tree dominant, typically with more productive growth than adjacent sites. Disturbance is likely the removal of trees and shrubs, with significant disturbance to soil or permafrost.
Retrogressive succession	Removal of insulating peat layer causes a change in the soil thermal regime. Active permafrost layer depth increases, releasing water content. Resulting habitat is likely moss, graminoid, forb, or low shrub dominated, with high moisture content. Disturbance includes the complete removal of trees and shrubs, and soil or active permafrost layer.
Successional stagnation	Suspension of succession at herb or low shrub stage. Likely dominated by graminoids; area may have been seeded. Check line age to differentiate from normal succession. Disturbance to soil or permafrost is likely. Ground may have been compacted.
No succession	No ecological differences except that the forest opening is linear instead of random. Disturbance is likely only the removal of trees and shrubs, with little to no disturbance to soil or permafrost.
Recent disturbance	Newer seismic line where successional patterns cannot yet be determined. Line age was checked to differentiate from other successional patterns.

5.2.4 HABITAT SUMMARY

The late winter season is often a difficult time for moose due to the limited availability of forage and increased energetic demands to move through crusted or deep snow. A winter habitat suitability map was developed for moose in the RSA to identify high-suitability winter forage habitat areas. Moose select winter habitat based on three criteria: food availability, snow conditions, and predator avoidance (Dussault et al. 2005). Within the RSA, moose primarily select winter habitat based on browse availability.

The development of the moose habitat model will focus on the following key points:

- Habitat use is believed to be driven by forage availability.
- Winter is the most limiting season for forage availability.
- Winter forage in the RSA is primarily willow species.
- Areas with high willow cover in the RSA are riparian areas, burn areas and some mesic and moist ecosystem units with moderate willow understory.
- Elevation and snow are not likely a significant factor given the limited topography within the RSA; and
- Linear features like seismic lines and trails may provide small patches with elevated willow cover, but their extent are too small to affect habitat selection.

Willows are the primary winter food for moose and signs of moose browsing were commonly observed in the areas that contain abundant willow during the Project baseline surveys. As willow is an early succession species, the shrub is most abundant in disturbed areas such as burns. Anthropogenic disturbances in the RSA, such as 2D seismic lines, may also have a high willow cover, but the extent of these areas is too small to provide significant forage opportunities to moose. Outside of regenerating areas, the high cover of willows is mainly associated with riparian shrublands along streams and disclimax shrublands within the RSA.

5.2.5 HABITAT SUITABILITY MAPPING

Habitat suitability mapping identifies the current ability of an ecosystem unit to provide certain life requisites for a given wildlife species or provide the environmental conditions needed for cover, food and space. A habitat suitability rating is a value given to each structural stage of each ecosystem unit in a project area. The rating is the suitability value assigned to a habitat for its potential to support a particular species for a specified season and activity. It is often expressed as a percentage of the best habitat. It also reflects the species' expected use of a habitat (Resources Inventory Committee 1999c). Habitat ratings are a product of knowledge and assumptions.

The important role of vegetation is incorporated into any wildlife habitat evaluation. Biophysical factors which are considered to influence wildlife habitats can include vegetation type, slope, aspect, and other geographic features. Since vegetation cover type is an expression of various biophysical conditions such as soil moisture, aspect, and relief, it generally offers a current and valid prediction of habitat for many terrestrial wildlife species, at least at broad scales.

The wildlife habitat evaluation is essentially a modelling process that has two primary requirements:

1. Good knowledge of the habitat needs of a species, and how these habitat needs relate to the described ecosystem units; and
2. A standard approach to establishing wildlife species-habitat relationships and ratings for ecosystem units consistently.

The suitability maps use ecosystem attributes for assigning suitability values to a polygon. Wildlife habitat suitability ratings are a widely applicable method of wildlife habitat assessments. While there are recognized limitations to any habitat evaluation and assessment procedure, suitability ratings using ecosystem unit classification have the following advantages (Resources Inventory Committee 1999c):

1. It is predictive.
2. The methodology is consistent.
3. Large areas can be covered.
4. It is flexible and can be applied to a range of map scales, wildlife species, and general to detailed habitat assessments.
5. It provides strategic planning for habitat management.
6. It ties the wildlife resource to other resource uses (e.g., forestry, recreation, and corridor analyses).

The results of this type of model can provide information on the suitability, amount and distribution of potential moose foraging habitat within the RSA.

5.3 METHODS

The moose habitat suitability model was based on habitat suitability mapping standards and methodology (Resources Inventory Committee 1999c). This methodology is commonly used in habitat assessment. The habitat suitability methodology involves three key steps:

1. Selection of relevant habitat variables to include in the model.
2. Development of rating scores for each habitat variable.
3. Building a relationship among the variables to produce overall habitat suitability scores.

A moose winter forage habitat suitability model was developed based on professional opinion and the availability of suitable datasets. Land cover datasets (vegetation, linear disturbances, and fire history) were considered for the suitability modelling. Other variables were considered but not included in the model. They were assumed to correlate with the vegetation cover types and associated structural stages.

5.3.1 RATING SCHEME

This model uses a categorical rating scheme where each category represents an ordinal measure of habitat suitability. The number of categories used in a rating scheme reflects knowledge of the species' ecology and habitat use (Resources Inventory Committee 1999c). For species like moose, where our understanding of the

species and the availability of relevant base environmental data to support habitat modelling is relatively good, 4- and 6-class schemes are typically used. A 6-class system was initially chosen to rank the base habitat units because the 6-class system facilitated finer differentiation of ratings across the numerous habitat types that occur in the RSA (Table 5-2). However, for interpretive purposes, the ratings were generalized into a 4-class system for most model outputs. In the 4-class system, High and Moderately-High were combined into one category (High) and Nil and Very Low were combined into one category (Nil/Very Low).

High and Moderately High suitability habitat provides some of the best winter foraging opportunities for moose within the RSA. Moderate suitability habitat provides some winter foraging opportunities. Low and very low-quality habitat has limited winter foraging opportunities for moose in the RSA. Nil suitability habitat provides no winter foraging opportunities. It is often associated with features without vegetation (e.g., rivers, streams, roads) or with very sparse vegetation cover.

Within the RSA, the highest rated areas included natural shrublands and regenerating burns in riparian areas, as well as small extents of deciduous and mixed-wood ecosystems on mesic and moist sites. Moderate rated areas were predominantly regenerating burns on mesic to wet sites. Low rated sites were mostly undisturbed stands of open, stunted spruce on mesic to wet sites, ranging from tall shrub to old forest structural stages. Differentiating ratings between Moderate and Low areas was often difficult. Many sites, both burned and unburned, had average willow cover less than 15%, with high variation in cover among sites in the same ecosystem units. Generally, 7% willow cover was used as the threshold to differentiate between Moderate and Low sites. This is a relatively low value of willow cover but using a higher threshold would have resulted in large areas of regenerating burn being classified the same (Low) as undisturbed areas. In Eagle Plains, a substantial amount of total winter forage appears to occur within large areas with relatively low willow cover (i.e., the Moderate suitability areas).

Although the vegetation field data confirmed that the amount of shrubby browse (i.e., willow cover) was greater in fire disturbed areas than undisturbed areas, the amount of browse in regenerating burns was not as high as reported in some other studies. For example, the percent cover of willow in burns in the most common ecosystem unit, EU33-Moist Spruce Labrador Tea, was 11% compared to 7% in unburned areas. As a result of this pattern, areas with fire disturbance attributes in the ecosystem mapping database were generally rated one class higher than the same ecosystem unit that was not burned (mostly Moderate for burns and Low for unburned areas).

Table 5-2. Rating scheme used to rate moose habitat suitability.

Rating	Code	HS Score	Description
High	1	95	Suitable. Conditions at optimal. The best foraging opportunities for moose are expected to be found in these areas of the RSA. Willow percent cover is greater than 15%. Includes both disclimax and seral shrublands areas.
Moderately High	2	75	Suitable. Conditions near optimal. Above average foraging opportunities for moose is expected to be found in these areas. Willow percent cover also typically greater than 15% but, on average, less than High.
Moderate	3	50	Suitable. Suitability is lower than optimal conditions but meet minimum requirements from an energy balance perspective. Willow percent cover generally ranges between 7% to 15%.

Rating	Code	HS Score	Description
			Although willow cover is moderate to low in absolute terms, the large extent in this rating category contributes a substantial amount of the total available forage across the RSA.
Low	4	30	Suitability Unknown. Areas in this rating class offer some forage but the amount is so low and dispersed that the energetic return of using these areas are, on average, mostly negative. Willow species present but typically less than 7% cover.
Very Low	5	10	Unsuitable. Willow species presence and cover is usually less than 2%. Moose are expected to strongly avoid these areas.
Nil	6	0	Unsuitable. Willow presence not expected.

5.3.2 SELECTION OF RELEVANT HABITAT VARIABLES

Potentially relevant foraging habitat variables were identified from published literature, other habitat models, and personal experience. A suite of different habitat variables was identified as candidates in this habitat model, based on their known importance to winter foraging ecology (Table 5-3). The variables were evaluated for inclusion based on availability in GIS database, the ecological relevance to moose in the RSA, and relationships found in other studies. Based on these criteria, ecosystem unit, structural stage data and fire disturbance, all from the ELC mapping database, were included in the moose habitat modelling. Other variables were not included in the model as they were not expected to play a major role in winter habitat use by moose or because they were correlated with one of the three selected variables.

Distance to riparian areas was considered for inclusion in the model. Riparian areas are important foraging habitats for moose (Clarke et al. 2017, McCulley et al. 2017). Within the RSA, riparian areas generally contain abundant browse species relative to the adjacent ecological units. The ELC developed ecosystem units specific to riparian habitats. The ecosystem unit data accurately represent increased habitat suitability in riparian areas found as narrow strips along most watercourse and drainages in the RSA. Therefore, a variable for distance to riparian was redundant and was not included in the model.

Elevation was considered as a variable for inclusion in the model. In winter, moose generally occur at lower elevations to minimize the energetic costs of travelling through deep snow. Moose generally start avoiding areas with >70 cm of snow and rarely occur in areas with >100 cm. However, elevation within the rolling topography of the RSA does not vary substantially (range = 343–752 masl) and was likely not a significant driver of moose distribution. Therefore, elevation was not included as a variable in the model.

Slope was considered as a variable for inclusion in the model. Moose avoid very steep slopes (i.e., generally >35 degrees). In more southerly locations, moose will select moderately steep, south aspect slopes in winter where the combination of slope and aspect reduces snow depth and favours shrubby browse cover. However, steep slopes >35 degrees do not occur in the area, and south aspect slopes do not play a significant role in snow depths at this northern latitude. Therefore, slope was not included as a variable in the model.

Linear features were considered for inclusion in the model. LFs were surveyed in the RSA as a companion study for exploration project proposal (EDI Environmental Dynamics, unpublished study). LFs that were classified as 2D had an average width of 5.4 m and, under normal succession, had greater mean shrub cover than the corresponding off-line sites. The 3D lines had narrower widths and were not as shrubby, or shrubs

were not consistent in shrub cover and species present. The few winter roads also were not consistent in available browse species. The greater shrub cover does not signify the presence of higher quality browse species such as willows. The combination of shrub species cover found within LFs, and the small extent of LF did not warrant including them as a variable in the model because these two factors would not substantially affect habitat use by moose.

Table 5-3. Summary of habitat variables commonly associated with moose habitat suitability from published literature relevant to the Regional Study Area.

Habitat Variable	Ecological Rational	Included in Model (Yes or No)
Ecosystem Unit (ELC)	Ecosystems units have specific vegetation communities associated with them and are the best predictor of winter browse species occurrence.	Yes
Structural Stage (ELC)	Moose typically select shrub structural stages or open mature forest habitats as forage habitat.	Yes
Distance to Riparian	Any shrubby feature influenced by a creek or stream was given a riparian code in the ELC. ELC data more accurately represent increased habitat quality in riparian forests than the distance to riparian	No
Elevation	Elevation can strongly affect snowpack depth, with depths >70 cm limiting winter movements by moose. The limited range in elevation within RSA (343 – 752 m), combined with average winter snowpacks just reaching critical depths for moose, is assumed to be insufficient to affect moose distribution in winter.	No
Slope	Moose avoid steep slopes (>35%) and prefer south-facing slopes. A combination of slope and aspect reduces snow depth and favors shrubby browse cover. However, steep slopes >35 degrees do not occur in the area, and south aspect slopes do not play a significant roll in snow depths at this northern latitude.	No
Fire History (ELC)	Fire may increase forage habitat quality for moose, but it is dependent on time since the disturbance and ecosystem unit. The ELC mapping accounts for the fire history by using the structural stage and a disturbance code.	Yes
Linear features	Moose may avoid linear features due to increased predation risk depending on the region. Linear features may provide foraging opportunities. Linear features within the RSA may affect habitat quality positively or negatively, dependent on ecosystem unit and time since disturbance.	No

5.3.2.1 Ecological and Landscape Classification Based Variables

Ecosystems units have specific vegetation communities associated with them and are the best predictor available of winter browse species occurrence. Moose typically select shrub structural stages or open mature forest habitats as forage habitats. The ecosystem unit and structural stage variables are based on the recently completed ELC mapping of the RSA. A summary of ELC methods and results are presented here. Refer to

the separate baseline report for more detailed information about the ELC mapping (EDI Environmental Dynamics Inc 2021).

Ecosystem Unit Variable

ELC mapping refers to an integrated approach to mapping and classifying units of land according to their ecological similarity (Environment Yukon 2016a). ELC mapping aims to provide information on the biological and physical characteristics of various landscape components to facilitate a range of interpretations and assist in sustainable management (Rowe and Sheard 1981, Environment Yukon 2016a). For example, defining ecosystem units (i.e., ecosites, ecological communities) with similar vegetation, site and soil characteristics can provide information on the current condition of vegetation, can facilitate the development of vegetation mitigation measures during infrastructure development and aid in assessing habitat suitability for wildlife across a landscape.

To best meet the needs of the Project, a manual ELC mapping approach was completed, where mappers examine and interpret digital ortho-imagery to delineate and attribute polygons with ecological information manually. Using existing GIS datasets, this method typically provides a higher level of detail and accuracy than predictive modelling approaches. The mapping and classification methodology conforms to the Yukon Ecological and Landscape Classification and Mapping Guidelines, Version 1.0 (Environment Yukon 2016a), and the Standard for Terrestrial Ecosystem Mapping in British Columbia (Resources Inventory Committee 1998b) were used as guidelines.

To complete the ELC mapping of the RSA, new broad-ecosystem classification units were developed that had similar floristic composition and clearly interpretable ecological context in terms of site-scale climate, landscape position, substrate, hydrology conditions, and moisture and nutrient regimes. The goal was to develop Project-specific ecosystem units representing the range of ecological communities within the RSA while being reliably and repeatedly identifiable from a mapping perspective. The final ELC system used for the Project merged the methodology outlined by the YBEC system with aspects of the BEC system used in BC and referenced some of the existing units.

The most common ecosystem unit mapped in the RSA is Moist Spruce – Labrador Tea (Code 33) (44%) followed by Moist Spruce – Alder – Labrador Tea (Code 34) (12%) and Mesic Black Spruce – Alaska Paper Birch (Code 04) (9%) (Table 5-4). The least common (0%) ecosystem units mapped in the RSA are Dry Sparsely Vegetation (Code 10) and Mesic Birch – Willow (Code 02), and Moist Birch – Willow (Code 36). Both Birch – Willow ecosystem units are influenced by anthropogenic disturbances. Other less common ecosystem units that occur more naturally are Dry Aspen (Code 17), Mesic White Spruce – Alaska Paper Birch – Alder (Code 03), and Wet Shrub Scrub Birch – Graminoid (Code 45).

Table 5-4. Ecosystem units mapped in the Eagle Plains RSA.

Code	Name	Total Area (ha)	% of RSA	Average percent cover of *Salix* sp.
10	Sparsely Vegetated	2.6	0.0	No data
14	Dry Spruce-Lichen (Conifer)	1,826.5	0.8	5.3%
15	Dry Aspen-Lichen (Deciduous)	280.8	0.1	No data
16	Dry Spruce-Birch-Lichen (Mixedwood)	2,103.6	0.9	4.5%
17	Dry Aspen (Deciduous)	80.1	0.0	No data
02	Mesic Birch - Willow	90.5	0.0	22.0%
03	Mesic White Spruce – Alaska Paper Birch – Alder	98.3	0.0	No data
04	Mesic Black Spruce – Alaska Paper Birch (Mixedwood)	21,150.0	8.9	4.6%
05	Mesic Alaska Paper Birch (Deciduous)	11,496.0	4.8	12.5%
06	Mesic Black Spruce – Labrador Tea (Conifer)	7,463.5	3.1	12.2%
20	Shrubby Riparian Birch – Willow	860.2	0.4	27.6%
21	Riparian White Spruce – Prickly Rose	192.1	0.1	12.0%
22	Riparian Spruce – Birch - Willow	674.4	0.3	15.3%
23	Drainage Shrubby Riparian	4,454.2	1.9	57.0%
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	9,129.9	3.8	14.2%
33	Moist Spruce – Labrador Tea	103,696.5	43.5	6.6%
34	Moist Spruce – Alder – Labrador Tea	27,428.6	11.5	6.0%
35	Moist Spruce – Scrub birch – Labrador Tea	12,163.3	5.1	5.5%
36	Moist Birch – Willow	33.4	0.0	39.0%
41	Wet Shrub – Tamarack	177.3	0.1	1.7%
42	Wet Shrub – Black Spruce – Tussock Cottongrass	14,517.0	6.1	4.3%
43	Wet Shrub – Black Spruce - Sphagnum	3,315.6	1.4	5.6%
44	Wet Shrub – Scrub Birch – Tussock Cottongrass	6,844.7	2.9	8.3%
45	Wet Shrub – Scrub Birch – Graminoid	98.7	0.0	10.0%
46	Wet Black Spruce – Labrador Tea – Cladonia	2,498.0	1.0	7.0%
47	Wet Black Spruce – Tussock Cottongrass – Sphagnum	4,232.3	1.8	4.0%
48	Wet Black Spruce – Carex	196.6	0.1	14.0%
B1	Bog – Black spruce – Lichen	764.7	0.3	0.0%
B2	Bog – Black Spruce – Sphagnum	1,960.9	0.8	2.0%

Code	Name	Total Area (ha)	% of RSA	Average percent cover of *Salix* sp.
F	Fen	42.5	0.0	9.0%
M	Marsh	59.5	0.0	3.2%
AN	Anthropogenic	34.9	0.0	0
ES	Exposed Soil	14.5	0.0	0
Fa	Flood Active Channel	5.1	0.0	No data
LA	Lake	6.5	0.0	0
PD	Pond	130.4	0.1	0
RI	River	457.1	0.2	0
RZ	Road	58.9	0.0	0
	Total Area	238,640		

Structural Stage Variable

Within the ELC database, the structural stage attribute (Table 5-5) describes the appearance of a stand or vegetation community and defined by the codes and criteria listed in the Field Manual for Describing Yukon Ecosystems (Environment Yukon 2017).

Most of the RSA is mapped in a Shrub structural stage (74%), with 45% of the RSA in a Low Shrub structural stage (Table 5-5). Approximately 1% of the RSA is in an Old Forest structural stage, and 21% is in a Mature Forest structural stage.

Table 5-5. Structural stages mapped in the Eagle Plains RSA.

Code	Structural Stage	Criteria	Area (ha)	% of RSA
1	Non-vegetated	No vegetation or less than 5% established vegetation, often due to recent disturbance (e.g., placer mining) or unvegetated rock.	8.0	0
2	Sparse / cryptogram	Either the initial stages of primary and secondary succession or a cryptogram community maintained by environmental conditions; sparsely vegetated or dominated by bryophytes and lichens; may be prolonged where there is little or no soil development (e.g., bedrock).	76.9	0.03
2a	Sparse (5–10% vegetation cover)	5–10% vegetation cover.	2.6	0
2b	Bryoid	Bryophyte-dominated	0	0
2c	Lichen	Lichen-dominated	0	0

Code	Structural Stage	Criteria	Area (ha)	% of RSA
3	Herb	Early successional stage or herbaceous communities maintained by environmental conditions or disturbance (e.g., wetlands, post-fire forest succession); herb dominated, including forbs, graminoids and ferns; some invading or residual shrubs and trees may be present but are usually sparse or absent; many herbaceous communities are continually maintained in this stage.	7.8	0
3a	Forb - dominated	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by non-graminoid herbs, including ferns.	0	0
3b	Graminoid – dominated	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by grasses, sedges, reeds and rushes.	161.1	0.07
3c	Aquatic	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by floating or submerged aquatic plants; does not include sedges growing in marshes with standing water.	0	0
3d	Dwarf shrub	Communities dominated (greater than 1/2 of the total herb cover) by dwarf woody species, such as kinnikinnick or dwarf willows.	0	0
4	Shrub	Early successional stage or shrub communities maintained by environmental conditions or disturbance (e.g., wetlands, flooding, post-fire forest succession); dominated by shrubby vegetation; either dominated by shrubby vegetation, including tree seedlings/saplings, or if sparsely vegetated overall, the dominance of shrubs characterizes the community as a shrubland. This may include sites where trees are stunted due to the presence of permafrost, preventing the stand from reaching a higher structural stage.	10,196.7	4.3
4a	Tall shrub	Communities dominated by tall shrub layer vegetation - woody plants > 2m tall and ≤ 7 cm dbh; may be a successional stage or may be in this stage perpetually due to environmental conditions or disturbance.	57,934.3	24.3
4b	Low shrub	Communities dominated by low shrub layer vegetation - woody plants < 2m tall; may be a successional stage or may be in this stage perpetually due to environmental conditions or disturbance.	107,861.2	45.2
5	Pole sapling	Trees > 5m tall and > 7 cm dbh, typically densely stocked. Self-thinning and vertical structure are not yet evident in the canopy. Younger stands are vigorous (usually > 15–20 years old); older stagnated stands (up to 100 years old) are also included; time since disturbance usually < 40 years; up to 100+ years for dense (5000 – 15000+ stems per ha) stagnant stands.	554.8	0.2
6	Young Forest	Self-thinning has become evident, and the forest canopy has begun to differentiate into distinct layers. A more open stand than the pole/sapling stage.	8,322.6	3.5

Code	Structural Stage	Criteria	Area (ha)	% of RSA
7	Mature Forest	Trees established after the last stand-replacing disturbance have matured; a second cycle of shade tolerant trees may have become established; shrub and herb understories become well developed as the canopy opens up.	50,518.9	21.2
8	Old Forest	Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstory. Fire maintained stands may have a 'single-storied' appearance. Very old stands having complex structure with abundant large-sized trees, snags and CWD; snags and CWD occurring in all stages of decomposition; stands are comprised entirely of shade-tolerant overstory species with well-established canopy gaps.	2,302.7	1.0
n/a	Not Applicable (River, etc.)		692.4	0.3
	Total RSA		**238,640**	

5.3.2.2 Fire History

Fire disturbance was considered as a variable in the model. Numerous studies in boreal and sub-boreal regions have found that moose select areas regenerating from fires. Recent burns and post-fire clearings are generally considered optimal foraging habitat for moose. Forest fires are a significant component of the landscape ecology of the Eagle Plains Ecoregion. Typically, regenerating burns contain higher cover of shrubby browse species than undisturbed areas. This includes both deciduous shrubs like willow, as well as sapling deciduous trees like aspen and paper birch. Although burns are classified as Low and Tall Shrub in the ELC, structural stage alone does not uniquely identify them. Large extents of disclimax, stunted black and white spruce ecosystem unit types were also classified as Tall Shrub.

Numerous studies and data from the ELC mapping, indicate that fire disturbance results in increased shrubby browse cover during the Low and Tall Shrub structural stages of regeneration, and that regenerating burns are selected by moose in winter. Therefore, fire disturbance was included in the model.

5.3.3 WILDLIFE HABITAT RATINGS

Qualitative, categorical habitat suitability ratings were developed for each combination of ecosystem unit and structural stage in a lookup table format. For the Shrub structural stages separate ratings were provided depending on whether the area was recently burned or not. The difference in the amount of browse cover was minimal in other structural stages according to burn status and burned and unburned areas were rated equivalently. The development of ratings was based on expert opinion and primarily by the following assumptions:

- Winter habitat suitability is primarily driven by the amount of shrubby browse species that are predicted to occur and especially the percent cover of willow species. The average percent cover

of willow species by ecosystem unit per structural stage was calculated using vegetation data collected during baseline surveys (Section 5.6.1).

- Low shrub structural stages, including disclimax shrublands (wetlands and shrubby drainages) and regenerating burns, generally offer the highest value forage and are generally rated High.
- The suitability of tall shrub areas depends on disturbance status. Tall shrub areas regenerating from fire disturbance are also rated Moderate (mostly) to High, depending on the ecosystem unit. However, Tall shrub stages also include extensive areas of disclimax stunted spruce (including multiple EUs) that generally offer low to moderate browse species, which are rated accordingly.
- Older structural stages (5–8) can have similar browse and are mostly rated depending on the EU (Table 5-4). On average stage 7 and 8 tend to have slightly more browse than stages 5 and 6.

Every combination of ecosystem unit and structural stage was assigned in initial habitat suitability score based on a 6-class rating scheme (Table 5-6). If there was no structural stage listed for an ecosystem unit, it received a rating of 6 (Nil) for moose winter forage.

The extent of areas with high cover of preferred browse species (mostly willow) is limited in the RSA. The ecosystem unit by structural stage combinations with >15% willow cover was generally rated High (1) and Moderately High (2) and account for only 12% of the extent in the RSA (Photo 5-5 to Photo 5-9). Large extents of the RSA have relatively low willow cover of 5–15% and were rated as Moderate (3) and Low (4) (Photo 5-10 to Photo 5-14). Differentiating the classifications between Low and Moderate was difficult because the differences in willow presence among different sites were not consistent, and variation in willow cover within the same site type was large (i.e., resulting in overlapping confidence intervals across sites). The basis for classifying sites as Low or Moderate considered (i) average cover of willow from field plots (>7% favouring classification to Moderate), (ii) fire history (fire disturbance within 40 years favouring classification to Moderate), and (iii) a qualitative assessment of the potential for each EU and structural stage combination to support willow and other browse species.

Although Moderate and Low rated habitats have relatively low cover of willow in an absolute sense, they likely provide a substantial proportion of total winter forage for moose in the RSA due to the large extents that Moderate and Low suitability habitats cover. That is, in Eagle Plains the overall, total availability of winter forage for moose appears to be distributed in relatively low levels across large portions of the RSA, versus being concentrated in relatively small portions of the landscape, which is typical in more mountainous portions of Yukon.

Overall, EUs in sparsely vegetated or herbaceous structural stages, non-vegetated EUs and certain wetland EUs were assigned Very Low (5) or Nil (6) ratings unless the presence of willow cover was observed (Photo 5-15 and Photo 5-16).

The effect of fire disturbance in boreal ecosystems in enhancing moose browse as the stand regenerates through the low shrub and tall shrub structural stages are well documented. Although evidence of this was observed in Eagle Plains, the degree to which regenerating burns resulted in an elevated cover of browse

species was somewhat muted compared to values reported in other studies. For example, for the most extensive EU, Moist Spruce-Labrador Tea (code 33) (comprising 43% of the RSA), the average percent cover of willow was 11% in burns compared to 6% in unburned areas (Photo 5-11 and Photo 5-12). Similar patterns were evident for most other moist and wet EUs. On average, fire disturbance resulted in a modest increase in willow cover. As a result, areas with fire disturbance within the last 40 years were generally rated one class higher than unburned areas. Most frequently, this resulted in a rating change from Low to Moderate.

Table 5-6. Moose Habitat Ratings Table.

Map Code	Ecosystem Unit Name	Structural Stage														
		1	**2**	**2a**	**3**	**3b**	**4**	**4a**	**4b**	4_F	4a_F	4b_F	**5**	**6**	**7**	**8**
02	Mesic Birch – Willow	6	6	6	6	4	1	1	1	1	1	1	2	2	3	3
03	Mesic White Spruce – Alaska Paper Birch – Alder	6	6	6	6	5	3	3	3	3	3	3	4	4	3	3
04	Mesic Black Spruce – Alaska Paper Birch	6	6	6	6	5	3	3	3	3	3	3	4	4	3	3
05	Mesic Alaska Paper Birch	6	6	6	6	5	2	2	2	2	2	2	3	2	2	2
06	Mesic Black Spruce – Labrador Tea	6	6	6	6	5	3	3	3	2	2	2	4	4	4	3
10	Sparsely Vegetated	6	6	6	6	5	4	4	4	4	4	4	5	5	5	5
14	Dry Spruce – Lichen	6	6	6	6	5	4	4	4	3	3	3	4	4	3	3
15	Dry Aspen – Lichen	6	6	6	6	5	3	3	3	3	3	3	4	4	3	3
16	Dry Spruce – Birch – Lichen	6	6	6	6	5	4	4	4	3	3	3	4	4	3	3
17	Dry Aspen	6	6	6	6	5	3	3	3	3	3	3	4	4	3	3
20	Shrubby Riparian Birch – Willow	6	6	6	6	4	1	1	1	1	1	1	2	2	2	2
21	Riparian White Spruce – Prickly Rose	6	6	6	6	4	1	1	1	1	1	1	2	2	2	2
22	Riparian Spruce – Birch – Willow	6	6	6	6	4	1	1	1	1	1	1	2	2	1	1
23	Drainage Shrubby Riparian	6	6	6	6	4	1	1	1	1	1	1	2	2	2	2
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	6	6	6	6	4	2	2	2	2	2	2	3	3	3	3
33	Moist Spruce – Labrador Tea	6	6	6	6	4	4	4	4	3	3	3	3	3	3	3
34	Moist Spruce – Alder – Labrador Tea	6	6	6	6	5	4	4	4	3	3	3	4	4	4	4
35	Moist Spruce – Scrub Birch – Labrador Tea	6	6	6	6	5	4	4	4	3	3	3	4	4	4	4
36	Moist Birch - Willow	6	6	6	6	4	1	1	1	1	1	1	2	2	3	3
41	Wet Shrub – Tamarack	6	6	6	6	5	5	5	5	4	4	4	5	5	5	5
42	Wet Shrub \ Black Spruce – Tussock Cottongrass	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
43	Wet Shrub \ Black Spruce – Sphagnum	6	6	6	6	5	4	4	4	3	3	3	4	4	4	4

Map Code	Ecosystem Unit Name	Structural Stage														
		1	**2**	**2a**	**3**	**3b**	**4**	**4a**	**4b**	4_F	4a_F	4b_F	**5**	**6**	**7**	**8**
44	Wet Shrub \ Scrub Birch – Tussock Cottongrass	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
45	Wet Shrub \ Scrub Birch – Graminoid	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
46	Wet Black Spruce – Labrador Tea – Cladonia	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
47	Wet Black Spruce – Tussock Cottongrass – Sphagnum	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
48	Wet Black Spruce - Carex	6	6	6	6	4	3	3	3	3	3	3	4	4	3	3
B1	Bog – Black Spruce – Lichen	6	6	6	6	5	5	5	5	4	4	4	5	5	5	5
B2	Bog – Black Spruce – Sphagnum	6	6	6	6	5	5	5	5	4	4	4	5	5	5	5
F	Fen	6	6	6	6	4	5	5	5	4	4	4	5	5	5	5
M	Marsh	6	6	6	6	5	5	5	5	5	5	5	5	5	5	5
AN	Anthropogenic	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
ES	Exposed Soil	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Fa	Flood Active Channel	6	6	6	6	4	3	3	3	3	3	3	4	4	4	4
LA	Lake	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
PD	Pond	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
RI	River	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
RZ	Road	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6



Photo 5-5. Low shrub – shrubby riparian birch – willow habitat (code 20) rated as High winter forage habitat.



Photo 5-6. Low shrub – drainage shrubby riparian habitat (code 23) rated as High winter forage habitat.



Photo 5-7. Tall shrub – moist birch – willow habitat (code 36) rated as High moose winter forage.



Photo 5-8. Low shrub – moist shrub\scrub birch – Labrador tea – willow habitat (code 31) rated as Moderately High moose winter forage.



Photo 5-9. Young forest – mesic Alaska paper birch habitat (code 05) rated as Moderately High moose winter forage.



Photo 5-10. Mature forest – wet black spruce – carex habitat (code 48) rated as Moderate moose winter forage.



Photo 5-11. Shrubby burnt – moist spruce – Labrador tea habitat (code 33) rated as Moderate moose winter forage habitat (note that this is not rated higher than Moderate because much of the shrub cover is less preferred scrub birch).



Photo 5-12. Unburnt – moist spruce – Labrador tea habitat (code 33), in Tall Shrub structural stage, was rated as low moose winter forage habitat.



Photo 5-13. Tall shrub – wet black spruce – tussock cottongrass – Sphagnum habitat (code 47) rated as low moose winter forage habitat.



Photo 5-14. Mature forest – mesic black spruce – Labrador tea habitat (code 06) rated as low moose winter forage



Photo 5-15. Low shrub – bog – black spruce – Sphagnum habitat (code B2) rated as very low moose winter forage.



Photo 5-16. Low shrub – bog – black spruce – lichen habitat (code B1) rated as very low moose winter forage.

5.3.4 MODEL STRUCTURE

In the ELC map, each polygon contains up to three components. For example, a polygon could contain 80% EU34-Moist Spruce – Alder – Labrador Tea and 20% EU22-Shrubby Riparian Birch – Willow. These composite polygons occur because the pattern of ecosystem distribution occurs as a set of small patches that are too small to map as separate individual polygons. To account for this issue of composite polygons, habitat ratings were applied in two ways (1) an area weighted average of the habitat suitability scores for the components within each polygon, and (2) the proportion of High suitability habitat in each polygon.

The area-weighted average score was calculated using the habitat suitability scores from Table 5-2 and the decile proportion for each polygon component, following equation:

$$ELC_r = \frac{\sum_{i=1}^{n} w_i X_i}{\sum_{i=1}^{n} w_i}$$

Where ELC_r is the weighted average score, w_i is the decile proportion for each polygon component, and X_i is the habitat rating for each polygon component from Table 5-2. An example is provided in Table 5-7 for a polygon with two components:

Although this weighted average approach is a good approach for summarizing average habitat suitability across the study area, it has the disadvantage that, with the averaging process, you lose track of the occurrence of small extents of High suitability areas. This issue is addressed in the second version of model outputs, mapping the proportion of High suitability habitats within each polygon.

The two types of outputs compliment each other for assessment and management at different scales. The weighted average output is intended to be used for strategic assessments and planning, such as assessing the overall effects of the Project on moose habitat, or to compare the relative suitability of moose habitat in one sub-watershed to another. The proportion of High suitability habitat can be used to support finer-scale operational measures, such as locating roads and well sites to avoid high suitability winter moose habitat.

Although the initial habitat ratings for each ecosystem unit/structural stage/fire disturbance combination used a 6-class rating scheme, the composite ratings of the ELC polygon scores were generalized to a 4-class system for simpler interpretation, essentially combining Moderately High and High, and Nil and Very Low.

Due to the small size of many of the High and Moderately High habitats areas, they were frequently formed the second or third component of composite ELC polygons. Consequently, these areas of High were often 'lost' when calculating the weighted average rating for the polygon (i.e., the polygon they were in ended up being rated Moderate or even Low overall). To account for this issue, the amount and location of High and Moderately High areas were examined separately from the polygon weighted average score. This was done by mapping the amount of High and Moderately High areas in each polygon. For example, a polygon with a weighted average habitat score of Low, might contain 20% High+Moderately High.

Table 5-7. An example of a multiple component polygon habitat scoring.

Component	Proportion	Ecosystem Unit	Structural stage	Burn Status	Habitat Score
1	0.8	Moist Spruce – Alder – Labrador Tea	Tall Shrub	Not Burnt	30
2	0.2	Shrubby Riparian Birch – Willow	Low Shrub	Not Burnt	95

ELCr = 0.8*30 + 0.2*95 = 43, which corresponds to an overall categorical rating of Low

5.4 RESULTS AND DISCUSSION

The amounts of predicted moose winter habitat in the RSA are presented for the finer-scale 6-class rating scheme before averaging scores within ELC polygons in Table 5-8, and the consolidated 4-class rating scheme after averaging scores within ELC polygons, in Table 5-9. As mentioned in the Methods, the 4-class scheme essentially combines the High and Moderately High classes and the Nil and Very Low from the 6-class scheme. The 6-class scheme was originally used because it was assumed that there would be greater amounts of areas in the high and low ends of the habitat suitability gradient. However, since the amounts of highest and lowest suitability habitat are so low (i.e., 2.5% High and 0.4% Nil) it makes sense to use the 4-class scheme from this point forward.

The model results indicate that High-suitability winter moose habitat (12%) is limited, and that the remaining area is approximately split between Moderate and Low, with Nil/Very Low areas only accounting for approximately 1% of the RSA. The distribution of winter moose habitat shows clear spatial patterns across the RSA, when examining the average habitat suitability scores across ELC polygons (Map 5-1) and the percent of High-suitability habitats occurring in each polygon (Map 5-2 and Map 5-3). In the map of the average suitability scores (Map 5-1), areas of Moderate suitability are concentrated in the southern half and along the western and northern boundary in the northern portion of the RSA. These areas often correspond to regenerating burns. In the northern half of the RSA, much of the Chance Creek watershed is rated Low, corresponding to a lack of fire disturbance and dominance of open canopy, stunted spruce ecosystems, which offer limited browse for moose. High-suitability winter habitat is found scattered across the RSA, generally in much smaller patches than areas of Moderate and Low. High suitability areas are often in narrow riparian strips along streams and non-confined drainage areas (Map 5-2), but also includes certain deciduous and mixed-wood ecosystem units, like the Mesic Alaska Paper Birch (code 05), which accounts for the concentration of High suitability habitats in the northwest portion of Map 5-3.

This pattern of having a relatively large portion of the landscape in Moderate suitability winter habitat is different than occurs in other parts of Yukon, especially in more mountainous areas, where suitable winter habitat (i.e., High and Moderate suitability) are often constrained by elevation, snow depths and greater distribution of diverse vegetation communities (McCulley et al. 2017). In Eagle Plains, a substantial amount (74%) of the RSA is in a shrub structural stage mostly dominated by scrub birch and Labrador tea and almost half (44%) of the RSA is described as the Moist Spruce – Labrador tea ecological unit which are large areas with relatively low willow cover (i.e., the Moderate suitability areas).

The pattern of winter habitat across the RSA is likely to affect the broad distribution of moose. Due to the scattered occurrence of High suitability habitat across the RSA, some moose are expected to occur across the RSA. However, local densities are likely to be vary in relation to the portions of Low and Moderate that form the matrix of habitat at a larger scale. Where most of the habitat matrix is Low, such as across most of the Chance watershed, moose densities are expected to be relatively low and habitat use is expected to be largely constrained to the scattered patches of High. Where most of the habitat matrix is Moderate, such as the southern half of the RSA, moose densities are expected to be substantially higher; and, although moose use is

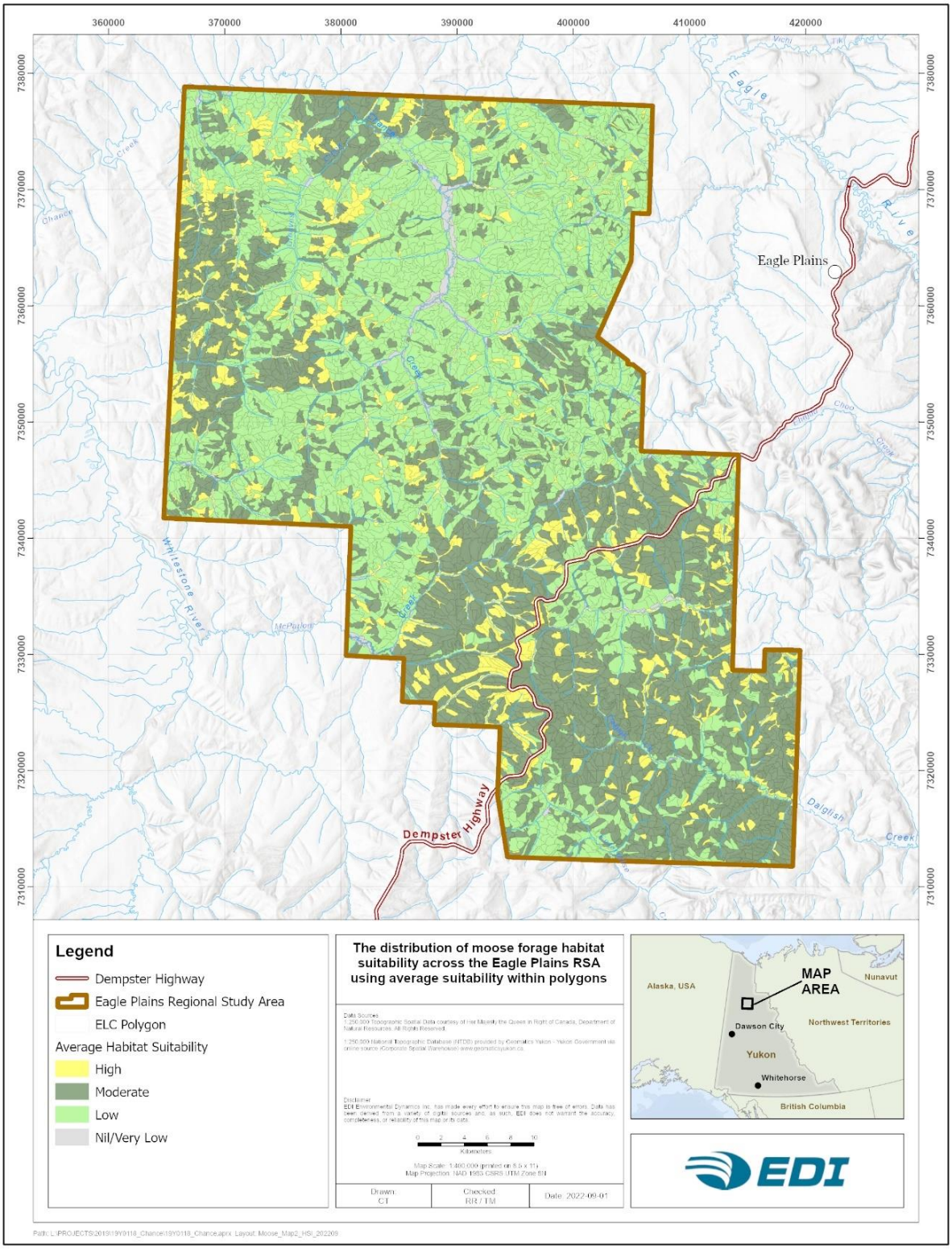
expected to still be relatively higher in the High habitats, considerable use of the Moderate suitability matrix is also expected.

Table 5-8. Estimated amounts of moose winter forage habitat across the Eagle Plains RSA using a 6-class rating scheme.

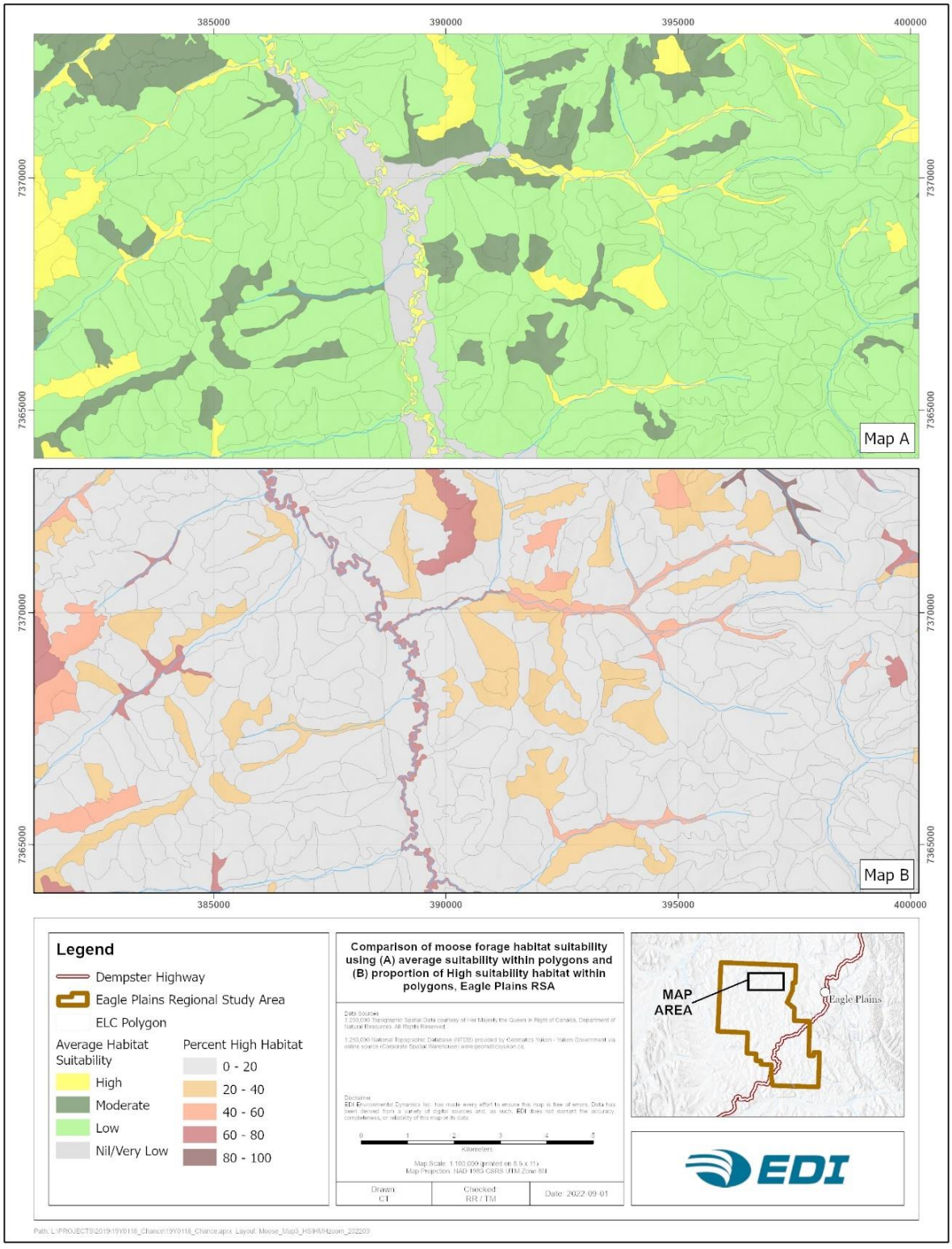
Habitat Rating	Area (ha)	Area (% of RSA)
High	5,961.9	2.5%
Moderately High	23,736.7	9.9%
Moderate	111,561.7	46.7%
Low	94,068.2	39.4%
Very Low	2,492.4	1.0%
Nil	842.6	0.4%
Total Area	238,663.5	100%

Table 5-9. Estimated amounts of moose winter forage habitat across Eagle Plains RSA averaging suitability scores within ELC polygons and generalizing to a 4-class rating scheme.

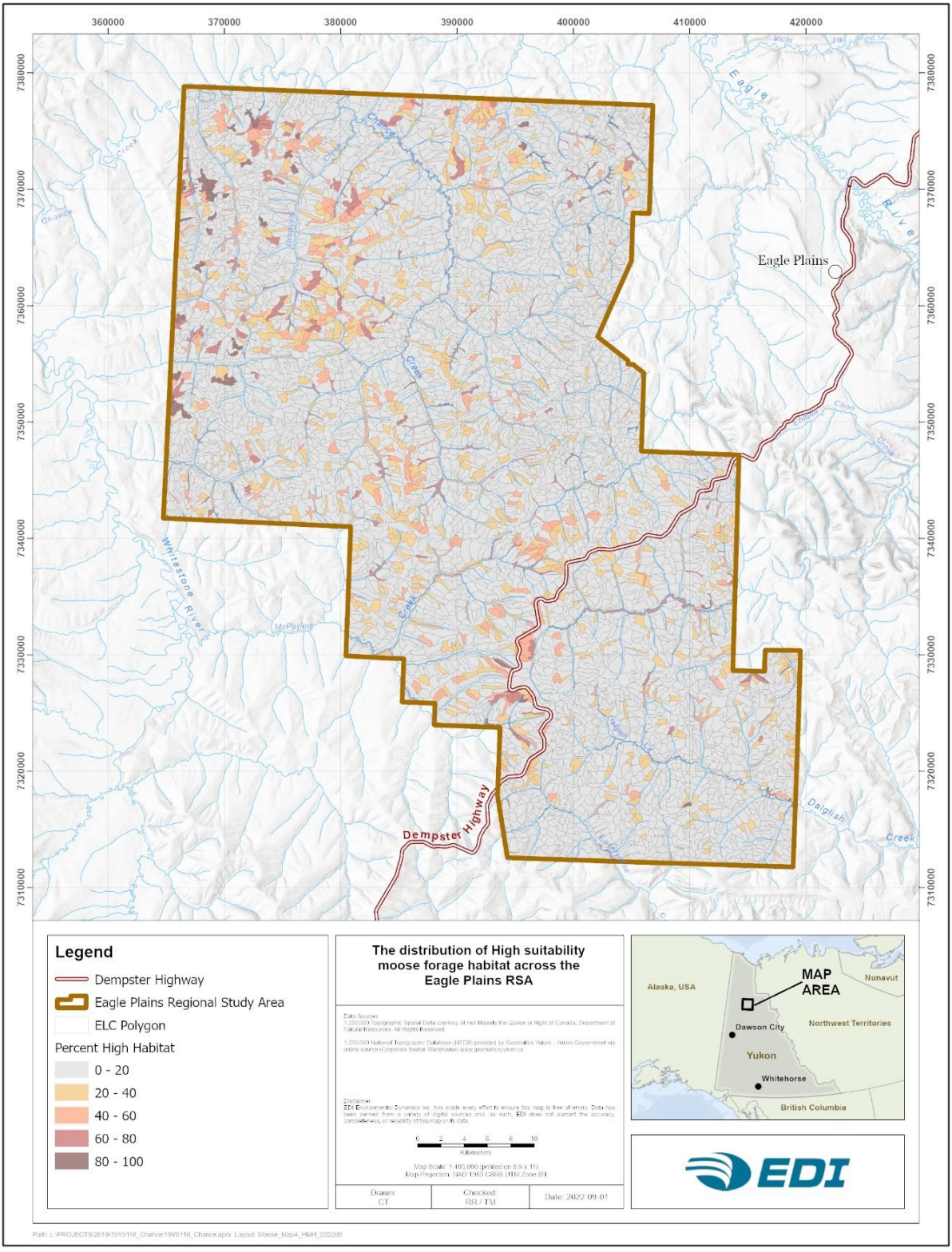
Average Habitat Suitability	Area (ha)	Area (% of RSA)
High	16,944.4	7.10%
Moderate	145,394.1	60.92%
Low	74,514.5	31.22%
Nil/Very Low	1,810.5	0.76%
Total	238,663.5	100%



Map 5-1. The distribution of moose forage habitat suitability across the Eagle Plains RSA using average suitability within polygons.



Map 5-2. Comparison of moose forage habitat suitability using (A) average suitability within polygons and (B) proportion of High suitability habitat within polygons, Eagle Plains RSA.



Map 5-3. The distribution of High suitability moose forage habitat across the Eagle Plains RSA.

5.5 SUMMARY

The suitability, amount, and distribution of potential habitat for moose were quantified across the RSA using a habitat suitability model. The habitat model was for foraging habitat during winter because this life requisite and season are believed to be the most limiting to moose in the RSA. The model consisted of qualitative ratings applied to combinations of three variables from the ELC mapping: ecosystem unit, structural stage and fire disturbance. High suitability habitats consisted of disclimax shrublands, most commonly associated with riparian areas. Moderate suitability habitats were dominated by regenerating burns but also included small areas of mixed and deciduous forests with shrubby understories. Low suitability habitats were mostly open canopy, stunted spruce forests. High-suitability moose winter foraging habitat is limited across the RSA (12%), but Moderate habitat is extensive (43%). Although moose are expected to select the High-suitability areas preferentially, a substantial amount of total winter forage appears to occur within large areas with relatively low willow cover (i.e., the Moderate suitability areas). Due to the scattered occurrence of High-suitability habitat across the RSA, some moose are expected to occur across the RSA in winter. However, local densities are likely to vary with the portions of Low and Moderate habitats that form the habitat matrix at a larger scale.

5.6 MOOSE SECTION ATTACHMENTS

5.6.1 ATTACHMENT 5–A — WILLOW SPECIES PERCENT COVER

Attachment Table 3. Calculated percent willow cover for each ecosystem unit by structural stage based on collected vegetation baseline data. In some cases, no data was collected (NDC) since no ground plots were established within the EU or within a specific structural stage.

Map Code	Ecosystem Unit Name	Structural Stage											Total #Plots
		1	2	2a	3	3b	4a	4b	5	6	7	8	
02	Mesic Birch – Willow	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	22.0 n=2	NDC	2
03	Mesic White Spruce – Alaska Paper Birch – Alder	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	0
04	Mesic Black Spruce – Alaska Paper Birch	NDC	NDC	NDC	NDC	0.0 n=1	5.0 n=1	4.0 n=3	NDC	0.0 n=2	5.2 n=9	4.4 n=6	22
05	Mesic Alaska Paper Birch	NDC	NDC	NDC	NDC	NDC	9.5 n=2	NDC	NDC	13.7 n=3	13.3 n=5	NDC	10
06	Mesic Black Spruce – Labrador Tea	NDC	NDC	NDC	NDC	NDC	38.0 n=3	12.6 n=5	1.0 n=1	0.0 n=2	3.5 n=6	5.0 n=1	18
10	Sparsely Vegetated	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	0
13		NDC	NDC	NDC	NDC	NDC	7.0 n=1	8.5 n=2	NDC	NDC	NDC	0.0 n=1	4
14	Dry Spruce – Lichen	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	2.0 n=3	6.0 n=5	8.0 n=4	12
15	Dry Aspen – Lichen	NDC	0.0 n=1	NDC	NDC	NDC	0.0 n=1	NDC	NDC	NDC	NDC	NDC	2
16	Dry Spruce – Birch – Lichen	NDC	NDC	NDC	NDC	NDC	NDC	NDC	8.0 n=2	0.0 n=1	1.0 n=1	NDC	4
17	Dry Aspen	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	0.0 n=1	NDC	NDC	1
20	Shrubby Riparian Birch – Willow	NDC	NDC	NDC	NDC	NDC	33.0 n=1	26.3 n=4	NDC	NDC	NDC	NDC	5
21	Riparian White Spruce – Prickly Rose	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	12.0 n=6	6
22	Riparian Spruce – Birch – Willow	NDC	NDC	NDC	NDC	NDC	NDC	NDC	1.0 n=1	NDC	26.7 n=4	5.5 n=2	7
23	Drainage Shrubby Riparian	NDC	NDC	NDC	NDC	NDC	NDC	57.0 n=1	NDC	NDC	NDC	NDC	1
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	NDC	NDC	NDC	NDC	NDC	NDC	14.2 n=6	NDC	NDC	NDC	NDC	6
33	Moist Spruce – Labrador Tea	NDC	NDC	NDC	NDC	4.0 n=1	3.2 n=11	8.6 n=12	NDC	9.0 n=2	7.1 n=21	6.3 n=3	38
34	Moist Spruce – Alder – Labrador Tea	NDC	NDC	NDC	NDC	NDC	11.0 n=3	5.5 n=4	NDC	NDC	3.2 n=7	0.0 n=1	15
35	Moist Spruce – Scrub Birch – Labrador Tea	NDC	NDC	NDC	NDC	NDC	7.0 n=4	7.3 n=3	NDC	NDC	4.2 n=9	NDC	16

Map Code	Ecosystem Unit Name	Structural Stage											Total #Plots
		1	2	2a	3	3b	4a	4b	5	6	7	8	
36	Moist Birch - Willow	NDC	NDC	NDC	NDC	NDC	43.0 n=1	NDC	NDC	35.0 n=1	NDC	NDC	2
41	Wet Shrub – Tamarack	NDC	NDC	NDC	NDC	NDC	NDC	1.7 n=5	NDC	NDC	0.0 n=1	NDC	6
42	Wet Shrub \ Black Spruce – Tussock Cottongrass	NDC	NDC	NDC	NDC	3.0 n=1	3.0 n=5	4.8 n=13	NDC	NDC	NDC	NDC	19
43	Wet Shrub \ Black Spruce – Sphagnum	NDC	NDC	NDC	NDC	NDC	5.0 n=4	6.5 n=9	NDC	NDC	NDC	NDC	13
44	Wet Shrub \ Scrub Birch – Tussock Cottongrass	NDC	NDC	NDC	NDC	NDC	NDC	8.3 n=19	NDC	NDC	NDC	NDC	19
45	Wet Shrub \ Scrub Birch – Graminoid	NDC	NDC	NDC	NDC	NDC	NDC	10.0 n=1	NDC	NDC	NDC	NDC	1
46	Wet Black Spruce – Labrador Tea – Cladonia	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	6.3 n=5	8.5 n=2	7
47	Wet Black Spruce – Tussock Cottongrass – Sphagnum	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	5.0 n=1	3.0 n=1	NDC	2
48	Wet Black Spruce - Carex	NDC	NDC	NDC	NDC	NDC	NDC	10.0 n=2	NDC	NDC	22.0 n=1	NDC	3
B1	Bog – Black Spruce – Lichen	NDC	NDC	NDC	NDC	NDC	NDC	0.0 n=8	NDC	NDC	NDC	NDC	8
B2	Bog – Black Spruce – Sphagnum	NDC	NDC	NDC	NDC	NDC	NDC	2.0 n=11	NDC	NDC	NDC	NDC	11
F	Fen	NDC	NDC	NDC	NDC	9.0 n=7	NDC	0.0 n=1	NDC	NDC	NDC	NDC	8
M	Marsh	NDC	NDC	NDC	NDC	3.2 n=6	NDC	NDC	NDC	NDC	NDC	NDC	6

6 CARIBOU

The Porcupine Caribou Technical Committee (PCTC) provided telemetry data and seasonal range polygons for the Porcupine Caribou Herd (PCH). Technical discussions and feedback provided by the PCTC also helped align subsequent analyses conducted in this section. This section and much of the technical content reflect responses to their detailed technical review.

6.1 PURPOSE AND OBJECTIVES

Caribou were selected as a VC for the Project due to their importance to the Gwich'in people for subsistence hunting and their cultural and ecological values. The Project occurs exclusively within the range of the PCH, which is a subpopulation of the barren-ground subspecies of caribou (*Rangifer tarandus groenlandicus*). Within the North Yukon Land Use Plan, the PCH is considered "the most significant and culturally important wildlife resource in the planning region" (Vuntut Gwitchin Government and Yukon Government 2009). The herd has been the mainstay of Gwich'in culture for centuries. It is considered a keystone species whose presence or absence influences the composition and dynamics of the wildlife communities and ecosystems in North Yukon. The PCH is a migratory herd with an extensive annual range that spans most of North Yukon and a large area in north-eastern Alaska. The PCH overlaps the Project area primarily during the rut/late fall and winter seasons.

This section summarizes existing information about the ecology of the PCH, and, using telemetry data and analysis outputs to: i) Quantify the degree of seasonal range overlap by the PCH with the RSA during fall and winter, when seasonal range use overlaps the RSA; ii) Quantify habitat use patterns and selection by the PCH during fall and winter; iii) Quantify movement rates and residency periods of the PCH during fall and winter; and, iv) Quantify the potential effects of linear features on the occurrence and movements of the PCH.

6.1.1 SPATIAL BOUNDARIES

Three spatial extents were considered as part of this study:

- The Eagle Plains Project RSA (2,386 km²)
- The Eagle Plains Ecoregion (20,400 km²), and
- The Yukon portion of the PCH's rut and late fall and winter seasonal ranges (65,000 km² and 58,000 km², respectively).

The Eagle Plains Project RSA includes all proposed exploration areas. The RSA has relatively similar patterns of vegetation communities and historical exploration disturbances across it. The Eagle Plains Ecoregion (see Section 1.3) encompasses the Project RSA and provides an ecologically similar area, beyond the proposed exploration areas, that allows certain comparisons between the RSA and adjacent undisturbed areas (e.g., habitat distribution and within-season movement patterns).

The Yukon portion of the PCH's fall and winter seasonal ranges is the largest extent and covers much of North Yukon. This area occurs predominantly within the Taiga Cordillera Ecozone. This Ecozone covers most of the northern Yukon and the southwest corner of the NWT. The Taiga Cordillera includes mountainous areas (e.g., British Mountains, Richardson Mountains, and North Ogilvie Mountains) separated by subdued basins (e.g., Eagle Plains, Old Crow Flats, and Old Crow Basin). The area consists of glaciated and unglaciated terrain and continuous permafrost. The climate in the Taiga Cordillera is variable from its northern to southern extent, with summers ranging from cool to warm with extended periods of daylight, while winters are generally long, cold, and dark. The vegetation in the taiga is dominated by stunted, open spruce forests, which result from short, cool growing seasons, and poor soils over permafrost (Ecological Stratification Working Group 1995). This extent was used to reference spatially broad questions, such as the PCH's seasonal distribution and movement patterns.

6.2 GENERAL ECOLOGY OF THE PORCUPINE CARIBOU HERD

6.2.1 CONSERVATION STATUS

The PCH is a subpopulation of barren-ground caribou in Canada, known for large aggregations of individuals, dramatic population fluctuations, lengthy migrations, and significant cultural and social value to northern Indigenous peoples and other Canadians (COSEWIC 2016). All caribou belong to one species, *Rangifer tarandus*. Within Canada, caribou populations are classified within 12 "Designatable Units" based on a suite of biological, genetic, and evolutionary traits (COSEWIC 2011). All 14–15 subpopulations of barren-ground caribou are considered part of one Designatable Unit (DU 3). Barren-ground caribou were assessed as Threatened by COSEWIC (COSEWIC 2016). The subspecies is not listed on Schedule 1 of the federal SARA. Within Yukon, barren-ground caribou are considered Vulnerable/Apparently Secure (Yukon Government 2020).

6.2.2 SEASONAL RANGES AND MOVEMENTS

Like most barren-ground caribou subpopulations, the PCH has a large annual range and makes long-distance migrations, hundreds or thousands of kilometres, among different seasonal ranges. Often, seasonal ranges vary across and within years in response to variation in forage availability, snow cover, and predation or parasite risk (Russell et al. 1993). The PCH's annual range extends approximately 250,000 km² from Alaska, through Yukon, and into the western edge of NWT. The herd undertakes long-distance migrations across seasonal ranges necessary for key aspects of their life cycle. Eight (8) primary life cycle periods occur for the PCH (Porcupine Caribou Technical Committee 1993). Key information for the eight periods are summarized in Table 6-1 (using information from Russell et al. 1993, Porcupine Caribou Technical Committee 1993, Ryder et al. 2007). The Porcupine Caribou Technical Committee (1993) assessed the relative importance of seasonal ranges using six criteria: energy balance, reproductive contribution, tolerance to disturbance, escape requirements, the intensity of use, and whether alternative habitats are available. Although all seasons are important to meeting the annual life requisites of the PCH, the calving and post-calving seasons are considered

of highest importance and fall and winter are considered of lowest importance (Porcupine Caribou Technical Committee 1993).

Key information associated with each of the eight seasons is provided below, elaborating on summary information in Table 6-1, and including a combination of scientific knowledge (Russell et al. 1993, Porcupine Caribou Technical Committee 1993, Ryder et al. 2007) and traditional ecological knowledge (Sherry and Vuntut Gwitchin First Nation 1999, Ryder et al. 2007). Typical patterns of seasonal range use are shown in Map 6-1. After calving on the north slope and Arctic coastal plains, the PCH typically splits in two, with portions of the herd moving southwest in Alaska and southeast in Yukon. Animals in the Yukon typically follow a clockwise movement through the seasonal ranges from the calving grounds on the north slope, to the British Mountains in summer, to the Richardson Mountains in late summer, dispersing widely and variably across northern Yukon (as far south as the Ogilvie Mountains) in fall and winter, before returning north to the coastal plains in spring. The PCH can potentially overlap the RSA primarily in the rut/late fall and winter periods.

During the Calving and Post-Calving periods cows and bulls tend to occupy different habitats and exhibit different movement patterns, so their ranges are described separately for these periods. During the relatively short calving period (June 1–10), cows occur in the Arctic coastal plains and adjacent uplands and foothills in Alaska and Yukon. Concentrated use often occurs in the Jago Uplands between the Hulahula and Aichilik rivers in Alaska. The calving season is one of the seasons of greatest importance (rank 1) (Porcupine Caribou Technical Committee 1993). Adult females are generally in their poorest body condition and have the largest energy deficits. The calving period is critical to the survival and development of calves (i.e., the source of initial annual population recruitment). The herd occurs in a relatively concentrated range, which appears to offer reduced predation risk and abundant forage that coincides with the timing of calving, and no alternative areas of similar value are available.

During the Post-Calving and Movement period (June 11–30) cows (and new calves) travel away from the calving areas. Cows that calved in the Yukon tend to move west into Alaska. Often, movements are higher into the foothills and uplands, following melting snow and newly emerging vegetation. However, the herd can occur anywhere from the coastline well into the foothills during this period. Selection of local habitats to avoid insect harassment is often a factor by the end of June. The Post-Calving period is also considered a period of highest importance (rank 1) (Porcupine Caribou Technical Committee 1993). Lactating females have their highest energy demands. Movement rates and group sizes increase through June, and cow/calf groups are believed to be relatively intolerant to disturbance.

During the calving to post-calving movement period (June 1–30) most bulls, juveniles, and non-productive cows occur in north Yukon between the Babbage and Firth rivers across a range of habitats within the coastal plains and the British Mountains. Animals tend to be quite mobile and follow plant emergence across habitats and elevations as spring progresses. This period is considered to have relatively low importance (rank 3) for bulls and non-productive cows (Porcupine Caribou Technical Committee 1993) because they are not tending young-of-the-year, high-quality forage is becoming abundant, and insect harassment is limited.

During Early Summer (July 1–15), both cows and bulls remain concentrated in the general north slope area, but the overall range continues to expand. Group sizes increase to the tens of thousands, and movement rates can average 25 km per day. Early summer often marks the beginning of the split of the herd between Alaska and Canada. In Alaska, distribution is widespread into the Brooks Range, and, in Canada, animals typically move into the southern British Mountains by mid-July. Local habitat use is driven by both selection for high-quality forage and insect avoidance. Insect avoidance strategies include using coastal areas adjacent to the Beaufort Sea (often primarily females) and higher elevation snow patches and barren ground in the Brooks Ranges and British Mountains (mostly males). Early summer is considered to have an importance rank of 2. Though food is generally abundant, the energy balance is limited by insect avoidance, resulting in reduced feeding times and selection of areas with less forage. Animals are still susceptible to disturbance, but tolerance is higher than during the calving and post-calving periods (e.g., calves have greater mobility, and more range is available due to snow melt).

By mid-summer (July 16–August 7), the majority of the PCH has left the coastal plains. Animals in Alaska have moved into the southern portion of the Brooks Range, and animals in Yukon have moved southeast into, or are en route to, the northern Richardson Mountains. Daily movement rates remain high through the mid-summer period, and though group sizes are often still large, groups are often breaking up and more dispersed than the aggregations that occur during post-calving and early summer. Mid-summer has an importance rating of 2 for the same reasons identified for early summer. Mid-summer is the period of potentially highest insect harassment, and, similar to early summer, habitat selection may favour insect avoidance over areas with the highest forage. Lactating females suffering insect harassment may be in an energy deficit.

During late summer and fall migration (August 8–October 7), insect harassment declines dramatically. Forage quality and abundance also begin to decline but are generally still abundant. Caribou exhibit high feeding rates during this period and gain fat reserves for the winter. During this period, the herd breaks up into smaller groups and disperses widely across North Yukon, mostly staying north of the treeline for most of the period. Fall migration often follows terrain features like ridges and valleys, but movement routes are unpredictable from year to year. Late-summer and fall migration is considered to have less importance (rank 3) due to the abatement of insect harassment, the relative abundance of forage across a variety of habitat types, the dispersed distribution of the herd, and relatively high tolerance to disturbance (Porcupine Caribou Technical Committee 1993).

The rut and late fall (October 8–November 30) continue to be a period of broad distribution and movement by the PCH, including widespread movement south of the treeline. In Yukon, the rut can occur from the Richardson Mountains to the southern Ogilvie Mountains. The areas where the rut occurs do not appear to have affinity from year to year. Rather, the rut appears to occur wherever the herd happens to be at that time along the fall migration. The rut and late fall period has the lowest level of importance(rank 4), due to the lack of insects, large range extent, ample food, the dispersed distribution of the herd, and relatively high tolerance to disturbance (Porcupine Caribou Technical Committee 1993).

During early, mid, and late winter (December 1–March 31), the PCH is at its most dispersed stage, both in terms of the extent of the range it uses and group aggregations. Average daily movement distances (2 km per

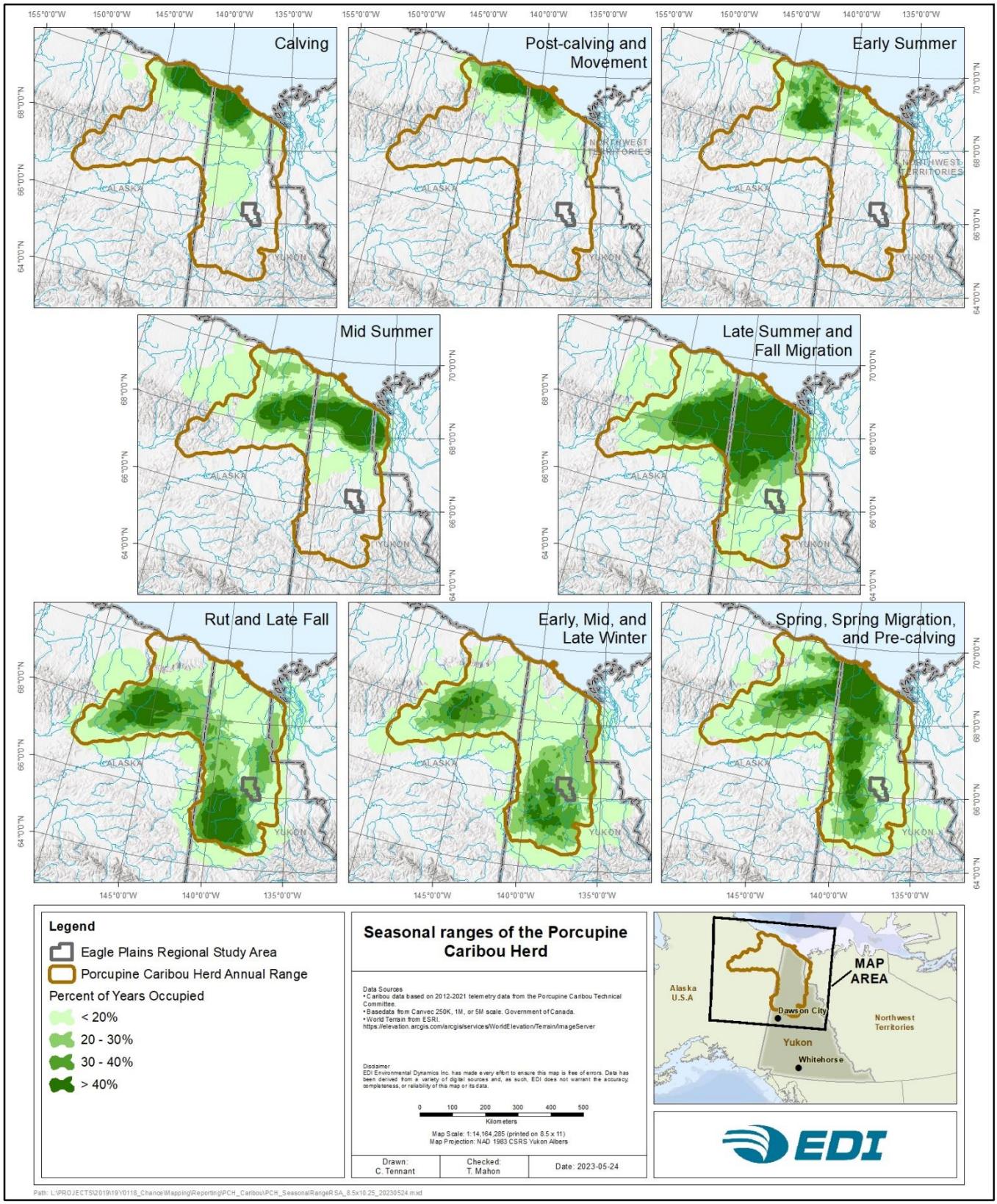
day [km/day] to 5 km/day) (Russell and Gunn 2017) are lower than in other seasons, except for cows during calving (Russell and Gunn 2017). Winter range use varies from year to year, depending on snow depth and condition. In Yukon, during deep snow years, use is concentrated in the Richardson Mountains and the Ogilvie-Hart basins. The Whitestone River and Eagle Plains areas are used more in low snow years. Forage during winter consists primarily of lichens. Unlike reports for some other caribou herds, winter habitat is generally not considered limiting for the PCH (Russell et al. 1993). In shallow to average snow years, the caribou maintain neutral to surplus energy balances (Russell et al. 1993). The PCH is relatively tolerant to human activity during the winter (Porcupine Caribou Technical Committee 1993). Similar to the rut and late fall period, winter has the lowest level of importance (rank 4) due to the lack of insects, large range extent, ample food, the dispersed distribution of the herd, and relatively high tolerance to disturbance (Porcupine Caribou Technical Committee 1993).

During the spring, spring migration, and pre-calving season, (April 1–May 31) caribou begin moving north toward the calving grounds. Average daily movement rates increase from approximately 6 km/day at the start of the season to approximately 24 km/day through May. Similar to the fall migration, no well-defined migration corridors are used consistently from year-to-year during spring migration, but certain terrain feature types like ridges and valleys are regularly used. During spring migration, local snow conditions often affect movement patterns and routes. In years or locations with low snow levels, migration tends to be more dispersed. In years or locations with high snow levels, movements tend to be more concentrated along trail networks on ridges (Porcupine Caribou Technical Committee 1993). Caribou, especially pregnant cows, typically enter an energy deficit during spring due to reduced forage availability as they leave the lichen-rich taiga and before forbs have emerged; in addition, higher energy expenditure is associated with migration. Spring is rated as higher in importance than winter, but still relatively low overall (rank 3), due to lack of association with specific habitats, relatively low threats from predators, and lack of insect harassment (Porcupine Caribou Technical Committee 1993).

Table 6-1. Key life cycle periods for the Porcupine Caribou Herd (after Porcupine Caribou Technical Committee 1993). The Porcupine Caribou Herd overlaps the Project Regional Study Area during Rut and Late Fall and Early, Mid, and Late Winter.

Season	Dates	Characteristics	Importance*
Early, Mid, and Late Winter	Dec. 1 – Mar. 31	The herd is at its most dispersed at this time across 2 winter ranges: in Yukon, mostly south of the Porcupine River in boreal taiga and in Alaska, centred in the Chandalar River/Arctic Village area. Winter range use varies from year to year, depending on snow depth and condition. Caribou at this time of year are relatively tolerant to human activity. In shallow to normal snow years, animals can gain weight.	4
Spring, Spring Migration, and Pre-Calving	Apr. 1 – May 31	Herd distribution varies depending on snowmelt; migration routes vary yearly. Pregnant females are typically in an energy deficit due to reduced forage once they leave the lichen-rich taiga.	3
Calving (cows)	June 1 – 10	Calving occurs on the coastal plain of NE Alaska and, to a lesser degree, NW Yukon. This area offers reduced predators and abundant spring forage; no alternative range is available. Cows are at the lowest point of physical condition and are least tolerant to human disturbance.	1
Post-Calving and Movement (cows)	June 11 – 30	As calves develop over the first two weeks of life, the cows and calves tend to aggregate into larger groups and increase movement rates to track plant green-up. The post-calving period imposes high energetic demands on lactating females, and cow/calf groups are relatively intolerant of disturbance. The post-calving range is primarily in Alaska, and cows that calved in Yukon tend to move west along the foothills into Arctic National Wildlife Refuge. Insect avoidance can affect distribution by the end of June.	1
Calving to Movement (bulls)	June 1 – 30	Bulls, non-pregnant cows, and subadults tend to concentrate east of the calving grounds in northern Yukon. Animals track the progression of green-up from the coastal plains to the northern foothills and into intermountain regions.	3
Early Summer	July 1 – 15	Cows continue to require a high-energy intake for milk production, but insect avoidance also drives distribution. Key areas selected for insect avoidance are the coastal plain adjacent to the Beaufort Sea (mostly cows/calves) and mountains in the Brooks and British Mountains (mostly bulls and cows without calves). Long-distance movements during this period are also an insect avoidance behaviour.	2
Mid Summer	July 16 – Aug. 7	Mid-summer continues to be a period of high insect harassment. Two areas are consistently used – the northern Richardson Mountains in Yukon and the southern portion of the Brooks Range in Alaska. Females with cows may be in energy deficit.	2
Late Summer and Fall Migration	Aug. 8 – Oct. 7	As insect activity declines, the herd disperses widely but mostly stays north of the tree line until the latter part of the period – in Alaska south of the Brooks Range and in Yukon north of the Porcupine River. Animals exhibit high feeding rates and gain fat for the winter.	3
Rut and Late Fall	Oct 8 – Nov. 30	The region where rut occurs has no affinity from year to year; rut occurs wherever the herd happens to be along fall migration. In Yukon, distribution can occur from the southern Ogilvie Mountains to the Richardson Mountains.	4

* 1 = highest importance, 4 = lowest.



Map 6-1. Seasonal ranges of the Porcupine Caribou Herd from 2012–2021.

6.2.3 DIET AND HABITAT

Barren-ground caribou are generalist foragers who feed on grasses, sedges, forbs, lichens, and shrubs during the growing season. During winter lichens constitute the primary forage of most barren-ground caribou populations (Photo 6-1 and Photo 6-2). Over three winters, the composition of PCH fecal samples was similar, consisting of, on average, 64% fruticose lichens, 11% evergreen shrubs, 8% moss, 6% horsetails, and 5% foliose lichens (Russell et al. 1993).

Russell et al. (1993) surveyed lichen distribution across the Yukon portion of the PCH range. Fruiticose lichens were widespread across survey plots and overall biomass estimates were similar to values reported in other western barren-ground caribou ranges (Joly and Cameron 2018). Within the PCH's Yukon range, lichen biomass varied across regions, habitat (range) types and stand ages. Average lichen biomass varied substantially among regions, with the highest biomass occurring in Eagle Plains (78.3 g/m^2), followed by North Fork Pass (45.0 g/m^2), Chapman Lake (33.6 g/m^2), Ogilvie Valley (32.5 g/m^2), and Richardson Mountains (29.9 g/m^2). In terms of habitat type, lichen biomass varied over three-fold across the seven habitats (range) that Russell et al. (1993) surveyed. Open conifer forest types had the greatest lichen biomass, and the forb herbaceous type had the lowest.

In terms of stand age, the generally accepted theory is that lichen biomass is greatly reduced following a fire, increases in abundance up to 125–175 years, and decreases as lichens are overtaken by mosses and shrubs (Klein 1982). Field surveys by Russell et al. (1993) found that lichen biomass in the PCH range was actually highest in stands <50 years since fire, and that lichen biomass decreased across all subsequent older age classes, to a nearly 50% reduction in the oldest age class (>270 years) (Photo 6-3). This local data suggests that younger stands may make a greater contribution to lichen forage than previously believed. Russell et al. (1993) emphasizes the importance of a mosaic of stand age classes, resulting primarily from wildlife, to maintaining lichen biomass at the regional level over time.

Although habitat selection is often driven by forge availability, especially in winter, reducing predation risk (Latham et al. 2011) and minimizing exposure to insect harassment during summer (Russell and Nixon 1990) also factor into habitat selection by caribou.

6.2.3.1 Effects of Snow

The regional patterns of PCH distribution in winter vary among years, often related to snow accumulation, which can limit forage availability (Russell et al. 1993). During the 1970s and 1980s, the distribution of the PCH in winter varied in a regular pattern across four regions with different snow regimes: Yukon/Alaska border, Richardson Mountains, Ogilvie/Hart region, and the Whitestone/Eagle region (Russell et al. 1993).

On average, the Ogilvie/Hart region had the lowest mean snow accumulation. During winters when most animals occupied this region snow depths were normal to high across the overall winter range. Heavy snows in the north early in the season seemed to emphasize concentrated use in this region, pushing animals to the south during the fall migration and rut. Once animals moved into the Ogilvie/Hart basin they typically remained in the region, taking advantage of the comparatively shallow snows, until spring migration.

During the winters when most Yukon wintering animals occupied the Richardson Mountains, snow depths tended to be normal to above normal. Strong winds in the Richardson Mountains resulted in uneven snow distribution, with many areas having reduced snowpacks, including some areas being blown completely bare. During the winters when most Yukon wintering animals occupied the Whitestone/Eagle area, snowpacks were invariably below normal. This area generally had the highest lichen biomass, but snow depths appeared prohibitive during years with normal to deep snow. In the two years when most of the Yukon wintering animals occupied the Yukon/Alaska border area (overlapping with the Fortymile Herd), snows were deeper than average in all other wintering areas.



Photo 6-1. Mesic, mature forest, with mat-forming terrestrial lichens in the Eagle Plains RSA.



Photo 6-2. Lichen communities are often diverse in Eagle Plains. This lichen mat includes *Cladonia spp.* (lighter green) that are preferred forage for caribou, as well as *Stereocaulon spp.* (darker grey) and *Flavocetraria spp.*, which are both also eaten by caribou but less preferred.



Photo 6-3. Lichen cover is generally reduced in regenerating burns. However, EDI observed high lichen abundance in some regenerating burns, consistent with previous work by other researchers (Russell et al. 1993).

6.2.4 POPULATION LEVELS AND TREND

Although most barren-ground caribou subpopulations are declining (COSEWIC 2016), the PCH numbers have increased over the last two decades. The last successful population survey in 2017 estimated the population at 218,457 (95% CI = 202,106 – 234,808) caribou (Porcupine Caribou Technical Committee 2019). Population surveys of the PCH began in the 1970s. The objective is to survey the herd every two to three years, but that period is sometimes extended depending on herd behaviour (aggregation patterns), funding, and logistical issues. Since the first survey in 1972, the PCH has had two periods of population growth, with an interceding decline (Figure 6-1). From 1972 to 1979 the population was relatively stable at just over 100,000 animals. By 1989 the herd had increased to approximately 178,000. Over the next 12 years, the herd declined by 55,000 to 123,000 in 2001. By 2010, the herd had recovered to 169,000 and increased to 218,000 in the last survey in 2017. During the latest growth phase, 2010 to 2017, the estimated population growth rate of 3.7% is almost identical to the growth rate during the 1972 to 1989 growth phase (Porcupine Caribou Technical Committee 2019).

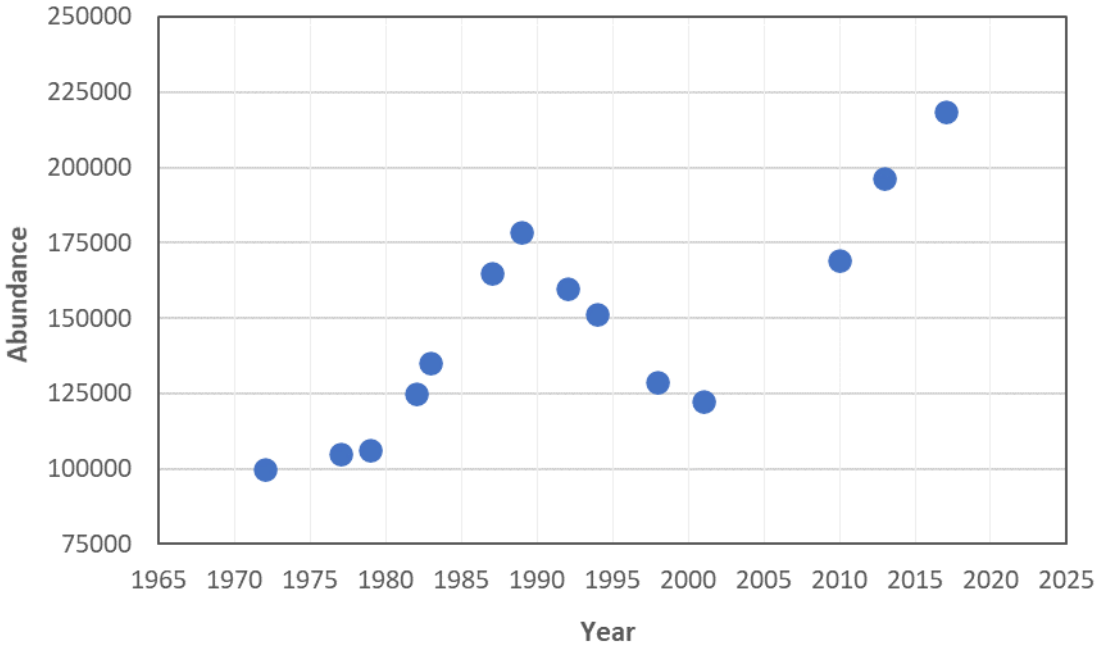


Figure 6-1. The population size of the Porcupine Caribou Herd from 1972 to 2017 (Porcupine Caribou Technical Committee 2019).

6.2.5 POPULATION DYNAMICS

Large magnitude population fluctuations are a key ecological trait of barren-ground caribou. Subpopulations (herds) often experience declines of >80% and increases >500%, which occur over several decades and caribou generations (COSEWIC 2016). Based on scientific studies and Indigenous Traditional Knowledge, the interval between population highs varies from approximately 30–80 years among subpopulations (Ferguson et al. 1998, Gunn 2003, COSEWIC 2016). There has long been debate about whether the intervals

between population highs and lows, and the population levels that occur at highs and lows, are regular enough to be considered cycles (Gunn 2003, COSEWIC 2016, Bongelli et al. 2020). A recent analytical study found that historical population fluctuations of the barren-ground caribou population overall and 9 of 11 sub-populations fit a sine-cyclic model with periods ranging from 26–55 years (Bongelli et al. 2020). However, COSEWIC (2016) points out that cumulative changes in the environment, habitat, climate, and harvest regimes for many caribou subpopulations are without historical precedent, and therefore it is uncertain whether future populations patterns will follow historical patterns.

Despite large magnitude changes in the abundance of barren-ground caribou, there is still a poor understanding of how limiting factors regulate population change. Predation, human harvest[1], parasites and disease, and food supply are all considered limiting factors of barren-ground caribou (COSEWIC 2016); however, no single factor has been conclusively demonstrated as a primary limiting factor across subpopulations and over time. Despite strong advocacy for certain factors by certain researchers (e.g., for predation by Bergerud (1996)), the weight of evidence is that population dynamics involve complex interactions among limiting factors that vary over time and among subpopulations (Klein 1991, Whitten 1996). Over the 50 years that the PCH has been monitored, the population has not exhibited population fluctuations as large as other barren-ground caribou populations (COSEWIC 2016). This may be due to the large annual and seasonal ranges and diversity of habitats across ranges (Russell et al. 1993, Whitten 1996). Whitten (1996) suggests that periods of decline are caused by nutritional stress and predation exacerbated by adverse weather. Population growth during periods of favourable weather is dampened by a combination of poor nutrition, predation, and human harvest and disease. No true density dependent regulation or equilibrium was observed for the PCH from the 1970s to early 1990s (Whitten 1996).

6.2.6 LIMITING FACTORS

6.2.6.1 Food Supply and Overgrazing

The amount and distribution of forage have implications for population distribution and demography of barren-ground caribou (COSEWIC 2016). In general, food limitation is most prevalent during winter, when caribou diet consists primarily of lichen, and does not pose a constraint to caribou from late-spring through fall when graminoids, forbs, and deciduous shrubs are bountiful and predominate their diet (Thompson and McCourt 1981, Russell et al. 1993). Lichen availability depends on both density-dependent and density-independent factors, but the degree to which either is a limiting factor depends on ecological context. For example, density-dependent competition for forage, when local densities are high, and competition is intense, can cause overgrazing of lichen and reduce its abundance (Ferguson et al. 2001, Joly 2009). Recovery of lichen communities following overgrazing can take more than 20 years (Klein 1987).

[1]Human harvest is considered a natural population factor for barren-ground caribou because hunting has occurred for centuries (Sherry and Vuntut Gwitchin First Nation 1999, COSEWIC 2016). However, it is recognized that the nature of hunting has dramatically changed over the last century with the advent of high-powered rifles and snowmobiles.

The potential for lichen supply to regulate caribou herd size and demography is most likely for herds with small ranges on low productivity tundra islands (e.g., Klein 1987). For large, widely-distributed herds, it is more likely that density-independent factors, such as climate and natural disturbance, contribute to limitations in lichen supply that affect caribou distribution (Gunn et al. 2011). Lichen is a slow-growing food source; its distribution is affected by fire (see Joly 2009) and its accessibility depends on regional snow conditions, such as snow hardness and depth (Collins and Smith 1991, COSEWIC 2016). Therefore, caribou tend to shift winter ranges and foraging locations based on burn and snow conditions so that they may access areas with higher lichen abundance (Jandt et al. 2008, Pedersen et al. 2021). In the PCH, annual variation in the distribution of caribou during winter is thought to be a result of caribou tracking available and accessible lichen patches (Russell et al. 1993, WMAC 2009).

The potential for food supply, especially lichen, to regulate the PCH is limited because of their large annual and seasonal ranges and the diversity of habitats (e.g., several broad ecoregions) found within those ranges. Variation in distribution and range use may counteract any limitations on food supply at local scales (Hinkes et al. 2005). PCH migration from the tundra, at the northern extent of their range, to the taiga cordillera, at the southern extent of their range, may serve as a strategy to maximize the available food supply. Overall, the PCH winter range is relatively rich in lichen resources and is comparable to, or better than, those of other herds that winter in taiga regions (Russell et al. 1993).

Forest Fires

Forest fires are a significant natural disturbance agent in taiga forests and play a substantial role in the availability of caribou forage, especially lichen. Occasional fires are important to maintaining lichen biomass at a landscape level. Peak lichen biomass is generally associated with forests 125-1750 years old before lichen volumes decrease due to competition from other species like moss and shrubs (Klein 1982). However, frequent fires can reduce the extent of mature and old forests where productive lichen biomass occurs. For example, forest fires in the winter range of the Bathurst Herd reduced the area of forest by 30% between 1990 and 2000 (Chen et al. 2013). More broadly, the average area burned by large fires in Canada's taiga has increased since the 1960s (Krezek-Hanes et al. 2010). Climate change modelling suggests a further increase in fire extent of 25% by 2030 and 75% by the end of the century (Wotton et al. 2010). Generally, caribou avoid burned areas in winter for several decades until lichen biomass increases to the point where it is favourable for caribou to forage. Changes in landscape vegetation patterns due to fire are believed to affect regional seasonal use areas and migration routes of caribou (Gunn et al. 2011).

The PCTC monitors the extent of burn areas across the forested portion of the PCH annual range; since 1960, 18% of the area has burned (Porcupine Caribou Technical Committee 2021a). The five-year average of the area burned in the Yukon portion of the PCH annual range is 1,552 km² (Porcupine Caribou Technical Committee 2021a).

6.2.6.2 Predation

Wolves are the primary predators of barren-ground caribou (COSEWIC 2016). However, grizzly bears can also be significant predators of caribou, especially calves (Gau et al. 2002). Predation is an important factor

affecting many facets of caribou ecology, as caribou movements and habitat choices are often made to minimize exposure to predators (Bergerud 1996). One of the hypotheses about why barren-ground caribou migrate is that it reduces predation risk. The idea is that moving throughout the year limits the numerical response of wolves (Hayes and Russell 2000). In the NWT, wolf densities in the arctic tundra calving grounds were only 22% compared to wolf densities in the taiga, where the herd wintered. However, as caribou numbers increase, their range expands, causing some caribou to return earlier to the ranges of taiga denning wolves, which results allows wolf numbers to increase (Heard et al. 1996).

A study of wolf predation on the PCH estimated that wolves killed about 7,600 adult caribou each year, regardless of herd size (Hayes and Russell 2000). In 1992 this corresponded to a predation rate of 5.8%, or about one-third of adult mortality. As the PCH declined through the 1990s, the predation rate by wolves increased from 5.8% to 7.4%. Migratory movements effectively reduced wolf predation during the calving through summer seasons due to the combination of smaller ranges and lower densities of wolves in the arctic tundra. Only 16% of the mortality occurred during the calving/summer seasons compared to 84% during the fall and winter seasons, when wolves were predominantly in the taiga zone.

Generally, wolf predation does not appear to regulate barren-ground caribou subpopulations (Crête and Huot 1993, Messier 1995, Hayes and Russell 2000). Hayes and Russell (2000) estimated that the predation rate would have had to be near twice the observed level to cause the PCH to decline during their study. However, the limiting effect of predation increases as population size decreases, which can result in a cumulative effect with other limiting factors as the population declines (COSEWIC 2016).

6.2.6.3 Hunting

Human hunting of barren-ground caribou has occurred for centuries over much of the species range in North America (Sherry and Vuntut Gwitchin First Nation 1999, COSEWIC 2016). Although humans and caribou have co-existed for centuries, technological changes (e.g., high-powered rifles, snowmobiles, and aircraft) and social changes (e.g., commercial hunting) have changed the potential effects human hunting can have on some barren-ground caribou populations (COSEWIC 2016). Over the last half-century, there has been clear evidence of population-level impacts from harvesting. From 2008 to 2011 the estimated harvest rate on north Baffin Island was 41%. During the mid-2010s harvest rates of the Southampton population were considered well beyond sustainable limits (COSEWIC 2016). Harvest is more likely to pose a threat when population monitoring data is poor and/or harvest management decisions lag population declines. For example, in the Bathurst subpopulation, a constant harvesting level during a period of population decline resulted in an increase in the harvest rate (i.e., as a percent of population size) from 2–4% to 10–16% of abundance (Boulanger et al. 2011).

There is no simple, sustainable harvest level applicable to all barren-ground caribou populations. Effects of harvesting depend on herd size, population trend, and the proportion of females that are harvested (Boulanger and Adamczewski 2016). Harvesting may also interact with other limiting factors, such as predation and weather (Klein 1991). Most harvest plans target a total harvest rate of 0–5%, depending on herd status, and with restrictions on harvesting females (e.g., Environment and Natural Resources 2013).

Recognizing the importance of effective harvest management for both the conservation and continued long-term harvest of the Porcupine Caribou, the Porcupine Caribou Management Board led the development of a comprehensive *Harvest Management Plan for the Porcupine Caribou Herd in Canada* (HMP) in 2010 (Porcupine Caribou Management Board et al. 2010)[2]. Key components of the plan include the determination of specific management actions related to the estimated herd size and a set of general best hunting practices. Management actions are determined each year using a set of six population indicators: 1) estimated herd size, 2) harvest information, 3) adult cow survival, 4) calf birth rate, 5) calf survival to nine months, and 6) body condition. In addition, descriptive indicators from people on the land include caribou health, hunting success, and weather conditions that affect caribou. The results from the indicators are rolled up into a 4-class colour chart, and management actions are specified for each colour zone. Management actions become more restrictive across each zone once the herd falls below 115,000 animals, including ceremonial harvests only below 45,000 animals (Porcupine Caribou Management Board et al. 2010).

Implementation of the HMP is guided by a formal Implementation Plan (Porcupine Caribou Management Board 2016). Key components of the Implementation Plan are to 1) guide annual monitoring of the population indictors and harvest levels, 2) provide a forum for all the HMP Parties to review and discuss the population indicators and harvest levels and 3) provide an annual recommended harvest management colour zone plus any additional management actions that are deemed appropriate. Population indictors are monitored each year by the PCTC and summarized in an annual report (e.g., Porcupine Caribou Technical Committee 2021). Annual harvest levels are monitored by each Party or user group and are compiled by the PCTC into an annual report (e.g., Porcupine Caribou Technical Committee 2021b). Each year, the HMP Parties hold an annual meeting to discuss the results of the population and harvest monitoring and determine the harvest management zone for the following year and any additional management actions the Parties feel may be required.

Over the eight-year period, 2013–2014 to 2020–2021, the annual reported harvest rates of Porcupine Caribou have ranged from 749 to 3,367 caribou. The reported annual harvest rates are considered the minimum estimated harvest (Porcupine Caribou Management Board 2022). Due to reporting challenges faced by some Parties, significant harvest may be missed in some regions in some years. Notwithstanding the reporting challenges, the reported Canadian harvest is estimated to be between 1% and 2% of the 2017 population estimate of 218,000 caribou and is not considered a threat to population decline (Porcupine Caribou Management Board 2022). The comprehensive measures within the HMP to monitor and respond to declines in the PCH (i.e., by reducing harvest) provide a solid system to minimize the potential effects that harvesting could have on the herd.

[2] The HMP was agreed to by eight Parties with authorities and responsibilities managing the PCH within Canada, including Gwich'in Tribal Council, Inuvialuit Game Council, Vuntut Gwitch'in Government, Trʻondëk Hwëchʻin Government, First Nation of Na-Cho Nyäk Dun, Government of the Northwest Territories, Government of Yukon, and Government of Canada.

6.2.6.4 Parasites and Disease

Biting and parasitic insects, pathogens (i.e., viruses and bacteria) and internal parasites are important factors in caribou ecology and population dynamics (Gunn and Irvine 2003, Kutz et al. 2012, COSEWIC 2016).

Harassment by parasitic insects can be a key driver of behaviour, movement, and body condition of caribou during summer (Downes et al. 1986, Russell and Nixon 1990). Warble flies (*Hypoderma tarandi*) and nose botflies (*Cephenemyia trompe*), both of the family Oestridae, are the primary source of harassment for Arctic caribou, though mosquitoes (Culicidae), blackflies (Simuliidae), and horseflies (Tabanidae) also are known to cause harassment (Downes et al. 1986, Toupin et al. 1996, Witter et al. 2012a). There are two primary harmful effects of insects. The direct effects of the parasitic burden can result in decreased body condition and reproduction (Albon et al. 2002, Cuyler et al. 2012). Indirect effects include the behavioural response to avoid insects, which includes a reduction in time spent foraging, increased energy expenditure, and selection of low-quality habitats such as ridge tops, coastal regions, snow patches, and unvegetated areas (Downes et al. 1986, Russell and Nixon 1990, Walsh et al. 1992, Toupin et al. 1996, Witter et al. 2012a). These behavioural responses can result in reduced body condition going into the winter with negative implications for survival and fecundity (Russell et al. 1993, Cuyler et al. 2012).

The responses of caribou to disease and other parasites are less evident and less studied than responses to insects. Most occurrences of disease and internal parasites in caribou are at subclinical levels (not severe enough to produce observable symptoms) but can still result in reduced body condition and fitness (Gunn and Irvine 2003). A range of pathogens and parasites observed in caribou includes viruses, bacteria (e.g. brucellosis), helminths (e.g., roundworms, tapeworms, and flukes) and protozoa (Tessaro and Forbes 1986, Gunn and Irvine 2003, Kutz et al. 2012, COSEWIC 2016). Gunn and Irvine (2003) suggest that caribou may have evolved foraging strategies to minimize exposure to parasites. Similar to parasitic insects, internal parasites can reduce caribou body condition and pregnancy rates resulting in population-level impacts (Albon et al. 2002, Kutz et al. 2012).

6.2.6.5 Climate Change

Climate change can potentially affect barren-ground caribou populations negatively and positively through various mechanisms. A recent literature review on this topic identified five primary factors that affect caribou population dynamics that could be affected by climate change: (i) summer range conditions, (ii) parasites and disease, (iii) movement, migration, and distribution, (iv) extreme weather and icing events, and (v) winter range conditions (Mallory and Boyce 2018). The effects of these factors are likely to be complex and interact with climate and non-climate-related factors that will result in substantial local variation and uncertainty in potential outcomes to caribou (Cebrian et al. 2008, COSEWIC 2016).

On balance, climate change is predicted to have mostly positive effects on the summer range condition of barren-ground caribou. Increasing temperatures will likely lead to longer growing seasons, increases in plant productivity, and an earlier onset of spring. Pearson et al. (2013) predict dramatic increases of 29-68% in above-ground plant biomass in the arctic by 2050. These effects could increase caribou body condition and reproductive success by lengthening the summer period of food availability, by increasing the amount of

forage and providing earlier access to forage (i.e., relative to the energetically demanding periods of birthing and lactation) (Tews et al. 2007, Cebrian et al. 2008, Mallory and Boyce 2018). This prediction is supported by a 20-year study in Norway, 1994–2015, where reindeer body mass resulted from greater plant productivity associated with warmer summer temperatures (Albon et al. 2017). In the PCH, earlier and warmer springs over the last thirty years have resulted in more food available for nursing cows, correlated with higher early calf survival (Griffith et al. 2002). However, positive effects on caribou summer range may not occur uniformly across all ranges. Some researchers have suggested the potential for a trophic mismatch between the timing of caribou and vegetation phenologies (Vors and Boyce 2009). Also, a predicted shift to greater cover of woody shrubs may be negative to caribou because shrubs tend to have greater chemical and structural defenses against herbivory and lower available protein than other forage such as grasses, forbs and sedges (Thompson and Barboza 2014).

Most studies suggest that climate change is predicted to increase the potential effects of parasitic insects and disease on barren-ground caribou (Mallory and Boyce 2018). Warmer and longer summers are likely to increase the length and severity of insect harassment, leading to lower body condition of caribou, including lactating cows and calves (Witter et al. 2012b). Climate change is also predicted to increase parasitism by other taxa, such as protozoans and helminths, and the northern expansion of some parasitic species has already been observed (Kutz et al. 2013). Certain ungulate diseases are also expanding northward as the climate warms (Arifin et al. 2020). Arctic ecosystems and species may be more susceptible to the spread of parasites and diseases than southern populations because they have had less exposure and opportunity to develop resistance from an evolutionary perspective.

Extreme weather, such as icing events, large changes in snowfall patterns, and summer heat episodes, is predicted to increase with climate change and negatively affect caribou (Mallory and Boyce 2018). Restricted or total loss of access to forage due to icing in the winter range can significantly affect survival and body condition for barren-ground caribou (Tyler 2010, Hansen et al. 2014). These events tend to be more catastrophic in the high Arctic but have been reported broadly across caribou ranges; including within the VGFN territory where the refreezing of wet snow one winter restricted access to food and greatly affected the health of a caribou herd (Sherry and Vuntut Gwitchin First Nation 1999, p. 186). Ice crusts on snow can also negatively affect travel abilities, body condition, and predation risk of caribou (Griffith et al. 2002). Deep snowpacks can reduce the availability of terrestrial lichen forage in winter. The Porcupine Caribou are known to vary winter range use in response to regional weather patterns (Russell et al. 1993). Changes to regional snow patterns may make areas, such as Eagle Plains, less available to the herd (Russell and Gunn 2017).

Several studies have predicted that climate change could affect the movements, migration and distribution of barren-ground caribou (Mallory and Boyce 2018). Effects are predicted to be most dramatic for subpopulations that travel over ice during the winter and where warming temperatures are already reducing the extent and duration of ice (Poole et al. 2010). Changes in regional snow conditions predicted due to climate change can also affect the migration patterns and seasonal distributions of barren-ground caribou. Russell et al. (1993) observed that the PCH adjusted the concentration of winter range use in relation to winter snowpacks. Areas such as Eagle Plains, which receive the greatest use during low snow years may become less available if regional snowpacks increase. Other studies have indicated that snow depths and snow conditions

(e.g., crusting) affect the migration routes, behaviours, and energetic costs of Porcupine Caribou during spring migrations (Whitten 1996, Griffith et al. 2002).

During winter, many barren-ground caribou subpopulations forage primarily on terrestrial lichen. Climate change is predicted to reduce terrestrial lichen biomass due to increased productivity from other plants (notably shrubs) and, in the boreal/taiga forest, due to increased forest fires (Mallory and Boyce 2018). Some studies indicate the area burned each year in northern Canada could double by the end of the century (Wotton et al. 2010). The potential adverse effects of climate change on caribou winter range depend mainly on the assumption that caribou require lichen-rich diets in winter. Some researchers have long questioned the need for lichens during the winter (Bergerud 1974), and more recent studies suggest that winter diets dominated by graminoids rather than lichens were not detrimental to caribou populations (Heggberget et al. 2002, van der Wal 2006). However, in the Western Arctic Herd a decline in recruitment and abundance in the herd occurred when the winter diet showed increased graminoids and decreased lichens being consumed (Joly 2009). In the past, the conditions of winter range and winter weather were not considered to be limiting to the PCH (Russell et al. 1993, Porcupine Caribou Technical Committee 1993). However, the combination of reduced lichen forage, deeper snow in some areas, and extreme weather events that are predicted to occur with climate change has the potential to increase the limiting effect of the winter range on the PCH.

6.3 PORCUPINE CARIBOU HERD MANAGEMENT

There is a long history of co-management of the PCH among indigenous, state, territorial and federal governments, with international and national management boards formalizing in the mid-1980s. Canada and the United States of America co-manage the herd under the *Agreement Between the Government of Canada and the Government of the United States of America on the Conservation of the Porcupine Caribou Herd (1987)*. The International Porcupine Caribou Board (IPCB) is comprised of Canadian and American representatives. The Porcupine Caribou Management Board (PCMB) is a co-management board for the Canadian portion of the herd's range, formed under the *Porcupine Caribou Management Agreement (1985)*. The *Porcupine Caribou Management Agreement (1985)* was established to coordinate management efforts toward conserving the herd and maintaining and protecting special harvesting rights in the Porcupine Caribou for indigenous users while providing for other users to share in the harvest. The PCMB and IPCB have led or contributed to the development of several plans for the PCH, including:

- *Plan for the International Conservation of the Porcupine Caribou Herd (1987),*
- *Wildlife Conservation and Management Plan for Yukon North Slope (2002),*
- *Porcupine Caribou Harvest Management Plan (2010)* and an associated *Implementation Plan (2010, revised 2016),*
- *Porcupine Caribou Herd Strategic Framework 2015-16 to 2019-20.*

The international agreement also provided for a joint technical committee to coordinate research and monitoring activities and advise the IPCB on scientific matters surrounding the herd. This committee, known

as the "Porcupine Caribou Technical Committee" (PCTC), has been functioning since the 1970s. Over time, the PCTC has taken on the role of advising the Canadian PCMB and the IPCB. The PCTC comprises biologists and scientists from Yukon, Alaskan, Canadian and American government agencies, university researchers, and other caribou experts.

The PCTC leads most of the monitoring and research initiatives associated with the PCH on behalf of the PCMB and the IPCB. Core monitoring work that the PCTC does includes population abundance surveys (normally every two to five years depending on herd behaviour, funding, and logistics), population demographic monitoring (e.g., calf birth and survival rates and important age and sex ratios), seasonal movement monitoring (via GPS telemetry tracking), caribou body condition monitoring, habitat and human disturbance assessments, and annual snow surveys. Monitoring results are normally provided to the PCMB and the IPCB via annual reports (e.g., Porcupine Caribou Technical Committee 2019) and via presentations at the annual harvest meetings. The PCTC also intermittently conducts specific data analyses, such as habitat selection studies and seasonal range mapping, to support land use planning and other management initiatives.

6.3.1 PROTECTED AREAS AND MANAGEMENT AREAS AND PLANS

A network of parks protects the portion of the PCH annual range that occurs within Yukon, special management areas, conservation areas, wilderness areas, protected areas, ecological preserves, habitat protection areas, and IMA zones within the North Yukon Regional Land Use Plan and the Peel Watershed Regional Land Use Plan (Map 6-2). In total, 54% of the annual range of the PCH within Yukon falls within some type of protected area where industrial activity is prohibited, 36% of the annual range occurs within regional LUP IMA zones, and 9% of the annual range is not covered by any type of land management zonation. A summary of the overlap of different types of protected areas and management areas with the seasonal ranges of the PCH is provided in Table 6-2.

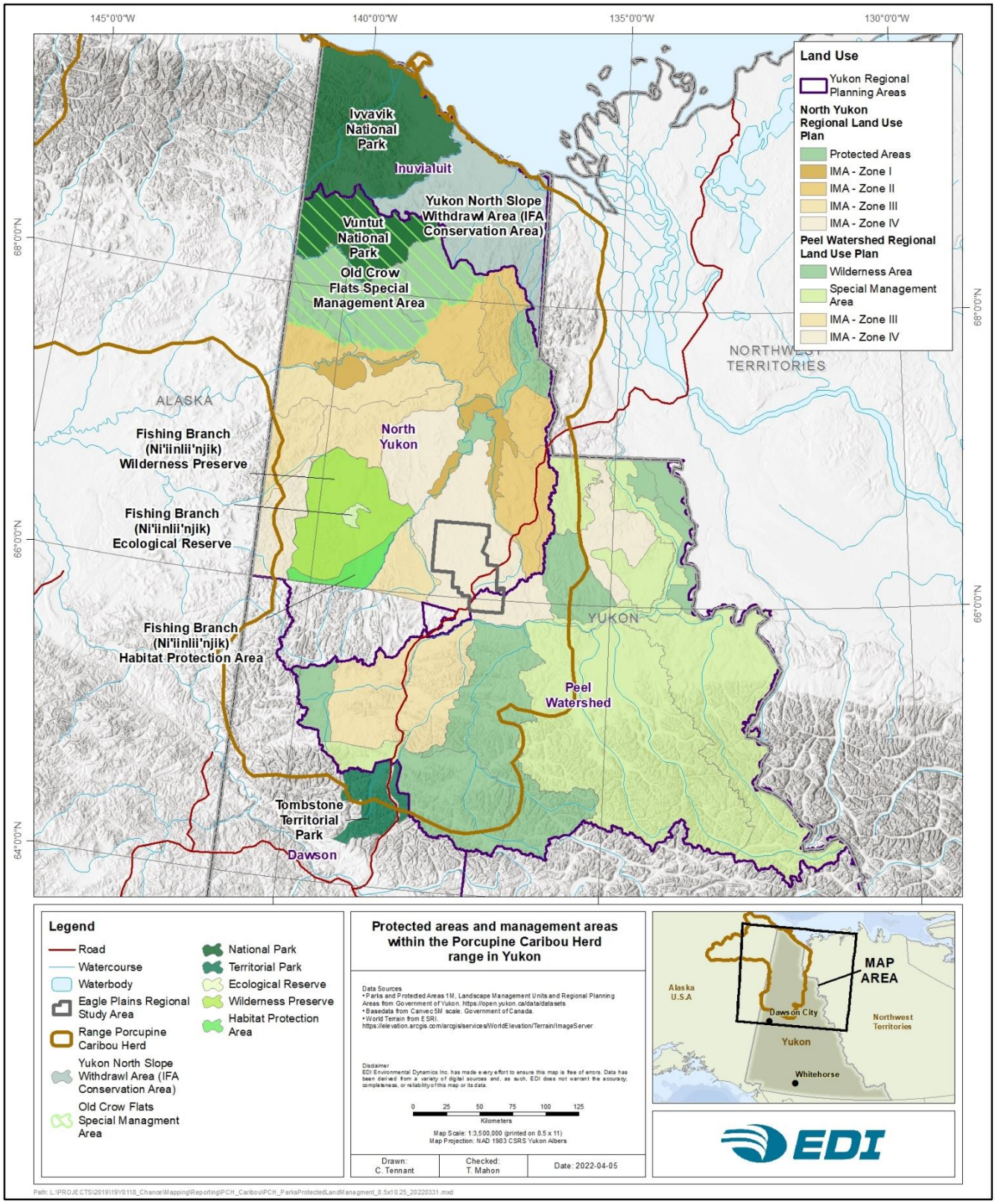
The Project is within the North Yukon Planning Region and Peel Watershed Planning Region and is subject to the NYLUP (Vuntut Gwitchin Government and Yukon Government 2009) and PWLUP (Peel Watershed Planning Commission 2019). The project falls within IMA Zone IV of both plans, a zone with lower ecological and cultural values and the highest permissible development of the four IMA zones. The NYLUP and PWLUP include management objectives and strategies to minimize the effects of human development activities on wildlife and wildlife habitat, generally, and specific objectives and strategies for caribou.

In addition to the Regional Land Use Plans, the Habitat Programs Section of the Yukon Department of Environment, Yukon Government maintains an inventory of important habitat areas for focal management species, including caribou, within the Wildlife Key Area Inventory (Environment Yukon 2014b). Wildlife Key Areas are specific geographic locations used by wildlife for critical, seasonal life functions, such as calving areas and mineral licks. No Wildlife Key Areas for caribou occur within the Project RSA (Government of Yukon 2015).

Table 6-2. Summary of the overlap of different types of protected areas and management areas with the seasonal ranges of the Porcupine Caribou Herd.

Season	Area (km²)	% of Seasonal Range					
		Protected Areas [1]	IMA I	IMA II	IMA III	IMA IV	Not Zoned
Early, Mid, Late Winter	58,090	37	2	8	19	18	15
Spring, Migration and Pre-calving	68,463	55	1	7	21	7	9
Calving	14,636	100	0	0	0	0	0
Post-Calving and Movement	7,622	100	0	0	0	0	0
Early Summer	5,901	100	0	0	0	0	0
Mid Summer	24,417	86	0	14	0	0	0
Late Summer and Fall Migration	57,928	60	4	15	13	8	0
Rut and Late Fall	65,249	31	3	10	23	13	20

[1] including parks, special management areas, conservation areas, wilderness areas, protected areas, ecological preserves, and habitat protection areas.



Map 6-2. Protected areas and management areas within the Porcupine Caribou Herd range in Yukon.

6.4 SEASONAL DISTRIBUTION

Considerable effort has been placed towards quantifying and mapping space use of PCH caribou in Yukon. Satellite-telemetry collaring programs have allowed for the tracking of individuals within the herd to delineate the herd's seasonal distributions. The PCTC supplied EDI with spatial polygons of PCH seasonal ranges spanning 37 years (1970–2016), which provided an opportunity to determine the amount of overlap between seasonal ranges and the RSA. Simple measures of overlap (%) can yield useful insight into the historical frequency of occupation and how PCH caribou are likely to interact with the Project.

The Project RSA overlaps a relatively small proportion of late fall (October 8 to November 30) and winter (December 1 to March 31) ranges. Most of the overlap occurs in portions of the ranges that are less frequently used on an annual basis. No overlap occurs with frequently used portions of late fall and winter ranges.

6.4.1 METHODS

The seasonal ranges used for this analysis consisted of mapped 'sensitive habitat' polygons provided by the PCTC that correspond to eight seasonal life cycle periods for the PCH (Porcupine Caribou Technical Committee 1993). Within each season, the PCTC identified four levels of use based on the frequency of overlap among annual estimates of seasonal home ranges computed for collared caribou, 1970–2016. The four use levels correspond to the proportion of years that home range estimates overlapped any given area: >40 %, 30–40 %, 20–30 %, and <20 %. The lowest category (<20 %) corresponds to very low use and is not considered part of the regular seasonal ranges of the PCH. The degree of overlap of the Project RSA with the PCH seasonal ranges was calculated in a GIS by measuring the overlap of the RSA with each 'frequency of use' category for each seasonal range. All eight life cycle periods were considered for the analysis, but only late fall (including rut, October 8 to November 30) and winter (December 1 to March 31) ranges overlapped the RSA. The overlap analysis was constrained to Yukon because fall and winter ranges in Yukon and Alaska are functionally discrete. Including the Alaskan ranges would dilute the degree of overlap of the RSA with the Yukon ranges.

6.4.2 RESULTS

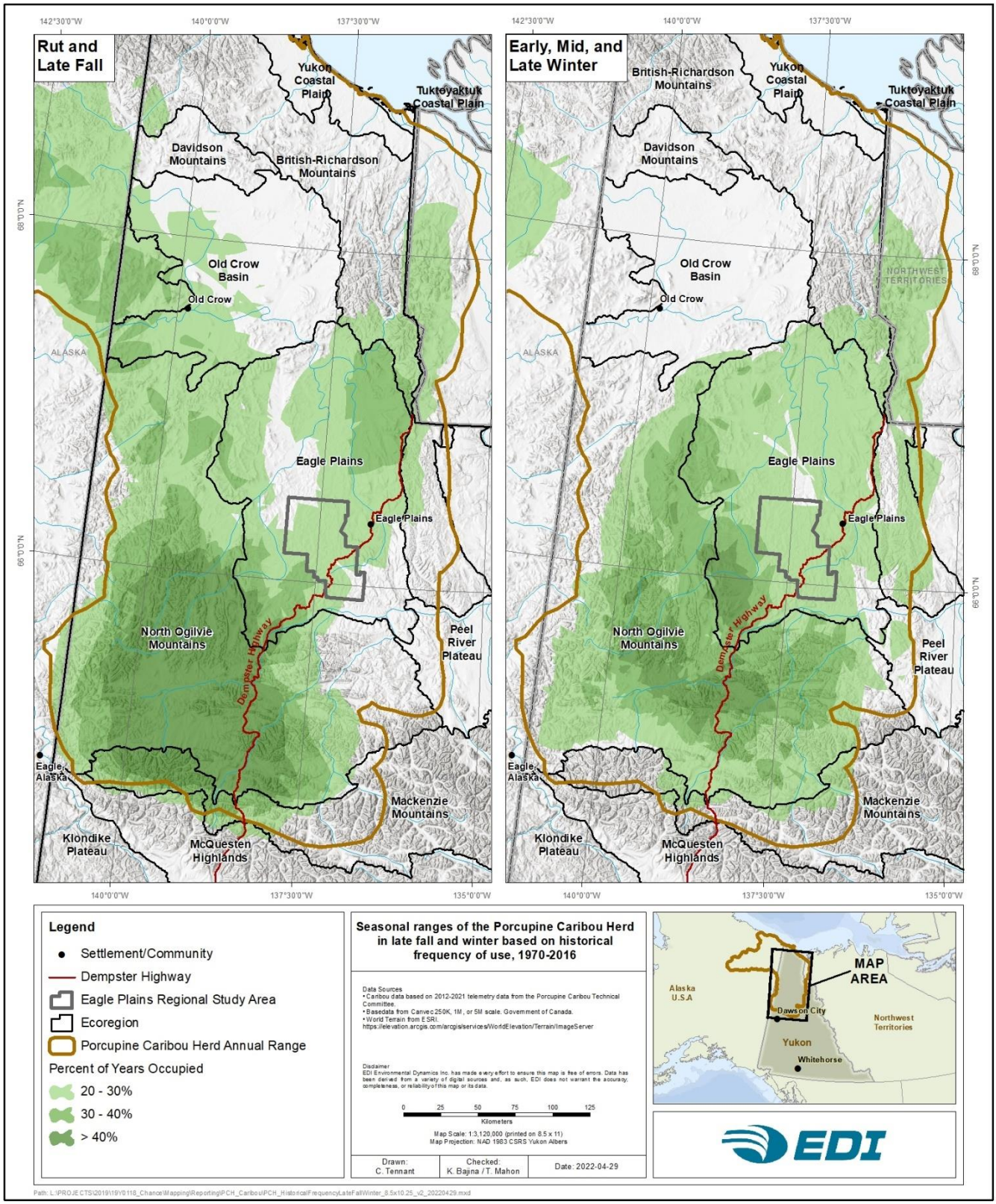
Only two seasonal life cycle periods had relatively frequent overlap (i.e., >20 % across years) with the RSA: (1) rut and late fall, and (2) early, mid, and late winter. For simplicity in this and subsequent analyses, these two periods are referred to as 'late fall' and 'winter' seasons. The RSA overlaps a relatively small portion of the seasonal ranges for both late fall and winter seasons: 5.97% in late fall and 6.54% in winter (Map 6-3). The greatest overlap occurred with the 20–30 % frequency of use areas; 5.90% and 6.12% of late fall and winter ranges, respectively (Table 6-3). No overlap occurred between the Project RSA and the most frequently used areas (>40 %) for either season.

PCH caribou have a wide-ranging distribution in late fall and winter and occupy a large portion of northern and central Yukon. Though some use occurs in the Project RSA and the broader Eagle Plains ecoregion, more frequent use occurs further southwest in the taiga cordillera of the North Ogilvie Mountains in late fall and

winter, and in the Richardson Mountains in late fall (Map 6-3). As discussed in the background sections, Section 6.2.2 *Seasonal Ranges and Movements* and Section 6.2.3.1 *Effects of Snow*, the distribution of the PCH in winter varies across four regions with different snow regimes: Yukon/Alaska border, Richardson Mountains, Ogilvie/Hart region, and the Whitestone/Eagle region (Russell et al. 1993). Use of the Whitestone/Eagle region is highest in years with lower than average snowpacks.

Table 6-3. Percent overlap of the Porcupine Caribou Herd late fall and winter ranges with the Project RSA based on the annual frequency of use by caribou, 1970–2016.

Seasonal Range	Annual Use by Caribou (%)	Percent Overlap with RSA (%)
Late Fall	< 20%	0.55
	20–30%	5.90
	30–40%	0.07
	> 40%	0.00
Winter	< 20%	0.07
	20–30%	6.12
	30–40%	0.42
	> 40%	0.00



Map 6-3. Annual frequency of use by the Porcupine Caribou Herd in late fall and winter ranges relative to the RSA, 1970–2016.

6.5 HABITAT USE

The general distribution of PCH caribou across seasons provides some context for their potential interaction with, and overlap of, the Project RSA. However, to caribou, all space on the landscape is not equivalent. Habitat needs to be considered to predict how often caribou might occur in the area based on the amount and distribution of necessary resources, such as forage. To better understand how PCH caribou use habitat across their late fall (including rut) and winter (i.e., early, mid, and late season) ranges, statistical models were developed to describe the relationship between caribou locations and relevant habitat components. These models considered habitat available to caribou broadly across their seasonal range. Habitat models were developed for late fall and winter using GPS location data (2012–2021) of satellite-collared caribou provided by the PCTC. Habitat model outputs were used to estimate the amount and distribution of habitat within the Project RSA and across the PCH's late fall and winter ranges.

The chosen models for late fall and winter performed reasonably well in predicting PCH caribou habitat selection based on several measures of model performance. Light macrolichen cover was the key driver of caribou habitat use in both seasons, though preference for lichen was strongest during winter. During late fall, caribou tended to select flat, mid-elevation regions near large waterbodies. During winter, caribou tended to select flat areas at low and high elevations while remaining distant from waterbodies. Caribou also avoided areas with dense conifer trees, shrub (deciduous and evergreen), forb, and graminoid cover. Base habitat models predicted the distribution and proportion of selected habitat in the Project RSA to be approximately equivalent during late fall and less during winter relative to the full extent of those seasonal ranges.

6.5.1 METHODS

6.5.1.1 Spatial Extent

Habitat modelling was conducted across the Yukon portion of the late fall and winter seasonal ranges defined in Section 6.5, *Seasonal Distribution* (i.e., areas with >20% frequency of annual use). Analyses were limited to the Yukon portion of late fall and winter ranges because of the potential differences in the ecology of caribou occupying Alaska versus Yukon. Using the full Yukon range yields the benefit of identifying broad patterns of habitat selection that affect the territory-wide distribution of the PCH. However, use of a broader scale may dilute patterns of habitat selection at local scales, e.g., only within Eagle Plains ecoregion. Whether such dilution leads to a loss of information depends on caribou habitat preferences in different ecoregions.

6.5.1.2 Data Preparation

The PCTC provided EDI with GPS location data (2012–2021) of satellite-collared PCH caribou. These data covered the entire annual range of the PCH and were reduced to include locations only within the late fall and winter range extents, as described above. The reduced data set consisted of 164 caribou in late fall and 172 caribou in winter. Most of these data (39.02% in late fall and 42.74% in winter) were attributed to locations collected in 2020–2021.

Spatial habitat data were acquired to relate caribou locations to environmental conditions within fall and winter seasonal ranges (as defined above) and, where appropriate, account for variation in conditions across time. For example, temporal changes (from 2010 to 2020) in the distribution of plant functional types (PFTs) due to grazing, fire, and climate-driven vegetation dynamics were captured using predicted top cover percentage (%) raster layers developed by Macander et al. (2022). Based on initial data exploration exercises, the PFTs that were considered ecologically relevant to habitat use of the PCH included light macrolichens (also see Macander et al. 2020), graminoids, forbs, evergreen shrubs, deciduous shrubs, and conifer trees. Data for topography on the landscape were acquired from a Digital Elevation Model (DEM; 1:250,000) for Yukon and were used to develop measures of absolute elevation (metres), slope percent (slope tool in the Spatial Analyst extension, ArcGIS 10.7; ESRI 2019), aspect (degrees), and a terrain ruggedness index (TRI; Sappington et al. 2007). A measure of relative elevation was created by combining absolute elevation and a simplified stream network (CanVec; nearest main watercourse from a 1:1,000,000 scale watercourse layer) and then employing the HAR tool from the Riparian Topography Toolbox in ArcGIS (Dilts 2015). A CanVec (1:1,000,000) waterbody layer was also used to map distances to waterbodies >1 ha. Caribou may use frozen waterbodies as an antipredator tactic to increase sightlines. They may also be mineral licks (Ferguson and Elkie 2005).

6.5.1.3 Statistical Models

Determining which resources (habitat features) are selected most often by animal populations is important because it provides information about how those animals meet fundamental requirements for survival and reproduction (Manly et al. 2002). Resource selection functions (RSF) are a statistical method that quantifies how resources are chosen by relating animal observations to resources available across the landscape. RSFs predict the probability of an animal occurring at specific locations (e.g., within a study extent) based on the combination of resources available at those locations. Results of a RSF can be mapped to identify important areas of resource selection for caribou and, therefore, can inform the conservation and management of the species.

Caribou observations were first overlayed with environmental spatial data layers to develop RSFs for PCH late fall and winter ranges. Environmental values were extracted for each known location of caribou plus ten times as many randomly sampled locations (spaced a minimum distance of 50 m apart). Availability was deemed global, so available locations were randomly selected within the late fall and winter study areas. Independence among observations of caribou was assumed by resampling caribou locations to a maximum of one per day. Available locations were compared to locations known to be occupied or 'used' by caribou to identify the combination of resource units preferred by caribou. Logistic regression was used to develop RSFs within a generalized linear mixed model framework. The general formula for logistic regression is as follows:

$$logit(P) = \beta_0 + \beta_1 x_1 \ldots \beta_n x_n + Y$$

where the predicted value P is dependent on the linear predictor ($\beta_0 + \beta_1 x_1 \ldots \beta_n x_n$) through a logit-link function, and x is the *i*-th environmental covariate and β is its associated coefficient. An interaction was included between Ecoregion and macrolichen cover to account for the varied distribution, and possibly selection, of lichen among ecoregions. An additional random effect term, Y, was added to account for (a) the

variation in habitat selection associated with each caribou year and (b) the unequal sample sizes among years. Large weights were applied to all available locations ($weight_{avail}$ = 1,000) relative to used locations ($weight_{used}$ = 1) to ensure that parameter estimates were not biased by the sampling ratio of used and available points (Muff et al. 2020). The linear predictor was used to calculate the probability of selection P:

$$P = \frac{e^{(\beta_0+\beta_1 x_1 \ldots \beta_n x_n+Y+E)}}{1+e^{(\beta_0+\beta_1 x_1 \ldots \beta_n x_n+Y+E)}}$$

where e is the natural exponential function and P is bounded by $0 < P < 1$.

6.5.1.4 Exploring Covariate Relationships

Before analyses, all continuous covariates, such as PFT top covers, elevation, slope, TRI, HAR, and distance to waterbodies, were standardized to have a mean of zero and a standard deviation of one. Standardizing the values across covariates ensures model convergence and improves the ability to rank the relative importance of each covariate in a model. The aspect was converted from continuous (degrees) to categorical (cardinal directions) based on 90° intervals. To prevent biased estimates of coefficients and inflated errors, multicollinearity among covariates was assessed using a correlation matrix (dropping variables with Pearson's product moment correlation $|r| > 0.7$ [see Dormann et al. 2013]) and variance inflation factor scores (dropping variables with VIF scores > 3 [Zuur et al. 2009]). For example, absolute and relative (HAR) elevation in winter were highly correlated (r = 0.69). The decision to choose one over the other was based on univariate response curves assessed using generalized additive modelling (GAM; see below). In other words, of the highly correlated covariates, the one with the greatest selection response (slope) was chosen. In this case, absolute elevation was retained over HAR.

Data exploration consisted of (1) univariate analyses with the response variable (i.e., used versus available), and (2) univariate and multivariate GAMs to assess the potential marginal effect of each covariate on the (non-linear) shape of the response curve (i.e., probability of use). These exercises informed model development. For example, rather than assuming a linear increase for percent light macrolichen cover, the variable was logarithmically transformed to fit the expectation that the probability of selection increased at incrementally smaller values as the quantity of lichen in a patch increased (Figure 6-2). Additionally, different patch sizes were considered for PFT covers by estimating the mean percent cover within 100 m, 500 m, and 1,000 m buffers around used and available points.

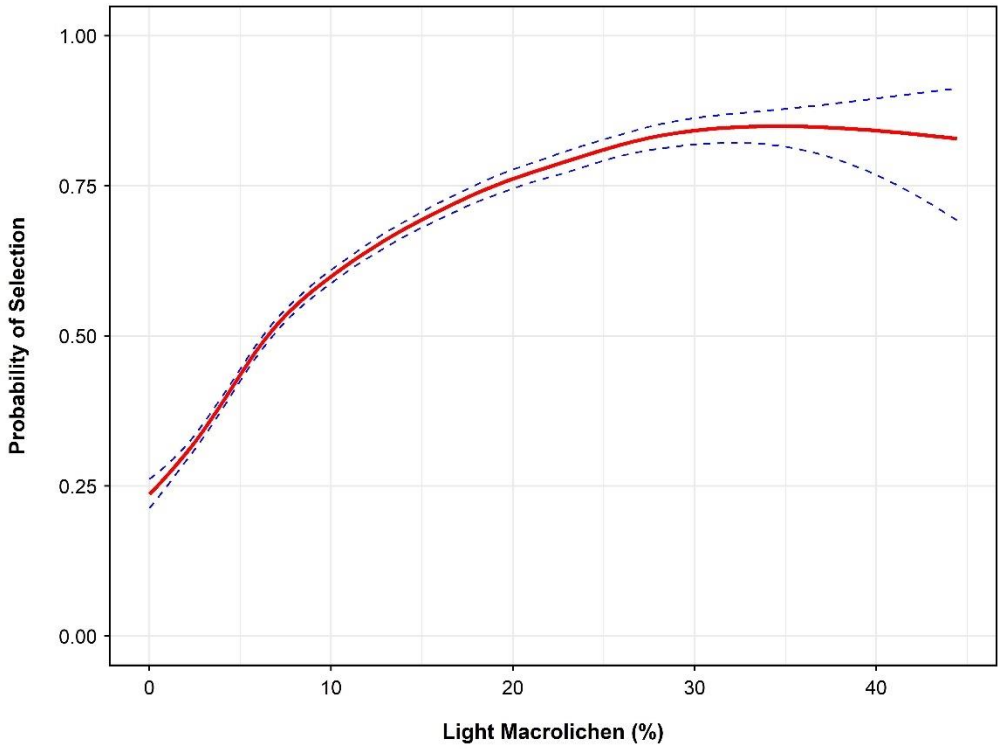


Figure 6-2. Generalized additive model assessing the probability of selection of light macrolichens by PCH during winter.

6.5.1.5 Model Selection and Validation

Habitat models were selected for late fall and winter by implementing 'full' models (with all relevant covariate terms) and assessing the variation explained by the inclusion of each covariate. The best models were chosen based on (1) statistical considerations using Akaike's information criterion (AIC; Burnham and Anderson 2002), which balances the trade-off in the amount of variance explained (i.e., model likelihood) with the number of parameters considered, and (2) ecological significance to caribou in the late fall and winter seasons. Since the goal of the model was prediction, as many covariates as necessary were retained. Thus, alternative candidate models were considered not by testing competing hypotheses but rather by dropping covariates with low magnitude (scaled) coefficients $< |0.1|$. Model diagnostics were run on simulated residuals to assess (a) goodness-of-fit (i.e., Kolmogorov-Smirnov test), (b) issues related to dispersion, (c) the frequency of outliers, (d) variance among categorical predictors, and (e) quantile regressions of observed versus expected residuals.

The predictive performance of late fall and winter models were assessed using a 5-fold cross-validation approach as per the steps outlined in Johnson et al. (2006). (1) The original data were partitioned into 5-fold groups. For each iteration of the evaluation procedures, four groups were combined into the training dataset. The remaining group was used as the testing dataset. (2) The RSF was estimated for each training dataset. (3) RSF values from the training dataset were predicted in a GIS and reclassified into 10 quantile rank bins. (4) Midpoint (median) values of raw RSF scores were calculated for each quantile bin. (5) Percent utilization was

calculated for each quantile bin using equation 4 in Johnson et al. (2006). (6) The number of used observations from the testing dataset that fell in each quantile bin were counted. (7) The number of expected observations from the testing dataset was calculated for each quantile bin using equation 5 in Johnson et al. (2006). (8) Observed versus expected counts and proportions from the testing dataset were compared and tested formally using linear regression, spearman's rank correlation, chi-square goodness-of-fit (i.e., observed versus expected counts), and tests of proportions for each quantile bin (i.e., chi-square observed versus expected proportions). These steps were repeated until each fold was used as the testing dataset. The 5-fold cross-validation procedure was implemented for several candidate models for both late fall and winter to determine whether simpler models yielded more accurate predictions.

6.5.1.6 Habitat Quality, Amount, and Distribution

Models selected for late fall and winter were used to generate predictive habitat maps across those seasonal ranges. These mapped predictions aimed to identify the amount and distribution of habitat available to PCH caribou. To facilitate the comparison of relative habitat quality across the study area, the RSF predictions were classified into four ordinal ratings: Very Low, Low, Moderate, and High. To help objectively define ecologically relevant classification of the RSF values we conducted a post-hoc selection-ratio test of the caribou locations against the RSF predictions. This approach identified the point within the RSF value range where values switch from avoided to being selected. The portion of the 'selected' RSF value range was divided at the midpoint into the Moderate and High ratings and the portion of the 'avoided' range was divided at the midpoint into the Very Low and Low ratings. For example, for RSF output with a range from 0 to 1, if the selection-ratio calculation determined the breakpoint between avoidance and selection occurred at 0.6, the habitat quality ratings would be Very Low = 0.0-0.3, Low = 0.3-0.6, Moderate = 0.6-0.8, and High = 0.8-1.0.

To determine the breakpoint within the RSF value range that switched from avoided to selected, the frequency distributions of mapped RSF predictions were partitioned into 50 quantile bins with each bin consisting of two-percentile intervals. Selection ratios were calculated for each quantile bin by associating mapped RSF predictions to used and available collar locations and then assigning each location to a quantile bin. The selection ratio for each bin was calculated as follows:

$$SR_{bin} = \frac{Used_{prop} - Avail_{prop}}{Avail_{prop}}$$

where $Used_{prop}$ and $Avail_{prop}$ are the proportion of used and available locations in each quantile bin. Selection ratios were used to categorize habitat quality into the discrete ratings discussed above (i.e., Very Low, Low, Moderate, and High). The bin at which selection ratios switched from negative to positive identified the threshold between Low and Moderate quality habitat. Very Low quality habitat was identified based on the midpoint between the smallest quantile bin and the Low/Moderate quality habitat threshold. Similarly, the midpoint between the Low/Moderate quality habitat threshold and the largest quantile bin differentiated Moderate and High quality habitat. For certain management questions or purposes, it may be adequate to just use two habitat classes—avoided or selected. Subdividing those into the four ratings provides further resolution for certain management questions or objectives. For example, when comparing different

road route options that must traverse an area of 'selected' habitat, potential impacts are expected to be minimized by locating the road in Moderate versus High habitat areas.

RSF frequency distributions were extremely right skewed so that very high RSF values were low in frequency. This issue arises when dealing with RSFs with 'infinitely weighted' available locations, which has become standard practice in recent years (e.g., Muff et al. 2020). In late fall and winter RSFs, the ratio of used to available locations was 1:10 with an additional large weight (i.e., 1,000) assigned to each available location. These large weights effectively reduce RSF predictions to very small decimal numbers and skews their distribution. To ensure that this skew did not underestimate the amount of High versus Moderate quality habitat, all RSF values equal to or greater than the 98th percentile were fixed at that value. Thus, there were effectively 49 quantile bins, in total, because all predictions in the 50th bin were assigned to the 49th bin.

To compare the amount and distribution of selected habitat within the Project RSA (~2,386 km^2) to the broader landscape, the amount of selected habitat was assessed within similar sized polygons across the seasonal ranges. A grid composed of 50 km x 50 km (2,500 km^2) cells was placed over the Yukon extent of the PCH ranges, and the proportion of selected habitat was assessed for each cell.

6.5.1.7 Statistical and Geospatial Software

All statistical analyses were completed in R software for Statistical Computing, version 4.1.0 (R Development Core Team 2020). Package 'mgcv' (Wood 2011) was used to develop and assess non-linearity in response-covariate relationships using generalized additive modelling. Package 'glmmTMB' (Brooks et al. 2017) was used to fit generalized mixed-effects models. In addition to visual assessment of covariate-response relationships, package 'DHARMa' (Hartig 2021) was used to assess simulated model residuals (e.g., goodness of fit, dispersion, outliers, heteroscedasticity). Package 'groupdata2' was used to partition data into training and testing datasets; it was especially useful for partitioning a consistent number of used and available locations among the data folds. All geospatial analyses were completed in R, version 4.1.0 (R Development Core Team 2020), QGIS (QGIS Development Team 2020), and ArcGIS, version 10.7 (ESRI 2020).

6.5.2 RESULTS AND DISCUSSION

6.5.2.1 Habitat Models

The selection of late fall and winter habitat models required an iterative model fitting, testing, and cross-validation process. The appropriate patch size (i.e., 100 m, 500 m, or 1,000 m) of each PFT was selected based on GAM plots to identify which patch size corresponded with the greatest change (slope) in selection. Initial model selection procedures determined that 'full' models, with all possible covariates, were the most parsimonious for late fall (No. 1 in Table 6-4) and winter (No. 1 in Table 6-5) RSFs. However, the 'full' model for late fall did not yield the best predictive performance based on the 5-fold cross-validation procedure. The best performing model for late fall excluded the effects of all PFTs except lichen (No. 3 in Table 6-4; Table 6-6), which yielded a better fit between observed and expected proportions across 10 quantile bins based on regression (i.e., higher R^2; intercepts closer to zero and slopes closer to one), tests of proportions

(i.e., greater number of equivalent observed/expected bins), and spearman rank correlations (i.e., larger correlation coefficients). See Section 5.6.1 for plots and summaries of 5-fold cross-validation results for the selected late fall RSF model. Regressions for each fold had very strong fits (all $R^2 > 0.93$) but did have intercepts that differed from zero and slopes that differed from one. The primary reason for this deviation was a greater number of observed proportions in the largest (10th) quantile bin, whereas all other bins were close to the line of unity (1:1 ratio). Spearman rank correlations were consistently very high (all $r > 0.98$ and $p < 0.001$). The mean number of bins in which observed proportions were no different than expected proportions, across all five folds, equalled 5.2 (low = 4, high = 8).

The best performing model for winter consisted of the full parameterization (No. 1 in Table 6-5; Table 6-7), which yielded a better fit between observed and expected proportions across 10 quantile bins based on regression (i.e., higher R^2; more intercepts closer to zero and slopes closer to one), tests of proportions (i.e., greater number of equivalent observed/expected bins), and spearman rank correlations (i.e., larger correlation coefficients) than any alternative candidate model. See Section 5.6.1 for plots and summaries of 5-fold cross-validation results for the selected winter RSF model. Regressions for each fold had strong fits (all $R^2 > 0.79$) and had intercepts that were no different than zero and slopes that were no different than one. Spearman rank correlations were consistently very high (all $r > 0.98$ and $p < 0.001$). The mean number of bins in which observed proportions were no different than expected proportions, across all five folds, equalled 5 (low = 3, high = 6). In conclusion, both late fall and winter model had a fair agreement between observed and expected proportions and had very high spearman rank correlations, which suggests that these models perform adequately for prediction (e.g., see Johnson and Russell 2014, White and Gregovich 2017, Johnson et al. 2020).

Habitat use varied moderately between late fall and winter. Although selection coefficients were highest for macrolichen cover and elevation in both seasons, the relationships varied somewhat, and the extent of Moderate and High rated habitat was reduced in winter compared to late fall. Selection (positive coefficient) for macrolichen cover, the most relevant plant functional type in either season, was greater in magnitude during winter (Table 6-7) than during late fall (Table 6-6). Though the magnitude of selection for macrolichen varied by ecoregion (i.e., interaction), the best-fitting patch size for the selection of macrolichen was consistently 100 m. However, patch size varied for other plant functional types considered during winter (Table 6-7; e.g., conifer tree cover versus forbs). During late fall, caribou selection (positive coefficients) of vegetation was solely driven by lichen cover. Meanwhile, during winter, caribou tended to avoid (negative coefficients) other PFTs such as conifer trees, forbs, graminoids, deciduous shrubs, and evergreen shrubs. The lack of selection/avoidance of other PFTs during late fall is likely the result of more diverse forage use in late fall than in winter and individual variation in habitat choice. Such variation is consistent with a broad habitat selection pattern at the population-level, which led to the poorer predictive performance of late fall models that included other PFT covers.

Preference of absolute elevation also varied between the seasons. Caribou occupied primarily mid elevations (approximately 750 m) during late fall (Table 6-6) but selected low and high elevations during winter (Table 6-7). Caribou also varied in their proximity to waterbodies >1 ha between seasons. Caribou tended to be closer to such waterbodies (negative coefficient) during late fall but remained farther (positive coefficient)

during winter. The ecological basis for these relationships to waterbodies is unclear, but the covariates were retained in the models because they improved predictive performance.

Coefficients associated with lichen cover were of the greatest magnitude, which suggests that the selection of lichen is the primary driver of habitat selection in late fall and winter. This pattern in vegetation use across both seasons is consistent with what is expected of PCH caribou diet and ecology (Thompson and McCourt 1981, Russell et al. 1993). Late fall and winter diets are mostly composed of lichens (and mosses). Though there is some evidence that caribou may forage on evergreen shrubs and deciduous shrubs during late fall (Russell et al. 1993), this pattern was weak, and these covariates were not included in the final model. Another similarity in selection among seasons was in terms of slope and aspect. Caribou avoided steep slopes (negative coefficients, logarithmic) and selected south- and west-facing aspects, which receive greater solar radiation than east- and north-facing aspects. This pattern could be attributed to productive lichen patches during both seasons and to decreased snow depth due to melt and wind during winter.i

Selection gradients (i.e., the degree of preference/avoidance) were greater during winter than late fall. This is likely because forage was more broadly available across different habitats due to lower snowpacks in late fall and because more locations in the late fall were likely associated with travelling than foraging. Though caribou distribution is broader in winter, there was clearly a stronger preference (positive coefficient) for light macrolichens and a stronger avoidance (negative coefficient) of areas with high cover of conifer trees. Stronger preference and avoidance in winter may result in more concentrated forage on lichen and from snow constraints on caribou distribution.

Temporal patterns of habitat selection also varied between late fall and winter. Habitat selection seemed to be fairly consistent across years in late fall but varied from winter to winter. A very small portion of the overall variance ($\sigma^2 = 0.00021$) in habitat selection could be explained by year effects during late fall. This model contributed little to the overall model likelihood and was penalized for an additional parameter ($AIC_\Delta = 2$); thus, year effects were not included for the late fall model. However, during winter, a year effect explained a sufficient amount of variation ($\sigma^2 = 0.013$) in habitat selection to warrant inclusion in the final model (i.e., $AIC_\Delta = -90.9$ with year effect). Variation among years was likely greater in winter due to the effects of snow across the landscape, which can broadly affect the distribution of PCH caribou and their foraging habits.

Snow accumulation and distribution is invariably an important factor affecting habitat selection by PCH caribou at multiple scales. At fine spatial scales, snow depth, density, and hardness can limit access to terrestrial lichens (Johnson et al. 2001). Although snow depth data were not available, elevation was considered as a suitable surrogate. In the winter RSF, caribou exhibited selection for low and high elevations and avoidance of mid elevations, where snowpacks are often deepest. Indeed, Pedersen et al. (2021) identified a significant correlation ($r > 0.6$) between elevation and snow depth in 33% of winters during their study of another barren-ground caribou herd, the Central Arctic Herd. The amount of snowfall and snowpack at broad spatial scales can cause the PCH to occupy different core wintering regions. For example, PCH caribou occupy the Ogilvie/Hart and Richardson Mountains regions on a rotational basis because these regions receive less snow than adjacent areas (Russell et al. 1993). This pattern is consistent with the current data, whereby GPS-collared PCH caribou occupied different ecoregions at different intensities (i.e., number of individuals and locations) across time.

Though snow depth could not be considered explicitly in habitat models, the variation estimated among years and differences in the use of ecoregions and elevations were considered to partially account for the influence of snow. These variables are considered coarse correlates of snowpack patterns across the landscape (Russell et al. 1993), yet, the exclusion of an explicit snowpack covariate does limit fine-scale predictions of how snow affects caribou resource selection. Ultimately, snow depth is probably the primary, ecologically relevant metric that would supplement the current covariate suite and provide greater insight on winter selection patterns. Available snow covariates were examined and deemed not to be useful. For example, information on snow prevalence, date of the first snow, or snow cover are not inherently useful because caribou (and other ungulates) are not constrained in their movements and foraging by shallow snow. Given these considerations, it was deemed more appropriate to account for the coarser effects of snow depth using ecoregion and elevation rather than using a snow cover that may be misleading both ecologically and mechanistically, resulting in a spurious correlation.

Table 6-4. Model selection of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during late fall.

No.	Model	*K*	AIC	Δ AIC
1	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_100m + Forbs_100m + Deciduous_Shrub_1000m + Graminoid_1000m + Evergreen_Shrub_100m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	22	167,637.4	0.0
2	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_100m + Deciduous_Shrub_1000m + Evergreen_Shrub_100m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	20	167,644.0	6.6
3*	~ Ecoregion * log(Lichen_100 + 1) + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	17	167,750.7	113.3
4	~ Ecoregion * log(Lichen_100 + 1) + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies	14	167,783.0	145.6
5	~ 1 (null model)	1	169,964.2	2,326.8

* Chosen model based on best predictive performance in 5-fold cross-validation.

Table 6-5. Model selection of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during winter.

No.	Model	*K*	AIC	Δ AIC
1*	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_1000m + Forbs_500m + Deciduous_Shrub_1000m + Graminoid_1000m + Evergreen_Shrub_100m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	21	255,398.7	0
2	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_1000m + Forbs_500m + Graminoid_1000m + Evergreen_Shrub_100m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	20	255,428.0	29.3
3	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_1000m + Forbs_500m + Deciduous_Shrub_1000m + Graminoid_1000m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	20	255,500.1	101.4
4	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_1000m + Forbs_500m + Graminoid_1000m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	19	255,538.9	140.2
5	~ 1 (null model)	1	265,758.0	10,359.3

* Chosen model based on best predictive performance in 5-fold cross-validation.

Table 6-6. Base habitat model of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during late fall.

Model Term	Estimate	Std. Error	*Z*-statistic	*P*
Intercept				
Eagle Plains & North *(Reference)*	-9.697	0.035	-273.568	<0.0001
Ecoregion (factor)				
North Ogilvie Mountains	-0.136	0.075	-1.803	0.0714
British-Richardson Mountains	0.533	0.047	11.312	<0.0001
Old Crow Basin	0.341	0.038	9.082	<0.0001
Davidson Mountains	0.666	0.041	16.132	<0.0001
Aspect (factor)				
South	0.099	0.032	3.147	0.00165
East	0.003	0.032	0.082	0.935
West	0.161	0.031	5.162	<0.0001
Ecoregion–Lichen_100m Interaction				
Eagle Plains * Lichen_100m Percent[1,2] *(Reference)*	0.694	0.029	23.880	<0.0001
North Ogilvie Mountains * Lichen_100m Percent[1,2]	0.062	0.063	0.990	0.322
British-Richardson Mountains * Lichen_100m Percent[1,2]	-0.311	0.043	-7.300	<0.0001
Old Crow Basin * Lichen_100m Percent[1,2]	-0.157	0.037	-4.216	<0.0001
Davidson Mountains * Lichen_100m Percent[1,2]	-0.224	0.042	-5.324	<0.0001
Digital Elevation Model				
Slope Percent[1,2]	-0.311	0.017	-18.006	<0.0001
Absolute Elevation[2] (linear)	0.865	0.073	11.907	<0.0001
Absolute Elevation[2] (quadratic)	-0.813	0.070	-11.661	<0.0001
Distances				
Distance to Waterbodies[2]	-0.184	0.016	-11.827	<0.0001

[1] covariate transformation = $\log_e(x + 1)$.

[2] covariate estimates based on standardized covariate values = (x – mean[x])/std. deviation(x).

Table 6-7. Base habitat model of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during winter.

Model Term	Estimate	Std. Error	*Z*-statistic	*P*
Intercept				
Eagle Plains & North *(Reference)*	-10.007	0.051	-195.485	<0.0001
Ecoregion (factor)				
North Ogilvie Mountains	0.616	0.040	15.502	<0.0001
British-Richardson Mountains	0.738	0.039	19.152	<0.0001
Old Crow Basin	0.281	0.034	8.229	<0.0001
Aspect (factor)				
South	0.196	0.025	7.671	<0.0001
East	0.030	0.026	1.154	0.249
West	0.329	0.025	13.294	<0.0001
Ecoregion– Lichen_100m Interaction				
Eagle Plains * Lichen_100m Percent[1,2] *(Reference)*	1.119	0.018	62.823	<0.0001
North Ogilvie Mountains * Lichen_100m Percent[1,2]	-0.154	0.034	-4.485	<0.0001
British-Richardson Mountains * Lichen_100m Percent[1,2]	-0.614	0.036	-17.203	<0.0001
Old Crow Basin * Lichen_100m Percent[1,2]	-0.123	0.034	-3.602	0.000316
Other Plant Functional Types				
Conifer_Tree_1000m Percent[2]	-0.256	0.009	-27.241	<0.0001
Forbs_500m Percent[2]	-0.166	0.010	-17.068	<0.0001
Deciduous_Shrub_1000m Percent[2]	-0.096	0.009	-10.137	<0.0001
Graminoid_1000m Percent[2]	-0.120	0.009	-12.706	<0.0001
Evergreen_Shrub_100m Percent[2]	-0.052	0.009	-5.580	<0.0001
Digital Elevation Model				
Slope Percent[1,2]	-0.216	0.012	-18.678	<0.0001
Absolute Elevation[2] (linear)	-1.369	0.056	-24.410	<0.0001
Absolute Elevation[2] (quadratic)	0.889	0.053	16.627	<0.0001
Distances				
Distance to Waterbodies[2]	0.201	0.010	20.321	<0.0001

[1] covariate transformation = $\log_e(x + 1)$.

[2] covariate estimates based on standardized covariate values = (x – mean[x])/std. deviation(x).

6.5.2.2 Predicted Habitat Distribution

Predicted habitat quality, amount, and distribution depended on the magnitude of resource selection and the distribution of habitat covariates across the landscape (i.e., primarily light macrolichen cover). Predictions from habitat models for late fall and winter were classified into four ordinal habitat quality ratings (i.e., Very Low, Low, Moderate, or High quality). See Section 6.9.2 for plots that demonstrate the switch from negative to positive selection ratios across quantile (two-percentile) bins for late fall (31st quantile bin [60th–62nd percentile]; Attachment Figure 11 and Attachment Figure 12) and winter (30th quantile bin [58th–60th percentile]; Attachment Figure 15 and Attachment Figure 16). Furthermore, Section 6.9.2 provides plots of (a) selection ratios associated with each habitat rating and (b) the proportion of the late fall and winter ranges composed of each habitat rating. In general, Very Low quality habitat had low, negative selection ratios while High quality habitat had high, positive selection ratios. Approximately 60% of the late fall and winter ranges consisted of avoided (Very Low and Low) habitat, and 40% consisted of selected (Moderate and High) habitat.

The distribution of habitat across the landscape differed between late fall (Map 6-4) and winter (Map 6-5) ranges. The proportion of selected late fall habitat in the Project RSA (0.404) was equivalent to the mean proportion in the broader late fall range when accounting for variance in that estimate (Table 6-8). In contrast, the proportion of selected winter habitat in the Project RSA (0.265) was substantially less than the mean proportion in the broader winter range (0.411) (Table 6-8). Though mean estimates of selected habitat in the broader late fall and winter ranges were approximately 0.40, there was considerable variation among the 50 km x 50 km cells used in the analyses. In the late fall range, the lowest and highest proportions of selected habitat were 0.140 and 0.881, respectively. Cells with the lowest proportions were located mostly along the western edge of the late fall range (i.e., high elevations in the North Ogilvie Mountains), and cells with the highest proportions were located mostly along the eastern edge of the late fall range (i.e., Eagle Plains ecoregion transitioning into Richardson Mountains). The lowest and highest proportions of selected habitat in the winter range were 0.106 and 0.764, respectively. Cells with the lowest proportions were located centrally in the winter range (i.e., Eagle Plains ecoregion) and cells with the highest proportions were located mostly along the eastern and southern edge of the winter range (i.e., Richardson mountains and North Ogilvie Mountains).

In the Project RSA, selected late fall habitat was concentrated at mid-elevation plateaus and depended on the amount of lichen cover. For example, a large patch of High quality habitat occurred adjacent (south side) to the Dempster Highway (inset in Map 6-4); this patch occurred on a large mid-elevation plateau, in proximity to waterbodies >1 ha in size, and relatively high amounts of lichen cover. In fact, several portions of the Dempster Highway intersected either Moderate or High quality habitat at mid-elevations and with moderate lichen cover. Across the broader landscape, the greatest amount of selected habitat occurred within the southern extent of the North Ogilvie Mountains ecoregion, the western extent of the British-Richardson Mountains ecoregion, and in large areas at the eastern extent of the Eagle Plains ecoregion (Map 6-4). Avoided habitat primarily occurred at low elevation valley bottoms or high elevations (> 750 m, e.g., at the peaks of British-Richardson Mountains) in areas with low lichen and vegetative cover.

Winter habitat occurred primarily at either valley bottoms with open stunted spruce or high elevations with sparse tree cover and high macrolichen cover. Selected habitat was also distant from large waterbodies and

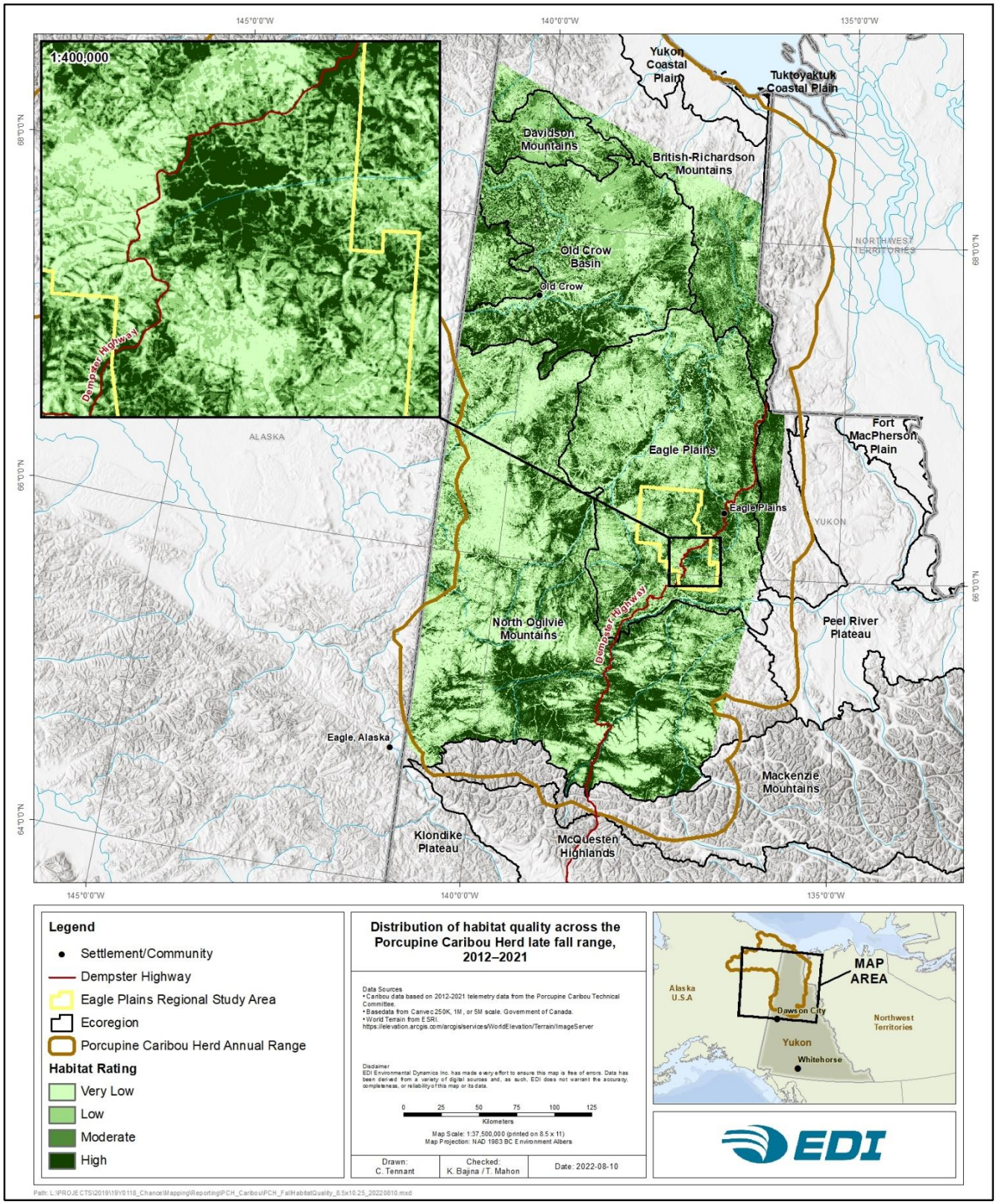
wet environments containing forbs and graminoids, as well as areas with high cover of deciduous or evergreen shrub. In the RSA, selected habitat was localized in specific regions. For example, a large extent of High quality habitat occurred at the northern extent of the RSA, on the west side of Chance creek (Map 6-5). This area is low in elevation and has relatively high lichen cover. Two other large patches of High quality habitat occur at the southern extent of the RSA, both associated with low elevation and very high lichen cover. Although mid-elevations have relatively lower RSF predictions, in general, certain mid-elevation areas with high lichen cover, such as the areas along the Dempster Highway for late fall habitat are also predicted to offer Moderate or High quality winter habitat (inset in Map 6-4). Across the broader landscape, large extents of selected habitat occurred in the Richardson Mountains, the Ogilvie Mountains, and northern extents of Eagle Plains ecoregion. The greatest amount of avoided habitat (Very Low and Low) also occurred in Eagle Plains due to large areas of recent wildfire and its vast mid-elevation plateaus.

The use of multiple habitat ratings, as opposed to a binary classification (e.g., suitable versus unsuitable), was necessary to retain high resolution information on the distribution of habitat quality. For example, there were stark differences in the amount of lichen cover in areas of Moderate versus High quality habitat, and this can have implications for timing and extent of Project operations. Map 6-6 provides a comparison between winter habitat quality ratings and macrolichen cover in the Project RSA. There is a clear distinction between areas of high versus low macrolichen cover. There are several High quality ratings that occur along circular and N-S oriented ridges at the southwest corner of the RSA. Adjacent areas of similar elevation but with low macrolichen cover, transition from Moderate to Very Low in quality. Since macrolichen cover is the strongest driver of resource selection by PCH caribou during winter, it is important to be able to distinguish these high-value regions for management purposes.

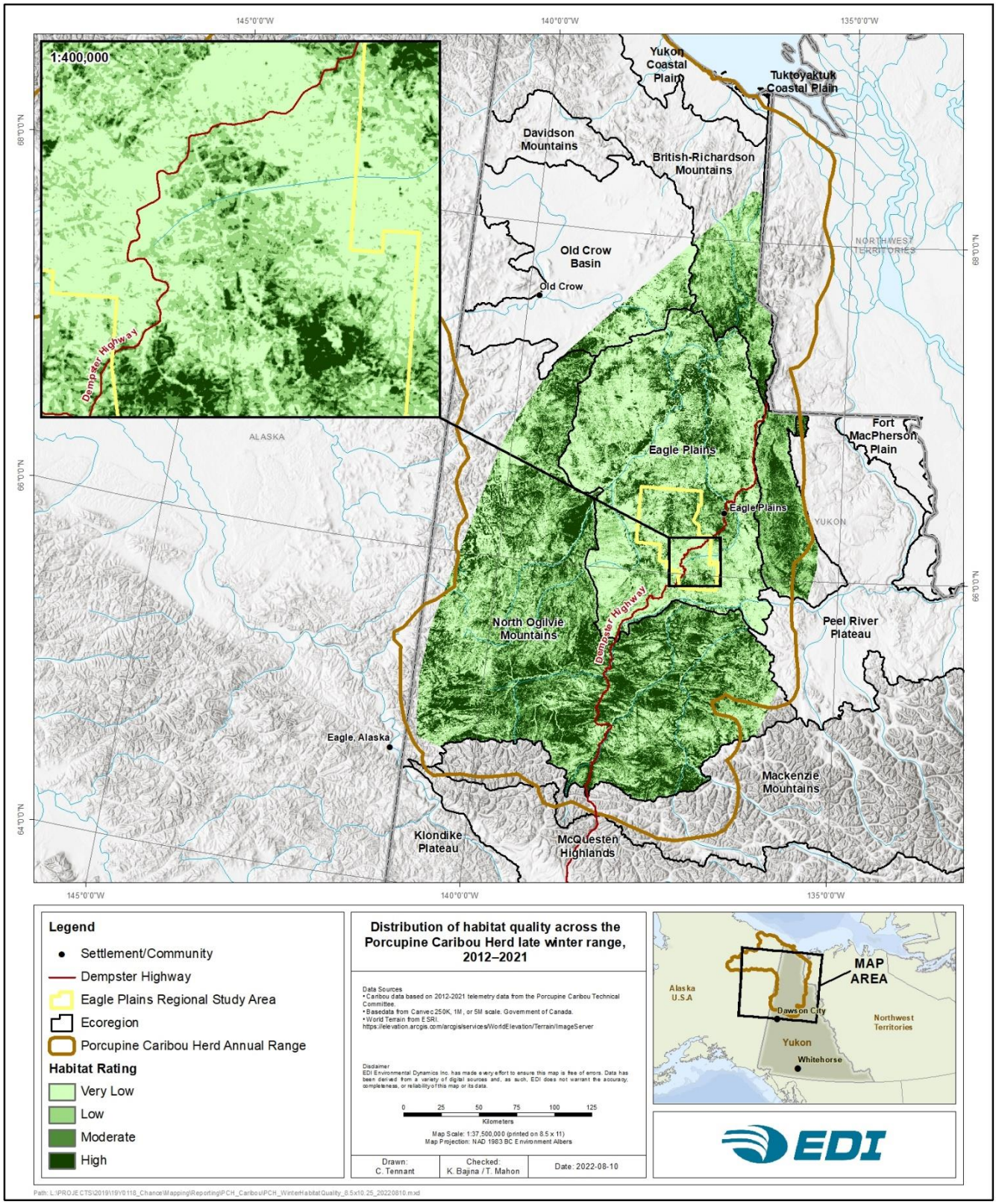
Table 6-8. Proportion of selected (Moderate and High) caribou habitat in the Project RSA relative to the mean (and std. error) of 50 km x 50 km cells covering late fall and winter range extents.

Season	Scale	Proportion of Moderate and High Quality Habitat	Std. Error
Late Fall	Project RSA (2,387 km² total)	0.404	–
	Late Fall Range (88,149 km²) [1] (2,500 km² per cell) – 53 cells total	0.415	± 0.025
Winter	Project RSA (2,387 km² total)	0.265	–
	Winter Range (65,077 km²) [1] (2,500 km² per cell) – 40 cells total	0.411	± 0.026

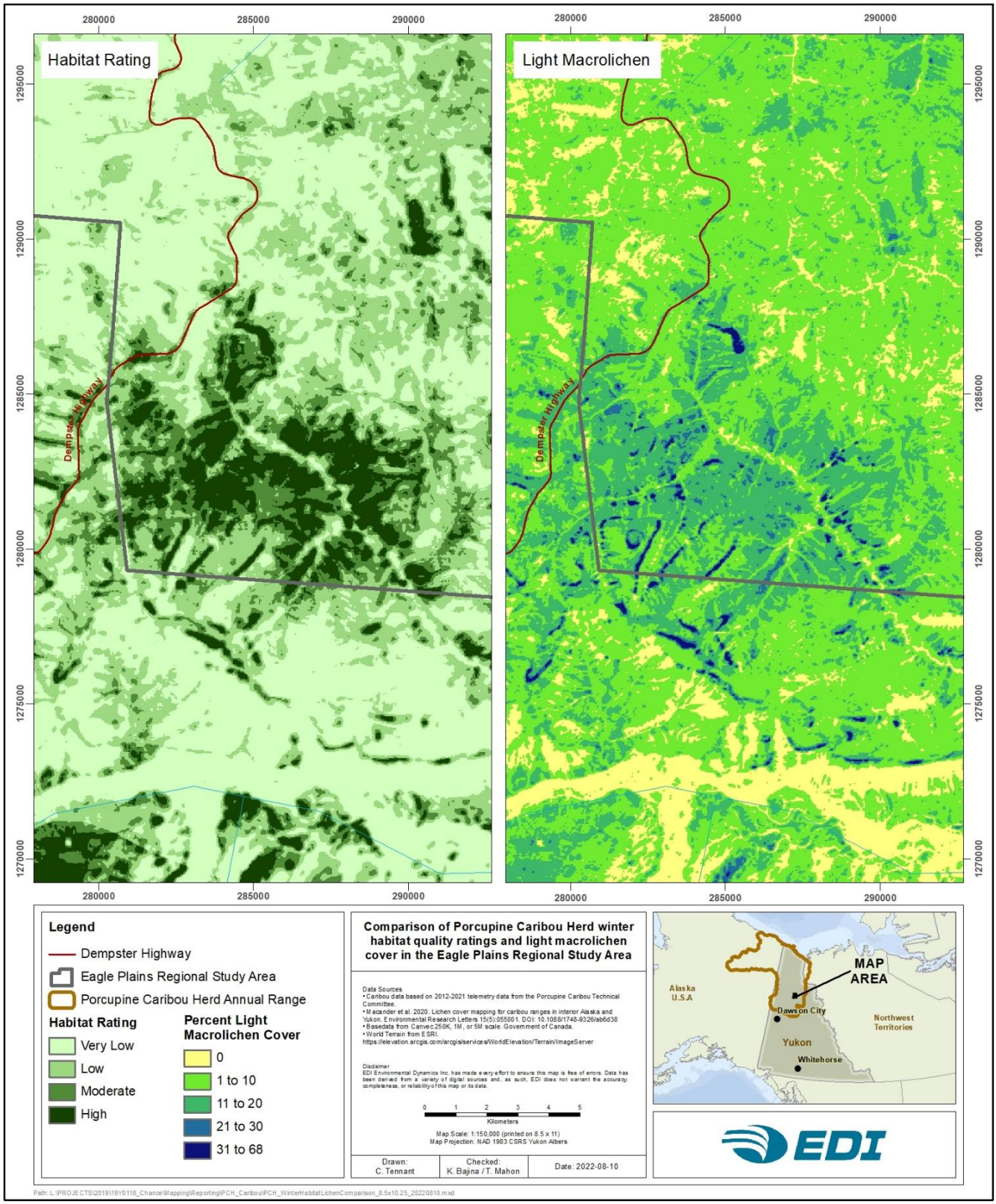
[1] Late fall and winter ranges were subsampled using 2,500 km² cells (approximately the same size and the RSA) to facilitate estimation of mean and variance.



Map 6-4. Distribution of habitat quality across the Porcupine Caribou Herd late fall range, 2012–2021.



Map 6-5. Distribution of habitat quality across the Porcupine Caribou Herd winter range, 2012–2021.



Map 6-6. Comparison of Porcupine Caribou Herd winter habitat quality ratings and light macrolichen cover in the Eagle Plains Regional Study Area.

6.6 MOVEMENT

In addition to habitat selection, movement patterns across the seasonal ranges and within the vicinity of the Project RSA are important to understanding how the PCH may interact with the Project. Metrics such as daily travel rates and duration of residency (i.e., how long caribou spend in an area before moving on) help quantify how caribou use the landscape and how they may react to features, such as the Dempster Highway. In addition to movement metrics, the spatial locations of travel movements can define areas of concentrated movement during migration. To better understand factors affecting PCH caribou movement, two analyses were conducted: (1) calculation of daily movement rates and residency times of caribou in the Project RSA relative to the broader landscape, and (2) delineation of movement paths to assess broad-scale movement patterns and the potential for caribou to interact with the Project.

The PCH typically exhibit movements of several kilometres per day in both late fall and winter. Late fall daily movements (8.7 km/day in the RSA) were substantially greater than those during winter (4.4 km/day in the RSA), and caribou tended to occupy portions of the landscape for shorter periods during late fall than during winter. Caribou residency times in both seasons were two-fold greater in the broader landscape than within the Project RSA, suggesting that, on average, the RSA, is used as more of a transitory area than other portions of the seasonal ranges. The locations and patterns of movement during late fall (i.e., the end of the fall migration period) was variable within and across years and, overall, there was little evidence of dedicated migration corridors. However, in late fall of 2015, several caribou made directed movements along the height of land parallel to the Dempster Highway, from the northeast to the southwest. Although a small number of movements crossed the Dempster Highway, most movements stayed north of the Dempster Highway, potentially reflecting avoidance of the Dempster Highway. However, this series of movements did cross numerous 2D seismic lines, winter roads and a large 3D seismic grid in the RSA.

6.6.1 METHODS

6.6.1.1 Daily Movement Rates and Residency Times

Daily movement rates and residency times were calculated for each radio-collared caribou that occurred in late fall and winter range extents. The locations of each caribou were resampled to obtain one GPS fix per day. Movement rates were calculated as the speed (km/day) travelled between consecutive relocations and residency time was calculated as the number of days within a specified area. Movement rates and residency times were calculated for caribou occurring within the Project RSA (2,387 km^2) and, to compare to the broader landscape, metrics were also calculated within 50 km x 50 km (2,500 km^2) grid cells that covered fall and winter ranges. Means and standard errors of movement rates and residency times were calculated for all 50 km x 50 km cells and compared to mean values in the Project RSA.

6.6.1.2 Migration Movements

Travel routes were delineated by developing occurrence-use polygons that assessed the trajectory of each collared caribou during late fall, 2012-2021. These polygons were created using Brownian bridge movement models (BBMMs), which account for autocorrelated movements in animal relocations and assume that an animal's trajectory follows a diffusion-based (Brownian motion) process (Horne et al. 2007). BBMMs were developed, and kernel density estimation was used to predict 95% utilization distributions (UDs) for each animal, assuming a GPS location error of 100 m and implementing a grid-cell size of 500 m. Analysis was bounded to a 100 km buffer around the RSA to identify spatially relevant movement trajectories. BBMMs and UD polygons were created using the R package 'adehabitatHR' (Calenge 2006).

6.6.2 RESULTS AND DISCUSSION

6.6.2.1 Daily Movement Rates and Residency Times

Mean daily movement rates and residency times varied considerably between late fall and winter and between the Project RSA and the broader landscape. On average, caribou tended to move faster during late fall than during winter, and this was evident both in the Project RSA and across the full late fall range. The movement rates between the Project RSA and the broader landscape were greatest during late fall, i.e., at least a two-fold difference in movement rates outside versus inside the RSA. A similar outcome was evident for residency time inside versus outside the Project RSA. In both seasons, the residency time was at least twice as long outside the RSA than within it (Table 6-9).

Patterns in movement and residency were consistent with what is known about PCH caribou ecology. Caribou are at their most dispersed in both late fall and winter. Except for cows during the calving period, daily movements are lowest in winter and second lowest in late fall (Russell and Gunn 2017). Normally, faster movement rates are associated with shorter residency periods, but this was not the case for the PCH in late fall (Table 6-9). During late fall, caribou in the RSA had slower movement rates but also had shorter residency periods compared to the broader late fall range. A review of the movement trajectories indicates that although travel rates were slower inside the RSA, those paths had greater directional bias (i.e., movement in a single direction) than paths outside the RSA, which exhibited much more tortuosity. These more directed movement paths resulted in shorter residency periods, despite the slower movement rates.

During winter, caribou movement rates inside the RSA were similar to the broader landscape, but, similar to late fall, their residency time inside the RSA was significantly shorter than in the broader late fall range. This suggests that similar to the pattern in late fall, caribou tended to pass through the RSA in winter more quickly than other portions of the broader winter range. This pattern may be explained by the lower predicted habitat quality within the RSA relative to the broader landscape (see Section 6.5.2.2, *Predicted Habitat Distribution*, above). The faster movements and shorter residency times in late fall compared to winter likely reflect the tail end of fall migration movements. Notwithstanding the important differences in movement patterns between late fall and winter, the key results of these analyses are that, in both late fall and winter, PCH caribou (1) travel

several kilometres per day, on average, and (2) the RSA (or similar sized areas outside the RSA) are used for a relatively short portion of the overall season.

Table 6-9. Mean daily movement rates and residency times of the Porcupine Caribou Herd in the Project RSA relative to the mean (and standard error) of 50 km x 50 km cells covering late fall and winter range extents.

Season	Scale[1]	Daily Movement (km/day)		Residency Time (days) [2]	
		Mean	Std. Error	Mean	Std. Error
Late Fall	Project RSA (2,387 km² total)	8.95	± 0.64	4.50 (8.33 %)	± 0.83
	Late Fall Range (88,149 km²) [1] (2,500 km² per cell) – 53 cells total	15.03	± 2.06	7.65 (14.17 %)	± 0.66
Winter	Project RSA (2,387 km² total)	4.02	± 0.64	15.69 (12.86 %)	± 5.11
	Winter Range (65,077 km²) [1] (2,500 km² per cell) – 40 cells total	4.77	± 0.51	25.93 (21.25 %)	± 2.13

[1] Late fall and winter ranges were subsampled using 2,500 km² cells (approximately the same size and the RSA) to facilitate estimation of mean and variance. Estimates of mean and variance within the RSA are derived from differences in rates and residencies of individual caribou.

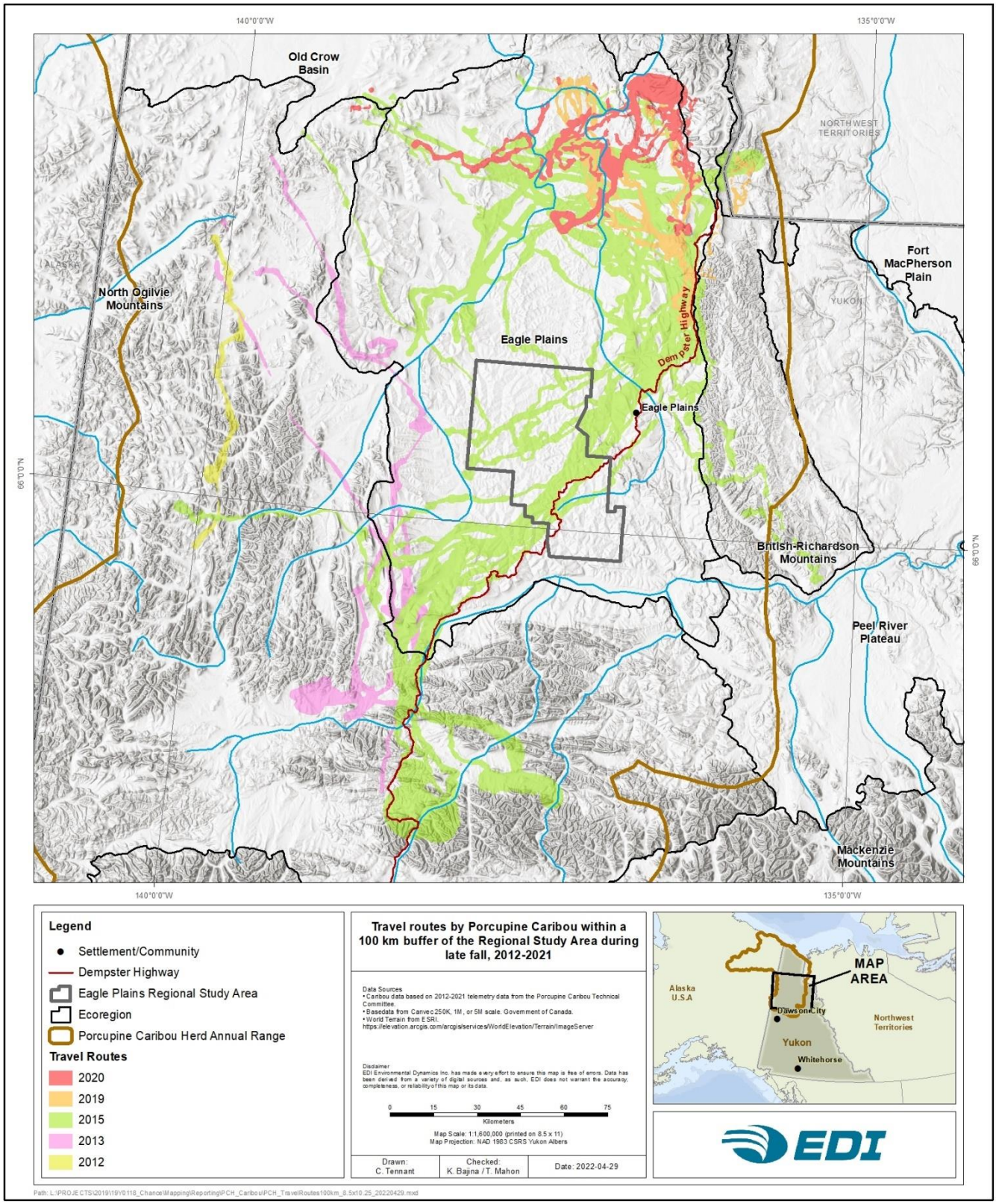
[2] Percent of the season indicated in brackets. Total days: late fall = 54 days, winter = 122 days.

6.6.2.2 Migration Movements

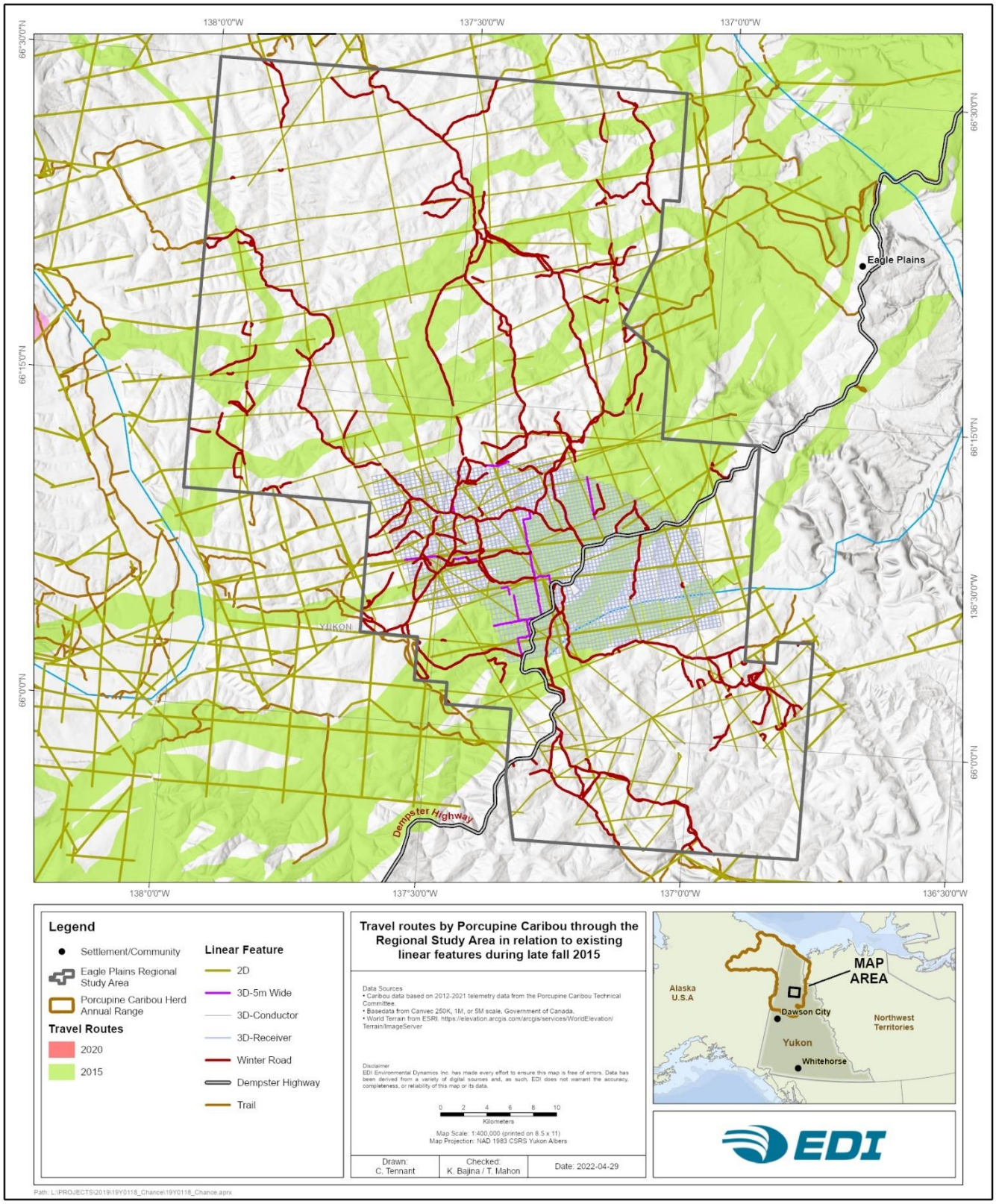
Travel routes through the Project RSA were only evident in late fall of 2015. At that time, 14 caribou travelled from the northeast quadrant of the Eagle Plains ecoregion to either the southwestern portions of that ecoregion or to the North Ogilvie Mountains, along the Dempster Highway (Map 6-7). Although two caribou did cross the highway in the vicinity of the RSA, most of the caribou (12) travelled parallel to the Dempster Highway, along its northwest side, before eventually crossing the highway south of the RSA in the Ogilvie Mountains (Map 6-7). The location of the movement routes in 2015 predominantly northwest of the Dempster Highway was previously noted by Russell and Gunn (2017), who suggested the caribou may have been avoiding crossing the highway. Although this is a valid hypothesis, supported by observations from VGFN elders (Sherry and Vuntut Gwitchin First Nation 1999, p. 288), it is important to note that the set of travel routes in 2015 did eventually cross the Dempster Highway south of the RSA in the Ogilvie Mountains. These crossings may be done at times of lower traffic such as nighttime, as elders had witnessed various unsuccessful attempts of herds to cross the Dempster as vehicles were passing during the day (Sherry and Vuntut Gwitchin First Nation 1999, p. 288). It is also important to note that travel routes in 2015 coincided with a broad, regional height of land (separating the Porcupine and Peel watersheds), which caribou sometimes travel on during migration movements (Russell et al. 1993). On an absolute scale, the height of land along the Dempster Highway, and proximate locations used by caribou as travel routes (~550–650 m), coincide with the mid elevations selected by caribou during fall (see Section 6.5.2.1, *Habitat Models*). The 12 caribou that

paralleled the Dempster Highway in the vicinity of the RSA did cross several inactive winter roads, numerous old 2D seismic lines, and a 350 km² area consisting of one-year-old 3D seismic exploration (Map 6-8).

Inferences about caribou movements are limited by the relatively small numbers of caribou that were collared (<0.1% of the herd annually) and the relatively small number of collared caribou that occurred within the RSA. Collared caribou only occurred in the Eagle Plains ecoregion in half of the years from 2012–2021; however, it is known from local knowledge that caribou occur in the ecoregion in most, if not all years. VGFN elders have discussed to importance of Eagle Plains for caribou winter habitat and noted that if caribou find a good feeding place with many trees, they will stay all winter (VGFN p185). During interviews in the late 1990's, they observed many caribou performing fighting, mating and rutting rituals around Blackstone Flats (Sherry and Vuntut Gwitchin First Nation 1999, p. 188). For the years when collared caribou were present in Eagle Plains, it is unknown how representative the collar locations are of the overall herd. For example, the concentration of travel routes through the RSA in 2015 suggests a potential movement corridor, but the proportion of caribou that is collared is too small to conclude this with confidence. The lack of movements in the same area in any other year does not support the idea that the cluster of movements in 2015 represent a regular travel corridor (but, again, this could reflect the small proportion of caribou collared).



Map 6-7. Travel routes identified for the Porcupine Caribou Herd within a 100 km buffer of the Project Regional Study Area during late fall, 2012–2021.



Map 6-8. Travel routes by Porcupine Caribou through the regional Study Area in relation to existing liner features during late fall 2015.

6.7 RELATIONSHIP TO LINEAR FEATURES

A key issue concerning the PCH is how anthropogenic development may alter caribou distribution, habitat use, and, ultimately, whether changes may influence population demography and access to the herd by First Nations and Inuvialuit harvesters. Linear features are the primary source of disturbance in the Project RSA and the broader Eagle Plains ecoregion. There is uncertainty about how caribou may respond to these features. To better understand the relationship between caribou and linear features, base habitat models were extended to assess the potential for habitat avoidance using a zone of influence (ZOI) framework. The ZOI delineates the area within which caribou behaviour is altered. ZOIs were estimated for three functionally distinct linear feature types (i.e., 2D seismic, winter roads and trails; 3D seismic; and the Dempster Highway). If ZOI estimates are statistically and ecologically significant (i.e., alter the selection of habitat and forage by caribou), they can be used to quantify effective habitat loss (i.e., perceived reduction in habitat quality by caribou due to avoidance) in the Project RSA and Eagle Plains ecoregion.

Statistical ZOIs were determined for 2D seismic lines (including winter roads and trails) in Eagle Plains in late fall and winter. However, confidence in those estimates is relatively low due to several factors. Statistical ZOIs were identified corresponding to 4 km avoidance of 2D seismic lines during late fall and 2 km avoidance of 2D seismic lines during winter. The analysis also identified that the PCH were attracted to the Dempster Highway and 3D seismic areas in both late fall and winter. Sufficient observations were associated with this pattern in relation to the Dempster Highway, but results for 3D seismic areas could be spurious due to a relatively low number of caribou locations in proximity to these features.

Although the analyses determined ZOIs associated with 2D seismic lines (and winter roads and trails), they should be interpreted with caution. (1) The magnitude of the ZOI effects was weak (i.e., including the ZOI effects in the habitat models had little effects on the habitat predictions). (2) Threshold distances estimated from ZOI analyses tend to be very sensitive to spatial and temporal contexts as well as the data and analytical methods used. Estimates of ZOIs can vary dramatically from year-to-year. This can include selecting to be closer to human features in some years and exhibiting dramatic difference in the threshold distances in years when human disturbances are thought to be avoided. The number of caribou locations in this study unevenly distributed with respect to the various linear features both spatially and across years. (3) The pattern of ZOI effects were not consistent with expectations and results from other studies. For example, having a 2 km ZOI for 2D lines and no ZOI for the Dempster Highway is counterintuitive. A previous study estimated a relatively large ZOIs for the Dempster (Johnson and Russell 2014). Based on these factors, it is recommended that these results not be used solely to estimate the effects of linear features on the PCH. Rather, it is recommended that the results be used in conjunction with results from other studies, adapted to the Eagle Plains setting and the ecology of the PCH, to develop a set of ZOIs for assessment and management purposes.

6.7.1 METHODS

A zone of influence framework evaluated the influence of linear features on PCH caribou distribution and habitat selection. Base habitat models developed for late fall and winter were extended by incorporating a 'distance to' covariate for each relevant linear feature and estimating the breakpoint beyond which the likelihood of observing caribou remained unchanged. If a ZOI was present, the likelihood of observing caribou would increase from linear feature footprint until the identified breakpoint. The primary method used to evaluate the presence and magnitude of a ZOI was a segmented regression approach (Boulanger et al. 2012, 2021).

Three functionally distinct types of linear features were considered based on their widths, densities, and extents in PCH fall and winter ranges: (1) 2D seismic, winter roads, and trails; (2) 3D seismic (grid); and (3) the Dempster Highway. The minimum distance between used/available locations and each feature was calculated and treated as a continuous covariate. To limit potential bias in ZOI estimates arising from broad-scale spatial patterns in distribution and habitat selection (see Boulanger et al. 2021, EDI Environmental Dynamics Inc. 2022b), GAMs were used to assess how the distribution of caribou changed at increasing distances from each linear feature type and to identify an 'iteration zone' to test for ZOIs. The iteration zone is defined as the boundary within which caribou distribution and habitat use are minimally affected by broad-scale patterns in climatic (e.g., snowfall) and biotic (e.g., caribou density and forage) processes. Practically, this refers to an initial range of distances (starting at 0 km) where selection is relatively flat (slope = 0) (see Boulanger et al. 2021). For example, during late fall, selection was fairly flat up to 100 km from the Dempster Highway, after which selection decreased sharply (see Attachment Figure 21 in Section 6.9.3). In other cases, such as the relationship to 2D lines during late fall, the slope was substantially greater than zero at very close distances (see Attachment Figure 19 in Section 6.9.3). Selection increased up until approximately 18 km, then sharply decreased until 25 km, and then, once again, sharply increased up until approximately 35 km. Given such non-linearity in the response, the iteration zone was identified within the first major bout of increase/decrease, i.e., within the first 25 km. This approach was taken in each case where a drastic, non-linear selection gradient occurred at very close distances to the linear feature.

Within the iteration zone, several distance thresholds were tested to identify a ZOI. The assumptions were that caribou presence would be reduced and resource selection altered within the threshold distance. We assigned all distances at or beyond the defined threshold the same distance value. For example, if a ZOI distance of 2 km was tested, then all distances up to 2 km retained their values (i.e., numbers ranging from 0 km to 1.99 km), but all distances at or greater than the ZOI were assigned a value of 2 km (e.g., 3 km or 4 km were assigned values of 2 km). A unique model was fit for each threshold tested, and the number of models corresponded to the outer boundary of the iteration zone identified for each linear feature type. In other words, if the iteration zone was deemed between 0 km and 25 km, then 25 models were tested — one for each kilometre interval. The best model, which corresponded with the most likely ZOI, was selected by evaluating the log-likelihoods of all models as a function of the distance thresholds. The highest log-likelihood corresponded with the model with the most statistical support (Boulanger et al. 2012). The magnitude of avoidance was estimated as the odds of caribou occurring at or beyond the ZOI relative to the odds of being on the linear feature (i.e., odds ratio = $e^{coefficient \times ZOI}$).

6.7.2 RESULTS AND DISCUSSION

The influence of linear features on PCH distribution and habitat selection varied between late fall and winter seasons and among functional linear feature types. ZOIs were detected for 2D seismic lines (including winter roads and trails) during late fall (4 km, Attachment Figure 25) and winter (2 km, Attachment Figure 28). These results were derived from analyses that considered only spatially relevant scales (i.e., iteration zones) (see GAM plots for 2D lines in Section 6.9.3). For example, relationships with 2D lines were evaluated only within the Eagle Plains ecoregion because most of these features occurred within this extent. The GAM plots in Section 6.9.3 also demonstrate that, though selection increased/decreased relative to 2D lines, these changes were low in magnitude. For example, within the iteration zones of 2D lines, there was an approximate 0.08 (or 8 %) increase in the probability of selection at far distances from these features. When estimated using a defined threshold, changes in the probability of selection necessarily increased (relative to GAMs) based on the imposed shape of the response (i.e., fitting a linear increase followed by a flat slope at distances equal to and beyond the ZOI). In practical terms, the odds of caribou occurring at distances equal to or beyond the ZOIs for 2D lines are 1.45 (odds ratio = $e^{0.000093 \times 4\ km}$) and 1.27 (odds ratio = $e^{0.00012 \times 2\ km}$) times greater, during late fall and winter, respectively, than the odds of caribou occurring on 2D lines. The ZOIs estimated for 2D lines in the current study were smaller than those previously estimated by Johnson and Russell (2014)—11 km from 1985–1998 and 6 km from 1999–2012 for wells, trails, winter roads, and seismic lines.

Although analysis of 2D seismic lines (including winter roads and trails) did identify statistically significant ZOIs, the results should be interpreted with caution. An important indicator to contextualize these results is whether estimated ZOIs influenced the selection of important habitat components. A comparison of coefficients between habitat models with and without ZOI terms provides a test of the ecological significance of estimated ZOIs (Boulanger et al. 2012). To accomplish this, predictions were made using the estimated ZOIs across the late fall and winter ranges to match the same spatial scale as base habitat models (see Table 6-10 and Table 6-11). During late fall, coefficients associated with macrolichen cover ($\beta_{lichen.base}$ = 0.694 ± 0.029 versus $\beta_{lichen.ZOI}$ = 0.689 ± 0.029) in Eagle Plains were invariant (Table 6-4 versus Table 6-10). Similarly, during winter, coefficients associated with lichen ($\beta_{lichen.base}$ = 1.119 ± 0.018 versus $\beta_{lichen.ZOI}$ = 1.114 ± 0.018) in Eagle Plains, and avoidance of other plant functional types, were consistent (Table 6-5 versus Table 6-11). So, even though ZOIs were determined for 2D lines, the magnitude of those effects was so small that it resulted in marginal changes to the habitat model predictions in both late fall and winter.

No ZOIs were detected for the Dempster Highway during either season. Instead, the segmented regression approach identified an attraction effect, rather than avoidance, for both late fall (9 km, Attachment Figure 27) and winter (11 km, Attachment Figure 30). Thus, caribou were more likely to occur within 9 km and 11 km of the Dempster Highway during late fall and winter, respectively, than beyond those distances. This result contradicts previous work by Johnson and Russell (2014), who identified ZOIs of major roads, including the Dempster Highway, to be as large as 30 km from 1985–1998 and 18.5 km during 1999–2012.

Similar to the results for the Dempster Highway, no ZOIs were determined for 3D seismic lines, but there is high uncertainty associated with those estimates due to the relatively small number of collared caribou that

interacted with the 3D seismic area. Attraction effects were found within 16 km and 4 km of 3D seismic lines during late fall (Attachment Figure 26) and winter (Attachment Figure 29), respectively. As with 2D lines, the magnitude of the attraction effect for Dempster Highway and 3D seismic lines was small relative to base habitat selection. Additionally, considering the potential mechanisms of effects that 3D lines could have on caribou, the apparent attraction of caribou to the 3D seismic lines is likely a spurious result. Based on other studies examining the effects of 3D lines on caribou and their primary predators, wolves, it was expected that the PCH would exhibit a neutral or weak avoidance response to 3D lines due to the potential for facilitated predation to occur.

In addition to the weak effects exhibited by ZOIs relative to base habitat selection, there are other factors that warrant cautious interpretation and use of these analytic results. (1) ZOI estimates and their magnitude of effect can be sensitive to (a) sample sizes and (b) spatial and temporal coverage of the data. Though numerous overall, the data used in this analysis had relatively modest sample sizes near linear features and were unevenly distributed in relation to linear features in Eagle Plains. (2) Caribou can exhibit dramatically different ZOIs from year to year. Collared caribou were only present in modest numbers in 2012/13, 2014/15, 2017/18, and 2018/19, so the data had to be lumped across years to estimate a single ZOI. (3) ZOIs estimated for the PCH in this analysis are substantially smaller than those estimated by Johnson and Russell (2014). The issues associated with these factors are discussed below.

The spatial and temporal context of ZOI studies can influence outcomes. Estimates of ZOIs are a consequence of broad- and fine-scaled space use, and these patterns of distribution can emerge from population demography, biotic interactions (e.g., density-dependent competition or predator-prey interactions), abiotic conditions (e.g., snowfall, forage availability), habitat selection, and potential sources of disturbance (e.g., dust fall, sensory disturbance) (Messier et al. 1988, Johnson et al. 2001, Mahoney and Schaefer 2002, Hinkes et al. 2005, Bowyer et al. 2014, Chen et al. 2017, Boulanger et al. 2021, Pedersen et al. 2021). These sources of variation in space use do not negate the importance of quantifying indirect effects of anthropogenic development, but they do point to underlying issues with the ZOI framework and its utility for management and mitigation. For example, Boulanger et al. (2021) documented ZOI responses by Bathurst caribou to the Ekati-Diavik mine complex (Northwest Territories) that have varied dramatically from year-to-year, which the authors attribute to changes in drought conditions. Similarly, Johnson et al. (2020) found that ZOIs around energy infrastructure (North Slope of Alaska, USA) reduced during periods of high mosquito activity for the Central Arctic Herd (CAH). In these examples, fine-scale changes in caribou space use was primarily driven by selection for areas adjacent to large, open bodies of water: Lac de Gras by Bathurst caribou and the Arctic Ocean by CAH caribou.

Another issue regarding the interpretation of ZOIs is their sensitivity to the data and analytical methods used. For example, Boulanger et al. (2021) found that GPS-collared caribou exhibited 'avoidance' (a ZOI) in only four out of nine years at the Ekati-Diavik mine complex (range = 6–13 km). In five of those nine years, caribou exhibited either no relationship or attraction to mine infrastructure. Additionally, when comparing an overlapping year (2012) between GPS data and aerial survey data for Bathurst caribou, a ZOI was identified using GPS collar data (ZOI = 7.09 km, odds ratio not overlapping zero; see Table 3 in publication) but was not identified using aerial survey data (ZOI = 11.4 km, odds ratio overlapping zero; see Table 4 in

publication). During the data exploration phase of the current study, ZOI results also varied considerably based on different subsets of the PCH data. For example, the estimates of a ZOI around 2D seismic lines (including winter roads and trails) changed by several kilometres when assessing not only different years but different spatial extents (e.g., ecoregions).

The ZOI analysis conducted by Johnson and Russell (2014) for the PCH used a similar approach to the current analysis and other studies, but yielded very different results for seismic lines and major roads. Johnson and Russell (2014) also caution against interpreting their results based on several factors, including a large change in the PCH's population size over their study duration, variation in animal behaviour across the range of development types, and relatively small effect sizes for caribou-disturbance responses. The potential reason for differences between the results in this study and those of Johnson and Russell (2014) are not apparent and may reflect the sensitivity of results to the differences in sample sizes and spatiotemporal patterns in the data used between the two studies. Landscape conditions and land use activities were similar between the two study periods and likely included some of the same data (e.g., winter 2012). Both Johnson and Russell (2014) and the current study dealt with trade-offs in spatial and temporal coverage. Though Johnson and Russell (2014) had data with longer temporal coverage (27 years), these data suffered from poorer spatial resolution associated with larger interval collar fixes (on average, once every seven days), smaller sample sizes (N = 2,127), and coarser habitat variables (i.e., landcover classification). In contrast, the current study used data with shorter temporal coverage (8 years) but had higher spatial resolution associated with collar fixes (on average, one per day), larger sample sizes (N_{fall} = 8,323 and N_{winter} = 13,014), and high resolution habitat variables (i.e., 30 m x 30 m plant functional type percent and digital elevation model). The current study had the advantage of higher spatial resolution, which is especially important for ZOIs, which are, by nature, a spatial phenomenon. A limitation to both this study and Johnson and Russell (2014) is the lack of sufficient interaction between caribou and linear features each year, which prevented the estimation of annual ZOIs.

ZOI analyses, including the analyses in this study, often do not explicitly test specific mechanisms that could be causing caribou to avoid anthropogenic features. It is assumed, correctly or incorrectly, that caribou avoid these areas because they perceive elevated predation risk (Frid and Dill 2002, Semeniuk et al. 2012). This can include avoidance due to direct sensory disturbances associated with the features and learned behaviours that could result in avoidance beyond sensory perception distances (Boulanger et al. 2021). Assuming the ZOIs detected in this study are 'real', potential mechanisms that cause caribou to avoid 2D seismic lines, winter roads, and trails are perceived mortality risk associated with human hunting (Wolfe et al. 2000, Plante et al. 2017) and facilitated predation by wolves (James and Stuart-Smith 2000, Dickie et al. 2017).

Ultimately, the purpose of measuring and testing caribou responses to linear features is to inform management and mitigation. Given the weak effects associated with the ZOIs generated here, and the analytical issues discussed above, it is recommended that these results not be used solely to estimate the effects of linear features on the PCH. Rather, it is recommended that the results be used in conjunction with results from other studies, adapted to the Eagle Plains setting and the ecology of the PCH, to develop a set of ZOIs for assessment and management purposes.

Table 6-10. Zone of influence habitat model of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during late fall.

Model Term	Estimate	Std. Error	*Z*-statistic	*P*
Intercept				
Eagle Plains & North *(Reference)*	-9.579	0.038	-254.424	<0.0001
Ecoregion (factor)				
North Ogilvie Mountains	-0.281	0.077	-3.649	0.000263
British-Richardson Mountains	0.357	0.051	7.033	<0.0001
Old Crow Basin	0.171	0.042	4.050	<0.0001
Davidson Mountains	0.462	0.047	9.814	<0.0001
Aspect (factor)				
South	0.103	0.032	3.251	0.00115
East	0.004	0.032	0.127	0.899
West	0.157	0.031	5.028	<0.0001
Ecoregion–Lichen_100m Interaction				
Eagle Plains * Lichen_100m Percent[1,2] *(Reference)*	0.689	0.029	23.628	<0.0001
North Ogilvie Mountains * Lichen_100m Percent[1,2]	0.065	0.063	1.041	0.298
British-Richardson Mountains * Lichen_100m Percent[1,2]	-0.296	0.043	-6.929	<0.0001
Old Crow Basin * Lichen_100m Percent[1,2]	-0.137	0.037	-3.665	0.000248
Davidson Mountains * Lichen_100m Percent[1,2]	-0.216	0.042	-5.117	<0.0001
Digital Elevation Model				
Slope Percent[1,2]	-0.309	0.017	-17.947	<0.0001
Absolute Elevation[2] (linear)	0.810	0.073	11.091	<0.0001
Absolute Elevation[2] (quadratic)	-0.785	0.070	-11.219	<0.0001
Distances				
Distance to Waterbodies[2]	-0.177	0.016	-11.402	<0.0001

[1] covariate transformation = $\log_e(x + 1)$.

[2] covariate estimates based on standardized covariate values = (x – mean[x])/std. deviation(x).

Note: the zone of influence estimate derived within the iteration zone was used to predict habitat selection across the late fall range for the purpose of comparing habitat coefficients only.

Table 6-11. Zone of influence habitat model of global–availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during winter.

Model Term	Estimate	Std. Error	*Z*-statistic	*P*
Intercept				
Eagle Plains & North *(Reference)*	-9.982	0.051	-196.452	<0.0001
Ecoregion (factor)				
North Ogilvie Mountains	0.569	0.040	14.207	<0.0001
British-Richardson Mountains	0.675	0.039	17.242	<0.0001
Old Crow Basin	0.242	0.034	7.018	<0.0001
Aspect (factor)				
South	0.192	0.025	7.536	<0.0001
East	0.032	0.026	1.223	0.221
West	0.324	0.025	13.074	<0.0001
Ecoregion– Lichen_100m Interaction				
Eagle Plains * Lichen_100m Percent[1,2] *(Reference)*	1.114	0.018	62.639	<0.0001
North Ogilvie Mountains * Lichen_100m Percent[1,2]	-0.154	0.034	-4.511	<0.0001
British-Richardson Mountains * Lichen_100m Percent[1,2]	-0.602	0.036	-16.842	<0.0001
Old Crow Basin * Lichen_100m Percent[1,2]	-0.119	0.034	-3.495	0.000474
Other Plant Functional Types				
Conifer_Tree_1000m Percent[2]	-0.253	0.009	-26.810	<0.0001
Forbs_500m Percent[2]	-0.165	0.010	-16.910	<0.0001
Deciduous_Shrub_1000m Percent[2]	-0.094	0.009	-9.980	<0.0001
Graminoid_1000m Percent[2]	-0.121	0.009	-12.829	<0.0001
Evergreen_Shrub_100m Percent[2]	-0.052	0.009	-5.607	<0.0001
Digital Elevation Model				
Slope Percent[1,2]	-0.220	0.012	-19.034	<0.0001
Absolute Elevation[2] (linear)	-1.441	0.056	-25.507	<0.0001
Absolute Elevation[2] (quadratic)	0.941	0.054	17.572	<0.0001
Distances				
Distance to Waterbodies[2]	0.206	0.010	20.711	<0.0001

[1] covariate transformation = $\log_e(x + 1)$.

[2] covariate estimates based on standardized covariate values = (x – mean[x])/std. deviation(x).

Note: the zone of influence estimate derived within the iteration zone was used to predict habitat selection across the winter range for the purpose of comparing habitat coefficients only.

6.8 SUMMARY

The PCH is known for large population aggregations, dramatic population fluctuations, lengthy migrations, and significant cultural and social value to northern Indigenous peoples. Within the NYLUP, the PCH is considered "…*the most significant and culturally important wildlife resource in the planning region.*" Habitat, food supply, predation, hunting, disease and climate range likely play interactive roles as limiting factors to the PCH population. Factors have limited potential to regulate the PCH, individually.

- The potential for food supply, especially lichen, to regulate the PCH is more limited than other barren ground caribou herds because of the PCH's very large annual and seasonal ranges and the diversity of habitats found within those ranges (e.g., including several ecoregions). Overall, the PCH winter range is relatively rich in lichen resources and is comparable to, or better than, those of other herds that winter in taiga regions.
- Predation does not seem to play a role in limiting PCH growth while the herd is at high numbers. One study suggested that the predation rate had to be near twice the observed level to cause the PCH to decline.
- The comprehensive measures within the Harvest Management Plan to monitor and respond to declines in the PCH (i.e., by reducing harvest) provide a solid system to minimize the potential effects that harvesting could have on the herd.

The portion of the PCH annual range that occurs within Yukon is protected by a network of parks, special management areas, conservation areas, wilderness areas, protected areas, ecological preserves, habitat protection areas, and IMA zones within the North Yukon Regional Land Use Plan and the Peel Watershed Regional Land Use Plan. In total, 54% of the annual range of the PCH within Yukon falls within some type of protected area where industrial activity is prohibited, 36% of the annual range occurs within Integrated Management Area zones where development is limited, and 9% of the annual range is not covered by any land management zonation. The Eagle Plains RSA occurs within IMA Zone IV, which permits the highest level of development.

The PCH have historically overlapped the Eagle Plains RSA in the rut/late fall and winter periods. However, the RSA constitutes only a small portion of those ranges — 6.0% of the late fall range and 6.5% of the winter range. The RSA does not overlap with the most frequently used portions of the late fall and winter ranges.

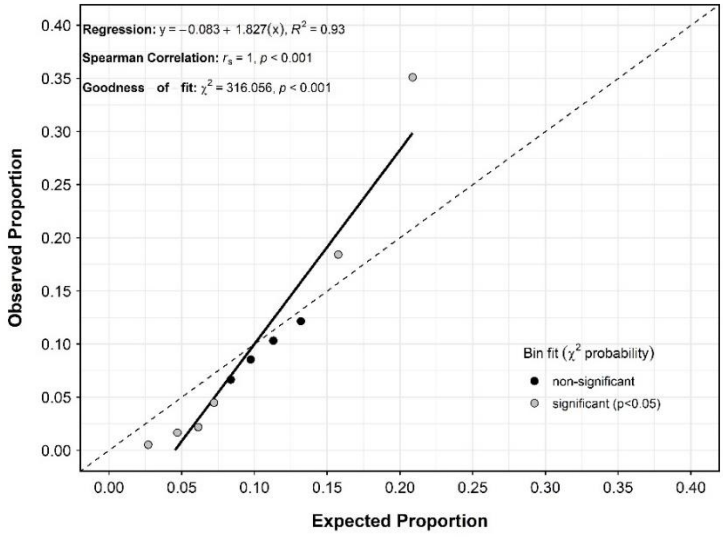
Habitat selection by the PCH in late fall and winter was estimated using resource selection functions. Selected habitats were dependent primarily on the distribution of macrolichen cover. Distance to linear features had a small effect on habitat model predictions. Overall, the strength of selection was greater in winter than late fall, which corresponds to broader movement patterns and use of more diverse habitats by the PCH in fall. In terms of regional habitat distribution, the RSA had similar proportions of selected habitat in fall as the full late fall range; however, the RSA had a much lower proportion of selected habitat in winter compared to the full winter range. Within the RSA, lichen distribution (and caribou use) was strongly affected by extensive recent burns, which had lower lichen cover than unburned areas.

The PCH typically exhibits movements of several kilometres per day in late fall and winter. Late fall daily movements (8.7 km/day in the RSA) were substantially greater than during winter (4.4 km/day). Caribou tended to occupy portions of the landscape for shorter periods during late fall than winter. Caribou residency times in both seasons were two-fold greater in the broader landscape than within the Project RSA, suggesting that, on average, the RSA is more of a transitory area than other portions of the seasonal ranges.

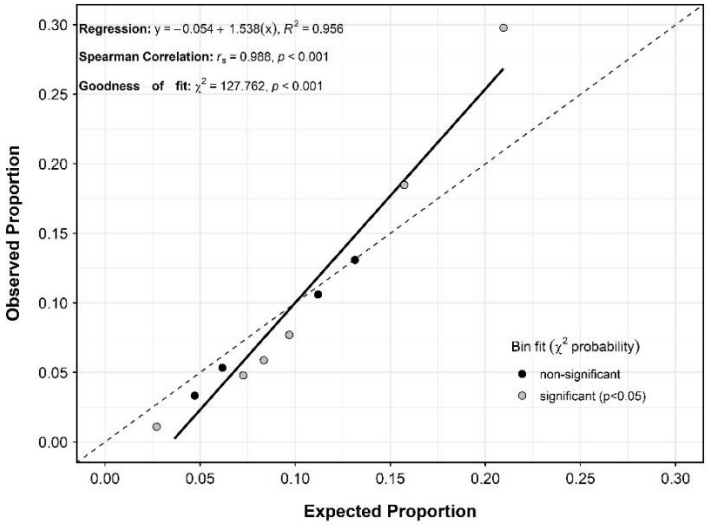
6.9 CARIBOU SECTION ATTACHMENTS

6.9.1 ATTACHMENT 6–A — 5-FOLD CROSS-VALIDATION

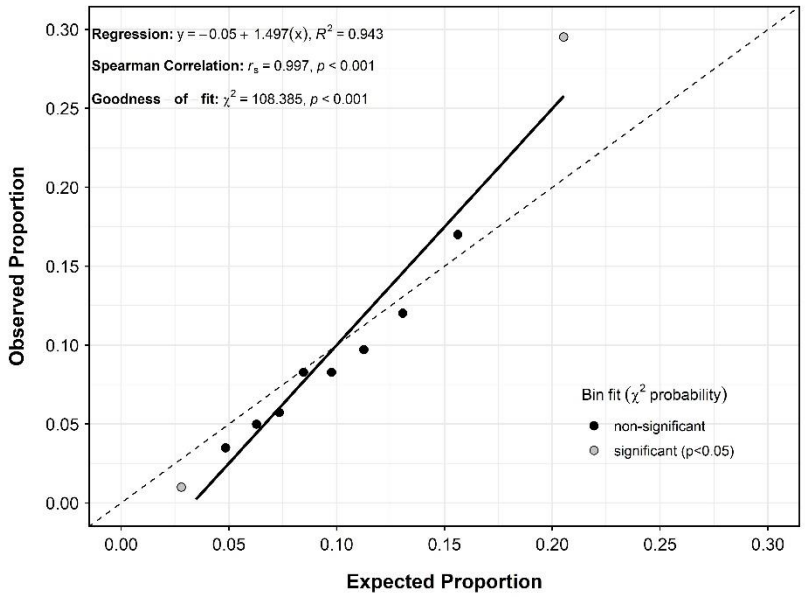
Late Fall



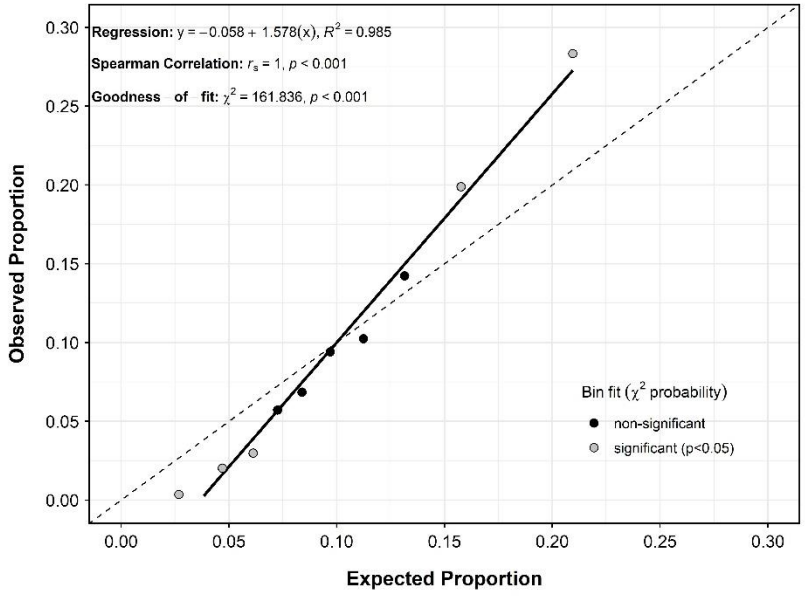
Attachment Figure 1. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 1). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



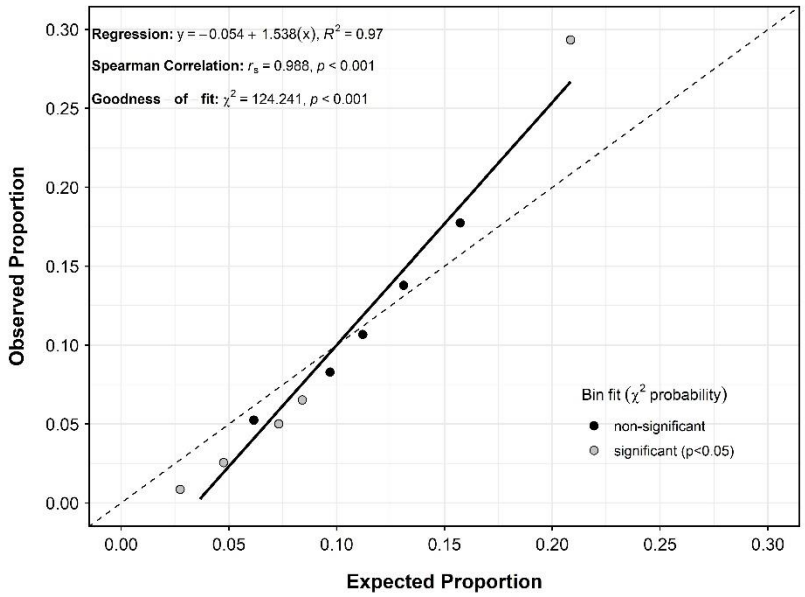
Attachment Figure 2. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 2). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



Attachment Figure 3. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 3). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.

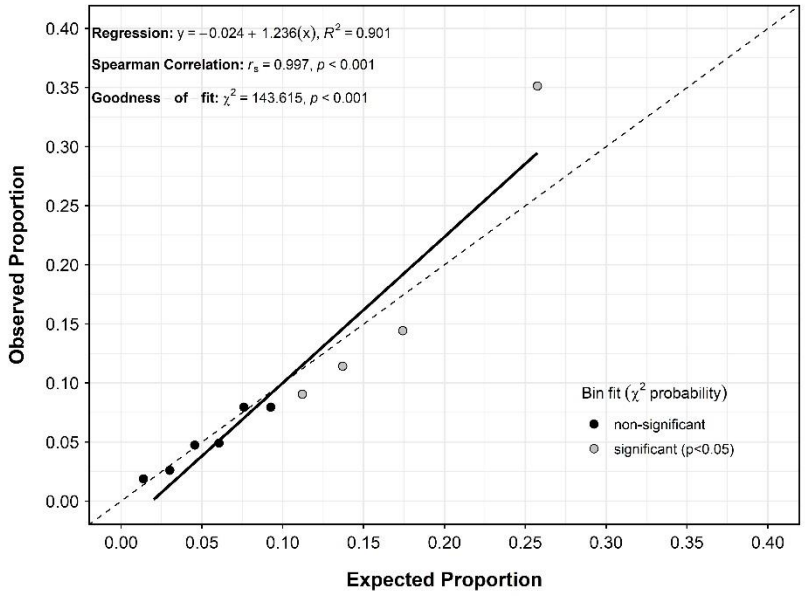


Attachment Figure 4. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 4). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.

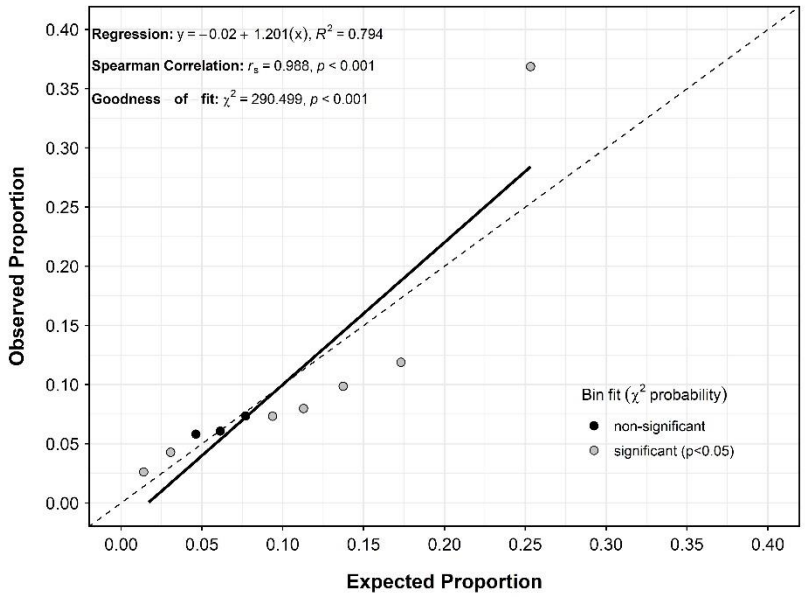


Attachment Figure 5. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 5). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.

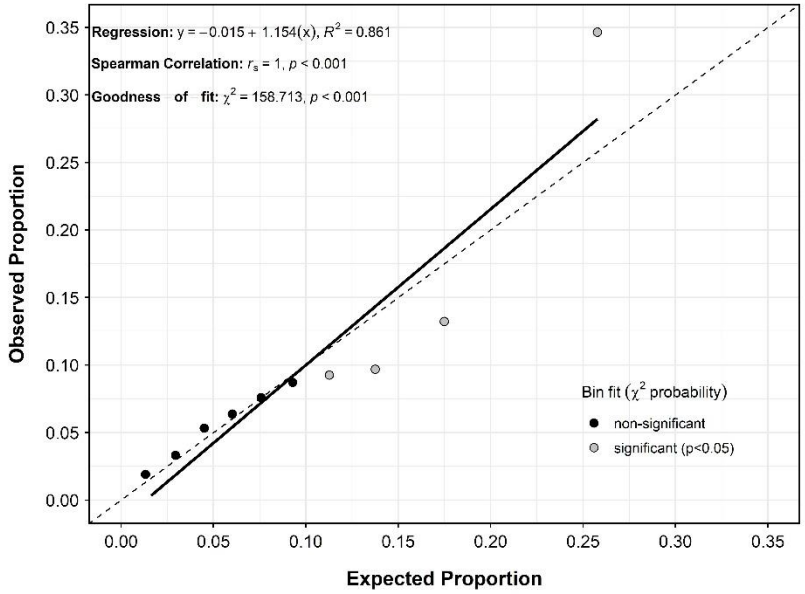
Winter



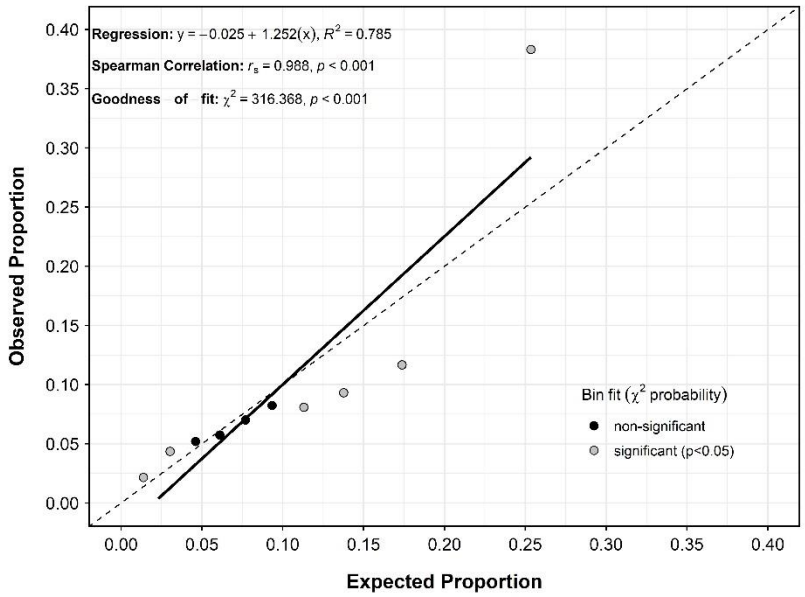
Attachment Figure 6. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 1). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



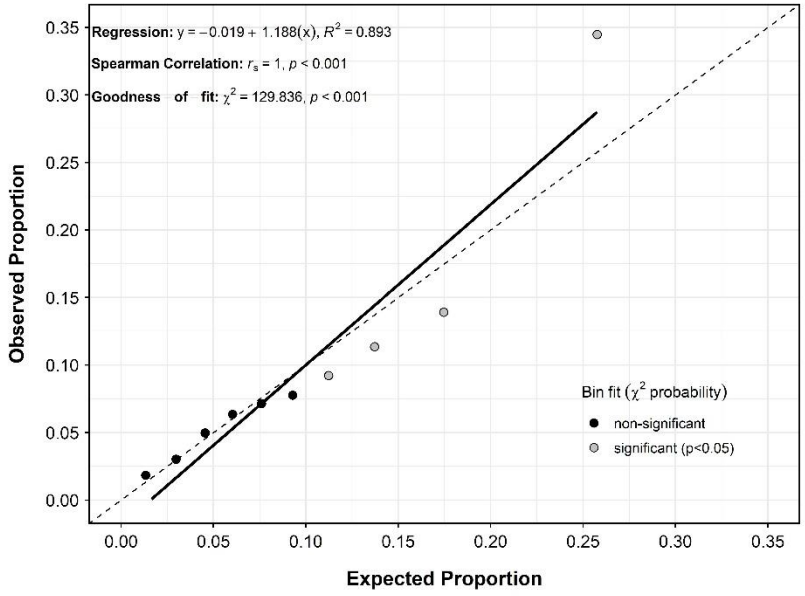
Attachment Figure 7. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 2). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



Attachment Figure 8. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 3). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



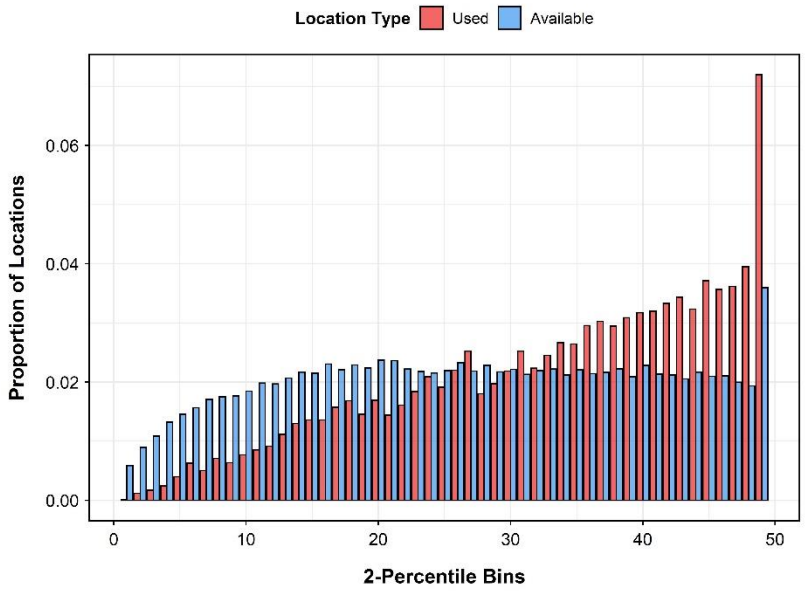
Attachment Figure 9. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 4). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



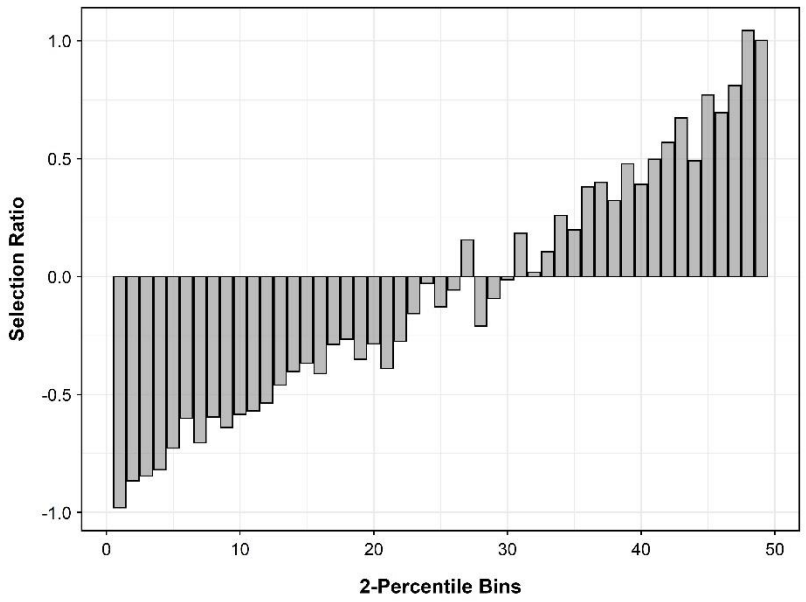
Attachment Figure 10. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 5). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.

6.9.2 ATTACHMENT 6–B — SELECTION RATIOS AND HABITAT RATINGS

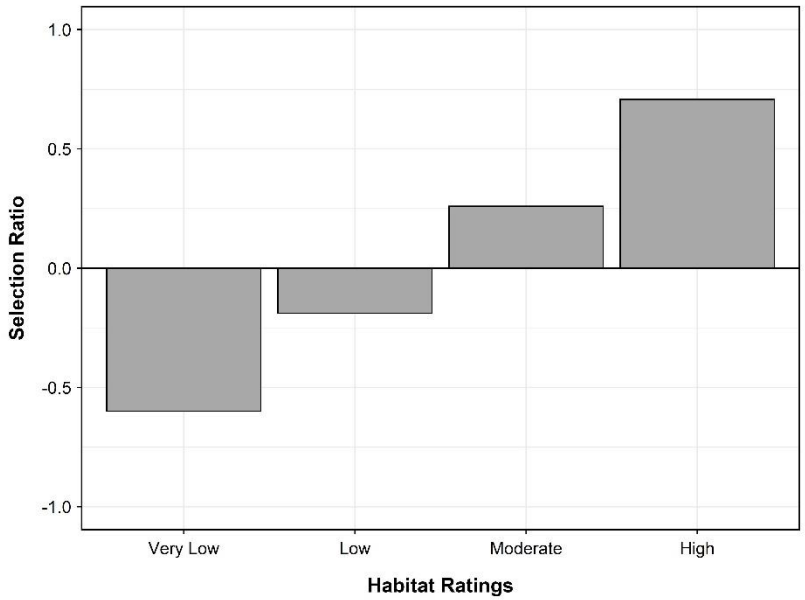
Late Fall



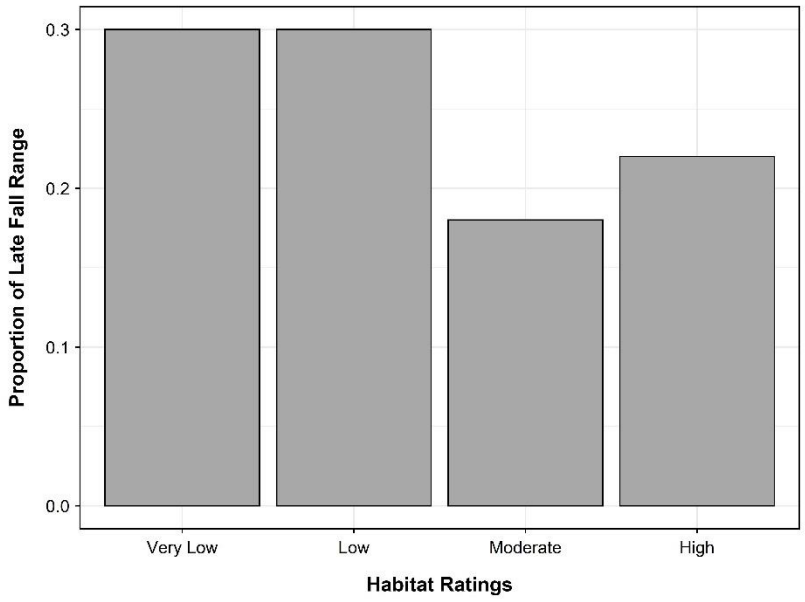
Attachment Figure 11. Proportions of used and available locations across 2-percentile (49 quantiles) interval bins of resource selection predictions during late fall, 2012–2021.



Attachment Figure 12. Selection ratios comparing the proportion of used to available locations across 2-percentile (49 quantiles) interval bins of resource selection predictions during late fall, 2012–2021.

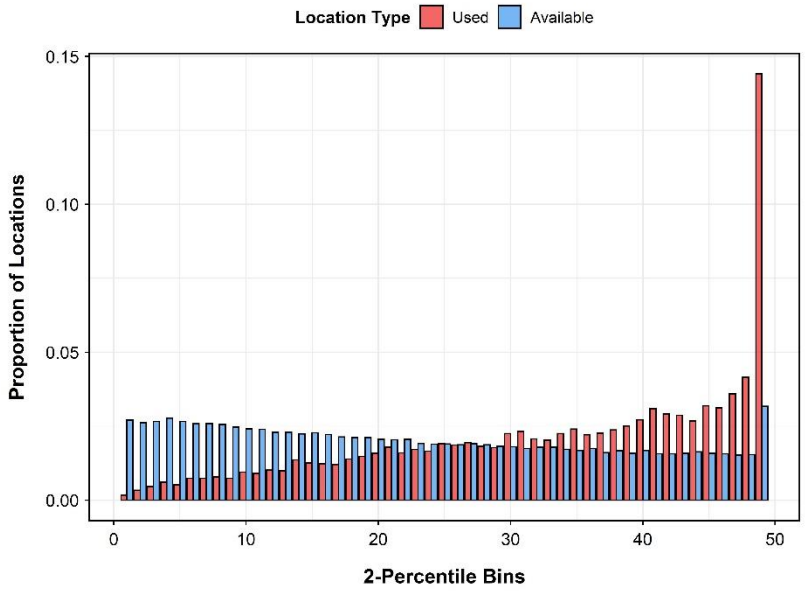


Attachment Figure 13. Selection ratios comparing the proportion of used to available locations across habitat rating classifications during late fall, 2012–2021.

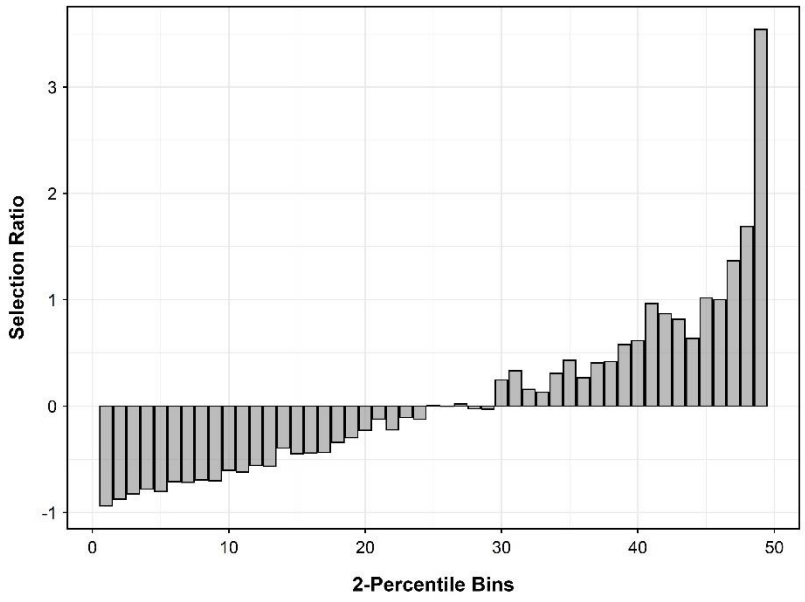


Attachment Figure 14. Proportion of the PCH late fall range composed by each habitat rating classification.

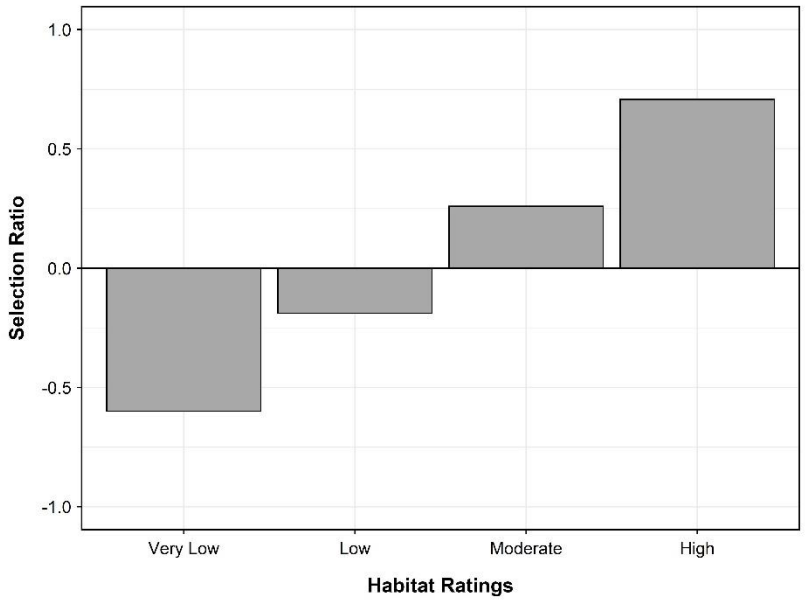
Winter



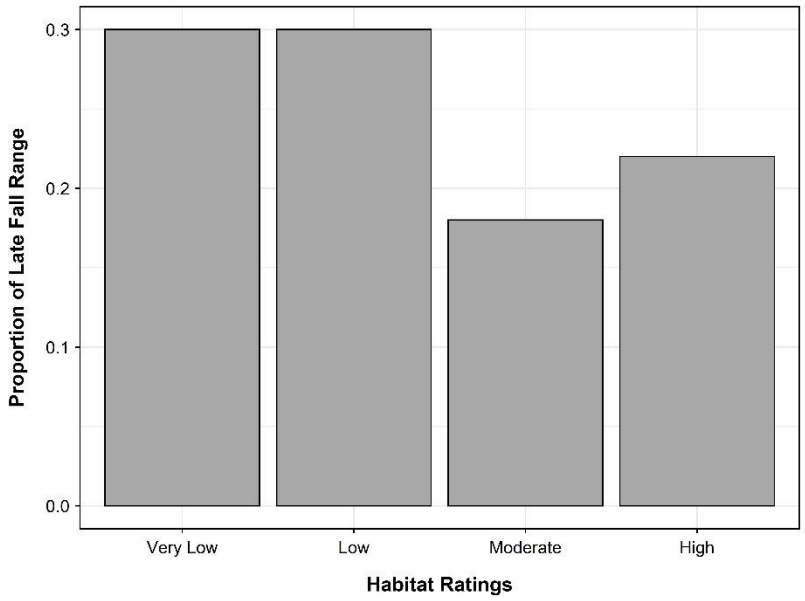
Attachment Figure 15. Proportions of used and available locations across 2-percentile (49 quantiles) interval bins of resource selection predictions during winter, 2012–2021.



Attachment Figure 16. Selection ratios comparing the proportion of used to available locations across 2-percentile (49 quantiles) interval bins of resource selection predictions during winter, 2012–2021.



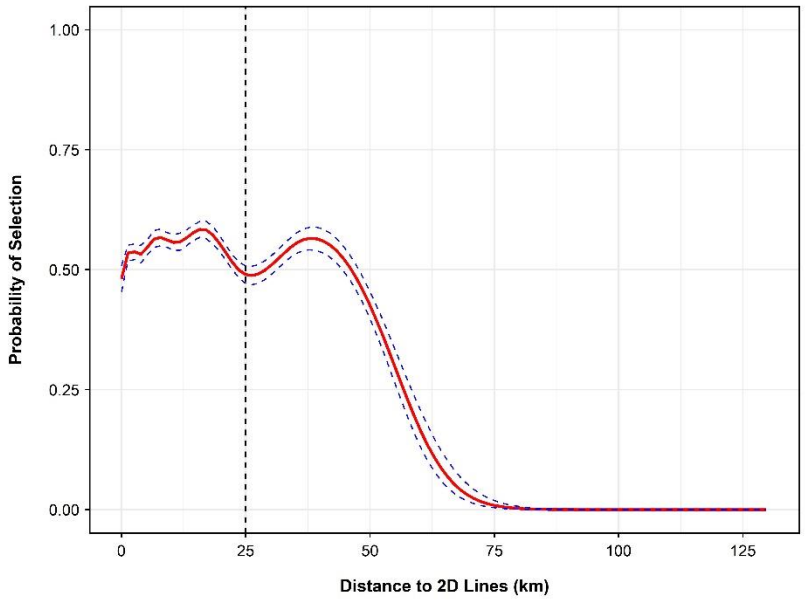
Attachment Figure 17. Selection ratios comparing the proportion of used to available locations across habitat rating classifications during winter, 2012–2021.



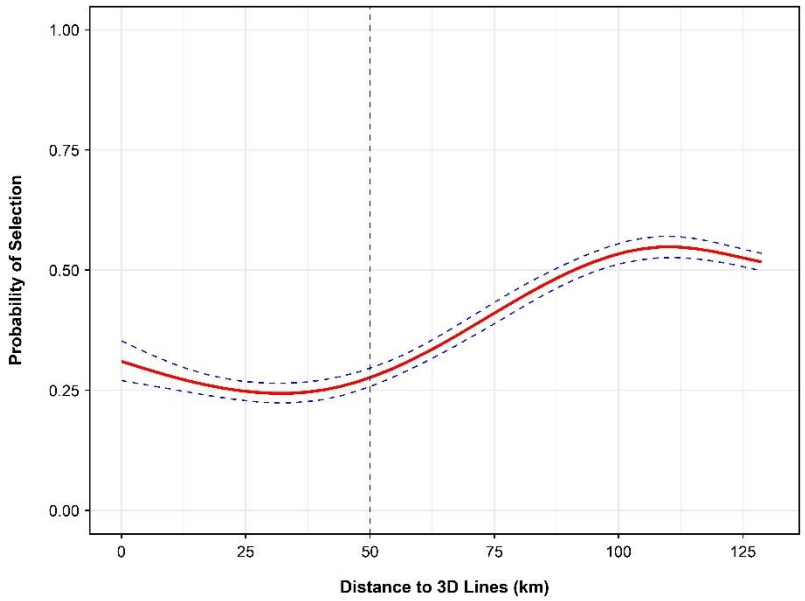
Attachment Figure 18. Proportion of the PCH winter range composed by each habitat rating classification.

6.9.3 ATTACHMENT 6–C — ZONE OF INFLUENCE ANALYSES

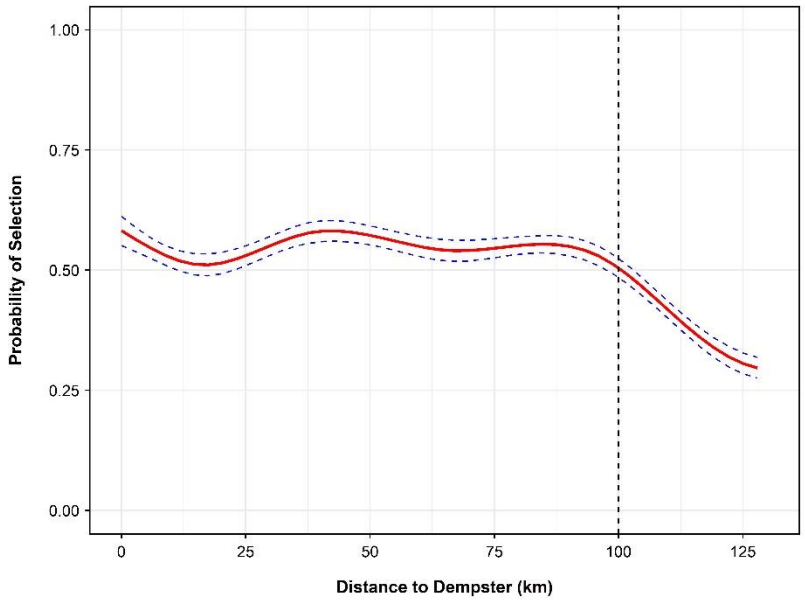
Late Fall



Attachment Figure 19. Marginal effect of distance to 2D seismic lines (including winter roads and trails) on the probability of selection by caribou during late fall (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

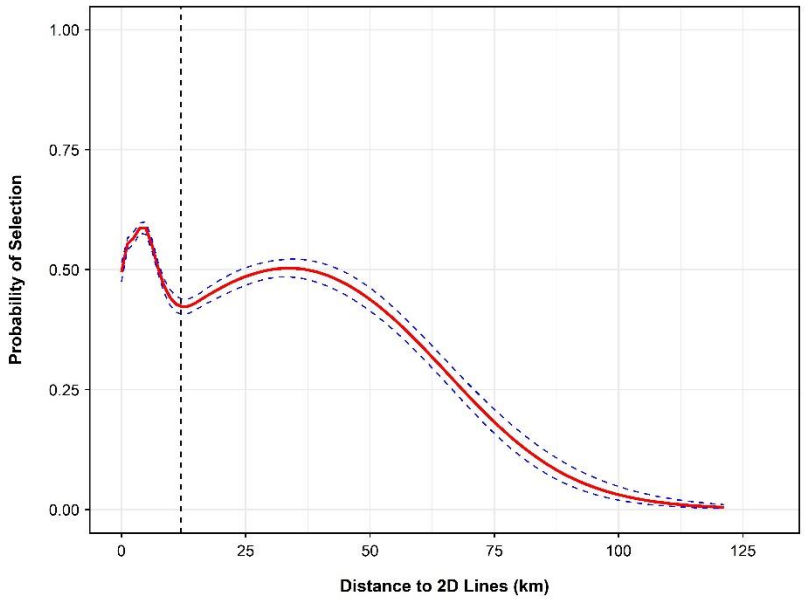


Attachment Figure 20. Marginal effect of distance to 3D seismic lines (single grid in Project RSA) on the probability of selection by caribou during late fall (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

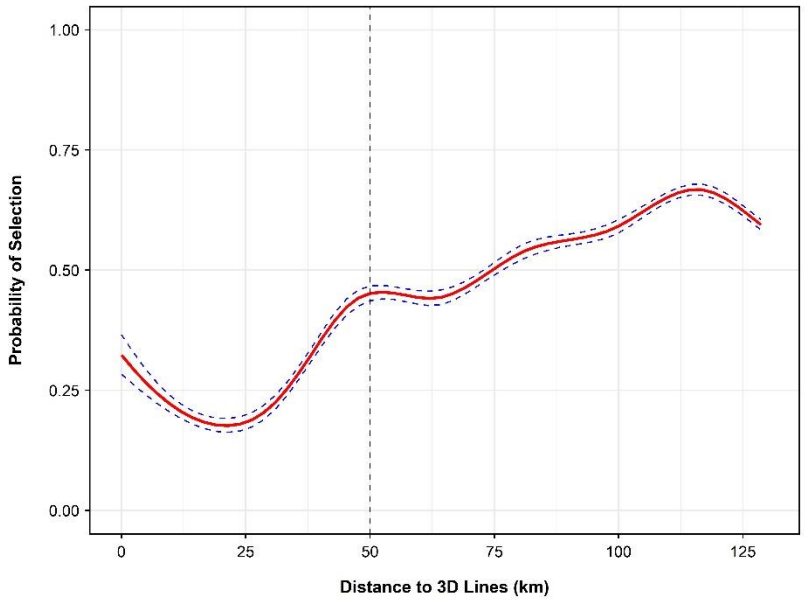


Attachment Figure 21. Marginal effect of distance to the Dempster Highway on the probability of selection by caribou during late fall (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

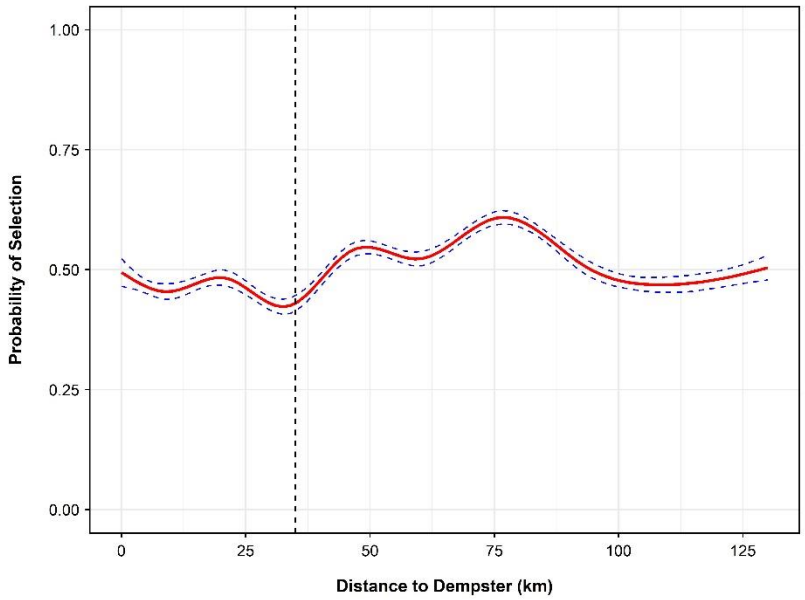
Winter



Attachment Figure 22. Marginal effect of distance to 2D seismic lines (including winter roads and trails) on the probability of selection by caribou during winter (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

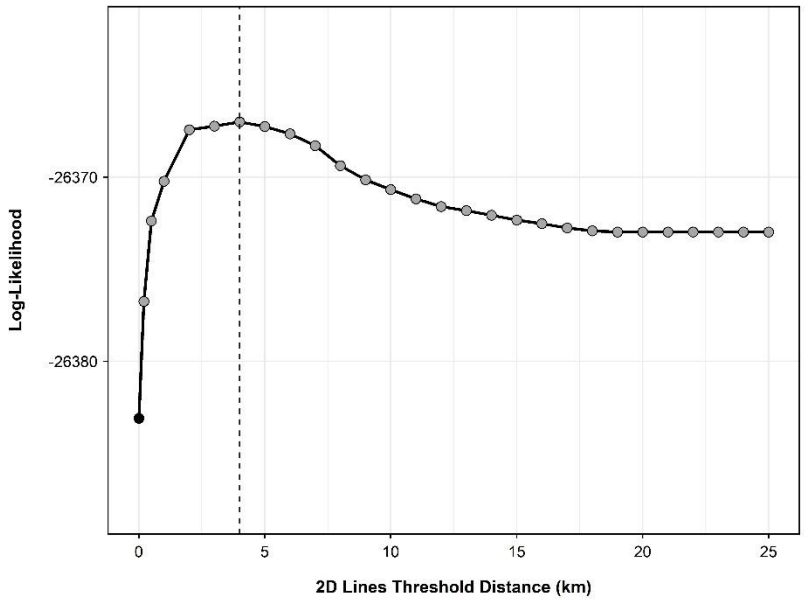


Attachment Figure 23. Marginal effect of distance to 3D seismic lines (single grid in Project RSA) on the probability of selection by caribou during winter (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

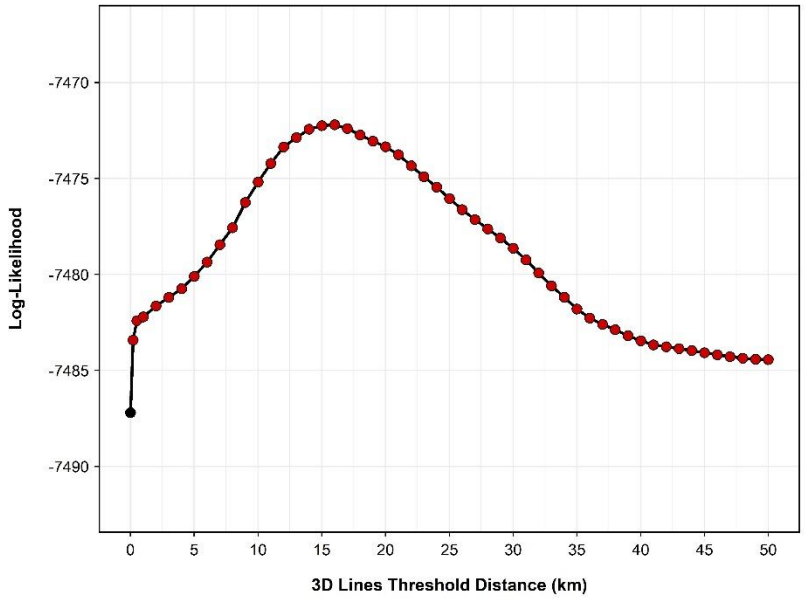


Attachment Figure 24. Marginal effect of distance to the Dempster Highway on the probability of selection by caribou during winter (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

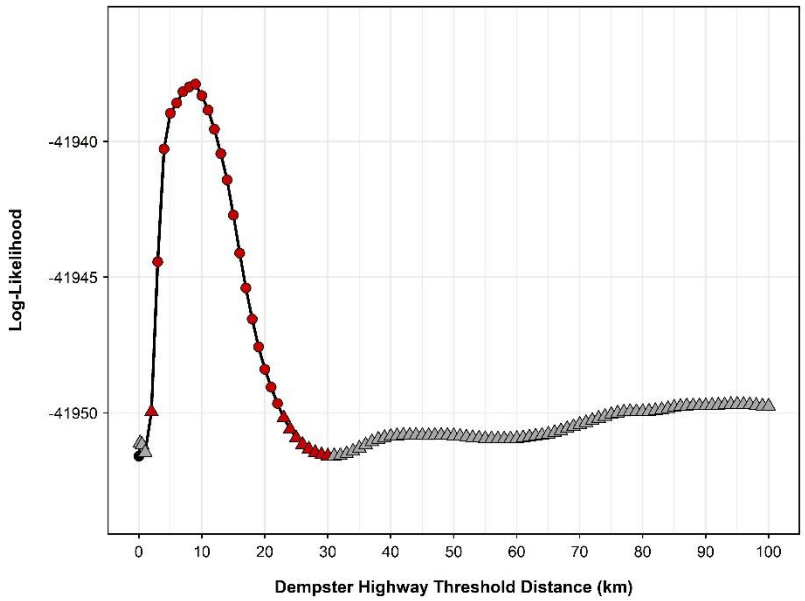
Late Fall



Attachment Figure 25. Segmented regression approach to estimating a zone of influence (ZOI) relative to 2D seismic lines (including winter roads and trails) using GPS collar data from PCH caribou during late fall, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively. Vertical dashed line indicates ZOI at 4 km.

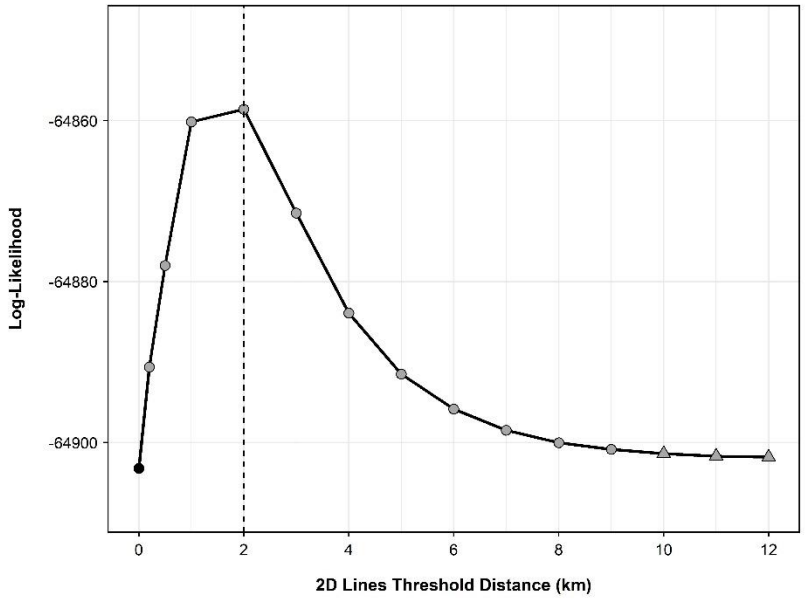


Attachment Figure 26. Segmented regression approach to estimating a zone of influence (ZOI) relative to the lone 3D seismic grid using GPS collar data from PCH caribou during late fall, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively.

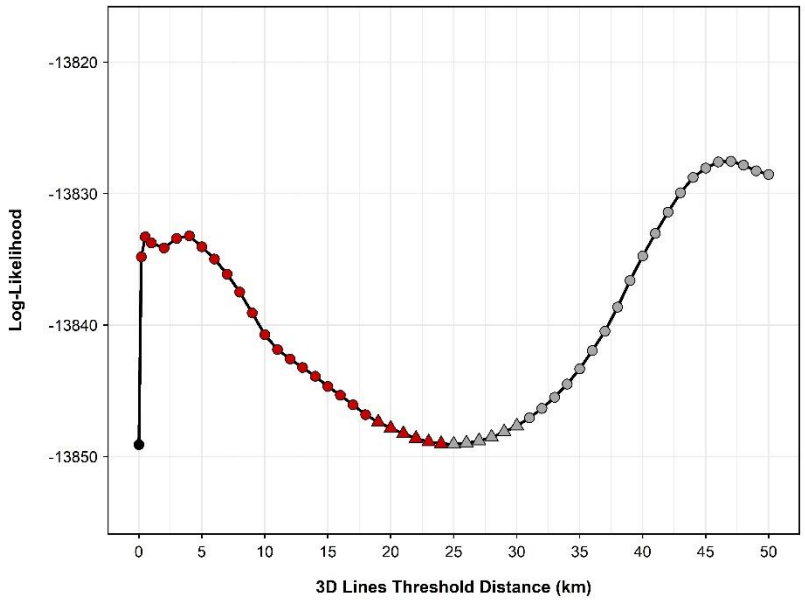


Attachment Figure 27. Segmented regression approach to estimating a zone of influence (ZOI) relative to the Dempster Highway using GPS collar data from PCH caribou during late fall, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively.

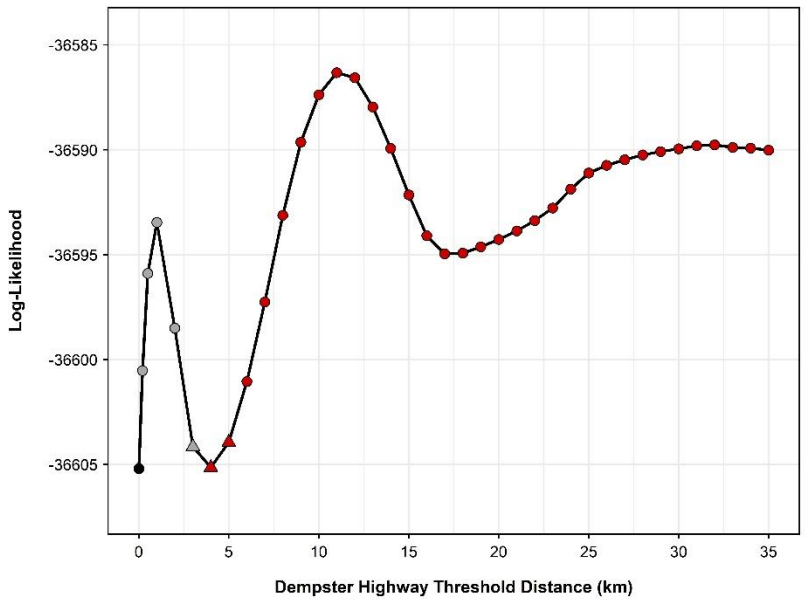
Winter



Attachment Figure 28. Segmented regression approach to estimating a zone of influence (ZOI) relative to 2D seismic lines (including winter roads and trails) using GPS collar data from PCH caribou during winter, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively. Vertical dashed line indicates ZOI at 2 km.



Attachment Figure 29. Segmented regression approach to estimating a zone of influence (ZOI) relative to the lone 3D seismic grid using GPS collar data from PCH caribou during winter, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively.



Attachment Figure 30. Segmented regression approach to estimating a zone of influence (ZOI) relative to the Dempster Highway using GPS collar data from PCH caribou during winter, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively.

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APPENDIX 2-A-30. *Chance Oil and Gas, Eagle Plains Project: Linear Feature Study*

Chance Oil and Gas, Eagle Plains Project: Linear Feature Study



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EXECUTIVE SUMMARY

The Eagle Plains Exploration Project (the Project) is an oil and gas exploration project located in north Yukon. Chance Oil and Gas Ltd. (Chance) intends to conduct exploratory activities to confirm the quality, quantity, and extent of hydrocarbons over ten years. Work will include seismic exploration and exploratory wells supported by an expanded winter road network. Oil and gas exploration activities create long, narrow clearings through natural vegetation, such as seismic lines and roads, collectively known as 'linear features.' Linear features can be a management challenge because they can affect how people and animals move and plants disperse within a landscape. For example, in southern parts of the boreal forest, linear features appear to affect predator-prey dynamics that can result in increased caribou mortality by wolves. The North Yukon and Peel Watershed Regional Land Use Plans identify mitigations to minimize the potential effects of linear features, including cautionary (0.75 km/km^2) and critical (1.0 km/km^2) indicator levels of linear disturbance.

Intermittent exploration activities in the Eagle Plains area from the 1950s to 2014 have created a network of winter roads, 2D seismic lines, and, most recently, 3D seismic lines in parts of the Regional Study Area (RSA). However, the extent of liner features that currently occur in the RSA, the structural, vegetation, and functional characteristics of different linear feature types, and their degree of regeneration are unknown. EDI Environmental Dynamics Inc. conducted a linear features study to characterize the structural, vegetation, and functional aspects of linear features in the RSA to address these information gaps. The study addressed three objectives: (1) comprehensive mapping and classification of existing linear feature footprints within the RSA; (2) quantification of structural aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and (3) quantification of regeneration pathways and structural stages of linear features. This combined information supports assessing potential effects of linear features in the Project application and refinement of mitigation measures for linear features to minimize possible effects.

The linear features inventory was compiled from multiple spatial datasets and was verified and supplemented using satellite imagery in a Geographic Information System. Linear feature densities were estimated for each linear feature type. Estimates were adjusted to account for (i) overlap with open habitats, such as recent burns, where vegetation heights were similar on and off the line, and (ii) for average rates of regeneration determined from field studies.

Site selection used a stratified random design to obtain a representative sample of different feature types across the RSA. Ground and aerial surveys measured specific structural, vegetation, and functional characteristics across the different line types. Measures included width, successional class, structural stage, vegetation composition and height, and sightline distances. A 'walk test' was used to index ease of movement for large mammals. A driving survey documented the visibility of seismic lines from the Dempster Highway (i.e., as an index of potential human access onto the seismic lines). An aerial winter track survey was conducted in March 2020 to assess ungulates' relative use of different linear feature types.

Four primary types of linear features occur in the RSA, totalling 4,269 km: 2D seismic (34%), 3D seismic (51%), winter roads (14%), and the Dempster Highway (1%). The unadjusted linear feature density for the RSA totalled 1.79 km/km^2. After accounting for burns, natural openings and regeneration, the adjusted linear

feature density for the RSA totalled 0.52 km/km², below the cautionary and critical indicator levels in the North Yukon and Peel Watershed Regional Land Use Plans.

Structural, vegetation, and functional characteristics differed substantially among linear feature types. 3D seismic accounts for the largest extent of linear features in the RSA and had the narrowest widths and limited functional effects (e.g., the proportion of features used by ungulates in the winter was less than a third of the rates of use on 2D and winter roads). Winter roads had the widest average widths and the greatest functional effects except for the Dempster Highway. However, a substantial portion (39%) had also regenerated into or past the Tall Shrub stage (which this study suggests may be the best criterion for functional recovery). Most 2D lines had substantial vegetation regeneration, resulting in the shortest average sightlines and slowest movement speeds. However, ungulates still appeared to select them to travel on during winter.

Except for the Dempster Highway, where walking speeds were near twice the rate of other linear feature types, there was relatively little difference in movement rates among linear feature types and control areas. The density of shrubs and trees primarily limited movement rates. 2D lines, which had the highest density of shrubby regeneration, had the slowest average movement rates. For other linear feature types, the combination of vegetation regeneration on linear features and the naturally open nature of most adjacent undisturbed areas did not convey a substantial increase in movement rates on linear features compared to undisturbed areas.

Sightline distances on 2D lines and winter roads were also affected mainly by the degree of vegetation regeneration. Where regeneration was limited, sightlines on 2D lines and winter roads regularly exceeded 150 m. On 3D lines, which have not had enough time since their creation for vegetation to regenerate to the height that restricts vision, sightlines were limited by meanders purposely constructed to reduce sightlines. The meanders employed on 3D lines were also effective in reducing the detectability of the lines from the Dempster Highway. In the blind test, where observers did not know the location of the 3D lines, only 5% (4 out of 74) crossings were spotted. With a map showing the crossing locations, only two additional 3D lines were detected.

These results provide information to assess the potential effects of linear features in the Project application and refine mitigation measures.

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EDI Environmental Dynamics Inc. (EDI) completed the work within the traditional territories of the Vuntut Gwitchin First Nation (VGFN), First Nation of the Na-Cho Nyäk Dun, and the Tetlit Gwich'in Council (Secondary Use Area). Tyrel Kassi, a VGFN citizen, played an active role in the field components of the project. We thank him for his diligence and shared perspectives during the project.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
2D	Two Dimensional
3D	Three Dimensional
AIC	Akaike's Information Criterion
asl	above sea level
BC	British Columbia
°C	degrees Celsius
ELC	Ecosystem and Landscape Classification
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectares
IMA	Integrated Management Area
km	kilometers
km^2	square kilometers
km/hr	kilometer per hour
LIS	Low Impact Seismic
LMU	Landscape Management Unit
m	meter
mm	millimeter
NND	Na-cho Nyäk Dun
NWT	Northwest Territories
NYRLUP	North Yukon Regional Land Use Plan
PCH	Porcupine Caribou Herd
OHV	Off-Highway Vehicle
PWRLUP	Peel Watershed Regional Land Use Plan
RSA	Regional Study Area
the Project	the Eagle Plains Project (proposed by Chance Oil and Gas Ltd.)
YLUPC	Yukon Land Use Planning Council

1 INTRODUCTION

1.1 PROJECT OVERVIEW

The Eagle Plains Project (the Project) encompasses a 2,386 km² area in north-central Yukon, approximately 605 km north of Whitehorse and 40 km south and west of Eagle Plains hotel, along the Dempster Highway (Map 1-1). The Project occurs within the Eagle Plains petroleum basin, north of the Ogilvie River and west of the Richardson Mountains. The basin contains proven natural gas and oil reserves (Peel Watershed Planning Commission 2019), including 4.6 billion m³ of gas and 3.2 million m³ of oil (Hannigan 2014).

The Regional Study Area (RSA) has had intermittent periods of oil and gas exploration since the 1950s. That activity has developed winter roads, seismic lines, and exploratory wells across parts of the current RSA. Approximately 40 exploration wells have been drilled at Eagle Plains. Eight wells are maintained in suspended status, and the remaining wells have been plugged and abandoned. Seismic exploration has included approximately 10,000 km of two-dimensional (2D) lines (mainly before 1985), and about 325 km² of three-dimensional (3D) seismic was conducted in 2013–2014 (Northern Cross (Yukon) Ltd. 2014).

The current exploration program will build on past exploration to better define the extent, amount and quality of oil and gas deposits. Under the current program, Chance Oil and Gas Ltd. proposes conducting additional 3D seismic over large extents of the RSA and drilling up to 30 exploratory wells. Depending on the drilling program results, extended flow testing over several months may be conducted at a subset of the wells to determine the quantity and quality of the oil and gas deposit. The existing winter road network will be expanded to support the seismic and drilling programs. Most work is expected to be conducted in the winter (e.g., seismic line clearing and drilling); however, seismic recordings and extended flow testing may also occur during summer.

Oil and gas exploration activities create long, narrow clearings through natural vegetation, such as seismic lines and roads, collectively known as 'linear features.' Linear features can be a management challenge because they can affect how people and animals move and plants disperse within a landscape. For example, in southern parts of the boreal forest, linear features appear to affect predator-prey dynamics that can result in increased caribou mortality by wolves. The North Yukon and Peel Watershed Regional Land Use Plans identify mitigations to minimize the potential effects of linear features. The Plans also include cautionary (0.75 km/km²) and critical (1.0 km/km²) linear density indicator levels.

1.2 PURPOSE AND OBJECTIVES

Intermittent exploration activities in the Eagle Plains area from the 1950s to 2014 have created a network of winter roads, 2D seismic lines, and, most recently, 3D seismic lines in parts of the RSA. However, the extent of liner features that currently occur in the RSA, the physical and functional characteristics of different linear feature types, and their degree of regeneration are unknown.

EDI Environmental Dynamics Inc. (EDI) conducted a linear features study to characterize the physical and functional aspects of linear features in the RSA to address these information gaps. The three objectives of this study were to: (1) conduct comprehensive mapping and classification of existing linear feature footprints within the RSA; (2) determine physical aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and, (3) quantify regeneration pathways and stages of linear features. The combined information forms the basis for assessing the potential effects of linear features in the RSA and refining mitigation measures for linear features.

1.3 STUDY AREA

The RSA for the Eagle Plains Project is approximately 2,386 km² (238,566 ha), centred in the Eagle Plains Ecoregion in north Yukon (Map 1-1). The area consists of subdued topography of rolling hills and sloping plains. The RSA is centred on a major watershed divide (denoted by the location of the Dempster Highway), with the northwestern two-thirds of the RSA draining into the Porcupine River watershed to the north, via Chance Creek, and west, via McParlon Creek and the Whitestone River. The southeastern third of the RSA drains into the Peel River watershed via Dalglish Creek.

Development in the RSA and the surrounding Eagle Plains is low. The Dempster Highway is the primary vehicle access corridor, running from approximately Dawson City, Yukon in the south to Inuvik, Northwest Territories in the north, and transiting the RSA. The Eagle Plains settlement is on the Dempster Highway, approximately 40 km northeast of the RSA and includes the Eagle Plains Hotel and the Government of Yukon's Highway Maintenance camp. The Eagle Plains area has had intermittent periods of oil and gas exploration since the 1950s. That activity has created winter roads, seismic lines, and exploratory wells across parts of the RSA. Approximately 40 exploration wells have been drilled at Eagle Plains. Eight wells are maintained in suspended status, and the remaining wells have been plugged and abandoned. Approximately 10,000 km of 2D lines have been developed across the Eagle Plains Ecoregion, mostly between 1961 and 1984 (Access Consulting Group and EBA Engineering Consultants Ltd. 2001, GEOTIR 2014). More recently, approximately 2,200 km of 3D LIS exploration was conducted in a 325 km² area between November 2013 and April 2014 (GEOTIR 2014). This 3D exploration grid is near the centre of the RSA, spanning north and south of the Dempster Highway.

1.3.1 REGIONAL ECOLOGICAL SETTING

The Eagle Plains Ecoregion is a 20,400 km² portion of the Taiga Cordillera Ecozone in north Yukon between the Richardson and Ogilvie Mountains. Unlike much of the mountainous Taiga Cordillera, most of the Eagle Plains Ecoregion occurs as low altitude rolling topography between 300 m and 600 m above sea level (masl), with few scattered peaks above and around 1,000 masl (Ecological Stratification Working Group 1995). Most of the ecoregion is unglaciated terrain, with surficial features formed due to permafrost and frozen ground-related processes, including thermokarst subsidence, soil creeps, cryoturbation, solifluction, and active layer detachment slides on shale (Yukon Ecoregions Working Group 2004).

The Eagle Plains Ecoregion experiences moderate precipitation, with annual amounts around 400 mm. Most precipitation falls as rain throughout the summer, averaging 50 to 80 mm per month, June through August. Precipitation is lighter through September to April and falls as snow, with average winter snowpacks of 80 cm peaking in April. The climate is strongly affected by latitude, with extended winter conditions from October to early May. There is a substantial variation in seasonal temperatures in the Eagle Plains, with cool short summers and long cold winters. Average winter temperatures are between −30°C and −25°C, with extremes as low as −60°C. Average summer temperatures are around 13°C, with extremes as high as 30°C. Due to the northern latitude, this region experiences continuous sun above and below the horizon, in summer and winter, respectively.

Most of the Ecoregion, including the northeast portion of the RSA, drains north into the Yukon River via the Whitestone, Porcupine and Eagle rivers. That part of the RSA includes the headwaters of the Eagle River and several other tributaries of the Porcupine River, along with the Chance and McParlon Creek subdrainages of the Whitestone River. The southeast corner of the Ecoregion drains east to the Mackenzie River via the Peel, Wind and Ogilvie Rivers. Dalglish and Enterprise creeks flow directly into the Peel River. The few lakes in the Ecoregion are generally oxbow or thermokarst lakes (Yukon Ecoregions Working Group 2004). Several wetland complexes are associated with larger creeks in the RSA.

The Eagle Plains Ecoregion is within the continuous permafrost zone where permafrost can be found up to 200 m thick. The Eagle Plains Ecoregion is dominated by the Cryosolic soils that occupy much of the northern third of Canada, characterized by near-surface permafrost. Turbic Cryosols predominate, exhibiting patterned ground formations and hummocks, and are often associated with open stands of black spruce (*Picea mariana*), tamarack (*Larix laricina*) and birch (*Betula* spp.). The active permafrost layer in these ecosystems generally ranges between 20 cm and 90 cm below the surface. The active layer depth is generally deeper directly under hummocks and shallower under inter-hummock areas (Yukon Ecoregions Working Group 2004).

The RSA is entirely within the Subarctic Bioclimate Zone (Environment Yukon 2014). Vegetation in the RSA is characterized by open-canopy, spruce-dominated habitats where permafrost and short cool growing seasons limit tree growth and often result in stunted, disclimax vegetation communities (Environment Yukon 2016). Hummocky, black and white spruce (*Picea glauca*) woodlands with well-developed shrub communities are common in upland areas. White spruce and ground lichens increase in abundance in well-drained sites. Areas with low slope gradients and fine-textured soils often have ground cover dominated by cottongrass tussocks beneath a shrub layer of birch, black spruce, Labrador tea (*Rhododendron groenlandicum*), and occasionally tamarack (*Larix laricina*) (Yukon Ecoregions Working Group 2004).

Forest fires are a common disturbance agent in the region, and burns of various ages occur throughout the RSA. Fires increase the depth of the active permafrost layer and changes in soil moisture and productivity, affecting vegetation regeneration and resulting in terrain disturbances, such as slope failures and erosion. Regenerating burns are dominated by shrubs, such as scrub birch (*Betula glandulosa*), willows (*Salix spp.*) and alder (*Alnus spp.*), with Alaskan paper-birch (*Betula neoalaskana*) often the first tree species to colonize burn areas. As burns regenerate into young and mature forest, black and white spruce typically become the dominant forest species. Residual Alaskan birch in spruce-dominated stands often defines the extent of old burns (Yukon Ecoregions Working Group 2004).

Mammal diversity is relatively low in the Eagle Plains Ecoregion due to its northern location and low productivity. Voles (*Microtus* spp., *Myodes* spp., *Phenacomys* spp.), American marten (*Martes americana*), ermine (*Mustela erminea*), and red fox (*Vulpes vulpes*) are common smaller mammals. Wolves (*Canis lupus*), wolverines (*Gulo gulo*), and both black and grizzly bears (*Ursus americanus* and *U. arctos*.) are present at low densities. Moose (*Alces alces*) inhabit the region year-round. The RSA overlaps a small portion of the winter range of the Porcupine caribou herd (PCH), a subpopulation of the barren-ground caribou (*Rangifer tarandus granti*). The PCH is an iconic species in north Yukon, with high cultural, social, economic, and ecological values. The PCH's population has been increasing over the last several decades and is currently estimated to consist of 202,106 to 234,808 caribou (Caikoski 2017, Porcupine Caribou Technical Committee 2018). The PCH is known to occupy portions of the Eagle Plains Ecoregion in fall and winter when they tend to occur in smaller groups over a larger area than during other seasons.

1.3.2 REGIONAL LAND USE PLANNING

The RSA overlaps four First Nation Traditional Territories. Most of the RSA is within the Traditional Territory of the Vuntut Gwitchin First Nation. The southeastern portion is in an area of overlapping Traditional Territories of Vuntut Gwitchin First Nation, the Tetlit Gwich'in Council, the First Nation of Na-cho Nyäk Dun, and Tr'ondëk Hwëchin. Although the RSA is located outside of any First Nation Settlement Lands, it does abut Vuntut Gwitchin First Nations Settlement Lands on parts of its east and southwest borders. Each First Nations government has provided input to, and approved of, the Regional Land Use Plan(s) on their Traditional Territory under the respective First Nation Final Agreements.

1.3.2.1 North Yukon Regional Land Use Plan

The RSA lies mainly within the North Yukon Planning Region and is subject to the North Yukon Regional Land Use Plan (NYRLUP) (Map 1-1). The NYRLUP was created to protect the natural and cultural resources of the region while allowing sustainable economic development opportunities (Vuntut Gwitchin Government and Yukon Government 2009). It provides management direction for using public and settlement lands based on four principles: sustainable development, precautionary principle, conservation, and adaptive management. The NYRLUP divides the Planning Region into 23 land management units classified into three categories: protected area, integrated management area (IMA), and community area. IMAs are further classified into four zones: Zone 1 (lowest development), Zone II (low development), Zone III (moderate development), and Zone IV (highest development). IMA zones are classified based on the area's sensitivity to landscape disturbance, ecological and cultural values, risk of significant impacts, and level of acceptable change. The RSA is a Zone IV IMA with lower ecological and cultural values in a moderately sensitive biophysical setting. Subsequently, Zone IV IMAs allows for the highest development level to occur.

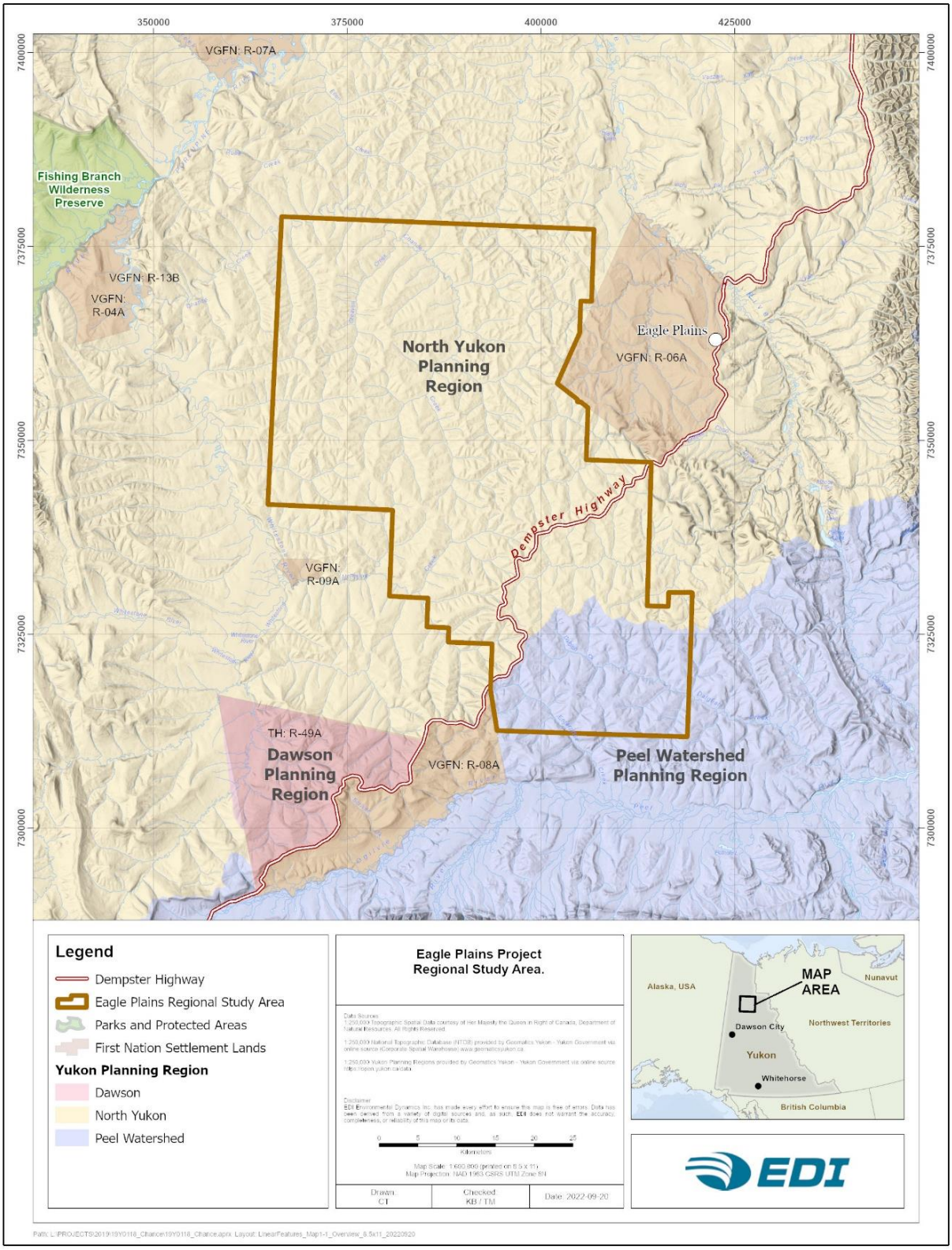
The NYRLUP encourages results-based management and uses cumulative effects indicators to determine if goals and objectives are met. Results-based management allows for innovation and creativity in land-use strategies and approaches. The two cumulative effects indicators included in the NYRLUP are direct surface disturbance and linear density. The NYRLUP guidelines for Zone IV IMAs are 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density (Vuntut Gwitchin Government and Yukon Government 2009).

However, as surface disturbances and linear features reach a level of functional recovery and become part of the continuous landscape, they can be subtracted from the total amount of disturbed area (Vuntut Gwitchin Government and Yukon Government 2009). The NYRLUP suggests using a height of 1.5 m for woody vegetation in forested areas, as vegetation above this height would likely no longer allow for travel or access by humans or wildlife and is, therefore, considered functionally recovered. Activities considered exempt from functional disturbance restrictions are (1) new linear features less than 1.5 m wide; (2) land-use activities that occur on frozen water bodies; (3) winter work with no required clearing of trees; and (4) winter work that uses existing disturbances and linear features.

1.3.2.2 Peel Watershed Regional Land Use Plan

The southeastern corner of the RSA lies within the Peel Watershed Planning Region (PWPR) and is subject to the Peel Watershed Regional Land Use Plan (PWRLUP) (Peel Watershed Planning Commission 2019) (Map 1-1). Like the NYRLUP, the PWRLUP was established to provide management direction and ensure long-term sustainable development in the Planning Region. The PWRLUP was founded on three main themes: environmental protection, social considerations, and economic development. It follows a similar framework as the NYRLUP. The PWPR is divided into 16 Landscape Management Units (LMU), which each share similar ecological characteristics, planning issues, and management intent. Each LMU is categorized by a land-use designation system. Conservation Areas are managed to protect ecological and cultural resources, while IMAs are 'working' landscapes where new development and surface disturbance may be allowed. IMAs are further classified into Zones, which correspond to the level of allowable development with comparable justification as the NYRLUP. The RSA is part of LMU 7 (Dalglish Creek), classified as an IMA Zone IV, allowing for the highest level of development.

Like the NYRLUP, the PWRLUP encourages results-based management and uses the same cumulative effects indicators, surface disturbance and linear density to inform decisions. The PWRLUP cautionary and critical indicators are identical to those of the NYRLUP: 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density. As surface disturbances reach a level of functional recovery and no longer enable travel or access by wildlife and people, they can be subtracted from the total amount of disturbed area. The PWRLUP suggests using a 1.5 m woody vegetation height as a threshold for functional recovery in forested or shrubland areas. In areas dominated by low-growing vegetation, a feature could be considered functionally recovered when covered by native species roughly the same height and composition as the surrounding vegetation. To be considered as "functionally recovered," features must have similar sediment and run-off compared to background levels, roughly match original contours, and have no human-brought materials on the site. Exceptions to the linear density calculation are identical to those outlined in the NYRLUP.



Map 1-1. Eagle Plains Project Regional Study Area.

2 BACKGROUND

The term "linear feature" refers to any narrow, linear clearings of vegetation on the landscape. They include roads, seismic lines, power lines, and pipelines. Seismic lines are the dominant linear feature class in northern Canada, accounting for approximately 46% of all linear features in the Canadian boreal region (Pasher et al. 2013). Seismic exploration detects underground oil and natural gas reservoirs by analyzing sound waves reflected from the underlying geology (Yukon Energy Mines and Resources 2006). Sound waves are emitted by detonating small charges in a series of drilled shot holes (up to 20 m deep) or by vibrating a heavy metal plate on the ground's surface using a truck-mounted vibrator (Yukon Energy Mines and Resources 2006). Both methods require cleared travel corridors for equipment transportation, which results in a network of seismic lines across the landscape where seismic exploration has occurred.

Until the late 1990s, conventional 2D was the primary form of seismic exploration used in North America. 2D seismic lines were created using bulldozers to clear all vegetation in straight swaths, approximately 5–10 m wide in their earliest form. These wide, straight lines were necessary to enable large, heavy equipment movement. This process resulted in significant physical disturbance, often removing most surface vegetation and roots and the top layer of soil (Bliss and Wein 1972). Progressive improvements in 2D seismic exploration methods reduced the environmental impact, such as clearing in winter instead of summer and raising and adding mushroom shoes to the bulldozer blade to reduce soil disturbance. Despite these improvements, many of the 2D seismic lines created in the 1960s and 1970s in northern Canada remain disturbed, with little evidence of ecological recovery (Lee and Boutin 2006, van Rensen et al. 2015).

3D seismic exploration provides more accurate subsurface geological structure data than 2D technology. 3D seismic exploration techniques were developed in the mid-1990s, and their use became widespread in the early 2000s (Dabros et al. 2018). At the same time as the transition to 3D, the seismic industry was transitioning to smaller and more specialized equipment that reduces cost, improves efficiency and reduces environmental impacts. Modern seismic equipment and methods typically use what is referred to as Low Impact Seismic (LIS) methods that minimize line widths and site disturbance and compaction. Typical 3D seismic lines are 2–3 m wide, constructed in 100–500 m spaced grids, and follow meandering rather than straight routes. There have been substantial improvements in the equipment used for 3D seismic line creation: low ground pressure mulchers, lighter equipment, ATV-mounted equipment, mushroom shoes and smear blades, and 'envirodrills' greatly reduce physical and vegetation disturbance (Dabros et al. 2018). These methods often leave the ground vegetation intact and only remove trees and tall shrubs, reducing overall disturbance and facilitating faster regeneration. The location of the seismic line can be adjusted on the fly in the field to minimize impacts, such as avoiding the cutting of large trees.

Continuous advancements in seismic exploration technology have improved geophysical accuracy while simultaneously reducing environmental impact. Numerous studies have examined the effects of linear disturbances on soil, hydrology, vegetation, regeneration, and wildlife responses (see Dabros et al. 2018 for a comprehensive review). Although the bulk of literature focuses on 2D seismic lines, as they have been part of the landscape for over 60 years, there have been several recent studies investigating the effects of LIS and 3D seismic lines (e.g., Kemper and Macdonald 2009a, Kansas et al. 2015, Golder Associates 2016).

Linear features have been associated with various environmental effects, including permafrost thaw, soil compaction and rutting, increased soil moisture and pooling, altered snow cover, temperature and wind patterns, and varied vegetation and wildlife responses (Dabros et al. 2018). In addition to the immediate loss of vegetation, linear features can create extensive edge effects, facilitate non-native or disturbance-induced species establishment, alter species composition, and positively and negatively affect wildlife (Dabros et al. 2018).

One of the most extensively studied effects of linear features in the southern boreal forest is the indirect effects that linear features can have on mortality risk to woodland caribou (*R. tarandus caribou*). Linear features can result in complex effects on populations dynamics that include (i) increases in secondary prey (moose and deer), which elevate wolf populations (apparent competition) and (ii) more efficient hunting by predators along linear features (facilitated predation) (Wittmer et al. 2007, Latham et al. 2011, Dickie et al. 2017a, Keim et al. 2019b, 2021). Research has also documented the responses of birds to linear features (Bayne et al. 2005, Machtans 2006, Lankau et al. 2013), bears (Tigner et al. 2014, Finnegan et al. 2018), and furbearers (Tigner et al. 2015).

Most studies investigating impacts and recovery of seismic lines and other linear features were conducted in southern boreal forest ecosystems (i.e., Boreal Plains Ecozone; e.g., Lee and Boutin 2006, Kansas et al. 2015, van Rensen et al. 2015, Dickie et al. 2017a). There are fundamental differences in the climate, vegetation communities, wildlife communities, and ecological processes in taiga ecosystems that may result in different patterns and responses to linear features. For example, regeneration patterns of linear features in taiga ecosystems over permafrost can follow different successional trajectories than those of southern boreal regions (Simpson 2008). The few studies that have examined linear features in taiga regions have found similarities and differences to southern studies revegetation (Kemper and Macdonald 2009, Dabros et al. 2018). One of the key objectives of this study was to collect local information from Eagle Plains that can be used to better contextualize or adapt the findings from other studies to the Eagle Plains Project.

3 METHODS

A GIS analyses and field surveys were conducted to characterize linear features within the RSA. The inventory of linear features in the RSA was developed in a GIS by compiling available spatial data and then verifying and updating that against satellite imagery. Field studies quantified the width, vegetation characteristics, ecological function (line-of-sight, large mammal ease of movement assessment), and visibility of lines from the Dempster Highway.

3.1 LINEAR FEATURES INVENTORY

The inventory of existing linear features in the RSA was developed in a GIS by compiling available spatial data and then verifying and updating that against satellite imagery. A preliminary linear feature database was first developed that was used to support field surveys (described below in this section). A second step linked the field data to the linear feature database and conducted a more thorough review and verification process using satellite imagery to produce a final linear feature dataset for the RSA (see details in section 3.5.1).

Linear feature spatial data were obtained from the following sources:

- Yukon Government Energy, Mines and Resources "Oil and Gas Seismic Lines" dataset (a combination of less detailed National Energy Board data pre-1999 and the more detailed company-submitted data post-1999) (Yukon Government 2019)
- Natural Resources Canada CanVec "Roads," "Trails," and "Cut Lines" 1:50,000 scale datasets (Natural Resources Canada 2019)

The two datasets were merged into one dataset of all linear features documented in Yukon and clipped to the RSA. Key attribute data included (if available) the linear feature type (i.e., 2D and 3D seismic lines, winter roads, trails, Dempster Highway), width, year of establishment, and data source. This preliminary linear feature dataset was compared against satellite imagery at a (minimum) 1:10,000 scale to verify its accuracy. Any linear features that did not correspond with features visible in satellite imagery were either corrected or deleted based on satellite imagery interpretation. In the case of duplicate features across datasets, the 'best' data were attributed to a single feature by considering the spatial accuracy and the amount and accuracy of attribute data, as assessed against satellite imagery. Where duplicate widths occurred in the two source datasets, the wider width was retained.

3.2 LINEAR FEATURE CHARACTERISTICS SURVEY

Field studies quantified the width, vegetation characteristics, line-of-sight, and large mammal ease of travel assessment across the linear feature types identified from the GIS inventory. One aspect of the field study was to compare vegetation, line-of-sight, and ease of movement on the linear features to undisturbed areas adjacent to the cleared lines. Three types of surveys collected data for the linear feature study: ground surveys

(finest level of detail), air surveys (medium level of detail), and air calls (coarsest level of detail). EDI crews collected field data between July 28 and August 8, 2019.

3.2.1 SITE SELECTION

All ground surveys and aerial surveys occurred at predetermined, random sites. Sample sites were selected using a clustered, random sampling approach. This approach balanced obtaining a random, representative sample across linear feature types with survey efficiency (i.e., without clustering sites, the travel time between points would have been substantially greater and resulted in smaller sample size). Survey sites were drawn from 5,000 points distributed randomly across the set of mapped linear features (minimum spacing of 200 m between points). Each point was randomly assigned a unique number.

Each survey cluster included options for both ground and air surveys. For ground surveys, the cluster used a 2 km radius designed to accommodate approximately four ground survey sites, intended to be surveyed within a half-day of work (and close enough so crews could walk between sites). The objective was that two ground clusters could be surveyed by a crew each day. For air surveys, a 4 km radius was used that generally provided at least ten random survey site options. The objective for air survey clusters was that they could be surveyed while transiting between ground survey clusters.

Survey sites were selected via a two-stage process. The first stage was randomly drawing 100 points from the 5,000-point dataset. These points defined the survey clusters and served as actual survey sites. In this first stage, site selection was stratified to obtain an approximately equal sample across 2D, 3D and winter roads. This overweighted sampling of 2D and winter roads, relative to their extents in the RSA, but those features had the highest uncertainty in terms of their widths, vegetation characteristics, and functional characteristics. Stratification was necessary to obtain sufficient sample sizes across these less-common features. The second site-selection stage selected additional random points from the 5,000-point dataset in proximity to the first point, using the 2 km radius for ground surveys and the 4 km radius for aerial surveys.

The RSA was divided into 10 work areas to implement the sample design, each corresponding to a day of surveys. Each day the survey crew selected clusters to survey using the ascending order of the random identification number of the first point used to define each cluster. Similarly, points within each cluster were prioritized in ascending order of the random identification number. Normally, at least two ground clusters and two air clusters were sampled each day. However, that varied somewhat depending on the number of sample sites available in each cluster and the availability of the helicopter.

3.2.2 LINEAR FEATURE CHARACTERISTICS AND SURVEY METHODS

3.2.2.1 Linear Feature Characteristics

A range of structural, vegetation, human use, and functional characteristics was assessed in the field. A list of the various characteristics examined, with a description of each, is provided in Table 3-1. Successional classes and structural stages of vegetation are defined in Table 3-2 and Table 3-3, respectively.

Table 3-1. Description of physical, ecological and function characteristics assessed in the Eagle Plains linear feature study.

Parameter	Description	Survey Measured [1]
Plot location	Latitude and longitude using WGS 1984, measured by Garmin GPS units to ~4 m accuracy.	G, AS, AC
Linear feature type	Dempster Highway, winter road, 2D, 3Dc (conductor lines), 3Dr (receiver lines), and 3D5 (3D lines used both for seismic and local equipment/vehicle travel.	G, AS, AC
Linear feature width	During ground surveys, measured to the nearest 0.05 m and replicated four times. During aerial surveys, they were visually estimated to the nearest 1 m.	G, AS
Percent mulch	Percent cover of mulch (wood chips) on the seismic line, estimated to the nearest 1% using visual estimates. In areas with dense trees or large shrubs, the thick mulch layer produced during line clearing can hinder vegetation regeneration.	G, AS
Successional class	Refers to the successional trajectory of vegetation regeneration on the linear feature. Includes normal, magnified, stagnated, retrogressive, no succession, or recent disturbance class following Simpson (2008)[1].	G, AS, AC
Burn status	Burnt or not burnt; based on visual assessment (i.e., burned trees, charred ground vegetation).	G, AS, AC
Structural stage	Categorical descriptor of the dominant vegetation life form in the plot following the *Field Manual for Describing Yukon Ecosystems* criteria (Environment Yukon 2017). Structural stage categories are defined in Table 3-3.	G, AS
Height and species of tallest vegetation	Measured to the nearest 0.1 m for the tallest vegetation layer, approximated by the 90th percentile height to exclude extreme heights of individual plants.	G
Cover and species of dominant trees	Percent cover was recorded to the nearest 1% if less than 10%, and to the nearest 5% if over 10%. One or two dominant tree species were recorded.	G, AS
Cover and species of dominant shrubs	Percent cover was recorded to the nearest 1% if less than 10%, and to the nearest 5% if over 10%. Up to five co-dominant shrub species were recorded. Ground shrubs were excluded.	G, AS
Ecosite	Ecosite was recorded using Predictive Ecosystem Mapping (PEM) Units, available at the time of the survey. However, separate vegetation surveys indicated that the accuracy of the PEM mapping was poor, and ecosites were not used in subsequent analyses.	G
Permafrost activity/degradation	Present or absent. Additional comments (i.e., type of activity, percent cover) were recorded if applicable.	G
Wildlife trails	Present or absent. If present, rated as poorly, moderately, or well defined.	G
Potential for Off-Highway Vehicle (OHV) passage	Present or absent. Based on professional judgment, a 4x4 side-by-side is summer, considering obstructing vegetation, ground conditions (e.g., wetlands, peatlands), and graminoid tussocks.	G, AS
Signs of human activity	Present or absent. If present, applicable comments were recorded.	G
Ground disturbance	Percent cover of visibly disturbed ground. If present, type and additional descriptive comments were recorded.	G

[1] G=Ground Survey, AS=Aerial Survey, AC=Air Call.

[2] Between 2006 and 2008, Yukon Government, Department of Energy, Mines, and Resources investigated the recovery status of linear features in the Eagle Plains, British Mountains, and Peel River Plateau Ecoregions (Simpson 2008). They found that linear features typically regenerated into one of six categories: normal succession, magnified succession, retrogressive succession, successional stagnation, no succession, and recent disturbance (Table 3-2).

Table 3-2. Descriptions of successional classes on linear features in the Eagle Plains area (following Simpson 2008).

Successional Class	Description
Normal succession	Vegetation is similar to the adjacent undisturbed area but often in an earlier seral stage. E.g., often young trees surrounded by early successional shrubs and forbs. The disturbance was likely limited to removing trees and shrubs, with little to no disturbance to soil or permafrost.
Magnified succession	Vegetation on the feature is taller than the adjacent undisturbed area. Deciduous species often dominate tree and shrub layers, but a similar pattern was also observed for coniferous trees on some sites. The response is likely due to increased site productivity (including increased soil moisture, nutrients, and temperature) due to soil disturbance or increased depth to permafrost. Most frequently, but not exclusively, observed in burns.
Retrogressive succession	Sites are typically moss or sedge-dominated (rarely forb or low shrub), with high moisture content, often including standing water (i.e., micro wetlands), that contrast to upland conditions in adjacent undisturbed areas. The condition appears to result from permafrost melting and water pooling associated with vegetation removal and removal/compaction of the peat layer and mostly associated with winter roads.
Successional stagnation	Vegetation is typically dominated by graminoids or shrubs and not progressing to more advanced successional stages. Disturbance to soil or permafrost is likely. The ground may have been compacted. Almost exclusively associated with winter roads.
No succession	No ecological differences between the linear feature and adjacent undisturbed areas except that there is no or very little tree or shrub regeneration on the line, other than what was left after creation of the feature. Disturbance appears to be limited to the removal of trees and shrubs, with little to no disturbance to ground vegetation, soil, or permafrost.
Recent disturbance	Newer seismic line where successional patterns could not be determined. Features in this class were most likely trending to 'normal succession' or 'no succession', but the degree of regeneration was too limited to classify confidently.

Table 3-3. Structural stage categories used in ground and air surveys for the Eagle Plains linear feature study.

Structural Stage Code	Structural Stage Name	Description
1	Non-vegetated	Very recent disturbance (e.g., fire or flood) and no vegetation or less than 5% vegetation.
2	Sparse/Cryptogram	Either the initial stages of primary succession or a cryptogram community maintained by environmental conditions (e.g., bedrock, talus). Sparse tree, shrub and herb cover. Either sparsely vegetated overall (low cover of vascular plants and cryptograms, if present) or dominated by cryptograms.
2a	Sparse	5–10% vegetation cover.
2b	Bryoid	Bryophyte-dominated.
2c	Lichen	Lichen-dominated.
3	Herb	Early successional stage (e.g., post-fire forest succession) or a herb community maintained by environmental conditions or disturbance. Vegetation is dominated by herbs, although if the site overall is sparsely vegetated, herb cover can be low as long as herbs characterize the vegetation. Trees and shrubs are usually sparse or absent; however, shrub cover and stature (compared to herb cover and stature) determine whether the site is considered herbaceous.
3a	Forb-dominated	Includes non-graminoid herbs and ferns.

Structural Stage Code	Structural Stage Name	Description
3b	Graminoid-dominated	Includes grasses, sedges, reeds, and rushes.
3c	Aquatic	Floating or submerged plants dominate.
3d	Ground shrub-dominated	Dominated by dwarf woody species such as kinnikinnick (*Arctostaphylos uva-ursi*) or dwarf willows.
4	Shrub	Early successional stage of a forest or a shrub community maintained by environmental conditions or disturbance. Dominated either by shrubby vegetation, including tree seedlings or saplings; or, if sparsely vegetated overall, dominated by shrubs, which characterize the community as a shrubland.
4a	Tall Shrub	Dominated by woody plants >2 m tall with diameter at breast height (dbh) ≤7 cm.
4b	Low Shrub	Dominated by woody plants <2 m tall.
5	Treed: Pole/Sapling	Trees >2 m tall and with dbh >7 cm, typically densely stocked. Self-thinning and vertical structure are not yet evident in the canopy. Younger stands are vigorous (usually >15 to 20 years old); older stagnated stands (up to 100 years old) are also included; time since disturbance usually <40 years; up to 100+ years for dense (5,000–15,000+ stems per ha) stagnant stands.
6	Treed: Young Forest	Self-thinning has become evident and the forest canopy has begun to differentiate into distinct layers. A more open stand than at the pole/sapling stage.
7	Treed: Mature Forest	Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understoreys become well developed as the canopy opens up.
8	Treed: Old Forest	Stands of old age with complex structure; patchy shrub and herb understoreys are typical; regeneration is usually of shade-tolerant species with a composition similar to the overstorey. Fire-maintained stands may have a single-storey appearance.
9	Treed: Very Old Forest	Very old stands with complex structures, abundant large trees, snags and coarse woody debris (CWD); snags and CWD occurring in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species, with well-established canopy gaps.

3.2.2.2 Survey Methods

Three types of surveys assessed linear feature characteristics: ground surveys (finest level of detail), air surveys (medium level of detail), and air calls (coarsest level of detail). The reason for using different survey types was to maximize the sample size obtained, recognizing that the ability to collect certain types of data, or the level of measurement precision, decreased from ground surveys to aerial surveys to air calls. The characteristics that were measured during each survey type are noted in Table 3-1. Surveys were conducted between July 28 and August 8, 2019.

Ground surveys collected the most information and had the highest measurement precision of the three survey methods. All parameters listed in Table 3-1 were recorded. Field measurements generally followed methods in *Field Manual for Describing Terrestrial Ecosystems* (BC MFLNRORD and BC MOE 2010) with parameter specific details noted in Table 3-1. Photographs were taken of representative on-line and off-line plots.

Air surveys collected moderate resolution data on linear features. Air surveys efficiently collected a larger quantity of more generalized data than ground surveys. The subset of parameters recorded for aerial surveys is noted in Table 3-1. The survey methods generally followed procedures outlined for helicopter-based 'visual checks' in *Standard for Terrestrial Ecosystem Mapping in British Columbia* (Resources Inventory Committee 1998). Data were collected by hovering in a helicopter approximately 30 m over the sample sites for approximately three minutes while field crews recorded data for the reduced set of variables. Like ground surveys, relevant data were collected for both on-line and off-line plots. Photographs were taken at representative air survey plots (Attachment A).

Air calls collected data at the coarsest resolution of the three survey types, and no off-line data were collected. The data collected during air calls were limited to linear feature type, successional class, and burn status. Air calls were opportunistically conducted when EDI crews were flying through the RSA and linear features were encountered.

A fundamental aspect of the field study was to compare linear feature characteristics to adjacent undisturbed areas. Hence, field surveys included paired on-line and off-line plots at each sample site (excluding sites assessed via air calls). Off-line plots were located 50 m off the linear feature, with the direction off the feature selected randomly at each site using a coin toss. Data collected for each sample site were recorded on tailored survey forms (Attachment B).

3.2.2.3 Line-of-Sight and Ease of Travel

In addition to the structural and vegetation measures noted above, line-of-site and ease-of-movement were assessed as functional characteristics of the linear features at each ground plot. The sightline, measured to the nearest metre, was calculated as the farthest line that could be sighted using a range finder at the height of 1.5 m off the ground. Two measurements were recorded, one in each direction along the linear feature. Sightline measurements were repeated using the same bearings in the off-line plot.

Ease of travel was assessed using a 'walk test,' as Keim et al. (2019a) described in a study assessing the functional recovery of linear features. They found that ease of travel, as measured by a walk test conducted by human researchers, positively correlated with the intensity of use by several wildlife species. One EDI crew member timed themselves to the nearest second for the walk test while walking an approximately 75 m transect, measured to the nearest metre using a hip chain. This walk test was repeated in both the on-line and off-line plots, the paired transects spaced in parallel, approximately 50 m apart. The same observer conducted both walk tests to minimize observer bias at each site.

3.3 VISIBILITY OF LINEAR FEATURES FROM THE DEMPSTER HIGHWAY

One of the management concerns associated with seismic exploration is that seismic lines create travel routes that humans use. The probability of human use of seismic lines to access the surrounding landscape likely increases if the seismic line is visible and accessible from roads. The intersections of seismic lines and winter roads with the Dempster Highway are the primary locations where this could originate. Driving surveys were conducted along the 47 km section of the Dempster Highway within the RSA to determine the number and

type of linear features that could be located and accessed by the public from the Dempster Highway. Two types of surveys were conducted: a blind search where the location of the linear features was unknown and a 'map search,' where the observers had a map of the linear features that showed where they occurred. Both surveys were conducted on August 8, 2019.

The blind search approximated the proportion and type of linear features that the public could locate and access without prior knowledge of their locations. An EDI field crew drove along Dempster Highway at 35 km/h and attempted to identify linear features by visual inspection alone, unaware of where they intersected the highway. When a linear feature was identified, the crew stopped to record the following parameters:

- linear feature type;
- sight line distance;
- evidence of human use;
- evidence of wildlife use; and
- potential for OHV passage.

Photographs were taken, and relevant comments were recorded for each linear feature intersection where applicable.

The map search was a targeted search designed to approximate the proportion and type of linear features the public could spot from the Dempster Highway with prior knowledge of their locations. Using a map of linear features present in the RSA, an EDI field crew drove along the Dempster Highway, slowing to 10 km/h and attempting to identify the linear features when passing a point where the map showed they intersected the highway. When a linear feature intersection was reached, the crew recorded whether the line was visible or not and the parameters listed above for the blind search where a line was detected.

3.4 WINTER TRACK SURVEY

An aerial survey was conducted to assess the relative frequency of use of different liner feature types by ungulates and humans in late winter (March 2020). The survey consisted of 11 transects spanning the width of the RSA. Three of the transects were established parallel to the Dempster Highway at 50 m, 1 km and 5 km off the highway. The remaining transects were spaced approximately 5 km apart across the remainder of the RSA.

Before the field survey, each transect was established in a GIS. Each intersection with a linear feature was given a unique identification point and used to generate a field form (i.e., with a row for each linear feature intersection). The field survey involved flying along each transect and recording the presence of ungulate tracks or human tracks (e.g., snowmobile tracks) at each linear feature that was traversed. Surveys were conducted via helicopter at approximately 70 km/h, 50 m above the ground, with one navigator/data recorder and one primary observer. The surveyors classified tracks to species and counted the number of unique tracks. However, overlapping tracks and dustings of new snow made track identification and counts uncertain in over

half the detections. Therefore, analyses defaulted to the simple presence/absence of ungulate tracks. The primary metric examined was the proportion of linear features with ungulate tracks.

The original survey plan was also to count tracks in undisturbed areas between linear features. However, tracks were so numerous that surveying the entire area between linear features would have required substantially reducing the aircraft speed. This would have reduced the number of transects that could have been surveyed. As a compromise, field crews subsampled the area between lines by surveying an approximate 200 m band of an undisturbed area adjacent to each linear feature.

In conjunction with winter fish habitat assessments, the transects were surveyed over six days (March 7–13, 2020). Each day, one or two transects were surveyed while transiting to/from the study area. No track-erasing snowfalls occurred during the survey period. Snow depths ranged from 65 to 80 cm.

3.5 DATA PREPARATION AND ANALYSIS

3.5.1 SPATIAL DATA

The project generated two primary spatial datasets — a point database corresponding to all field survey sites and the linear feature database. The Linear Feature Survey Point Database (ArcGIS point feature class) contains all location-specific (point coordinate) field data collected at sample sites in summer 2019. Several fields were added to this database based on calculations and spatial joins (e.g., year of linear feature establishment and most recent fire). Paired on-line and off-line plot data were recorded as part of the same sample site coordinate.

The Linear Feature Inventory (ArcGIS polyline feature class) is a compilation of all documented linear features within the RSA, verified by comparing the preliminary linear feature inventory to aerial and satellite imagery and ground-truthing results.

Several modifications were made to improve the accuracy and detail of the Linear Feature Inventory:

- Linear features were classified into the following categories:
  - 2D (historical seismic lines, typically >3m wide),
  - 3D5 (including 4–5 m wide 3D lines that were used for both seismic and local vehicle/equipment travel);
  - 3Dc (3 m wide 3D seismic conductor lines);
  - 3Dr (2 m wide 3D seismic receiver lines);
  - winter roads (any trails or limited use roads used by vehicle or equipment, generally wider than 5 m and often with an obviously curving path); and,
  - Dempster Highway.
- Overlapping features (within a 3 m tolerance) were addressed according to the following rules:

- If two linear features of the same or unknown age overlapped, the wider feature was saved and the narrower feature deleted.
- If two linear features of the same or unknown width overlapped, the more recent feature was saved and the older feature deleted.
- If a 3D line overlapped with a 2D line, both lines were saved. This is because the older 2D lines were often still evident on the landscape in some state of regeneration, as were the 3D lines. However, both were saved since it was unknown at what state each line was in (i.e., if the 2D line was still evident, or only the 3D line, or both in varying states of regeneration). This occurred for 33 km of linear features within the RSA.

The preliminary linear feature inventory within the RSA was compared against a recent high-resolution satellite or aerial imagery (generally, 0.5–1 m resolution) at a 1:10,000 (or finer) scale to verify the accuracy of the source data. Any features that were visibly offset from georeferenced imagery were corrected to match the imagery.

Some older (1960s and 1970s) 2D seismic lines included in the source databases did not appear in satellite imagery. These 2D lines were compared against the imagery along the length of the feature to search for any sign of linear disturbance and then cross-referenced with field surveys conducted along the line, if present. These unverified linear features were classified as 'not applicable' and excluded from analysis if there was no evidence of linear disturbance along the feature's length in the imagery, which could often be verified with associated surveys noting that the feature was 'not present,' 'not visible,' or 'completely regenerated.' Unverified linear features were retained if there was evidence of linear disturbance along any feature's length in the imagery or if associated surveys had noted that the feature was present and in some state of regeneration, even if the feature was not visible in the imagery. A total of 199,473 m of erroneous or regenerated linear features were deleted from the linear feature inventory within the RSA.

Some linear features were visible on the imagery that had not been included in any of the source databases. In these cases, the linear features were manually digitized and classified into linear feature types based on visual assessment and attributes of adjacent connecting features, if present. Digitized linear features were assigned a year if they were obviously a continuation of a documented feature or if they were surrounded by features of the same type and year. Otherwise, the year was not included. High-resolution imagery was not available for the southernmost portion of the RSA (approximately 25 km by 15 km). This area was compared against lower quality Google Earth imagery, but this was not detailed enough to detect undocumented linear features if any existed (Google Earth 2019). However, existing linear features were verified using this method. A total of 202,945 m of linear features were digitized within the RSA.

After the Linear Feature Inventory was verified and corrected to be consistent with imagery and field observations, it was spatially joined to the Linear Feature Survey Point Database. In cases where the survey point did not correspond with any nearby linear feature, or if a linear feature was deleted (following the methods described above), the data were retained in the survey point database, but the linear feature type was updated to 'not applicable' and excluded from data analysis. Ten survey plots were identified as 'not applicable' and excluded from analyses; thus, the corrected sample size for survey plots is n = 210.

3.5.2 FIELD DATA

After completing field sampling, data forms and field notes were reviewed for completeness and accuracy during an internal data quality-assurance process. All associated digital photographs and GPS coordinates were reviewed to correspond to the appropriate field plots. A summary of field plots by linear feature type and survey type is provided in Table 3-4. All recorded data were entered into MS Excel databases (Microsoft 2019). Spatial data were uploaded to the ArcGIS platform (ESRI 2019).

Field-collected data were summarized primarily using Excel spreadsheets (Microsoft 2019). More detailed statistical analyses were performed on select data using R Statistical Software (R Development Core Team 2020). For example, the variation in ease of travel and vegetation cover as a function of linear feature types, burn history, successional stage, or ecosite were explored. During formal analyses, standard assumptions of normality and homogeneity of variance were assessed, and variance-covariance structures were applied to model heterogeneity (of residuals) if required. For instance, the sightline distance (m) was fourth-root transformed to meet normality. In certain models, random effects were included to account for variance among different subjects. For example, observers were included as a random variable to account for observer bias (i.e., a random intercept model; package "nlme", Pinheiro et al. 2016). Corrected Akaike's Information Criteria (AICc) scores were used to compare sets of candidate models. Models with the lowest AICc score were selected because they yielded the best balance (parsimony) between explained variance and level of complexity.

Table 3-4. The number of sites surveyed using ground surveys, air surveys, and air calls for each linear feature type in the Eagle Plains RSA.

Linear Feature Type	Survey Type			
	Ground Survey	Air Survey	Air Call	Total
2D	31	32	44	107
3D-5m wide	5	0	0	5
3D-Conductor	26	3	0	29
3D-Receiver	23	1	0	24
Winter Road	18	17	8	43
Dempster Highway	2	0	0	2
Not Applicable	3	2	5	10
Total	108	55	57	220

3.5.3 LINEAR FEATURE DENSITY CALCULATION

Linear feature densities were calculated in two ways: (1) using the total linear feature extents, and (2) adjusting the extents to account for (a) lines through 'open' habitats, such as wetlands and recent burns, where the vegetation on the line did not differ from vegetation off the line, and (b) functionally recovered linear features such as 2D lines from the 1960s and 1970s that had advanced regenerated at least to the Tall Shrub structural stage. Adjustments were determined by intersecting the Linear Feature Inventory with a recently developed

Ecological Landscape Classification (ELC) map of the RSA (a companion Eagle Plains Project baseline report). The ELC map documented the type and structural stage of vegetation communities across the RSA. The extent of linear features in open habitats was determined by the lengths of linear features overlapping Low Shrub, Herb and Bryoid structural stages in the ELC maps. This includes seral habitats regenerating from burns and ecosystems that are maintained in those stages over time, such as wetlands and shrub-carrs. The extent of regenerated linear features was determined by integrating the proportion of regenerated lines observed from the field surveys (e.g., 61% for 2D lines) with the length of lines through non-open vegetation types in the ELC map. Adjustments were applied to generate functional linear feature densities for each linear feature type individually (i.e., to compare the relative extents of different feature types) and combined to provide an overall density for all linear feature types. For example, the linear feature density for 2D lines was calculated by starting with the total length of 2D lines in the RSA, reducing that by the length of lines through open vegetation types, then reducing the remaining extent by the average proportion of 2D lines that were observed to be regenerated, and then dividing the remaining total length of lines by the extent of the RSA.

4 RESULTS

4.1 LINEAR FEATURE INVENTORY AND DENSITIES

A total of 4,269 km of linear features were mapped and verified in the RSA (Map 4-1, Table 4-1). Winter roads and 2D seismic occur in varying densities across much of the RSA. The extent of 3D seismic is limited to the one area straddling the Dempster Highway in the centre of the RSA.

The total linear feature density in the RSA was 1.79 km/km², based on a total length of 4,269 km and the RSA area of 2,386 km². 3D seismic lines accounted for approximately half of the total length of linear features in the RSA, 2D seismic lines accounted for about one-third, followed by winter roads and the Dempster Highway (Table 4-1). Adjusting for open habitats (i.e., areas in structural stages Low Shrub, Herb, and Bryoid) and vegetation regeneration[1] resulted in substantially lower densities of 0.52 km/km² (Table 4-2). Relatively large extents of recent wildfires were the greatest factor reducing linear feature densities. The relative proportions of the different linear feature types were similar after adjustments, though the proportion of 3D increased and 2D decreased. This was mainly due to the greater degree of vegetation regeneration on 2D lines, consistent with their age since disturbance.

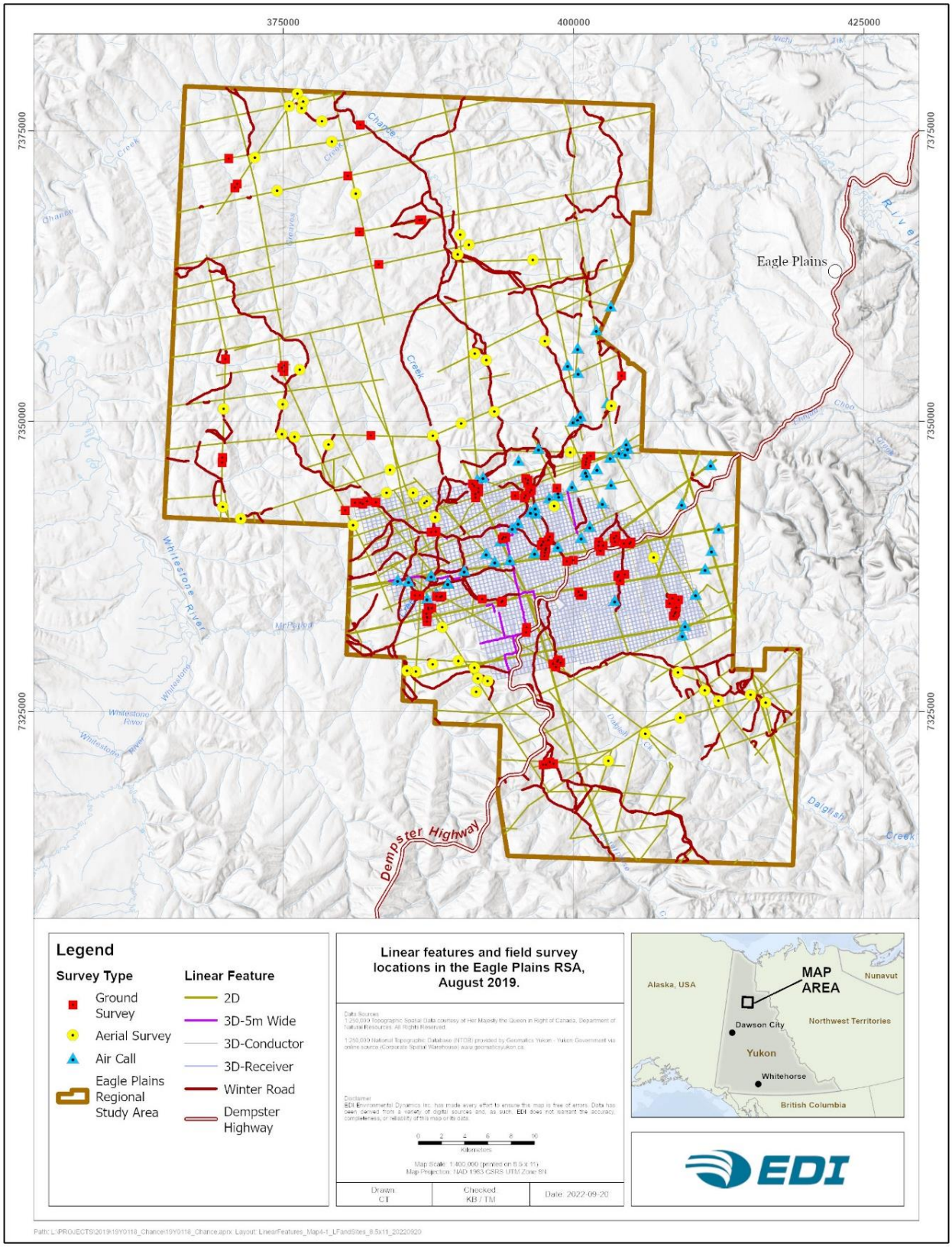
Table 4-1. Summary of total length and density of linear features documented in the Eagle Plains RSA.

Linear Feature Type	Total Length (km)	The Proportion of Total Length	Linear Feature Density (km/km²)
2D	1,452	34%	0.608
3D (combined)	2,165	51%	0.907
3D-5m wide	48	1%	0.020
3D-Conductor	1,189	28%	0.498
3D-Receiver	928	22%	0.389
Winter Road	596	14%	0.250
Dempster Highway	47	1%	0.020
Unknown	8	<1%	0.003
Total	**4,269**	**100%**	**1.788**

[1] See Section 5.5 Functional Recovery of Linear Features for details about vegetation regeneration criteria.

Table 4-2. Summary of total effective length and density of linear features in the Eagle Plains RSA adjusted for open habitat and vegetation regeneration.

Linear Feature Type	Total Length (km)	Proportion of Total Length	Linear Feature Density (km/km²)
2D	289	23%	0.121
3D (combined)	750	60%	0.314
3D-5m wide	21	<1%	0.009
3D-Conductor	401	32%	0.168
3D-Receiver	328	26%	0.138
Winter Road	171	14%	0.072
Dempster Highway	26	<1%	0.011
Unknown	8	<1%	0.003
Total	1,243	100%	0.521



Map 4-1. Linear features and field survey locations in the Eagle Plains RSA, August 2019.

4.2 LINEAR FEATURE CHARACTERISTICS

4.2.1 LINE WIDTHS

Line width varied by linear feature type. Mean line widths ranged from 1.96 m for the narrowest line type (3D receiver lines) to 33.75 m for the Dempster Highway (Table 4-3). Standard error around mean estimates were smallest for 3D seismic lines, which were cleared in the same season using the same equipment and methods, and greatest (by a large margin) for winter roads. The average difference in widths between 3D conductor (wider) and 3D receiver lines was 1.2 m.

Table 4-3. Widths of different linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Minimum mean width (m)	Maximum mean width (m)	Overall mean width (m)	Standard Error (m)
2D	107	3.97	8.5	5.42	0.11
3D-5m wide	5	5.30	6.40	5.68	0.22
3D-Conductor	29	2.50	4.80	3.17	0.13
3D-Receiver	24	1.63	2.53	1.96	0.04
Winter Road	43	2.53	17.97	7.42	0.66
Dempster Highway	2	33.00	34.50	33.75	0.75

4.2.2 MULCH COVER

Mulching of woody vegetation is common during seismic line clearing activities and was used in the 2013/14 3D program. In areas with thick tree or shrub cover, mulching can create a thick blanket of wood chips that inhibits vegetation regeneration (Golder Associates 2016). There was no evidence that this was an issue with any of the seismic lines within the RSA. On average, the percent cover of mulch was <1% on all line types.

4.2.3 HUMAN USE

No sign of human use was detected along linear features during the summer ground surveys (e.g., OHV tracks, ruts, water crossings, vegetation trampling/scarring, tree blazes, trap sets, garbage, and campsites), except for the two sites on the Dempster Highway.

On average, 42% of on-line sites were deemed passable to an OHV (a 4x4 side-by-side) during summer, considering obstructing vegetation, ground conditions (e.g., wetlands or peatlands), and the presence of graminoid tussocks (Table 4-4).

Table 4-4. Proportion of survey sites deemed passable to OHV in summer across different linear feature types in the Eagle Plains RSA.

Linear Feature Type	No. Survey Sites	% Passable
2D	55	9%
3D-5m wide	5	80%
3D-Conductor	29	59%
3D-Receiver	24	75%
Winter Road	29	55%
Dempster Highway	2	100%
Total	144	42%

4.2.4 SUCCESSIONAL CLASSES

Linear features surveys in the Eagle Plains RSA observed five of the six of the successional classes documented by Simpson (2008): normal succession, magnified succession, stagnated succession, no succession, and recent disturbance (Figure 4-1) (Attachment A). No retrogressive succession sites were observed at official survey sites. However, a small number of retrogressive sites were incidentally observed on winter roads while travelling through the RSA.

Most sites surveyed (79%) were undergoing normal succession. The next most common successional class was magnified succession, occurring in 11% of sites, followed by stagnated succession, occurring in 5% of sites. All 3D seismic lines surveyed followed a normal successional trajectory, except for one site that was classed as recently disturbed. Magnified succession was most common in 2D seismic lines (21%), while stagnated succession was most common in winter roads (19%). Successional classes were defined as 'not present' if the linear feature was not present in the field or had regenerated to a stage that was not discernable from the adjacent areas. The Dempster Highway was classified as recently disturbed due to the regular maintenance of the road.

Fire history appeared to influence some successional classes. Magnified succession was more common at burnt sites (19 burnt versus 5 unburnt). In contrast, stagnated succession was more common at unburnt sites (3 burnt versus 7 unburnt). Sites on a normal successional trajectory did not appear to have any relationship to burnt status. The remaining successional classes were too uncommon to draw any conclusions.

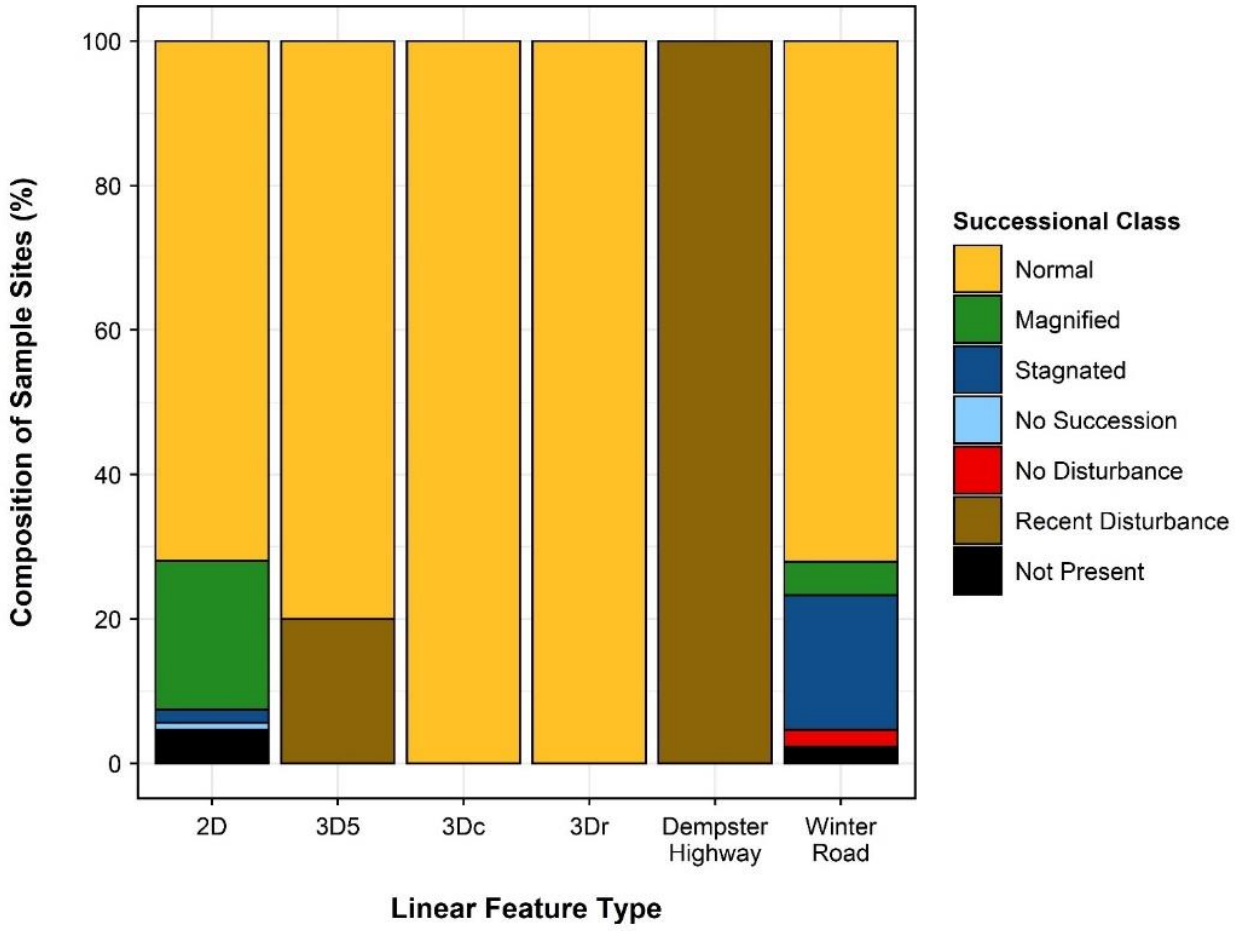


Figure 4-1. Summary of successional classes observed across different linear feature types in the Eagle Plains RSA.

4.2.5 STRUCTURAL STAGE

Most linear features were in a Low Shrub (56.1%) or Tall Shrub (29.0%) structural stage. However, the distribution of structural stages varied substantially across linear feature types (Table 4-5). Although herbaceous and forested stages occurred at some on-line plots, they were not common (less than 5%each). Nearly all forested structural stages were observed on 2D seismic lines and winter roads, reflecting the long time since they were created. Tall Shrub stages were almost twice as frequent in 2D seismic lines than any other linear feature type. Conversely, 83% of 3D linear features were in the Low Shrub structural stage, with most of the remaining in the Tall Shrub stage. The differences in structural stages between 2D and 3D lines appear to be primarily due to the time since disturbance. Winter roads were less consistent in their structural stages; herbaceous, shrubland and forested stages were all observed with moderate frequency. The two Dempster Highway plots were the only non-vegetated stages recorded.

Off-line plots were also mostly in Low Shrub and Tall Shrub stage, but they also included a higher proportion of Young Forest and Mature Forest compared to on-line plots (Table 4-5; Photos A-15 to A-20 in

Attachment A). For off-line plots, the Low Shrub sites were mostly burned areas, and the Tall Shrub sites were mostly stunted, open-canopy, black spruce forest 2–8 m tall.

Fire had a strong effect when comparing structural stages between paired on-line and off-line plots (Figure 4-2). The top two charts in Figure 4-2 show that the pattern of structural stages for burnt areas was very similar between on-line and offline plots. The bottom two charts show that the pattern of structural stages differs substantially between on-line and offline plots in unburnt areas. In unburnt areas, off-line plots had much lower numbers of sites in Low Shrub and much higher numbers of sites in Young Forest and Mature Forest than on-line plots. For burnt areas, the on-line and off-line plots at the same site were the same structural stage in 72% of cases, and within one structural stage of each other 91% of the time (e.g., Tall Shrub vs Pole Sapling). For areas that were not burnt, the on-line and off-line plots at the same site were the same structural stage in only 29% of cases. These results demonstrate that in the absence of fire, pronounced differences between linear disturbances and the surrounding community are evident in both recent (3D) and legacy (2D and winter road) linear feature types. But following a fire, the vegetation structure on-line and off-line are likely to be similar (Photos A-22 to A-24 in Attachment A).

Table 4-5. Vegetation structural stages observed on different linear feature types as a proportion of all plots sampled (n = 156) in the Eagle Plains RSA.

Linear Feature Type	No. Sites	Structural Stage[1]								
		Non-vegetated	Bryoid	Herb	Low Shrub	Tall Shrub	Pole-Sapling	Young forest	Mature forest	Old Forest
2D	62	0%	0%	2%	37%	47%	2%	8%	3%	2%
3D-5m wide	5	0%	0%	20%	80%	0%	0%	0%	0%	0%
3D-Conductor	29	0%	0%	0%	83%	14%	0%	3%	0%	0%
3D-Reciever	24	0%	4%	0%	83%	13%	0%	0%	0%	0%
Dempster Highway	2	100%	0%	0%	0%	0%	0%	0%	0%	0%
Winter Road	33	0%	0%	12%	48%	27%	3%	3%	6%	0%
Off-line	155	0%	1%	1%	33%	29%	1%	18%	17%	1%

[1] See Table 3-3 for structural stage codes and descriptions.

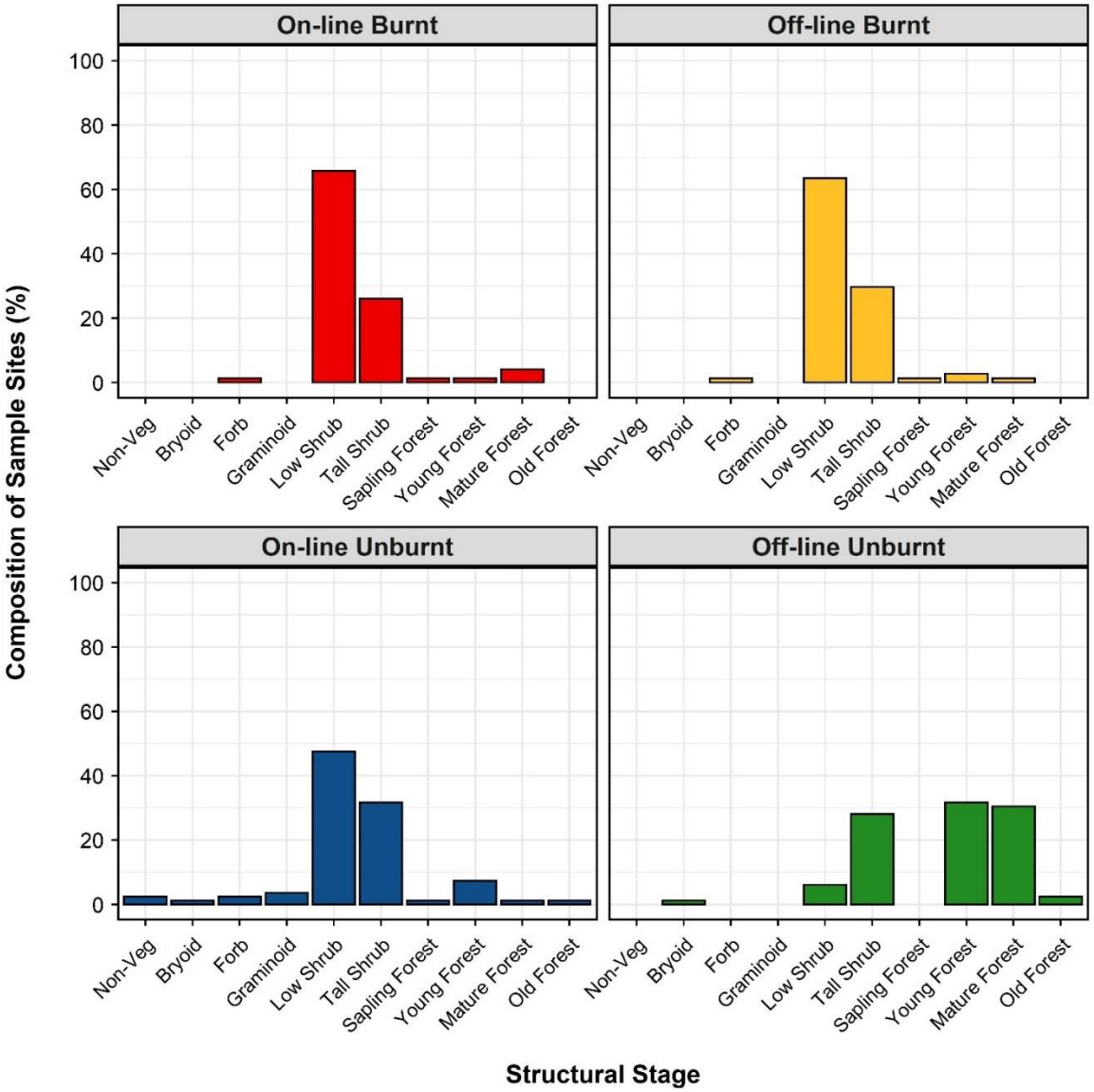


Figure 4-2. Comparison of structural stages on linear features to off-line plots in burnt and unburnt areas, in the Eagle Plains RSA.

4.2.6 VEGETATION HEIGHT

Based on the similarity of patterns in vegetation composition and structure, linear feature types were combined into two groups for assessment of patterns in height: (i) 2D and winter roads and (ii) 3D. A wide range of vegetation heights was recorded at both on-line and off-line plots in the RSA, from 0.3 m to 16 m. Collectively, off-line plots had a normal distribution of vegetation heights between 0 m and 4 m, and then a scattered distribution across heights up to 16 m (Figure 4-3). Plots with ≥4 m tall vegetation accounted for approximately 40% of all off-line reference plots.

In comparison, recovering 2D seismic lines and winter roads shared a relatively uniform distribution between 0 m and 4 m but with a peak occurring at vegetation heights measuring 1.5–2 m tall (Figure 4-4). Only 21% of 2D and winter roads contained dominant vegetation ≥4 m, and only 5% were ≥8 m tall. 3D seismic lines were rarely composed of vegetation ≥2 m, and most of the vegetation (67%) recovering on 3D lines was less than 1 m (Figure 4-5). This is very different from the off-line undisturbed height distribution. However, 3D lines were all only five years old at sampling, and shorter vegetation was expected.

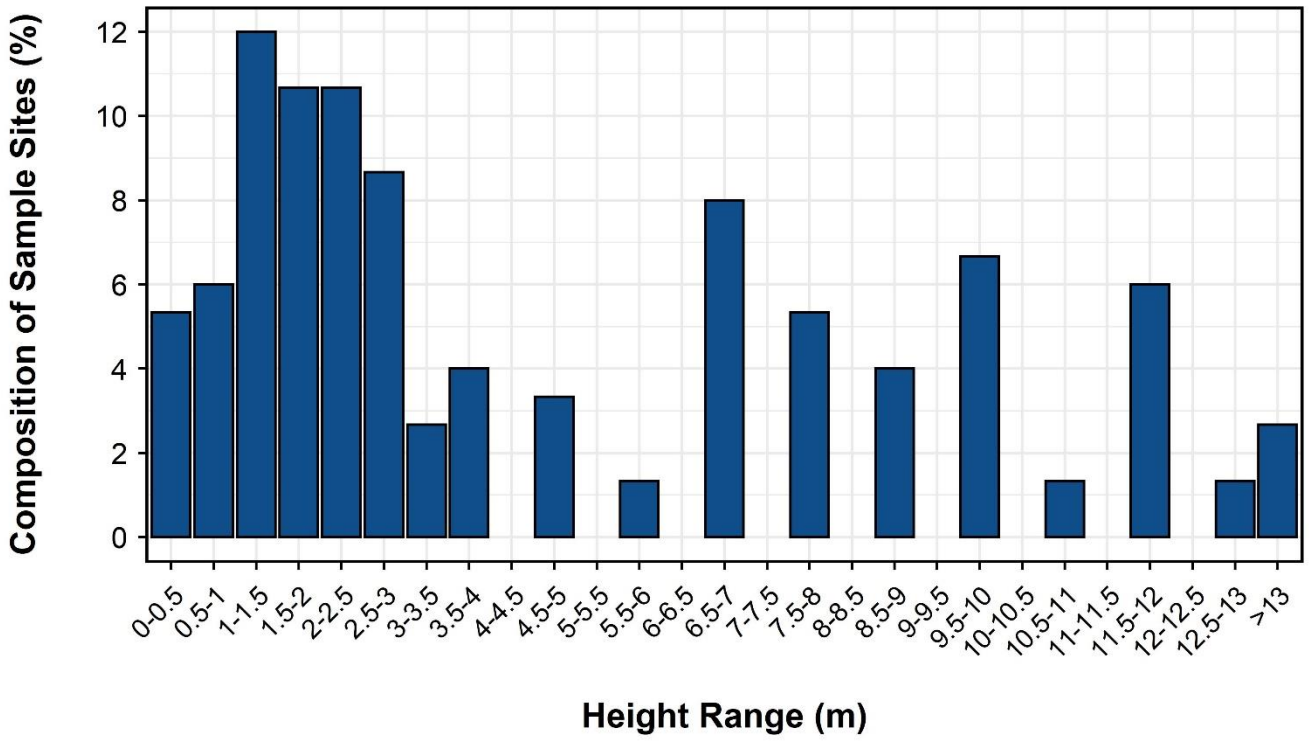


Figure 4-3. Vegetation height distribution of off-line reference plots in the Eagle Plains RSA.

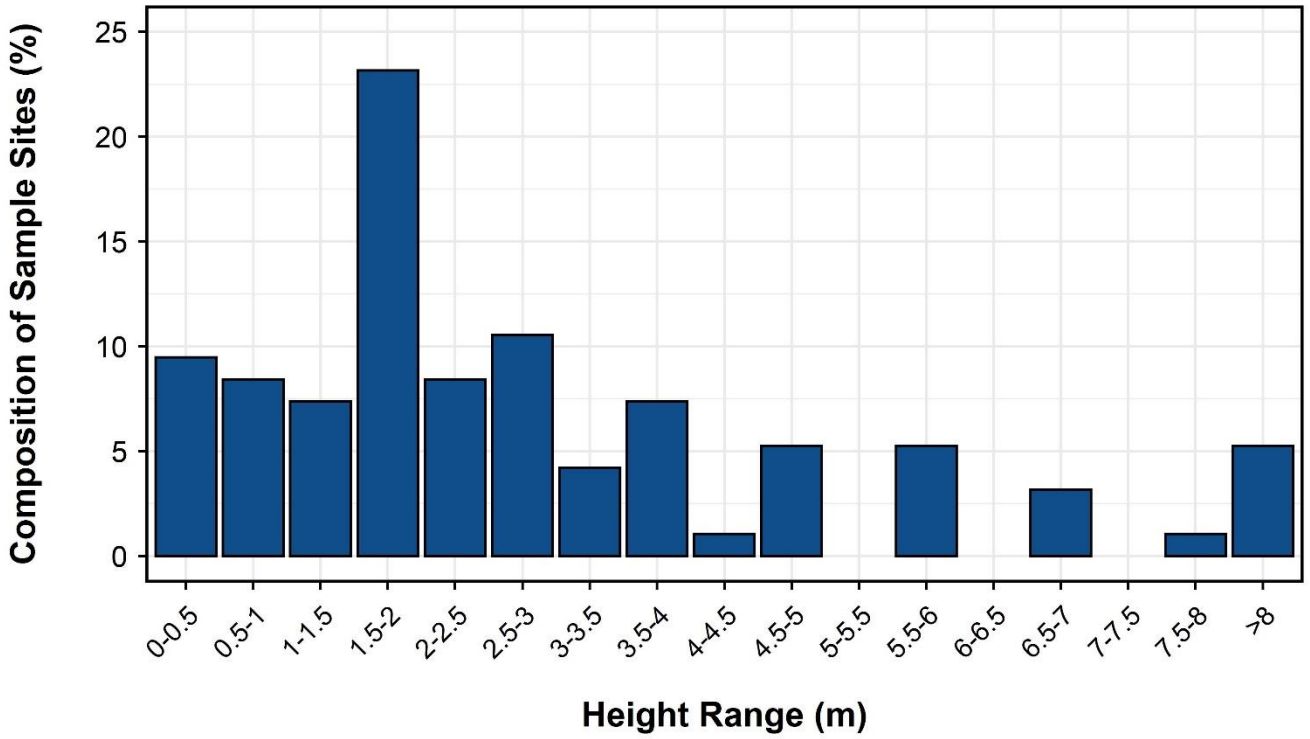


Figure 4-4. Vegetation height distribution of on-line 2D and winter road plots in the Eagle Plains RSA.

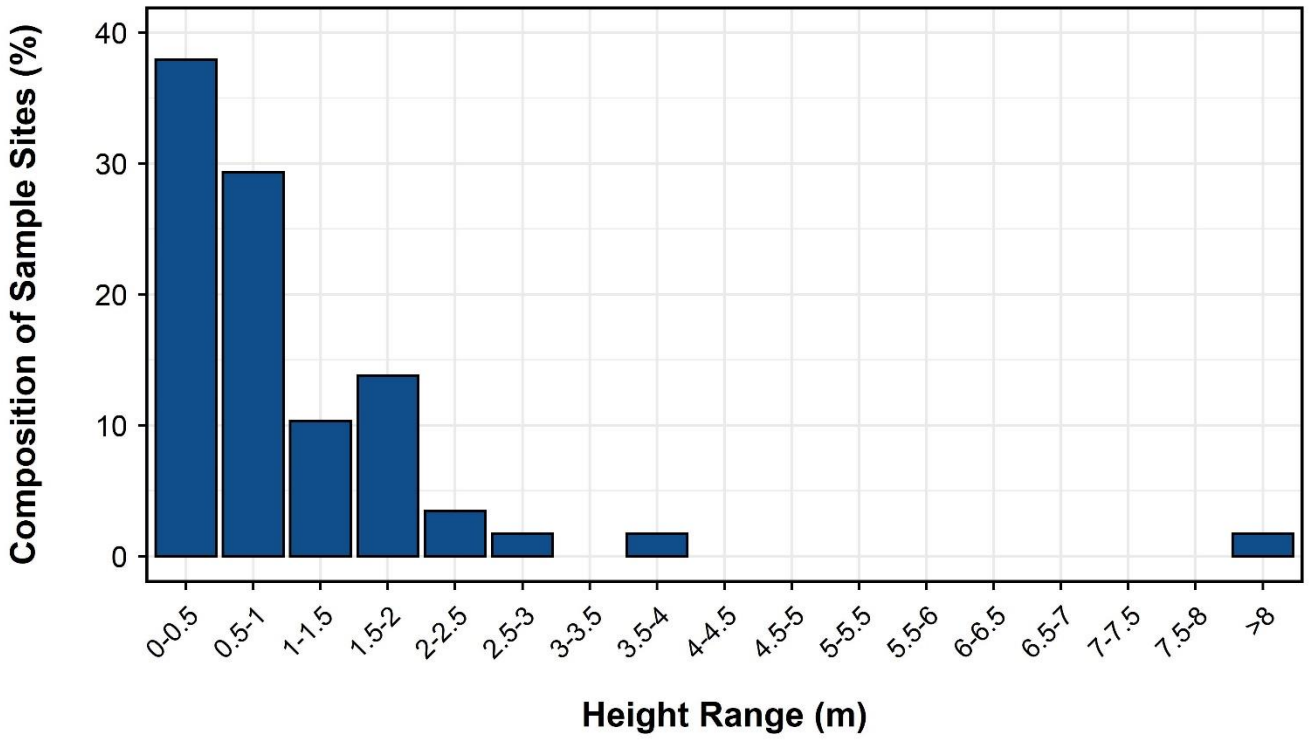


Figure 4-5. Vegetation height distribution of on-line 3D plots in the Eagle Plains RSA.

4.2.7 VEGETATION COVER

Tree and shrub cover varied between linear feature types and burn status (Table 4-6). Generally, tree cover was low on undisturbed reference plots (mean tree cover of 8% on unburnt and 2% on burnt sites). This is typical of the taiga cordillera landscape — forests are generally stunted and sparse due to poor nutrient regime and continuous permafrost conditions (Smith et al. 2004). Of the on-line plots, tree cover was greatest on 2D seismic lines and burnt winter roads (5% to 8%) and lowest on 3D seismic lines and the Dempster Highway (0%), regardless of burn status. This is likely due to the recently disturbed 3D seismic lines that are too young for trees to have re-established. Burnt 2D seismic lines and winter roads had greater tree cover than unburnt lines.

Shrub cover was much greater than tree cover overall. Shrub cover was typically 30–40% on unburnt off-line plots and 40–50% on burnt off-line plots. Shrub cover was highest on 2D seismic lines (~54%), regardless of burn status. Shrub cover was moderate on winter roads (38–45%) and lowest on unburnt 3D seismic lines (8–22%). Burnt 3D seismic lines had approximately twice as much shrub cover as unburnt 3D lines.

Table 4-6. Summary of the mean tree and shrub cover (%) between on-line and off-line, and burnt and unburnt plots surveyed in the Eagle Plains RSA.

Linear Feature Type	Burn Status	Mean Tree Cover (%)		Mean Shrub Cover (%)	
		On-line	Off-line	On-line	Off-line
2D	Burnt	7.0	3.5	54.0	36.0
	Unburnt	5.5	13.4	53.2	32.8
3D5	Burnt	0.0	0.3	41.7	60.0
	Unburnt	0.0	0.5	7.5	42.5
3Dc	Burnt	0.0	0.2	40.4	46.1
	Unburnt	0.4	6.0	21.5	34.3
3Dr	Burnt	0.0	0.7	35.0	51.9
	Unburnt	0.0	5.5	20.6	32.5
Winter Road	Burnt	7.7	1.0	45.0	43.8
	Unburnt	1.3	4.0	37.5	32.3
Dempster Highway	Unburnt	0.0	1.0	0.0	37.5

4.2.8 LINE-OF-SIGHT AND EASE OF TRAVEL

Line-of-sight (sightline) distance was examined primarily as a function of line type; however, vegetation height (the primary factor affecting sightlines) was also examined for on-line and off-line plots for each linear feature type using multiple linear regression. Mean sightlines varied significantly by linear feature type (Table 4-7, $F_{4,187} = 3.3$, $P = 0.01$). For reference, the average sightline distance for offline controls was 46.7 m. This relatively far distance reflects the open stand structure on most sites in the region. Burn status had little influence on sightlines (e.g., burnt off-line=50.2 m, unburnt offline=43.6 m). 2D lines had the shortest average sightline distances at 41.2 m. This was mainly due to the advanced stage of regenerating vegetation on the lines. Where regenerating vegetation was limited, sightline distances on 2D lines frequently exceeded 150 m.

On 3D lines, the time since clearing was too recent for regenerating vegetation to obscure sightlines. Instead, sightline distances on 3D lines were generally controlled by bends in the lines, which were specifically designed as mitigation measures to reduce sightlines. For 3D lines, sightline distances decreased from 3D5 to 3Dc to 3Dr lines. The reduction in sightline distances resulted from differences in line width and the average distance between bends across the feature types.

The regression analysis also found a significant interaction between on-line versus off-line occurrence and vegetation height ($F_{1,187}$ = 13.0, P = 0.0004), whereby on-line plots had, on average, more negative slopes than off-line plots. In other words, sightlines at on-line plots decreased more drastically than off-line plots with each incremental increase in vegetation height. This is consistent with the qualitative observations of field crews that the regenerating vegetation on lines was thicker than the vegetation off lines.

Similar to sightline distances, determining differences in ease of travel among line type the primary factor of interest for the walking speed tests. However, burn status, and the percent cover of trees and shrubs were expected to be the most important explanatory variables related to walk speeds, so they were included as secondary variables using a mixed-effects linear regression. Walking speeds across linear feature types and the differences between on- and off-line plots within linear feature types varied significantly (Table 4-8, $F_{5,170}$ = 3.4, P = 0.006). However, the magnitude of the difference between on-line and off-line plots was modest. Even the Dempster Highway only conveyed a 35% increase in walking speed over off-line plots. Other researchers, in other areas, often observed walk speeds on linear features were often at least twice as fast as off-line transects (Keim et al. 2019a).

Notwithstanding the modest magnitude of faster walking speeds on-lines, there were clear patterns in walking speed differences across linear feature types. 2D lines were the one feature type where walking speeds were slower on lines than off lines. This reflected the thick, shrub stage vegetation that had regenerated on most 2D lines, which impeded travel (similar to the effect that regenerating vegetation had on sightline distances in the previous section). Walk speeds decreased across the other feature types in relation to line width and the degree to which ground cover was levelled or compacted.

Statistical analyses indicated that both burn status ($F_{1,170}$ = 17.85, P < 0.0001) and percent cover of shrubs and trees (hereafter woody vegetation; $F_{5,170}$ = 5.29, P = 0.0002) affected walking speeds, both on and off lines. On average, walk speeds in burns were approximately 10% slower than in unburnt areas. This is partly related to thicker woody cover in most burns, which hinders walking speed because of the time it takes to push through or walk around it. Walking speeds significantly decreased, on average, by 0.04 (CI = 0.02–0.06) km/h and with every 10% increase in the percent of woody cover off-line and 0. 11 (0.07–0. 15) km/h on 2D lines.

Table 4-7. Average sightline distances along different linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Average Sightline Distance (m)	Comments
2D	30	41.2	Sightlines are frequently reduced by regenerating vegetation >1.5m tall
3D-5m	5	105.6	Has fewer bends than 3Dc and 3Dr
3D-Conductor	26	75.9	Sightlines limited by bends in lines; too recent for regenerating vegetation to impede sightlines
3D-Receiver	23	60.2	Sightlines limited by bends in lines; too recent for regenerating vegetation to impede sightlines
Dempster Highway	2	814.8	
Winter Road	17	106.2	
Off-Line Controls	103	46.7	

Table 4-8. Differences in walking speeds among linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Average Walk Speeds (km/h)		Difference (%)
		On-line	Off-line	
2D	28	2.5	2.8	-10%
3D5	5	3.8	3.0	30%
3Dc	23	3.5	3.1	13%
3Dr	23	3.2	2.9	10%
Dempster Highway	2	5.6	4.1	35%
Winter Road	16	3.6	3.1	17%
Off-Line Controls	97	n/a	2.9	

4.3 VISIBILITY OF LINEAR FEATURES FROM THE DEMPSTER HIGHWAY

Overall, the blind search identified 11 of 100 possible linear feature intersections with the Dempster Highway (Table 4-9). Five of the features were roads that were classified as winter roads in the GIS inventory, but most (four) were actually short, all-season roads leading to gravel pits or well sites. Two of the observed features were human truck/OHV trails that led to camp sites 100–200 m off the Dempster Highway, and four were 3D seismic lines. The map search detected two more 3D lines, one 2D line, and one old winter road. The 2D line and the old winter road had regenerated into Young Forest structural stages. Excluding the four short secondary roads into gravel pits and well sites, and the two human trails, only 8% of linear features that intersected the Dempster Highway were visible during the two driving surveys.

Only 6 of the 74 3D lines that crossed the Dempster were detected. The combination of construction design (i.e., creating a bend in the 3D line adjacent to the highway) and regenerating vegetation in the right-of-way made it difficult to detect the 3D lines. Evidence of human use (e.g., packed vegetation, tire tracks, rutting, garbage, campfire remnants, tree stumps, or tree blazes) was observed on four of the short, all-season roads

and the two trails. No evidence of human use was noted on any of the 2D or 3D seismic lines, or the three winter roads (including the Chance and Blackie winter roads). However, some types of human use do not leave sign during the snow-free season (e.g., snowmobile use in the winter).

Table 4-9. Summary of linear features identified and intersecting the Dempster Highway during a blind search test.

Linear Feature Type	No. Features Intersecting the Dempster	No. (%) Observed Blind Search	No. (%) Observed Map Search	Total No. (%) Observed	OHV Accessible	Sign of Human Use
2D	18	0 (0%)	1 (6%)	1 (6%)	0	0
3D	74	4 (5%)	2 (5%)	6 (8%)	4	0
Secondary Roads	8	5 (63%)	1 (13%)	6 (75%)	5	4
Trail	n/a	2 (n/a)		2	2	2
Total	100	11 (11%)	4 (4%)	15 (15%)	11	6

4.4 WINTER TRACKS

In total, 462 linear features were surveyed for winter tracks over 358 km along the 11 transects. No human sign was observed on any linear features, except the Dempster Highway. Ungulate tracks were frequently observed travelling along linear features. The proportion of linear features with tracks decreased with decreasing linear feature widths, from 29% on winter roads, 24% on 2D lines, 8% on 3D conductor lines, and 6% on 3D receiver lines (Figure 4-6).

The frequency of use in adjacent undisturbed areas, corrected to account for different survey extents between the linear features and the undisturbed areas, was 1%. As discussed in the methods, it was difficult to compare the frequency of use along linear features to use in undisturbed areas. The issue is that for the comparison to be relevant, the survey design needs to account for the size of the sample units (i.e., the extent of the undisturbed area needs to be comparable to the width of the linear features), and the two samples should be independent. These conditions were not achieved under the current survey design (i.e., the extent of the survey area in the undisturbed area was much larger than the width of the linear feature, and the location of the undisturbed area was spatially correlated to the linear feature). The estimated relative use rate of 1% in undisturbed areas adjusts the total counts within the 200 m survey area to 5 m (i.e., the average linear feature width); however, the adjustment fails to account for spatial correlation between the two samples. Therefore, the estimate of use in undisturbed areas could be biased. Notwithstanding this limitation in the estimate of travel rates in undisturbed areas, it is supported by qualitative observations of the survey crew that travel rates on even the least used linear features (i.e., 3D lines) are higher than undisturbed areas.

The relative use of linear features by ungulates also appeared to vary with distance from the Dempster Highway, with features within 1 km of the highway receiving lower use than features equal to or greater than 5 km from the highway (Figure 4-7). It is worth noting that the Highway and 1 km transects were completed on the first and second day of surveys, respectively, and the other transects were surveyed one to six days later, providing more time for tracks to accumulate. Snowfall data prior to the crew's arrival on site was not

available; however, road crews at Eagle Plains reported that there had not been a major snowfall in the area for at least a week. Based on this information, the issue of time since last snow has less potential to bias results than if a track-erasing snow event had recently occurred.

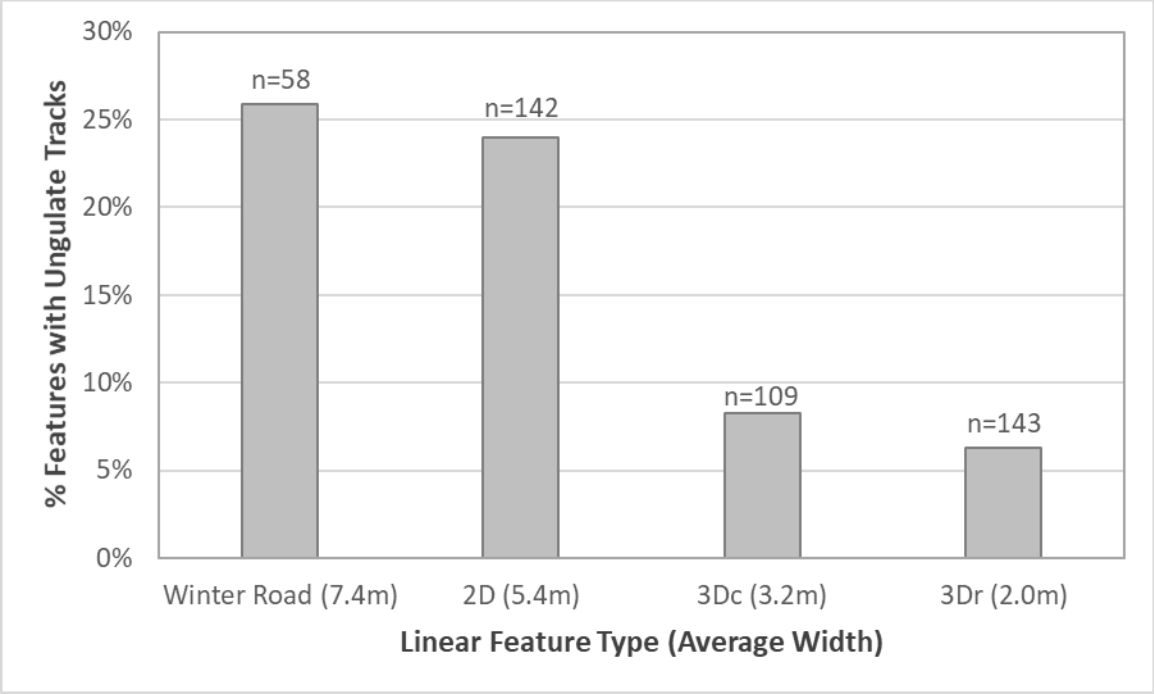


Figure 4-6. Relative use of different linear feature types by ungulates in the Eagle Plains RSA, March 2020.
The numbers above bars indicate the number of features surveyed.

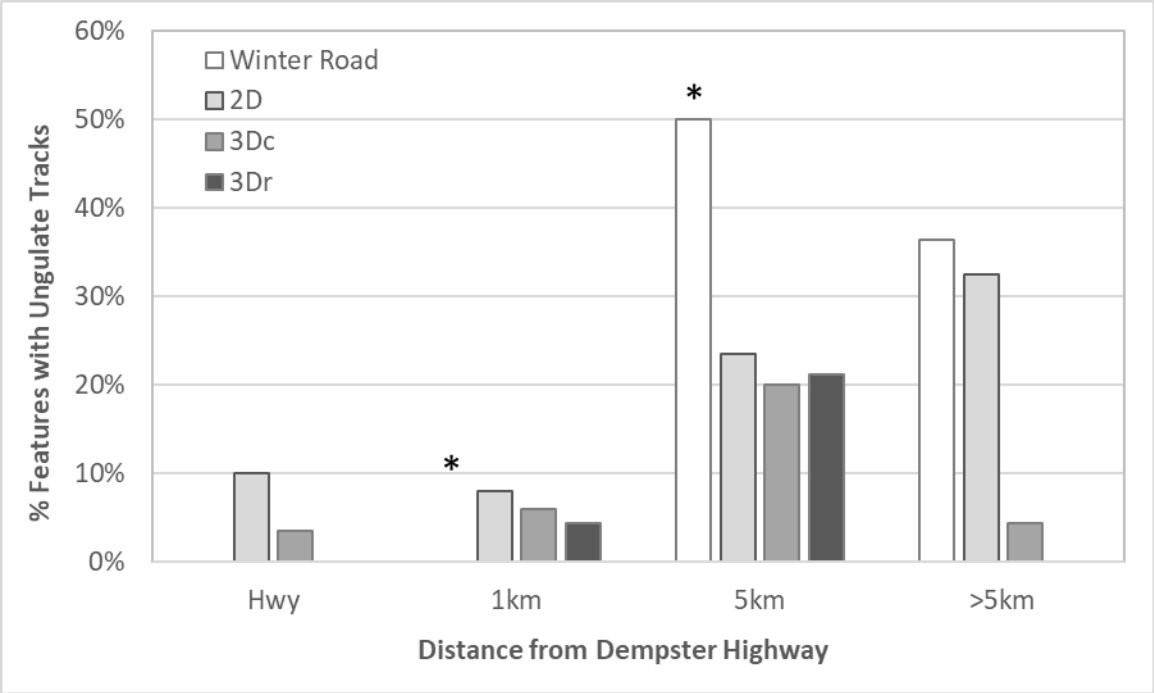


Figure 4-7. Relative use of different linear feature types by ungulates in relation to distance from the Dempster Highway in the Eagle Plains RSA, March 2020.

*The * indicates bars with small samples sizes (n=5-10); all other instances have at least 10 data points per feature type within each distance class*

5 DISCUSSION

5.1 SUMMARY OF LINEAR FEATURES IN THE EAGLE PLAINS RSA

Table 5-1 summarizes key characteristics across linear feature types in the Eagle Plains RSA.

Table 5-1. Summary of structural, ecological and functional characteristics of linear feature types in the Eagle Plains RSA.

Linear Feature Type	Mean Width (m)	Mean Sightlines (m)	Mean Movement Speed (km/h)	% Regenerated[1]	% Inhibited Regeneration[2]	Linear Feature Density (km/km²)	Adjusted Linear Feature Density (km/km²)[3]	% Ungulate Use[4]
3D seismic	2.6	71.98	3.36	14	0	0.91	0.31	7
2D seismic	5.4	41.17	2.53	61	4	0.61	0.12	24
Winter Roads	7.4	106.18	3.58	39	19	0.25	0.07	26
Dempster Highway	33.8	814.75	5.60	0	100	0.02	0.01	N/S
Off-line Controls	N/A	46.67	2.95	N/A	N/A	N/A	N/A	N/S

[1] as characterized by reaching a tall shrub stage, or greater.
[2] including stagnated and disturbed successional patterns.
[3] accounting for burns, natural openings, and regeneration.
[4] percent of lines with ungulate tracks during March 2020.

2D Seismic — 2D lines are, on average, the oldest features in the area and have had the longest time to regenerate. Most features were cleared before 1985, but some were developed in the early 2000s. Historical 2D lines were generally long and straight, with moderate widths of 4–8 m. Lines were typically constructed with bulldozers that cut into the moss layer and often included some patches of soil disturbance. The combination of site disturbance and wider widths generally resulted in a successional reset to pioneering vegetation (including early seral graminoids, forbs, and shrubs). Most sites were following a normal successional pathway (73%). However, 27% of sites exhibited atypical pathways, dominated by magnified succession (21%, mostly in burns), stagnated succession (3%) or no succession (1%). Sixty-one percent of the 2D sites had regenerated to a Tall Shrub or more advanced structural stage. 2D lines had the shortest sightlines and slowest walk test speeds of all feature types (including off-line controls), reflecting the regenerating vegetation's effect on these functional metrics. During winter, ungulates regularly used 2D lines to travel along.

3D Seismic — All 3D lines were created during the last exploration period, during the winter of 2013/14. 3D lines constitute the most extensive combined lengths of the different linear feature types, but their areal extent is limited to a relatively small portion of the RSA along the Dempster Highway. Due to their basic design, as well as specific mitigations, 3D lines minimize environmental effects compared to other linear feature types. They are narrow (averaging 3.2 m and 2.0 m for conductor and receiver, respectively), often

narrower than average tree spacing in the region. They were constructed during winter, over snow, using low-ground pressure equipment, which avoids ground disturbance and maintains vegetation in the moss, herb and low shrub layers. The lines were constructed with a meandering path, and strategically placed sharp angle dogleg bends to reduce the visibility of the lines from roads, reduce sightlines along them, and hamper travel by OHVs. All 3D lines that were surveyed were undergoing a normal successional pathway and were dominated by the same vegetation as in adjacent undisturbed areas. Regenerating vegetation was mostly in a Low Shrub structural stage, consistent with the relatively short six-year period since they were cleared. Sightlines and movement speeds were intermediate compared to other linear feature types, with sightlines primarily controlled by dogleg bends purposely designed to reduce sightline distances. Ungulates occasionally used 3D lines to travel on in winter, but at less than a third of the rate as 2D lines and winter roads.

Winter Roads — A network of winter roads across much of the RSA results from the historical exploration programs that have occurred. Although many of the winter roads were initially developed during the earliest exploration programs, vegetation has not had the same opportunity to regenerate as on 2D lines because the vegetation was re-cleared on several roads during subsequent exploration programs. The average width of winter roads was 7.4 m, but major roads, like the Chance road, were often 10–12 m wide. Historical winter roads were typically cleared with a bulldozer, and then snow was packed and graded to create a road surface. Similar to historical 2D seismic, the combination of site disturbance and wider widths (i.e., that increases solar exposure) generally resulted in a successional reset to pioneering vegetation (including early seral graminoids, forbs, and shrubs). Most sites were following a normal successional pathway (72%), but 26% of sites exhibited atypical pathways, dominated by stagnated succession (19%), magnified succession (6%) and no succession (1%); 2% of the sites were classified as no disturbance (indistinguishable from vegetation community off the road). Thirty-nine percent of the winter road sites had regenerated to a Tall Shrub or older structural stages. Winter roads had the longest sightlines and fastest walk test speeds of all feature types, other than the Dempster Highway, reflecting the variable levels of regenerating vegetation that occurred on winter roads. During winter, ungulates regularly used 2D lines for travel.

Dempster Highway — The Dempster Highway is the only all-season road in the RSA (except for short spurs off the Dempster to well sites and gravel pits). It is fundamentally different from all other linear features in the area in terms of wide width, surface material and maintenance, long sightlines, regular traffic, and base of access for human land use activities such as hunting, camping, and trapping.

5.2 LINEAR FEATURE CHARACTERISTICS

5.2.1 FIRE

The presence or absence of recent forest fires affected several linear feature characteristics, including linear feature width, successional class, structural stage, and vegetation height and cover. Mean measured linear features widths were 0.2–0.6 m wider at burnt sites than at unburnt sites. This may be due to the already shorter vegetation at burnt sites, which would reduce overgrowth occurring from forest edges and decrease the measured width between driplines (branches extending into the linear feature from either side of the line).

Magnified succession was nearly four times more common in burnt plots than unburnt plots, and stagnated succession was half as common. Fire likely facilitates magnified succession by increasing soil temperatures, accelerating decomposition, and releasing stored water and nutrients to promote vegetation growth (Seccombe-Hett and Walker-Larsen 2004, Simpson 2008). Stagnated succession is likely less common at burnt sites because the associated nutrient and water increase allows woody plant species to colonize more easily and advance through successional stages.

Overall structural stage distribution was very similar between burnt on-line and off-line plots, but was markedly different between unburnt on-line and off-line plots. Furthermore, when the structural stages were compared between paired on-line and off-line plots, they matched two to four times more frequently at burnt sites than at unburnt sites and were mismatched two to six more frequently at unburnt sites than at burnt sites. Nearly all burnt plots were in a low shrub, or tall shrub structural stage, which is expected as fires tend to remove overstory trees, and shrubs generally colonize rapidly post-fire (Seccombe-Hett and Walker-Larsen 2004).

Vegetation height was 4.4 m shorter in burnt than unburnt reference plots, and tree cover was approximately 6% less. These modest differences reflect the stunted and open nature of the taiga forest. There was little change in vegetation height between burnt and unburnt linear features, likely because there were very few linear disturbances in a forested structural stage; most of them, even in unburnt conditions, were already in a shrub-dominated stage due to the clearing of trees. For shrub cover, except for 2D seismic lines, the mean was approximately 10% to 20% greater at burnt plots than at unburnt plots. The increase in shrub cover at burnt sites was most prominent in 3D seismic lines due to their comparatively lower pre-fire shrub cover.

Post-burn vegetation was, on average, shorter and shrubbier than unburnt off-line plots, but taller and shrubbier than unburnt on-line plots. Furthermore, burnt paired plots were more similar in vegetation characteristics than unburnt paired plots. This evidence supports the theory that forest fires in taiga ecosystems resets the landscape to some extent and effectively erase signs of anthropogenic disturbance (Seccombe-Hett and Walker-Larsen 2004, Simpson 2008). Forest fire in the taiga returns ecosystems to an early successional stage (i.e., low shrub) and synchronizes baseline biophysical conditions on a landscape scale, allowing previously disturbed and undisturbed areas to recover at equal rates, as has been documented by Seccombe-Hett and Walker-Larsen (2004). Thus, most linear features that have experienced forest fires no longer create different ecological conditions or functional disturbances than the surrounding landscape.

5.2.2 SUCCESSIONAL CLASS

The idea that vegetation regeneration on linear features could follow different successional trajectories came out of work by the Yukon Government in the early 2000s (Simpson 2008). That work described six successional trajectory classes observed in the Eagle Plains area. However, that study did not quantify the relative extents of linear features that followed the different trajectories. This study used the classes that the Yukon Government work developed and quantified the proportion of linear features in each successional class across a random sample of linear features.

Successional classes in the Eagle Plains RSA varied according to linear feature type and burn status. However, one of the key findings was that normal succession was the dominant trajectory observed for all linear features except the Dempster Highway. All 3D seismic lines followed a normal successional trajectory, except for one recently disturbed site. This was likely attributable to the low impact methods used in 3D line creation that minimize ground and vegetation disturbance, creating conditions more likely to result in a normal successional trajectory (Yukon Energy Mines and Resources 2006, Golder Associates 2016). Magnified and stagnated succession were only observed in 2D seismic lines and winter roads. These linear features were generally wider and were created using methods that cause greater disturbance to soils, hydrology, and vegetation, leading to these alternative successional trajectories (Simpson 2008, Jorgenson et al. 2010, Dabros et al. 2018). Magnified succession is unique among the classes in that it results in accelerated vegetation regeneration. Magnified succession was most common on burned 2D seismic lines where the combination of site disturbance associated with the 2D lines and fire is suspected of causing accelerated soil warming, moisture availability, and nutrient flush, which increase on-line vegetation growth (Simpson 2008). Successional stagnation was most common on unburnt winter roads. Stagnation tends to occur on features that have experienced ground disturbance or have been seeded to agronomic species, which may have happened on winter roads in the RSA (Simpson 2008). Repeated disturbance associated with multiple exploration programs over time may also limit successional advancement and contribute to successional stagnation (Lee and Boutin 2006, Jorgenson et al. 2010).

Although some alternative successional pathways were observed in this study, most linear features in the Eagle Plains RSA are following a normal successional trajectory. This implies that most of these disturbances will recover to an ecological condition like that of the surrounding community with adequate time.

5.2.3 STRUCTURAL STAGE

The taiga forest in Eagle Plains presents a unique situation where the Tall Shrub stage is applied to two very different stand conditions. One condition, the more traditional, is of regenerating stands following a natural or anthropogenic disturbance. In this setting, the vegetation consists of deciduous shrubs and 2–8 m tall, 10–30 years old trees. The stage is transitional, with the vegetation expected to advance to the Pole-Sapling stage over time. The second condition where the Tall Shrub stage is applied is to stunted, old, black spruce stands in a disclimax state. In this setting, the vegetation consists of open, stunted, black spruce stands that are typically ≥50 years old and 2–8 m tall. Stands in this condition are expected to remain in the same condition over time(i.e., a disclimax state). Structurally, the stunted black spruce trees function more like shrubs than trees. Both Tall Shrub conditions (referred to as disturbance and disclimax forms hereafter) are widespread across the RSA in off-line sites. Only the disturbance form was observed on linear features.

The structural stage on linear features was predominantly Low Shrub or Tall Shrub, determined mainly by the time since line clearing and burn status. Less than 4% of surveyed features were in forested stages (Pole-Sapling or greater). Off-line plots had a higher proportion of forested structural stages (37%). However, they were still predominantly Low Shrub and Tall Shrub, resulting from extensive burns across the RSA and large extents in the disclimax form for Tall Shrub in un-burned areas.

The structural stage of on-line plots was also influenced by successional class. The small number of forested structural stages observed on features only occurred on sites undergoing normal succession. Stagnated succession was associated with only the Herb structural stage, which was expected as stagnation is defined by its high herbaceous species cover (among other factors) that limits the establishment of other structural groups. Magnified succession was the one atypical successional class with accelerated vegetation growth. Most structural stages on sites with magnified succession were in Tall Shrub and, occasionally, Pole/Sapling. Often the structural stage on magnified succession sites was one stage greater than the off-line plot.

5.2.4 VEGETATION HEIGHT

This study observed a range of vegetation heights across different feature types. Except for the 3D lines, the linear features' age was unknown, so it was impossible to estimate growth rates. Although some regenerating vegetation on 2D seismic lines and winter roads reached 8 m high, most were between 1.5 m and 2 m. Though the ages of specific features were mostly unknown, the minimum age for most was at least 35 years. Having most vegetation heights at only 1.5–2.0 m after this long period suggests regeneration growth rates on linear features may be quite slow. This pattern of slow vegetation growth on linear features may partly reflect the generally poor growing conditions in the taiga region. Still, it is also a pattern that has been observed on linear features in other studies in the southern boreal forest.

Interestingly, the vegetation heights on linear features in Eagle Plains are greater than reported in several other studies. For example, approximately 65% of sites on linear features in northeast Alberta had not advanced beyond a cover low forbs after 35 years (Lee and Boutin 2006). Key factors that have been linked to slow vegetation regeneration on linear features were continued human disturbance (e.g., OHV travel), ecosystem type (bogs and fens regenerated much slower than upland sites), competition from early seral and invasive graminoids and forbs, and soil or site degradation associated with feature construction (Lee and Boutin 2006, van Rensen et al. 2015, Finnegan et al. 2018).

There is limited data on vegetation regeneration in the taiga. A study from NWT found that vegetation regeneration on conventional seismic lines was affected by both a time lag for seedling establishment (as long as 17 years for black spruce) and slow growth rates (83 years to reach 5 m) (Seccombe-Hett and Walker-Larsen 2004). In burned areas, the seedling establishment delay was reduced to five years.

Although the 3D lines in Eagle Plains were only six years old when they were surveyed, a combination of field survey results and information from other studies suggests that vegetation recovery on 3D lines could be much faster than the previous examples for conventional 2D lines. This is because the undisturbed ground conditions and maintenance of the vegetation community in the moss, forb and low shrub layer provide both plants and growing conditions that support faster shrub and tree growth compared to sites beginning primary succession. In northeast British Columbia, Golder Associates (2016) found that in the first year following 3D seismic line creation, there were already black spruce seedlings exceeding 0.5 m in height. These seedlings were plants that were initially present on the site and that had survived line clearing. This is consistent with the results of this study, where nearly all of the 3D plots contained black spruce seedlings. Despite their relatively young age, most 3D seismic lines in Eagle Plains included shrubs and trees between 0.5 m and 1 m

tall. Although growth rates in Eagle Plains are not known, similar species that occur in Eagle Plains were observed to grow 5–10 cm per year on 3D lines in the boreal forest in northeastern British Columbia (Golder Associates 2016). If similar growth rates occur in Eagle Plains, regeneration on the 3D lines can be 2 m over the next 5–20 years.

5.3 HUMAN USE AND ACCESS ALONG LINEAR FEATURES

The NYRLUP and the PWRLUP indicate that one of the primary concerns about linear features is that they can increase human access into remote areas. This has been demonstrated in southern regions, and that access can have secondary effects of inhibiting vegetation regeneration (Lee and Boutin 2006) and, in winter, packing snow that can affect predator-prey dynamics (Latham et al. 2011, McKenzie et al. 2012, Keim et al. 2019a). In the boreal forest in northern Alberta, OHV travel was common on most conventional 2D seismic lines. After 35 years, approximately 20% of the lines were considered to have been converted to tracked access routes (Lee and Boutin 2006). In the same study, about 65% of the lines remained cleared after 35 years, and OHV use along the lines was identified as one factor contributing to the lack of vegetation regeneration. In contrast, there is little evidence of human use along linear features in the Eagle Plains RSA. No sign of human use was detected along linear features during the summer ground surveys (e.g., OHV tracks, ruts, water crossings, vegetation trampling/scarring, tree blazes, trap sets, garbage, campsites, etc.) or the winter track survey (e.g., snowmobile tracks). Although these surveys provided limited snapshots in time, and that some types of human activity leave little sign (e.g., evidence of snowmobile tracks have limited persistence during winter and leave no sign behind after snow melt), the results suggest that human use of the area is very limited outside of the Dempster Highway corridor. This is consistent with general comments from highway workers, staff at the Eagle Plains Hotel, pilots, and some First Nation residents that most areas beyond the Dempster Highway corridor receive very little human use. Specific instances of use of the area outside the Dempster Highway corridor include intermittent activity on the community trapline that occurs in Eagle Plains and occasional forays by hunters (First Nation and non-First Nation), mostly in winter.

People's limited use of the Eagle Plains area is likely due to its far distance from any human settlements and the difficulty of travel off the Dempster Highway. The network of winter roads in the area does provide access via specific types of OHVs in summer and snowmobiles in winter. However, there was no evidence observed that this occurs regularly. Travel along seismic lines, though possible in specific locations, would be hampered over any substantial distance by vegetation regeneration along the historical 2D lines, the narrow widths of and frequent dogleg bends in 3D lines and, during summer, difficult terrain (extensive peatlands and graminoid tussocks).

5.3.1 EFFECTIVENESS OF MITIGATION MEASURES FOR 3D SEISMIC LINES

In addition to the narrow widths of 3D lines, which hampers OHV travel, the 3D lines included regular bends in the lines, which were designed to limit the visibility of the lines at intersections with roads and other seismic lines, and to hamper OHV along the lines further. The driving survey along the Dempster found that this mitigation was very effective in reducing the visibility of the 3D lines from the road (i.e., only 6 of the 74 3D

lines intersecting the Dempster Highway were visible). Incidental observations during ground surveys observed similarly reduced visibility of 3D lines crossing winter roads. Regular bends in the 3D lines away from roads were also designed to limit human access by reducing sightlines and making travel more difficult along the line (i.e., needing to reduce speed to navigate the tight turns of a dogleg bend approximately every 70 m).

5.4 FUNCTIONAL CHARACTERISTICS OF LINEAR FEATURES

In addition to human travel, linear features can also affect how wildlife move within a landscape. Several studies in western Canada have documented the effects of linear features on the movements and population dynamics of large mammals, such as caribou, moose, deer, wolves and bears (Latham et al. 2011, McKenzie et al. 2012, Dickie et al. 2017b, Keim et al. 2019a). EDI focused on two established indicators of human and wildlife access and travel on linear features: sightline distance and ease of travel. These measurements act as a proxy for the functional recovery of disturbed areas. They are mainly dependent on vegetation height, cover, and terrain.

5.4.1 LINE-OF-SIGHT

Line-of-sight or sightline distance is how far one can see under normal conditions and was compared between linear features and paired reference plots. It has been proposed that humans and predators select linear disturbances because it is easier to travel and detect prey using those features (Finnegan et al. 2018). As vegetation grows taller and denser, sightlines diminish, and the use of linear features decreases (e.g., for wolves, Dickie et al. 2017a). This study found that average sightlines were farther on-line versus off-line for most linear feature types, but that sightlines varied substantially across line types. Sightlines were shorter on seismic lines than on roads, especially 2D lines which had more advanced vegetation regeneration than other feature types. On 3D lines, sightlines averaged approximately 30 m farther on lines than off lines. However, this difference probably provides little advantage to predators or human hunters because the increase is still within the olfactory and auditory detection zone for most large prey species. Average sightlines were 60 m farther on winter roads than surrounding forest, which may begin to confer more advantage to predators and hunters.

The range of sightlines observed on most linear features probably do not provide an advantage to detect prey species visually. For 2D lines and winter roads, sightline distances were primarily driven by the height and density of regenerating vegetation. The recovery period for 2D seismic lines appears to be sufficient to support vegetation that reduces visibility to a similar level as the surrounding habitats. The reason for longer sightlines on winter roads is that they are subject to intermittent re-activation, where the vegetation is cleared once again, which resets vegetation recovery and maintains longer sightlines. In contrast to 2D lines and winter roads, where sightlines were largely determined by vegetation regeneration, the sightlines on 3D lines were presently limited by the bends purposely constructed into the lines. Sightlines along all feature types will continue to diminish over time as vegetation regeneration continues.

5.4.2 EASE OF TRAVEL

Ease of travel is a fundamental indicator of functional recovery of linear features. Wolves, bears, and humans have been documented to select linear features with greater ease of travel, which is generally associated with lower and more sparse vegetation and stable, even terrain (Dickie et al. 2017b, Keim et al. 2019a). Access and travel resistance are the main determinants of predator and human use of linear features and the key concern of linear disturbances in the RSA (Vuntut Gwitchin Government and Yukon Government 2009, Peel Watershed Planning Commission 2019).

The walk test used in this study, as an index of ease of travel, found differences among linear feature types and between linear features and controls. However, the magnitude of the differences for both comparisons was modest. Even the Dempster Highway only conveyed a 35% increase in walking speed over off-line plots. Other researchers, in other areas, often observed walk speeds on linear features were often at least twice as fast as off-line transects (Keim et al. 2019a). Two conditions associated with the Eagle Plains area appear to limit the advantage of travelling on linear features. One is that the vegetation in most ecosites and structural stages is relatively open and has a limited effect on impeding movement. The second factor is that ground conditions limiting movement, including soft, thick peat and graminoid tussocks, were similar on both on-line and off-line plots for most linear feature types.

Notwithstanding the modest magnitude of faster walking speeds on-lines, there were clear patterns in walking speed differences across linear feature types. 2D lines were the one feature type where walking speeds were slower on lines than off lines. This reflected the thick, shrub stage vegetation that had regenerated on most 2D lines, which impeded travel (similar to the effect that regenerating vegetation had on sightline distances in the previous section). Walk speeds decreased across the other feature types in relation to line width and the degree to which ground cover was levelled or compacted. 3D seismic lines allowed slightly easier travel than paired off-line plots. They usually had lower vegetation cover and clearer route selection. As linear feature width decreased in 3D lines, walking speed also decreased. This implies that width may be related to functional recovery, with narrower lines having smaller impacts than wider lines, even within an already narrow linear feature type. Although ease of travel was greater in 3D seismic lines than surrounding community, it is expected that this will decrease in future years as vegetation increases in height and density.

5.5 FUNCTIONAL RECOVERY OF LINEAR FEATURES

Functional disturbance is defined in the NYRLUP and PWRLUP as "*physical land use disturbance that results in disruption of soil or hydrology, or that requires the cutting of trees*." One of the main concerns with linear disturbances under these land use plans is that such features can technically allow increased access to previously remote areas, potentially leading to a greater harvest of wildlife and fish, higher predation rates, and a change in how people and wildlife use the land (Vuntut Gwitchin Government and Yukon Government 2009). A disturbance can be considered functionally recovered and subtracted from the overall linear density when it no longer facilitates access or travel by humans or wildlife (Vuntut Gwitchin Government and Yukon Government 2009), or otherwise no longer functions as a surface disturbance (Peel Watershed Planning Commission 2019). Both plans use 1.5 m vegetation height as a threshold for functional recovery in forested communities. The

PWRLUP includes the following additional criterion for recovery "*in non-forested areas (dominated by vegetation under 1.5 m), when the disturbed area is covered by native species roughly the same height and composition as the surrounding dominant vegetation*" (Peel Watershed Planning Commission 2019):

One limitation of using height alone as a functional recovery criterion is that it does not consider vegetation density. Although regeneration may meet the recommended height criteria, if it is very sparse (as is often the case in the Eagle Plains Ecoregion), it may still facilitate access and travel by humans and wildlife. Attachment Photo A-25 provides an example in the Eagle Plains RSA where tall but sparse regeneration meets the 1.5 m criteria but does not inhibit access or travel.

The combined results of this study indicate that using regeneration to the Tall Shrub structural stage may be a more appropriate criterion for functional recovery. Attachment Photo A-3 and Attachment Photo A-10 provide examples of linear features that have regenerated to a tall shrub structural stage. Using the Tall Shrub criterion, 38% of all linear features in the RSA would be considered functionally recovered compared to 53% using the 1.5 m height criterion. For this study, the more conservative criterion of reaching the Tall Shrub structural stage was used to adjust (reduce) linear feature densities.

5.6 LINEAR FEATURE INVENTORY AND DENSITY

This study was successful in mapping all linear features within the RSA. The combined results of the mapping exercise and the field studies found that the extent of open habitats (burns and naturally open habitats like wetlands and shrublands), and the degree of vegetation regeneration, played a significant role in the effective density of linear features across the RSA. Before accounting for open areas and regeneration, the total linear feature density was 1.79 km/km². After accounting for open areas and vegetation regeneration (to the Tall Shrub structural stage), the effective linear feature density was 0.52 km/km². The NYRLUP and PWRLUP suggest cautionary levels for linear density of 0.75 km/km² and critical levels of 1.0 km/km² (Vuntut Gwitchin Government and Yukon Government 2009, Peel Watershed Planning Commission 2019).

The Yukon Land Use Planning Council (YLUPC) was conducting a pilot study of surface disturbance across the broader Eagle Plains Ecoregion (Skinner 2021) at the same time as this study. The methods they used consisted of mapping and attributing human-caused disturbances solely using high-resolution satellite imagery. The YLUPC classified vegetation into eight broad classes based on whether the surrounding area was forested or non-forested, the similarity of vegetation on-line to off-line, and the presence or absence of woody cover (i.e., shrubs or trees). The features were then classified as recovered or not-recovered based on the presence of woody cover (recovered) or, if woody cover was not present, the similarity to surrounding vegetation (i.e., if similar then recovered, if not similar, then not-recovered). Historical field data and photographs from the area (Simpson 2008) were used to verify interpretations.

The spatial data from the YLUPC work was not available to compare in detail to the linear feature inventory compiled in this study. However, the mapping linework is expected to be very similar because satellite imagery was used to verify and supplement the linear feature geospatial data compiled in this study (presumably the same satellite imagery that YLUPC used because the imagery was obtained from Yukon Geomatics). One

difference between the two products is that the YLUPC completed the inventory for the entire Eagle Plains Ecoregion, while this study was restricted to the RSA. Another difference is that the attribute data in this study is expected to be more detailed and more precise than the YLUPC data because (i) the original geospatial data includes some information, like date of creation, that would be impossible to estimate from imagery, and (ii) because this study linked field surveys to the mapping exercise to determine line widths and other characteristics more precisely.

Although it is impossible to directly compare the linear feature density estimates between the two studies, due to the different study extents, the general pattern of results is similar. The YLUPC estimated the linear density (accounting for recovery) to be 0.38 km/km² across the entire Eagle Plains Ecoregion. This is consistent with the estimate from this study for the RSA of 0.52 km/km² because the portion of the Ecoregion outside the RSA has lower linear feature density than the RSA.

6 CONCLUSION

This study successfully mapped all linear features within the RSA and measured a suite of structural, vegetation, and functional characteristics across different feature types. Generally, the effects associated with linear features (i.e., differences between conditions on-line and adjacent off-line areas) correlated to feature width and the degree of ground disturbance. In terms of combined effects across the range of feature types that occur in the Eagle Plains RSA, the ranks were:

Dempster Highway >>> Winter Roads > 2D Seismic > 3D-5m >> 3D Conductor > 3D Receiver[2]

The effects of 3D lines (both conductor and receiver lines) appear to be substantially lower than other feature types. This reduced magnitude of effects is important because 3D lines have the longest combined length of exiting linear features. They are also the predominant feature planned for the next exploration program. Important findings for 3D lines include:

- Relatively narrow line widths of 2–3 m are often smaller than natural tree spacing and minimize the potential for changes to microsite conditions (e.g., solar radiation, air and ground moisture) reported in other studies.
- Minimal ground disturbance and maintenance of the moss, herb, and low shrub layers, which retains the natural vegetation community and accelerates vegetation regeneration.
- Successful application of mitigations, notably dogleg bends that minimize sightlines, ease of human travel, and visibility of lines from roads.
- Ungulate use of 3D lines in winter was less than a third of the rate observed on 2D lines and winter roads.

The adverse effects of linear features in other areas are often caused or exacerbated by human use after the lines are initially constructed, including effects on vegetation regeneration and predator-prey dynamics. Human use does not appear to be a significant factor in Eagle Plains. No sign of human use was observed outside the Dempster Highway corridor.

Substantial vegetation regeneration has occurred on existing features in the Eagle Plains RSA. Previous work by the Yukon Government identified the potential for atypical successional trajectories to occur on linear features in the region. Although atypical succession occurred to a limited extent, this study determined that 81% of the sites exhibited a normal succession (100% on 3D lines). Only 5% exhibited inhibited regeneration trajectories (mostly stagnated succession on winter roads). Regarding functional recovery, 53% of sites met the NYRLUP and PWRLUP criterion of vegetation reaching 1.5 m, and 38% of sites met the criterion of attaining a Tall Shrub structural stage. Using the Tall Shrub structural stage as a criterion of functional recovery may be a more ecologically appropriate criterion to meet LUP objectives.

The extent of open habitats (e.g., burns, wetlands and shrublands) and the degree of regeneration on existing linear features (mostly the older 2D lines and winter roads) play an important role in calculating effective linear

[2] Relative magnitudes of effects: >>> large effect, >> moderate effect, > small effect.

feature density in the RSA. Before accounting for open areas and regeneration, the total linear feature density was 1.79 km/km². After accounting for open areas and vegetation regeneration (to the Tall Shrub structural stage), the effective linear feature density was 0.52 km/km².

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ATTACHMENTS

ATTACHMENT A EAGLE PLAINS PROJECT LINEAR FEATURES SURVEY PHOTOGRAPHS



Attachment Photo A-1. Air survey plot SL237, an unburnt 2D seismic line undergoing normal succession at a young forest structural stage when surveyed.



Attachment Photo A-2. Air survey plot SL269, an unburnt 2D seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-3. Ground survey plot SL310, an unburnt 2D seismic line undergoing normal succession at a tall shrub structural stage when surveyed.



Attachment Photo A-4. Aerial view of 3D seismic lines undergoing normal succession – meandering routes were used to mitigate some functional disturbance impacts.



Attachment Photo A-5. Ground survey plot SL357, a burnt 3D5 seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-6. Ground survey plot SL277, an unburnt 3Dc seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-7. Ground survey plot SL255, an unburnt 3Dr seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-8. Aerial view of a burnt 2D seismic line undergoing magnified succession at a tall shrub structural stage when observed.



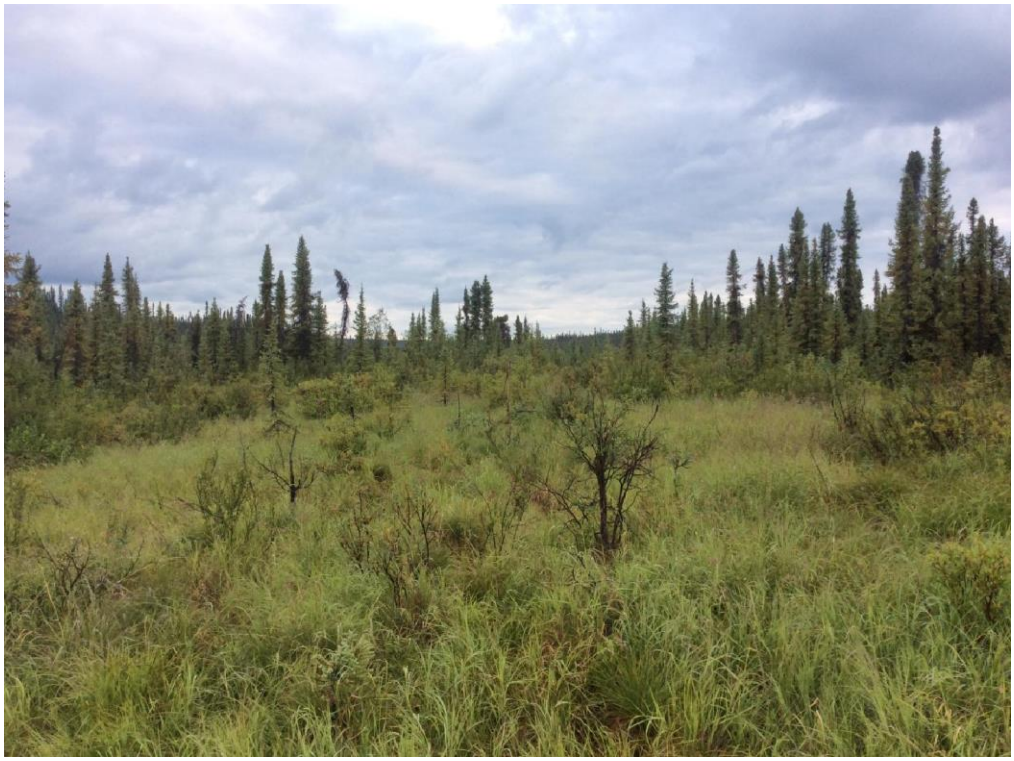
Attachment Photo A-9. Air survey plot SL234, an unburnt winter road undergoing magnified succession at a sapling forest structural stage when surveyed.



Attachment Photo A-10. Ground survey plot SL317, a burnt 2D seismic line undergoing magnified succession at a tall shrub structural stage when surveyed.



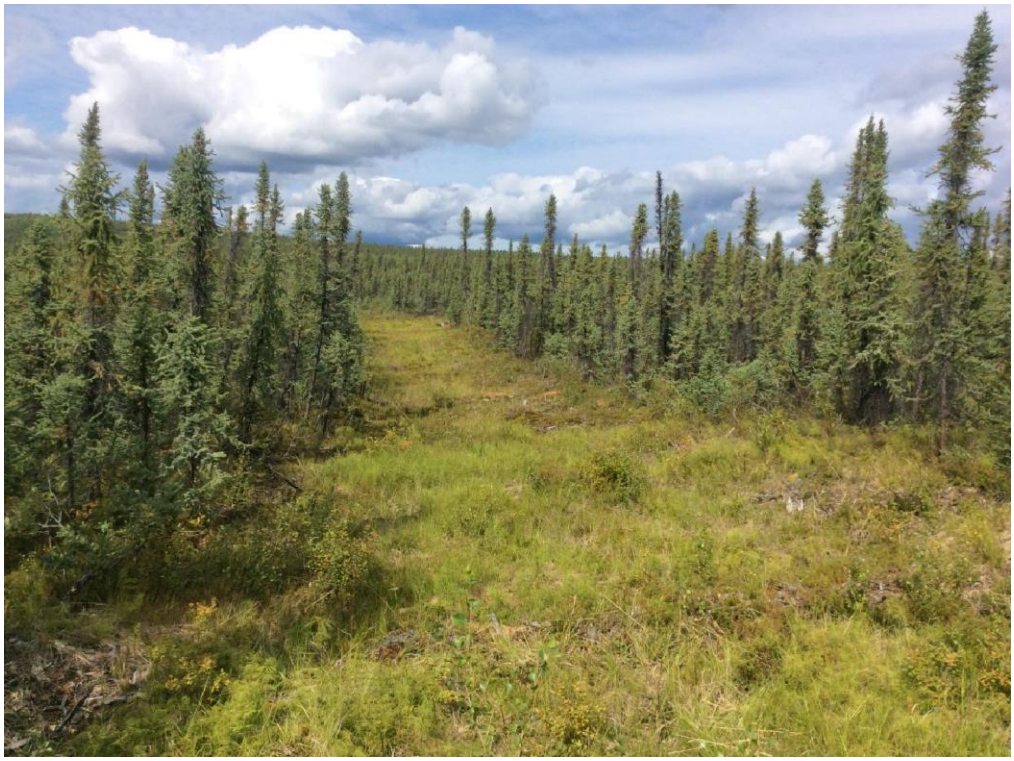
Attachment Photo A-11. Air survey plot SL238, an unburnt winter road undergoing stagnated succession at a forb-dominated herb structural stage when surveyed.



Attachment Photo A-12. Ground survey plot SL264, an unburnt winter road undergoing stagnated succession at a graminoid-dominated herb structural stage when surveyed.



Attachment Photo A-13. Ground survey plot SL226, a burnt 2D seismic line undergoing normal succession at a forb-dominated herb structural stage when surveyed.



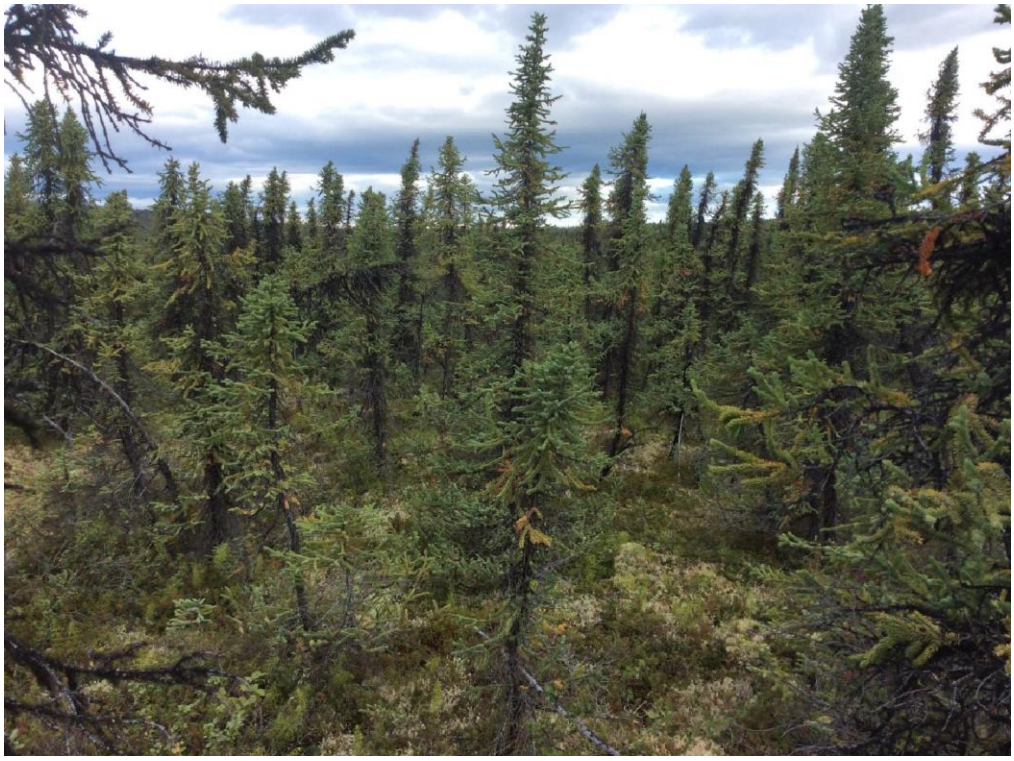
Attachment Photo A-14. Ground survey plot SL329, an unburnt 3D5 seismic line classified as recent disturbance at a forb-dominated herb structural stage when surveyed.



Attachment Photo A-15. Ground survey plot SL338, an unburnt, undisturbed reference plot at a low shrub structural stage when surveyed.



Attachment Photo A-16. Ground survey plot SL350, a burnt undisturbed reference plot at a low shrub structural stage when surveyed.



Attachment Photo A-17. Ground survey plot SL304, an unburnt undisturbed reference plot at a tall shrub structural stage when surveyed.



Attachment Photo A-18. Ground survey plot SL346, a burnt undisturbed reference plot at a tall shrub structural stage when surveyed.



Attachment Photo A-19. Ground survey plot SL3260, an unburnt undisturbed reference plot at a mature forest structural stage when surveyed.



Attachment Photo A-20. Ground survey plot SL264, an unburnt undisturbed reference plot at an old forest structural stage when surveyed.



Attachment Photo A-21. Ground survey plot SL243, a burnt winter road with melt pockets present, indicating permafrost degradation.



Attachment Photo A-22. Air survey plot SL228, a burnt 2D seismic line recovering at the same rate and stage as the surrounding community.



Attachment Photo A-23. Air survey plot SL326, a burnt winter road recovering at the same rate and stage as the surrounding community.



Attachment Photo A-24. Ground survey plot SL287, a burnt 3Dr seismic line recovering at the same rate and stage as the surrounding community.



Attachment Photo A-25. Ground survey plot SL216, a feature with regenerating trees over 1.5 m tall but very sparse, illustrating one of the limitations of the NYLUP and PWRLUP functional recovery threshold.

ATTACHMENT B DATA FORMS

Eagle Plains Linear Features Study

Surveyors: _____ **Date**: _____ **Type**: Air / Ground

Waypoint: _____ **Map Info**: _____

Line Widths: ____/____/____/____ **% Mulch**:_____

Succ. Class: Normal / No Succ / Magn / Stagn / Regress / Rcnt Dist

	On Line	Off Line
Struct. Stage		
Veg Ht / Spp	/	/
% Tree		
Tree Spp		
% Shrub		
Shrub Spp		
Ecosite		
Photos		
Sight Line (m)	/	/
Walk Test*	Dist: Time: Surveyor:	Dist: Time: Surveyor:

*Use same Surveyor for both walk tests.

Comments: _____

Eagle Plains Linear Features Study

Surveyors: _____ **Date**: _____ **Type**: Air / Ground

Waypoint: _____ **Map Info**: _____

Line Widths: ____/____/____/____ **% Mulch**:_____

Succ. Class: Normal / No Succ / Magn / Stagn / Regress / Rcnt Dist

	On Line	Off Line
Struct. Stage		
Veg Ht / Spp	/	/
% Tree		
Tree Spp		
% Shrub		
Shrub Spp		
Ecosite		
Photos		
Sight Line (m)	/	/
Walk Test*	Dist: Time: Surveyor:	Dist: Time: Surveyor:

*Use same Surveyor for both walk tests.

Comments: _____

APPENDIX 2-A-31. *2D and 3D Seismic Plain Language Summary – Chance Eagle Plains Exploration Project*

2D and 3D Seismic Plain Language Summary – Chance Eagle Plains Exploration Project

Both 2D and 3D seismic by definition are used to remotely image the subsurface. Both use the same sources, usually a small amount of dynamite buried greater than 3m in the ground, to create a compressional wave. Geophones are placed on the surface to receive and record the waves that are reflected back by the rock layers.

2D seismic, an older less accurate method, places sources and receivers intermingled on a meandering line. This creates a vertical line of seismic data that is subject to online and offline scatter and structures. Therefore the geophysicist needs to interpret along the line as well as extrapolate between the lines of a 2D program. The image created by the interpretation of the collected wave data of the subsurface layers of rock is akin to a two dimensional slice of the earth from the surface to the depth of investigation (3-4,000 metres subsurface). There is no true image of the subsurface layers outside of this two dimensional plane.

3D seismic places the sources and geophones on a grid of lines perpendicular to one another. Source lines are meandering straight lines set up in parallel to each other and shot holes charged with a small amount of dynamite are made along these lines. Receiver lines are meandering lines built parallel to each other oriented across the source lines in a perpendicular fashion. The compressional waves created by the detonation of the dynamite in the source lines is recorded by the receiver lines such that the subsurface image is three dimensional. This is a method that is much more accurate in terms of being able to properly map the subsurface geological layers.

Today, both of these methods use Low Impact Seismic (LIS) methods with much narrower lines. These lines are cut to widths that accommodate the new narrower tracked drilling equipment for the source, and even narrower lines for laying equipment using long line helicopter and personnel on foot and/or on UTVs. The mulchers try to cut as little as possible by meandering through the forest and missing as many larger trees as possible. This is the quickest, easiest, and least intrusive method for both the forest and the mulching equipment.

APPENDIX 2-A-32. Project Information Video – not available to append.

APPENDIX 2-A-33. First Nation of Na-Cho Nyäk Dun Record of Contact

First Nation of Na-cho Nyäk Dun Pre-Submission Record of Contact (January 1, 2014 - December 20, 2023)

Reference	Date	Communication Method	In / Outgoing	First Nation	Author	Proponent Names	First Nation and/or Organization Names	Subject	Summary	Additional Comments	Attachments
Note: Reference ID formatting and ordering may not be consistent or sequential due to splitting out the Master Record of Contact into First Nation-specific Record of Contacts.											
NND0125	17-Jun-14	Community Event	N/A	First Nation of Na-cho Nyäk Dun	N/A	N/A	N/A	Open House	Chance held an open house event in Mayo at First Nation of Na-cho Nyäk Dun's multi-purpose room. Chance informed attendees of the Proposed Project as well as direct any specific questions or concerns to their VP of Exploration or VP of Community and Government Relations. Both a geologist and geophysicist were available to inform attendees of the geological and geophysical characteristics above and below ground of the Eagle Plain basin.	N/A	N/A
NND0001	17-Jun-14	Community Event	N/A	First Nation of Na-cho Nyäk Dun	N/A	N/A	N/A	Open House	Chance received feedback survey forms from attendees regarding the Open House that occurred on June 16, 2014.	N/A	Feedback Forms
NND0129	13-Sep-16	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), David Thompson (Fist Nation of Na-cho Nyäk Dun)	Summary of key elements of the Proposed Exploration Drilling Project	Richard (Chance) emailed Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun), cc'd Greg (Chance), Cindy (Chance), David Thompson (Fist Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun), and attached a two page summary of key elements of the proposed exploration drilling project at Eagle Plains and current issues.	N/A	20160913-First Nation of Na-Cho Nyäk Dun0129A
NND0130	15-Sep-16	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Draft summary of Communication and Engagement Elements	Richard (Chance) emailed Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun), cc'd Greg (Chance), Cindy (Chance), and attached a draft of the elements to include in a comprehensive communications and engagement strategy between Northern Cross and the First Nations who are affected by proposed exploration activities.	N/A	N/A
NND0131	15-Sep-16	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Draft summary of Communication and Engagement Elements	Richard (Chance) emailed Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun), cc'd Greg (Chance), Cindy (Chance), and attached a new draft of the elements to include in a comprehensive communications and engagement strategy between Northern Cross and the First Nations who are affected by proposed exploration activities.This draft had Environmental Dynamics Inc. compared to the version sent earlier that day, and Richard (Chance) requested Albert refer to this version.	N/A	N/A
NND0132	18-Sep-16	Email	Incoming	First Nation of Na-cho Nyäk Dun	Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Draft summary of Communication and Engagement Elements	Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) emailed Richard (Chance), cc'd Cindy (Chance), Greg (Chance), stating the Engagement and Communication strategy looks good, and suggested it should be shared with the Chief as a draft for discussion.	N/A	N/A
NND0002	01-Dec-17	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement Plan	Chance sent a letter to First Nation of Na-Cho Nyäk Dun about the Communications and Engagement Plan that Chance would like to develop in partnership with First Nation of Na-Cho Nyäk Dun and provided an introduction of Hemmera as Chance's support on this engagement strategy.	N/A	N/A
NND0003	08-Dec-17	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Engagement Plan	Chance sent an email to First Nation of Na-Cho Nyäk Dun's representative to have a discussion about an Engagement Plan.	N/A	N/A
NND0005	18-Dec-17	Phone call	Incoming	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Meeting	Chief of First Nation of Na-Cho Nyäk Dun called Chance to let them know that the North Yukon Chiefs (First Nation of Na-Cho Nyäk Dun, TH, and VGFN) were interested in having a conference/meeting in the New Year. The Chief of First Nation of Na-Cho Nyäk Dun noted the contact name from First Nation of Na-Cho Nyäk Dun who will organize the meeting.	N/A	N/A
NND0006	22-Jan-18	Meeting	N/A	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Mike Chernoff, Richard Wyman (Chance), Greg Charlie (Chance)	Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Engagement	Held an informal meeting to introduce Chance's Chair of the Board of Directors to First Nation of Na-Cho Nyäk Dun's representative and receive an update from First Nation of Na-Cho Nyäk Dun's representative regarding any mandate that may have been given from the First Nation of Na-Cho Nyäk Dun Chief and Council with respect to engagement planning.	First Nation of Na-Cho Nyäk Dun's representative has not yet been given any direction from the Chief and Council to develop an engagement plan.	N/A
NND0009	27-Feb-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement Plan	Chance sent an email as a follow-up to the December 1, 2017 letter as well as the conversations between Chance team members and First Nation of Na-Cho Nyäk Dun's representative and a request to have an in-person meeting.	N/A	N/A
NND0010	15-Mar-18	Phone call	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement Plan	Chance called and left a message for Chief of First Nation of Na-Cho Nyäk Dun at 10:15AM following up on the email request of Feb 27th, 2018 about the Engagement and Communications Plan.	N/A	N/A
NND0011	20-Mar-18	Phone call	Incoming	First Nation of Na-cho Nyäk Dun	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement Plan	Chief of First Nation of Na-Cho Nyäk Dun called Chance about potentially setting up a meeting. Chance suggested the first half of April and provided First Nation of Na-Cho Nyäk Dun with an update of Chance's progress to date.	N/A	N/A
NND0012	22-Mar-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Meeting	Chance sent an email following up recent email correspondence and telephone conversations about setting up a meeting the week of April 9-13th. Chance notes that they met with the CEO of Na-cho Nyäk Dun Development Corporation that they expressed interest in discussing opportunities that are potentially available if Chance's exploration project moves forward.	N/A	N/A
NND0013	22-Mar-18	Email	Incoming	First Nation of Na-cho Nyäk Dun	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance)	Richard Wyman (Chance)	Meeting	The Executive Assistant, First Nation of Na-Cho Nyäk Dun, sent an email to Chance indicating that Chief and Council are available to meet on April 9 and asked about Chance's time of preference between 8:30AM and 4:30PM.	N/A	N/A
NND0014	26-Mar-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun)	Meeting	Chance sent an email to First Nation of Na-Cho Nyäk Dun indicating that the Director and Chair of the Community Relations Committee at Chance would also be able to attend and would be able to fly participants to Mayo for the meeting on April 9th, 2018. Chance asked if it would be possible for participants to be picked up at the airport and to discuss expected arrival times closer to the date.	N/A	N/A
NND0015	27-Mar-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun)	Meeting	Chance sent First Nation of Na-Cho Nyäk Dun an email to let First Nation of Na-Cho Nyäk Dun know that Chance would call on morning to inform First Nation of Na-Cho Nyäk Dun as to whether or not Chance would be flying in or driving to Mayo (weather permitting).	N/A	N/A
NND0016	28-Mar-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun)	Meeting	Chance sent First Nation of Na-Cho Nyäk Dun a draft agenda for the meeting as well as a map of the Eagle Plains area showing the settlement lands, traditional territories and location of the exploration permits and significant discovery licenses owned by Chance.	First Nation of Na-Cho Nyäk Dun sent Chance an email on March 28, 2017 at 1:42PM indicating that they received the email with the draft agenda and forwarded it to Council in preparation for the April 9th meeting.	N/A

NND0017	09-Apr-18	Meeting	N/A	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance), Rick Nielson	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Deputy Chief Mary Olsen, Council Members Irene Johnny, Melody Hutton, Ronald Peters, Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun), and Chief Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Lands Manager, Emily Mann (Hemmera).	Engagement Plan	The purpose of this meeting was to begin to build a new relationship between Chance and First Nation of Na-Cho Nyäk Dun and allow opportunities for participants to share their views about what they would like their relationship and Engagement and Communication plan to look like.	A representative from First Nation of Na-Cho Nyäk Dun said that they must maintain the unity of the Northern Chiefs. A representative from Chance asked if there has been any discussion between the three Northern Chiefs. A representative from First Nation of Na-Cho Nyäk Dun responded yes, saying that it is very important that they work together. First Nation of Na-Cho Nyäk Dun said that they need to get into the process, and that everything is very high-level right now. They do not want to dictate to other Nations but identify a process for working together without creating conflict.	N/A
NND0024	23-Apr-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Kelly Constable	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance), Rick Neilsen (Chance)	Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun), Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Kelly Constable (Hemmera)	Engagement	Hemmera sent draft meeting notes from April 9th, 2018 between the First Nation of Na-Cho Nyäk Dun and Chance for review and comment and asked First Nation of Na-Cho Nyäk Dun to provide any comments via tracked changes, if possible, by May 7th, 2018. Hemmera offered to draft a Communications and Engagement Plan for First Nation of Na-Cho Nyäk Dun to review and consider. There was an interest by First Nation of Na-Cho Nyäk Dun during the meeting on April 9th for Hemmera to assist with this.	N/A	N/A
NND0025	01-May-18	Phone call	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement Plan	Chance spoke to the Chief of First Nation of Na-Cho Nyäk Dun on May 1st, 2018 to update him on the progress made regarding Communications and Education Plans being developed with each of the First Nations that have an interest in Eagle Plain. Chance also followed up with the Chief of First Nation of Na-Cho Nyäk Dun's idea to have a meeting of all the North Yukon Chiefs and said that a meeting is tentatively being planned after the May long weekend, probably in Dawson.	N/A	N/A
NND0026	01-May-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Kelly Constable	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance), Rick Neilsen (Chance),	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun), Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Engagement	Hemmera sent an email out to First Nation of Na-Cho Nyäk Dun and colleagues thanking them for the revision they had sent for the Chance and First Nation of Nacho-Nyak Dun meeting of April 9th, 2018. Hemmera asked if First Nation of Na-Cho Nyäk Dun had considered the offer for Hemmera to provide a draft Engagement and Communication Plan for their review and input and asked them to advise. An update was provided about the interest from the Gwich'in Tribal Council, Tetl'it Gwich'in Council, Vuntut Gwitchin Government, Tr'ondëk Hwëch'in First Nation and Yukon Government. There was a discussion around an all-party meeting being of interest and tentatively proposed a meeting on May 22nd and 23rd.	N/A	N/A
NND0027	01-May-18	Email	Incoming	First Nation of Na-cho Nyäk Dun	Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance)	Greg Charlie (Chance)	Engagement	First Nation of Na-Cho Nyäk Dun's representative sent Chance an email stating that First Nation of Na-Cho Nyäk Dun Council has limited capacity to engage and required proponents active in their traditional territory to fund their engagement.	N/A	N/A
NND0028	02-May-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance), Rick Neilsen (Chance)	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun), Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Meeting	As further correspondence to the email string started by Hemmera to First Nation of Na-Cho Nyäk Dun on May 1st, 2018, Chance replied to First Nation of Na-Cho Nyäk Dun that the meeting would take place in Dawson City, May 22nd and 23rd. This would be also attended by Vuntut Gwitchin Government, Tr'ondëk Hwëch'in First Nation, Gwich'in Tribal Council, Tetlit Gwich'in Council, and Yukon Government.	N/A	N/A
NND0029	02-May-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Shena Shaw (Hemmera)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance), Rick Neilsen (Chance)	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun), Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Meeting	Hemmera said it would be important to find a date that works for everyone, and asked First Nation of Na-Cho Nyäk Dun to let everyone know when there is another two-day window in May or June that could be provided as an option to the rest of the participants.	N/A	N/A
NND0030	07-May-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement Plan	Details around capacity funding were discussed. The development of Engagement Plans with each of the First Nations who have a presence in Eagle Plain was discussed. At the meeting in April 2018, First Nation of Na-Cho Nyäk Dun's employee provided a document prepared by the First Nation of Na-Cho Nyäk Dun government that may be helpful to draft an Engagement Plan.	N/A	N/A
NND0031	07-May-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun)	Tenure Extension	A representative from Chance sent a letter to First Nation of Na-Cho Nyäk Dun to provide notification that Chance would be submitting a request to extend the tenure of the exploration permits numbered 0012-117, which were set to expire in August if not extended. The representative indicated to call him if there were any questions or concerns.	N/A	N/A
NND0032	08-May-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Maureen Huggard	Tenure Extension	A representative from Chance forwarded the email attachment he had sent earlier to Chief and Council as well as First Nation of Na-Cho Nyäk Dun's Lands & Resources Manager, who was out of the office from May 4th to 22nd. In their absence, the contact listed for Environmental Dynamics Inc.ate assistance was the Natural Resources Coordinator.	N/A	N/A
NND0034	14-May-18	Phone call	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement	A representative of Chance left a voice message to Chief of First Nation of Na-Cho Nyäk Dun to discuss details around capacity funding. Chance mentioned that would be in Whitehorse the following day and invited Chief of First Nation of Na-Cho Nyäk Dun to lunch, dinner or coffee if he had time.		N/A
NND0035	14-May-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement	A representative of Chance sent the Chief of First Nation of Na-Cho Nyäk Dun an email letting him know he just left him a voice message, to follow up on the email that Chance sent last week to ask for some clarity about the request received by Greg Charlie (Chance) from Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun) to discuss details around capacity funding. Richard said that he is in town on the 16th and will be there for the rest of the week so perhaps Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) would like to have coffee or go for lunch or dinner. Chief of First Nation of Na-Cho Nyäk Dun wrote back to Chance on May 15th indicating that he would be in town until and he would be available anytime after 5PM. Subsequent emails between Chance and First Nation of Na-Cho Nyäk Dun set the time and place.	N/A	N/A
NND0036	16-May-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Kelly Constable	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Engagement Plan	Hemmera sent a draft Engagement and Communication plan between the First Nation of Na-Cho Nyäk Dun and Chance for review and feedback. Hemmera also indicated not to hesitate to reach out should their be any questions or immEnvironmental Dynamics Inc.ate revisions. Hemmera also indicated they'd be happy to set up a teleconference for a joint review of the draft at a date and time that suits participants' schedules in the coming days.	N/A	N/A

NND0037	16-May-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement Plan	Chance sent Chief of First Nation of Na-Cho Nyäk Dun an email indicating he was glad he was able to join Chance for dinner and also to meet Chance's main investor, who had a long history with working in northern Canada and especially in the Eagle Plain area. The Chance representative also reiterated that as the Chief of First Nation of Na-Cho Nyäk Dun suggested during dinner, Chance, by copy of this email, asked the advisors at Hemmera to forward the Chief of First Nation of Na-Cho Nyäk Dun and the First Nation of Na-Cho Nyäk Dun representative a draft Engagement Plan that they prepared using the document that First Nation of Na-Cho Nyäk Dun's employee provided to Chance the previous month for reference. Chance requested that Chief of First Nation of Na-Cho Nyäk Dun let Chance know First Nation of Na-Cho Nyäk Dun's thoughts on the draft and whether amendments needed to be considered. The Chief of First Nation of Na-Cho Nyäk Dun followed up thanking Chance for the evening and for the discussion.	N/A	N/A
NND0039	24-May-18	Email	Incoming	First Nation of Na-cho Nyäk Dun	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance)	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun)	Engagement Plan	First Nation of Na-Cho Nyäk Dun sent Chance an email advising them that their inquiry of May 7th, 2018 about capacity funding would be on the Council's agenda on May 30th, 2017. First Nation of Na-Cho Nyäk Dun indicated they would be in touch thereafter.	N/A	N/A
NND0040	24-May-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun)	Engagement Plan	Chance sent First Nation of Na-Cho Nyäk Dun an email thanking them for advising them of the upcoming Council discussion regarding Engagement and Communication Plan matters. Chance asked if the discussion would be about the draft plan that was sent by email from Hemmera last week to Chief of First Nation of Na-Cho Nyäk Dun and the First Nation of Na-Cho Nyäk Dun representative, or if the focus of the meeting would be to discuss details around capacity funding? The Chance representative asked if the meeting was about the Plan, if they should forward the draft that was sent last week to distribute to Council.	N/A	N/A
NND0042	24-May-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun)	Engagement Plan	Chance sent First Nation of Na-Cho Nyäk Dun an email with the attached Draft Engagement and Communications Plan that was prepared by Hemmera using the reference material that was provided to Chance after the meeting in Mayo last month. The Chance representative asked the First Nation of Na-Cho Nyäk Dun representative to circulate the draft to anyone that needed to know about this topic. The Chance representative indicated that the First Nation of Na-Cho Nyäk Dun representative let them know anything else was required to help bring this effort to a conclusion. The representative of First Nation of Na-Cho Nyäk Dun sent Chance an email back on May 24th, 2018 indicating that the information was shared with Council and it was added as a discussion item for the following week's Chief and Council Meeting.	N/A	N/A
NND0043	28-May-18	Phone call	Incoming	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement Plan	Chance received a call from Chief of First Nation of Na-Cho Nyäk Dun seeking clarification about capacity funding. Details around capacity funding were discussed.	N/A	N/A
NND0044	28-May-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Kelly Constable	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun)	Engagement Plan	Hemmera sent an email with an attached "Chance Engagement Plan Memo" to support the First Nation of Na-Cho Nyäk Dun's Chief and Council meeting on May 30th, 2018. Hemmera said do not hesitate to reach out should they have any questions. First Nation of Na-Cho Nyäk Dun replied on May 28th, 2018 saying they have added the Memo for Council's meeting on .	A representative from Hemmera forwarded an email sent by First Nation of Na-Cho Nyäk Dun on May 31st. First Nation of Na-Cho Nyäk Dun informed Hemmera that the Nacho Nyak Dun First Nation Council meeting was postponed until June 5th and that they would get back to Hemmera.	N/A
NND0045	11-Jun-18	Text message	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Chance	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Meeting	A representative from Chance sent a text to the Chief of First Nation of Na-Cho Nyäk Dun to ask him if they would be able to move forward on an Engagement Plan. The chief stated that they could have Hemmera meet with an First Nation of Na-Cho Nyäk Dun representative to finalize the draft. The Chief sent a text back indicating that due to a series of unforeseen circumstances it was necessary to postpone a Council meeting as there was a death in the community. The Chief indicated that the meeting tomorrow (June 12th, 2018) would still be convened and offered to keep the Chance representative in the loop.	N/A	N/A
NND0046	06-Jul-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun)	Engagement Plan	Hemmera sent First Nation of Na-Cho Nyäk Dun an email to let them know they would be touching base on the Communications and Engagement Plan, as the deadline of August 1st, 2018, with Yukon Government was fast approaching. They indicated that a status update on the Plan would be appreciated.	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun) emailed Hemmera on July 9th, 2018 and let her know there is no update at this time. She said she would add this for discussion to the Council's next meeting on July 11th. She said due to time constraints they were not able to complete their last meeting agenda on June 12th. She said it was an extremely busy at this time due to General Assemblies and apologized for any inconveniences this has caused.	N/A
NND0047	06-Jul-18	Phone call	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement Plan	A representative of Chance had a telephone call with the Chief of First Nation of Na-Cho Nyäk Dun about who Chance should be in contact with regarding the draft Communications and Engagement Plan.	N/A	N/A
NND0048	06-Jul-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Engagement Plan	A representative from Chance sent an email to Hemmera and First Nation of Na-Cho Nyäk Dun and explained that they had spoken directly to the Chief and asked them to work with Lands and Resources to review the draft Engagement Plan.	A representative from First Nation of Na-Cho Nyäk Dun emailed Chance Oil & Gas back on July 9th, 2018 and thanked them for the update and said they would strike this from the Council's agenda on .	N/A
NND0049	06-Jul-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Engagement Plan	Chance sent a representative of First Nation of Na-Cho Nyäk Dun an email regarding his phone call to the Chief of First Nation of Na-Cho Nyäk Dun. Chance explained to the representative of First Nation of Na-Cho Nyäk Dun that the Chief had directed this person as the contact to review the draft attached Engagement Plan. Chance apologized for not sending a draft when it was sent in May but at that time there was no direction given from First Nation of Na-Cho Nyäk Dun as to who should receive a copy. Chance let them know the deadline was August 1st, 2018 to complete the plan and that they were hoping to set up a call with Hemmera and First Nation of Na-Cho Nyäk Dun to go through the plan. Chance stated their understanding that the timeline was short and with that in mind, they indicated that they were prepared to assist and have Hemmera facilitate. Chance explained they would make changes and provide a re-draft for Chief and Council's review.	N/A	N/A
NND0050	12-Jul-18	Email	Incoming	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun), Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Engagement Plan	Hemmera sent First Nation of Na-Cho Nyäk Dun an email to follow up on the previous day's Council meeting to see if Chance's Communication and Engagement Plan was discussed, and if any direction was given regarding its completion.	N/A	N/A
NND0051	13-Jul-18	Email	Incoming	First Nation of Na-cho Nyäk Dun	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun)	N/A	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Engagement Plan	First Nation of Na-Cho Nyäk Dun informed Chance that Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun) would communicate on the Communication and Engagement Plan. He was copied in the email for further correspondence.	N/A	N/A
NND0052	13-Jul-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Shena Shaw (Hemmera)	Shena Shaw (Hemmera)	Chrystal Lattie (Fist Nation of Na-cho Nyäk Dun) and Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Engagement Plan	Chance asked First Nation of Na-Cho Nyäk Dun point of contact Albert for his phone number and if he would be available to have a quick conference call within the next week.	N/A	N/A

NND0053	20-Jul-18	Phone call	Incoming	First Nation of Na-cho Nyäk Dun	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	N/A	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Engagement Plan	First Nation of Na-Cho Nyäk Dun called Chance to follow-up on the Engagement and Communication Plan and ask for another copy of the Plan.	N/A	N/A
NND0054	20-Jul-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Engagement Plan	Hemmera emailed First Nation of Na-Cho Nyäk Dun a copy of the draft Engagement and Communication Plan to review. Chance offered to meet via teleconference to discuss changes and suggested being in touch in the next week to arrange a meeting.	N/A	N/A
NND0055	22-Jul-18	Email	Incoming	First Nation of Na-cho Nyäk Dun	Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Shena Shaw (Hemmera)	Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Engagement Plan	First Nation of Na-Cho Nyäk Dun sent Chance an email saying that Council wanted an First Nation of Na-Cho Nyäk Dun representative to clarify the process for advancing proposals within the First Nation of Na-Cho Nyäk Dun Government such as the draft Communications and Engagement Plan. First Nation of Na-Cho Nyäk Dun indicated that the primary point of contact should be the First Nation of Na-Cho Nyäk Dun Lands and Resources Department. The email also stated that First Nation of Na-Cho Nyäk Dun requires all proponents to offset the burden on First Nation of Na-Cho Nyäk Dun's resources that are diverted to address these extra matters which are not funded by the Treaty implementation funding agreement.	N/A	N/A
NND0056	25-Jul-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Engagement Plan	Hemmera sent First Nation of Na-Cho Nyäk Dun a draft of the Engagement and Communication Plan for First Nation of Na-Cho Nyäk Dun to review. It was noted that this was directed by First Nation of Na-Cho Nyäk Dun. The August 1, 2018 deadline with Yukon Government was noted as well.	N/A	N/A
NND0057	25-Jul-18	Phone call	Incoming	First Nation of Na-cho Nyäk Dun	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	N/A	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Engagement Plan	First Nation of Na-Cho Nyäk Dun called Hemmera to let them know the draft of the Engagement and Communication Plan had been received. First Nation of Na-Cho Nyäk Dun and Chance discussed that they would try to meet the following , August 3rd.	N/A	N/A
NND0058	25-Jul-18	Phone call	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Engagement Plan	Hemmera called First Nation of Na-Cho Nyäk Dun to try to connect on the Draft Engagement and Communications Plan.	N/A	N/A
NND0059	03-Aug-18	Meeting	Incoming	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Engagement Plan	First Nation of Na-Cho Nyäk Dun met with Chance in Whitehorse to discuss the Engagement and Communications Plan. First Nation of Na-Cho Nyäk Dun stated they were fine with the draft that Chance had created and would communicate this through internal First Nation of Na-Cho Nyäk Dun processes and get back to Chance by the following week.	N/A	N/A
NND0060	05-Aug-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Shena Shaw (Hemmera)	Shena Shaw (Hemmera)	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	N/A	Chance sent Final Draft of the Engagement and Communications Plan and noted that the First Nation of Na-Cho Nyäk Dun logo needed to be inserted. Chance also sent a draft letter to accompany the Plan when it was sent to Minister Ranj Pillai of Energy, Mines and Resources. First Nation of Na-Cho Nyäk Dun was asked to Environmental Dynamics Inc.t as they saw fit. Chance thanked First Nation of Na-Cho Nyäk Dun for their time at the meeting on, August 3, 2018.	N/A	N/A
NND0061	08-Aug-18	Phone call	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Engagement Plan	Hemmera called First Nation of Na-Cho Nyäk Dun to follow-up on First Nation of Na-Cho Nyäk Dun's finalization of the Communications and Engagement Plan and letter sent by Chance on Sunday, August 5, 2018.	N/A	N/A
NND0062	09-Aug-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Engagement Plan	Hemmera followed up on the Plan that was sent to First Nation of Na-Cho Nyäk Dun on Sunday August 5, 2018 to ask if they had had the opportunity to review the Plan and finalize the documents.	N/A	N/A
NND0063	15-Aug-18	Email	Incoming	First Nation of Na-cho Nyäk Dun	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance)	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Engagement Plan	First Nation of Na-Cho Nyäk Dun sent Minister Ranj Pillai of Energy, Mines and Resources a cover letter re. the Submission of the First Nation of Na-Cho Nyäk Dun and Chance Engagement and Communications Plan, as well as the Plan itself. The original was sent in the mail. If the Minister had further questions, he was asked to contact the First Nation of Na-Cho Nyäk Dun office.	N/A	N/A
NND0064	15-Aug-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Engagement Plan	As a follow up on their earlier phone call, Hemmera sent First Nation of Na-Cho Nyäk Dun an email to ask how the letter to Minister Ranj Pillai of Energy, Mines and Resource was coming along and if they knew approximately when it would be finished.	N/A	N/A
NND0065	15-Aug-18	Phone call	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Engagement Plan	Hemmera called First Nation of Na-Cho Nyäk Dun to follow-up on their progress with the letter to the Minister of the submission of the Communications and Engagement Plan.	N/A	N/A
NND0066	21-Sep-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Engagement Plan	Chance emailed First Nation of Na-Cho Nyäk Dun in the interest of maintaining positive momentum created by the creation of the Engagement and Communications Plan. The Plan called for Chance and First Nation of Na-Cho Nyäk Dun to hold a meeting within 3-months of finalizing the plan. Chance noted that there were procedures that needed to be developed to implement the Plan such as a Terms of Reference for ongoing engagement and a confidentiality arrangement, among other considerations. Chance suggested having the first meeting by conference call and asked for First Nation of Na-Cho Nyäk Dun's availability. Chance noted to First Nation of Na-Cho Nyäk Dun that Chance would like to continue using Hemmera's services if First Nation of Na-Cho Nyäk Dun was in agreement. Chance enclosed an updated land disposition map.	N/A	N/A
NND0067	29-Oct-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Meeting	Chance forwarded a draft Confidentiality Agreement for First Nation of Na-Cho Nyäk Dun to consider as part of the process of implementing the Engagement and Communication Plan that was approved in August 2018. Since Chance had four or five First Nation parties with interests in the Eagle Plain area, they expressed that they would like to have a common form of agreement for all parties to minimize the administration of the agreement. The draft that was attached was prepared by legal counsel to Chance and Chance made a correction and also added some Notes To Draft (NTD's) in places where they expected further input from everyone. Chance noted there were also several places in the agreement marked by "•" where additional information was required by each of the parties. Chance also noted that the duration of this agreement might be better to be longer than the indicated in the draft agreement. Chance requested that First Nation of Na-Cho Nyäk Dun review the agreement and to notify Chance about any changes that they would like to see. Chance asked if the Confidentiality Agreement could be discussed at the November 6th conference call between Chance and First Nation of Na-Cho Nyäk Dun.	N/A	N/A
NND0068	06-Nov-18	Teleconference	N/A	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Engagement Plan	Chance and First Nation of Na-Cho Nyäk Dun met to discuss the implementation of the Communications and Engagement Plan.	Details around capacity funding were discussed.	N/A
NND0069	06-Nov-18	Email	Incoming	First Nation of Na-cho Nyäk Dun	Rob Wood (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance)	Rob Wood (First Nation of Na-cho Nyäk Dun)	Meeting	An First Nation of Na-Cho Nyäk Dun representative contacted Chance saying that they are working for First Nation of Na-Cho Nyäk Dun as a strategic advisor, and were hoping Chance and them might be able to have a conversation some time this week or next. The First Nation of Na-Cho Nyäk Dun Advisor wanted to provide Chance an update on some of the work they were doing and to catch up on Chance's opportunities in the Eagle Plains area. The Advisor indicated that if Chance could suggest a time when they might be available for a call, they would try to accommodate Chance's schedule.	N/A	N/A

NND0070	07-Nov-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance)	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Meeting	As a follow up to the conference call held on November 6, 2018, Chance forwarded a description of what oil and gas exploration might look like at Eagle Plains which included a summary of the objectives that Chance was trying to achieve. Chance also attached an updated map showing the current land dispositions at Eagle Plains where oil and gas exploration permits were located. The new map had removed Exploration Permit 0005, which was located at the northern end of the exploration lands. Chance surrendered this permit to Yukon to facilitate the formation of the Ch'lhilii Chik Habitat Protection Area in the Whitefish Lakes Area.	N/A	N/A
NND0071	20-Nov-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Meeting	Chance sent First Nation of Na-Cho Nyäk Dun the meeting summary for the November 6, 2018 teleconference. First Nation of Na-Cho Nyäk Dun was asked to make any Environmental Dynamics Inc. in tracked changes and send back to Chance.	N/A	N/A
NND0072	26-Nov-18	Email	Incoming	First Nation of Na-cho Nyäk Dun	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Meeting	An First Nation of Na-Cho Nyäk Dun representative informed Chance that they were not available to attend the teleconference meeting scheduled for November 26, 2018.	N/A	N/A
NND0073	26-Nov-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Meeting	Hemmera asked First Nation of Na-Cho Nyäk Dun if they could still attend the meeting that was scheduled for 1:30pm on November 26, 2018.	N/A	N/A
NND0074	26-Nov-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Meeting	Hemmera asked First Nation of Na-Cho Nyäk Dun to let them know when First Nation of Na-Cho Nyäk Dun was available to meet to have the second Plan implementation meeting. Chance suggested a few dates.	N/A	N/A
NND0075	27-Nov-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Meeting	Hemmera stated that because the November 25, 2018 meeting was postponed, Chance emailed First Nation of Na-Cho Nyäk Dun to let them know about an All-Party Meeting that Chance was interested to plan for February 1, 2019. Chance was hoping to start confirming attendance so they wanted to let First Nation of Na-Cho Nyäk Dun know in advance of the next schedule meeting. Chance described that the All-Party Meeting was meant to bring together the First Nation of Na-Cho Nyäk Dun, Vuntut Gwitchin First Nation, Gwich'in Tribal Council, Tetlit Gwich'in Council, Tr'ondëk Hwëch'in, and Yukon Government to discuss matters related to Chance's upcoming exploration project. The following topics were proposed for the agenda: An overview of the First Nations' and Chance's work with the Engagement Plans over the past year; North Yukon Regional Land Use Plan; Yukon Oil and Gas Act; In-camera First Nations session to discuss collaboration and leadership; and Chance's exploration project plans and expected YESAB application process. Chance indicated that they would like to host the meeting in Vancouver on February 1st, 2019, the day after AME Roundup (BC's Annual Mining Conference). Chance was hoping that scheduling this meeting immEnvironmental Dynamics Inc.ately after this widely attended conference would allow for maximum participation. Chance indicated that they would fund three Citizens from each First Nation to travel to and from Vancouver, and for accommodation for two nights. Chance was anticipating that the First Nations representatives who attended the meeting would include:The Chief; The staff member managing the Chance file; and The Director of Lands and Resources, or another staff member who has been working closely with Chance. Chance indicated that they were still in the early stages of planning this event, but wanted to ask about availability in advance so that the date could be reserved. Chance indicated that they would be happy to have further conversations regarding attendance and meeting logistics. Chance listed Emily at Hemmera as a contact for a call at any time if they had any questions and provided her contact information. Chance indicated that they were looking to know if this date would work for the above mentioned representatives to attend. Chance noted to send a response to Emily if they were available to attend the meeting and that once confirmed Chance would send a meeting scheduler to specific attendees.	N/A	N/A
NND0076	27-Nov-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Meeting	Hemmera informed the Chief of First Nation of Na-Cho Nyäk Dun of the All-Party Meeting on February 1, 2019.	N/A	N/A
NND0077	01-Dec-18	Email	Incoming	First Nation of Na-cho Nyäk Dun	Rob Wood (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance)	Rob Wood (First Nation of Na-cho Nyäk Dun)	Meeting	First Nation of Na-Cho Nyäk Dun followed up with Chance and stated that they understand that there will be a meeting in February and will try and attend this meeting. First Nation of Na-Cho Nyäk Dun asked that Emily keep First Nation of Na-Cho Nyäk Dun in the loop as the February 1, 2019 All-Party Meeting materializes.	N/A	N/A
NND0078	03-Dec-18	Email	Incoming	First Nation of Na-cho Nyäk Dun	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Meeting	A First Nation of Na-Cho Nyäk Dun representative informed Chance that, at this time, they do not know who else would be attending the tentative meeting planned for February 1, 2019. First Nation of Na-Cho Nyäk Dun indicated that they would follow-up with Chance in the new year once they knew more. First Nation of Na-Cho Nyäk Dun stated they would not be available for a meeting on any of the suggested dates for December. The First Nation of Na-Cho Nyäk Dun representative stated they would be taking some vacation time starting December 10th, right up until First Nation of Na-Cho Nyäk Dun's office closure for Christmas Break at the end of day December 21, 2018 and reopening January 7, 2019. The First Nation of Na-Cho Nyäk Dun representative indicated they had more availability the first week after reopening on January 7, 2019 and suggested that they meet at that time.	N/A	N/A
NND0079	03-Dec-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Rob Wood (First Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Meeting	Hemmera thanked First Nation of Na-Cho Nyäk Dun for responding about the February 1, 2019 All-Party Meeting, and stated that she would keep them informed as the details of the meeting are developed. Emily described that the event would be at the Vancouver Convention Centre on February 1, 2019, and would be a whole day meeting. She stated that they had invited the staff members with whom they had been working closely from First Nation of Na-Cho Nyäk Dun, Vuntut Gwitchin, TH, Tetlit Gwich'in Council and GTC. Chance would cover two nights accommodation in Vancouver and travel to and from Vancouver for up to three Citizens from each First Nation. Emily shared that Chance was thinking each person should book their own travel and accommodation and submit the details for reimbursement, and to please let them know if more information was needed. Emily stated she would be in touch with more details, such as the meeting agenda the following weeks, and to please identify when they can confirm their attendance.	N/A	N/A
NND0080	03-Dec-18	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Emily Mann (Hemmera)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Emily Mann (Hemmera)	Meeting	Hemmera emailed First Nation of Na-Cho Nyäk Dun to see if they were available for a teleconference on Dec. 13, 17 or 18. Chance thanked First Nation of Na-Cho Nyäk Dun for forwarding the February 1, 2019 All-Party Meeting information to another First Nation of Na-Cho Nyäk Dun representative and asked if First Nation of Na-Cho Nyäk Dun knew who else would be attending from First Nation of Na-Cho Nyäk Dun.	N/A	N/A
E00072	04-Jan-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Engagement/Consultation Meeting Coordination/Planning	Sent a meeting agenda.	N/A	E00072_190211_Chance and FNFirst Nation of Na-cho Nyäk Dun Meeting - January 7th

E00131	07-Jan-19	Phone Call	Incoming	First Nation of Na-cho Nyäk Dun	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun cancelled the Meeting with Chance due to lack of progress made on Meeting agenda items.	N/A	N/A
E00064	09-Jan-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Details around capacity funding were discussed.	N/A	E00064_190208_all party Meeting Details
E00134	09-Jan-19	Phone Call	Incoming	First Nation of Na-cho Nyäk Dun	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun called Emily regarding the logistics of the February 1, 2019 All-Party meeting.	N/A	N/A
E00067	10-Jan-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera indicated preference of invoice to Chance, or cheque ready from Chance for per diems.	N/A	E00067_190208_all party Meeting Per Diem Payment
E00028	11-Jan-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Leslie Blake (Gwich'in Tribal Council)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation), (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Catherine Mallon (Gwich'in Tribal Council), Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender, Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), John Fox (Yukon Government), Derek Fraser (Yukon Government)	Meeting Coordination/Planning	Leslie confirmed attendance in Vancouver for the February 1, 2019 All-Party Meeting.	N/A	E00028_190207_Re_ Chance all party Meeting Draft Working Agenda_1
E00065	11-Jan-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	Hemmera connected Calista and Dawna to arrange travel.	N/A	E00065_190208_all party Meeting Expenses
E00077	11-Jan-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation),, Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender, Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), John Fox (Yukon Government), Derek Fraser (Yukon Government)	Engagement/Consultation Meeting Coordination/Planning	Attached Draft Working Agenda for all party meeting February 1, 2019 to be finalized.	N/A	E00077_190211_Chance all party Meeting Draft Working Agenda_1
E00135	11-Jan-19	Phone Call	Incoming	First Nation of Na-cho Nyäk Dun	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Chance received a voicemail from First Nation of Na-Cho Nyäk Dun regarding the February 1, 2019 All-Party meeting.	N/A	N/A
E00137	14-Jan-19	Phone Call	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Chance called First Nation of Na-Cho Nyäk Dun regarding attendance and logistics for the February 1, 2019 All-Party meeting.	N/A	N/A
E00139	17-Jan-19	Phone Call	Incoming	First Nation of Na-cho Nyäk Dun	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun called Chance regarding logistics for the February 1, 2019 All-Party meeting.	N/A	N/A
E00140	17-Jan-19	Phone Call	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Chance called First Nation of Na-Cho Nyäk Dun regarding the logistics of the February 1, 2019 All-Party meeting.	N/A	N/A
E00020	22-Jan-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun indicated they were working on details to get back to Emily.	N/A	E00020_190206_RE_ Chance all party Meeting_5
E00070	22-Jan-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Contribution agreement between Chance and First Nation of Na-Cho Nyäk Dun for All-Party Meeting, discussion of Chance's contribution to expenses.	N/A	E00070_190211_Chance all party Meeting
E00101	22-Jan-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Sent a notice that First Nation of Na-Cho Nyäk Dun could let Hemmera know if any more information was needed.	N/A	E00101_190212_RE_ Chance all party Meeting_4
E00052	24-Jan-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun confirmed that accommodations were secured.	N/A	E00052_190208_RE_ Hotel rooms available in Vancouver
E00089	24-Jan-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera confirmed that hotel rooms were available.	N/A	E00089_190212_Hotel rooms available in Vancouver
E00147	24-Jan-19	Phone Call	Incoming	First Nation of Na-cho Nyäk Dun	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun called Chance regarding reimbursement for expenses for the all party meeting.	N/A	N/A

E00080	28-Jan-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation),, Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), John Fox (Yukon Government), Derek Fraser (Yukon Government), Sharon Peter (First Nation of Na-cho Nyäk Dun), Millie Olson, Hemmera	Meeting Coordination/Planning	Hemmera sent final February 1, 2019 All-Party meeting agenda for February 1.	N/A	E00080_190211_Chance all party Meeting Agenda - Final version
E00037	29-Jan-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Sharon Peter (First Nation of Na-cho Nyäk Dun)	N/A	Sharon Peter (First Nation of Na-cho Nyäk Dun), Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Sharon indicated to add Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun) as team representative for First Nation of Na-Cho Nyäk Dun.	N/A	E00037_190207_RE_ Chance all party Meeting Agenda - Final version
E00114	30-Jan-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Sharon Peter (First Nation of Na-cho Nyäk Dun), Albert Peter (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera indicated that Albert would be added to printed agenda.	N/A	E00114_190212_RE_ Chance all party Meeting Agenda - Final version
E00169	01-Feb-19	Meeting	N/A	First Nation of Na-cho Nyäk Dun	N/A	Mike Chernoff (Chance), Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation),, Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation); Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Millie Olsen (FNFirst Nation of Na-cho Nyäk Dun); Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council) (Gwich'in Tribal Council); Derek Fraser (Yukon Government), John Fox (Yukon Government)	Project Description/Activities Engagement/Consultation Regulatory Process Tenures/Dispositions/Permits Confidentiality Agreement Information Sharing	Sent meeting summary.	N/A	E00169_190402__all party_Meeting_summary_Draft_v0.4 (002)
E00167	15-Feb-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance), Mike Chernoff (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation),, Darius Elias (Vuntut Gwitchin First Nation), Rose Brown, Kris Statnyk (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation); Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Millie Olsen (FNFirst Nation of Na-cho Nyäk Dun); Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council) (Gwich'in Tribal Council); Derek Fraser (Yukon Government), John Fox (Yukon Government)	Engagement/Consultation	Hemmera shared draft summary of February 1, 2019 All-Party meeting for review and indicated it was alright to share to MS Teams.	N/A	E00167_190401_RE_ Chance all party Meeting - Thank You
E00154	18-Feb-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Hemmera	Confidentiality Agreement Engagement/Consultation	Hemmera asked First Nation of Na-Cho Nyäk Dun if more information was needed about Confidentiality Agreement and capacity funding details.	N/A	E00154_190401_Chance and FNFirst Nation of Na-cho Nyäk Dun Confidentiality Agreement and Capacity Funding
E00165	26-Mar-19	Letter	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Tenures/Dispositions/Permits	Richard requested to extend tenure on Exploration Permits 0006-0011 and 0019 at Eagle Plains.	N/A	E00165_190401_Notice or Exploration Permit extension request
E00245	08-May-19	Letter	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement/Consultation	Richard sent congratulations from Chance to Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) on his re-election to be Chief for another term. Stated that Chance has enjoyed working with Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) in the past, and looked forward to future work. Chance stated they were planning to continue exploration at Eagle Plains and it would be helpful to meet with Chief, Council and key government staff members to update plans and get feedback in accordance with Engagement and Communications Plan.	N/A	E00245_Congratulatory letter to Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun).
E00246	09-May-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement/Consultation	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) said thank you to Chance for recognizing the economic opportunities in their traditional territory. They shared that they look forward to creating a solid relationship with industry and creating a template for future generations.	N/A	E00246_FW_ re_ Congratulations on recent re-election to be Chief of the Na-Cho Nyäk Dun First Nation for an other term_
E00243	10-May-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	Chance asked if possible to meet with Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) and new council next month (as election had now passed) to provide an update about exploration Project status and plans going forward. Suggested June 10, 2019, in Mayo, as an option and also suggested to meet with members of Land and Resources Department to provide an update.	N/A	E00243_Meeting June 10__
E00247	14-May-19	Phone Call	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	Richard called Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) to follow up email from last week requesting meeting on June 10, 2019 and left a message.	N/A	E00247_Telephone contact
E00249	21-May-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Site Visit/Field Work	Chance indicated that field work is planned July 10-24, 2019 and are required to consult under geoscience license guideline to inform Vuntut Gwitchin Government, First Nation of Na-Cho Nyäk Dun, and Tetlit Gwich'in Council. The field work would be based out of Eagle Plains Lodge with helicopters, and would include flying to remote outcrop locations through out Eagle Plains Basin to extract rock samples with geological hammer. No mechanical tools were planned to be used.	N/A	E00249_FW_ Geological Mapping Program Consultation

E00276	22-May-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Site Visit/Field Work Engagement/Consultation	Chance had sent email to Dawna, but as she is no longer with First Nation of Na-Cho Nyäk Dun, was transferred to Josee's extension by front desk, so there was an assumption that Josee has taken on responsibilities of Donna's position. Following up about field work for summer. Chance indicated they were working with Hemmera to set up a Meeting with First Nation of Na-Cho Nyäk Dun to provide an update and present Project Description for June 10th. Required to consult under geoscience license guideline to inform Vuntut Gwitchin Government, First Nation of Na-Cho Nyäk Dun and Tetlit Gwich'in Council, and field work was planned July 10-24, 2019. The field work would be based out of Eagle Plains Lodge with helicopters, and would include flying to remote outcrop locations through out Eagle Plains Basin to extract rock samples with geological hammer. No mechanical tools were planned to be used.	N/A	E00276_Meeting_
E00277	23-May-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Colleen Fraser (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Josee at First Nation of Na-Cho Nyäk Dun indicated she is acting in position until further notice and appreciates communication about the Project. June 10th marked on calendar. Indicated that Hemmera can contact Colleen to make arrangements, and to let Colleen know if neEnvironmental Dynamics Inc. any support for summer field work.	N/A	E00277_RE_ Meeting_1
E00278	23-May-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Colleen Fraser (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Chance thanked First Nation of Na-Cho Nyäk Dun for the email, and indicated they would coordinate with Colleen for June 10th meeting.	N/A	E00278_RE_ Meeting_2
E00454	03-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Greg Charlie (Chance)	Colleen Fraser (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera began coordinating the June 10th meeting with First Nation of Na-Cho Nyäk Dun and wanted to confirm if they had a room available. Indicated there would be handouts, and so there was no need for a projector. Asked if transportation to and from the airport for the meeting could be arranged.	N/A	E00454_RE_ Chance Meeting Coordination_1
E00455	03-Jun-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Colleen Fraser (First Nation of Na-cho Nyäk Dun)	N/A	Colleen Fraser (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun indicated that pick up at the airport was not a problem and that the Multi purpose room had been booked. Asked about the meeting time and need for any posters to be put up, as well as if there was anything else they could do.	N/A	E00454_RE_ Chance Meeting Coordination_1
E00456	03-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Greg Charlie (Chance)	Colleen Fraser (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera thanked First Nation of Na-Cho Nyäk Dun for booking the room and arranging a ride from the airport. Hemmera indicated they would have a few posters to put up and will have hand out material. Hemmera asked Chance about what time did was decided upon to hold the meeting.	N/A	E00454_RE_ Chance Meeting Coordination_1
E00459	03-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Colleen Fraser (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Indicated that the meeting will be 10-12. Coordination around lunch and catering was discussed.	N/A	E00459_RE_ Chance Meeting Coordination_2
E00460	03-Jun-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Colleen Fraser (First Nation of Na-cho Nyäk Dun)	N/A	Colleen Fraser (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun offered to arrange someone to cater and asked if there was a poster to be posted around town.	N/A	E00459_RE_ Chance Meeting Coordination_2
E00461	03-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Colleen Fraser (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera explained that there was not a need to put up posters around town. Hemmera stated that they would host a community event later and would then need to post posters around town. The participants for lunch were listed as 5 from Chance, and then those that attend from First Nation of Na-Cho Nyäk Dun. Asked if the restaurant could accommodate a large group and where was it located. Asked if the group would rather go out for lunch or have it catered.	N/A	E00459_RE_ Chance Meeting Coordination_2
E00471	05-Jun-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Colleen Fraser (First Nation of Na-cho Nyäk Dun)	N/A	Colleen Fraser (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun indicated catering would be best and that they had hired a caterer for June 10.	N/A	E00471_FW_ Chance Meeting Coordination
E00265	06-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Colleen Fraser (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	Meeting invitation was sent for June 10, 10-1. This Meeting was for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin. Additional agenda items include next steps with YESAB and the process for reviewing First Nation of Na-Cho Nyäk Dun Project Effects as well as the annual reporting required on the implementation of the Engagement and Communication Plan.	N/A	E00293_First Nation of Na-cho Nyäk Dun and Chance Exploration Project Description Meeting
E00293	06-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Colleen Fraser (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Finalized agenda and calendar invite for meeting between Chance and First Nation of Na-Cho Nyäk Dun the following week.	Attachment: 1906060_FNFirst Nation of Na-cho Nyäk Dun_Chance_Meeting_Agenda for June 10_DRAFT	E00265_Draft Agenda for Chance and First Nation of Na-cho Nyäk Dun Meeting June 10
E00297	06-Jun-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Colleen Fraser (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun) cc: Carol Canbibber, Dawna Day, Admin Floater, gapexp@yahoo.ca, Hemmera	Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun thanked Hemmera for organization and said they were looking forward to meeting on June 10th.	N/A	E00297_RE_ Draft Agenda for Chance and First Nation of Na-cho Nyäk Dun Meeting June 10
E00319	06-Jun-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Halona Johnny (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Colleen Fraser (First Nation of Na-cho Nyäk Dun), Dawna Hope (First Nation of Na-cho Nyäk Dun), Carol Vanbibber (First Nation of Na-cho Nyäk Dun)(First Nation of Na-cho Nyäk Dun)(First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun confirmed the orange room was reserved for meeting on June 10th.	N/A	E00319_Accepted_ First Nation of Na-cho Nyäk Dun and Chance Exploration Project Description Meeting
E00295	07-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Colleen Fraser (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Project Description/Activities Meeting Coordination/Planning	Hemmera sent Draft Project Description and presentation for meeting attached, and asked to distribute to those attending the meeting. Indicated that they would bring paper copies, and asked people in e-mail to provide an estimate of attendees.	Attachments: 190604_Chance_Presentation+ExCom_FN First Nation of Na-cho Nyäk DunMayo_v0.4, 190605_Chance Eagle Plains Project Description	E00295_Meeting Material for Chance Meeting June 10
E00420	07-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Colleen Fraser (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera asked if they should bring a small portable projector to the June 10 meeting.	N/A	E00420_RE_ Draft Agenda for Chance and First Nation of Na-cho Nyäk Dun Meeting June 10
E00259	11-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Information Sharing Engagement/Consultation	Hemmera sent background information following June 10th meeting.	Attachments: •Engagement and Communications Plan with accompanying First Nation of Na-cho Nyäk Dun Letter to Minister Pillai •all party Meeting summary •2014 Evaluation Report •Meeting Summaries	E00259_Chance Background Material
E00477	13-Jun-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Colleen Fraser (First Nation of Na-cho Nyäk Dun)	N/A	Colleen Fraser (First Nation of Na-cho Nyäk Dun), Annabelle Lattie (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Information Sharing	First Nation of Na-Cho Nyäk Dun asked Annabelle to invoice Geoscience for the catering of this meeting. First Nation of Na-Cho Nyäk Dun also asked Emily to advise Anabelle about the information needed to invoice.	N/A	E00477_RE_ PageWide Scan

E00269	14-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Site Visit/Field Work Engagement/Consultation	Chance attached details for First Nation's participation in Chance's fieldwork this summer and requested to give thought to potential participants.	Attachment: Chance FN Participant Information	E00269_FNFirst Nation of Na-cho Nyäk Dun Participation in Chance Fieldwork
E00478	14-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Colleen Fraser (First Nation of Na-cho Nyäk Dun), Annabelle Lattie (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement	Hemmera indicated that invoice can be sent to Richard Wyman (Chance) at Chance and provided Chance's billing address. Indicated that Lynn O'Neil would be the main contact for invoicing.	N/A	E00477_RE_ PageWide Scan
E00261	17-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Todd Mahon	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation Site Visit/Field Work	Hemmera state that dates were set for participation in Field Surveys. Proposed the following logistics for First Nation participation: 1) Each FN with territory overlapping Project area could have up to two Citizens participate 2) Work would be physically demanding, require hiking steep, rugged terrain and thick bush, requiring average or above-average fitness to participate 3) Limited spots available for participants due to helicopter constraints and availability at Eagle Plains Hotel, and asked that First Nation of Na-Cho Nyäk Dun please respond as soon as possible to Emily or Callista (Hemmera) to confirm availability 4) Participants should arrive on start date, but not mandatory to stay for duration of field study 5) All travel, including flights, vehicle travel to Eagle Plains Hotel, and stay in hotel were to be booked by the FN and billed to Chance. Table of Opportunities were provided by date. Purpose of participation would be to observe fieldwork and gain first hand understanding of the research. Deadline for Vegetation Survey # 1 was shared to be June 19th.	Attachment: Chance FN Participant Information	E00261_Chance Field Surveys-First Nation of Na-cho Nyäk Dun
E00254	24-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Information Sharing	Hemmera attached Notice Letter regarding DFO Licence Application for Environmental Dynamics Inc's Fish Studies.	Attachment: DFO license application Nacho Nyäk Dun	E00254_Notice Letter_ DFO application for upcoming fish studies (3)
E00256	24-Jun-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Ronalda Moses (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation	First Nation of Na-Cho Nyäk Dun thanked Hemmera for information on DFO Application. Indicated to copy Ronalda Moses (First Nation of Na-cho Nyäk Dun) on any future communication between First Nation of Na-Cho Nyäk Dun and Chance.	N/A	E00256_RE_ Notice Letter_ DFO application for upcoming fish studies-FNFirst Nation of Na-cho Nyäk Dun
E00257	24-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Ronalda Moses (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation	Hemmera acknowledged instructions to copy Ronalda Moses (First Nation of Na-cho Nyäk Dun) at First Nation of Na-Cho Nyäk Dun going forward.	N/A	E00256_RE_ Notice Letter_ DFO application for upcoming fish studies-FNFirst Nation of Na-cho Nyäk Dun
E00266	25-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Ronalda Moses (First Nation of Na-cho Nyäk Dun), Hemmera	Information Sharing Engagement/Consultation	Draft summary of June 10 meeting in Mayo between Chance and First Nation First Nation of Na-Cho Nyäk Dun.	Attachment: 190610_Draft_June10_FNFirst Nation of Na-cho Nyäk Dun-Chance_Meeting_summary_v0.1	E00266_Draft June 10th Meeting summary for Review
E00314	27-Jun-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Ronalda Moses (First Nation of Na-cho Nyäk Dun), Hemmera	Information Sharing	Hemmera shared revisions from Environmental Dynamics Inc. for the DFO Application with an attachment.	Attachment: 190627_First Nation of Na-cho Nyäk Dun_Notice Letter_DFO Permit_WithRevisions and peel_watershed_fish_habitat_assessment	E00314_RE_ Notice Letter_ DFO application for upcoming fish studies (2)
E00483	09-Jul-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Todd Mahon	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Ronalda Moses (First Nation of Na-cho Nyäk Dun), Hemmera	Site Visit/Field Work	Hemmera asked if First Nation of Na-Cho Nyäk Dun had any interest for participation in the Chance field surveys. They shared the surveys there was still time to participate in.	N/A	E00483_RE_ Chance Field Surveys_1
E00485	09-Jul-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Todd Mahon	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Ronalda Moses (First Nation of Na-cho Nyäk Dun), Hemmera	Site Visit/Field Work	Hemmera updated the highlighted list of surveys in previous e-mails to include all the surveys at the end of July and early August 2019 and identified that those surveys were still available to join.	N/A	E00485_RE_ Chance Field Surveys_3
E00591	15-Jul-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Lynn O'Neil	Ronalda Moses (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	Richard (Chance) indicated he would like to meet with Ronalda (First Nation of Na-Cho Nyäk Dun) and Josee Tremblay (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) and other interested government representatives on August 12 in Mayo. He explained that his colleagues and Chance's Hemmera advisors would be returning from the GA in Old Crow on August 10 via Dawson, so it might make sense for them to continue their engagement discussions as they advanced towards a YESAB submission in early 2020. He explained that Chance would rent a vehicle in Dawson and drive to Mayo for the meeting, and asked First Nation of Na-Cho Nyäk Dun to please let them know if that would work.	N/A	E00591_Meeting on August 12_
E00491	24-Jul-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Ronalda Moses (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation Meeting Coordination/Planning	Hemmera sent a follow-up e-mail for 2 items for Chance: the draft Communications and Engagement Plan Implementation Report, and the proposed meeting on August 13 in Mayo. Hemmera asked if First Nation of Na-Cho Nyäk Dun would like to provide feedback on the draft report, and indicated that they would like that feedback by . For the proposed meeting, Hemmera explained that the Chance team would be in Dawson August 12 and was proposing travel to Mayo August 13. At this meeting, Chance wanted to discuss Project updates and a Cooperation Agreement template. First Nation of Na-Cho Nyäk Dun also mentioned that Meeting with Chief and Council might be good. Hemmera asked First Nation of Na-Cho Nyäk Dun to please let them know their preference.	N/A	E00491_Feedback on Draft Plan Implementation Report and August 13 Meeting
E00320	25-Jul-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Ronalda Moses (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Richard (Chance) followed up about meeting on August 12 to discuss the exploration Project and details around capacity funding. He indicated that they would like to change the meeting date to August 13, as there is a conflict on August 12 meeting with TH in Dawson. He asked if First Nation of Na-Cho Nyäk Dun was able to meet with Chance on August 13, in Mayo.	N/A	E00320_August Meeting inquiry_3
E00321	25-Jul-19	Email	Incoming	First Nation of Na-cho Nyäk Dun	Ronalda Moses (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Ronalda Moses (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation Meeting Coordination/Planning	Ronalda (First Nation of Na-Cho Nyäk Dun) inquired about why Chance is not meeting together with the First Nations, instead of separately.	N/A	E00321_RE_ August Meeting inquiry_2

E00322	25-Jul-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Ronalda Moses (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation Meeting Coordination/Planning	Chance replied that they would love to meet collectively with all the affected First Nations, but have not had indications from the various First Nation governments that they wish to continue gathering in All-Party meetings. Richard (Chance) explained that he felt there would merit in meeting all together where Value Components of the Eagle Plains area were common. Richard asked if it was possible to meet with First Nation of Na-Cho Nyäk Dun on August 13 in Mayo. He indicated he would be driving from Dawson and returning to Dawson on the same day.	N/A	E00322_August Meeting inquiry_1
E00500	25-Jul-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement Reports/OIC Requirements	Hemmera attached Chance's Environmental Dynamics Inc.ts to the Draft Plan Implementation report.	attached: 190715_DRAFT Plan Implementation Report_TH_RMW.docx	E00500_FW_ Draft Annual Report to Yukon Government regarding Engagement and Communications with First Nation of Na-cho Nyäk Dun
E00536	30-Jul-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Ronalda Moses (First Nation of Na-cho Nyäk Dun)	Engagement Reports/OIC Requirements	Hemmera followed up on First Nation of Na-Cho Nyäk Dun Comments on Draft Implementation Report. They indicated that they left a voice mail, and also followed up with Ronalda (First Nation of Na-Cho Nyäk Dun) yesterday, but have not hear back. Hemmera explained that the final report would be due to Yukon Government tomorrow, and they were hoping that First Nation of Na-Cho Nyäk Dun could review and sign off on the content. They asked to please let Hemmera know if First Nation of Na-Cho Nyäk Dun would like to provide revisions by noon the next day so Hemmera had the opportunity to revise with First Nation of Na-Cho Nyäk Dun's feedback, otherwise Hemmera indicated they would submit to Yukon Government tomorrow at 4 pm.	attached: 190715_Draft Plan Implementation Report_FNFirst Nation of Na-cho Nyäk Dun, 190715_DRAFT Plan Implementation Report_FNFirst Nation of Na-cho Nyäk Dun_RMW.docx	E00536_RE_ Draft Plan Implementation Report to Review_8
E00543	31-Jul-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Ronalda Moses (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement Reports/OIC Requirements	Hemmera indicated they had prepared reports for Yukon Government on behalf of Chance on the implementation of the Communications and Engagement Plan that First Nation of Na-Cho Nyäk Dun and Chance completed last summer (Draft Plan Implementation Report). It was previously discussed that both First Nation of Na-Cho Nyäk Dun and Chance would review this report and sign to demonstrate both parties agreed to the report's contents. Hemmera indicated that they had not heard back with revisions or approval of the report, and explained they would submit the report to Yukon Government as a draft, however any feedback was welcome.	attached: 190715_Draft Plan Implementation Report_FNFirst Nation of Na-cho Nyäk Dun, 190715_DRAFT Plan Implementation Report_FNFirst Nation of Na-cho Nyäk Dun_RMW.docx	E00543_FW_ Draft Plan Implementation Report to Review
E00544	31-Jul-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Derek Fraser (Yukon Government) Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement Reports/OIC Requirements	Hemmera sent the attached annual report on the implementation of the First Nation of Na-Cho Nyäk Dun and Chance Engagement and Communication Plan (Draft Plan Implementation Report) to Yukon Government. Hemmera indicated that the report had been reviewed and signed by Chance, but had not yet been reviewed or signed by First Nation of Na-Cho Nyäk Dun despite their efforts to send the draft report and follow-up. Hemmera indicated they would let Yukon Government know if they had received any feedback.	attached: 190731_FNFirst Nation of Na-cho Nyäk Dun and Chance Plan Implementation Report.pdf	E00544_Annual Plan Implementation Report - FNFirst Nation of Na-cho Nyäk Dun and Chance
E00346	09-Aug-19	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Richard (Chance) sent Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) a note indicating it was great to connect by telephone earlier that morning. Richard was following up to bring awareness to colleagues and advisors at Hemmera of the potential to meet with Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) and First Nation of Na-Cho Nyäk Dun's new council on August 13 in Mayo. Richard indicated it would be an opportunity to introduce themselves to those unfamiliar with Chance and to summarize Chance's exploration plans. He indicated they were presently in Old Crow attending the GA but travelling to Dawson on Saturday to meet with Tr'ondëk Hwëch'in officials. Richard indicated if Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) was able to arrange to meet with them at Chance, they would drive to Mayo morning, so they could arrive around 10am. Richard explained the Chance team would have to be back in Dawson for 3:30pm. Richard thanked Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) in advance for setting up this meeting on short notice and indicated that Chance looked forward to meeting with him and members of the First Nation of Na-Cho Nyäk Dun council.	N/A	E00346_FW August 13 Meeting
E00388	09-Aug-19	Phone Call	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) (Chief of First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	Richard (Chance) called Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) about meeting with Council at 10am on August 13, 2019. First Nation of Na-Cho Nyäk Dun indicated they would organize a group for the meeting and would call back on August 12 to confirm the meeting.	N/A	N/A
E00390	12-Aug-19	Phone Call	Incoming	First Nation of Na-cho Nyäk Dun	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) (Chief of First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	Greg (Chance) called Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) and First Nation of Na-Cho Nyäk Dun confirmed they were unable to meet on August 13 and requested to meet at another time.	N/A	E00390_190812_FW_First Nation of Na-cho Nyäk Dun Canceled Meeting
E00602	28-Jan-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Tenures/Dispositions/Permits DO Project Engagement/Consultation	Richard (Chance) indicated they would be applying to the Yukon Government very shortly to extend the tenure of Exploration Permit 20. The application would be for the maximum period allowable under the Oil and Gas Act of 5 years. This permit included one suspended well at McParlon A-25 which Chance was hoping to use for fluid disposal of any produced water associated with the proposed exploration Project. Chance was at an interm Environmental Dynamics Inc.ate stage of discussions with the Manager of Oil and Gas Operations with Yukon to extend the suspended well status on the suspended wells at Eagle Plain. A manager had indicated that Chance would need to do some physical assessments of the legacy wells to confirm the integrity of the wells before granting an extension. The assessments would require access to 3 suspended wells at SDL M-08, G-08, and J-19 as well as M-59 in order to do the work. Chance was anticipating a service rig, cement pumping equipment, and wireline services to be used to conduct the assessments. They anticipated taking temperature measurements in wells to evaluate permafrost depth. The program was expected to take 1-2 months. This would be a winter operation and would be done during the winter of 2020-2021 and may require a designated office screening by YESAB. Chance explained that they would provide more information as soon as possible.	N/A	E00602_FW_ Suspended wells and Exploration Permit 20_4

E00646	23-Mar-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Roberta Hager (First Nation of Na-cho Nyäk Dun), Barb Buyck (First Nation of Na-cho Nyäk Dun), Irene Johnny(First Nation of Na-cho Nyäk Dun), Andy Lucas (First Nation of Na-cho Nyäk Dun), Elders Councilor (First Nation of Na-cho Nyäk Dun), Sharon Peter (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Information Sharing	Richard (Chance) shared information about Chance's ongoing initiatives, some of which were time sensitive, and all required engagement with the affected First Nations. A summary of these initiatives was provided below: 1. Application to the Yukon Government to get tenure extension on Exploration Permit 0020 which was set to expire on August 30, unless extended. This permit was located mostly in the Traditional Territory of the Vuntut Gwichin, but a portion is in the Secondary Use Area of the Tetlit Gwich'in and in the overlap area with First Nation of Na-Cho Nyäk Dun Traditional Territory. There was a suspended well in this Permit at McParlon A-25 which has ongoing value to Chance. 2. There were several suspended wells at the Chance Significant Discovery License (SDL 022) and one at the Blackie SDL (SDL 021) which the Yukon Government requires Chance to undertake some maintenance work. This activity would require an impact assessment by the Designated Office (DO) of YESAB in Dawson prior to permissions being granted by Yukon Government to undertake the work. The plan was to submit to the DO of the program in the next month with the objective of being able to do the work over approximately a 6 week to two month period in the winter of 2020-2021. This was a regulatory requirement made by the Manager of Oil and Gas Operations with the Yukon Government. Importantly for First Nation of Na-Cho Nyäk Dun's knowledge, there was no indication that these suspended wells had any problems, but they were wells that were drilled in the 1960's so the regulator had asked for work to be done in order to be able to continue the suspended status of these wells. 3. Continuing engagement with respect to the multi-well drilling and seismic data acquisition Project that had been described to First Nation of Na-Cho Nyäk Dun in the past couple of years. A current map of Chance landholdings was attached for First Nation of Na-Cho Nyäk Dun's reference. Chance indicated that because of the COVID 19 outbreak, travel and face to face get togethers were not appropriate, if not prohibited, so they would have to make arrangements to exchange information in writing, electronically and by conference call. They explained there was quite a geographic spread for everyone to manage and that Chance looked forward to	Attachment:Chance_Permits_geoscience_9 Sept2019.pdf	E00646_Chance Update_FNFirst Nation of Na-cho Nyäk Dun
E00673	25-May-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Hemmera	Project Description/Activities DO Project	Hemmera indicated that Chance was preparing a proposal for well maintenance work in the Eagle Plains. They attached a letter meant to initiate engagement and to provide initial Project information, and asked to please let Hemmera know if there were any issues opening the attachment.	Attachment: 200522_Chance_WellMaintenance_Initiation_of_Engagement_FNFirst Nation of Na-cho Nyäk Dun_FINAL_signed_map	E00673_Chance - Proposal for Well Maintenance Work (Initiation of Engagement with First Nation of Na-cho Nyäk Dun)
E00675	26-May-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Calista Morrison (Hemmera)	Project Description/Activities DO Project Engagement/Consultation	Email read receipt	N/A	E00675_Read_ Chance - Proposal for Well Maintenance Work (Initiation of Engagement with First Nation of Na-cho Nyäk Dun)
E00818	26-May-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation DO Project	Email read receipt	N/A	E00818_Read_ Chance - Proposal for Well Maintenance Work (Initiation of Engagement with First Nation of Na-cho Nyäk Dun)
E00682	09-Jun-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Meeting Coordination/Planning	Greg (Chance) sent First Nation of Na-Cho Nyäk Dun follow up from our program description from a few weeks prior and asked if they had any questions or comments to contact Chance. Greg said if First Nation of Na-Cho Nyäk Dun would like a call with Chance to provide an overview of the program, they'd be happy to organize.	N/A	E00682_Chance Well Maintenance DO
E00796	09-Jun-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Meeting Coordination/Planning	Greg (Chance) sent First Nation of Na-Cho Nyäk Dun follow up from our program description from a few weeks prior and asked if they had any questions or comments to contact Chance. Greg said if First Nation of Na-Cho Nyäk Dun would like a call with Chance to provide an overview of the program, they'd be happy to organize.	N/A	E00796_RE_ Chance Well Maintenance DO
E00797	24-Jun-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation DO Project	Hemmera reached out to First Nation of Na-Cho Nyäk Dun see if they had any questions about Chance's proposed well maintenance work. They re-attached the May 25 letter that was sent via email. Referring to Greg's (Chance) past email mentioned below, Hemmera said they would be more than happy to set up a conference call to provide a brief overview of the Project and answer any questions First Nation of Na-Cho Nyäk Dun may have.	Attachment: 2005_Chance_WellMaintenance_Initiation_of_Engagement_FNFirst Nation of Na-cho Nyäk Dun_FINAL_signed_map.pdf	E00796_RE_ Chance Well Maintenance DO
E00819	25-Jun-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation DO Project	Email read receipt	N/A	E00819_Read_ Chance Well Maintenance DO
E00710	13-Jul-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement Reports/OIC Requirements	Hemmera prepared a draft report on implementation of First Nation of Na-Cho Nyäk Dun and Chance Engagement and Communication Plan for First Nation of Na-Cho Nyäk Dun and Chance to review (Annual Report of First Nation of Na-Cho Nyäk Dun and Chance Engagement Activities). This report summarized Meetings/correspondence that have occurred between First Nation of Na-Cho Nyäk Dun and Chance since completing the 2019 Annual Report. Hemmera attached the draft as a Word Document, and asked both First Nation of Na-Cho Nyäk Dun and Chance to make revisions to that document in tracked changes, which would assist them in creating a final version. Hemmera suggested that if any issues arose between parties' revision, they could be addressed via email or a quick call. Once revisions had been incorporated and the document would be considered final by First Nation of Na-Cho Nyäk Dun and Chance, Hemmera would send the final version to both parties to sign. They had also attached, as a pdf, a draft of First Nation of Na-Cho Nyäk Dun and Chance's Engagement Log which functioned as Appendix D for the report. They asked that reviews be completed by , July 24. Hemmera included a reminder that reports needed to be signed and submitted to Yukon Government on July 31.	Attachments: 200713_Plan Implementation Report_FNFirst Nation of Na-cho Nyäk Dun_DRAFTv0.4.docx, 200713_AppendixD_FNFirst Nation of Na-cho Nyäk Dun_EngagementLog_DRAFT.pdf	E00710_DRAFT 2020 Annual Report of FNFirst Nation of Na-cho Nyäk Dun and Chance Engagement Activities - For Review(0)
E00741	14-Jul-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement Reports/OIC Requirements	Hemmera sent a note to First Nation of Na-Cho Nyäk Dun as they noticed a discrepancy between an email address we used to have on file for First Nation of Na-Cho Nyäk Dun and a new email that they had received some read receipts from recently (which was also on the First Nation of Na-Cho Nyäk Dun website). They asked if it was First Nation of Na-Cho Nyäk Dun's correct address, and said if they didn't hear from First Nation of Na-Cho Nyäk Dun that same day or the next day, they'd give First Nation of Na-Cho Nyäk Dun a call to confirm.	Attachments: 200713_Plan Implementation Report_FNFirst Nation of Na-cho Nyäk Dun_DRAFTv0.4.docx, 200713_AppendixD_FNFirst Nation of Na-cho Nyäk Dun_EngagementLog_DRAFT.pdf	E00741_FW_ DRAFT 2020 Annual Report of FNFirst Nation of Na-cho Nyäk Dun and Chance Engagement Activities - For Review

E00767	20-Jul-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance),	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Lands Manager, Nathan Aasman, Andrew MacPhail, Shena Shaw (Hemmera)	Engagement/Consultation DO Project	Hemmera sent an email to First Nation of Na-Cho Nyäk Dun that Chance was nearing completion of its proposal for well maintenance in the Eagle Plains and hoped to submit to the YESAB within the next two weeks. Chance and Hemmera provided an introductory letter, Project summary, and map via email on May 25, 2020 and again on June 24, 2020. Hemmera indicated that their original correspondence was to Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) and Josee Tremblay (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun). Hemmera identified that they may have used an outdated email address for Josee, so they had included an updated email address as well as the previous one in the correspondence. Hemmera explained that they value any feedback First Nation of Na-Cho Nyäk Dun may have with respect to this proposed Project and looked forward to working with First Nation of Na-Cho Nyäk Dun during the assessment process.	N/A	E00767_Chance - Proposal for Well Maintenance Work (Engagement with First Nation of Na-cho Nyäk Dun).msg
E00742	24-Jul-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Lands Manager, Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement/Consultation DO Project	Hemmera sent First Nation of Na-Cho Nyäk Dun an attached draft copy of Chance's YESAB Project Proposal for the Eagle Plains Well Maintenance Project. Hemmera explained that in order for Chance to receive its approvals before the winter season, Chance's application would need to be submitted very shortly after this draft was sent to First Nation of Na-Cho Nyäk Dun (on the current day). Hemmera indicated that at that time, their goal was to submit the Project Proposal by the middle of the following week. Hemmera explained stated that since the document had not gone through Hemmera's formatting procedure, it was absent some of the figures and appendices. Hemmera said that in the meantime they had attached the Spill Response Plan which would be Appendix B. Hemmera said that Chance continues to be committed to engaging with the First Nation of Na-Cho Nyäk Dun, and if First Nation of Na-Cho Nyäk Dun wished to discuss the proposed Project in more detail, they could contact Chance or Hemmera.	Attachment: 200724_Chance_YESAB_PP_DRAFT.docx ; Spill Response Plan.docx	E00766_Chance Eagle Plains Well Maintenance Project - Draft YESAB Project Proposal.msg
E00766	24-Jul-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Lands Manager, Hemmera	Engagement Reports/OIC Requirements	Hemmera wanted to check in and see how First Nation of Na-Cho Nyäk Dun's review of the Annual Report of First Nation of Na-Cho Nyäk Dun and Chance Engagement Activities was going? They also apologized for not checking in sooner in the week. Referring to a previous email, Hemmera explained that despite their typo below, the reports were due to Yukon Government July 31, 2020. Not 2019, and there was no time travel involved.	Attachments: 200713_Plan Implementation Report_FNFirst Nation of Na-cho Nyäk Dun_DRAFTv0.4.docx, 200713_AppendixD_FNFirst Nation of Na-cho Nyäk Dun_EngagementLog_DRAFT.pdf	E00742_DRAFT 2020 Annual Report of FNFirst Nation of Na-cho Nyäk Dun and Chance Engagement Activities - For Review
E00743	31-Jul-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Derek Fraser (Yukon Government), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Engagement Reports/OIC Requirements	Hemmera sent the Yukon Government the attached 2020 Annual Report on the Implementation of the First Nation of Na-Cho Nyäk Dun (First Nation of Na-Cho Nyäk Dun) and Chance Engagement and Communication Plan. They explained that these reports had been prepared using Meeting agendas and summaries drafted by Hemmera and subsequently reviewed and agreed to by the parties. This report had been reviewed by Chance, but not reviewed by First Nation of Na-Cho Nyäk Dun, despite Hemmera's best efforts. Hemmera explained that the signature lines had been removed and the Draft watermark remained. Hemmera identified that should First Nation of Na-Cho Nyäk Dun wish to provide Environmental Dynamics Inc.ts at a later date, they would be happy to incorporate them and prepare a final report, including signatures, for submission to Yukon Government.	Attachment: 200731_Plan Implementation Report_FNFirst Nation of Na-cho Nyäk Dun_DRAFTv0.5wAppendixD.pdf	E00743_2020 Annual Report - First Nation of Na-Cho Nyäk Dun and Chance Engagement and Communication Plan
E00744	03-Aug-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Derek Fraser (Yukon Government), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Stephan Walke (First Nation of Na-cho Nyäk Dun)	Engagement Reports/OIC Requirements	Josee Tremblay (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) said First Nation of Na-Cho Nyäk Dun would be reaching out for a potential meeting update with Hemmera upon her return after August 18, 2020.	N/A	E00744_RE_ 2020 Annual Report - First Nation of Na-Cho Nyäk Dun and Chance Engagement and Communication Plan
E00745	03-Aug-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Ellenise Profeit (First Nation of Na-cho Nyäk Dun), Stephan Walke (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation	Josee Tremblay (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) responded that their correct email address is: landsmanager@First Nation of Na-Cho Nyäk Dun.com	N/A	E00745_RE_ DRAFT 2020 Annual Report of FNFirst Nation of Na-cho Nyäk Dun and Chance Engagement Activities - For Review
E00775	07-Aug-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	DO Project Engagement/Consultation Meeting Coordination/Planning	Richard (Chance) sent First Nation of Na-Cho Nyäk Dun an email intended to give them early notice that Chance had not yet submitted their Well Maintenance Program Project Proposal to YESAB due to evolving discussions with the regulator. The amendments were being incorporated into the Project Description and effects assessment over the next week or two as they managed vacation absences. Richard explained that once updated, Chance would share the updated YESAB submission with First Nation of Na-Cho Nyäk Dun to review. They suggested that a follow up conference call or Microsoft Teams Meeting be arranged with First Nation of Na-Cho Nyäk Dun to address their questions or respond to their comments to the amendments.	N/A	E00775_Fwd_Well Maintenance Program amendments.msg
E00999	21-Aug-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	DO Project Description/Activities	Email read receipt	N/A	E00999_FW_ Well Maintenance Program amendments.msg
E00872	27-Aug-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Engagement/Consultation	Email read receipt	N/A	E00872_Read_ Chance - Proposal for Well Maintenance Work (Engagement with First Nation of Na-cho Nyäk Dun)

E00909	28-Aug-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief	DO Project Description/Activities	Hemmera indicated that further to Richard's email dated August 7, Chance had made revisions to the Project Description for the Designated Office Evaluation of the proposed Well Maintenance Program. As a result of those changes, Hemmera had also revised the effects assessment sections of the Project Proposal. Hemmera outlined the reasons for the revisions that were been provided to them by Chance and a brief summary of the amendment itself:1. Ongoing conversations between Chance and Yukon Government, Oil and Gas Branch at the Yukon Government necessitated the changes. While Chance was previously of the impression wells could continue to be suspended, Yukon Government was now directing Chance to conduct inspection and maintenance activities for all eight suspended wells and then abandon those wells or bring them into active status. Chance was now proposing to abandon six wells and to bring the remaining two wells into active status as deep-injection wells. Waste fluid produced during the abandonment of the six wells would then be disposed of via injection into the deep-injection wells. No oil or gas was expected to be produced from the two wells proposed to be activated; they would specifically be used for disposal of waste fluid from activities associated with these maintenance activities. 2. At that time, Chance could not confirm whether it would use the Eagle Plains Hotel or the existing Chance Camp for housing workers over the duration of the Project. The decision to utilize the Eagle Plains Hotel or the Chance Camp would be made when the Project schedule is finalized. It would also have to take into consideration the Hotel's ability to accommodate Chance workers over the full duration of the Project as well as COVID-19 related self-isolation requirements at that time. As a result both options were considered in the effects assessment for the housing of the Project workforce.3. When the Chance field team were at Eagle Plain early August, they observed that the route used to access M-59 would require realignment of the final portion of Blackie Winter Road. The section of the original route that proceeded north for the final kilometer was not ideal for traffic due to steeper terrain. The steeper route would result in a significant risk to the trucks bearing heavy loads, fuel supply, and other fluid handling shipments. Chance was proposing shifting the final portion of Blackie Winter Road east of the original route in order to attain a much gentler gradient.	Attachments: Fwd: Well Maintenance Program amendments.msg, 200828_Chance_YESAB-DO_ProjectProposal_REVISED.pdf	E00909_Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED (73
E00871	29-Aug-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Engagement/Consultation	Email read receipt	N/A	E00871_Read_ Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED
E00903	15-Sep-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	DO Project Engagement/Consultation Project Description/Activities	Hemmera stated that since their email dated August 28, they had been in the final stages of concluding the revised DO Project Proposal for Chance's Well Maintenance program. Hemmera said that they had appreciated First Nation of Na-Cho Nyäk Dun's feedback and worked to include that into the application. Hemmera explained that Chance's timeline for completing this work was tied to compliance with regulations, so in an effort to ensure that the maintenance activities could occur that winter Chance needed to submit the application last week. It was submitted late evening and today Hemmera received confirmation that the Project was on the YESAB registry. Hemmera acknowledged that First Nation of Na-Cho Nyäk Dun may have future comments on the Project as it progressed through the YESAB process. Hemmera continued to look forward to hearing First Nation of Na-Cho Nyäk Dun's views and were happy to hold additional meetings to discuss and answer any questions First Nation of Na-Cho Nyäk Dun may have. They provided a link to the registry: Project 2020-0151 Eagle Plains Well Maintenance and Winter Activities	N/A	E00903_Chance DO Project (Well Maintenance) - YESAB Registry Information (52)
E00857	16-Sep-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	Erika Tizya-Tramm (VGFN), Derek Fraser (Yukon Government) (Yukon Government), John Fox (Yukon Government) (Yukon Government), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Engagement/Consultation DO Project Cooperation Agreement	Greg (Chance) sent First Nation of Na-Cho Nyäk Dun, Vuntut Gwitchin First Nation (VGFN), and Yukon Government the most recent agreement Chance had with signatures from all parties to section 68 of Yukon Oil and Gas Act. Chance stated that they hoped this would help with the beginning of their discussion on the Workover Project. They asked to please feel free to let Chance know what would be the next steps to begin their discussion.	Attachment: 2013 BA - Northern Cross-4 party.pdf	E00857_Section 68 Agreement
E00928	17-Sep-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Benefits/Capacity Agreement DO Project Engagement/Consultation	Richard (Chance) provided a short update to initiate discussions beginning as soon as possible regarding a Benefits Agreement among the First Nation of the First Nation of Na-Cho Nyäk Dun (First Nation of Na-Cho Nyäk Dun), the Vuntut Gwitchin First Nation (VGFN), Yukon Government, and Chance in accordance with Section 68 of the Yukon Oil and Gas Act. Hemmera, acting on behalf of Chance, filed a Project description with the Designated Office of the YESAB in Dawson last week concerning required work on eight suspended wells operated by Chance at Eagle Plain. The Project was small scale and was anticipated to be completed in a two to three-month period during the winter of 2020-2021. The plan would be to prepare for and abandon six of these wells and convert two others to be used for disposal of well bore fluids used in the abandonment procedures and/or recovered in the process. The activities were governed by Yukon Government oil and gas regulations and are routine oilfield practices. Details were provided in the submission document, but if there were any questions or comments, Richard said to please feel free to contact them or any of their colleagues at Chance. The Project area was mostly in the traditional territory of the VGFN, but one of the wells to be abandoned was located in the overlap area on the east side of the Dempster at Blackie M-59 which was also in Significant Discovery License 021. Although small scale, the Project triggered the need for a benefits agreement with the First Nations who are affected by the activities, Yukon Government acting on behalf of all Yukoners and the proponent, namely Chance. Chance asked to please advise who from the First Nation of Na-Cho Nyäk Dun would be negotiating this Benefits Agreement so arrangements could be made to begin discussions.	N/A	E00928_Fw_ Benefits Agreement discussion
E00883	18-Sep-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm, Derek Fraser (Yukon Government), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Engagement/Consultation Meeting Coordination/Planning	Greg (Chance) followed up with First Nation of Na-Cho Nyäk Dun, VGFN, and Yukon Government to see if everyone had a chance to review the last BA agreement. Chance would suggest that they set up a call sometime soon with everyone to discuss how they would like to proceed with section 68 negotiations. Greg stated they would be away all the following week, but included Richard (Chance) and Cindy (Chance) in the thread so they could make themselves available if the parties agreed to discuss next steps. Greg stated they looked forward to their response.	N/A	E00883_BA Discussion
E00955	21-Sep-20	Phone Call	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	DO Project	Voicemail left.	N/A	E00955_Communication Log
E01001	21-Sep-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Cindy Dickson (Chance)	Cindy Dickson (Chance)	Millie Olsen	DO Project Jobs/Contracts Education and Training	Cindy (Chance) sent Millie (First Nation of Na-Cho Nyäk Dun) information for opportunities to work on the service rig. The attachments were all the forms that need to be completed. There would be a need to have some training prior to being able to complete these forms (H2S Alive, WHMIS, First Aid and TDG).	N/A	E01001_FW_ Service Rig Hire Package (43).msg Hire Package (no tax forms).pdf

E00834	02-Nov-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation DO Project	Hemmera explained that after further consideration of the proposed Project (Eagle Plains Well Maintenance and Winter Activities) activities and the requirements of the Yukon Oil and Gas Act, Chance determined that changes were required to the Project submitted to the Dawson Designated Office on September 11, 2020 (Project #2020-0151). As such, Chance decided to withdraw its Project Proposal and would be informing the YESAB on the present day, November 2, 2020. Chance still intended to incorporate changes into a revised Project Proposal. Once the revised proposal was drafted, Chance would notify First Nation of Na-Cho Nyäk Dun by sharing a draft and requesting a Meeting to discuss the changes further. After Chance had discussed those changes with the First Nation of Na-Cho Nyäk Dun, the Project Proposal would be finalized and resubmitted to the Dawson Designated Office. Hemmera explained that Chance understands and appreciates that making changes to this Project a second time would be requesting additional effort and capacity of the First Nation of Na-Cho Nyäk Dun. Chance looked forward to continuing to work with the First Nation of Na-Cho Nyäk Dun and would do its best to ease this process.	N/A	E00834_Re_ Chance DO Proposal Withdrawal - First Nation of Na-cho Nyäk Dun Notification
E00905	02-Nov-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief, Hemmera	DO Project Engagement/Consultation	Hemmera explained that after further consideration of the proposed Project (Eagle Plains Well Maintenance and Winter Activities) activities and the requirements of the Yukon Oil and Gas Act, Chance determined that changes were required to the Project submitted to the Dawson Designated Office on September 11, 2020 (Project #2020-0151). As such, Chance decided to withdraw its Project Proposal and would be informing the YESAB on the present day, November 2, 2020. Chance still intended to incorporate changes into a revised Project Proposal. Once the revised proposal was drafted, Chance would notify First Nation of Na-Cho Nyäk Dun by sharing a draft and requesting a Meeting to discuss the changes further. After Chance had discussed those changes with the First Nation of Na-Cho Nyäk Dun, the Project Proposal would be finalized and resubmitted to the Dawson Designated Office. Hemmera explained that Chance understands and appreciates that making changes to this Project a second time would be requesting additional effort and capacity of the First Nation of Na-Cho Nyäk Dun. Chance looked forward to continuing to work with the First Nation of Na-Cho Nyäk Dun and would do its best to ease this process.	N/A	E00905_Chance DO Proposal Withdrawal - First Nation of Na-cho Nyäk Dun Notification
E00835	17-Nov-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Stephan Walke (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun informed Chance that Skeeter (First Nation of Na-Cho Nyäk Dun) will now be the primary First Nation of Na-Cho Nyäk Dun contact person on the Project.	N/A	E00834_Re_ Chance DO Proposal Withdrawal - First Nation of Na-cho Nyäk Dun Notification
E00836	18-Nov-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Stephan Walke (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Meeting Coordination/Planning	Hemmera confirmed they would include Skeeter (First Nation of Na-Cho Nyäk Dun) on all future emails.	N/A	E00834_Re_ Chance DO Proposal Withdrawal - First Nation of Na-cho Nyäk Dun Notification
E00837	18-Nov-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	DO Project Meeting Coordination/Planning	Hemmera confirmed they would definitely include Skeeter (First Nation of Na-Cho Nyäk Dun) on all future emails regarding Chance's DO Project (Well Maintenance and Winter Activities). Hemmera asked if Skeeter should also be included in future emails regarding Chance's Executive Committee Project (Eagle Plains Exploration).	N/A	E00837_RE_ Chance DO Proposal Withdrawal - First Nation of Na-cho Nyäk Dun Notification (3)
E00838	18-Nov-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Adrienne Hill (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Meeting Coordination/Planning	Josee Tremblay (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) confirmed that Skeeter (First Nation of Na-Cho Nyäk Dun) should be included in correspondence about Chance's Executive Committee Project (Eagle Plains Exploration).	N/A	E00838_RE_ Chance DO Proposal Withdrawal - First Nation of Na-cho Nyäk Dun Notification (2)
E00890	19-Nov-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Engagement/Consultation Project Description/Activities	Hemmera sent an email further to an earlier email dated November 2nd (attached) to notify First Nation of Na-Cho Nyäk Dun that Chance had revised its Project Proposal (including updated Project Description and Effects Assessment) for Designated Office Evaluation. Key Project components that changed were included: 1) Extended Flow Testing: After maintenance activities were complete and depending on well bore integrity (as confirmed through maintenance activities), Chance proposed to conduct Extended Flow Testing (EFT) on up to three of the wells which had the highest potential for natural gas reserve. The reason for this change was to allow Chance to gather important information about the nature of the natural gas resource accumulation and its productive capability. a) Wells proposed for EFT are M-59, M-08, and J-19 (see PDF attached for Figure 2-1). Figure 2-1 was currently being updated to reflect this change. b. Revert up to three wells to suspended status (if the EFT results proved to have sufficient resources). c. Abandon three to six wells (the three remaining wells (G-08, B-73, and H-28) would be abandoned and up to additional three wells may be abandoned if wellbore integrity was not confirmed or if EFT results proved to have insufficient resources). Timelines: If work could not be completed that winter season (due to low snow pack, COVID-19 considerations, or permitting delays), Chance would complete the Project during the winter of December 2021 to March 2022. Additional details were included within the attached revised Draft Project Proposal. Hemmera stated that while revisions were made throughout the document, Section 2.1.3 was the substantive addition with respect to EFT. They had attached both a clean version and a version with tracked changes to facilitate First Nation of Na-Cho Nyäk Dun's review. Given the very short time frame for winter work, Chance would be submitting the application to YESAB on , November 20. Hemmera anticipated First Nation of Na-Cho Nyäk Dun requiring additional discussions with Chance to review these changes and looked forward to scheduling a meeting where they could discuss these matters further to support your future submissions to the YESAA process.	Attachments: Chance DO Proposal Withdrawal - First Nation of Na-cho Nyak Dun Notification.msg, 102229_Chance_YESAB_PP_Revised_v2.0.docx, 201119_Chance_YESAB_PPRevised_v2.0_redline.docx. Fig2_1_104709_01_Overview_200828.pdf	E00890_Chance Designated Office Project Proposal - Revised Draft for Sharing with First Nation of Na-cho Nyäk Dun
E01020	20-Nov-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Project Description/Activities Engagement/Consultation	Skeeter (First Nation of Na-Cho Nyäk Dun) thanked Hemmera and stated they were reviewing the documents as well as some of the previous work by First Nation of Na-Cho Nyäk Dun. As a recent addition to the First Nation of Na-Cho Nyäk Dun representatives, Skeeter explained they'd also be conferring with others at First Nation of Na-Cho Nyäk Dun.	N/A	E01020_Re_ Chance Designated Office Project Proposal - Revised Draft for Sharing with First Nation of Na-cho Nyäk Dun (26).msg
E01021	20-Nov-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Project Description/Activities Engagement/Consultation	Hemmera stated they needed to amend their email sent the previous day. While Chance would like to submit as soon as possible, the submission would be delayed until mid next week. Hemmera noted that if the First Nation of Na-Cho Nyäk Dun had any immEnvironmental Dynamics Inc.ate concerns to please contact them and they would make scheduling a meeting a priority.	N/A	E01021_RE_ Chance Designated Office Project Proposal - Revised Draft for Sharing with First Nation of Na-cho Nyäk Dun (27).msg

E01022	23-Nov-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	DO Project Project Description/Activities Engagement/Consultation	Hemmera stated to First Nation of Na-Cho Nyäk Dun to let them know if there was anything they needed.	N/A	E01022_RE_ Chance Designated Office Project Proposal - Revised Draft for Sharing with First Nation of Na-cho Nyäk Dun.msg
E00839	25-Nov-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Hemmera	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Engagement/Consultation DO Project	Skeeter (First Nation of Na-Cho Nyäk Dun) asked Hemmera further to their notes below, to please send them the earlier YESAB submission and a list of changes in the next submission. This would allow Skeeter to do a faster review.	N/A	E00834_Re_ Chance DO Proposal Withdrawal - First Nation of Na-cho Nyäk Dun Notification
E00858	25-Nov-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Engagement/Consultation	Email read receipt	N/A	E00858_Read_ Chance Designated Office Project Proposal - Revised Draft for Sharing with First Nation of Na-cho Nyäk Dun
E00840	26-Nov-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Engagement/Consultation Project Description/Activities	Hemmera attached an email they sent to First Nation of Na-Cho Nyäk Dun June 2019. It included the draft Project description for Chance's Eagle Plains Exploration Project and a presentation that Chance gave to First Nation of Na-Cho Nyäk Dun at that time. This Project would go through a YESAB Executive Committee level screening. Hemmera clarified to Skeeter (First Nation of Na-Cho Nyäk Dun) that this was the Project they were referring to with respect to including them on any future emails pertaining to Chance's Executive Committee Project. Although, Hemmera explained that Chance (and Hemmera) hadn't been actively engaging on that Project this year. Hemmera indicated that Chance (and Hemmera) had been focused on Chance's Eagle Plains Well Maintenance Project (or subsequently called Eagle Plains Well Maintenance and Winter Activities) which would be going through the YESAB Designated Office (DO) in Dawson City. That is the proposal they had been engaging with First Nation of Na-Cho Nyäk Dun on for the past few months. It's this Project that has changed a couple times and which Chance withdrew from YESAB a couple weeks ago. Hemmera attached a number of emails that "tell the story" and that I hope answer Skeeter's question: 1. Email with original draft of the DO submission (Eagle Plains Well Maintenance Project). 2. Email from Richard Wyman (Chance) (Chance) stating the submission had been delayed because Chance was considering additional changes to the proposed Project. 3. Email from Hemmera with revised DO submission, including a high level overview of the changes and Chance's reasons for those changes. a. Note: This was the draft ultimately submitted to YESAB and which Chance then withdrew. 4. Email Hemmera sent the previous week. Contained the current version of Chance's DO submission. The email highlighted the main change (inclusion of Extended Flow Testing or EFT). The red-line version that was attached would be the best resource for seeing/reviewing the recent changes.	Attachments: Meeting Material for Chance Meeting June 10, Chance Eagle Plains Well Maintenance Project - Draft YESAB Project Proposal, Fwd_Well Maintenance Program amendments, Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED, Chance Designated Office Project Proposal - Revised Draft for Sharing with First Nation of Na-cho Nyak Dun	E00840_RE_ Chance DO Proposal Withdrawal - First Nation of Na-cho Nyäk Dun Notification (1)
E00841	26-Nov-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	N/A	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Engagement/Consultation DO Project Engagement/Consultation Project Description/Activities	Skeeter (First Nation of Na-Cho Nyäk Dun) indicated they'd review the material and get back to Hemmera if they had any questions.	N/A	E00834_Re_ Chance DO Proposal Withdrawal - First Nation of Na-cho Nyäk Dun Notification
E01002	26-Nov-20	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	DO Project Meeting Coordination/Planning	Greg (Chance) said to Skeeter (First Nation of Na-Cho Nyäk Dun) that it had been awhile since they had last seen each other or worked together! Greg recalled he thought the last time was at the implementation reviews when they were last at the table. Greg said welcome back and that they looked forward working with Skeeter and if they would like an update please give them a call anytime.	N/A	E01002_FW_ Hello!.msg
E01003	26-Nov-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	DO Project Engagement/Consultation	Skeeter (First Nation of Na-Cho Nyäk Dun) said it had been quite awhile since I had any contact with Chance (was Northern Cross at that time). Skeeter did not remember who contacted them when they were working on Final Agreement chapter 12 implementation.	N/A	E01002_FW_ Hello!.msg
E00895	15-Dec-20	Email	Incoming	First Nation of Na-cho Nyäk Dun	Jordan Peterson (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance)	Jordan Peterson, (First Nation of Na-cho Nyäk Dun), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Erika Tizya-Tramm, Kris Statnyk (Vuntut Gwitchin First Nation), Justin Page, Derek Fraser (Yukon Government), Hemmera	DO Project Engagement/Consultation Meeting Coordination/Planning	Vuntut Gwitchin First Nation sent a follow up to Hemmera and Chance, cc'ing First Nation of Na-Cho Nyäk Dun and Yukon Government, after communications over the last month from Chance to see if Chance still planned to host a meeting to discuss the revised proposal on that week.	N/A	E00895_COGL Meeting - Dec 17
E00986	01-Jan-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Richard Wyman (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Jordan Peterson (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Benefits/Capacity Agreement DO Project	Greg (Chance) indicated First Nation of Na-Cho Nyäk Dun could call anytime on their cell or phone if any information or an update was needed. Greg said if NDD representatives were in Whitehorse to please stop by their office and they could provide First Nation of Na-Cho Nyäk Dun with more details and photos of the area Chance was talking about. Greg said they were looking forward working with First Nation of Na-Cho Nyäk Dun on this Project.	N/A	E00986_FW_ Section 68 Discussion (11
E00985	11-Jan-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Jordan Peterson (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Benefits/Capacity Agreement DO Project	Skeeter (First Nation of Na-Cho Nyäk Dun) said it had certainly been a while since they Greg (Chance) and Skeeter last spoke. Skeeter was writing about two things. First Nation of Na-Cho Nyäk Dun was also to be involved in the discussions Greg proposed. Skeeter said that themself and Josee Tremblay (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) were the two main First Nation of Na-Cho Nyäk Dun contacts. Skeeter said the proposed January 14 at 10:30 AM date did not work for First Nation of Na-Cho Nyäk Dun. First Nation of Na-Cho Nyäk Dun indicated they would leave it to VGFN to suggest a time/date and see if First Nation of Na-Cho Nyäk Dun can manage their proposed schedule.	N/A	E00986_FW_ Section 68 Discussion (10
E00897	19-Jan-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Hemmera	DO Project Engagement/Consultation	Hemmera provided a brief updated about Chance's proposed Eagle Plains Well Maintenance and Extended Flow Testing Project below: • Project was submitted to the Dawson District Office (DO) December 24, 2020. • Adequacy Review started December 29, 2020 and was extended January 11, 2021. o The Adequacy Review period was extended for 21 days due to the complexity of the Project. • Dawson DO issued an Information Request on January 15, 2021 At the present date, Chance was working on its response to Information Request 1 which could be found here. Hemmera provided the link to the Project's page on the YESAB registry: 2020-0197.	N/A	E00897_Chance DO Project_ Eagle Plains Well Maintenance and Extended Flow Testing (First Nation of Na-cho Nyäk Dun Update)

E01065	07-Apr-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera notified First Nation of Na-Cho Nyäk Dun that at the present date they were resuming work on Chance's Executive Committee Project titled Eagle Plains Exploration Program. They explained as it had been quite some time since Chance and First Nation of Na-Cho Nyäk Dun had discussed this particular Project, Chance was hoping to schedule a meeting. Some items that Chance would like to discuss are: • a refresher of the draft Project description • update of events since Chance last engaged on the ExCom Project • anticipated timeline for submission to YESAB, and • First Nation of Na-Cho Nyäk Dun's preferences/guidance for engagement with its government and its Citizens over the coming months. Hemmera asked if First Nation of Na-Cho Nyäk Dun had any availability to meet the week of April 26 – 30.	N/A	E01065_Chance Eagle Plains Exploration Project (ExCom) - Meeting request with the First Nation of Na-cho Nyäk Dun.msg
E01107	07-Apr-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Skeeter (First Nation of Na-Cho Nyäk Dun) replied that they could rearrange their schedule for that week to meet other's needs, although they were booked for the morning of April 29.	N/A	E01107_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with the First Nation of Na-cho Nyäk Dun (10).msg
E01108	07-Apr-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera noted that they only sent this request to Skeeter (First Nation of Na-Cho Nyäk Dun) and Josee Tremblay (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) and asked if there was anyone else from First Nation of Na-Cho Nyäk Dun whose schedule that Hemmera needed to consider.	N/A	E01107_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with the First Nation of Na-cho Nyäk Dun (10).msg
E01109	07-Apr-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Skeeter (First Nation of Na-Cho Nyäk Dun) clarified that Josee Tremblay (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) is on the First Nation of Na-Cho Nyäk Dun contact list so Josee can document information. Skeeter identified themselves as the functioning First Nation of Na-Cho Nyäk Dun contact.	N/A	E01107_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with the First Nation of Na-cho Nyäk Dun (10).msg
E01110	07-Apr-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera explained they were not available all day on April 26 and between 10:00 and 12:00 (MT) on April 27. They indicated that the rest of the week was open although they would be in Ontario so would be 3 hours ahead of Yukon time.	N/A	E01110_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with the First Nation of Na-cho Nyäk Dun (12).msg
E01111	07-Apr-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Josee Tremblay (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) thanked everyone.	N/A	E01111_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with the First Nation of Na-cho Nyäk Dun.msg
E01052	08-Apr-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Josee Tremblay (First Nation of Na-cho Nyäk Dun)	N/A	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Josee Tremblay (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) said this correspondence was great, and confirmed that Skeeter (First Nation of Na-Cho Nyäk Dun) would be in attendance on behalf of the First Nation of Na-Cho Nyäk Dun Lands and Resources department. Josee said thank you for keeping them copied on the communications.	N/A	E01052_Tentative_ Placeholder for Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom).msg
E01090	08-Apr-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun) Josee Tremblay (First Nation of Na-cho Nyäk Dun),	Project Description/Activities Meeting Coordination/Planning	Hemmera sent meeting invitation to First Nation of Na-Cho Nyäk Dun.	N/A	E01090_Placeholder for Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom) (9).msg
E01125	08-Apr-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun confirmed attendance.	N/A	E01125_RE_ Placeholder for Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom) (3).msg
E01126	15-Apr-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	Hemmera attached a draft agenda for the Chance and First Nation of Na-Cho Nyäk Dun Meeting April 30. Hemmera asked First Nation of Na-Cho Nyäk Dunand Chance to please let them know if they would like to make any changes. After that Hemmera said they would finalize the agenda and attach it to the meeting invitation.	N/A	E01125_RE_ Placeholder for Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom) (3).msg
E01127	15-Apr-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	First Nation of Na-Cho Nyäk Dun thanked Hemmera and said that they had no additions to the agenda to suggest.	N/A	E01125_RE_ Placeholder for Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom) (3).msg
E01128	16-Apr-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera asked if Chance had any additions they'd like to make.	N/A	E01125_RE_ Placeholder for Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom) (3).msg
E01129	17-Apr-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Greg (Chance) said there were no additions to the agenda from them.	N/A	E01125_RE_ Placeholder for Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom) (3).msg
E01091	23-Apr-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Hemmera, Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun) Josee Tremblay (First Nation of Na-cho Nyäk Dun),	Project Description/Activities Engagement/Consultation Regulatory Process	Hemmera finalized and attached the meeting agenda.	210415_FNFirst Nation of Na-cho Nyäk Dun_Chance_MeetingAgenda_April30_Draft_v0.3.docx	E01091_Placeholder for Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom).msg
E01057	26-Apr-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	Hemmera removed "Placeholder" from meeting invitation and attached the meeting agenda.	210415_FNFirst Nation of Na-cho Nyäk Dun_Chance_MeetingAgenda_April30_Draft_v0.3.docx	E01057_Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom).msg
E01094	28-Apr-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Skeeter (First Nation of Na-Cho Nyäk Dun) sent their apologies as they had just been told they were to attend a meeting with a number of Chiefs at 10 AM on April 30 for a few hours. They had not been provided a draft date/time earlier and just found out minutes before sending this correspondence. Skeeter stated that hopefully another date/time could be found that worked for everyone.	N/A	E01095_RE_ Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom) (1).msg

E01095	28-Apr-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera stated that Skeeter's (First Nation of Na-Cho Nyäk Dun) meeting conflict was not a problem. Hemmera asked Skeeter to send them some dates/times that may work for them the following week. Hemmera stated then they would work with Chance to coordinate their attendance and they could hopefully find a time that would work for everyone.	N/A	E01095_RE_ Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom) (1).msg
E01096	28-Apr-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	N/A	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Skeeter (First Nation of Na-Cho Nyäk Dun) thanked Hemmera for understanding and provided the following availabilities: May 3 - all day May 4 Wed - 1PM onward May 6 - before 3PM May 7 - after 1PM	N/A	E01096_RE_ Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom) (15).msg
E01054	29-Apr-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera re-scheduled and re-sent the meeting invitation.	210415_FNFirst Nation of Na-cho Nyäk Dun_Chance_MeetingAgenda_April30_Draft_v0.3.docx	E01054_Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom) (14).msg
E01097	29-Apr-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Hemmera sent a response that the meeting invitation had been re-scheduled, and for First Nation of Na-Cho Nyäk Dun to advise if the new time did not work.	N/A	E01096_RE_ Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom) (15).msg
E01098	29-Apr-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	N/A	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Skeeter (First Nation of Na-Cho Nyäk Dun) thanked Hemmera for finding a new date/time that worked or them.	N/A	E01098_Re_ Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom) (16).msg
E01055	05-May-21	Meeting	N/A	First Nation of Na-cho Nyäk Dun	N/A	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Project Description/Activities Well Location	The purpose of this meeting was for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin. Chance provided recent information and updates regarding baseline information gathered by consultants (Environmental Dynamics Inc., Peer Solutions, Palmer) and Parties discussed next steps with community engagement and consultation schedules for the First Nation of Na-Cho Nyäk Dun.	See Meeting summary for details.	E01193_210514_May05_First Nation of Na-cho Nyäk Dun-Chance_Meetingsummary_v0.2.docx
E01056	05-May-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Project Description/Activities Meeting Coordination/Planning	Hemmera shared a PDF copy of the presentation Richard (First Nation of Na-Cho Nyäk Dun) would be discussing, on the off chance that there are poor connection issues during our call later that afternoon. Hemmera would still aim to share the PowerPoint up during the call.	210414_Chance_ProjectDescription_April2021.pdf	E01055_Chance and First Nation of Na-cho Nyäk Dun Meeting re Eagle Plains Exploration Project (ExCom) (17).msg
E01193	05-May-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Project Description/Activities Meeting Coordination/Planning	Hemmera sent a meeting invite (in accordance with Greg's (Chance) attached email) so that it would be in everyone's calendars. A draft agenda for the Chance and NYRRC Meeting was included below. Hemmera noted that the draft agenda could be updated if any changes were proposed. DRAFT Agenda Introduction to Meeting • Introductions • Review of agenda • Meeting purpose and objectives Eagle Plains Exploration Project • Provide overview of Project Description • Discussion and questions Next Steps • Timelines • Future Meetings/engagement	210415_FNFirst Nation of Na-cho Nyäk Dun_Chance_MeetingAgenda_April30_Draft_v0.3.docx	E01056_Chance and NYRRC Meeting_ Eagle Plains Exploration Project.msg
E01071	13-May-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation Meeting Coordination/Planning Project Description/Activities	Hemmera attached a few items that were discussed during the Chance/First Nation of Na-Cho Nyäk Dun Meeting the week before. The first is a memo summarizing Chance's draft engagement schedule over the summer/fall. The second is the Heritage report that Chance completed back in 2013.	210512_Chance_ScheduleMemo_for_FNFirst Nation of Na-cho Nyäk Dun_v0.1.docx MATRIX_HROA_Abridged_for_YESAB.pdf	E01071_Chance_FNFirst Nation of Na-cho Nyäk Dun - May 5 Meeting Action Items.msg
E01146	14-May-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun) Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation	Hemmera attached the May 5th Chance / First Nation of Na-Cho Nyäk Dun Meeting summary Draft for Review.	210514_May05_First Nation of Na-cho Nyäk Dun-Chance_Meetingsummary_v0.2.docx	E01146_Chance_FNFirst Nation of Na-cho Nyäk Dun - May 5 Meeting summary .msg
E01147	14-May-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement/Consultation	Skeeter (First Nation of Na-Cho Nyäk Dun) confirmed they would review the May 5th Chance / First Nation of Na-Cho Nyäk Dun Meeting summary on the weekend.	N/A	E01146_Chance_FNFirst Nation of Na-cho Nyäk Dun - May 5 Meeting summary .msg
E01159	18-May-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Hemmera	Information Sharing Project Description/Activities Engagement/Consultation	Hemmera sent a report and accompanying appendices from Palmer Environmental who worked on permafrost/terrain studies as well as suitability mapping. Hemmera indicated that they attached the main memo/report from Palmer.	Palmer_RPT_Eagle Plains Terrain Permafrost_DRAFT_25January2021.pdf	E01159_Chance Eagle Plains Exploration Project - Baseline information on terrain_ permafrost_ and suitability maps.msg
E01172	21-May-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	N/A	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Hemmera	Information Sharing	Hemmera offered to check-in and see if First Nation of Na-Cho Nyäk Dun had any issues with downloading the maps.	N/A	E01172_RE_ Chance Eagle Plains Exploration Project - Baseline information on terrain_ permafrost_ and suitability maps (1FNFirst Nation of Na-cho Nyäk Dun).msg

E01174	21-May-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	N/A	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Hemmera	Information Sharing	Skeeter (First Nation of Na-Cho Nyäk Dun) explained to Hemmera that the only minor hassle they had to download the maps was that they had to go into town to do it due to their poor off grid internet connection. They explained that that is standard procedure with off grid life and office.	N/A	E01174_RE_ Chance Eagle Plains Exploration Project - Baseline information on terrain_ permafrost_ and suitability maps (2FNFirst Nation of Na-cho Nyäk Dun).msg
E01209	30-Jun-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Hemmera, Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	Hemmera wanted to check in and see if Chance was able to connect with First Nation of Na-Cho Nyäk Dun Chief and Council and receive any guidance pertaining to First Nation of Na-Cho Nyäk Dun's engagement preferences. Hemmera indicated they were aware that with the Yukon's recent outbreak things were becoming quite complicated, especially with respect to broader community engagement. Although, Hemmera said that they had discussed a potential meeting with First Nation of Na-Cho Nyäk Dun lands staff and the Mayo RRC. Hemmera asked if Chance thought that the parties would be satisfied with a virtual meeting. If Chance thought that a virtual meeting would be satisfactory, maybe they could work together to schedule something.	210514_May05_First Nation of Na-cho Nyäk Dun-Chance_Meetingsummary_v0.2.docx	E01209_Chance_FNFirst Nation of Na-cho Nyäk Dun - Engagement Next Steps.msg
E01245	30-Jun-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Hemmera	Meeting Coordination/Planning	Skeeter (First Nation of Na-Cho Nyäk Dun) stated that First Nation of Na-Cho Nyäk Dun and Mayo had been having a rough time recently. COVID-19 combined with an internal discussion regarding responses to development proposals were delaying First Nation of Na-Cho Nyäk Dun's responses. Skeeter said that while a virtual Meeting is now mandatory due to recent COVID-19 outbreaks, the matter of responding to development proposals was still not finalized. Skeeter said that they'd let Hemmera and Chance know when they knew more.	N/A	E01245_Re_ Chance_FNFirst Nation of Na-cho Nyäk Dun - Engagement Next Steps.msg
E01213	16-Jul-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement Reports/OIC Requirements	Hemmera prepared a draft report on the implementation of the First Nation of Na-Cho Nyäk Dun and Chance Engagement and Communication Plan for First Nation of Na-Cho Nyäk Dun and Chance to review. This report summarized Meetings/correspondence that had occurred between First Nation of Na-Cho Nyäk Dun and Chance since completing the 2020 Annual Report. Hemmera attached the draft as a word document. Hemmera stated that if both First Nation of Na-Cho Nyäk Dun and Chance could make revisions to that document in tracked changes, that would assist them in creating a final version. Hemmera said that if there were any issues that arose between the parties' revisions, those could be addressed via email and/or a quick call. Once revisions have been incorporated and the document would be considered final by First Nation of Na-Cho Nyäk Dun and Chance, Hemmera stated they would send the final version to both parties to sign. Either later today, or , Hemmera indicated they would send a follow-up email with a draft of First Nation of Na-Cho Nyäk Dun and Chance's Engagement Log which would serve as Appendix D.	210716_EngagementPlan_2021ImplementationReports_FNFirst Nation of Na-cho Nyäk Dun_v0.2.docx	E01213_DRAFT 2021 Annual Report of FNFirst Nation of Na-cho Nyäk Dun and Chance Engagement Activities - For Review.msg
E01249	16-Jul-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Engagement Reports/OIC Requirements	Skeeter (First Nation of Na-Cho Nyäk Dun) indicated that some relevant First Nation of Na-Cho Nyäk Dun staff would return in the following week and that they'd ask them to review and send the First Nation of Na-Cho Nyäk Dun comments.	N/A	E01249_RE_ DRAFT 2021 Annual Report of FNFirst Nation of Na-cho Nyäk Dun and Chance Engagement Activities - For Review (2).msg
E01248	19-Jul-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement Reports/OIC Requirements	Richard (Chance) said that the summary looked pretty good to them. Richard sent Hemmera a reminder to remember to complete Appendix D with the formal communications log.	N/A	E01248_Re_ DRAFT 2021 Annual Report of FNFirst Nation of Na-cho Nyäk Dun and Chance Engagement Activities - For Review (1).msg
E01250	19-Jul-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun)	Engagement Reports/OIC Requirements	Hemmera clarified that as mentioned in their earlier email on , they had again attached a copy of Chance's Engagement Log which would serve as Appendix D. Hemmera stated that they looked forward to everyone's comments.	210714_ChanceCommunicationLog_v7_FNFirst Nation of Na-cho Nyäk Dun.pdf	E01249_RE_ DRAFT 2021 Annual Report of FNFirst Nation of Na-cho Nyäk Dun and Chance Engagement Activities - For Review (2).msg
E01251	20-Jul-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement Reports/OIC Requirements	Hemmera thanked Richard (Chance) for the feedback. Hemmera stated that they had sent a copy of Appendix D yesterday. Hemmera said that just in case there were issues, they had attached it again. Hemmera said that they looked forward to First Nation of Na-Cho Nyäk Dun's comments.	210714_ChanceCommunicationLog_v7_FNFirst Nation of Na-cho Nyäk Dun.pdf	E01251_RE_ DRAFT 2021 Annual Report of FNFirst Nation of Na-cho Nyäk Dun and Chance Engagement Activities - For Review.msg
E01347	27-Jul-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement Reports/OIC Requirements	Hemmera checked in with Skeeter (First Nation of Na-Cho Nyäk Dun) about whether First Nation of Na-Cho Nyäk Dun had been able to review the engagement report. Hemmera stated that they'd hoped to have it reviewed, and hopefully signed by an First Nation of Na-Cho Nyäk Dun representative, by the end of that week. Hemmera explained that usually the reports were due July 31, however Yukon Government has allowed us to submit on , August 3. Greg (Chance) and Richard (Chance) were both in Eagle Plains for that week, but Hemmera asked that Greg set aside some time next to sign/finalize the report. Hemmera stated for First Nation of Na-Cho Nyäk Dun to let them know if there was anything they could do to help and/or if First Nation of Na-Cho Nyäk Dun thought this timeline might not work. If that was the case, Hemmera offered to work on some alternative plans/ideas.	N/A	E01344_RE_ DRAFT 2021 Annual Report of FNFirst Nation of Na-cho Nyäk Dun and Chance Engagement Activities - For Review (2).msg
E01348	27-Jul-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement Reports/OIC Requirements	First Nation of Na-Cho Nyäk Dun is in the midst of substantial internal discussions regarding Chance's current and proposed Projects and as such is not ready to support the report. I know it's been a while, but those discussions have yet to reach a conclusion. The discussions include consideration of a number of factors/aspects of both Projects. First Nation of Na-Cho Nyäk Dun have not needed any information from Chance to facilitate those discussions. If additional information is required, Skeeter will reach out.	N/A	E01348_Re_ DRAFT 2021 Annual Report of FNFirst Nation of Na-cho Nyäk Dun and Chance Engagement Activities - For Review (1).msg
E01349	27-Jul-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Hemmera	Engagement Reports/OIC Requirements	Hemmera indicated that they had coordinated with Derek Fraser (Yukon Government) at Yukon Government to submit Chance's engagement reports on August 2. Hemmera stated that if they did not hear from First Nation of Na-Cho Nyäk Dun any further between the present date and August 2, which may likely be the case as they understood, Hemmera would proceed in a similar manner as they had done last year for the DRAFT 2020 Annual Report on the Implementation of the First Nation of Na-Cho Nyäk Dun and Chance Engagement and Communication Plan. The report was previously submitted with the DRAFT watermark, with DRAFT still in the title, and with the signature page removed. Hemmera attached a copy of that email, so First Nation of Na-Cho Nyäk Dun could refer to it as an example.	2020 Annual Report - First Nation of Na-Cho Nyäk Dun and Chance Engagement and Communication Plan .msg	E01349_RE_ DRAFT 2021 Annual Report of FNFirst Nation of Na-cho Nyäk Dun and Chance Engagement Activities - For Review.msg

E01281	02-Aug-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Derek Fraser (Yukon Government), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement Reports/OIC Requirements	Hemmera sent Derek (Yukon Government) the attached DRAFT 2021 Annual Report on the Implementation of the First Nation of Na-Cho Nyäk Dun and Chance Engagement and Communication Plan. Hemmera noted that the report had been prepared using meeting agendas and summaries drafted by Hemmera and subsequently reviewed and agreed to by the parties. Hemmera explained that the report had been reviewed and approved by Chance, but had not yet been approved by First Nation of Na-Cho Nyäk Dun. To that end, the signature lines had been removed and the DRAFT watermark remained in place. Hemmera indicated that should First Nation of Na-Cho Nyäk Dun wish to provide Environmental Dynamics Inc. at a later date, Hemmera would be happy to incorporate them and prepare a final report, including signatures, for submission to Yukon Government.	E01281_210729_EngagementPlan_DRAFT2021ImplementationReport_FNFirst Nation of Na-cho Nyäk Dun_v0.4wAppD.pdf	E01281_2021 Annual Report - First Nation of Na-Cho Nyäk Dun and Chance Engagement and Communication Plan .msg
E01354	02-Aug-21	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Derek Fraser (Yukon Government), Hemmera	Engagement/Consultation Engagement Reports/OIC Requirements	Skeeter (First Nation of Na-Cho Nyäk Dun) thanked Hemmera for including First Nation of Na-Cho Nyäk Dun in the note below. Skeeter stated that First Nation of Na-Cho Nyäk Dun was still striving to sort things out.	N/A	E01354_Re_ 2021 Annual Report - First Nation of Na-Cho Nyäk Dun and Chance Engagement and Communication Plan
E01364	17-Dec-21	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Mike Chernoff, Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Chief Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation), (VGFN), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (First Nation of Na-cho Nyäk Dun)	Engagement/Consultation	Greg (Chance) sent the Chiefs of First Nation of Na-Cho Nyäk Dun, VGFN, and Gwich'in Tribal Council a formal letter that had been sent to Minister Streicker. Greg noted that if anyone had any questions, to contact them via email or cell. Greg wished everyone the best through out Christmas and the New Year.	E01363_Government of Yukon Land Tenure Extension Request.pdf	E01364_FW_ Land Tenure Request (2).msg
NND0105	20-Jan-22	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Tim Bennett	Richard Wyman (Chance), Greg Charlie (Chance)	Ty Heffner (Yukon Government), Megan Williams (Vuntut Gwitchin First Nation), Sharon Snowshoe (Gwich'in Tribal Council), heritagemgr@First Nation of Na-Cho Nyäk Dunfn.com, James Mooney (Ecofor), Calista Morrison (Hemmera)	Eagle Plains Basin Exploration Project HROA	Tim (Ecofor) emailed Ty (Yukon Government), Megan (Vuntut Gwitchin First Nation), Sharon (Gwich'in Tribal Council), Heritage Manager of First Nation of Na-Cho Nyäk Dun, and cc'd James (Ecofor), Richard (Chance), Greg (Chance), and Calista (Hemmera), attaching a link to the Eagle Plains Basin Exploration Project Heritage Resource Overview Assessment (HROA).		
E01412	29-Jul-22	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Jeffrey McLean (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Engagement	Jeffrey M. sent Skeeter (First Nation of Na-Cho Nyäk Dun) the 2022 Annual Report on the Implementation of the First Nation of Na-Cho Nyäk Dun and Chance Communication and Engagement Plan. They noted the report had been reviewed and signed by Chance and First Nation of Na-Cho Nyäk Dun.	N/A	E01401_220729_2022ImplementationReport_FNFirst Nation of Na-cho Nyäk Dun_v1.pdf E01401_2022 Implementation Report First Nation of Na-Cho Nyäk Dun and Chance .msg
NND0103	29-Nov-22	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Tim Bennett	N/A	Ty Heffner (Yukon Government), Megan Williams (Vuntut Gwitchin First Nation), Sharon Snowshoe (Gwich'in Tribal Council), heritagemgr@First Nation of Na-Cho Nyäk Dunfn.com, James Mooney (Ecofor)	Eagle Plains Exploration Project 2022 HRIA Interim Report (22-22ASR)	Tim (Ecofor) emailed Ty (Yukon Government), Megan Williams (Vuntut Gwitchin First Nation) (VGFN), Sharon Snowshoe (Gwich'in Tribal Council) (VGFN), the Heritage Manager of First Nation of Na-Cho Nyäk Dun, and cc'd James (Ecofor) attaching a pdf of the Eagle Plains Exploration Project 2022 Heritage Resource Impact Assessment (HRIA) Interim Report (22-22ASR).		
NND0082	19-Jan-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Cindy Dickson (Chance)	Cindy Dickson (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Meeting Availability	Cindy sent Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) an invitation to an in-person meeting with Chance and other potentially affected First Nations on January 26, 2023 in Vancouver, BC.	N/A	E01492 - January 26th 2023 Meeting from 2-5PM - Skwachàys Lodge 31 W Pender St Vancouver BC.
E014810	26-Jan-23	Meeting	N/A	First Nation of Na-cho Nyäk Dun	N/A	Cindy Dickson (Chance), Greg Charlie (Chance), (joined by telephone), Mike Chernoff, Richard Wyman (Chance)	Adrienne Hill (First Nation of Na-cho Nyäk Dun), Chief Pauline Frost (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Elizabeth Staples (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Erin Prelypchan (Two Worlds Consulting) (Two Worlds Consulting), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), James Smith (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), President President Abe Wilson (Gwich'in Tribal Council) (Gwich'in Tribal Council), Roy Erasmus Jr. (Gwich'in Tribal Council) (Gwich'in Tribal Council), Tara Kyikavichik (Gwich'in Tribal Council), Willard Hagen (Gwich'in Tribal Council)	Engagement	Chance hosted an in-person meeting with leadership and technical advisors from First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Vuntut Gwitchin First Nation in Vancouver. The purpose of the meeting was to re-establish collaborative working relationships, discuss engagement preferences going forward, and provide a Project update.	N/A	N/A
E014814	01-Feb-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Pauline Frost (Vuntut Gwitchin First Nation), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Mike Chernoff, Tara Kyikavichik (Gwich'in Tribal Council), Willard Hagen (Gwich'in Tribal Council), Roy Erasmus, James Smith (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Elizabeth Staples (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Adrienne Hill (First Nation of Na-cho Nyäk Dun), Erin Prelypchan (Two Worlds Consulting) (Two Worlds Consulting)	Engagement, Land Tenure, Baseline Studies	Richard sent Chief Pauline Frost (Vuntut Gwitchin First Nation), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), and Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) a thank you letter for a constructive meeting and noted Chance would wait the First Nations to provide direction on engagement going forward. Richard also informed that Chance had commissioned several studies to gather and evaluate baseline environmental data using experts at Environmental Dynamics, Palmer Environmental, Ecofor, Mountford Consulting, Peer Solutions, Tetratech, Ausenco, and Two Worlds Consulting.	N/A	E01502 - FW email to Chiefs of Vuntut Gwitchin Government Gwich'in Tribal Council and First Nation of Na-cho Nyäk Dun

NND0083	01-Feb-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	Abe Wilson, Adrienne Hill (First Nation of Na-cho Nyäk Dun), Chief Pauline Frost (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Elizabeth Staples (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Erin Prelyphan, Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), James Smith (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Mike Chernoff, Roy Erasmus, Tara Kyikavichik (Gwich'in Tribal Council)	Engagement	Richard W. emailed Chief Pauline Frost (Vuntut Gwitchin First Nation), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), and Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) and stated Chance had commissioned Environmental Dynamics Inc. and Palmer Environmental to cover several studies to gather and evaluate baseline environmental data. Chance stated heritage resource studies have begun by Ecofor. Chance noted Chance has retained supervision of drilling and completions, well maintenance, and follow testing activities help from Mountford Consulting; Peer Solutions for seismic program design and project management; TetraTech for civil engineering advice; Ausenco for preparing YESAB submission documents and project management; and Two Worlds Consulting for engagement and communication processes and gathering socio-economic data to complete YESAB submissions. Chance stated that all information that is gathered can be shared with the Nations and their feedback is welcome. Chance noted that Chance intended to extend the Land Tenure of Exploration Permits that are due to expire August 30, 2023. Chance stated a Benefits Agreement needs to be completed by First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Vuntut Gwitchin First Nation. Chance said that accommodation in Old Crow is difficult to arrange and Chance had tentatively arrange accommodation on March 7, 2023 in Old Crow and March 8 to 9, 2023 in Inuvik and Fort McPherson for consideration. Chance noted no meetings in Mayo or other communities in the Yukon have been committed to.	N/A	N/A
E014827	07-Mar-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Cindy Dickson (Chance), Richard Wyman (Chance)	Aparna Verma, Chief Pauline Frost (Vuntut Gwitchin First Nation), Chief Roberta Joseph (Tr'ondëk Hwëch'in), Derek Fraser (Yukon Government), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), John Strecker, Mike Chernoff, Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement	Greg C. emailed John S. and cc'd Derek F., Aparna V., Mike C., Richard W., Cindy D., Chief Pauline Frost (Vuntut Gwitchin First Nation), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), and Chief Roberta Joseph (Tr'ondëk Hwëch'in) providing the Land Tenure extension request. Stated to contact Chance if there are any questions.	N/A	E0141860 - Land Tenure Extension Request
NND0104	15-Mar-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Tim Bennett	N/A	Ty Heffner (Yukon Government), Megan Williams (Vuntut Gwitchin First Nation), Sharon Snowshoe (Gwich'in Tribal Council), heritagemgr@First Nation of Na-Cho Nyäk Dunfn.com, James Mooney (Ecofor)	Eagle Plains Exploration Project 2022 HRIA FINAL Report (22-22ASR)	Tim (Ecofor) emailed Ty (Yukon Government), Megan W., Sharon S., the Heritage Manager of First Nation of Na-Cho Nyäk Dun, and cc'd James (Ecofor) attaching a link to the Eagle Plains Oil and Gas 2022 Heritage Resource Impact Assessment (HRIA) Final Report (22-22ASR).	N/A	Eagle Plains Oil and Gas 2022 HRIA Final Report (22-22ASR)
NND0108	23-Jun-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting)	Meeting Agenda	Greg (Chance) emailed Skeeter (First Nation of Na-Cho Nyäk Dun) and cc'd Cindy (Chance) and Eliza (Two Worlds Consulting) providing an agenda outline for the upcoming meeting. Greg (Chance) stated that Chance would provide a copy of the Project Description before the meeting. Greg (Chance) proposed that the meeting take place on , July 10, 2023.	N/A	N/A
NND0109	27-Jun-23	Text message	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Meeting Availability	Skeeter (First Nation of Na-Cho Nyäk Dun) texted Greg (Chance) stating they would provide confirmation shortly on whether they were available to meet on July 12, 2023.	N/A	N/A
NND0110	27-Jun-23	Text message	Outgoing	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Meeting Availability	Greg (Chance) texted Skeeter (First Nation of Na-Cho Nyäk Dun) asking if July 12, 2023 was the new date because the meeting was originally scheduled for July 10, 2023. Skeeter (First Nation of Na-Cho Nyäk Dun) texted Greg (Chance) stating they contacted Greg (Chance) regarding the date change. Greg (Chance) texted Skeeter (First Nation of Na-Cho Nyäk Dun) stating Greg (Chance) did not receive the initial text regarding the date change but Chance could work with the new dates. Skeeter (First Nation of Na-Cho Nyäk Dun) texted Greg (Chance) requesting an agenda, outline, and other materials for the meeting. Skeeter (First Nation of Na-Cho Nyäk Dun) stated there was no need for legal. Greg (Chance) texted Skeeter (First Nation of Na-Cho Nyäk Dun) asking for confirmation that the meeting would be in Mayo so that Greg (Chance) could book travels. Skeeter (First Nation of Na-Cho Nyäk Dun) texted Greg (Chance) stating Skeeter (First Nation of Na-Cho Nyäk Dun) would confirm the location. Skeeter (First Nation of Na-Cho Nyäk Dun) texted Greg (Chance) confirming the meeting would be in Mayo on July 10, 2023. Greg (Chance) texted Skeeter (First Nation of Na-Cho Nyäk Dun) thanking Skeeter (First Nation of Na-Cho Nyäk Dun) for the confirmation.	N/A	N/A
NND0111	27-Jun-23	Text message	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Project Letter	Richard (Chance) emailed Chief Dawna H. and cc'd Greg (Chance) and Cindy (Chance) providing a letter on the Project and stated that Chance looked forward to meeting with First Nation of Na-Cho Nyäk Dun to discuss the Project. Richard (Chance) noted that there are some modifications to the Project based on preliminary feedback from other affected Indigenous Nations.	N/A	Letter Chief Dawna Hope (Fist Nation of Na-cho Nyäk Dun).pdf
NND0112	28-Jun-23	Text message	Incoming	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	Greg (Chance) texted Skeeter (First Nation of Na-Cho Nyäk Dun) requesting confirmation of the meeting time so that Chance could book flights. Skeeter (First Nation of Na-Cho Nyäk Dun) texted Greg (Chance) confirming the meeting for July 12, 2023 in the afternoon and evening.	N/A	N/A
NND0113	28-Jun-23	Text message	Outgoing	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Engagement	Skeeter (First Nation of Na-Cho Nyäk Dun) texted Greg (Chance) stating Chief Dawna Hope (Fist Nation of Na-cho Nyäk Dun) was unavailable for July 11-12, 2023.	N/A	N/A
NND0114	30-Jun-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Cindy Dickson (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance)	Teri Buyck (First Nation of Na-cho Nyäk Dun)	Meeting Availability	Cindy (Chance) emailed Teri (First Nation of Na-cho Nyäk Dun) requesting availability in early fall 2023 to reschedule the meeting because Chief Dawna Hope (Fist Nation of Na-cho Nyäk Dun) was unavailable between July 10-12, 2023.	N/A	N/A
NND0084	10-Jul-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Jennifer Shalagan (Environmental Dynamics Inc.)	John Bailey (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun), John Bailey (Vuntut Gwitchin First Nation)	Meeting Availability	Greg (Chance) emailed Skeeter (First Nation of Na-Cho Nyäk Dun), Jennifer (Environmental Dynamics Inc.), and John (Vuntut Gwitchin First Nation) and invited Skeeter to come to the August 3, 2023 Project overview meeting at Environmental Dynamics Inc.'s Whitehorse office.	N/A	N/A
NND0084	10-Jul-23	Email	Incoming	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), John Bailey (Vuntut Gwitchin First Nation), Jennifer Shalagan (Environmental Dynamics Inc.)	Meeting Availability	Skeeter (First Nation of Na-Cho Nyäk Dun) emailed Greg (Chance), Jennifer (Environmental Dynamics Inc.), and John (Vuntut Gwitchin First Nation) thanking Chance for the meeting invite and stated they will see them on August 3, 2023.	N/A	N/A
NND0086	13-Jul-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Jennifer Shalagan (Environmental Dynamics Inc.)	Engagement	Greg (Chance) emailed Skeeter (First Nation of Na-Cho Nyäk Dun) and Jennifer (Environmental Dynamics Inc.) and provided a draft Project Description. Chance requested that Skeeter share with the First Nation of Na-Cho Nyäk Dun team. Chance stated they can discuss next steps at the August 3, 2023 meeting. Chance noted that they are preparing community engagement meetings in Old Crow, Inuvik, Tsiigehtchic, and Teetl'it Zheh (Fort McPherson) during the August 22, 2023 week. Chance stated they look forward to hearing from First Nation of Na-Cho Nyäk Dun on dates for Community Engagement in Mayo. Chance said to not hesitate to reach out if there are any questions.	N/A	N/A

NND0087	28-Jul-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	N/A	Eliza Bethune (Two Worlds Consulting), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Engagement	Greg (Chance) emailed Skeeter (First Nation of Na-Cho Nyäk Dun) and cc'd Eliza (Two Worlds Consulting) providing a presentation Chance is planning to share on August 3, 2023 at 9:00 am. The presentation detailed information on the changes to the Project design, Project schedule, and summarized Project plans. Chance stated they will meet in the Environmental Dynamics Inc. office and there will be refreshments during the meeting. Chance noted to let Chance know if there is anything that should be added to the meeting agenda.	N/A	323-Chance EaglePlainsExplPresentation_August 3 2023_20230728_FINAL.pptx
NND0088	03-Aug-23	Meeting	N/A	First Nation of Na-cho Nyäk Dun	N/A	Cindy Dickson (Chance), Greg Charlie (Chance),	Eliza Bethune (Two Worlds Consulting), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Jennifer Shalagan (Environmental Dynamics Inc.), Pat Tobler (Environmental Dynamics Inc.) (Environmental Dynamics Inc.)	Meeting	Chance hosted an in-person meeting with advisors from behalf of both First Nation of Na-Cho Nyäk Dun and TH in Whitehorse. The purpose of the meeting was to discuss engagement, socioeconomic and baseline data, primary data, and abandonment wells.	N/A	323-Chance_EaglePlainsExplPresentation_August 3 2023_20230728_TWC.pptx
NND0089	23-Aug-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	N/A	McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting)	Engagement	Greg (Chance) emailed McGary S. and cc'd Eliza (Two Worlds Consulting) providing a copy of the draft Project description and stated Chance looks forward to direction from First Nation of Na-Cho Nyäk Dun on Community Engagement. Greg (Chance) noted to contact Chance anytime via email or phone. Chance stated Chance will send a copy of the 2 page fact sheet to be shared with leadership.	N/A	Eagle Plains_Draft_Exploration_Project Description_July 12, 2023.pdf
NND0090	23-Aug-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	N/A	McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting)	Engagement	Greg (Chance) emailed McGarry (First Nation of Na-Cho Nyäk Dun) and cc'd Eliza (Two Worlds Consulting) providing the Final First Nation of Na-Cho Nyäk Dun and Chance Engagement and Communication Plan.	N/A	Final FNFirst Nation of Na-Cho Nyäk Dun and Chance Engagement and Communication Plan_03Aug2018.docx
NND0091	28-Aug-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance), Cindy Dickson (Chance)	Eliza Bethune (Two Worlds Consulting), John Bailey (Vuntut Gwitchin First Nation), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	YESAB Meeting Summary	Eliza (Two Worlds Consulting) emailed John (Vuntut Gwitchin First Nation) and Skeeter (First Nation of Na-Cho Nyäk Dun) regarding the August 24, 2023 meeting summary documenting the meeting between Chance and YESAB about the Project.	N/A	August 24, 2023 Meeting Summary
NND0092	31-Aug-23	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	N/A	Adrienne Hill (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Josee Tremblay (First Nation of Na-cho Nyäk Dun), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	YESAB Meeting Summary	Skeeter (First Nation of Na-Cho Nyäk Dun) emailed Eliza (Two Worlds Consulting) and cc'd Josee Tremblay (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) and Adrienne H. stating they could not find the invitation to attend the meeting with YESAB. Skeeter requested that Eliza send it again. Skeeter cautioned Chance's statement regarding community support for the Project, since First Nation of Na-Cho Nyäk Dun submissions have not been supportive as of recently.	N/A	N/A
NND0093	05-Sep-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Eliza Bethune (Two Worlds Consulting)	Cindy Dickson (Chance), Richard Wyman (Chance), Greg Charlie (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Adrienne Hill (First Nation of Na-cho Nyäk Dun), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), Eliza Bethune (Two Worlds Consulting), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	YESAB Meeting Summary & Follow Up Aug Action Items	Eliza (Two Worlds Consulting) emailed Skeeter (First Nation of Na-Cho Nyäk Dun) and cc'd Josee (First Nation of Na-Cho Nyäk Dun), Adrienne (First Nation of Na-Cho Nyäk Dun), Kevin (Two Worlds Consulting), Jennifer (EDI), Cindy (Chance), Richard (Chance), and Greg (Chance) stating that the meeting minutes had been updated with the feedback from First Nation of Na-Cho Nyäk and attached them to the email. Eliza (Two Worlds Consulting) also provided the presentation from the August 3rd meeting, a Draft project overview video, a plain language 2D and 3D seismic definition, linear feature baseline data, wildlife baseline data, socioeconomic baseline data, socioeconomic baseline data, Andrea Wilson (Yukon Government) contact details. Eliza (Two Worlds Consulting) stated that Chance would like to receive direction from the leaderships of First Nation of Na-Cho Nyäk Dun and Tr'ondëk Hwëch'in aroud interest in meeting with Chance (in person or virtually), support for community open house events, community-based research protocols to inform primary socio-economic baseline data collection, Project Proposal review period, and preferences around the incorporation of Indigenous Knowledge in the draft Project Proposal.	N/A	20230905-First Nation of Na-Cho Nyäk Dun0093A 20230905-First Nation of Na-Cho Nyäk Dun0093B 20230905-First Nation of Na-Cho Nyäk Dun0093C 20230905-First Nation of Na-Cho Nyäk Dun0093D
NND0094	06-Sep-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	Eliza Bethune (Two Worlds Consulting), McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Meeting Availability	Greg (Chance) emailed McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun) and cc'd Eliza (Two Worlds Consulting) and Cindy (Chance) requesting an update on what First Nation of Na-Cho Nyäk Dun would like in terms of community engagement. Greg (Chance) stated they are heading to VGFN Government and Community as part of their consultation process.	N/A	N/A
NND0095	07-Sep-23	Email	Incoming	First Nation of Na-cho Nyäk Dun	McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance), Cindy Dickson (Chance)	McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting)	Meeting Availability	McGarry (First Nation of Na-Cho Nyäk Dun) stated the recent evacuations had affected their meeting availability, and noted Chief Dawna Hope (Fist Nation of Na-cho Nyäk Dun) had been sick. McGarry (First Nation of Na-Cho Nyäk Dun) stated they would confirm dates for meeting in a couple of days.	N/A	N/A
NND0096	07-Sep-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	Eliza Bethune (Two Worlds Consulting), McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Meeting Availability	Greg (Chance) thanked McGarry for the update and wishing Chief Donna well.	N/A	N/A
NND0097	20-Sep-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance) Cindy Dickson (Chance)	Josee Tremblay (First Nation of Na-cho Nyäk Dun), Adrienne Hill (First Nation of Na-cho Nyäk Dun), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), Eliza Bethune (Two Worlds Consulting), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Engagement	Eliza (Two Worlds Consulting) emailed Skeeter (First Nation of Na-Cho Nyäk Dun) and cc'd Josee Tremblay (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun), Adrienne H., Kevin (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), Cindy (Chance), Richard (Chance), and Greg (Chance) following up on the September 5, 2023 email to Skeeter (First Nation of Na-Cho Nyäk Dun) regarding the August 3, 2023 meeting minutes, draft project overview video, plain language 2D and 3D seismic definition, linear features baseline data, wildlife baseline data, information on the Porcupine Caribou Herd, and socioeconomic baseline data materials. Eliza (Two Worlds Consulting) asked if Skeeter (First Nation of Na-Cho Nyäk Dun) had questions regarding the materials provided in that email from September 5, 2023.	N/A	N/A
NND0098	21-Sep-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Engagement	Greg (Chance) emailed McGarry (First Nation of Na-Cho Nyäk Dun) forwarding the email chain which included correspondence from Eliza (Two Worlds Consulting) to Skeeter (First Nation of Na-Cho Nyäk Dun) on September 5, 2023. Greg (Chance) asked First Nation of Na-Cho Nyäk Dun to provide direction on how they want to do community engagement and said there is a meeting on October 13, 2023 with all potentially affected First Nations about capacity funding opportunitites and that Chance will send over the meeting information.	N/A	N/A
NND0099	21-Sep-23	Email	Incoming	First Nation of Na-cho Nyäk Dun	McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance)	McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Meeting Availability	McGarry (First Nation of Na-Cho Nyäk Dun) emailed Greg (Chance) stating First Nation of Na-Cho Nyäk Dun Chief and Council will be discussing the Project at their next council meeting on September 25, 2023. Confirmed no questions about the Project at that time.	N/A	N/A

NND0135	19-Sep-23	Email	Incoming	First Nation of Na-cho Nyäk Dun	John Bailey (Vuntut Gwitchin First Nation)	Greg Charlie (Chance) Cindy Dickson (Chance)	John Bailey (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) Bailey, Andrea Wilson (Yukon Government), Brian Macdonald (Yukon Government), Keith Maguire (Yukon Government), Katie Fraser (Tr'ondëk Hwëch'in), executivedirector@First Nation of Na-Cho Nyäk Dunfn.com, lands.director@First Nation of Na-Cho Nyäk Dunfn.com, Jim Taggart (Unknown), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Bryony Mcintyre (Yukon Government), Laura Melvin (Yukon Environmental Socio-economic Assessment Board), Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council), Brandon Roebuck (Government of Canada), Elizabeth Staples (Vuntut Gwitchin First Nation), McGarry Selbee (First Nation of Na-cho Nyäk Dun), Jennifer Shalagan (Environmental Dynamics Inc.), Eliza Bethune (Two Worlds Consulting)	Executive Committee Screening	John (Vuntut Gwitchin First Nation) invited Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, and Gwich'in Tribal Council to a meeting with the Yukon Government, Chance, and Yukon Environmental Socio-economic Assessment Board regarding the Yukon Environmental Socio-economic Assessment Board Executive Committee screening for the Project. John (Vuntut Gwitchin First Nation) requested individuals RSVP if they were available for a virtual meeting at 10:30AM on , October 13th.	N/A	N/A
NND0136	21-Sep-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance) Cindy Dickson (Chance)	John Bailey (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) Bailey, Andrea Wilson (Yukon Government), Brian Macdonald (Yukon Government), Keith Maguire (Yukon Government), Katie Fraser (Tr'ondëk Hwëch'in), executivedirector@First Nation of Na-Cho Nyäk Dunfn.com; lands.director@First Nation of Na-Cho Nyäk Dunfn.com; Jim Taggart (Unknown), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Bryony Mcintyre (Yukon Government), Laura Melvin (Yukon Environmental Socio-economic Assessment Board), Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council), Brandon Roebuck (Government of Canada), Elizabeth Staples (Vuntut Gwitchin First Nation), McGarry Selbee (First Nation of Na-cho Nyäk Dun), Jennifer Shalagan (Environmental Dynamics Inc.), Eliza Bethune (Two Worlds Consulting)	Executive Committee Screening	Greg (Chance) emailed and stated thanks for organizing a meeting with the parties. Chance stated their team will be available for this meeting and will send out a presentation ahead of time.	N/A	N/A
NND0101	10-Oct-23	Email	Incoming	First Nation of Na-cho Nyäk Dun	Elizabeth Staples (Vuntut Gwitchin First Nation)	Greg Charlie (Chance) Cindy Dickson (Chance)	Shane Kilpatrick (Government of Canada), Kim Pawley (Government of Canada), Carey Sibbald (Government of Canada), Krista Magee (Government of Canada), Jennifer Walsh (Government of Canada), Alicia McKae (Gwich'in Tribal Council), Maggie Crump, Kanda Gnama (Gwich'in Tribal Council), Brian MacDonald, Keith Maguire (Yukon Government) (Yukon Government), Andrea Wilson (Yukon Government), Tiffani Fraser (Yukon Government), Jim Taggart (Unknown) (Yukon Government), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), and John Bailey (Vuntut Gwitchin First Nation)	Meeting	Elizabeth Staples (Vuntut Gwitchin First Nation)emailed Vuntut Gwitchin First Nation, Gwich'in Tribal Council, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Chance, and Two Worlds Consulting forwarding them a meeting invite for October 13, 2023. Elizabeth attached an agenda.	N/A	20231010-ALLNATIONS
NND0102	13-Oct-23	Meeting	N/A	First Nation of Na-cho Nyäk Dun	Elizabeth Staples (Vuntut Gwitchin First Nation)	Greg Charlie (Chance) Cindy Dickson (Chance)	Shane Kilpatrick (Government of Canada), Kim Pawley (Government of Canada), Carey Sibbald (Government of Canada), Krista Magee (Government of Canada), Jennifer Walsh (Government of Canada), Alicia McKae (Gwich'in Tribal Council), Maggie Crump, Kanda Gnama (Gwich'in Tribal Council), Brian MacDonald, Keith Maguire (Yukon Government) (Yukon Government), Andrea Wilson (Yukon Government), Tiffani Fraser (Yukon Government), Jim Taggart (Unknown) (Yukon Government), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), and John Bailey (Vuntut Gwitchin First Nation)	Meeting	A meeting was had between Chance, Vuntut Gwitchin First Nation, Gwich'in Tribal Council, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, the Yukon Government, Crown-Indigenous Relations and Northern Affairs Canada, Environmental Dynamics Inc., and Two Worlds Consulting. They discussed consultation activities for the Project and capacity funding opportunities to support First Nations' involvement in the Project's regulatory process.	N/A	20231010-ALLNATIONS
NND0106	16-Oct-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Meeting	Greg (Chance) emailed McGarry (First Nation of Na-Cho Nyäk Dun) and cc'd Skeeter (First Nation of Na-Cho Nyäk Dun) and Eliza (Two Worlds Consulting) to follow up and share our last presentation they provided on October 13, 2023. Greg (Chance) thanked Skeeter (First Nation of Na-Cho Nyäk Dun) for attending and representing First Nation of Na-Cho Nyäk Dun. Greg (Chance) said they provided another timeline for Chance submission which is in early/mid February 2024.	N/A	N/A

NND0107	17-Oct-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Traditional Knowledge Sources for First Nation of Na-Cho Nyäk Dun's Review, Comment, and Permission for Use	Eliza (Two Worlds Consulting) emailed Skeeter (First Nation of Na-Cho Nyäk Dun) and cc'd Kevin (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), Richard (Chance), Greg (Chance), Cindy (Chance), stating that Two Worlds Consulting on behalf of Chance had identified some existing secondary sources of Traditional Knowledge for First Nation of Na-Cho Nyäk Dun's review, comment, and permission for use. The table provided listed secondary sources related to First Nation of Na-Cho Nyäk Dun that, based on Two World's understanding, may contain Traditional Knowledge related to the Project area. Chance requested First Nation of Na-Cho Nyäk Dun's feedback including any protocols or guidance for the use of Traditional Knowledge and permission to use the listed secondary sources by , October 27, 2023. Chance also invited First Nation of Na-Cho Nyäk Dun to share any additional Traditional Knowledge sources that may not be listed to help inform the development of the socio-economic assessment and Project Proposal. Eliza stated that if First Nation of Na-Cho Nyäk Dun wanted to use alternative submission options for certain Traditional Knowledge sources, Chance would be happy to meet and discuss further.	N/A	N/A
NND0115	17-Oct-23	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Eliza Bethune (Two Worlds Consulting), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting)	Traditional Knowledge Sources for First Nation of Na-Cho Nyäk Dun's Review, Comment, and Permission for Use	Skeeter (First Nation of Na-Cho Nyäk Dun) emailed Eliza (Two Worlds Consulting) and cc'd Kevin (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), Richard (Chance), Greg (Chance), and Cindy (Chance), and stated they will forward the email regarding Traditional Knowledge sources sent on October 17, 2023 and will follow up with Eliza to confirm requested information.	N/A	N/A
NND0117	17-Oct-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	Eliza Bethune (Two Worlds Consulting), McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Traditional Knowledge Sources for First Nation of Na-Cho Nyäk Dun's Review, Comment, and Permission for Use	Greg (Chance) emailed McGarry (First Nation of Na-Cho Nyäk Dun) and cc'd Eliza (Two Worlds Consulting), attaching an email regarding the Traditional Knowledge Sources for First Nation of Na-Cho Nyäk Dun's review, sent on October 17, 2023.	N/A	N/A
NND0118	18-Oct-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting)	Meeting Minutes	Eliza (Two Worlds Consulting) emailed Skeeter (First Nation of Na-Cho Nyäk Dun) and cc'd Greg (Chance), Cindy (Chance), Richard (Chance), Kevin (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), and attached meeting minutes. Eliza (Two Worlds Consulting) noted that First Nation-specific restricted access file sharing sites will be available soon.	N/A	N/A
NND0119	18-Oct-23	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting)	Meeting Minutes	Skeeter (First Nation of Na-Cho Nyäk Dun) emailed Eliza (Two Worlds Consulting) and cc'd Cindy (Chance), Greg (Chance), Richard (Chance), Kevin (Two Worlds Consulting), and Jennifer (Environmental Dynamics Inc.) stating that they would check with First Nation of Na-Cho Nyäk Dun and Tr'ondëk Hwëch'in regarding who should have access to their respective file sharing sites.	N/A	N/A
NND0120	23-Oct-23	Email	Incoming	First Nation of Na-cho Nyäk Dun	McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Information Sharing	McGarry (First Nation of Na-Cho Nyäk Dun) emailed Greg C and cc'd Skeeter (First Nation of Na-Cho Nyäk Dun) requesting a clean copy of the CCBA for Chief Dawna Hope (Fist Nation of Na-cho Nyäk Dun) to sign.	N/A	N/A
NND0121	14-Nov-23	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Engagement	Skeeter (First Nation of Na-Cho Tr'ondëk Hwëch'in Dun) emailed Greg (Chance) stating they have reached out to TH and First Nation of Na-Cho Nyäk Dun regarding interest in meeting with Chance or an interest in Chance coming to their respective communities for an information session about the Project, and to date, has received no response.	N/A	N/A
NND0122	14-Nov-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Engagement	Greg (Chance) emailed Skeeter (First Nation of Na-Cho Nyäk Dun) stating they are hopeful TH or First Nation of Na-Cho Nyäk Dun engage in the Project soon. Greg (Chance) requested updates if Tr'ondëk Hwëch'in or First Nation of Na-Cho Nyäk Dun want to engage in the Project going forward.	N/A	N/A
NND0123	17-Nov-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Andrea Wilson (Yukon Government), Laura Melvin (Yukon Environmental Socio-economic Assessment Board), Chief Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Engagement	Greg (Chance) emailed a letter to Chief Dawna Hope (Fist Nation of Na-cho Nyäk Dun) and cc'd Richard (Chance), McGarry (First Nation of Na-Cho Nyäk Dun), Skeeter (First Nation of Na-Cho Nyäk Dun), Andrew W., Laura (Yukon Government), stating they have been informed through Skeeter (First Nation of Na-Cho Nyäk Dun) that First Nation of Na-Cho Nyäk Dun does not wish to be consulted on the draft Project Proposal at this time. To ensure clear communication, Greg (Chance) reached out to confirm this information formally via email and letter. Greg (Chance) attached a letter.	N/A	November 2023 Letter
NND0133	17-Nov-23	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	McGarry Selbee (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Andrea Wilson (Yukon Government), Laura Melvin (Yukon Environmental Socio-economic Assessment Board)	Consultation Update Letter	Greg (Chance) emailed Chief Dawna Hope (Fist Nation of Na-cho Nyäk Dun) and Council from First Nation of Na-Cho Nyäk Dun attaching a letter regarding the Proposed Eagle Plains Engagement and Consultation Update.	N/A	First Nation of Na-Cho Nyäk Dun0133A
NND0124	22-Nov-23	Letter	Outgoing	First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Greg Charlie (Chance)	Chief Dawna Hope (Fist Nation of Na-cho Nyäk Dun)	Consultation Update Letter	Greg (Chance) sent Chief Dawna Hope (Fist Nation of Na-cho Nyäk Dun) and Council from First Nation of Na-Cho Nyäk Dun a letter dated November 17, 2023 regarding the Proposed Eagle Plains Engagement and Consultation Update.	N/A	First Nation of Na-Cho Nyäk Dun0133A
NND0126	6-Dec-23	Email	Incoming	First Nation of Na-cho Nyäk Dun	Eliza Bethune (Two Worlds Consulting)	Cindy Dickson (Chance), Richard Wyman (Chance), Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Jennifer Shalagan (Environmental Dynamics Inc.)	Secondary TK Source Permission Request	Eliza (Two Worlds Consulting) emailed Skeeter (First Nation of Na-Cho Nyäk Dun) and cc'd Jennifer (Environmental Dynamics Inc.), Greg (Chance), Cindy (Chance), Richard (Chance), and Kevin (Two Worlds Consulting) providing a list of respective secondary TK sources for Tr'ondëk Hwëch'in and First Nation of Na-Cho Nyäk Dun, and requested confirmation that Skeeter (First Nation of Na-Cho Nyäk Dun) had received direction from Tr'ondëk Hwëch'in or First Nation of Na-Cho Nyäk Dun on preferences for use of publicly available secondary TK.	N/A	N/A
NND0134	6-Dec-23	Email	Incoming	First Nation of Na-cho Nyäk Dun	Skeeter Bethune	Cindy Dickson (Chance), Richard Wyman (Chance), Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Jennifer Shalagan (Environmental Dynamics Inc.)	Secondary TK Source Permission Request	Skeeter W. emailed Eliza B. confirming Skeeter W. would remind Tr'ondëk Hwëch'in and First Nation of Na-Cho Nyäk Dun about the source lists.	N/A	N/A

NND0127	20-Dec-23	Meeting	N/A	First Nation of Na-cho Nyäk Dun	N/A	Cindy Dickson (Chance), Greg Charlie (Chance)	Chris Albrecht (Environmental Dynamics Inc.) (Environmental Dynamics Inc.) (Environmental Dynamics Inc.), Mike Setterington (Environmental Dynamics Inc.), Kerman Bajina (Environmental Dynamics Inc.), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Deana Lemke (Porcupine Caribou Management Board), Joe Tetlichi (Porcupine Caribou Management Board), Matt Clarke, Eliza Bethune (Two Worlds Consulting), Haylee Dlouhy, John Bailey (Vuntut Gwitchin First Nation), Mike Suitor (Yukon Government)	Technical Working Group	Chance met with Environmental Dynamics Inc., a technical advisor on behalf of First Nation of Na-Cho Nyäk Dun and Tr'ondëk Hwëch'in, a technical advisor on behalf of Vuntut Gwitchin First Nation, the Porcupine Caribou Management Board, and Yukon Government to have a hybrid technical working group session. The purpose of this meeting was to discuss Project updates and Environmental Baseline Studies including potential effects and mitigation to Fish, Wildlife, Porcupine Caribou Herd, Linear Features, North Yukon Land Use Planning Conformity. The working group session also included and a question-and-answer period.	N/A	323-Chance_PCMB_Technical_Working_Group-December 20 2023_20240104
E014810	26-Jan-23	Meeting - In Person	N/A	First Nation of Na-cho Nyäk Dun	N/A	Cindy Dickson (Chance), Greg Charlie (Chance), (joined by telephone), Mike Chernoff, Richard Wyman (Chance)	Adrienne Hill (First Nation of Na-cho Nyäk Dun), Chief Pauline Frost (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Elizabeth Staples (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Erin Prelypchan (Two Worlds Consulting) (Two Worlds Consulting), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), James Smith (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) President Abe Wilson (Gwich'in Tribal Council) (Gwich'in Tribal Council), Roy Erasmus Jr. (Gwich'in Tribal Council) (Gwich'in Tribal Council), Tara Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), Willard Hagen (Gwich'in Tribal Council) (Gwich'in Tribal Council)	Engagement	Chance hosted an in-person meeting with leadership and technical advisors from First Nation of Na-Cho Nyäk Dun Gwich'in Tribal Council, and Vuntut Gwitchin First Nation in Vancouver. The purpose of the meeting was to re-establish collaborative working relationships, discuss engagement preferences going forward, and provide a Project update.	N/A	January 26, 2023 Meeting Minutes
NND0004	08-Dec-17	Email	Outgoing	First Nation of Na-cho Nyäk Dun	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	N/A	N/A	N/A	N/A

APPENDIX 2-A-34. Residents ofCommunities Record of Contact

Residents of Communities Record of Contact (January 1, 2014 - January 1, 2024)

Reference	Date	Communication Method	Location	Community Open House Attendees	Subject	Summary	Additional Comments	Attachments
VG0207	15-Jun-14	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 4:00 pm - 7:00 pm. Chance shared Project information by presentation. Chance provided dinner and door prizes.	N/A	210607_Chance_OldCrow_June15OpenHouseFlyer
VG0237	16-Jun-14	Community Event	Whitehorse	Residents of Whitehorse	Community Event	Chance held a community open house event in Whitehorse at the Yukon Inn from 4:30 pm - 6:00 pm. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided an open house survey to get feedback to improve future engagement with the community.	N/A	Open House Advertisement June 2014.pdf
VG0209	16-Jun-14	Community Event	Whitehorse	Residents of Whitehorse	Community Event	Chance held a community open house event from 1:00 PM to 2:00PM MST at the Vuntut Gwitchin First Nation Whitehorse Office at 3A-508 Hansen Street.	N/A	20140616-VG0209
NND0128	17-Jun-14	Community Event	Mayo	Residents of Mayo	Community Event	Chance held a community open house event in Mayo at the First Nation of Na cho Nyäk Dun Multi-Purpose Room from 10:00 am - 12:00 pm. Chance shared Project information by presentation and held a question-and-answer period after. Chance provided lunch to the residents of Mayo.	N/A	Mayo Open House Notice for June 17 2014.pdf Open House Advertisement June 2014.pdf
VG0210	17-Jun-14	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Old Crow Community Hall from 4:00 pm - 6:00 pm. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided dinner to the residents of Old Crow.	N/A	Old Crow Notice for June 17 2014.pdf Open House Advertisement June 2014.pdf
TH0099	18-Jun-14	Community Event	Dawson City	Residents of Dawson City	Community Event	Chance held a community open house event in Dawson City at the YOOP Hall from 4:00 pm - 6:00 pm. Chance shared Project information by presentation and had a question-and-answer period after.	N/A	Dawson City Open House Notice for June 18 2014
VG0238	03-Sep-14	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 3:30 pm - 7:30 pm. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided juice boxes and packaged sandwiches to the residents of Old Crow.	N/A	200826_Chance_OldCrowOpenHouseFlyerRevised.pdf
E01252	06-Jun-19	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community dinner in Old Crow at the Community Hall. Chance presented the draft Project Description, as well as the transition from Northern Cross to Chance Oil and Gas Limited, seismic techniques, YESAB process, YESAB's Executive Committee, consultation and engagement, and the Porcupine Caribou Herd.	N/A	E01252_190606_Chance_OldCrowCommunity_June6_SignInSheet.pdf E01252_190620_Draft_June6_VGCommunity-ChanceMeetingsummary_v.0.3.docx
E01254	19-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01255	20-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01253	21-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01256	22-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01257	20-Apr-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Meeting summary not available at time of submission.	N/A	E01257_210430_Chance_OldCrowOpenHouse_April20_SignInSheet.pdf
E01258	21-Apr-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Meeting summary not available at time of submission.	N/A	E01258_210430_Chance_OldCrowOpenHouse_April21_SignInSheet.pdf
E01259	18-May-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Meeting summary not available at time of submission.	N/A	E01259_210521_Chance_OldCrowOpenHouse_May18_SignInSheet.pdf
E01260	13-Oct-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 4:30 pm - 7:30 pm. Chance shared Project information by presentation. Chance provided a dinner and door prizes.	N/A	E01260_211101_Chance_OldCrowOpenHouse_Oct13_SignInSheet.pdf E01260_211123_VGCommunity-Chance_Oct13OpenHouse_Metingsummary_v.0.4.docx

E01398	05-May-22	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Darius Elias Community Centre from 11:00 am – 7:00 pm MST. Chance shared information regarding the Project, heritage resources, permafrost, seismic testing, and wildlife studies.	N/A	E01397_220526_VGCommunity-Chance_May5OpenHouse_Meetingsummary_v.0.3.docx E01397_220505_VGCommunity-Chance_May5OpenHouse_Sign-inSheet.pd
E01384	26-May-22	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Darius Elias Community Centre from 10:00 am – 8:00 pm MST. Chance shared information regarding the Project, drilling techniques and equipment, YESAA and YESAB's Pre-Submission Engagement Process, linear features and disturbance, and water bodies in the Project area.	N/A	E01384_220606_VGCommunity-Chance_May26OpenHouse_Meetingsummary_v.0.5.docx E01384_220525_VGCommunity-Chance_May25OpenHouse_sign-inSheet.pdf
VG0098	10-Jan-23	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance went to Old Crow to witness the Swearing In Ceremony of the newly elected Vuntut Gwitchin First Nation leadership.	N/A	E01485 - Air North Yukon's Airline-Confirmation 23163751
VG0142	15-May-23	Community Event	Old Crow	N/A	Community Event	The Project Team travelled to Old Crow and planned to conduct an in-person community open house event. This event was cancelled due to a potential flash flood. Chance, with approval from Chief Frost, provided a catered dinner for leadership and community members at the Old Crow Community Centre.	N/A	N/A
VG0143	15-May-23	Community Event	Old Crow	N/A	Community Event	The Chance team travelled to Old Crow and the meeting ended up being postponed due to potential flooding of the community.	N/A	N/A
E0141852	16-May-23	Community Event	Inuvik	Residents of Inuvik	Community Event	Chance held a community open house event in Inuvik at the Nihtat Gwich'in Council Board Room from 4:00 pm – 8:00 pm MST. Six community members attended this event. Open house attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to open house attendees. This presentation included a question-and-answer period as well as a draw for two Air North tickets.	N/A	Summary Report
E0141852	17-May-23	Community Event	Fort McPherson	N/A	Community Event	Chance planned to conduct an in-person community open house event in Teetł'it Zheh (Fort McPherson). This event was cancelled due to flash flooding in the Teetł'it Zheh (Fort McPherson) area.	N/A	N/A
E0141852	17-May-23	Community Event	Fort McPherson	N/A	Community Event	Chance planned to conduct an in-person community open house event in Teetł'it Zheh (Fort McPherson). This event was cancelled due to flash flooding in the Teetł'it Zheh (Fort McPherson) area.	N/A	N/A
VG0236	06-Dec-23	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a World Cafe event in Old Crow at the Darius Elias Community Centre from 4:00 pm – 8:00 pm MST. World Cafe attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to World Cafe attendees. After dinner, technical experts from EDI, Ecofor, and Palmer were divided amongst the groups. Focus group #1 had a presentation from EDI on Wildlife and Fish and Fish Habitat. Focus group #2 had presentations from Ecofor and Palmer on Archaeology / Heritage Resources and Permafrost. Once presentations and comments/concerns were addressed, the technical experts switched tables and presented to the rest of the attendees. The World Cafe event had door prizes that were drawn throughout the event which included 2 Air North gift cards, 3 Co-op grocery gift cards, Ecofor packages, and a mug from Indigo.	N/A	Summary Report

GTC0220	07-Dec-23	Community Event	Fort McPherson	Residents of Fort McPherson	Community Event	Chance held a community open house event in Fort McPherson at the Tetlit' Zheh Fort McPherson Hamlet Chamber from 4:00 to 8:00 pm MST. Open house attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to the Open House attendees. The Open House event had door prizes that were drawn throughout the event which included 2 Air North gift cards, 2 Co-op grocery gift cards, and Ecofor packages.	N/A	Summary Report

APPENDIX 2-B. Gwich'in Tribal Council and Residents of Inuvik, Fort McPherson, Tsiigehtchic, and Aklavik Consultation and Engagement Records

APPENDIX 2-B-01. Eagle Plains Multi-Well Exploration Program – Northern Cross (Yukon) Ltd. Letter

NORTHERN CROSS

September 26, 2016

President Bobby Jo Greenland-Morgan
Gwich'in Tribal Council
P.O. Box 1509
Inuvik, NT

sent by fax: (867) 777-7919

Dear President Greenland-Morgan:

On behalf of Northern Cross (Yukon) Limited ("NCY"), I would like to congratulate you on your recent election victory to become the new President of the Gwich'in Tribal Council ("GTC"). We wish you a successful term as President and look forward to working with you and the GTC in the future.

As you likely know, NCY is involved in a small scale project exploring for oil and natural gas in the Eagle Plains area of northern Yukon. At this time, there is no activity pending the outcome of a Judicial Review and future Yukon Environmental and Socio-Economic Assessment Board ("YESAB") assessment and eventual regulatory approval processes.

Since mid 2012, NCY has drilled four exploration wells and completed a 325 square kilometer seismic program on some of the exploration lands awarded to NCY by the Yukon Government. There is a plan to drill up to 20 more exploration wells over a multi-year period to continue the evaluation of the oil and natural gas resource potential on prospects identified using the recently obtained seismic data. NCY has also relied on information available from other wells drilled by other companies in the area over the past fifty years and data obtained from wells drilled by NCY to help generate these drilling locations. Whether all 20 wells get drilled will depend on results as the program unfolds. This planned program is designed to minimize environmental impacts by operating only one drilling rig. Spreading the program out over several years gives northern businesses the visibility to invest in training, equipment and services to be able to participate in this project more effectively than if the work is compressed into a shorter time period using more drilling rigs. The maximum areal impact if the entire drilling program is completed is about 1 square kilometer in an area that is about 325 square kilometers. The maximum area of impact is smaller than the town site of Fort McPherson.

The exploration work that NCY has done to date and the future exploration work described above is not situated in the drainage of the Peel River Watershed, but some of the activities that NCY has done and proposes to do are in the Secondary Use Area. Lastly NCY has not done any hydraulic fracturing and does not plan to use hydraulic fracturing in the proposed exploration program.

Northern Cross (Yukon) Limited

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Cell (867) 333-0010

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Calgary, AB T2P 3J4
Telephone (403) 699-0055
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Depending on the results of the exploration work, there is potential to develop resources to serve the regional market, including the Mackenzie Delta region, which could bring significant economic benefits to the region and displace very high cost imported fuel. There will also be significant reductions in greenhouse gas emissions by dramatically reducing the transportation fuel consumption to bring fuel from current sources like North Dakota, Washington State, Alaska, British Columbia and Alberta. Using modern designs and best operating practices, the environmental impact of any development of resources at Eagle Plain is expected to be minimized.

In addition to the environmental benefits described above, there are employment and business opportunities. NCY has retained the services of several Gwich'in businesses in Ft. McPherson and Inuvik during past exploration work and anticipates using them again in the future.

In case there is some misconception, I want to clarify the reason for NCY to apply to the Federal Court for a Judicial Review of a recent YESAB evaluation report and the Designated Office referral to Executive Committee for further review. NCY took this step to ensure that the project under review gets a fair hearing and address procedural practices of YESAB that NCY considers to be unfair. In accordance with the rules of the Federal Court, all participants in the YESAB process evaluating the proposed 20 well exploration project were served with the Judicial Review Application, but the objectives of the application are not directed at First Nations nor are they aimed at diminishing any rights under land claim agreements. This is purely a matter of achieving procedural fairness.

I have also attached a summary of key aspects of NCY's project, partnership opportunities for First Nations, the Judicial Review and protecting caribou for your reference.

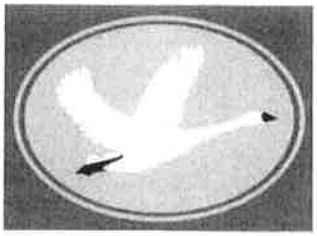
Once you have settled into your new role, NCY would be pleased to meet with you to discuss the exploration program, efforts we take to minimize environmental impacts, economic benefits and other matters that are important to you.

Please contact me if you have any questions and to advise when you wish to meet. We look forward to working with the GTC in the future. I can be reached at (587) 390 4136 or by email at rwyman@northerncrossyukon.ca.

Yours truly,
Northern Cross (Yukon) Limited

Richard Wyman
President

Attachment
Cc: Greg Charlie
Cindy Dickson



Exploration Project

- Small size impact: less than 1 square kilometer of total impact if all 20 of the proposed exploration wells are drilled and all are discoveries of oil or natural gas that proceed to extended flow testing, which also includes building up to 87 kilometers of year round access roads
- For perspective, excluding the airfields, the town sites of Mayo and Old Crow each cover an area similar to the maximum impact of the exploration drilling program. Dawson City covers an area that is more than 30 times the size of the area of maximum impact.
- The proposed exploration project is planned to occur within the 325 square kilometer area where 3D seismic data was obtained during the winter of 2013-2014
- This project proposal is exploration related work and is not development. More YESAB screening is expected on any discoveries that become development projects
- Exploration activities have uncertain outcomes.
- How many of the proposed 20 wells actually get drilled depends on results as the drilling program proceeds because many of the planned wells depend on successful outcomes from the initial wells drilled
- If drilling results are discouraging, fewer exploration wells will get drilled
- The most likely outcome is that only a few discoveries will be made and undergo extended flow testing, which means the impact will be much less than the maximum described above.
- Any wells undergoing flow testing provide useful information to be able to design development plans
- Nothing in the proposed exploration project is resource development
- Northern Cross has an excellent track record of environmental protection and minimizing impacts
- Activities are designed to be small scale and extend over a longer time period to create more job and business opportunities for Yukoners and to minimize environmental impacts
- Hydraulic fracturing is not part of the proposed exploration drilling and evaluation program.
- The proposed exploration activities are not in the Peel River Watershed

Partnership Opportunities

- Northern Cross recognizes the important role that First Nations offer in the longer term success of resource exploration and development
- Environmental stewardship (base line studies, monitoring, adaptive management plans, protecting traditional uses)
- Business development opportunities (oil field services, direct investment similar to the VG ownership of Air North, synergies with other VG businesses)

Judicial Review

- Northern Cross has challenged YESAB on grounds of procedural unfairness
- YESAB made a referral to Executive Committee based on reasons that had never been presented to Northern Cross
- Northern Cross was never given the opportunity to address these new concerns
- In the interest of fairness, Northern Cross wants the opportunity to respond to the new issues identified by YESAB in its Evaluation Report of February 8, 2016
- The judicial review is a challenge only against the Government of Canada, who is acting on behalf of YESAB in this court process.
- Northern Cross is NOT challenging any First Nation or any legal rights of First Nations under Umbrella Final Agreements in this Judicial Review
- However, all parties who participated in the YESAB review of the exploration drilling program were served with the court application made by Northern Cross for a Judicial Review in the normal course of the legal process

Caribou protection

- Northern Cross cares deeply about caribou and the environment and manages its activities to minimize or eliminate impacts.
- Northern Cross has a demonstrated track record of environmental protection, including protecting caribou
- Northern Cross has prepared several management plans with the help of professional experts in their fields including recognized experts knowledgeable in the Porcupine Caribou Herd
- The management plans have been reviewed by VG government departments and are designed to be adaptable based on experience gained in the field.
- Northern Cross has proposed forming a Caribou Stakeholder Advisory Board comprised of interested stakeholders to provide guidance in the management of project activities in situations where caribou are present.

APPENDIX 2-B-02. Chance Oil and Gas Limited Introductions and Engagement and Communication Plan Letter

Chance
OIL AND GAS LIMITED

December 1, 2017

Chief [redacted]
Tetlit Gwich'in Council
PO Box 30
Fort McPherson, NT
X0E 0J0

Attention: Chief [redacted]

Re: Chance Oil and Gas Limited Introductions and Engagement and Communication Plan

Firstly, we would like to congratulate you on the recent news regarding the Peel Watershed decision; in addition to ensuring that the spirit and intent of modern day treaties and subsequent processes out of it are honoured, it will also provide much certainty of process for industry looking to develop projects within the Yukon.

In March of 2017, the structure of Northern Cross Yukon Limited substantially changed and Chance Oil and Gas Limited (Chance) was formed. As a result of these changes, the management team at Chance is looking to renew and reinvigorate the relationships we have with the First Nations our proposed exploration program may impact. We recognize that First Nations are very busy, and that the Tetlit Gwich'in Council (TGC) has many files that demand the attention of many of your resources. However, we hope that TGC is available as we work to develop engagement and communication plans with all of our potentially affected First Nations.

As you may know, the permits of interest that Chance currently holds were extended to August 30, 2018 under Order in Council (OIC) 2016/169. Permits 7, 9, 13, 14, 15, 17, 19, and 20 fall within TGC Secondary Use area and permit 15 falls within TGC Primary Use Area; Chance is seeking to engage TGC on our exploration program activities within these permits. The engagement and communication plan that we wish to develop through dialogue with you will also support our desire to continue holding these permits beyond August 30, 2018, and to work collaboratively with you to our mutual benefit into the future.

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an Executive Committee Screening in February 2016. We welcome the greater level of scrutiny an Executive Committee Screening provides, as we recognize that First Nations and other Yukon citizens will need a more comprehensive public discussion on the benefits and potential risks associated with oil and gas development in the Yukon. Further to this point, as we work toward preparing our revised Project Proposal, it is our sincere desire to work in closer partnership with all our affected First Nations throughout all phases of the project.

As Chance pursues the oil and gas exploration program, we are also seeking to build strong, collaborative relationships based on transparency, openness, and respect with the First Nations in whose territories we will be active. As such, an invitation to meet with you and representatives of your choosing at your Government office, or a location of your preference, in coming months would be most appreciated. This meeting will provide an opportunity for the Chance team to introduce ourselves and begin collaborative discussions with you to jointly establish an appropriate a framework for developing an engagement and communication plan that suites the needs of both TGC and Chance.

To support Chance's renewed approach to engagement, we have retained Hemmera, a Whitehorse-based consultancy, to support us in facilitating dialogue between ourselves and affected First Nations and Yukoners. As such, Hemmera will also be engaged in the meeting we wish to schedule with you to set forward a framework for developing an engagement and communication plan. We look forward to hearing from you at your earliest convenience.

Sincerely,

[redacted]

President, Chance Oil and Gas

CC:

[redacted] Gwich'in Tribal Council
[redacted], Vice President of Government and Community Relations, Chance Oil and Gas
[redacted], Regulatory, Environmental and Community Relations Coordinator, Chance Oil and Gas
[redacted], Chair of Community Relations Committee, Board Member, Chance Oil and Gas
[redacted], Socio-community Specialist, Hemmera
Hon. [redacted], Minister of Energy Mines and Resources, Yukon Government

APPENDIX 2-B-03. January 22, 2018, Meeting Summary – document not available at time of submission.

APPENDIX 2-B-04. May 29, 2018, Meeting Summary – document not available at time of submission.

APPENDIX 2-B-05. July 27, 2018, Meeting Summary - document not available at time of submission.

APPENDIX 2-B-06. July 31, 2018, Meeting Summary – document not available at time of submission.

APPENDIX 2-B-07. August 1, 2018, Meeting Summary - document not available at time of submission.

APPENDIX 2-B-08. Draft *Terms of Reference (TOR)* (Version 1) - document not available at time of submission.

APPENDIX 2-B-09. October 17, 2018, Meeting Summary - document not available at time of submission.

APPENDIX 2-B-10. November 15, 2018, Meeting Summary - document not available at time of submission.

APPENDIX 2-B-11. December 14, 2018, Meeting Summary - document not available at time of submission.

APPENDIX 2-B-12. *Gwich'in Tribal Council and Chance Oil and Gas Limited Communications and Consultation Plan*

Gwich'in Tribal Council and Chance Oil and Gas Limited Communications and Consultation Plan

1.0 Introduction

Chance Oil and Gas Limited ("Chance") is an oil and gas exploration company that holds permits to perform oil and gas exploration activities in the Eagle Plain basin of the Yukon Territory, Canada. The Gwich'in Tribal Council ("GTC") is an Indigenous organization that holds rights under Section 35 of the *Constitution Act*, 1982, *Treaty 11* and the *Gwich'in Comprehensive Land Claim Agreement* ("GCLCA"), including Appendix C – *Yukon Transboundary Agreement* ("YTA"). Under the YTA, "Tetlit Gwich'in" is defined as a Gwich'in who either: (a) resides in the Peel River watershed, including the community of Fort McPherson, Northwest Territories; or (b) is descended from an aboriginal person who used or occupied the Peel River watershed on or before December 31, 1921. Under this definition, Tetlit Gwich'in and their descendants currently reside in Aklavik, Inuvik, Tsiigehtchic and Fort McPherson, as well as elsewhere in Canada and abroad. Under the GCLCA, the GTC is the body responsible for representing the collective rights of GCLCA participants, including all Tetlit Gwich'in as defined in the YTA.

As part of Chance's exploration program, Chance, as the proponent, seeks to develop a communication and consultation plan ("the Plan") with the GTC, as a rights holder for these Yukon lands that could potentially be affected by Chance's exploration program activities. These Yukon lands are identified in the YTA as the Primary Use Area and the Secondary Use Area lands. With the exception of permit 15 which straddles the Primary Use Area, all of the permits held by Chance, namely 7, 9, 13, 14, 15, 19, and 20, are located within the Secondary Use Area.

The Plan will reflect and be consistent with the GTC's role as the Indigenous organization responsible for upholding the collective rights held by Gwich'in in the Primary Use Area and Secondary Use Area within the Yukon. This Plan will acknowledge the GCLCA organizational structure, and as such, is intended to extend to and encompass the GTC, the Designated Gwich'in Organizations, and including the Tetlit Gwich'in Council (the "Gwich'in Partners"). The Gwich'in Partners will seek to establish an internal Memorandum of Understanding (MOU).

2.0 Purpose

This document serves as a Plan to provide a mutually agreed upon framework to support collaborative and effective communication and consultation between Chance and the Gwich'in Partners.

3.0 Relationship

Chance and the Gwich'in Partners will execute this Plan according to the following principles:

- Transparency;
- Timeliness; and
- Mutual respect, trust and understanding.

4.0 Key Gwich'in Tribal Council and Chance Connections

Communication and consultation between Chance and the Gwich'in Partners will be generally associated with the proposed works and potential effects associated with Chance's oil and gas exploration program, and with potential new opportunities or benefits received by the Gwich'in people, from Chance, as the project proponent. Once the scope of Chance's specific plans are determined, the Gwich'in Partners, together with Chance, will discuss the anticipated impacts on Gwich'in rights within the Primary and Secondary Use Areas, as well as the best way of addressing the impacts defined at that time.

This section of the Plan identifies the key contacts related to these overarching communication and consultation themes. Key representatives involved in communication and consultation are expected to be as follows:

- Grand Chief/President of the Gwich'in Tribal Council;
- President of the Tetlit Gwich'in Council (TGC);
- Gwich'in Tribal Council's Chief Operating Officer (COO); and
- Chance Management and designated staff and advisors.

Communication and consultation with the Gwich'in Partners will be coordinated through the Gwich'in Tribal Council's Chief Operating Officer.

Key Chance representatives involved in communication and consultation are expected to be as follows:

- Chance Oil and Gas Chairman and Chief Executive Officer (CEO)
- President of Chance Oil and Gas;
- Vice President of Government and Community Relations; and
- Regulatory, Environmental, and Community Relations Coordinator.

5.0 Communication and Consultation Methods

Chance and the Gwich'in Partners will employ the following communication and consultation methods:

- In person meetings;
- Email;
- Sharing Power Point Presentations (to support in person meetings);
- Sharing reports and documents (as requested and as required);
- Telephone correspondence (teleconferences and less formal phone calls); and

- Identifying and documenting issues of concern raised by the Gwich'in Partners during consultation meetings, and Chance providing written responses to the identified issues within 30 days of the meeting, to serve as the basis for ongoing dialogue and resolution.

5.1 Meetings Process

Communication and consultation meetings will be executed in the following manner:

1. Chance and/or the Gwich'in Partners will request a meeting in writing to the other party according to the connections iterated in Section 4.0, no less than ten business days of the proposed meeting date;
2. The parties to meet will develop the agenda collaboratively;
3. The party requesting the meeting will develop supporting materials (collaboratively, where possible), and share those at least two days in advance of the meeting; and
4. The meeting will take place in a mutually agreeable location.

The above general process applies to meetings with subject matter leads, and where reasonable, meetings with communities at large.

5.2 Documentation

The following documentation sharing and review protocols support the communication and consultation methods described above:

- Action items and meeting outcomes will be logged during meetings and reviewed by both Chance and by the Gwich'in Partners at the end of the meeting to ensure that there is general agreement on the list of actions and entities responsible for those actions. The list of action items and meeting outcomes will be recorded in writing and shared between Chance and the Gwich'in Partners, within ten business days following the meeting date;
- Chance and the Gwich'in Partners will agree upon and use a file sharing platform to facilitate sharing of large files, such as Power Point presentations, reports and documents exchange relating to specific issues identified that were the object of specific consultations;
- Should Chance and the Gwich'in Partners employ a third party for records development and management, the third party will follow the process described above for recording and providing meeting minutes;
- Pursuant to Section 5.1, Chance and the Gwich'in Partners will exchange documents pertaining to issues identified in the communications and consultation process that may affect Gwich'in rights pertaining to the Primary and Secondary Use Areas in the Yukon. These documents will include written summaries of decisions reached collectively and agreed upon concerning these issues.

6.0 Records Management

Summarized records of communication and consultation between Chance and the Gwich'in Partners will be kept in a records log. Chance will ultimately submit the items below to regulators and assessors for review if and when a potential project is assessed in the future:

- Meeting Agendas;
- Meeting Action Items as described in **Section 5.0;**
- Invitee/Attendees lists and/or meeting sign-in sheets;
- Records log, which will include summaries of the following:
    - In person meetings;
    - Phone calls and teleconferences;
    - Incoming and outgoing emails between Chance and the Gwich'in Partners.
- Reports and documents provided to the Gwich'in Partners by Chance and reports and documents provided to Chance by the Gwich'in Partners for review and consideration;
- Copies of Power Point presentations delivered by Chance to the Gwich'in Partners;
- Copies of any presentations delivered by the Gwich'in Partners to Chance; and
- Documents exchanged pertaining to issues raised during the communications and consultations process, as identified in Section 5.0.

7.0 Adaptive Management of the Communication and Consultation Plan

Chance and the Gwich'in Partners will review and assess the effectiveness and success of this Plan on at least a six-month basis.

Chance and the Gwich'in Partners agree to establish a *Chance-Gwich'in Communications and Consultation Management Committee* of senior officials to serve as a focal point for the co-development and co-management of current and future plans and activities associated with Chance's exploration program activities. Chance and the Gwich'in Partners will nominate representatives to serve on this Committee. Those representatives will determine the required frequency of meetings, but it is envisaged that for the first year following agreement on the Plan that meetings of the Committee would be held one time per each season. It is also understood by Chance and Gwich'in Partners, that a Terms of Reference will be developed by the Committee. The Committee will be supported by a Secretariat, both of which will be wholly funded by Chance. Chance and Gwich'in partners will hold the first meeting within 60 days of finalizing this Plan.

8.0 Cost and Economic Opportunity

The Gwich'in Partners, together with Chance, have discussed their mutual interest in working towards ensuring that GCLCA Participants are able to derive and participate in benefits arising from Chance's proposed oil and gas exploration activity within the Primary and Secondary Use Areas in the Yukon. Chance recognizes the importance of, and commits to, working respectfully and collaboratively with the GTC and Gwich'in partners during engagement, consultation, and any negotiations on agreements that will take place in the future, to the same degree and manner as Chance would with any Yukon First Nation, whose settlement land or traditional territory may be affected by oil and gas activity in the Eagle Plain Basin.

As the Communications and Consultation Plan is implemented, Chance and GTC agree to discuss a Cooperation Agreement wherein opportunities or benefits are defined that the Gwich'in people, as represented by the Gwich'in Partners, would receive from Chance. Benefits could include such things as, capacity funding, employment opportunities, contracting opportunities, scholarships and education and training opportunities, other financial and implementation payments, and equity participation.

9.0 Signatures of the Parties

This Plan is approved by the following parties:

[redacted]

Gwich'in Tribal Council

[redacted]

Chance Oil and Gas limited

APPENDIX 2-B-13. February 1, 2019, Meeting Summary

Summary

Chance Oil and Gas Limited All-Party Meeting

Date: February 1st, 2019 **Time:** 8:00 am to 4:15 pm

Location: Princess Louisa Room, Fairmont Waterfront Hotel, Vancouver, BC V6C 3L5

Meeting Participants:

Vuntut Gwitchin Government:

- Chief [redacted]
- [redacted] Fish and Wildlife Manager
- [redacted] Lands Manager
- [redacted] Intergovernmental Coordinator

First Nation of Na-cho Nyak Dun:

- [redacted] Deputy Chief
- [redacted] Lands and Resources Manager
- [redacted] Strategic Advisor

Gwich'in Partners (Gwich'in Tribal Council and Tetlit Gwich'in Council):

- Chief [redacted]
- [redacted] Director, Lands and Resources

Yukon Government

- Minister [redacted] Energy, Mines and Resources and Economic Development
- [redacted] Assistant Deputy Minister, Oil, Gas and Mineral Resources, Energy, Mines and Resources
- [redacted] Director, Oil, Gas and Mineral Resources, Energy, Mines and Resources

Chance Oil and Gas Limited:

- [redacted] Chairman/ CEO
- [redacted] President
- [redacted] Vice President of Community and Government Relations
- [redacted] Regulatory, Environmental and Community Relations Coordinator

Hemmera:

- [redacted] VP Human Environment
- [redacted] Business Leader, Human Environment
- [redacted] Human Environment Specialist
- [redacted] Human Environment Specialist

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Summary:

Topic	Lead
Introduction to Meeting • Review of Agenda • Meeting purpose and objectives Summary: Hemmera was hired in 2017 to assist with the consultation and engagement activities for Chance's exploration project in Eagle Plains.	[redacted]
Round Table Introductions and Opening Statements by Chiefs Summary: Chief [redacted], Minister [redacted] Chief [redacted], and [redacted] provided opening statements.	All Parties
First Nation Engagement Plans • Overview of how we got here and an update on implementation Summary: Chance's current round of engagement was spurred by the 2016 OIC, followed by the 2017 Ministerial Order. A series of meetings started in 2018 to collaboratively create engagement plans, starting with a template, then building out from there. This resulted in unique documents between Chance and each First Nation. Annual reports are required under the 2018 Ministerial Order. Likely not an onerous task, and along the lines of a communication summary. Level of detail will likely be decided by individual First Nations. ***See Appendix 1 – Chance All-Party Meeting: Engagement Plan Presentation***	[redacted]
Overview of Vuntut Gwitchin Government Oil and Gas Engagement Policy Summary: Vuntut Gwitchin Government (VGG) wanted an opportunity to share with the group the work VGG has done over the past year. Guiding principles of the VGG Oil and Gas Engagement Policy (Policy): sustainable development; the NYRLUP; VGG Final Agreement; past learning experiences with YESAB (e.g., gaps in regulatory regime in the Yukon); international standards. The development of oil and gas is a community decision. The Policy is two pieces/themes: internal engagement within the community and how the community will decide on oil and gas; and, external engagement with industry (i.e., the Policy establishes a committee). The Policy itself has three phases. All phases are meant to occur prior to a YESAB submission. VGG believes the new YESAB process (i.e., Pre-Submission Engagement process) largely aligns with the objectives of the Policy. Currently, we are before stage one – waiting for notification from Chance Question: Regarding the format/structure diagram – in terms of YESAB, once an application is complete and there is feedback, does that go to the Council? VGG: Feedback goes back into the whole loop – the loop including Council, the committee, and citizens. The committee isn't an interface between the VGG and YG. The committee would be tasked, as per its specific role, and then they would	[redacted]

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report back to the Chief and Council after having done their work. At a later date VGG could expand on the internal processes for clarity.

See Appendix 2 – Chance All-Party Meeting: VGG Oil and Gas Engagement Policy Presentation

Exploration Project Description and Discussion

- Overview of the exploration project plans, oil and gas disposition plans, and YESAB application
- Answer questions or provide clarity on the Exploration Project Description

[redacted]

Summary: First exploration of oil and gas occurred in the Yukon when it was still being permitted by Ottawa back in the 50s, 60s, 70s. Red polygons on the permit map – legacy of exploration done approximately 1959-1968 when oil was found in the Yukon. These properties by themselves are not adequate to move forward with development – more needs to be discovered.

Question: For the discoveries, are conventional or non-conventional means required?

Chance: Do not need to stimulate the rock to facilitate production. Conventional means of extraction would be used.

Winter 2013/2014 had 3D seismic activity, the first in the Yukon. Chance has a base camp that can house 75 people. A limiting factor is man power (i.e., limited places to stay). Land tenure is the period of time that a permit is valid. On the Permits Map, the colour pertains to how the tenures have been extended.

Exploration activities can entail a number of things. Seismic: now lines carved through the bush are not straight, there is no line of sight, and the line are much narrower than those in the 1950s and 1960s. 3D seismic allows you to collect subsurface information in all directions. Exploration activities will include running a basecamp. Chance has to bring up everything needed in order to undertake an activity. Exploration is the riskiest part of the oil and gas industry, and the hardest part of the industry to get money allocated. A population of wells, in order to drill, learn more, and increase your probability of success is preferred.

Question: If Chance went with a 35 well program – is it 35 well pads on the surface with horizonal drilling under ground, or 35 wells total?

Chance: Not certain if we've thought well enough ahead to know that. Not all 30 wells will be exploratory. If something is found, then may need to drill in the vicinity. Possibly drill from the same well pad or one close to it in order to get a better idea of the resource.

YTG: Each well would be authorized. Not by pad.

Question: Would activities be primarily seismic first?

Chance: We do not necessarily have to shoot seismic in order to drill right now as there is legacy data. Chance does not have to do new seismic in all cases.

Chance's goal is to discover and develop a resource that meets the needs of the North and then expand. Chance wants to build local capacity. Around 80% of what Chance needs to

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execute a program they cannot get from the Yukon (i.e., a supply line from the Edmonton area is required). If the supply chain can be shortened, it is building capacity and economy in the Yukon. Additionally, it is cheaper to operate in a continuous fashion as opposed to stopping and starting (more costly).

Question: Would activity be year-round?

Chance: Depends on the production, depends on the nature of the access. All weather access is the Dempster. However, if discoveries are made elsewhere, may need to consider all weather access off the Dempster.

Chance would assess before going out on the land to minimize footprint (e.g., build winter access on existing access routes is preferable)

Chance's drilling plan would have one rig maybe two at any given point. Trying to have a smaller scale over a longer period of time. This gives people/community time to get ready, buy equipment, get training.

Question: The concept around winter road versus summer road. All season road would be required if you need to flow test, correct? A year-round fixture on the land?

Chance: Yes, if you are flow testing then you are taking a product out of the ground, over longer periods of time, and you need to get equipment to test it (e.g., trucking operations in the testing period).

Question: For the purpose of the proposal, would that be addressed?

Chance: Yes, it would be covered off in the proposal.

First Chance would go with winter access. and then explain what would happen in the future with a well (e.g., if a well bears fruit, then this is where permanent access would need to be). This would be in the proposal to YESAB.

A multi-well program in an identified area of interest would ensure flexibility. If something is discovered, there will be a significant green house gas reduction (i.e., supply line will be reduced). The camp location was the location used when the highway was under construction – Chance is trying to reactivate/reuse previously disturbed areas.

Question: What does 300 million litres mean?

Chance: The amount of fuel trucked around the Yukon. Fuel is carried in two truck trailers that carry 50,000L each. Chance is likely not going to take out the full 300 million litres but could reduce it to 200 million litres. 2000-3000 barrels a day would remove the need to get fuel to the Yukon. The source would be local instead of foreign. 2000 barrels is about 11 truck loads.

Question: VGG has about 20 monitoring stations to keep a close eye on what's going on in the watershed – how can Chance participate in that?

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Chance: Will need clarification, but Chance will be identifying data gaps. E.g., creeks in the area of interest. There is going to be monitoring place for parties to track what's going on. With respect to the Policy. There are stages to go through, and they align well with YESAB processes. Fairly soon Chance is going to have to work on/refine its project scope. Chance's objective is to build capacity and try to operate as continuously as possible. Sequencing of project activities would need to meet Chance's capacity. In the start limited to winter activities. Steady work gives the basis for local businesses to commit to local training. YESAB takes quite a bit of time, and the tenure clock is always ticking. There is a cost associated with multiple entries into YESAB. Question: 400 km/sq area? What area? Chance: Area of interest is about 40% of the total area under permits (See Appendix 3) Question: Expectation of timing for field work and the YESAB process? Chance: Ideally, field work two years from now, after YESAB. Also, likely an application to the Yukon Water Board. Confirming scale and scope with the hope to enter YESAB later this year. Have to satisfy the Policy and any new changes to YESAB. VGG: Can see the benefits but weigh it with concerns for the land and waters. Parties have different mandates but there is overlap. Cooperation Agreement and the front-end approach could be beneficial. Time pressure yes, but it will facilitate YESAB and YOGA agreement. A balance to be struck with timelines and capacity. There is limited oil and gas experience in the Yukon, and the Yukon is nothing like the rest of the country because there is robust land use planning and the power of the people. Mandates come from the people and this will benefit the people. Both sides have significant investments. Acknowledges that parties have and are seeking different requirements: certainty versus flexibility. Question: Is the NYRLUP up for review? It was completed in 2009, parties to the plan have been talking about what a review looks like. Currently assessing the plan to see where it's doing its job and where it might not be (Note: the plan will have new lines/boundaries). Minister Ranj Pillai departed 11:26 am. ***See Appendix 4 – Chance All-Party Meeting: Chance Oil and Gas Project Description Presentation***	
In-camera First Nations Session	
Review of Afternoon Agenda and Opportunity for Statements/Questions Following In-camera Session and Lunch Summary: No questions or comments.	[redacted] All Parties

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Presentations and Discussion • Yukon Environmental Assessment Process • Other regulatory processes such as YOGA and the Water Act Summary: YESAA, YOGA, and the Water Act each have various regulations that could apply to any number of activities. There are other departments involved as well (e.g., workers compensation). No work or activity can occur before a decision document and a water license has been issued. Question: What will be the decision body be for Chance's project? YG: Likely Oil and Gas Branch if YESAB process is District Office (DO), or Major Projects Office if it is an Executive Committee (EC). There are three types of processes. DO, EC (typically a longer process and handled out of the head office in Whitehorse, has timelines, specific requirements for consultation prior to submitting an application to YESAB), and panel process. January 2019 YESAB released information around a new process. Pre-Submission Engagement process (PSE). Currently, proponents are creating the entirety of the project proposal and submitting it all at once. Proponents have not had a facilitated process with YESAB prior to submission (i.e., opportunity to receive feedback on scope and size) and this has downsides. It's possible to have 5-10 years of exploration and baseline data. Then have YESAB require baseline data on a separate matter. Providing guidance and direction around scope and valued components would be beneficial to the process and ensure that a proposal is moving in the right direction during development. There are information sessions in the coming weeks, and the process may come into force fall 2019. It is possible that this could reduce time spent on information requests. The intention being to take time away for the stages/process after submission. Question: How will this mirror or link into VGG Oil and Gas Policy? VGG: VGG is also new to what is being proposed by YESAB. After looking at preliminary materials, it appears to align well with the Policy. Question: If Chance proceeds through the three stages of VGG, is the new YESAB process a requirement? Hemmera: Not a requirement yet, but it will be. If a proposal is submitted to YESAB before the new process is in effect, it would proceed under the old/current process. The new PSE process is consistent with what the Federal Government has done and also what BC has done with their new Environmental Assessment process. Question: If Chance proceeded prior to the implementation of the PSE and followed the Policy, would Chance be doing the same activity? Hemmera: The Policy is only for VGG. The PSE process is for everyone, including VGG. Additionally, YESAB collects the views of all of the Yukon. Question: Should Chance implement the PSE process before it is mandatory?	[redacted] All Parties

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Hemmera: That is for the group to weigh the pros and cons and decide. Nov 2019 is an estimated date and a Federal election may cause more delays. Question: Is this legislation? Is parliamentary time required? Is this a policy, regulatory, or legislative change? Hemmera: This is a question for YESAB. YESAB is independent of the government and they are changing their rules. Maybe gazetting? Because YESAA is a Federal act. YESAA will set out the rules for processes and what consultation is necessary. ***See Appendix 5 – Chance All-Party Meeting: Regulatory Processes Presentation***	
YESAB Application Process • Where are we? • Anticipated timelines and mapping next steps Suggestion (Chance): Moving forward there will need some form of information exchange. Depending on the information, may need to be exchanged in a confidential manner. Finish Confidentiality Agreements. Chance has shared project ideas. Chance is open to feedback. Look into which steps can be done concurrently. Budget estimates and items associated with capacity will assist Chance with internal approval processes. Suggestion (Chance): Future discussion on whether or not there could be agreement or interest in using common consultants – where needed for professional and technical advice. Trying to get common recommendations. Feedback: This may be a good idea on the technical front and a capacity one. However, a biological or cultural assessment, First Nations may want to do that independently. Question: Is YG interested in doing oil and gas 101? YG: YG is amenable to doing oil and gas 101s. Different presentations could be tailored for different audiences Suggestion (VGG): Use previous documents (multi-well project) and analyze the criticism against them, to work on the areas within them, and bring them to a place where the parties support them. E.g., are concerns some that were raised by multiple people, or ones born of miscommunication? Feedback: Hemmera will be conducting a gap analysis to evaluate what is needed to apply to YESAB again (i.e., looking at everything from the DO screening and, if there is an EC, what more is needed). Take those comments from the registry (from the DO process) and evaluate whether there were adequate responses or if since then, different information has arisen, or more adequate best practices have been developed. Suggestion (VGG): Put our minds to the monitoring plan and whether mitigation measures are doing what they should (i.e., applying adaptive management). **Next steps as they were listed on the flipchart** • **Confidentiality Agreements**	[redacted] All Parties

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• **Project Scope** • **Processes in Parallel vs. Sequentially** • **Shared consultants – technical disciplines** • **Oil and Gas 101** • **Adaptive Management**	
Wrap Up and Closing Statements Question: Is it useful to have All-Party meetings? Summary: Parties agreed it was valuable. Future All-Party meetings could be timed with key milestones and planned to proceed/follow other key dates/events. VGG: Offered to send a list of key dates/events that could be used. Summary: Chief [redacted], Chief [redacted], and Yukon Government provided closing statements.	S. Shaw

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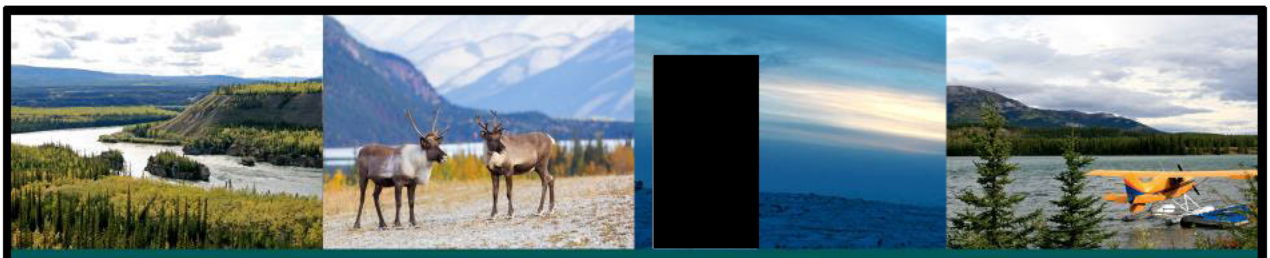


The Engagement Plans:
Development and Next Steps

Hemmera
An Ausenco Company

Creating the Engagement Plans

- Chance's current engagement with First Nations was prompted by M.O. 2017/37
- M.O. 2017/37 requested that Chance file Engagement Plans with each of the affected First Nations listed in the M.O.
- All Engagement Plans were filed in summer 2018

O.I.C. 2016/169
OIL AND GAS ACT

OIL AND GAS ACT

Pursuant to section 10 of the *Oil and Gas Act* and subsection 12(6) of the *Oil and Gas Disposition Regulations*, the Commissioner in Executive Council orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by the subject permittee

(a) oil and gas permit No. 0005,

(b) oil and gas permit No. 0006,

M.O. 2017/37
OIL AND GAS ACT

OIL AND GAS ACT

Pursuant to section 31.01 of the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"affected First Nation" means each of the Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in First Nation, First Nation of Na-Cho Nyak Dun, Gwich'in Tribal Council and Tetlit Gwich'in Council; « *Première nation concernée* »

"subject permit" means each of the following oil and

Next Steps

- M.O. 2018/ 42 orders that Chance submit annual reports on the First Nations Engagement Plans (due on July 31 of each year)
- Continue with Plan implementation
- Continue engagement with each First Nation individually, and also as a group

YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

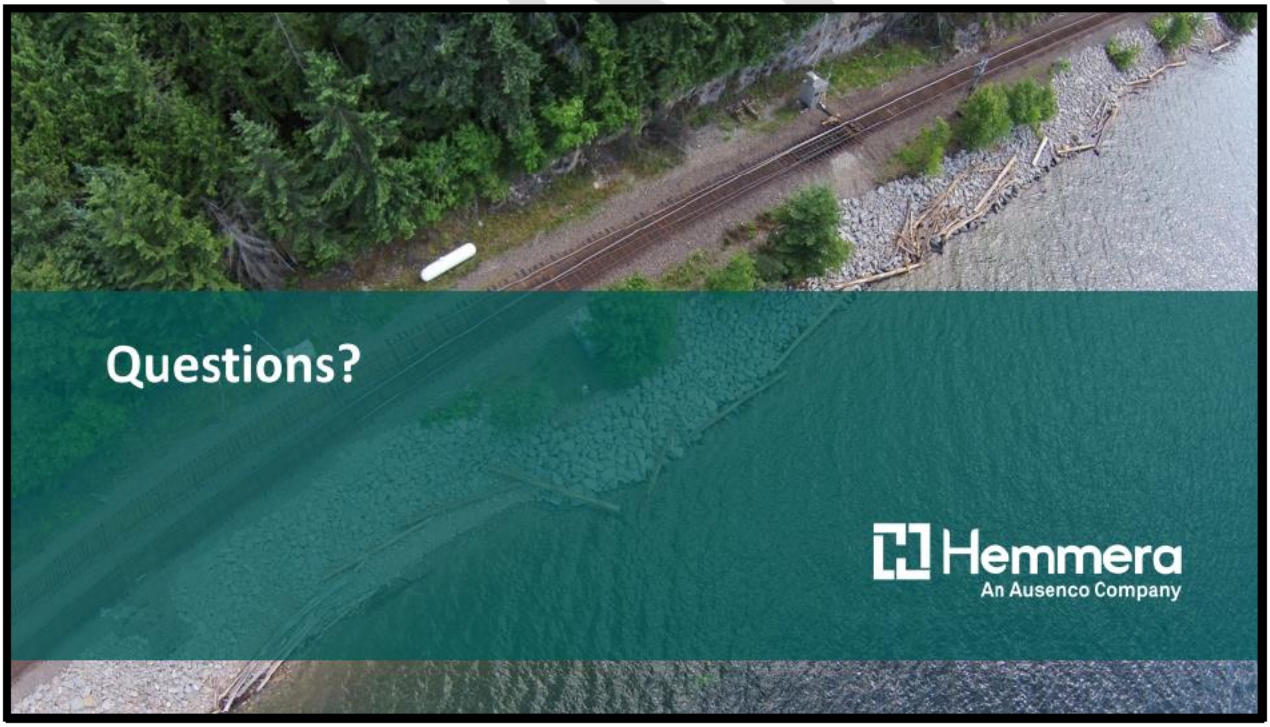
1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

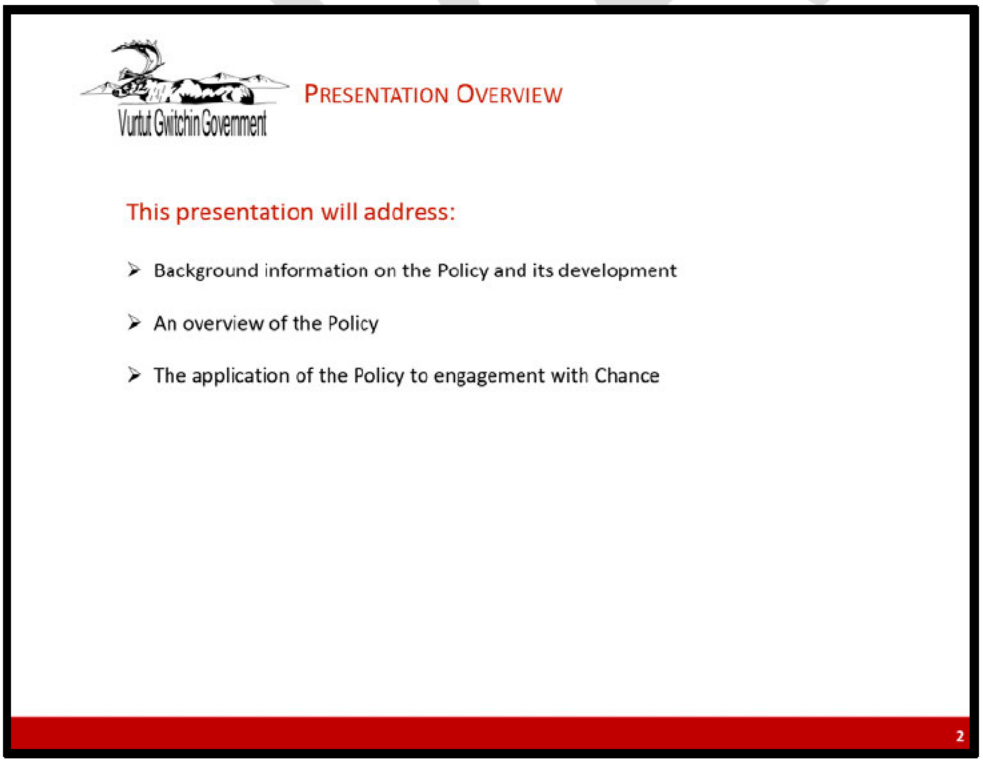
(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,




VUNTUT GWITCHIN GOVERNMENT
OIL AND GAS ENGAGEMENT POLICY:
BACKGROUND AND OVERVIEW
Vuntut Gwitchin Government
This presentation was prepared by the Vuntut Gwitchin Government for discussions with Chance Oil and Gas on December 12, 2018 in the traditional territories of the Kwanlin Dün and Ta'an Kwäch'än


Vuntut Gwitchin Government
PRESENTATION OVERVIEW
This presentation will address:
Background information on the Policy and its development
An overview of the Policy
The application of the Policy to engagement with Chance
2

Vuntut Gwitchin Government

BACKGROUND

The development of the Policy was informed by:

- The principle of sustainable development as enshrined in the VGFN Final Agreement and North Yukon Regional Land Use Plan
  - "'Sustainable Development' means beneficial socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent" [VGFN Final Agreement, Chapter 1].
  - "The core principle that guides the Plan is sustainable development, as defined in the VGFNFA... Sustainable development requires consideration of the economic, social and ecological consequences of land use decisions, and management of lands and resources in an integrated and coordinated manner" [NYRLUP]
- The principles, goals, recommendation and best management practices provided for in the North Yukon Regional Land Use Plan

3

Vuntut Gwitchin Government

BACKGROUND

The development of the Policy was informed by:

- Past experience of engagement activities with proponents and in participating in the YESAB assessment process
  - "The Designated Office is unable to determine if adverse effects to the access to and use of the PCH are or are not significant... development in the region is not intrinsically adverse, but rather that additional information is required to make confident effects predictions and to determine the significance of those adverse effects. The requirement for confidence in predicting effects in this assessment is elevated for two reasons: first, the significant importance for the First Nation and the Inuvialuit way of life that is intrinsically linked to the PCH; and second, the unprecedented scale of the Project within this region" [YESAB DO Report].

4

BACKGROUND

The development of the Policy was informed by:

- Shortcomings in the existing territorial regulatory regime
  - "VGG would like to address our concerns with provisions of the Yukon Oil and Gas Act, R.S.Y. 2002, c. 216 and its associated regulations as it relates to benefits agreements and permit extensions. Additionally, VGG would like to resume the development of resource access roads regulations under the Territorial Lands (Yukon) Act, S.Y. 2003, c. 17" [VGG Letter to Premier Silver, May 10, 2017].
  - "The most recent annual report for the NYRLUP stresses the need for baseline data collection and development of best management practices in order to better understand and predict effects. Industrial development in the region is predicated upon fulfillment of goals for information collection as set out in the NYRLUP and associated annual reports" [YESAB DO Report].

5

BACKGROUND

The development of the Policy was informed by:

- An identified need for public policy that establishes a framework for respectful, meaningful and transparent engagement
  - "It is a condition of this Order that Chance Oil and Gas Limited must, in consultation with each affected First Nation, revise the first nations communications and engagement plan filed under O.I.C. 2016/169 to the satisfaction of the Minister on or before August 1, 2018" [Ministerial Order 2017/37].
  - "[THEREFORE BE IT RESOLVED] That VGG proceed with efforts that lead to constructive engagement with oil and gas industry proponents and government agencies including partnerships in the areas of employment and training, environmental stewardship and business development" [VGFN GA Resolution No. 2017-02].

6

Vuntut Gwitchin Government

BACKGROUND

The development of the Policy was informed by:

- International standards and best practices
  - "Indigenous peoples have the right to determine and develop priorities and strategies for the development or use of their lands or territories and other resources... [and to] free and informed consent prior to the approval of any project affecting their lands or territories and other resources, particularly in connection with the development, utilization or exploitation of mineral, water or other resources" [UNDRIP, Article 32].
  - "FPIC is relevant... in relation to development projects encompassing the full project cycle, including but not limited to assessment, planning, implementation, monitoring, evaluation and closure" [UN Permanent Forum on Indigenous Issues, Report of the International Workshop on Methodologies regarding Free, Prior and Informed Consent and Indigenous Peoples].

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Vuntut Gwitchin Government

BACKGROUND

The development of the Policy was informed by:

- International standards and best practices
  - "Due to the fragility of arctic environments, with high vulnerability to climate change, the high proportions of Indigenous peoples within arctic populations, and increasing resource development pressures, Indigenous-led impact assessment is particularly important... [Indigenous-led impact assessment] is a process that is completed prior to any approvals or consent being provided for a proposed project, which is designed and conducted with meaningful input and an adequate degree of control by Indigenous parties—on their own terms and with their approval. The Indigenous parties are involved in the scoping, data collection, assessment, management planning, and decision-making about a project" [Gwich'in Council International, Impact Assessment in the Arctic: Emerging Practices of Indigenous-Led Review].

8



Overview of the Policy

The main components of the Policy include:

- A clearly defined purpose section
  - "The purpose of this policy is to establish a respectful, transparent and meaningful framework to guide the engagements of the Vuntut Gwitchin Government in relation to Oil and Gas Activities and Oil and Gas Dispositions in a manner that supports and upholds the objective of Sustainable Development" [section 3].
- The establishment and mandating of a committee to facilitate the participation of Citizens in the engagement and decision-making process
  - Membership consists of Standing Committee Chair on Natural Resources, Director of Natural Resources, Elders Representative, Youth Representative and Citizen Representative [section 12].
  - Mandate includes informing and seeking views from Citizens, and assisting and providing recommendations to the Council throughout the Engagement Process [section 11].

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Overview of the Policy

The main components of the Policy include:

- A process to guide the organizing and carrying out consultations with Citizens regarding Oil and Gas Activities and Oil and Gas Dispositions
  - Director of Natural Resources has primary responsibility for organizing and carrying out any consultation between the Vuntut Gwitchin Government and Citizens regarding Oil and Gas Activities and Oil and Gas Dispositions with the assistance of the Committee as necessary [section 20].
  - Proponents are to coordinate any of its consultation with Citizens by submitting written notice to the Director of Natural Resources that sets out proposed date, location, agenda, description of the purpose of the meeting and any materials to be shared with Citizens [section 21].

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Overview of the Policy

The main components of the Policy include:

- A three stage process for engagement with Proponents in relation to any Oil and Gas Activity to be completed prior to the Proponent submitting any Proposal to the Board
- Stage 1: Notice Period
  - Sufficient notice of a proposed Oil and Gas Activity must be provided to the Director of Natural Resources at the earliest opportunity [section 24].
  - Director of Natural Resources will refer the notice it receives from the Proponent to the Committee who will review it for sufficiency. The Committee will notify the Proponent in writing of its determination. If notice is not sufficient then more information will be requested. If notice is sufficient then engagement on the Oil and Gas Activity can proceed to Stage 2 [section 25].

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Overview of the Policy

The main components of the Policy include:

- Stage 2: Cooperation
  - A Cooperation Agreement must be negotiated and entered into following Stage 1 and before proceeding to Stage 3 [section 26].
  - Prior to entering into a Cooperation Agreement, Council must refer the Cooperation Agreement to the Committee. The Council can enter into the Cooperation Agreement if the Committee determines that the Cooperation Agreement adequately addresses items related to compliance with the policy, communications, information sharing and capacity funding [section 27].
  - If a Cooperation Agreement is entered into in relation to an Oil and Gas Activity then the engagement process proceeds to Stage 3. A Cooperation Agreement does not provide free, prior and informed consent to any Oil and Gas Activity.

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Vuntut Gwitchin Government

Overview of the Policy

The main components of the Policy include:

- Stage 3: Benefits and Stewardship

  - A Benefits and Stewardship Agreement must be negotiated and entered into following Stage 2 and before proceeding to the Board with a Proposal. It is the mechanism in which the free, prior and informed consent of the Vuntut Gwitchin First Nation is effectively to be provided in relation to any Oil and Gas Activity [section 28].
  - Prior to entering into a Benefits and Stewardship Agreement, Council must refer the Benefits and Stewardship Agreement to the Committee. The Council can enter into the Benefits and Stewardship Agreement if the Committee determines that the Benefits and Stewardship Agreement adequately addresses various items related to economic benefits and environmental stewardship [section 29].
  - Benefits and Stewardship Agreement will be subject to an approval and ratification process deemed adequate by the Committee.

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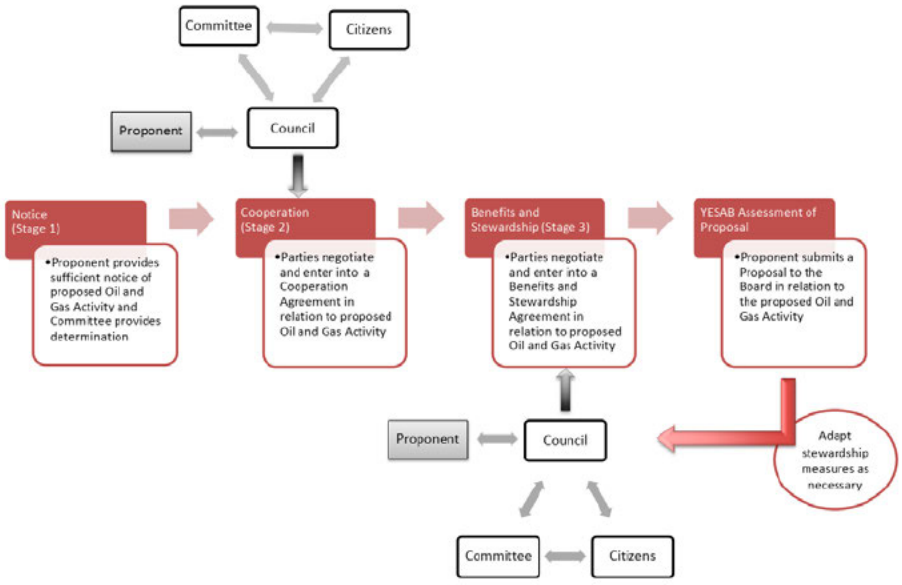

14

Application of the Policy to Engagement with Chance

The Policy applies to engagement with Chance:

- Chance review of the draft Policy
- Chance acceptance of the final Policy
  - "Chance will comply with the Policy and any other applicable VGG policies. To the extent that there may be any inconsistency between this Plan and the Policy, the Policy will prevail" [Joint Communication and Engagement Plan]
  - "The Plan, which incorporates the Vuntut Gwitchin Government Oil and Gas Engagement Policy (the "Policy"), sets the framework for all communication and engagement between Chance Oil and Gas Limited ("Chance") and the Vuntut Gwitchin Government ("VGG") moving forward. Chance's commitment to the Plan and Policy is a significant achievement and provides an example for the outside world on how industry ought to approach oil and gas exploration and development in the North within a framework premised on free, prior and informed consent" [VGG June 11, 2018 Letter to Chance]

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Application of the Policy to Engagement with Chance

The Policy applies to engagement with Chance:

- VGG and Chance engagement is currently in Stage 1 (Notice)
- Chance has shared scenarios for various Oil and Gas Activities at different scales but has not submitted notice of an Oil and Gas Activity it wishes to advance for further consideration under the Policy
- VGG has shared a draft Cooperation Agreement for discussion purposes prior to the completion of Stage 1 (Notice) and in advance of Stage 2 (Cooperation)
- Next steps: Chance to provide written notice of any proposed Oil and Gas Activity to the Director of Natural Resources at the earliest possible opportunity as provided under section 24 of the Policy

16


QUESTIONS AND COMMENTS?
Contact:
Vuntut Gwitchin Government
P.O. Box 94
Old Crow, Yukon
Canada, Y0B 1N0
Tel: (867) 966-3261
Fax: (867) 966-3800
www.vgfn.ca
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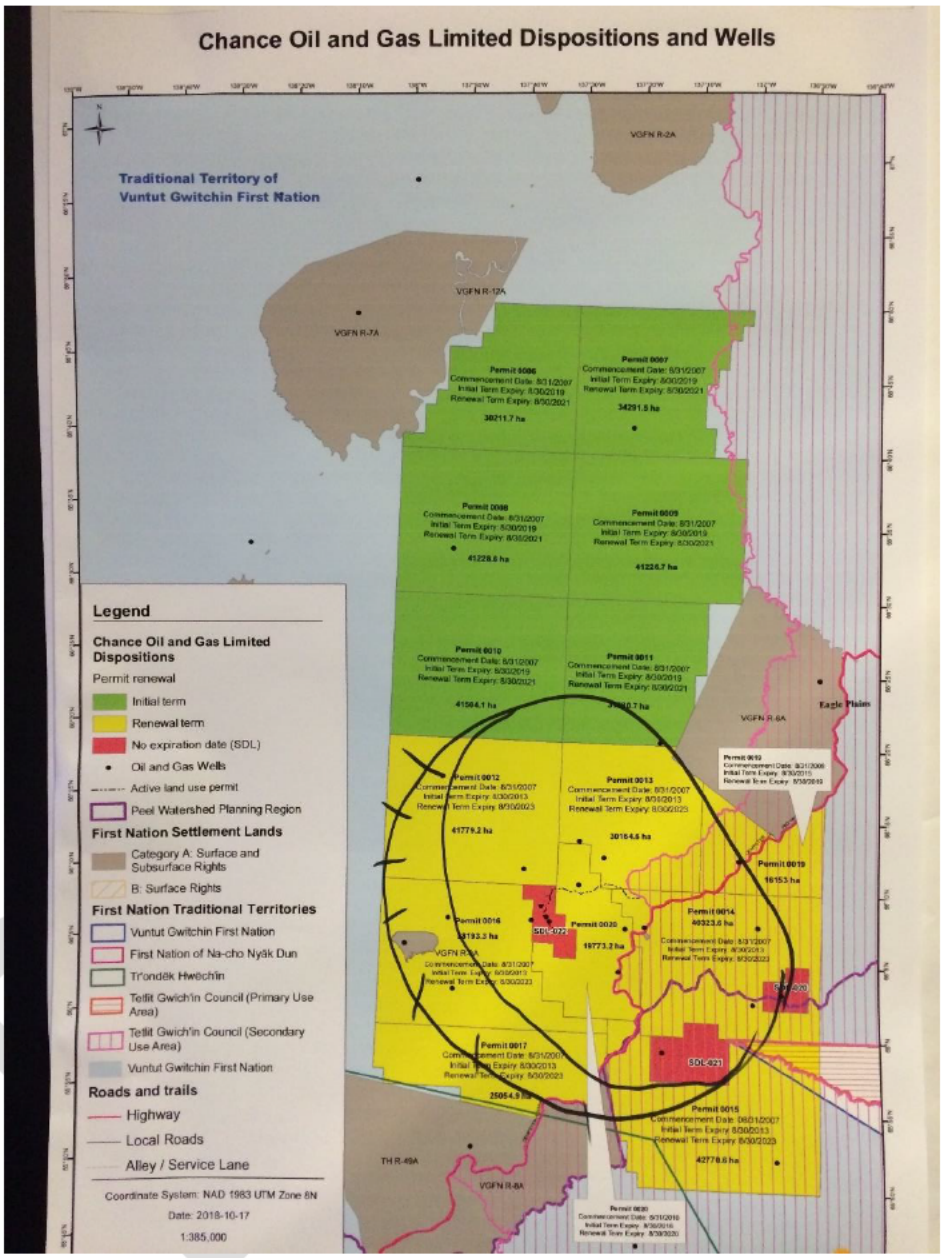
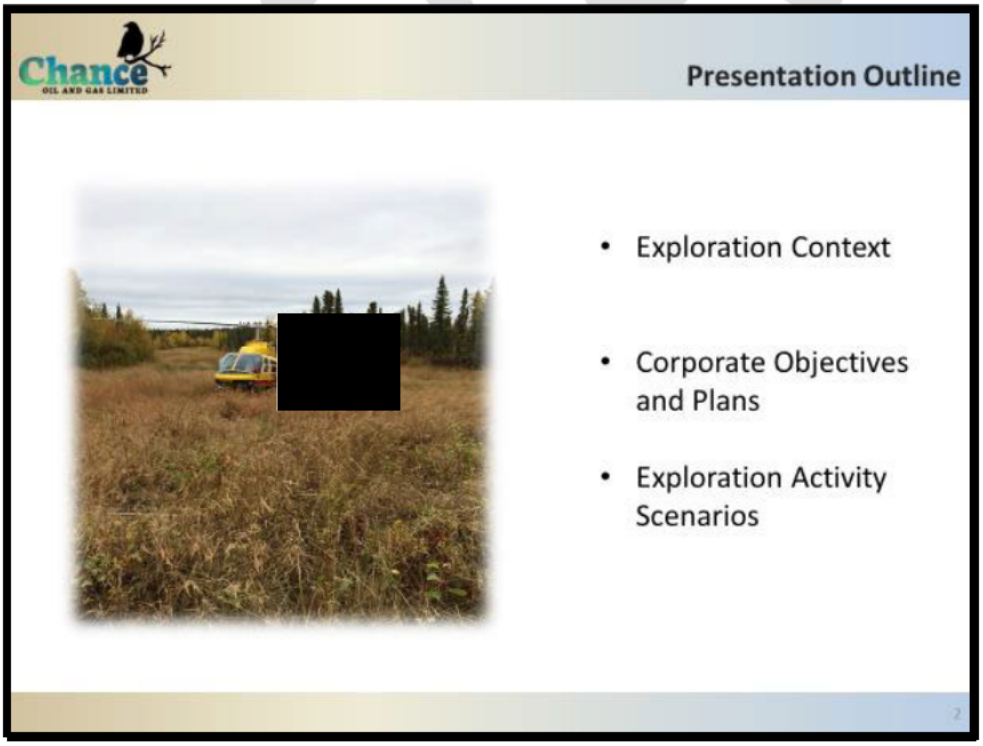
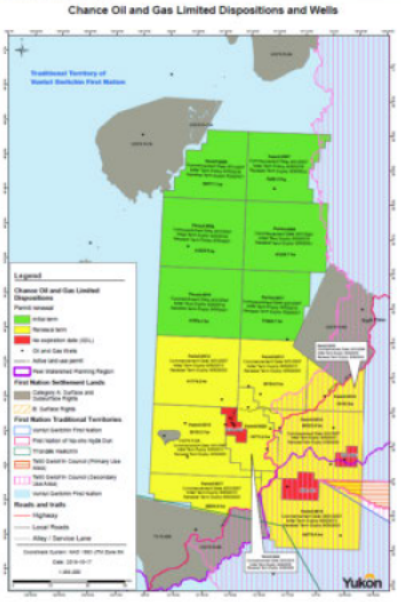
Appendix 3 – Chane All-Party Meeting: Permits map with area of interest highlighted




Chance
OIL AND GAS LIMITED
CONFIDENTIAL
Corporate Presentation
Presentation to the All Parties Meeting
Chance Oil and Gas Limited
February 1st, 2019


Chance
OIL AND GAS LIMITED
Presentation Outline
[redacted]
• Exploration Context
• Corporate Objectives and Plans
• Exploration Activity Scenarios

Land Holdings Eagle Plain, Yukon



- 14 Exploration Permits (0006-0017, 0019-0020 expiring between Aug 30, 2019 and Aug 30, 2023
- 3 Significant Discovery Licenses ("SDL's") with indefinite tenure with discovered oil and natural gas
- Landholdings total about 490,000 hectares
- North Yukon Regional Land Use Plan indicates that this area is suitable for multiuse, including oil and gas industry activities
- Chance surrendered ep. 0005 in 2018 to allow the creation of Ch'ihilii Chik - HPA

3

Infrastructure and Support



- Eagle Plains is an underexplored sedimentary basin
- Discovered resources located at the SDL's is not sufficient to proceed to development
- Oil and gas exploration began in the 1950's and both oil and natural gas have been discovered
- Almost 40 wells have been drilled at Eagle Plains
- Over 10,000 kms. of 2D and about 325 sq. kms. of 3D seismic data has been acquired

4

Land Tenure



- Tenure is the length of time that exploration permits or leases are valid
- Tenure has a large influence on obtaining financing, planning activities and doing the work
- For a remote area like Eagle Plains, longer tenure is better than shorter tenure
- How the legal action against Yukon gets resolved will have an impact on tenure

5

Exploration Activities





- Field work to investigate the geological opportunities
- Acquiring more seismic data (both 2D and 3D)
- Exploration drilling of new wells
- Production testing of any discoveries showing commercial potential
- Construction of seasonal and year-round access trails and roads
- Installing and operating processing facilities connected with production testing

6

Exploration Activities



- Operating the base camp
- Converting wells for injection of water produced with oil and natural gas
- Logistical support for the camp and exploration activities
- Environmental data gathering and monitoring of operations
- No plan to do hydraulic fracturing

Exploration Activities



- Exploration work is the most expensive and most uncertain activity which affects funding commitments
- Exploration activities are unpredictable because results guide the future steps
- Plans are subject to change as priorities change with new information
- Even though Chance has several prospects to evaluate, drilling may find something that could not be predicted before hand that changes the plans
- Flexibility is needed from Assessors, regulators and goods and service providers to accommodate the uncertainties and need to adapt the activity as the work progresses

Objectives and Plans



- Based on current geological understanding, the area of exploration focus includes parts or all of Exploration Permits 0012-0016 and 0019-0020 and the three SDL's
- Acquire more seismic data and drill more wells to evaluate the resource potential
- Discover sufficient oil and natural gas resources to support future development
- Develop discoveries to serve the regional market needs and possibly export markets if the resource base is large enough
- Undertake the exploration program on a small scale over a long period of time to minimize the environmental and social impacts
- Try to operate as continuously as possible to provide steady employment and minimize the high costs of starting up and shutting down

9

Benefits



- Develop local capacity to participate in the projects and displace high cost imported services and equipment
- Diversify the regional economy
- New business, training and employment opportunities
- Reduced GHG's by substituting imported fuel that is shipped thousands of kilometres with Yukon sourced fuel
- Potential to reduce the cost of fuel in the Yukon and surrounding area

10

Project Alternatives



- YESAB assessments are required in order to obtain regulatory approvals to undertake any exploration work
- Depending on the scale and scope of the program, the YESAB assessment could be done by the Designated Office in Dawson or by Executive Committee in Whitehorse
- Two project execution scenarios can be considered: 1) a series of short duration, limited activity projects each with its own YESAB assessment; or 2) one longer duration, but limited scale project over the entire exploration region that undergoes one comprehensive YESAB assessment
- All work is exploration to evaluate the resource potential in order to understand whether the opportunities can eventually be developed commercially

11

Activity Scenarios- Issues to Manage



- YESAB processes are expensive and lengthy
- Lengthy assessment processes grind the tenure clock
- The cost of multiple assessments could hurt the amount of exploration work
- Multiple YESAB assessments of shorter duration, limited scope exploration work means intermittent employment
- Financial and project management are more efficient under a regional YESAB assessment of exploration in a broader area, but still small-scale operation (e.g. a single drilling rig or a single seismic survey)

12


Chance
OIL AND GAS LIMITED
Thank-you
T. Allen, 2013; YOS Report 2015-02
13

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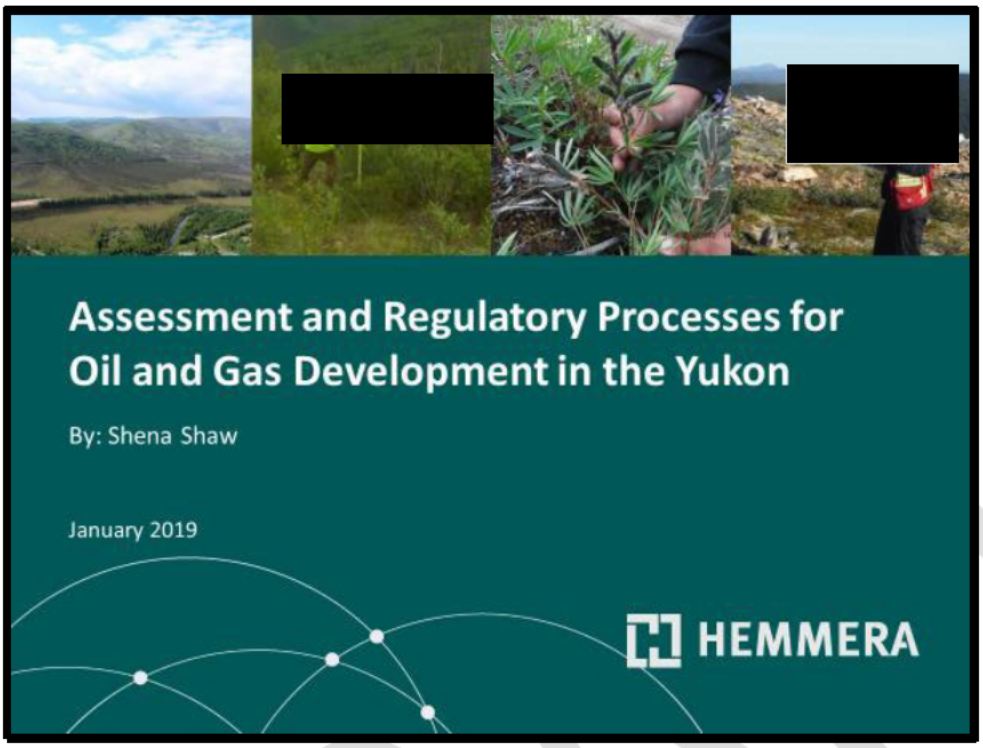
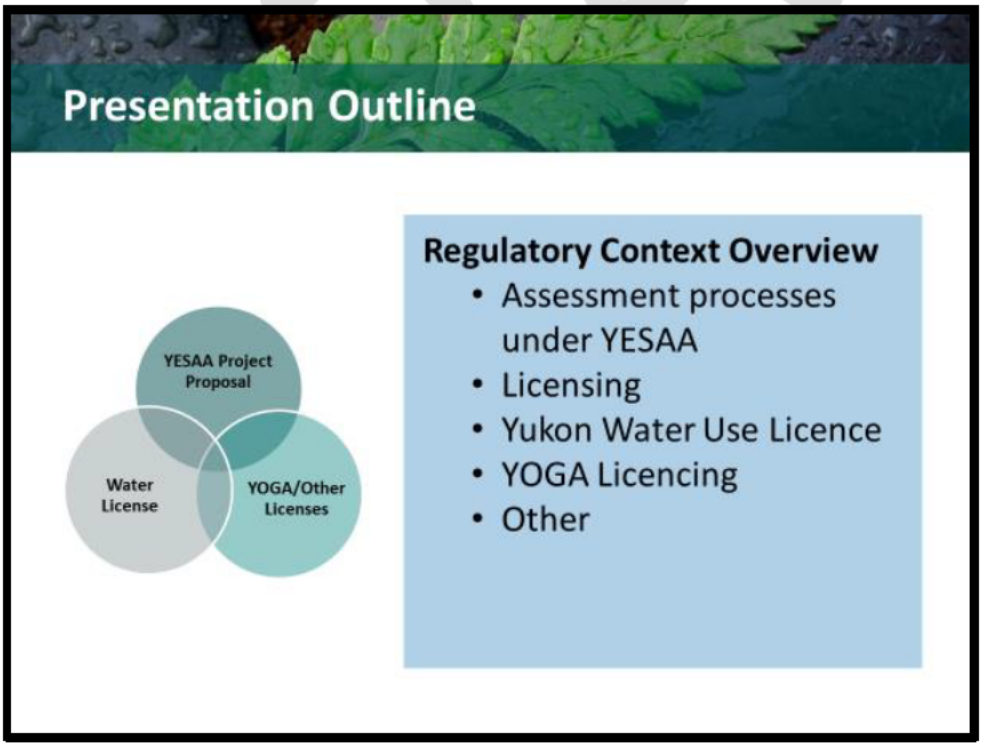
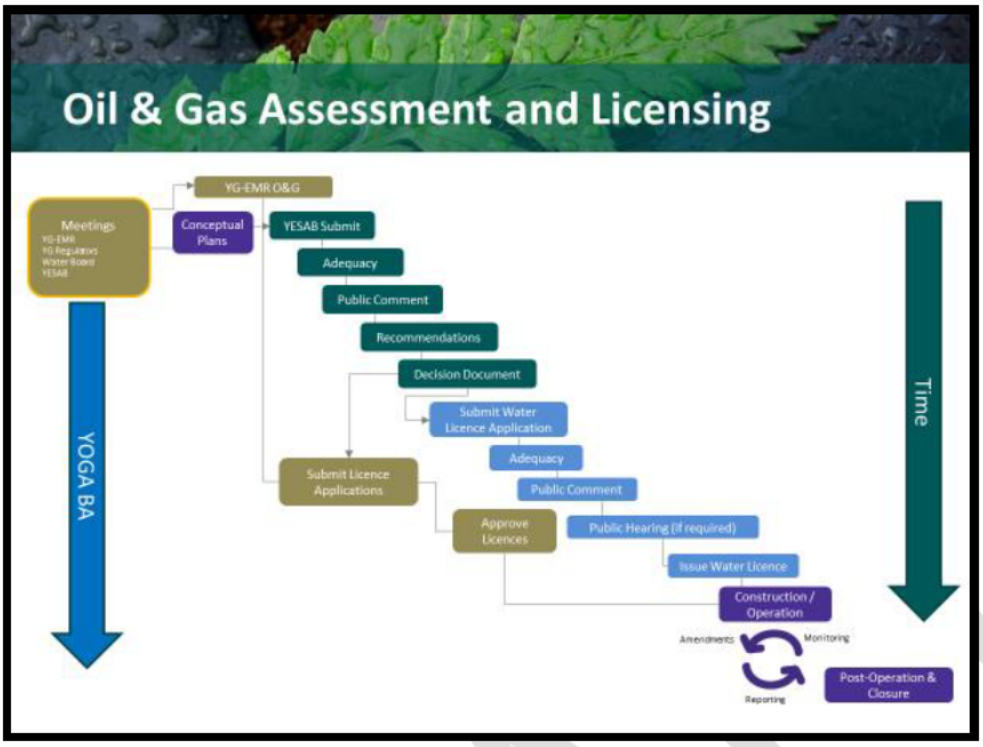
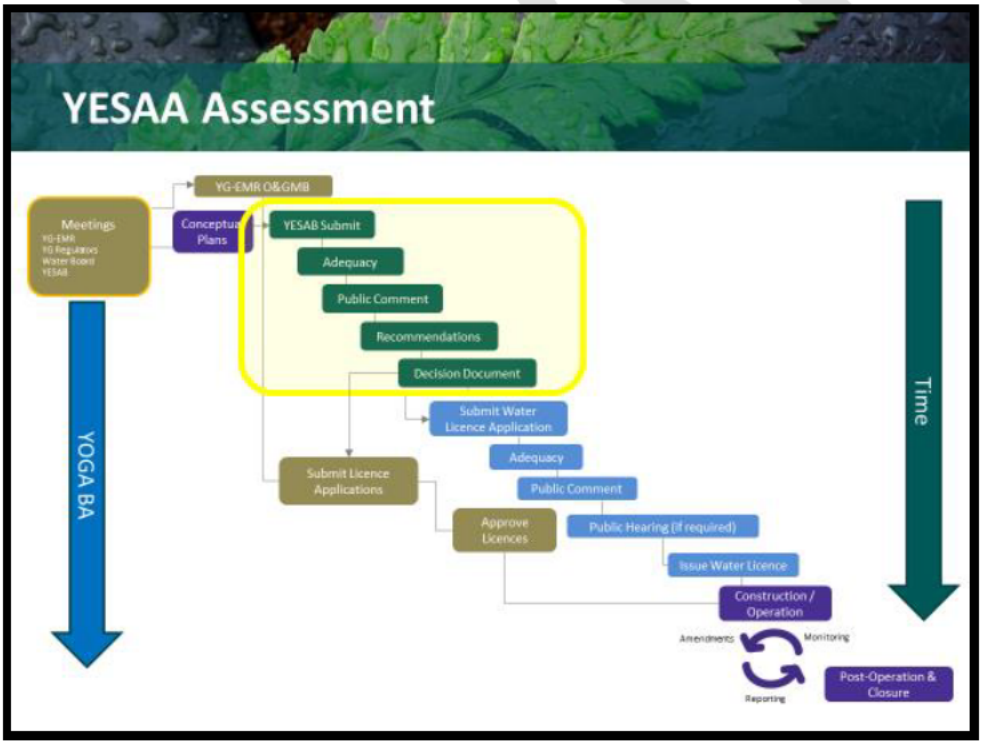

Assessment and Regulatory Processes for Oil and Gas Development in the Yukon
By: Shena Shaw
January 2019
HEMMERA


Presentation Outline
YESAA Project Proposal
Water License
YOGA/Other Licenses
Regulatory Context Overview
• Assessment processes under YESAA
• Licensing
• Yukon Water Use Licence
• YOGA Licencing
• Other


Oil & Gas Assessment and Licensing
YG-EMR O&G
Meetings
YG-EMR
YG Regulators
Water Board
YESAB
Conceptual Plans
YESAB Submit
Adequacy
Public Comment
Recommendations
Decision Document
Submit Water Licence Application
Adequacy
Public Comment
Submit Licence Applications
Approve Licences
Public Hearing (if required)
Issue Water Licence
Construction / Operation
Amendments
Monitoring
Reporting
Post-Operation & Closure
YOGA BA
Time


YESAA Assessment
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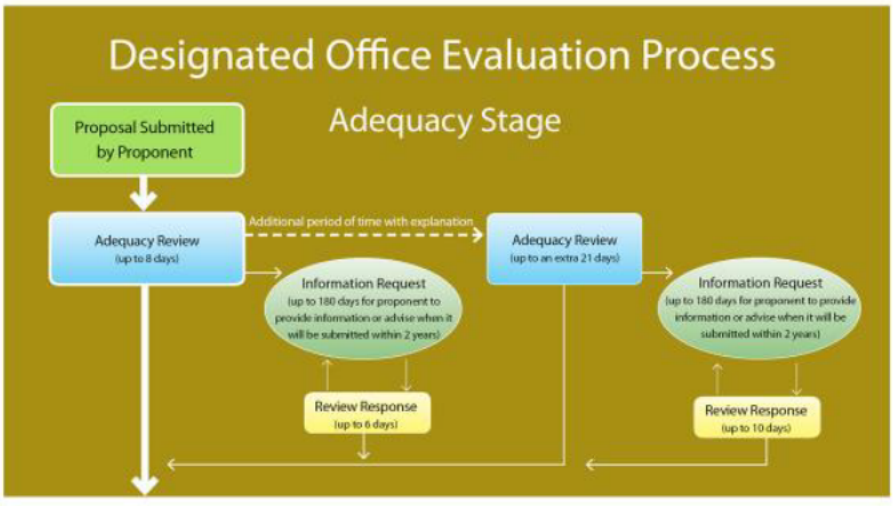
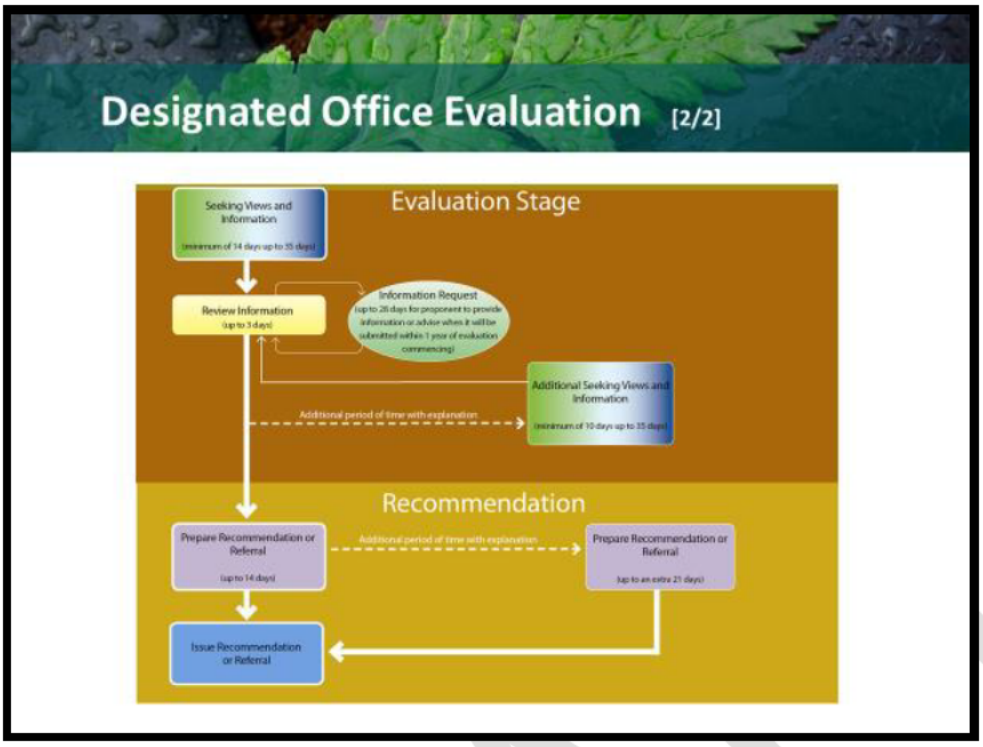
Time

YESAA Assessment Process

- Assessors look at the potential environmental and socio-economic effects of proposed activities and recommend whether the activities should proceed, proceed with terms and conditions, or not proceed.
- When assessments are complete, recommendations are sent to the relevant Decision Body(s)
  - Designated Office Evaluation
  - Executive Committee Screening
  - Panel of the Board of Review
- Decision Body(s) decide to accept, reject, or vary YESAB's recommendation
- Decision Document issued

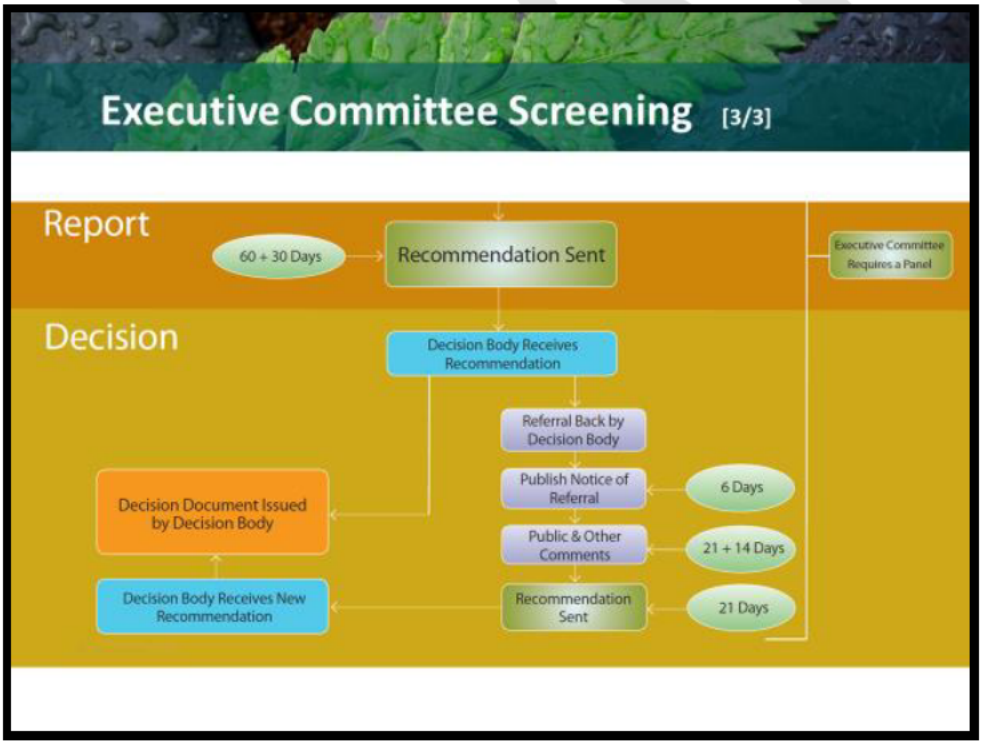
Designated Office Evaluation [1/2]




Designated Office Evaluation [2/2]
Evaluation Stage
Seeking Views and Information
Review Information
Information Request
Additional Seeking Views and Information
Additional period of time with explanation
Recommendation
Prepare Recommendation or Referral
Additional period of time with explanation
Prepare Recommendation or Referral
Issue Recommendation or Referral


Executive Committee Screening [1/3]
Executive Committee Screening Process
Proposal Submitted by Proponent
Adequacy
Proposal Checklist
30 + 30 Days
More Info from Proponent
Adequacy Review
60 + 30 Days


Executive Committee Screening [2/3]
Screening
Publish Notice of Screening
6 Days
Public & Other Comments on Proposal
30+30 Days
21 + 21 Days
More Info from Proponent
Assess Comments & Need for More Information
21 Days
Complete Draft Screening Report
120 + 270 Days
Public & Other Comments on Draft Report
30 + 30 Days
21 Days
More Info from Proponent
Assess Comments Need for More Information
21 Days

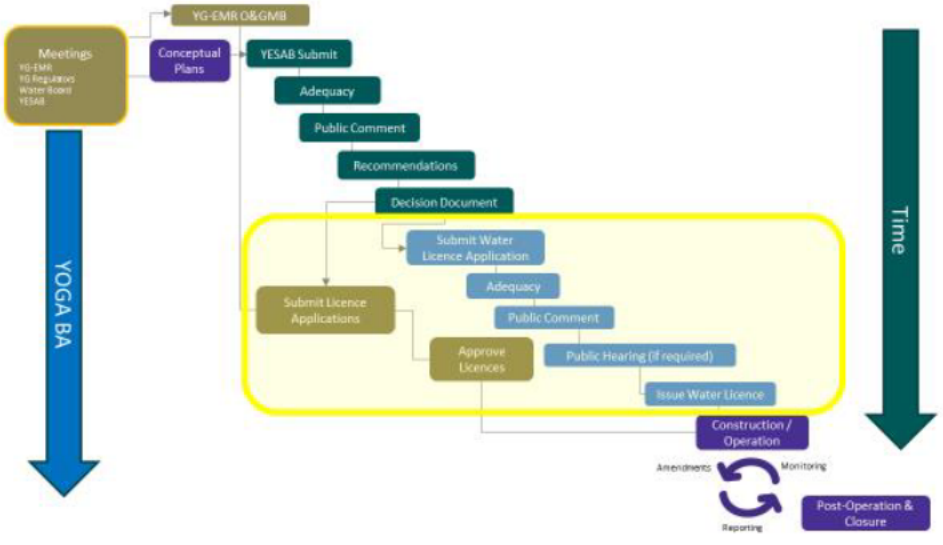

Executive Committee Screening [3/3]
Report
60 + 30 Days
Recommendation Sent
Executive Committee Requires a Panel
Decision
Decision Body Receives Recommendation
Referral Back by Decision Body
Publish Notice of Referral
6 Days
Public & Other Comments
21 + 14 Days
Recommendation Sent
21 Days
Decision Document Issued by Decision Body
Decision Body Receives New Recommendation

YESAA Assessment Process

New: Pre-Submission Engagement (PSE) process

- YESAB approved the PSE and it will come into effect late Fall 2019 (estimated).
- For Executive Committee screenings only.
- Brings parties together to review project requirements in advance of proposal submission.
- Helps identify gaps and issues of concern, define values and baseline information requirements, and ensure a timely and certain screening process.
- "Terms of Reference" style of process

Licensing Process



Yukon Water Use Licence [1/2]

- Use of water or deposit waste into water
- Petroleum exploration/development are "Industrial Undertakings"
- Interim - Oil and Gas Information Package for Applicants (2013)
- Quasi-judicial board supported by Yukon Water Board Secretariat

Yukon Water Use Licence [2/2]

Choice of Type A vs Type B will drive information requirements, process, and timelines

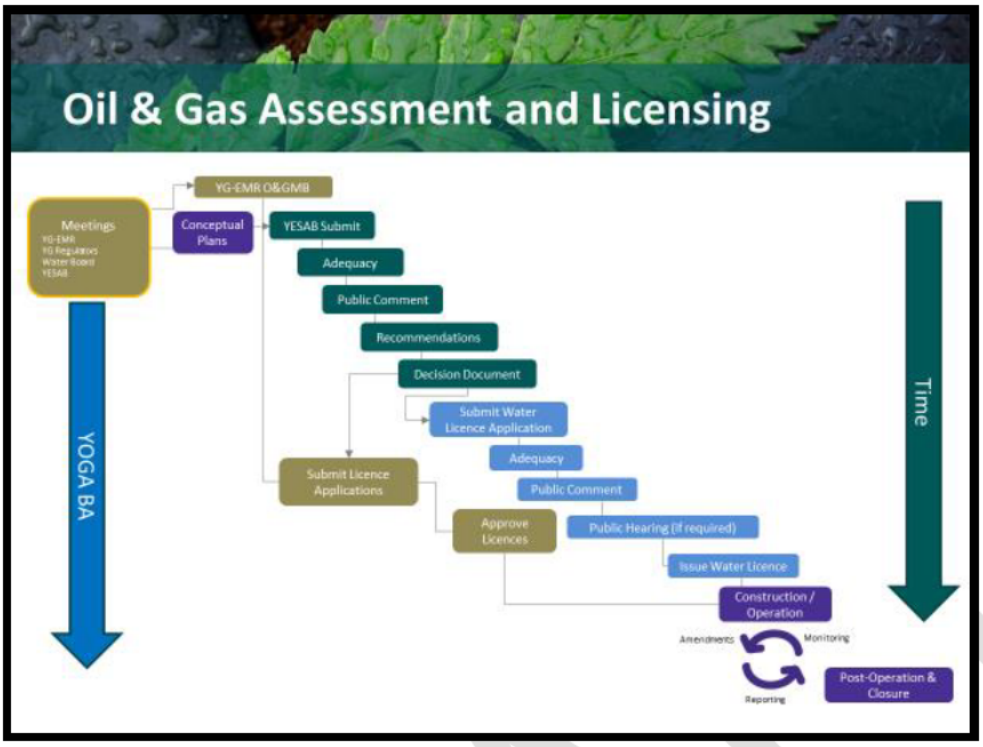
- Hearing required for Type A
- Both require YESAA decision document prior to issuance

Permitting and Licensing

1. Land Use Permit (YG – EMR, Land Management)
2. Well Licence and Well Operation Approval (YG – EMR, Oil and Gas Resources)
3. Permit for Air Emissions (YG – ENV)
4. Temporary Highway Access Permits (YG – HPW, Transportation Branch)
5. Water Licence/Notification of Water Use (YG, Water Board)
6. Dempster Highway Area Authority Authorization

YOGA Well Licence

- First Nation and community consultation prior to application
- Benefits Agreement for projects >$1M/year
- Requires YESAA decision document prior to issuance


Oil & Gas Assessment and Licensing
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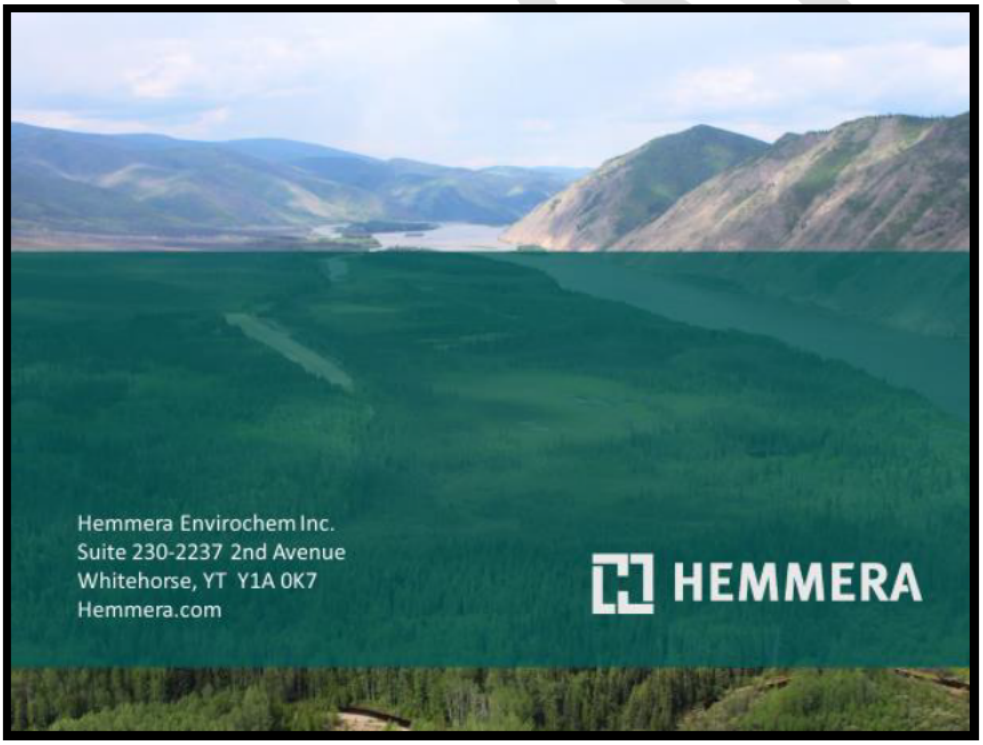
YOGA BA
Time


Hemmera Envirochem Inc.
Suite 230-2237 2nd Avenue
Whitehorse, YT Y1A 0K7
Hemmera.com
HEMMERA

APPENDIX 2-B-14. Request to extend tenure on Exploration Permits 0006-0011 and 0019 at Eagle Plains Letter

March 26, 2019.

Gwich'in Tribal Council
3 Council Crescent
Inuvik, NT
X0E 0T0

sent by email: [redacted]

Attention: Grand Chief [redacted], **Director** [redacted] **President** [redacted]
COO [redacted]

Dear Grand Chief [redacted], Director [redacted] President [redacted] and COO [redacted]:

Re: Request to extend tenure on Exploration Permits 0006-0011 and 0019 at Eagle Plains

As you know, the Chance Oil and Gas Limited ("Chance", the "Company") currently has fourteen exploration permits located in the Eagle Plains area of northern Yukon. The permits are numbered 0006 to 0017 and 0019 to 0020. Of these, exploration permits 0006-0011 and 0019 will expire on August 30, 2019 unless extended in accordance with some combination of Sections 27, 28 and 31.01 of the Yukon *Oil and Gas Act* (the "Act"). For convenience, I have attached a map showing all the existing exploration permits held by the Company.

Pursuant to the Communication and Consultation Plan dated August 1, 2018 and following up the All Party meeting in Vancouver in January, I am writing to advise you that Chance wishes to extend the tenure of the expiring permits for a period of five years in order to continue exploring for crude oil and natural gas in the area of these Expiring Permits.

CHANCE OIL AND GAS LIMITED

☐ **Whitehorse Office:**
Suite 202, 208 Main Street
Whitehorse, YT Y1A 2A9
Telephone (867) 456-7805

☒ **Calgary Office:**
Suite 1000, 340 - 12th Ave S.W.
Calgary, AB T2R 1L5
Telephone (403) 699-0055
Fax (403) 699-0044

With the expiry deadline for the permits fast approaching and knowing that Yukon Government consultation needs to occur in relation to any tenure extension request of existing exploration permits, I wish to inform you that Chance will be submitting the tenure extension application this week to the Oil and Gas Branch of the Department of Energy, Mines and Resources.

We would be pleased to discuss the tenure extension request at your convenience. We look forward to working together on this and other matters in the future.

Please contact either Greg Charlie or me if you require additional information and to share your views on this course of action.

Yours truly,
Chance Oil and Gas Limited

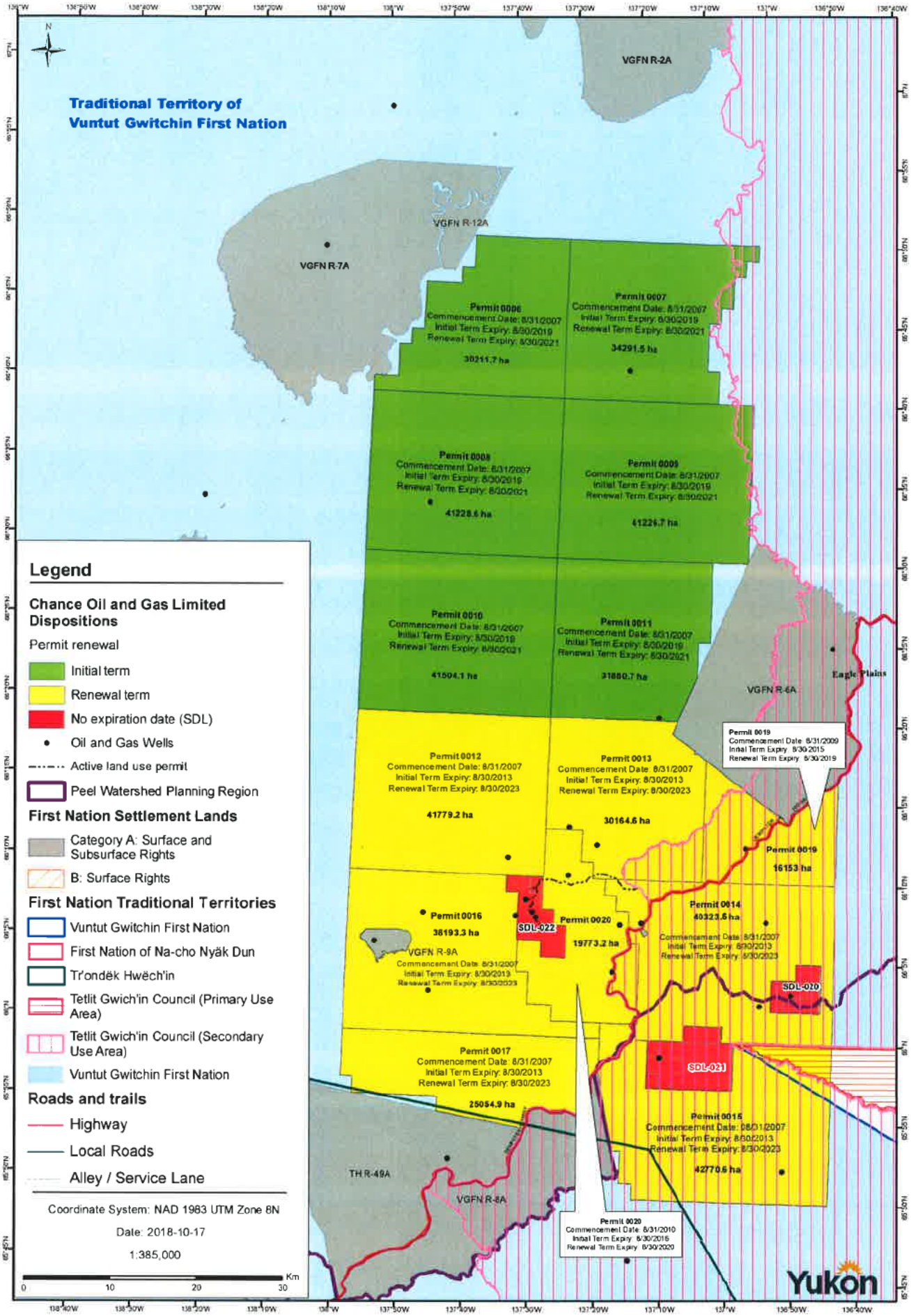
[redacted]

President

Encl.

Cc: [redacted], Oil and Gas and Minerals, EMR, Government of Yukon
[redacted], Director, Oil and Gas Branch, Government of Yukon

Chance Oil and Gas Limited Dispositions and Wells



APPENDIX 2-B-15. Fieldwork Email

From: Emily Mann
To: David MacMartin
Cc: Richard Wyman; Greg Charlie; Cindy Dickson; Shena Shaw; Calista Morrison; Todd Mahon
Subject: Chance Field Surveys
Date: June 17, 2019 5:16:03 PM
Attachments: [redacted]

Hello,

We have dates set for participation in the Field Surveys that are being conducted in Chance's project area this summer. We are proposing the following logistics for First Nations participation:

- Each First Nation with Traditional Territory overlapping the project area can have up to two members participate in the Field surveys
- This work will be physically demanding requiring hiking in steep, rugged terrain and thick bush under production oriented work conditions. Participants require average to above average fitness to participate and must meet the requirements in the attached role profiles
- There are limited spots for participants to join field surveys due to helicopter constraints and availability at the Eagle Plains Hotel. As such, we are making two spots available to each First Nation with Traditional Territory overlapping the project area. Please respond as soon as possible with the name of the participant, the field survey they would like to take part in, and the dates they would like to attend and Emily and Calista (Hemmera) will confirm availability.
- Participants are encouraged to arrive on the day that the field survey starts, but it is not mandatory that they stay for the duration of the field survey. For example, a participant could join Vegetation Survey #1 from June 25-28 if those are the dates the participant is available.
- All travel, including flights, vehicle travel to Eagle Plains Hotel, and stay in the Eagle Plains Hotel must be booked by the First Nation and billed to Chance.

This table shows the type of survey, details of the work and the number of spots available to participants

Survey	Lead Consultant	Date	Shift	# EDI crews	Participation Opportunities
Vegetation surveys (#1)	EDI	June 25- June 29 July 1 – July 7	4am-3pm	1	1 participant June 25 – June 29 AND 1 Participant July 1 – July 7
Vegetation surveys (#2)	EDI	July 25- 29 Aug 1 - 6	7am-6pm	1	1 participant July 25-29 AND 1 participant Aug 1-6
Seismic line study	EDI	July 25- 29 Aug 1 - 6	7am-6pm	1	1 participant July 25-29 AND 1 participant Aug 1-6
Fish and Water	EDI	July 25- 29	7am-6pm	1	1 participant July 25-29

The purpose of participation will be to observe the fieldwork and gain a firsthand understanding of the research that will inform Chance's project proposal. As space is limited to only a few participants

from each First Nation, there will be future site visit opportunities that will be made available to more participants. Hemmera will approach First Nations about planning these site visits later in the summer.

We apologise for the late notice in getting the above dates sorted.
To participate in Vegetation Survey #1 (starting June 25), the deadline for informing Hemmera is Wednesday June 19 at 5:00pm. Then we can coordinate the logistics on Thursday. For all the other field surveys, please let Hemmera know as soon as possible.

If you have any questions please direct them to Emily or Calista at Hemmera.

Best,

Emily

Emily Mann, BA, MPPGA
Human Environment Specialist

Hemmera, an Ausenco Company
Suite 230-2237 2nd Avenue | Whitehorse, YT | Y1A 0K7
T: 867.456.4865 ext. 719 | F: 604.669.0430
emann@hemmera.com | hemmera.com | unsubscribe

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APPENDIX 2-B-16. June 7, 2019, Meeting Summary

Gwich'in Partners and Chance Oil and Gas Limited Meeting Notes

Date: June 7, 2019

Location: Gwich'in Tribal Council Office, Inuvik

Attendees:

Gwich'in Partners:

[redacted], Director, Intergovernmental Relations, Gwich'in Tribal Council
[redacted] Transboundary Specialist, Gwich'in Tribal Council
[redacted] ciate Director, Intergovernmental Affairs, Gwich'in Tribal Council
[redacted], Executive Assistant, Tetlit Gwich'in Council

Chance Oil and Gas Limited:

[redacted] President
[redacted] Vice President of Community and Government Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator

Hemmera:

[redacted], Business Leader, Human Environment
[redacted], Human Environment Specialist

Introduction: Purpose and Objectives

The purpose of this meeting was for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin to Gwich'in Tribal Council (GTC) and Tetlit Gwich'in Council (TGC) as well as to discuss the annual reporting required on the Implementation of the Communications and Engagement Plan.

Meeting Objectives:

- Presentation of Draft Project Description
- Discuss Draft Project Description in more detail and provide clarity on any items if needed
- Discuss annual reporting requirement

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Key Meeting Outcomes

Outcome	Notes
The engagement practices that GTC and Chance have developed are being used as a model for GTC's engagement on other Yukon-based projects.	GTC is using these practices to inform the Canadian government on what transboundary agreements mean to Land Claims, and to educate Canada on funding requirements for trans-boundary land claims.
Chance presented the Draft Project Description for Exploration in the Eagle Plain Basin. There was discussion on the project details and timing and location of activities such as roads and wells.	
Chance shared what fieldwork is planned for Summer 2019 – including bird, vegetation, fish and water, seismic line, and geologic surveys.	There was interest in having GTC participation in the field work.
Chance suggested that all First Nations share a common advisor for each area of study, for example have a common caribou advisor. Chance is concerned that multiple advisors could cause conflicting viewpoints.	
Hemmera provided an overview of the Yukon Environmental and Socio-economic Assessment Board's process for screening projects, explaining that there are three levels of assessment: 1. Designated Office (small, locally reviewed projects) 2. Executive Committee (large projects, reviewed by YESAB head office) 3. Panel Review (very large projects, reviewed by an established panel) Chance's past multi-well project proposal was referred from a Designated Office level screening to an Executive Committee level screening. The draft project that Chance presented to GTC on June 7, 2019 will be developed into a submission for the Executive Committee. During the Executive Committee screening, the proponent is required to consult with First Nations to inform their project proposal, and during screening, YESAB is required to determine that proponent consultation was adequate, and Yukon Government is required to do their own consultation.	
Hemmera provided a proposed schedule to align the YESAB Project Proposal preparation with consultation topics.	Chance confirmed that they would be doing public consultation in communities.

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Outcome	Notes
To satisfy Ministerial Order 2018-42, Chance and First Nations must report annually on implementation of the Communications and Consultation Plan. The deadline for the 2018/2019 annual report is July 31, 2019. Hemmera proposed to prepare a draft report for Chance and Gwich'in Partners to review.	GTC and Chance will review the draft report before submission.
GTC has a new engagement protocol in place wherein proponents must meet with the four Designated Gwich'in Organizations (DGOs): • Tetlit Gwich'in Council in Fort McPherson • Gwichya Gwich'in Council in Tsiigehtchic • Ehdiitat Gwich'in Council in Aklavik • Nihtat Gwich'in Council in Inuvik	GTC will help arrange meetings to discuss the Draft Project Description with the DGOs.

Action Items

Action Item	Responsible Party	Date Required
Send further details on Chance field surveys and opportunities for GTC participation.	Hemmera	ASAP These details were sent in two emails on June 14 and June 17, 2019.
Discuss the idea of having common advisors for various project matters or "issue leads" among First Nations.	GTC	As project conversations develop.
Schedule meetings with the four DGOs for Chance to present the Draft Project Proposal.	GTC	Conversations to schedule these meetings have been ongoing since meeting on June 7, 2019.
Share lidar and/or aerial imagery of the Tetlit Gwich'in Council Primary and Secondary Use areas.	Chance	When imagery is finalized.
Send shape files of the project area to GTC.	Hemmera	Sent to GTC on June 19, 2019.
Prepare Communication and Consultation Plan Implementation report for submission to Yukon Government.	To be drafted by Hemmera and reviewed by all	Draft to GTC and Chance by mid July. Final to Yukon Government by July 31, 2019.

DRAFT

APPENDIX 2-B-17. November 22, 2019, Meeting Summary – document not available at time of submission.

APPENDIX 2-B-18. July 22, 2020, Meeting Summary

GWICH'IN PARTNERS AND CHANCE OIL AND GAS

DRAFT MEETING SUMMARY – CHANCE WELL MAINTENANCE PROPOSAL

Date: July 22, 2020

Location: Conference Call

Attendees:

Gwich'in Partners:

- [redacted], President, Tetlit Gwich'in Council
- [redacted], Director of Lands and Resources
- [redacted], Economic Development Officer
- [redacted], Heritage Specialist
- [redacted], Transboundary Specialist, Lands and Resources
- [redacted] Lands and Resources Specialist

Chance Oil and Gas Limited:

- [redacted], President
- [redacted], VP Government and Community Relations
- [redacted], Regulatory, Environmental and Community Relations Coordinator

Hemmera/EDI:

- [redacted], Biologist, Hemmera
- [redacted], Human Environment Specialist, Hemmera
- [redacted], Senior Wildlife Ecologist, Environmental Dynamics Inc.

Purpose and Objectives

The purpose of this meeting is for Chance Oil and Gas (Chance) and Gwich'in Partners to continue their discussion with respect to Chance's proposed Eagle Plain Well Maintenance Project. Chance will also take this opportunity to provide an overview of changes to the project design that have occurred as a result of engagement activities and refinement during proposal development.

Meeting Discussion:

The meeting opened with identifying participants on the call.

GTC informed Chance and Hemmera that the Lands Department has all new staff as of January 2020.

[redacted] – Provided a brief overview of aspects to the project design that had changed since the draft Project Description shared with Gwich'in Partners June 18th. There are no changes with respect to using the Chance and Blackie winter roads. However, we have added more contingencies with respect to ensuring adequate snowpack. Roads will follow height of land and use the same routes that

were used historically. The roads will be left to melt (i.e., reclamation plan). Pertaining to water withdrawal, Eagle River and Ogilvie River are still the potential water resources. Chance camp will be used as storage, but the crew will stay at Eagle Plains Hotel. Crews will be flown from Alberta into Inuvik via a private charter. We have added language with respect to COVID, for health and safety, however that section is dynamic and may need to change. We have added more clarification pertaining to scenarios when a well would be abandoned. The Project schedule is still the same: Winter 2020/2021. We added detail, and the design of the project itself hasn't changed much.

[redacted] Crew changes are only applicable to the specialty services coming from Alberta and BC. There will be other people working, such as wildlife monitors or people building the winter roads. Those people will likely be sourced from the north. There may be some positions on the service rig, for the oil field service of the program, that local folks may be able to join. Approximately, 25-30 people throughout an entire day. Some stuff, like water hauling and fuel hauling. A few people will have to stay on the site around the clock.

[redacted] – Thank you for the clarity on the positions that will be sourced in the north. It was not clear in the written response that Chance/Hemmera provided. Point #1 from GTC's comments pertaining to a Wildlife monitor on site. GTC would require a bi-weekly update on the findings of the wildlife monitor. For example, wildlife seen and progress of work. Is that something that Chance can commit?

[redacted] – We could certainly issue bi-weekly reports. This will likely be a requirement set by YESAB.

[redacted] – Would this be a meeting/call? Or a written email report?

[redacted] – Email written would be great. If there is a need to follow-up, we can do that. We can review and then determine if we need further discussion.

[redacted] Who should it be sent to?

[redacted] – Myself and our Chief Operating Officer. Then we will review internally. James Thorbourne.

[redacted] – Would like to discuss which Gwich'in business and individuals may be able to contribute.

[redacted] – Anticipate 25-30 people on site. Majority will be speciality service crew from down south. There are possibilities for northern employment though. For example, wildlife monitors, winter road construction, and water and fuel hauling. We are not using our camp – not a long enough program to justify opening it. Eagle Plains Hotel will serve the crew. Rig managers, safety medic – are some of the personnel that will be on site around the clock. There are some opportunities for northern businesses. The size of the project will impact the number of people we're able to hire. Hoping to enter YESAB by the end of the week. There may be things (measures, requirements) identified during that process. Northern businesses are better designed for hauling, logistical support, wildlife monitors, etc.

[redacted] – Gwich'in services can definitely satisfy Chance's need for winter roads. Gwich'in companies would be excited to bid on this opportunity. In the areas you described, they do have a lot of experience.

[redacted] – From our previous work, I have a lot of great experience with LJ, Arctic Allen, Bob's Welding etc. These businesses could be called upon. However, under Yukon Oil and Gas Act we need to negotiate

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economic benefits with affected Yukon First Nations. In term of implementing the opportunities, we have a fine line where and how we will/can manage the benefits associated with this work.

[redacted] – That's good to know, we recognized the constraints you have. Equipment rentals is another opportunity.

[redacted] – Two wells in particular may have sour gas. This may require specific certification in order to be on site. So we'll have to find a way to get people certified, so that's not a constraint. Or maybe for first aid training.

[redacted] – Would that training have to be done before time, or would Chance help with that?

[redacted] – Sometimes done through Yukon College or Aurora College – we'll have to investigate how that can be arranged. We would like to be through YESAB by end of September. That would allow us time to do some of these logistic/training items. To source services and make sure everyone is trained to be on site. The whole project will take about 2-3 months.

[redacted] – How would your staff handle wildlife encounters? Will there be training, or suspending activities when encountered within 1 km of the project.

[redacted] – In the YESAB proposal, we have mitigation measure with respect to caribou. Such as giving animals the right of way. There will be a wildlife component to the initial training, and a reporting program for workers to record what they see. Those items are in addition to what the wildlife monitors actually see during their activities. Our ability to detect wildlife within 1 km is difficult, our activities are ground based and we may only be able to see 100 m. However, if there is a collared caribou in the area, that would help us. We'd like to have a data sharing agreement with PCMB. For the 1 km distance, our hurdle is detection.

[redacted] – What are ways to detect those animals?

[redacted] – Using telemetry data is one option. We thought about aerial drones to provide wider coverage. Not committed to the latter. Operating the drones could cause more disturbance, with the noise.

[redacted] – Another limiting factor is decreased daylight hours. Drones would have to fly during the day. Daylight during the project limits what we can do to detect.

[redacted] – Is it possible for wildlife monitors to be provided binoculars?

[redacted] – Depending on the area, the site line will be the edge of the winter road or the edge of the well site. During this operation, when we have a service rig on top of the wall, when that well is open, there are safety issues that have to be managed. You cannot stop instantaneously. That would/could take hours (i.e., stopping). Not only do we have the risk of an open hole, we have to have heat to keep everything from freezing up. Either the equipment continues to run, or the boilers have to keep running. You are not going to be able to shut down completely without an increase in risk to people and the environment.

[redacted] – Just make sure that there are mitigation measures to carry out work in a different ways.

[redacted] – In the proposal we talk about scheduling where the work will occur to minimize impacts to animals. Have wildlife monitors at potential sites to see if anything is there.

[redacted] – We have looked at the project description, we would like to receive the full package.

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[redacted] – Any thought into other ways to keep caribou away? Noise to keep them away?

[redacted] – It's a double edge sword, sometimes people are concerned about noise keeping caribou away from places they may like to be, so that suggestion could compound negative impacts to caribou.

[redacted] – Maybe not a loud/continuous noise. Maybe every hour. An idea.

[redacted] – We're hoping that the noise created by general project activities may accomplish that.

[redacted] – With respect to GSN wanting the full package of information. Should be able to posal soon. It could not be provided previously as it was still being developed. Delays in project design, YESAB timelines, needing to do work winter 2020/2021 – factors causing timeline issues.

[redacted] – I understand, but getting more complete info in the future would help GTC with respect to resourcing and making our review more whole/complete.

[redacted] – We initiated engagement with the Project Description and your comments were very helpful. They helped shaped development of the documents we are finishing now.

[redacted] – [redacted] can you expand on timelines?

[redacted] – Yukon Government (YG) is largely responsible for the timeline. This started last October when we applied to YG to extend the suspended status of these wells. Then worked with a consultant to determine what tests would need to be done on the wells to satisfy regulations. Then COVID happened. We are also trying to stay on top what people and equipment will be available from the south given a recent federal funding program. We're sorry for how the timeline is restricting people.

[redacted] – A project of this nature, and not a lot of information, could be a hinderance. We had to stretch ourselves. For us to work better in the future. We would need to have the necessary amount of information.

[redacted] – Moving forward, that's our goal. Previously, we have had meetings with GTC and the Gwich'in about Chance's Executive Committee Project (Eagle Plain Exploration Program).

[redacted] – To avoid any confusion between Chance's different projects, I'd like to bring us back to the Well Maintenance Project. However, a good action item would be for us to schedule a meeting with the GTC lands group (i.e., the new staff) in order to provide background information and activities to date on the Executive Committee Project.

[redacted] – Can we have the spill response plan?

[redacted] – Yes, that will be included in the project proposal. We can share that in the next couple of days.

[redacted] – With respect to culture and heritage. The points about caribou, would recommend engagement with Tetlit Gwich'in Renewable Resource Council. Increased risk of ski-doo traffic? How will that be handled. Perhaps for a later time, we are wondering about archaeological training for the wildlife monitors? Can that be a part provided? Because this project is close to an area with paleontological remains.

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[redacted] – We have a traffic/access plan. Access will be restricted for safety (e.g., the sour gas). Also, project related traffic on the winter roads will all be able to communicate with each other. If others use the trails, then no one will know, and it could be dangerous. We will want to keep people off the trails.

[redacted] – Feel this conversation should be happening with the Tetlit Gwich'in Renewable Resource Council.

[redacted] – We have not spoken with the renewable resource council. Chance is not developing new roads, but clearing brush and the tree regeneration of previous roads. There will be some enhanced access after this work clears the routes of those roads. We did a survey/study to observe human use in the area (e.g., snow tracks). Didn't find any evidence that people were accessing the area.

[redacted] – Personally not familiar with the area. Did you compare your findings (i.e., study of human use) with the migration pattern for that area, for that particular year?

[redacted] – Thinking along those lines. If caribou are in the area, then people are more likely to be in the area.

[redacted] – Possibly, but those questions should be discussed with the harvesters.

[redacted] – We did look at the number of years that collared caribou were in the area. They certainly don't occupy the area of every year. They also don't have collars on all the caribou out there.

[redacted] – We can reach out to Resource Council?

[redacted] – At this time, we haven't no. Our engagement activities are usually guided by the engagement plan we have with the Gwich'in Partners. We may have to look at how other groups are considered.

[redacted] – Any ground altering impacts?

[redacted] – No soil disturbing at all.

[redacted]– Chance had work done by previous consultants during an earlier project. Contacted GTC and their Culture and Heritage Department on a previous project. Those studies identified some areas that could use more investigation. But right now, we are using existing roads and existing well sites.

[redacted] – Heritage resources was selected as a valued component. There was an effects assessment and that information will be in the draft proposal we provide.

[redacted]– When will negotiations with VG and FNNND happen, with respect to economic opportunities, and when will we know about the Gwich'in opportunities?

[redacted] – The Project is in the territory of the VG and FNNND. Have to complete agreements with those two Yukon First Nations. Those negotiations include YG. We're thinking, as early as this fall to commence negotiations with those First Nations. It puts Chance in a difficult position, even though we have used GTC business in the past. That is the law of the land, we are required to follow those requirements with Yukon First Nations.

[redacted] – Concerned about the protection of wildlife habitat. Project is designed to happen in the winter, but you have said "there won't be clearing" and you have said you "will require minimal clearing". What is the situation with respect to clearing and what is the reclamation plan?

[redacted] – Regarding the winter roads, all of which was disturbed at some point in the past, the width is approximately 10 metres. Then each well site is roughly one hectare. Though not a perfect square. The sites themselves haven't been in production, so not much disturbance has occurred at the site.

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[redacted] – The winter roads will require a minimum of 10 cm of snow. Mulching will be done/used to reduce the effects on the soil. Trying to push vegetation aside to try preserve the root mass. The roads will be left to melt fully. The roads will be restricted. To prevent folks from causing additional degradation. The nature of winter roads and working on well sites in the winter – is designed to maintain the dust layer and the moss layer. Retaining the ground plants that are growing there, as opposed to disturbing the soil and triggering/causing primary succession.

[redacted] – Part of this project is happening in the Peel, Land Management Unit 7. There are High environmental standards there. Any disturbance needs to be reclaimed. That's why I'm asking. Chance road is a new road. Look to the Peel plan. Add some more details with respect to reclamation for the area. Even if your area is small, there are other activities in the area by other projects. The negative effects and disturbances will add up/cumulate.

[redacted] – GTC will be updating our comments given the conversation today. Then will send that updated version along.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Chance to share draft Project Proposal with Gwich'in Partners, including Spill Response Plan.	Chance/ Hemmera	Sent July 24, 2020
Schedule a meeting between Chance and GTC Lands Department for Chance to introduce the Executive Committee Project (Eagle Plains Exploration Project) and provide an overview of activities to date.	Hemmera to schedule	ASAP
GTC is updating their comments on Chance's Well Maintenance Project and will provide an updated version when it is ready.	GTC	When Available

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APPENDIX 2-B-19. *Draft 2020 Annual Report Implementation of Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan*

DRAFT 2020 ANNUAL REPORT

Implementation of Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan

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Prepared for:

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July 31, 2020

1.0 INTRODUCTION

This report demonstrates implementation of the *Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan* (Plan) (see **Appendix A**) finalized on August 1, 2018. It summarizes discussions held between Gwich'in Tribal Council (GTC), Tetlit Gwich'in Council (TGC), collectively referred to as Gwich'in Partners, and Chance Oil and Gas Limited (Chance) since the *2019 Annual Report: Implementation of Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan* was submitted July 31, 2019. The purpose, objectives, and outcomes of each discussion are described below to fulfill the requirements of Ministerial Order (MO) 2018/42 (see **Appendix B**) issued to Chance on August 30, 2018.

2.0 BACKGROUND

The development of communications and engagement plans began with Order in Council (OIC) 2016/169. OIC 2016/169 required Chance to file a First Nations communication and engagement plan with the Minister of Energy, Mines and Resources in order to extend tenure on their northern permits: 0005, 0006, 0007, 0008, 0009, 0010, and 0011 (see **Appendix C**). Chance complied with OIC 2016/169 and received their tenure extension.

Chance subsequently received MO 2017/37 when applying for tenure extension on six of eight southern permits: 0012, 0013, 0014, 0015, 0016, and 0017. MO 2017/37 required Chance to revise, in consultation with affected First Nations, the consultation and engagement plan filed under OIC 2016/169. The affected First Nations listed in MO 2017/37 were Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Tetlit Gwich'in Council.

Gwich'in Partners and Chance developed the Plan collaboratively through a series of in-person meetings and conference calls. Hemmera was retained by Chance in November 2017 to facilitate the development and completion of the communications and engagement plans with the affected First Nations and facilitated all discussions between the Gwich'in Partners and Chance.

The Gwich'in Partners and Chance submitted their finalized Plan to Minister Ranj Pillai on August 1, 2018. To satisfy its obligations under MO 2017/37, Chance filed a total of four communications and engagement plans. All four plans were approved by the Minister, and Chance received a five-year tenure extension on the six southern permits.

A condition of the five-year tenure extension, issued via MO 2018/42, required that Chance submit annual reports summarizing actions taken to implement each communications and engagement plan.

See **Appendix C** for a map of Chance's current permits.

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3.0 ENGAGEMENT AND COMMUNICATION PLAN IMPLEMENTATION SUMMARY

3.1 Summary

In the past year, the Gwich'in Partners and Chance have continued to build their relationship. Parties have advanced discussions in Chance's proposed Eagle Plains Exploration Project and Chance's proposed Eagle Plain Well Maintenance Project (see **Table 1**).

Table 1 Chance proposed projects

Project Name	Date Draft Project Description was Shared with VGG	YESAB Assessment Process	Anticipated Submission to YESAB
Eagle Plains Exploration Project	June 2019	Executive Committee Screening	Spring 2021
Eagle Plain Well Maintenance Project	May 2020	Designated Office Evaluation	July/August 2020

Between August 1, 2019 and June 30, 2020, Chance and the Gwich'in Partners have had 5 in-person meetings and exchanged informal phone calls and emails. The main themes of discussions between the Gwich'in Partners and Chance have been:

- Creation of Chance-Gwich'in Communications and Consultation Management Committee (including Terms of Reference)
- Confidentiality Agreement
- Cooperation Agreement
- Draft Project Description and scope of activities for Chance's proposed Eagle Plains Exploration Project
- Draft Project Description for Chance's proposed Eagle Plain well Maintenance Project
- Proposal submission processes to Yukon Environmental and Socio-economic Assessment Board (YESAB)
- Explanation and understanding of oil and gas activities
- Employment and training opportunities

Chance is abiding by GTC's consultation protocol/preferences and has met with each Designated Gwich'in Organization (DGOs) and Gwich'in community.

The correspondence between Chance and the Gwich'in Partners is documented in the Engagement Log (see **Appendix D**).

3.2 August 19, 2020 – Gwichya Gwich'in Council / Tsiigehtchic Community Meeting (In-Person)

Location: Tsiigehtchic, NWT

Attendees: Gwichya Gwich'in Council, Community Members of Tsiigehtchic, Chance Management, Hemmera

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This meeting was the first in a series of community meetings. The purpose was to provide background information on Chance's proposed Eagle Plains Exploration Project background and to have an open discussion with the Gwichya Gwich'in Council and community members.

During the meeting, Chance described their exploration project, proposed timeline, and the Project's geographic location in relation to the Traditional Territories of Yukon First Nations and the Gwich'in Settlement Region. Chance presented the well drilling and extended flow testing processes, described the seismic exploration program, workforce requirements, and the closure and reclamation activities.

Hemmera presented information on the consultants retained by Chance to assist with the preparation of the Project Proposal. Hemmera also provided an overview of the YESAB Executive Committee Screening process and expected timelines.

Attendees asked questions and sought additional detail on various project components: drilling history and licences, drilling operations and processes, camp operations, and previous engagement activities. Attendees asked about project feasibility in the area, watershed impacts, potential impacts on the permafrost, and ongoing research.

Attendees requested information regarding the Project's potential to build local capacity and a desire to see local employment opportunities. Community members expressed a desire to see Gwich'in working on the Project.

Discussion regarding how information is mutually shared between Tsiigehtchic community members and GTC occurred. A recommendation was made to involve the Development Corporations. Attendees recommended that all consultants should attend community meetings in order to answer questions.

3.3 August 20, 2019 – Gwich'in Partners and Chance Meeting (In-Person)

Location: GTC Main Office, Inuvik

Attendees: GTC Grand Chief, GTC Senior Officials, Chance Management, Hemmera

The purpose of this meeting was for Chance to provide GTC with an activity update and to discuss engagement processes going forward. The Confidentiality Agreement and Cooperation Agreement were also discussed.

GTC and Chance both stated that confidentiality provisions could be incorporated into a Cooperation Agreement and that a separate Confidentiality Agreement would not be required. GTC and Chance also discussed the preferred approach of having one Cooperation Agreement with GTC representing the four DGOs (i.e., as opposed to five separate Cooperation Agreements).

During this meeting, Chance provided an overview of fieldwork activities that were completed by Chance's consultants over the 2019 summer months. It was decided that fieldwork reports would be provided to GTC once they were available in mid to late September of 2019.

3.4 August 20, 2019, Nihtat Gwich'in Council / Inuvik Community Meeting (In-Person)

Location: Inuvik, NWT

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Attendees: Nihtat Gwich'in Council (NGC), GTC representatives, Community Members of Inuvik, Chance Management, Hemmera

This meeting was the second in a series of community meetings. The purpose was to provide background information on Chance's proposed Eagle Plains Exploration Project background and to have an open discussion with the NGC and community members.

During the meeting, Chance described their exploration project, proposed timeline, and the Project's geographic location in relation to the Traditional Territories of Yukon First Nations and the Gwich'in Settlement Region. Chance presented the well drilling and extended flow testing processes, described the seismic exploration program, workforce requirements, and the closure and reclamation activities.

Hemmera presented information on the consultants retained by Chance to assist with the preparation of the Project Proposal. Hemmera also provided an overview of the YESAB Executive Committee Screening process, and expected timelines.

During and after the presentation, attendees asked questions and sought additional detail on various project components: boundaries between oil and gas underground, project timelines, seasonal timing of project activities, camp capacity, emissions regulations, winter road construction, airstrip use and construction, and local capacity building.

It was emphasized that caribou (i.e., Porcupine Caribou Herd) would be a topic of importance to the community and NGC moving forward. Chance stated that caribou considerations will be a key part of engagement with GTC, NGC, and the other DGOs.

NGC President explained that NGC Council members are currently working for, or have previously worked for, local and regional regulatory regimes. It was suggested that members may be able to contribute to the Project in that aspect. It was also noted that NGC is not opposed to the Project but will continue to have further internal discussions and follow up questions for Chance to address.

All parties agreed to work together to plan and strategize information sharing among members and relay meeting updates for those unable to attend.

3.5 August 21, 2019 – Ehdiitat Gwich'in Council / Aklavik Community Meeting (In-Person)

Location: Aklavik, NWT

Attendees: Ehdiitat Gwich'in Council, Community Members of Aklavik, Chance Management, Hemmera

This meeting was the third in a series of community meetings. The purpose was to provide background information on Chance's proposed Eagle Plains Exploration Project background and to have an open discussion with the Ehdiitat Gwich'in Council and community members.

During the meeting, Chance described their exploration project, proposed timeline, and the Project's geographic location in relation to the Traditional Territories of Yukon First Nations and the Gwich'in Settlement Region. Chance presented the well drilling and extended flow testing processes, described the seismic exploration program, workforce requirements, and the closure and reclamation activities.

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Hemmera presented information on the consultants retained by Chance to assist with the preparation of the Project Proposal. Hemmera also provided an overview of the YESAB Executive Committee Screening process and expected timelines.

Attendees asked questions and sought additional details on various project components including Chance's history with oil production, YESAB processes, and employment/training opportunities. It was noted that a main concern for the community is potential impacts on caribou (i.e., Porcupine Caribou Herd).

All parties discussed a potential caribou workshop and brainstormed potential workshop objectives.

3.6 August 22, 2019 – Tetlit Gwich'in Council / For McPherson Community Meeting (In-Person)

Location: Fort McPherson, NWT

Attendees: TGC, Community Members of Fort McPherson, Chance Management, Hemmera

This meeting was the fourth, and final, in a series of community meetings. The purpose was to provide background information on Chance's proposed Eagle Plains Exploration Project background and to have an open discussion with the TGC and community members.

During the meeting, Chance described their exploration project, proposed timeline, and the Project's geographic location in relation to the Traditional Territories of Yukon First Nations and the Gwich'in Settlement Region. Chance presented the well drilling and extended flow testing processes, described the seismic exploration program, workforce requirements, and the closure and reclamation activities.

Hemmera presented information on the consultants retained by Chance to assist with the preparation of the Project Proposal. Hemmera also provided an overview of the YESAB Executive Committee Screening process and expected timelines.

Attendees asked questions pertaining to the proposed timeline, partnerships with local businesses, and potential for local employment opportunities.

Attendees also expressed concerns regarding treaty rights. Attendees recommended having access to meeting notes which are shared with GTC and raised concerns with respect to community members being kept informed. A suggestion to have a large meeting in Dawson City with all parties and interested community members was made. It was noted that the Tetlit Gwich'in Band should be included in communications moving forward.

3.7 Spring 2020

Chance is currently developing a YESAB Designated Office submission for its proposed Eagle Plain Well Maintenance Project. Chance sent a letter to the Gwich'in Partners May 25th, 2020 with the purpose of introducing the project and initiating engagement. GTC provided feedback to Chance, and Chance and Hemmera are currently working on follow-up activities to respond to GTC's comments. Parties intend to schedule a meeting to continue discussions.

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4.0 PLANS FOR ONGOING ENGAGEMENT AND NEXT STEPS

Gwich'in Partners and Chance will continue to hold discussions at regular intervals. Upcoming engagement activities are expected to involve the following:

- Detailed discussion on Chance's proposed Eagle Plain Well Maintenance Project
- Negotiation of a Cooperation Agreement with GTC (including confidentiality provisions)
- Updating/revising Plan to include all DGOs as well as Band Offices
- Share data collected during 2019 Summer/Fall field season

5.0 APPROVAL OF IMPLEMENTATION SUMMARY

Gwich'in Partners and Chance have reviewed this report and agree to its contents as an accurate summary of engagement activities carried out between August 1, 2019 and June 30, 2020.

Per: Gwich'in Partners

Dated: _____

[redacted], Interim Chief Operating Officer
Gwich'in Tribal Council

Per: Chance Oil and Gas Limited

Dated: _____

[redacted], VP Government and Community Relations

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APPENDIX A

Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan

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July 2020

Chance OIL AND GAS LIMITED

Gwich'in Tribal Council
Gwich'in land, culture & economy for a better future

Gwich'in Tribal Council and Chance Oil and Gas Limited Communications and Consultation Plan

1.0 Introduction

Chance Oil and Gas Limited ("Chance") is an oil and gas exploration company that holds permits to perform oil and gas exploration activities in the Eagle Plain basin of the Yukon Territory, Canada. The Gwich'in Tribal Council ("GTC") is an Indigenous organization that holds rights under Section 35 of the *Constitution Act*, 1982, *Treaty 11* and the *Gwich'in Comprehensive Land Claim Agreement* ("GCLCA"), including Appendix C – *Yukon Transboundary Agreement* ("YTA"). Under the YTA, "Tetlit Gwich'in" is defined as a Gwich'in who either: (a) resides in the Peel River watershed, including the community of Fort McPherson, Northwest Territories; or (b) is descended from an aboriginal person who used or occupied the Peel River watershed on or before December 31, 1921. Under this definition, Tetlit Gwich'in and their descendants currently reside in Aklavik, Inuvik, Tsiigehtchic and Fort McPherson, as well as elsewhere in Canada and abroad. Under the GCLCA, the GTC is the body responsible for representing the collective rights of GCLCA participants, including all Tetlit Gwich'in as defined in the YTA.

As part of Chance's exploration program, Chance, as the proponent, seeks to develop a communication and consultation plan ("the Plan") with the GTC, as a rights holder for these Yukon lands that could potentially be affected by Chance's exploration program activities. These Yukon lands are identified in the YTA as the Primary Use Area and the Secondary Use Area lands. With the exception of permit 15 which straddles the Primary Use Area, all of the permits held by Chance, namely 7, 9, 13, 14, 15, 19, and 20, are located within the Secondary Use Area.

The Plan will reflect and be consistent with the GTC's role as the Indigenous organization responsible for upholding the collective rights held by Gwich'in in the Primary Use Area and Secondary Use Area within the Yukon. This Plan will acknowledge the GCLCA organizational structure, and as such, is intended to extend to and encompass the GTC, the Designated Gwich'in Organizations, and including the Tetlit Gwich'in Council (the "Gwich'in Partners"). The Gwich'in Partners will seek to establish an internal Memorandum of Understanding (MOU).

2.0 Purpose

This document serves as a Plan to provide a mutually agreed upon framework to support collaborative and effective communication and consultation between Chance and the Gwich'in Partners.

3.0 Relationship

Chance and the Gwich'in Partners will execute this Plan according to the following principles:

- Transparency;
- Timeliness; and
- Mutual respect, trust and understanding.

4.0 Key Gwich'in Tribal Council and Chance Connections

Communication and consultation between Chance and the Gwich'in Partners will be generally associated with the proposed works and potential effects associated with Chance's oil and gas exploration program, and with potential new opportunities or benefits received by the Gwich'in people, from Chance, as the project proponent. Once the scope of Chance's specific plans are determined, the Gwich'in Partners, together with Chance, will discuss the anticipated impacts on Gwich'in rights within the Primary and Secondary Use Areas, as well as the best way of addressing the impacts defined at that time.

This section of the Plan identifies the key contacts related to these overarching communication and consultation themes. Key representatives involved in communication and consultation are expected to be as follows:

- Grand Chief/President of the Gwich'in Tribal Council;
- President of the Tetlit Gwich'in Council (TGC);
- Gwich'in Tribal Council's Chief Operating Officer (COO); and
- Chance Management and designated staff and advisors.

Communication and consultation with the Gwich'in Partners will be coordinated through the Gwich'in Tribal Council's Chief Operating Officer.

Key Chance representatives involved in communication and consultation are expected to be as follows:

- Chance Oil and Gas Chairman and Chief Executive Officer (CEO)
- President of Chance Oil and Gas;
- Vice President of Government and Community Relations; and
- Regulatory, Environmental, and Community Relations Coordinator.

5.0 Communication and Consultation Methods

Chance and the Gwich'in Partners will employ the following communication and consultation methods:

- In person meetings;
- Email;
- Sharing Power Point Presentations (to support in person meetings);
- Sharing reports and documents (as requested and as required);
- Telephone correspondence (teleconferences and less formal phone calls); and

- Identifying and documenting issues of concern raised by the Gwich'in Partners during consultation meetings, and Chance providing written responses to the identified issues within 30 days of the meeting, to serve as the basis for ongoing dialogue and resolution.

5.1 Meetings Process

Communication and consultation meetings will be executed in the following manner:

1. Chance and/or the Gwich'in Partners will request a meeting in writing to the other party according to the connections iterated in Section 4.0, no less than ten business days of the proposed meeting date;
2. The parties to meet will develop the agenda collaboratively;
3. The party requesting the meeting will develop supporting materials (collaboratively, where possible), and share those at least two days in advance of the meeting; and
4. The meeting will take place in a mutually agreeable location.

The above general process applies to meetings with subject matter leads, and where reasonable, meetings with communities at large.

5.2 Documentation

The following documentation sharing and review protocols support the communication and consultation methods described above:

- Action items and meeting outcomes will be logged during meetings and reviewed by both Chance and by the Gwich'in Partners at the end of the meeting to ensure that there is general agreement on the list of actions and entities responsible for those actions. The list of action items and meeting outcomes will be recorded in writing and shared between Chance and the Gwich'in Partners, within ten business days following the meeting date;
- Chance and the Gwich'in Partners will agree upon and use a file sharing platform to facilitate sharing of large files, such as Power Point presentations, reports and documents exchange relating to specific issues identified that were the object of specific consultations;
- Should Chance and the Gwich'in Partners employ a third party for records development and management, the third party will follow the process described above for recording and providing meeting minutes;
- Pursuant to Section 5.1, Chance and the Gwich'in Partners will exchange documents pertaining to issues identified in the communications and consultation process that may affect Gwich'in rights pertaining to the Primary and Secondary Use Areas in the Yukon. These documents will include written summaries of decisions reached collectively and agreed upon concerning these issues.

6.0 Records Management

Summarized records of communication and consultation between Chance and the Gwich'in Partners will be kept in a records log. Chance will ultimately submit the items below to regulators and assessors for review if and when a potential project is assessed in the future:

- Meeting Agendas;
- Meeting Action Items as described in **Section 5.0;**
- Invitee/Attendees lists and/or meeting sign-in sheets;
- Records log, which will include summaries of the following:
    - In person meetings;
    - Phone calls and teleconferences;
    - Incoming and outgoing emails between Chance and the Gwich'in Partners.
- Reports and documents provided to the Gwich'in Partners by Chance and reports and documents provided to Chance by the Gwich'in Partners for review and consideration;
- Copies of Power Point presentations delivered by Chance to the Gwich'in Partners;
- Copies of any presentations delivered by the Gwich'in Partners to Chance; and
- Documents exchanged pertaining to issues raised during the communications and consultations process, as identified in Section 5.0.

7.0 Adaptive Management of the Communication and Consultation Plan

Chance and the Gwich'in Partners will review and assess the effectiveness and success of this Plan on at least a six-month basis.

Chance and the Gwich'in Partners agree to establish a *Chance-Gwich'in Communications and Consultation Management Committee* of senior officials to serve as a focal point for the co-development and co-management of current and future plans and activities associated with Chance's exploration program activities. Chance and the Gwich'in Partners will nominate representatives to serve on this Committee. Those representatives will determine the required frequency of meetings, but it is envisaged that for the first year following agreement on the Plan that meetings of the Committee would be held one time per each season. It is also understood by Chance and Gwich'in Partners, that a Terms of Reference will be developed by the Committee. The Committee will be supported by a Secretariat, both of which will be wholly funded by Chance. Chance and Gwich'in partners will hold the first meeting within 60 days of finalizing this Plan.

8.0 Cost and Economic Opportunity

The Gwich'in Partners, together with Chance, have discussed their mutual interest in working towards ensuring that GCLCA Participants are able to derive and participate in benefits arising from Chance's proposed oil and gas exploration activity within the Primary and Secondary Use Areas in the Yukon. Chance recognizes the importance of, and commits to, working respectfully and collaboratively with the GTC and Gwich'in partners during engagement, consultation, and any negotiations on agreements that will take place in the future, to the same degree and manner as Chance would with any Yukon First Nation, whose settlement land or traditional territory may be affected by oil and gas activity in the Eagle Plain Basin.

Chance OIL AND GAS LIMITED

Gwich'in Tribal Council
Gwich'in land, culture & economy for a better future

As the Communications and Consultation Plan is implemented, Chance and GTC agree to discuss a Cooperation Agreement wherein opportunities or benefits are defined that the Gwich'in people, as represented by the Gwich'in Partners, would receive from Chance. Benefits could include such things as, capacity funding, employment opportunities, contracting opportunities, scholarships and education and training opportunities, other financial and implementation payments, and equity participation.

9.0 Signatures of the Parties

This Plan is approved by the following parties:

[redacted]

Gwich'in Tribal Council

[redacted]

Chance Oil and Gas limited

APPENDIX B

Ministerial Order 2018/42

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YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,

(d) oil and gas permit No. 0015,

(e) oil and gas permit No. 0016,

(f) oil and gas permit No. 0017. « *permis visé* »

2 The renewal term of each subject permit is extended by five years (so that it ends on August 30, 2023).

3 The resulting total length of the initial term and the renewal term of a subject permit is 16 years.

MO-OGA-18-07 (ExtPrmt)-E06-F01-FIN

YUKON

CANADA

ARRÊTÉ MINISTÉRIEL 2018/42

LOI SUR LE PÉTROLE ET LE GAZ

Le ministre de l'Énergie, des Mines et des Ressources, conformément à la *Loi sur le pétrole et le gaz*, arrête :

1 La définition suivante s'applique au présent arrêté.

« permis visé » Les permis suivants de pétrole et de gaz détenus par Chance Oil and Gas Limited :

a) permis de pétrole et de gaz nº 0012;

b) permis de pétrole et de gaz nº 0013;

c) permis de pétrole et de gaz nº 0014;

d) permis de pétrole et de gaz nº 0015;

e) permis de pétrole et de gaz nº 0016;

f) permis de pétrole et de gaz nº 0017. "*subject permit*"

2 La durée du renouvellement de chaque permis visé est prolongée de cinq ans, de façon à ce qu'elle se termine le 30 août 2023.

3 La durée totale d'un permis visé, y compris la durée initiale et la durée du renouvellement, est de 16 ans.

2018/42

4(1) In this section

"first nations communications and engagement plan" means the plan filed under O.I.C. 2016/169 and revised in accordance with M.O. 2017/37. *« plan de participation et de communication avec les premières nations »*

(2) It is a condition of this Order that Chance Oil and Gas Limited must file annual reports with the Division Head, in accordance with subsection (3) and to the satisfaction of the Division Head, about the implementation of the first nations communications and engagement plan.

(3) For the purposes of subsection (2), Chance Oil and Gas Limited must file

(a) the first annual report on or before July 31, 2019, in respect of the period beginning on September 1, 2018, and ending on May 31, 2019; and

(b) each subsequent annual report on or before July 31 of each year in respect of the period beginning on June 1 of the preceding year and ending on May 31 of the year in which the report is to be filed.

4(1) La définition suivante s'applique au présent article.

« plan de participation et de communication avec les premières nations » Le plan déposé en vertu du Décret 2016/169 et révisé en conformité avec l'Arrêté 2017/37. *"first nations communications and engagement plan"*

(2) À titre de condition du présent arrêté, Chance Oil and Gas Limited dépose des rapports annuels auprès du chef de division, en conformité avec le paragraphe (3) et à la satisfaction du chef de division, concernant la mise en œuvre du plan de participation et de communication avec les premières nations.

(3) Pour l'application du paragraphe (2), Chance Oil and Gas Limited dépose :

a) le premier rapport annuel au plus tard le 31 juillet 2019, pour la période débutant le 1er septembre 2018 et se terminant le 31 mai 2019;

b) chaque rapport annuel subséquent, au plus tard le 31 juillet de chaque année pour la période débutant le 1er juin de l'année précédente et se terminant le 31 mai de l'année au cours de laquelle le rapport doit être déposé.

Dated at Whitehorse, Yukon,
~~30~~ August 30th 2018.

Fait à Whitehorse, au Yukon,
le August 30th 2018.

[redacted]

Minister of Energy, Mines and Resources/Ministre de l'Énergie, des Mines et des Ressources

MO-OGA-18-07 (ExtPrmt)-E06-F01-FIN

APPENDIX C

Map of Chance Dispositions and Wells

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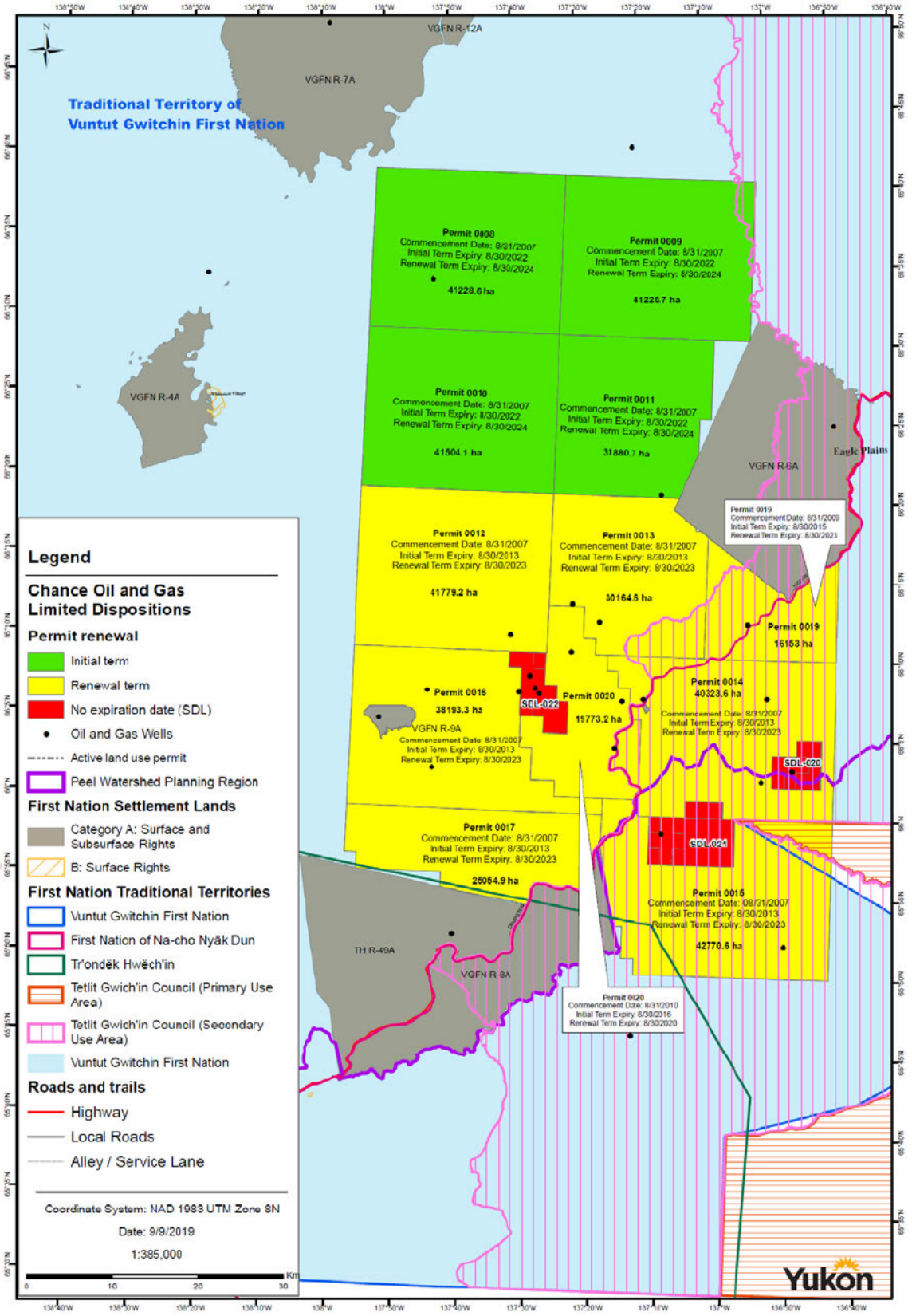
Chance Oil and Gas Limited Dispositions and Wells



APPENDIX D
Engagement Log

- I assume that the specifics of mitigating culture/heritage impacts will be covered in the specific conversations and negotiations that will follow?

- The special relationship that the TG (and therefore all citizens of Gwich'in nation) have with these lands should be acknowledged, although again, perhaps this is not the place for it.

Page 12 (or Page 4)

7.0 - It states that parties agree to establish a communications management committee. Perhaps it should state something to the effect that the communications and management committee "has been established".

Do we have the Terms of Reference for the Committee? Perhaps I've overlooked that, just asking.

Page 11 (or Page 3)

6.0 - I don't believe w've seen the records log. Does GTC have access to this?

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APPENDIX 2-B-20. November 16, 2020, Meeting Summary

GWICH'IN TRIBAL COUNCIL AND CHANCE OIL AND GAS

DRAFT MEETING SUMMARY – CHANCE WELL MAINTENANCE AND WINTER ACTIVITIES PROPOSAL

Date: November 16, 2020

Location: Conference Call

Attendees:

Gwich'in Tribal Council:

- [redacted], Grand Chief
- [redacted], Deputy Grand Chief
- [redacted], Interim Chief Operating Officer
- [redacted], Director Culture Heritage
- [redacted], Heritage Specialist
- [redacted], Director of Lands and Resources

Chance Oil and Gas Limited:

- [redacted], President
- [redacted], VP Government and Community Relations
- [redacted], Regulatory, Environmental and Community Relations Coordinator

Hemmera:

- [redacted], Business Leader
- [redacted], Senior Environmental Specialist
- [redacted], Human Environment Specialist

Purpose and Objectives

The purpose of this meeting was to introduce Chance Oil and Gas and its projects to Gwich'in Tribal Council's (GTC) new leadership.

Meeting Discussion:

[Participants identified themselves and provided a brief introduction, including a summary of their title and role within their respective institutions and brief overview of their history.]

Grand Chief [redacted] – Have driven by Chance's camp at Eagle Plains in the past and have often wondered what was going on. Suspect that other Gwich'in have had the same thoughts. I welcome the opportunity to introduce myself to Chance. The Designated Gwich'in Organization for Fort McPherson is very complementary of Chance's outreach. Also note that Chance has supported our hockey team. This represents a collaborative approach, that myself and the Deputy Grand Chief expect and support. We don't always need to convene a meeting though, there is strength in us having access to each other.

Where we are able to pick up the phone and clarify things when we have questions Willingness to have open and transparent dialogue that's frequent. That's our expectation. If there are opportunities for GTC participants and businesses to participate, that's what we're looking for, and to ensure practices work with our use in the area.

[redacted] – I agree, our relationship over the last four years, under a more formalized process, has been working well and we really appreciate the efforts of the GTC and the DGOs in giving us advice. With respect to history, Chance had its 26th birthday in September. In those 26 years, we've only been able to operate in the field for perhaps 3 years. In the early years, the plan was to focus on local standard resources to develop in the local regional market, in later 90s, the commodity markets collapsed. Another 7-8 years after that, there was enough of a rebound for Chance to start up. Another change during that time, switched from dealing with Ottawa to the Yukon when it came to oil resources. In the past, Chance was called Northern Cross Yukon and was successful in being awarded 16 permits in the Eagle Plain basin. Most permits are within the Traditional Territory of the Vuntut Gwitchin (VG). A portion of the overlap with the VG, is also with First Nation of Na-cho Nyäk Dun and some of the Secondary Use Area of the Tetlit Gwich'in. Fast forward, we did go through Yukon Environmental and Socio-economic Assessment Board (YESAB) (Designated Office evaluation) to undertake an exploration drilling project. For 12 months we were able to drill 4 wells. Assessing opportunities in shale formations and identifying resource mass to be able to support resource development. Undertook a 3-dimensional seismic data program. Since then, tried to go through various processes to continue exploration, but its been a challenge to get through YESAB. Last time we did a field program in 2014, we implemented Engagement Plans with each of the affected First Nations. In relative terms of exposure, the VG would have the most exposure since their Traditional Territory covers all the areas of our project/s. Chance has been communicating its plans to each of the affected First Nations. The Yukon moratorium on fracking resulted in Chinese investors leaving Northern Cross (i.e., previous iteration of Chance). Chance is now Canadian owned. We have plans to continue exploration work and look forward to working with the communities.

[redacted] – Chance will speak to each project in more detail through the call. For now, I will provide overview of the Communications and Consultation Plan that was agreed to between the Gwich'in Partners and Chance. Yukon Government issued a Ministerial Order for Chance to make engagement plans with affected First Nations. In the order, Yukon Government listed both GTC and Tetlit Gwich'in Council (TGC). Hemmera was brought in late 2017 to help create those plans. GTC and TGC worked collaboratively to develop a plan that addressed both interests of both parties. [redacted] walked through the different sections of the Communications and Consultation Plan. Plan attached.] Someone from Hemmera takes notes, then sends out those notes to GTC and Chance for comments. Those notes are sent as a draft and for records management. Moving forward, as we get into more substantive discussions, they will need to be documented in a potential submission to YESAB. Section 7.0 of the Communications and Consultation Plan hasn't been fully implemented at this time. Largely because the main goal of the plan was to develop the Executive Committee project. Work on that larger project has slowed down and, in the interim, the smaller Designated Office project has ramped up. We would be happy to work with GTC and Chance to develop the items in Section 7.0. In the absence of formally implementing the items in this section, it has been implemented in spirit.

[redacted] – I don't have any questions, seems pretty straight forward at this point.

[redacted] – I think it's working well. There may have to be amendments to it, but the feedback has been good.

[redacted] – These documents are great to frame out the info that's been flowing. However, the expectation is that your technical people are dealing with ours. If there is a need for leadership, then I would be pulled in (i.e., pulled into the nitty and gritty). If there are activities in the area, there is an expectation that we'd have some business opportunities.

[redacted] – Executive Committee screening project. Chance has been working on its exploration plans for a number of years. That plan has always been evolving as we learn more about the geological opportunities. The focus is on opportunities that do not require hydraulic fracturing. Within our exploration license we have 3 Significant Discovery Licences (SDLs). These were drilled between 1959-1972. Two SDLs are located in the Tetlit Gwich'in Secondary Use Area. Four wells were drilled in the 1960s to make those discoveries. As time passed and technology evolved, Chance would explore new opportunities. Eagle plain has had close to 40 wells drilled in its life. We've drilled 4. Most of that work happened in 1959-1972.

[redacted] – Have you heard of Eagle Plain Resources?

[redacted] – Yes, it is a mining company. Related to a discovery in the fishing branch area. An iron deposit near a Vuntut Gwitchin protected area.

[redacted] – I saw them at a conference before, but the projects they were pitching were not near Eagle Plains.

[redacted] – The multiyear exploration project (project for Executive Committee level screening) is intended to take 8-10 years. Our intention is to keep it small scale, but have it run for a long enough period of time so that the environmental impact is limited but that local businesses are given opportunities to invest (e.g., businesses, people, and training). Since the time we've been in the north, we've seen that people want opportunities. We are trying to do this in a manner that sets the stage for consistency and longer-term activity. We want to establish capacity in the north so that services don't have to be brought from the south. The only place you can get services for the oil industry is out of Alberta. That's a long ways – to bring things to the Yukon. If we can start getting that expertise in the north, that is economically advantageous to us, Chance, and the North. [Eagles Plains Exploration Project Description attached.] The lands where we want to undertake this wide area of exploration activity is outlined in black. Within that area are SDL 20 (Birch), SDL 21 (Blackie), and SDL 22 (Chance). Within this area of interest, we hope to drill up to 30 exploratory wells, those locations have not been determined. Need access to data, some of that data is seismic data, gathered by other operators that we have acquired or seismic that we would gather ourselves. There is 2D [seismic] data, and first 3D data was collected in 2013-2014 which we shot. Chance would shoot 1500 sq KM of 3D and 2,000-line kilometers of 2D. The methods for seismic today are less intrusive than the lines of the 1950s. Seismic lines are no longer straight, and they are thinner than they were in the past. Chance's draft project description has been provided to the predecessors of GTC's leadership. Chance would deploy one drilling rig or perhaps 2. The camp you've driven by has a maximum of 75-80 people. This limits the number of drilling programs and how the drilling program is combined with the seismic program. It will be winter access, so there are also seasonal constraints. For extended flow testing, those activities would require year-round roads. That product (i.e., from the extended flow tests) would either be trucked to market, used onsite, flared, or disposed of in disposal wells. The goal of extended flow testing is to understand the capability of the well, the size of the resource, and help with long-term planning. Could take up to 2 years for extended testing for oil, or for natural gas could take a few weeks. Oil

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accumulation takes longer to assess than a natural gas accumulation. There are opportunities for First Nations to participate in the oil industry, some of which is exemplified in Alberta.

[redacted] – When will you start?

[redacted] – we have to go through YESAB's Executive Committee process. Have been trying to get that document (i.e., project proposal) ready for a few years now. However, we need to set up cooperation and benefits arrangements with First Nation. I can't tell you when we would get started. Executive Committee screening is maybe a 2-year process. However, YESAB is starting/initiating a Pre-Submission Engagement Process, this may affect our timelines. I think this project is still a couple/few years away. Hopefully not much longer than that.

[redacted] – Essentially moving forward, will be engaging with affected FNs on ecological Valued Components, for example, Caribou. We know this is a top priority. We are well aware of the Artic Wildlife Refuge and the issues/concerns being raised there. It is very important for us to get into the communities and engage the communities. We have[redacted] (with Environmental Dynamics Inc.), who is a biologist who will help facilitate those conversations along with Hemmera. It is a detailed process, but it is a very important process. Gathering feedback from the community to inform plans and mitigation measures. With regards to capacity building, there is the technical component, but also economic opportunities. I think there is a huge appetite to look at the broader picture when having discussions.

[redacted] – If approved, will this project run into the next decade?

[redacted] – In YESAB 2021. Then a couple years in YESAB, permits in 2023/2024, and then go from there, depending on what the results are.

[redacted] – I think some of the businesses that we have at our disposal and that we are looking to create, will be able to support Chance. We have businesses with experience in arctic operations and experience in that specific area. There hasn't been enough done, to utilize northern business and services provides. For Mackenzie, a lot of firms came from the south.

[redacted] – Because this is still fairly early stage, the areas where we have had success hiring from northern businesses is in access construction (e.g., winter roads), camp operations, and supply drivers.

[redacted] – What is the Rough value of the drilling program?

[redacted] – Project would roll out based on results as we went along. A typical well, might be 7-12 million dollars to drill. The camp will limit activities. We'd have an airstrip, 800-meter strip by our camp. I think Vuntut Gwitchin is thinking about a new airstrip, off the dempster. However, those are just ideas right now.

[redacted] - If you come aware of any opportunities that could align with this work, please let us know.

[redacted] – Occupational health and safety and labour codes have changed. Almost like an apprenticeship program now. First, they start with book work and then on the job training. Having lead time to get this organized is a good idea.

[redacted] – Those are good changes. More training is a good thing. Worst thing we could do is train people and have them waiting for a year. Timing will be very important.

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[redacted] – Will gather info on training requirements and labour code requirements and we will share that information with the group. In the near term, Yukon oil and gas regulators have asked us to undertake a maintenance program on 8 wells. Yukon Government instructions are to put those wells into operation or abandon them. Hopefully, this winter. However, COVID has impacted timelines. Plans to enter the field this winter. Would take approximately 70 days to undertake the work on the 8 wells. Godlove, my next comments on the Designated Office project will be new to you. Changes have occurred. M59 is a natural gas discovery. M08, G08 and J19 are on the SDL. A25, E78, H28, and B73 are wells Chance drilled. We are revising our document that went into YESAB. Now we propose to abandon 3 wells: H28, B73, and G08. Convert two into downhole disposal wells: E78 and A25. It's environmentally safer to have a location near the working sites that can be used for disposal. Conduct extended flow testing on M59, M08, J19. This is the component that is new. The extended flow testing would be new to Godlove. One service rig would come up from the south (Alberta) to do the well maintenance work. As for well abandonment, it's brining all wells up to current standard. Cement trucks will be required. Winter roads will be needed for access routes.

[redacted] – The project proposal provided as a draft this past spring. GTC provided comments. That project was submitted to YESAB as a Designated Office evaluation. We received 6 information requests and we were in the process of responding to those requests when Chance informed Hemmera of the project changes. We talked through those changes with YESAB and they advised Chance to withdraw its proposal and resubmit. So Chance will re-engage on this new project design and then resubmitted. Godlove would have received the email from Calista Morrison (Hemmera) notifying GTC that the proposal was being withdrawn.

[redacted] – Received the email from Calista, and look forward to the new proposal.

[redacted] – Hope to have the new document maybe this week.

[redacted] – Making the final edits now, should be ready this week.

[redacted] - The YESAB process takes an uncertain amount of time. Typically Designated Office evaluations take a couple months. However, oil and gas in the Yukon is a hot button topic. Knowing that the proposed work should take 70 days. We will probably have to get the permits in January for the timing to work. If that doesn't happen, then we will have to wait until next year. Also, have to wait until there is enough snow. That will impact our start time as well. COVID affects timing as well. Equipment and people will have to come up from Alberta and that could affect our ability to execute. We will need input from government, GTC, and TGC. Your thoughts on COVID management. We have a plan that has not been approved yet by the Yukon Government. It is a plan that is independent of the Yukon Government's polices. For example, it's requesting going to work and quarantining at the same time. As opposed to quarantine for 14 days and then work. We need to find a plan that will be suitable. We will be using facilities at the Eagle Plain Hotel. Doesn't make sense to open up the camp. The Eagle Plain Hotel will be our base camp. We will have to get a plan, that is different to what the Yukon is currently requiring, approved by the Minister of Communities Services. Getting feedback from First Nation leadership and businesses will be helpful for us.

[redacted] – Odd situation. We don't have a bubble with the Yukon. I don't have to isolate when I go to Yukon, but when I come back into NWT, I have to isolate. Isolation is not fun, but it is for the best of our communities. Important that people coming in, are following the rules. It's a shame that YT opened their border to BC. Then we likely would have had the northern bubble. There are pros and cons to

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everything. There are cons for people from the Mackenzie Delta that go into Whitehorse and then when they come back have to isolate. Border control is important. Working with GNWT to establish a 24-hour border control on the Dempster. Its not a matter of "if" but when. That we will have more cases in the Mackenzie Delta. Increased measures, border control, and maybe even lock-down measures, may be needed in the future.

[redacted] – We already initiated conversations at a high level, e.g., with the Vuntut Gwitchin. To inform affected First Nations on the Yukon side and start working with their development corporation.

[redacted] – Couple more long-term questions. What is the broader business case for this? You mentioned earlier production in the Yukon, where would it go, the desired customer?

[redacted] – Flow testing of natural gas. Yukon power generation is relying increasingly on diesel. Yukon Energy. The idea would be to deliver natural gas for power generation. Would mean changes to the equipment that is currently used. I think what Yukon Energy is doing in Faro and in Whitehorse is fairly temporary. I think if we were to look long-term, the best place to put electricity generation is near Dawson at the intersection of the Klondike and Dempster highways. An alternative use for the heat. We have not investigated all these options yet. Natural gas could be used to provide home heating or space heating just like it is in Alberta or even Inuvik. The idea would be similar. We have to demonstrate flow. Before we can get anyone to listen to us. Exploration project, the preference is to focus on liquids. Have a facility to get diesel, and sell that into the regional market. The volume and composition of the liquid. Diesel is an easily made product.

[redacted] - Having it sent north to the NWT?

[redacted] – Had a conversation with GNWT folks. However, first we need to draw attention to the site and the project by looking at the flow rate. One we have that information we can engage with the market.

[redacted] – What flow rate would you need?

[redacted] – 20-30 million cubic feet a day. I'd like to get that. The north has a unique dynamic when it comes to resource use, i.e., peek in the winter, low in the summer. However flow rates don't change with the season.

[redacted] – Purpose of our meeting was to give GTC's new leadership an overview of Chance's projects. Godlove has been our primary point of contact.

[redacted] – We have hired consultants to do baseline studies. Environmental Dynamics Inc. out of Whitehorse is looking into aquatics, fish, birds, caribou, and impacts of old and new seismic lines. They have been gathering and interpreting data. They are getting to a stage where they can share their findings more broadly. Close to the point where we can share this information with the First Nations and communities and combine that data with information that the communities can share. Palmer, another consultant, is looking into permafrost and changes in the permafrost. In order to move this forward.

[redacted] – The primary concerns, trapping and caribou hunting. There isn't as much trapping any more. However, historically that area has been used in the past. Those will likely be the primary concerns for our residents. Difference from ANWAR, Eagle Plains isn't calving grounds.

[redacted] – Going forward, GTC always takes the collaborative approach. Even if a project is in the Primary or Secondary Use Area, we still talk to the other Designated Gwich'in Organizations and we

include our Department of Culture and Heritage. If we could have enough time to provide a review, that would be very helpful. It would help the Gwich'in work with each other.

[redacted] – What is the technology available in the communities, with respect to online meetings with Microsoft Teams or Skype.

[redacted] – Would have to test and prepare ahead of time to make sure the connection is good. Also ensure technician is there.

[redacted] – We will need to think about what would work best. For example, with respect to workshops?

[redacted] – We have used Teams in the past.

[redacted] – That's just how we have to plan to engage moving forward. Thank you. This provided me with necessary context. If I have any questions, I will reach out t[redacted]. Hope [redacted] reaches out to me. I'm willing to exchange cell numbers.

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Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Gather information on training requirements for workers in the Oil and Gas	Chance	December 2020/January 2021
Share revised Project Proposal for Chance's Well Maintenance and Winter Activities for Designated Office Evaluation	Chance/Hemmera	Draft shared with GTC November 19, 2020
Share copies of *Chance and GTC Communications and Consultation Plan* and Draft Project Description for Chance's Eagle Plains Exploration Project for Executive Committee Level Screening	Chance/Hemmera	ASAP (Attached)

APPENDIX 2-B-21. June 3, 2021, Meeting Summary

GWICH'IN TRIBAL COUNCIL AND CHANCE OIL AND GAS MEETING

Date: June 3rd, 2021

Location: Microsoft Teams

Attendees:

Gwich'in Tribal Council:
Grand Chief [redacted]
[redacted], Manager, Lands & Resources
[redacted], Associate Director, Intergovernmental Relations

Chance Oil and Gas Limited:
[redacted], President
[redacted], VP Government and Community Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator

Hemmera:
[redacted], Human Environment Specialist
[redacted], Human Environment Specialist

Purpose and Objectives

The purpose of this meeting was for Chance Oil and Gas (Chance) to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin, and for Chance to provide updates regarding baseline information gathered by consultants (Environmental Dynamics Inc. (EDI), Peer Solutions, Palmer) and Parties discussed next steps with community engagement and consultation schedules for the Gwich'in Tribal Council (GTC) and communities (Inuvik, Aklavik, Fort McPherson, Tsiigehtchic).

Discussion:

[redacted]: [Reviewed agenda] Chance will provide updates on the Eagle Plains Exploration Project. Chance will provide presentation on project description, almost the same presentation as that shared in 2019, but we will highlight any changes that have happened since. Then we will go over next steps on developing the project proposal, community consultation and engagement schedules, and preferences of the GTC and communities. Grand Chief [redacted], would you like to make any opening statements?

Grand Chief: Good afternoon everyone. It is great to reconnect with everyone. As I recall we had a discussion back in January. It's a good opportunity for us to have a reconnection. [redacted] will be responsible for managing and implementing any lands and resources communication. Looking forward to hearing what has changed with this project.

[redacted]: Grateful for the opportunity to provide an update on this project. I would say that our company relationship with GTC and Chance is very good, with great communication exchanged.

In terms of our projects, we have had 2 information requests with YESAB in regard to the well maintenance project. The plan is that the well maintenance project will occur in 2022. The project will run about 70 days. We will likely use the Eagle Plains Hotel as our camp. There is a benefit agreement that has to be concluded. Then we will be moving ahead with the bigger project that requires drilling new wells and further assessing the potential for oil and gas in the Eagle Plains Basin.

[redacted]: Any updates from the Gwich'in Tribal Council?

Grand Chief: For the Tribal Council, we have had a number of changes to our staff. We are activity recruiting a new Chief Executive Officer. Our Chief Operating Officer will be starting in July. For us right now, our primary concern is keeping our people safe from COVID. We are undertaking a review of our bylaws and will provide updates on our point of view in terns of economic development. Right now we have several projects: the wind energy project, the extension of the air strip in Inuvik, and the installation of the fiber optic line.

[redacted]: This presentation will cover what has changed since the 2019 presentation and provide an overview of the new plans for the exploratory project. It is about 18 slides and I'll cover the various parts in the project; where it's going to happen, wells and drilling components, the workforce potential, the reclamation process, and an overview of the YESAB process. The project area of interest is within Chance's exploration permits. We hope to dispose of the drill cuttings in local areas so that it doesn't have to be taken to British Columbia. Part of this project includes a seismic program. [Reference to presentation] The 2014 program shown here was much different than the seismic work done decades ago. The lines no longer have to be straight. They are less visible. It's also harder for people to access these lines from the road than the ones done decades ago.

This map [redacted] referred to presentation], outlines the area of interest. It shows the traditional territories and settlements blocks. Green shapes are settlement blocks. Chances permits are shown in the tan colour. The pink, blue, green, and yellow lines show the Vuntut Gwich'in, Tr'ondëk Hwëch'in, Tetlit Gwich'in, and First Nation of Na-cho Nyäk Dun traditional territories. The red line on the map represents the Dempster Highway.

On the drilling side of things. We plan on drilling up to 30 wells over 10 years. A given well site is about 1.44 ha, but isn't necessarily square. Will conform to the different areas or landscapes. We intend to be positioning these on high land to avoid permafrost issues. The ground is better drained and creates less issues on the top of ridges. We'll avoid heritage areas and sensitive areas. We also must avoid waterways. All governed by the Yukon Oil and Gas Act.

We have also undertaken a number of field studies. Work on ecosystem characteristics was performed by EDI. Permafrost processes by Palmer Environmental. Technical design by Peer Solutions who is working on the seismic program. EDI had several teams go into the field in 2019 and 2020. They were looking at bird studies, old seismic lines, fish, and surface water. Those old lines are a result of the technology at the time and the lack of understanding of the geology in the region. During the 50s to mid 80s there was 2D seismic activity. We did 3D seismic. Now, the seismic footprint is much smaller today than it was 60 years ago. EDI looked at old seismic lines, and if those lines get any sort of use from animals. If they are regenerating, if humans use the area, etc. They obtained porcupine caribou information/data from the Porcupine Caribou Management Board; they have not finished their interpretation.

[redacted]: A change from the previous 2019 presentation on the Project Description is drilling up 5 wells per years rather than 8.

[redacted]: We're expecting to find oil, gas, and water. The water found in this mixture is not potable. The technology has evolved over the years. Directional drilling allows us to access areas horizontally underground without further surface disturbances. [redacted] referred to presentation] The photo here is of a Chance well drilled in 2013/2014. The diagram shows the mud storage, mixing, and the connection to the drilling operation. This is the layout of a drilling operation, and how the equipment would be organized around the operation. The trailers, the mud tanks, the boilers, etc. that are needed to run the rig. There are often a few other buildings on site. At any given time, there are 8 to 20 people on site. The idea would be that the bulk of the crew would housed at the camp. There would be a handful of people housed at the actual site.

Extended flow testing would be done to separate what we find. We would dispose of the test fluids in the abandoned wells. The flow testing gives us a better idea of the rock formation, the resource, and potential future development of the resources. We don't know much about the rock properties in this region compared to Alberta. The drilling operation would occur during the winter, to begin with, but move into year-round trials with the extended flow testing. The well head is a sequence of valves. [redacted] referred to presentation] The fluids come up on the left side to the separator, and the initial bits of natural gas come off the crude oil. There would be some initial separation of gas, water, and oil. The gas would be used for the operation and provide heat. The oil would be trucked somewhere in BC to be shipped off. We would use our own wells to dispose of unwanted fluids. There shouldn't be any issue from a contamination point of view. The soil characteristics in that area are good for using mix-bury-cover. Natural gas can be flared or re-injected into the wells. Possibility that we liquify it and truck it to a place like Inuvik. This is an estimate, but we could be getting up to 4,000 barrels per day.

When we do this work, our camp will be a limiting factor. We would be doing either seismic or drilling. The seismic is up to 1500km² of 3D and 2000km² lines of 2D. This may happen all in one season, but likely split up into different years. The techniques used today for seismic are much better than they were decades ago. There are no long sight lines, and the devices used for drilling the shotes holes are much thinner. This all fits in with the disturbance criteria in the North Yukon Regional Land Use Plan. The footprint really is not that big in reality. We can share our consultants' work around this.

Workforce is around 75 people whether it's drilling or seismic. 24 hours operations with 4-6 people per shift on each drill. 20 days on and 10 days off. We will cycle them through by air on 1 or 2 flights per week. Potentially add an airstrip. If we have overflow, they would move into the Eagle Plains Hotel. We are also thinking of using remote shelters to make things warmers for workers. Even though there's not many projects of this nature, there's a lot of work opportunities. 20% of money spent on this project will stay within northern communities.

[redacted]: Any technical information is important for us regarding the mix- bury-cover. There are quite a few relic sumps that have been exposed by water erosion.

[redacted]: Couple of things. The soil situation and water situation is different in our Project region compared to the Delta. The nature of the soil is different. If thawed, it would just turn into muck in the Delta. Eagle Plains doesn't have enough water to create those erosional experiences/issues. There is not the same kind of ground material in Eagle Plains as in the Mackenzie Delta region. The current mix-bury-cover sumps in the Yukon are doing well and it doesn't look like there are any issues with them.

Grand Chief: What is the size of the mix-bury-cover sumps?

[redacted]: Depends on how much rock and what you've taken out from the sump. Devon's dimensions are approximately 20 meters by 8 meters.

Grand Chief: How deep would they be?

[redacted]: Probably be around 3 meters deep. All depends on the mixture of the soil and cuttings. So we're looking at around 20 meters by 5-8 meters.

[redacted]: Do you mean the soil on top of the mixture?

[redacted]: The soil would be a couple of feet thick on top.

Grand Chief: The most concerning things to us would be the sumps.

[redacted]: The methodology that we would apply would be patterned after best practices in Alberta and Alberta regulations.

Grand Chief: It might be helpful for us to see baseline information of the other sites in the Yukon.

[redacted]: The Devon site is at about KM 336 up the Dempster Highway.

[redacted]: Richard, would it possible to take a look at the Devon sump when you go to visit the camp?

[redacted]: We are going up in early July and August. We could look then.

[redacted]The last slides here are on the YESAB screening process. We're at the Executive Committee level. Right now we are in the pre-submission engagement step.

[redacted]: Like Richard mentioned, the goal is to submit this fall to YESAB. Hemmera is responsible for the majority of the project planning for this project, as well as gathering the information from other consultants on the project. Palmers is looking at permafrost, EDI is looking at the fish, wildlife, and vegetation, Vertex does the design of the drilling, and Peer Solutions does the seismic work.

[redacted] has photos of the sump that he can share.

[redacted]: We have presented to leadership at GTC as well as DGOs in 2019. Each of those presentations were essentially what you've seen today. The presentations from other consultants go into detail on the different subject areas. We are wondering how best to proceed with engagement in general with the DGOs and subsequent meetings with GTC. Would it be your preference for us to come to the communities to present this information? We can present to both technical staff and community members.

[redacted]: All this would occur before this August?

[redacted]: Before late fall. That is Chance's goal. We have started community meetings in Old Crow. We're looking at potentially heading to Dawson City soon. We're also re-engaging with Tr'ondëk Hwëch'in and First Nation of Na-cho Nyäk Dun.

[redacted]: I'm not comfortable speaking for the community yet. It's up to [redacted].

Grand Chief: We'll get back to you. I think something for both public and leadership meetings. Band Councils also need to be included.

R. Wyman: In August of 2019 we visited each of the Gwich'in communities. I imagine that there's been changes in staff all around.

Grand Chief: All four Gwich'in communities will be helpful. Everyone drives by the camp.

R. Wyman: If travel limitations are an issue, we can use teams and zoom.

Grand Chief K[redacted]: We should be seeing further easing of restrictions in the next coming months.

R. Wyman: I'm going to get my next shot soon, so hopefully I can make it up this summer.

Grand Chief: Thank you for the presentation, the main things we would be concerned about is water usage, depths of disposal wells, in general the mix-bury-cover sumps, and the presence of aquifers in those areas.

Action Items:

- Summary of meeting with be drafted by Hemmera. That draft will be shared with Chance and GTC.
- Copy of presentation, and the original draft project description from 2019 will be sent to GTC by Hemmera.
- Chance/Hemmera will send the updated Project Description once it is complete.
- GTC will discuss internally and advise on next steps for future meetings e.g., community meetings, meetings with the DGOs
- Hemmera to send Palmer report and mapping (permafrost, terrain, and suitability mapping)to GTC
- Chance to share photos and reports of mix bury cover sumps in Yukon.

APPENDIX 2-B-22. *Draft 2021 Annual Report Implementation of the Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan*

DRAFT 2021 ANNUAL REPORT

Implementation of the Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan

Prepared for:

Yukon Government
Department of Energy, Mines and Resources
Oil and Gas Resources
Box 2703
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July 5, 2021

1.0 INTRODUCTION

This report demonstrates implementation of the *Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan* (Plan) (see **Appendix A**) finalized on August 1, 2018. It summarizes discussions held between Gwich'in Tribal Council (GTC), Tetlit Gwich'in Council (TGC), collectively referred to as Gwich'in Partners, and Chance Oil and Gas Limited (Chance) between June 1, 2020 and May 31, 2021. The purpose, objectives, and outcomes of each discussion are described below to fulfill the requirements of Ministerial Order (MO) 2018/42 (see **Appendix B**) issued to Chance on August 30, 2018.

2.0 BACKGROUND

The development of communications and engagement plans began with Order in Council (OIC) 2016/169. OIC 2016/169 required Chance to file a First Nations communication and engagement plan with the Minister of Energy, Mines and Resources in order to extend tenure on their northern permits: 0005, 0006, 0007, 0008, 0009, 0010, and 0011 (see **Appendix C**). Chance complied with OIC 2016/169 and received their tenure extension.

Chance subsequently received MO 2017/37 when applying for tenure extension on six of eight southern permits: 0012, 0013, 0014, 0015, 0016, and 0017. MO 2017/37 required Chance to revise, in consultation with affected First Nations, the consultation and engagement plan filed under OIC 2016/169. The affected First Nations listed in MO 2017/37 were Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Tetlit Gwich'in Council.

Gwich'in Partners and Chance developed the Plan collaboratively through a series of in-person meetings and conference calls. Hemmera was retained by Chance in November 2017 to facilitate the development and completion of the communications and engagement plans with the affected First Nations and facilitated all discussions between the Gwich'in Partners and Chance.

Gwich'in Partners and Chance submitted their finalized Plan to Minister Ranj Pillai on August 1, 2018. To satisfy its obligations under MO 2017/37, Chance filed a total of four communications and engagement plans. All four plans were approved by the Minister, and Chance received a five-year tenure extension on the six southern permits.

A condition of the five-year tenure extension, issued via MO 2018/42, required that Chance submit annual reports summarizing actions taken to implement each communications and engagement plan.

See **Appendix C** for a map of Chance's current permits.

3.0 ENGAGEMENT AND COMMUNICATION PLAN IMPLEMENTATION SUMMARY

3.1 Overview

Parties have advanced discussion in Chance's proposed Eagle Plains Exploration Project and Chance's proposed project for Well Maintenance and Extended Flow Testing. The following sections provide separate

summaries of engagement activities that occurred for Chance's projects between June 1, 2020 and May 31, 2021.

3.2 Summary of Engagement – Well Maintenance and Extended Flow Testing Project

Chance initially notified the GTC and TGC on May 25, 2020. That package included a high-level overview of the project (e.g., project activities, components, goals, outcomes), the regulatory submissions Chance would be making, a brief introduction to Hemmera and its role, as well as a request to discuss any concerns the affected party may have and an offer to arrange a conference call should they so desire. Also included was a 4-page project summary and map of the project location.

On June 12, 2020, the GTC provided input from its departments of Lands and Resources, Cultural Heritage, and Economic Development. The following themes were raised by the GTC:

- High environmental standards in the Peel River watershed and protection of scattered wetlands within the LMU 7
- Protection of wildlife and wildlife habitats
- Protection of the environment, water quality and quantity, and risks related to potential spills
- Protection of cultural heritage resources and values.

The GTC also requested that Chance share the full project description and any other materials related to the Project that might be available. Chance sent a draft project description (dated May 22, 2020) to both the GTC and TGC; however no other materials (e.g., effects assessments, summaries of mitigation measures, management plans) were available at that time.

The GTC's original feedback, provided June 12, 2020, helped Chance select valued components, identify mitigation measures, and identify where additional detail was needed in the project description. Chance provided a formal response to the GTC on July 9, 2020. Chance and the GTC then organized a conference call for July 22, 2020 where parties were able to further discuss the project. During this call, Chance provided an update on changes that had been made to the project design since the draft project description (dated May 22, 2020) and GTC asked follow-up questions about potential project-related impacts. A draft of the project proposal was subsequently shared with the GTC and TGC on July 24, 2020.

Following additional conversations with the regulator (Government of Yukon), Chance was required to make changes to its project design. On August 7, 2020, GTC and TGC was provided notice that revisions were being made to the project and that additional information would be forthcoming. A revised project proposal was provided, via email, to GTC and TGC on August 28, 2020, along with a cover letter summarizing the revisions and providing a rationale for each.

On September 2, 2020, GTC provided updated feedback on the project via email. GTC was explicit in stating that their feedback only considered the additional information provided in the July conference call and that they had not yet had a chance to review the revised project proposal sent August 28, 2020. GTC indicated that they would review the revised project proposal and provided additional input where required. GTC also informed Chance that Renewable Resources Council members in Fort McPherson were interested in meeting to discuss the project and that GTC would be proving contact information to facilitate that meeting. Chance submitted an initial project proposal to Yukon Environment and Socio-Economic Assessment Board (YESAB) on September 11, 2020. However, after further consideration, Chance

determined that additional changes were required. On November 2, 2020, via email, Chance notified GTC and TGC that it had decided to withdraw its project proposal from YESAB and submit a revised version. In that email Chance stated that once a revised proposal had been drafted, Chance would notify GTC and TGC by sharing a draft and requesting a meeting to discuss the changes further, and Chance stated at that time that after it had the opportunity to discuss those changes with GTC and TGC, the project proposal would be finalized and resubmitted to the Dawson Designated Office.

On November 16, 2020, Chance and GTC had a meeting wherein Chance introduced itself and its projects to GTC's new leadership (i.e., new Grand Chief and new Deputy Grand Chief). While Chance provided a high-level overview of its Eagle Plains Exploration Project, this meeting largely focused on the proposed Well Maintenance and Extended Flow Testing Project. During this meeting, Chance provided an overview of changes to the project design and indicated that the draft would be ready to share with GTC later in the week. GTC inquired about the business case for Chance's projects and potential for future employment opportunities and how training should be timed to allow Gwich'in to benefit from employment opportunities. GTC mentioned that the primary concerns for the region were likely trapping and caribou hunting, and that compliance with COVID-19 measures were important to health and safety.

The revised draft project proposal was provided via email to GTC and TGC on November 19, 2020, and in that email Hemmera indicated that Chance would be submitting the proposal to YESAB the following day. On November 20, 2020, Hemmera informed GTC and TGC that Chance would delay submission until the following week. However, to allow for additional revisions, the submission was delayed until December 24, 2020During engagement, the GTC flagged potential services that Gwich'in businesses might be able to offer Chance and inquired as to what project-related employment opportunities would be available. Chance indicated that it welcomes the opportunity for additional discussions with the GTC to identify and facilitate potential economic development and employment opportunities, however, it would have to balance those interests with requirements to source specific equipment and professions for the maintenance work as well as requirements under section 68 of YOGA (i.e., benefits agreements with Yukon First Nations).

3.3 Summary of Engagement – Eagle Plains Exploration Project

Between June 1, 2020 and May 31, 2021, Chance and Gwich'in Partners did not have a meeting that specifically targeted the Eagles Plains Exploration Project. When GTC and Chance met November 16, 2020, the purpose of the meeting was for Chance to introduced itself and its projects to GTC's new leadership (i.e., new Grand Chief and new Deputy Grand Chief). While Chance provided a high-level overview of the Eagle Plains Exploration Project, the meeting largely focused on the proposed Well Maintenance and Extended Flow Testing Project.

3.4 Communication Log

The correspondence between the Gwich'in Partners and Chance is documented in the Engagement Log (see **Appendix D**).

4.0 PLANS FOR ONGOING ENGAGEMENT AND NEXT STEPS

No additional engagement activities are expected for the Well Maintenance and Extended Flow Testing Project while it is undergoing YESAB's review.

Gwich'in Partners and Chance will continue to hold discussions at regular intervals as Chance develops its project proposal for the Eagle Plains Exploration Project.

Upcoming engagement activities for the Eagle Plains Exploration Project are expected to involve the following:

- Negotiation of a Cooperation Agreement with GTC (including confidentiality provisions).
- Discussion and establishment of the Chance-Gwich'in Communications and Consultation Management Committee for the purpose of, among other things, planning and organizing future engagement activities.
- Updating/revising Plan to include all DGOs, as well as Band Offices, and to revisit the meeting frequency of Chance and the Gwich'in Partners.
- Ongoing discussions between Chance and Gwich'in Partners on how parties can facilitate and identify training opportunities and employment opportunities for qualified Gwich'in professionals and Gwich'in businesses.
- Sharing baseline data
- Meetings between Gwich'in Partner's technical staff and Chance's technical consultants preparing the project proposal for proposed Eagle Plains Exploration Project
- Community engagement events for Gwich'in citizens.

5.0 APPROVAL OF IMPLEMENTATION SUMMARY

Gwich'in Partners and Chance have reviewed this report and agree to its contents as an accurate summary of engagement activities carried out between June 1, 2020 and May 31, 2021.

Per: Gwich'in Partners

Dated:

Name, Position
Gwich'in Tribal Council

Per: Chance Oil and Gas Limited

Dated:

[redacted], VP Government and Community Relations

APPENDIX A

Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan

Chance OIL AND GAS LIMITED

Gwich'in Tribal Council
Gwich'in land, culture & economy for a better future

Gwich'in Tribal Council and Chance Oil and Gas Limited Communications and Consultation Plan

1.0 Introduction

Chance Oil and Gas Limited ("Chance") is an oil and gas exploration company that holds permits to perform oil and gas exploration activities in the Eagle Plain basin of the Yukon Territory, Canada. The Gwich'in Tribal Council ("GTC") is an Indigenous organization that holds rights under Section 35 of the *Constitution Act*, 1982, *Treaty 11* and the *Gwich'in Comprehensive Land Claim Agreement* ("GCLCA"), including Appendix C – *Yukon Transboundary Agreement* ("YTA"). Under the YTA, "Tetlit Gwich'in" is defined as a Gwich'in who either: (a) resides in the Peel River watershed, including the community of Fort McPherson, Northwest Territories; or (b) is descended from an aboriginal person who used or occupied the Peel River watershed on or before December 31, 1921. Under this definition, Tetlit Gwich'in and their descendants currently reside in Aklavik, Inuvik, Tsiigehtchic and Fort McPherson, as well as elsewhere in Canada and abroad. Under the GCLCA, the GTC is the body responsible for representing the collective rights of GCLCA participants, including all Tetlit Gwich'in as defined in the YTA.

As part of Chance's exploration program, Chance, as the proponent, seeks to develop a communication and consultation plan ("the Plan") with the GTC, as a rights holder for these Yukon lands that could potentially be affected by Chance's exploration program activities. These Yukon lands are identified in the YTA as the Primary Use Area and the Secondary Use Area lands. With the exception of permit 15 which straddles the Primary Use Area, all of the permits held by Chance, namely 7, 9, 13, 14, 15, 19, and 20, are located within the Secondary Use Area.

The Plan will reflect and be consistent with the GTC's role as the Indigenous organization responsible for upholding the collective rights held by Gwich'in in the Primary Use Area and Secondary Use Area within the Yukon. This Plan will acknowledge the GCLCA organizational structure, and as such, is intended to extend to and encompass the GTC, the Designated Gwich'in Organizations, and including the Tetlit Gwich'in Council (the "Gwich'in Partners"). The Gwich'in Partners will seek to establish an internal Memorandum of Understanding (MOU).

2.0 Purpose

This document serves as a Plan to provide a mutually agreed upon framework to support collaborative and effective communication and consultation between Chance and the Gwich'in Partners.

3.0 Relationship

Chance and the Gwich'in Partners will execute this Plan according to the following principles:





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- Transparency;
- Timeliness; and
- Mutual respect, trust and understanding.

4.0 Key Gwich'in Tribal Council and Chance Connections

Communication and consultation between Chance and the Gwich'in Partners will be generally associated with the proposed works and potential effects associated with Chance's oil and gas exploration program, and with potential new opportunities or benefits received by the Gwich'in people, from Chance, as the project proponent. Once the scope of Chance's specific plans are determined, the Gwich'in Partners, together with Chance, will discuss the anticipated impacts on Gwich'in rights within the Primary and Secondary Use Areas, as well as the best way of addressing the impacts defined at that time.

This section of the Plan identifies the key contacts related to these overarching communication and consultation themes. Key representatives involved in communication and consultation are expected to be as follows:

- Grand Chief/President of the Gwich'in Tribal Council;
- President of the Tetlit Gwich'in Council (TGC);
- Gwich'in Tribal Council's Chief Operating Officer (COO); and
- Chance Management and designated staff and advisors.

Communication and consultation with the Gwich'in Partners will be coordinated through the Gwich'in Tribal Council's Chief Operating Officer.

Key Chance representatives involved in communication and consultation are expected to be as follows:

- Chance Oil and Gas Chairman and Chief Executive Officer (CEO)
- President of Chance Oil and Gas;
- Vice President of Government and Community Relations; and
- Regulatory, Environmental, and Community Relations Coordinator.

5.0 Communication and Consultation Methods

Chance and the Gwich'in Partners will employ the following communication and consultation methods:

- In person meetings;
- Email;
- Sharing Power Point Presentations (to support in person meetings);
- Sharing reports and documents (as requested and as required);
- Telephone correspondence (teleconferences and less formal phone calls); and





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- Identifying and documenting issues of concern raised by the Gwich'in Partners during consultation meetings, and Chance providing written responses to the identified issues within 30 days of the meeting, to serve as the basis for ongoing dialogue and resolution.

5.1 Meetings Process

Communication and consultation meetings will be executed in the following manner:

1. Chance and/or the Gwich'in Partners will request a meeting in writing to the other party according to the connections iterated in Section 4.0, no less than ten business days of the proposed meeting date;
2. The parties to meet will develop the agenda collaboratively;
3. The party requesting the meeting will develop supporting materials (collaboratively, where possible), and share those at least two days in advance of the meeting; and
4. The meeting will take place in a mutually agreeable location.

The above general process applies to meetings with subject matter leads, and where reasonable, meetings with communities at large.

5.2 Documentation

The following documentation sharing and review protocols support the communication and consultation methods described above:

- Action items and meeting outcomes will be logged during meetings and reviewed by both Chance and by the Gwich'in Partners at the end of the meeting to ensure that there is general agreement on the list of actions and entities responsible for those actions. The list of action items and meeting outcomes will be recorded in writing and shared between Chance and the Gwich'in Partners, within ten business days following the meeting date;
- Chance and the Gwich'in Partners will agree upon and use a file sharing platform to facilitate sharing of large files, such as Power Point presentations, reports and documents exchange relating to specific issues identified that were the object of specific consultations;
- Should Chance and the Gwich'in Partners employ a third party for records development and management, the third party will follow the process described above for recording and providing meeting minutes;
- Pursuant to Section 5.1, Chance and the Gwich'in Partners will exchange documents pertaining to issues identified in the communications and consultation process that may affect Gwich'in rights pertaining to the Primary and Secondary Use Areas in the Yukon. These documents will include written summaries of decisions reached collectively and agreed upon concerning these issues.

6.0 Records Management

Summarized records of communication and consultation between Chance and the Gwich'in Partners will be kept in a records log. Chance will ultimately submit the items below to regulators and assessors for review if and when a potential project is assessed in the future:

- Meeting Agendas;
- Meeting Action Items as described in **Section 5.0;**
- Invitee/Attendees lists and/or meeting sign-in sheets;
- Records log, which will include summaries of the following:
  - In person meetings;
  - Phone calls and teleconferences;
  - Incoming and outgoing emails between Chance and the Gwich'in Partners.
- Reports and documents provided to the Gwich'in Partners by Chance and reports and documents provided to Chance by the Gwich'in Partners for review and consideration;
- Copies of Power Point presentations delivered by Chance to the Gwich'in Partners;
- Copies of any presentations delivered by the Gwich'in Partners to Chance; and
- Documents exchanged pertaining to issues raised during the communications and consultations process, as identified in Section 5.0.

7.0 Adaptive Management of the Communication and Consultation Plan

Chance and the Gwich'in Partners will review and assess the effectiveness and success of this Plan on at least a six-month basis.

Chance and the Gwich'in Partners agree to establish a *Chance-Gwich'in Communications and Consultation Management Committee* of senior officials to serve as a focal point for the co-development and co-management of current and future plans and activities associated with Chance's exploration program activities. Chance and the Gwich'in Partners will nominate representatives to serve on this Committee. Those representatives will determine the required frequency of meetings, but it is envisaged that for the first year following agreement on the Plan that meetings of the Committee would be held one time per each season. It is also understood by Chance and Gwich'in Partners, that a Terms of Reference will be developed by the Committee. The Committee will be supported by a Secretariat, both of which will be wholly funded by Chance. Chance and Gwich'in partners will hold the first meeting within 60 days of finalizing this Plan.

8.0 Cost and Economic Opportunity

The Gwich'in Partners, together with Chance, have discussed their mutual interest in working towards ensuring that GCLCA Participants are able to derive and participate in benefits arising from Chance's proposed oil and gas exploration activity within the Primary and Secondary Use Areas in the Yukon. Chance recognizes the importance of, and commits to, working respectfully and collaboratively with the GTC and Gwich'in partners during engagement, consultation, and any negotiations on agreements that will take place in the future, to the same degree and manner as Chance would with any Yukon First Nation, whose settlement land or traditional territory may be affected by oil and gas activity in the Eagle Plain Basin.

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As the Communications and Consultation Plan is implemented, Chance and GTC agree to discuss a Cooperation Agreement wherein opportunities or benefits are defined that the Gwich'in people, as represented by the Gwich'in Partners, would receive from Chance. Benefits could include such things as, capacity funding, employment opportunities, contracting opportunities, scholarships and education and training opportunities, other financial and implementation payments, and equity participation.

9.0 Signatures of the Parties

This Plan is approved by the following parties:

[redacted]

Gwich'in Tribal Council

[redacted]

Chance Oil and Gas limited

APPENDIX B
Ministerial Order 2018/42

YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,

(d) oil and gas permit No. 0015,

(e) oil and gas permit No. 0016,

(f) oil and gas permit No. 0017. « *permis visé* »

2 The renewal term of each subject permit is extended by five years (so that it ends on August 30, 2023).

3 The resulting total length of the initial term and the renewal term of a subject permit is 16 years.

MO-OGA-18-07 (ExtPrmt)-E06-F01-FIN

YUKON

CANADA

ARRÊTÉ MINISTÉRIEL 2018/42

LOI SUR LE PÉTROLE ET LE GAZ

Le ministre de l'Énergie, des Mines et des Ressources, conformément à la *Loi sur le pétrole et le gaz*, arrête :

1 La définition suivante s'applique au présent arrêté.

« permis visé » Les permis suivants de pétrole et de gaz détenus par Chance Oil and Gas Limited :

a) permis de pétrole et de gaz nº 0012;

b) permis de pétrole et de gaz nº 0013;

c) permis de pétrole et de gaz nº 0014;

d) permis de pétrole et de gaz nº 0015;

e) permis de pétrole et de gaz nº 0016;

f) permis de pétrole et de gaz nº 0017. "*subject permit*"

2 La durée du renouvellement de chaque permis visé est prolongée de cinq ans, de façon à ce qu'elle se termine le 30 août 2023.

3 La durée totale d'un permis visé, y compris la durée initiale et la durée du renouvellement, est de 16 ans.

4(1) In this section

"first nations communications and engagement plan" means the plan filed under O.I.C. 2016/169 and revised in accordance with M.O. 2017/37. *« plan de participation et de communication avec les premières nations »*

(2) It is a condition of this Order that Chance Oil and Gas Limited must file annual reports with the Division Head, in accordance with subsection (3) and to the satisfaction of the Division Head, about the implementation of the first nations communications and engagement plan.

(3) For the purposes of subsection (2), Chance Oil and Gas Limited must file

(a) the first annual report on or before July 31, 2019, in respect of the period beginning on September 1, 2018, and ending on May 31, 2019; and

(b) each subsequent annual report on or before July 31 of each year in respect of the period beginning on June 1 of the preceding year and ending on May 31 of the year in which the report is to be filed.

4(1) La définition suivante s'applique au présent article.

« plan de participation et de communication avec les premières nations » Le plan déposé en vertu du Décret 2016/169 et révisé en conformité avec l'Arrêté 2017/37. *"first nations communications and engagement plan"*

(2) À titre de condition du présent arrêté, Chance Oil and Gas Limited dépose des rapports annuels auprès du chef de division, en conformité avec le paragraphe (3) et à la satisfaction du chef de division, concernant la mise en œuvre du plan de participation et de communication avec les premières nations.

(3) Pour l'application du paragraphe (2), Chance Oil and Gas Limited dépose :

a) le premier rapport annuel au plus tard le 31 juillet 2019, pour la période débutant le 1er septembre 2018 et se terminant le 31 mai 2019;

b) chaque rapport annuel subséquent, au plus tard le 31 juillet de chaque année pour la période débutant le 1er juin de l'année précédente et se terminant le 31 mai de l'année au cours de laquelle le rapport doit être déposé.

Dated at Whitehorse, Yukon,
~~30~~ August 30th 2018.

Fait à Whitehorse, au Yukon,
le August 30th 2018.

[redacted]

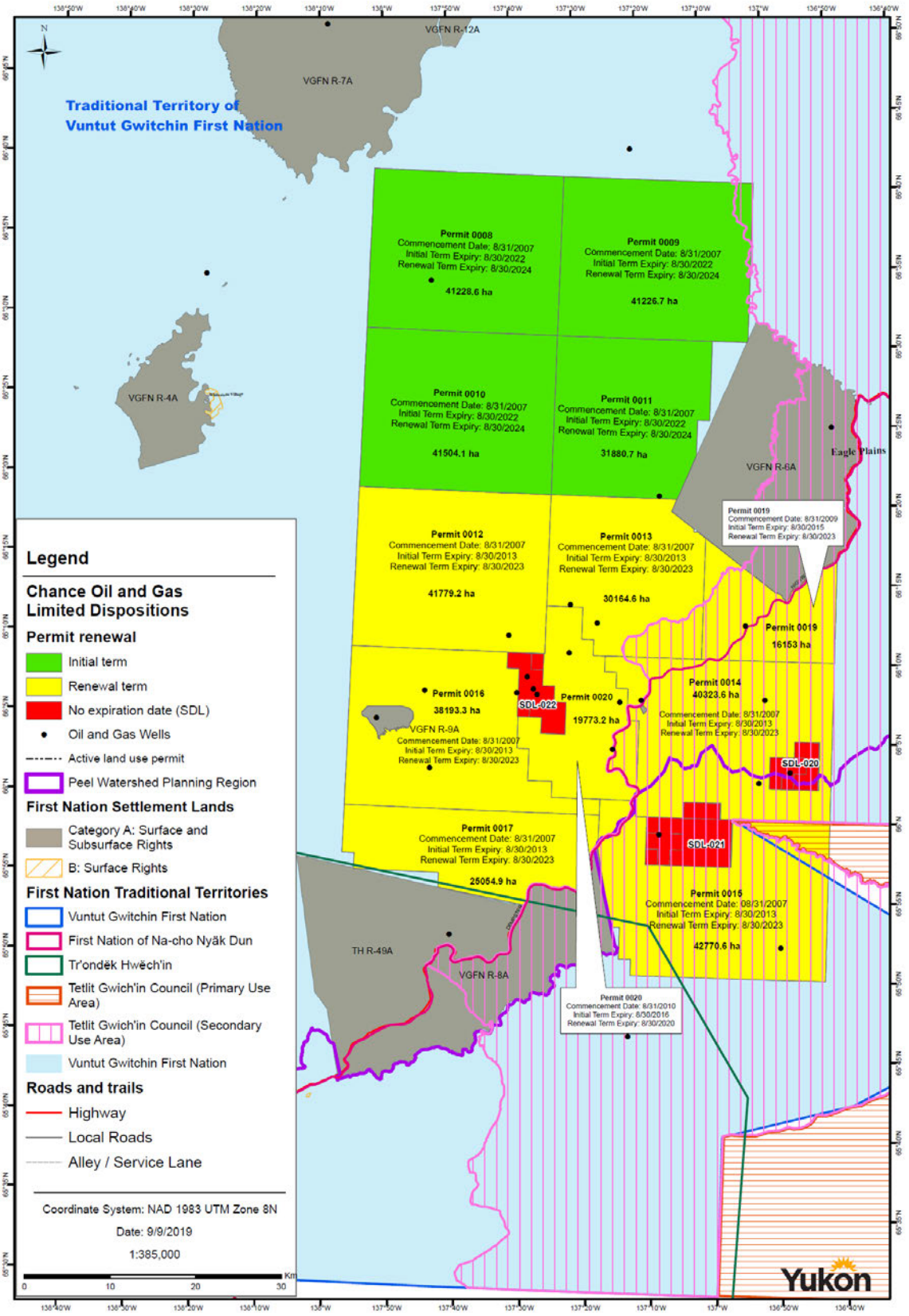
Minister of Energy, Mines and Resources/Ministre de l'Énergie, des Mines et des Ressources

MO-OGA-18-07 (ExtPrmt)-E06-F01-FIN

APPENDIX C

Map of Chance Dispositions and Wells

Chance Oil and Gas Limited Dispositions and Wells



APPENDIX D
Engagement Log

APPENDIX 2-B-23. *Draft 2021 Annual Report Implementation of the Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan*

DRAFT 2021 ANNUAL REPORT

Implementation of the Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan

PLEASE NOTE: Chance Oil and Gas Limited has reviewed and approved this report. Gwich'in Partners were provided a draft, but have not provided feedback. As Hemmera was unable to secure a signature from the First Nation, the signature boxes were removed from Page 5 and this document retains the DRAFT watermark.

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Prepared for:

Yukon Government
Department of Energy, Mines and Resources
Oil and Gas Resources
Box 2703
Whitehorse, YT Y1A 2C6

Prepared by:

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July 30, 2021

1.0 INTRODUCTION

This report demonstrates implementation of the *Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan* (Plan) (see **Appendix A**) finalized on August 1, 2018. It summarizes discussions held between Gwich'in Tribal Council (GTC), Tetlit Gwich'in Council (TGC), collectively referred to as Gwich'in Partners, and Chance Oil and Gas Limited (Chance) between June 1, 2020 and May 31, 2021. The purpose, objectives, and outcomes of each discussion are described below to fulfill the requirements of Ministerial Order (MO) 2018/42 (see **Appendix B**) issued to Chance on August 30, 2018.

2.0 BACKGROUND

The development of communications and engagement plans began with Order in Council (OIC) 2016/169. OIC 2016/169 required Chance to file a First Nations communication and engagement plan with the Minister of Energy, Mines and Resources in order to extend tenure on their northern permits: 0005, 0006, 0007, 0008, 0009, 0010, and 0011 (see **Appendix C**). Chance complied with OIC 2016/169 and received their tenure extension.

Chance subsequently received MO 2017/37 when applying for tenure extension on six of eight southern permits: 0012, 0013, 0014, 0015, 0016, and 0017. MO 2017/37 required Chance to revise, in consultation with affected First Nations, the consultation and engagement plan filed under OIC 2016/169. The affected First Nations listed in MO 2017/37 were Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Tetlit Gwich'in Council.

Gwich'in Partners and Chance developed the Plan collaboratively through a series of in-person meetings and conference calls. Hemmera was retained by Chance in November 2017 to facilitate the development and completion of the communications and engagement plans with the affected First Nations and facilitated all discussions between the Gwich'in Partners and Chance.

Gwich'in Partners and Chance submitted their finalized Plan to Minister Ranj Pillai on August 1, 2018. To satisfy its obligations under MO 2017/37, Chance filed a total of four communications and engagement plans. All four plans were approved by the Minister, and Chance received a five-year tenure extension on the six southern permits.

A condition of the five-year tenure extension, issued via MO 2018/42, required that Chance submit annual reports summarizing actions taken to implement each communications and engagement plan.

See **Appendix C** for a map of Chance's current permits.

3.0 ENGAGEMENT AND COMMUNICATION PLAN IMPLEMENTATION SUMMARY

3.1 Overview

Parties have advanced discussion in Chance's proposed Eagle Plains Exploration Project and Chance's proposed project for Well Maintenance and Extended Flow Testing. The following sections provide separate

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summaries of engagement activities that occurred for Chance's projects between June 1, 2020 and May 31, 2021.

3.2 Summary of Engagement – Well Maintenance and Extended Flow Testing Project

Chance initially notified the GTC and TGC on May 25, 2020. That package included a high-level overview of the project (e.g., project activities, components, goals, outcomes), the regulatory submissions Chance would be making, a brief introduction to Hemmera and its role, as well as a request to discuss any concerns the affected party may have and an offer to arrange a conference call should they so desire. Also included was a 4-page project summary and map of the project location.

On June 12, 2020, the GTC provided input from its departments of Lands and Resources, Cultural Heritage, and Economic Development. The following themes were raised by the GTC:

- High environmental standards in the Peel River watershed and protection of scattered wetlands within the LMU 7
- Protection of wildlife and wildlife habitats
- Protection of the environment, water quality and quantity, and risks related to potential spills
- Protection of cultural heritage resources and values.

The GTC also requested that Chance share the full project description and any other materials related to the Project that might be available. Chance sent a draft project description (dated May 22, 2020) to both the GTC and TGC; however no other materials (e.g., effects assessments, summaries of mitigation measures, management plans) were available at that time.

The GTC's original feedback, provided June 12, 2020, helped Chance select valued components, identify mitigation measures, and identify where additional detail was needed in the project description. Chance provided a formal response to the GTC on July 9, 2020. Chance and the GTC then organized a conference call for July 22, 2020 where parties were able to further discuss the project. During this call, Chance provided an update on changes that had been made to the project design since the draft project description (dated May 22, 2020) and GTC asked follow-up questions about potential project-related impacts. A draft of the project proposal was subsequently shared with the GTC and TGC on July 24, 2020.

Following additional conversations with the regulator (Government of Yukon), Chance was required to make changes to its project design. On August 7, 2020, GTC and TGC was provided notice that revisions were being made to the project and that additional information would be forthcoming. A revised project proposal was provided, via email, to GTC and TGC on August 28, 2020, along with a cover letter summarizing the revisions and providing a rationale for each.

On September 2, 2020, GTC provided updated feedback on the project via email. GTC was explicit in stating that their feedback only considered the additional information provided in the July conference call and that they had not yet had a chance to review the revised project proposal sent August 28, 2020. GTC indicated that they would review the revised project proposal and provided additional input where required. GTC also informed Chance that Renewable Resources Council members in Fort McPherson were interested in meeting to discuss the project and that GTC would be proving contact information to facilitate that meeting. Chance submitted an initial project proposal to Yukon Environment and Socio-Economic Assessment Board (YESAB) on September 11, 2020. However, after further consideration, Chance

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determined that additional changes were required. On November 2, 2020, via email, Chance notified GTC and TGC that it had decided to withdraw its project proposal from YESAB and submit a revised version. In that email Chance stated that once a revised proposal had been drafted, Chance would notify GTC and TGC by sharing a draft and requesting a meeting to discuss the changes further, and Chance stated at that time that after it had the opportunity to discuss those changes with GTC and TGC, the project proposal would be finalized and resubmitted to the Dawson Designated Office.

On November 16, 2020, Chance and GTC had a meeting wherein Chance introduced itself and its projects to GTC's new leadership (i.e., new Grand Chief and new Deputy Grand Chief). While Chance provided a high-level overview of its Eagle Plains Exploration Project, this meeting largely focused on the proposed Well Maintenance and Extended Flow Testing Project. During this meeting, Chance provided an overview of changes to the project design and indicated that the draft would be ready to share with GTC later in the week. GTC inquired about the business case for Chance's projects and potential for future employment opportunities and how training should be timed to allow Gwich'in to benefit from employment opportunities. GTC mentioned that the primary concerns for the region were likely trapping and caribou hunting, and that compliance with COVID-19 measures were important to health and safety.

The revised draft project proposal was provided via email to GTC and TGC on November 19, 2020, and in that email Hemmera indicated that Chance would be submitting the proposal to YESAB the following day. On November 20, 2020, Hemmera informed GTC and TGC that Chance would delay submission until the following week. However, to allow for additional revisions, the submission was delayed until December 24, 2020During engagement, the GTC flagged potential services that Gwich'in businesses might be able to offer Chance and inquired as to what project-related employment opportunities would be available. Chance indicated that it welcomes the opportunity for additional discussions with the GTC to identify and facilitate potential economic development and employment opportunities, however, it would have to balance those interests with requirements to source specific equipment and professions for the maintenance work as well as requirements under section 68 of YOGA (i.e., benefits agreements with Yukon First Nations).

3.3 Summary of Engagement – Eagle Plains Exploration Project

Between June 1, 2020 and May 31, 2021, Chance and Gwich'in Partners did not have a meeting that specifically targeted the Eagles Plains Exploration Project. When GTC and Chance met November 16, 2020, the purpose of the meeting was for Chance to introduced itself and its projects to GTC's new leadership (i.e., new Grand Chief and new Deputy Grand Chief). While Chance provided a high-level overview of the Eagle Plains Exploration Project, the meeting largely focused on the proposed Well Maintenance and Extended Flow Testing Project.

3.4 Communication Log

The correspondence between the Gwich'in Partners and Chance is documented in the Engagement Log (see **Appendix D**).

4.0 PLANS FOR ONGOING ENGAGEMENT AND NEXT STEPS

No additional engagement activities are expected for the Well Maintenance and Extended Flow Testing Project while it is undergoing YESAB's review.

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Gwich'in Partners and Chance will continue to hold discussions at regular intervals as Chance develops its project proposal for the Eagle Plains Exploration Project.

Upcoming engagement activities for the Eagle Plains Exploration Project are expected to involve the following:

- Negotiation of a Cooperation Agreement with GTC (including confidentiality provisions).
- Discussion and establishment of the Chance-Gwich'in Communications and Consultation Management Committee for the purpose of, among other things, planning and organizing future engagement activities.
- Updating/revising Plan to include all DGOs, as well as Band Offices, and to revisit the meeting frequency of Chance and the Gwich'in Partners.
- Ongoing discussions between Chance and Gwich'in Partners on how parties can facilitate and identify training opportunities and employment opportunities for qualified Gwich'in professionals and Gwich'in businesses.
- Sharing baseline data
- Meetings between Gwich'in Partner's technical staff and Chance's technical consultants preparing the project proposal for proposed Eagle Plains Exploration Project
- Community engagement events for Gwich'in citizens.

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5.0 APPROVAL OF IMPLEMENTATION SUMMARY

Gwich'in Partners and Chance have reviewed this report and agree to its contents as an accurate summary of engagement activities carried out between June 1, 2020 and May 31, 2021.

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APPENDIX A

Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan

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Chance OIL AND GAS LIMITED

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Gwich'in Tribal Council and Chance Oil and Gas Limited Communications and Consultation Plan

1.0 Introduction

Chance Oil and Gas Limited ("Chance") is an oil and gas exploration company that holds permits to perform oil and gas exploration activities in the Eagle Plain basin of the Yukon Territory, Canada. The Gwich'in Tribal Council ("GTC") is an Indigenous organization that holds rights under Section 35 of the *Constitution Act*, 1982, *Treaty 11* and the *Gwich'in Comprehensive Land Claim Agreement* ("GCLCA"), including Appendix C – *Yukon Transboundary Agreement* ("YTA"). Under the YTA, "Tetlit Gwich'in" is defined as a Gwich'in who either: (a) resides in the Peel River watershed, including the community of Fort McPherson, Northwest Territories; or (b) is descended from an aboriginal person who used or occupied the Peel River watershed on or before December 31, 1921. Under this definition, Tetlit Gwich'in and their descendants currently reside in Aklavik, Inuvik, Tsiigehtchic and Fort McPherson, as well as elsewhere in Canada and abroad. Under the GCLCA, the GTC is the body responsible for representing the collective rights of GCLCA participants, including all Tetlit Gwich'in as defined in the YTA.

As part of Chance's exploration program, Chance, as the proponent, seeks to develop a communication and consultation plan ("the Plan") with the GTC, as a rights holder for these Yukon lands that could potentially be affected by Chance's exploration program activities. These Yukon lands are identified in the YTA as the Primary Use Area and the Secondary Use Area lands. With the exception of permit 15 which straddles the Primary Use Area, all of the permits held by Chance, namely 7, 9, 13, 14, 15, 19, and 20, are located within the Secondary Use Area.

The Plan will reflect and be consistent with the GTC's role as the Indigenous organization responsible for upholding the collective rights held by Gwich'in in the Primary Use Area and Secondary Use Area within the Yukon. This Plan will acknowledge the GCLCA organizational structure, and as such, is intended to extend to and encompass the GTC, the Designated Gwich'in Organizations, and including the Tetlit Gwich'in Council (the "Gwich'in Partners"). The Gwich'in Partners will seek to establish an internal Memorandum of Understanding (MOU).

2.0 Purpose

This document serves as a Plan to provide a mutually agreed upon framework to support collaborative and effective communication and consultation between Chance and the Gwich'in Partners.

3.0 Relationship

Chance and the Gwich'in Partners will execute this Plan according to the following principles:

Chance OIL AND GAS LIMITED

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- Transparency;
- Timeliness; and
- Mutual respect, trust and understanding.

4.0 Key Gwich'in Tribal Council and Chance Connections

Communication and consultation between Chance and the Gwich'in Partners will be generally associated with the proposed works and potential effects associated with Chance's oil and gas exploration program, and with potential new opportunities or benefits received by the Gwich'in people, from Chance, as the project proponent. Once the scope of Chance's specific plans are determined, the Gwich'in Partners, together with Chance, will discuss the anticipated impacts on Gwich'in rights within the Primary and Secondary Use Areas, as well as the best way of addressing the impacts defined at that time.

This section of the Plan identifies the key contacts related to these overarching communication and consultation themes. Key representatives involved in communication and consultation are expected to be as follows:

- Grand Chief/President of the Gwich'in Tribal Council;
- President of the Tetlit Gwich'in Council (TGC);
- Gwich'in Tribal Council's Chief Operating Officer (COO); and
- Chance Management and designated staff and advisors.

Communication and consultation with the Gwich'in Partners will be coordinated through the Gwich'in Tribal Council's Chief Operating Officer.

Key Chance representatives involved in communication and consultation are expected to be as follows:

- Chance Oil and Gas Chairman and Chief Executive Officer (CEO)
- President of Chance Oil and Gas;
- Vice President of Government and Community Relations; and
- Regulatory, Environmental, and Community Relations Coordinator.

5.0 Communication and Consultation Methods

Chance and the Gwich'in Partners will employ the following communication and consultation methods:

- In person meetings;
- Email;
- Sharing Power Point Presentations (to support in person meetings);
- Sharing reports and documents (as requested and as required);
- Telephone correspondence (teleconferences and less formal phone calls); and





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- Identifying and documenting issues of concern raised by the Gwich'in Partners during consultation meetings, and Chance providing written responses to the identified issues within 30 days of the meeting, to serve as the basis for ongoing dialogue and resolution.

5.1 Meetings Process

Communication and consultation meetings will be executed in the following manner:

1. Chance and/or the Gwich'in Partners will request a meeting in writing to the other party according to the connections iterated in Section 4.0, no less than ten business days of the proposed meeting date;
2. The parties to meet will develop the agenda collaboratively;
3. The party requesting the meeting will develop supporting materials (collaboratively, where possible), and share those at least two days in advance of the meeting; and
4. The meeting will take place in a mutually agreeable location.

The above general process applies to meetings with subject matter leads, and where reasonable, meetings with communities at large.

5.2 Documentation

The following documentation sharing and review protocols support the communication and consultation methods described above:

- Action items and meeting outcomes will be logged during meetings and reviewed by both Chance and by the Gwich'in Partners at the end of the meeting to ensure that there is general agreement on the list of actions and entities responsible for those actions. The list of action items and meeting outcomes will be recorded in writing and shared between Chance and the Gwich'in Partners, within ten business days following the meeting date;
- Chance and the Gwich'in Partners will agree upon and use a file sharing platform to facilitate sharing of large files, such as Power Point presentations, reports and documents exchange relating to specific issues identified that were the object of specific consultations;
- Should Chance and the Gwich'in Partners employ a third party for records development and management, the third party will follow the process described above for recording and providing meeting minutes;
- Pursuant to Section 5.1, Chance and the Gwich'in Partners will exchange documents pertaining to issues identified in the communications and consultation process that may affect Gwich'in rights pertaining to the Primary and Secondary Use Areas in the Yukon. These documents will include written summaries of decisions reached collectively and agreed upon concerning these issues.

6.0 Records Management

Summarized records of communication and consultation between Chance and the Gwich'in Partners will be kept in a records log. Chance will ultimately submit the items below to regulators and assessors for review if and when a potential project is assessed in the future:





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- Meeting Agendas;
- Meeting Action Items as described in **Section 5.0;**
- Invitee/Attendees lists and/or meeting sign-in sheets;
- Records log, which will include summaries of the following:
    - In person meetings;
    - Phone calls and teleconferences;
    - Incoming and outgoing emails between Chance and the Gwich'in Partners.
- Reports and documents provided to the Gwich'in Partners by Chance and reports and documents provided to Chance by the Gwich'in Partners for review and consideration;
- Copies of Power Point presentations delivered by Chance to the Gwich'in Partners;
- Copies of any presentations delivered by the Gwich'in Partners to Chance; and
- Documents exchanged pertaining to issues raised during the communications and consultations process, as identified in Section 5.0.

7.0 Adaptive Management of the Communication and Consultation Plan

Chance and the Gwich'in Partners will review and assess the effectiveness and success of this Plan on at least a six-month basis.

Chance and the Gwich'in Partners agree to establish a *Chance-Gwich'in Communications and Consultation Management Committee* of senior officials to serve as a focal point for the co-development and co-management of current and future plans and activities associated with Chance's exploration program activities. Chance and the Gwich'in Partners will nominate representatives to serve on this Committee. Those representatives will determine the required frequency of meetings, but it is envisaged that for the first year following agreement on the Plan that meetings of the Committee would be held one time per each season. It is also understood by Chance and Gwich'in Partners, that a Terms of Reference will be developed by the Committee. The Committee will be supported by a Secretariat, both of which will be wholly funded by Chance. Chance and Gwich'in partners will hold the first meeting within 60 days of finalizing this Plan.

8.0 Cost and Economic Opportunity

The Gwich'in Partners, together with Chance, have discussed their mutual interest in working towards ensuring that GCLCA Participants are able to derive and participate in benefits arising from Chance's proposed oil and gas exploration activity within the Primary and Secondary Use Areas in the Yukon. Chance recognizes the importance of, and commits to, working respectfully and collaboratively with the GTC and Gwich'in partners during engagement, consultation, and any negotiations on agreements that will take place in the future, to the same degree and manner as Chance would with any Yukon First Nation, whose settlement land or traditional territory may be affected by oil and gas activity in the Eagle Plain Basin.

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As the Communications and Consultation Plan is implemented, Chance and GTC agree to discuss a Cooperation Agreement wherein opportunities or benefits are defined that the Gwich'in people, as represented by the Gwich'in Partners, would receive from Chance. Benefits could include such things as, capacity funding, employment opportunities, contracting opportunities, scholarships and education and training opportunities, other financial and implementation payments, and equity participation.

9.0 Signatures of the Parties

This Plan is approved by the following parties:

[redacted]

Gwich'in Tribal Council

Chance Oil and Gas limited

APPENDIX B
Ministerial Order 2018/42

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YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,

(d) oil and gas permit No. 0015,

(e) oil and gas permit No. 0016,

(f) oil and gas permit No. 0017. « *permis visé* »

2 The renewal term of each subject permit is extended by five years (so that it ends on August 30, 2023).

3 The resulting total length of the initial term and the renewal term of a subject permit is 16 years.

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YUKON

CANADA

ARRÊTÉ MINISTÉRIEL 2018/42

LOI SUR LE PÉTROLE ET LE GAZ

Le ministre de l'Énergie, des Mines et des Ressources, conformément à la *Loi sur le pétrole et le gaz*, arrête :

1 La définition suivante s'applique au présent arrêté.

« permis visé » Les permis suivants de pétrole et de gaz détenus par Chance Oil and Gas Limited :

a) permis de pétrole et de gaz nº 0012;

b) permis de pétrole et de gaz nº 0013;

c) permis de pétrole et de gaz nº 0014;

d) permis de pétrole et de gaz nº 0015;

e) permis de pétrole et de gaz nº 0016;

f) permis de pétrole et de gaz nº 0017. "*subject permit*"

2 La durée du renouvellement de chaque permis visé est prolongée de cinq ans, de façon à ce qu'elle se termine le 30 août 2023.

3 La durée totale d'un permis visé, y compris la durée initiale et la durée du renouvellement, est de 16 ans.

4(1) In this section

"first nations communications and engagement plan" means the plan filed under O.I.C. 2016/169 and revised in accordance with M.O. 2017/37. *« plan de participation et de communication avec les premières nations »*

(2) It is a condition of this Order that Chance Oil and Gas Limited must file annual reports with the Division Head, in accordance with subsection (3) and to the satisfaction of the Division Head, about the implementation of the first nations communications and engagement plan.

(3) For the purposes of subsection (2), Chance Oil and Gas Limited must file

(a) the first annual report on or before July 31, 2019, in respect of the period beginning on September 1, 2018, and ending on May 31, 2019; and

(b) each subsequent annual report on or before July 31 of each year in respect of the period beginning on June 1 of the preceding year and ending on May 31 of the year in which the report is to be filed.

4(1) La définition suivante s'applique au présent article.

« plan de participation et de communication avec les premières nations » Le plan déposé en vertu du Décret 2016/169 et révisé en conformité avec l'Arrêté 2017/37. *"first nations communications and engagement plan"*

(2) À titre de condition du présent arrêté, Chance Oil and Gas Limited dépose des rapports annuels auprès du chef de division, en conformité avec le paragraphe (3) et à la satisfaction du chef de division, concernant la mise en œuvre du plan de participation et de communication avec les premières nations.

(3) Pour l'application du paragraphe (2), Chance Oil and Gas Limited dépose :

a) le premier rapport annuel au plus tard le 31 juillet 2019, pour la période débutant le 1er septembre 2018 et se terminant le 31 mai 2019;

b) chaque rapport annuel subséquent, au plus tard le 31 juillet de chaque année pour la période débutant le 1er juin de l'année précédente et se terminant le 31 mai de l'année au cours de laquelle le rapport doit être déposé.

Dated at Whitehorse, Yukon,
~~the~~ August 30th 2018.

Fait à Whitehorse, au Yukon,
le August 30th 2018.

[redacted]

Minister of Energy, Mines and Resources/Ministre de l'Énergie, des Mines et des Ressources

MO-OGA-18-07 (ExtPrmt)-E06-F01-FIN

APPENDIX C
Map of Chance Dispositions and Wells

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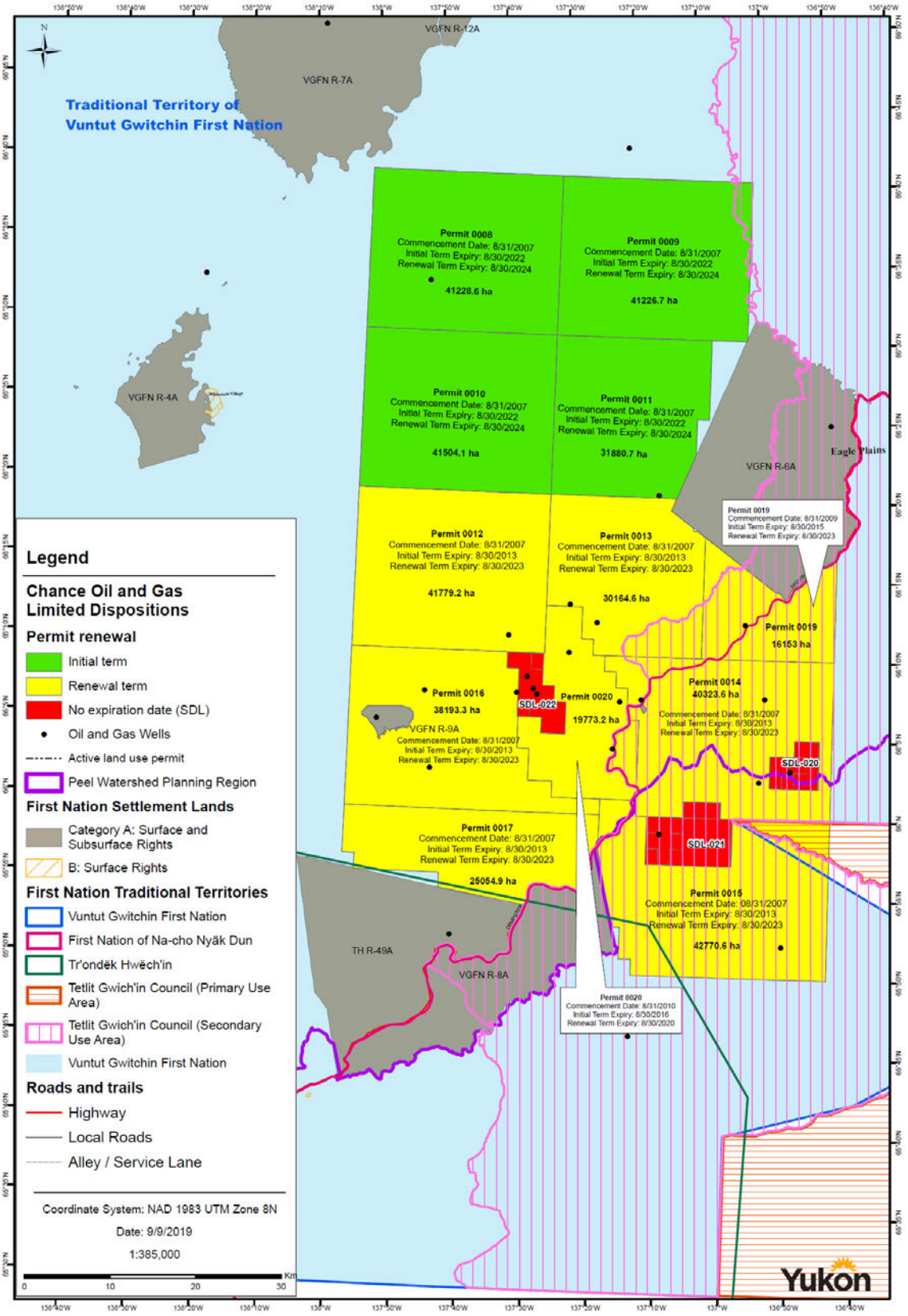
Chance Oil and Gas Limited Dispositions and Wells



APPENDIX D
Engagement Log

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APPENDIX D: Chance Consultation Log

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00076	January 8, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement/Consultation Confidentiality Agreement	Follow up from Dec 14th meeting. Attached Communications and Consultation Plan for signing, and Draft Confidentiality Agreement.
E00024	January 9, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement/Consultation	GTC Chance Oil and Gas Communication and Consultation plan attached and signed
E00025	January 9, 2019	Email	In	Gwich'in Tribal Council	[redacted]			Meeting Coordination/Planning	Costs to be covered
E00026	January 9, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Honoraria amount
E00051	January 9, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Confirming honorarium [redacted]
E00062	January 9, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement/Consultation	Attached signed Communication and Consultation Plan
E00088	January 9, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Asking about honorarium clarification.
E00104	January 9, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Confidentiality Agreement	Asking for update on Confidentiality Agreement
E00105	January 9, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]
E00106	January 9, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Per diem and honoraria discussion
E00121	January 9, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Will let [redacted] of [redacted]
E00132	January 9, 2019	Phone Call	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Chance called GTC regarding attendance at the All-Party Meeting.
E00100	January 9, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Travel details for All-Party Meeting, [redacted].
E00092	January 10, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	All-Party Meeting logistics, asking for clarification
E00063	January 11, 2019	Email	Out	Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Travel plans for Vancouver, please call.
E00028	January 11, 2019	Email	In	Tetlit Gwich'in Council (DGO) Tr'ondëk Hwëch'in First Nation of Na-cho Nyäk Dun Gwich'in Tribal Council Vuntut Gwitchin First Nation YG	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Leslie confirming attendance in Vancouver
E00077	January 11, 2019	Email	Out	Vuntut Gwitchin First Nation Tr'ondëk Hwëch'in First Nation of Na-cho Nyäk Dun Gwich'in Tribal Council Tetlit Gwich'in Council (DGO) YG	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Attached Draft Working Agenda for All Party Meeting Feb 1. To be finalized
E00138	January 14, 2019	Phone Call	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Chance called GTC regarding logistics of the All-Party Meeting.
E00030	January 14, 2019	Email	In	Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Confirmation of attendance
E00019	January 15, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted] Discuss travel arrangements
E00053	January 15, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thank you [redacted]
E00141	January 18, 2019	Phone Call	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Chance called GTC regarding the logistics of flights and accommodation for the All-Party Meeting.
E00006	January 19, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Connecting [redacted] for making travel arrangements
E00027	January 21, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Confirming attendees to Vancouver
E00079	January 21, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Follow up details for All Party Meeting Feb 1. Who/Staying where?
E00034	January 22, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Confirming travel details of attendees [redacted]
E00111	January 22, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]
E00112	January 22, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]
E00035	January 23, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]
E00021	January 24, 2019	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Still reviewing document, and will speak to it next week
E00074	January 24, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Confidentiality Agreement Meeting Coordination/Planning	Following up on Draft Confidentiality Agreement, mention of all-party meeting
E00075	January 24, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]
E00023	January 25, 2019	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]

APPENDIX D: Chance Consultation Log

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00102	January 25, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Confidentiality Agreement Meeting Coordination/Planning	Notice of travel, and discussion of agreement signing.
E00022	January 25, 2019	Email	In	Tetlit Gwich'in Council (DGO) Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted] will not be attending Vancouver meeting
E00103	January 25, 2019	Email	Out	Tetlit Gwich'in Council (DGO) Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Response to [redacted] not being able to be at All-Party meeting
E00080	January 28, 2019	Email	Out	Vuntut Gwitchin First Nation First Nation of Na-cho Nyäk Dun Gwich'in Tribal Council YG	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Final All Party Meeting Agenda for Feb 1
E00087	January 29, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]
E00058	January 30, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]
[redacted]	January 30, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]
E00059	January 31, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Discussion of flights/hotels [redacted]
E00126	February 1, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thank you, hope meeting goes well
E00128	February 1, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]
E00060	February 2, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thank you for follow up
E00008	February 4, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]
E00061	February 4, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]
E00125	February 4, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]
E00129	February 4, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted]
E00150	February 4, 2019	Phone Call	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	GTC called Chance regarding [redacted] All-Party Meeting expenses.
E00167	February 15, 2019	Email	Out	Vuntut Gwitchin First Nation First Nation of Na-cho Nyäk Dun Gwich'in Tribal Council YG	[redacted]	[redacted]	[redacted]	Engagement/Consultation	Draft summary of Tuesday Feb 5, all-party meeting for review. Feel free to share to teams
E00161	February 18, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Confidentiality Agreement	Asking about status of GTC's review of Confidentiality Agreement.
E00162	February 18, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Confidentiality Agreement	GTC under impression that Communication and Consultation Plan was adequate in addressing all immediate confidentiality Concerns at this stage. If a project matter arose that Chance believed needed further reassurance of confidentiality, that concerns would be discussed at that time
E00159	March 8, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted] ooking for guidance on invoicing for expenses for January meeting.
E00156	March 12, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Contact info for [redacted] and times available
E00157	March 12, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Will get back to Emily ASAP
E00155	March 19, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Attached invoice for recovering [redacted] costs
E00160	March 19, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Confidentiality Agreement	Once Richard is back in the office (March), will touch base about confidentiality agreement
E00164	March 26, 2019	Letter	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Tenures/Dispositions/Permits	Request to extend tenure on Exploration Permits 0006-0011 and 0019 at Eagle Plains

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00158	March 27, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Confirming receipt of invoice. [redacted]
E00234	May 8, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	GTC and Tetlit Gwich'in Council President would like to confirm availability to meet on June 5th for an update on Chance's activities. [redacted] will confirm his attendance after May 16th
E00235	May 8, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Apologies for wrong date. Will be in Old Crow June 6 and can be in Inuvik June 7th. Please let me know if that date works.
E00236	May 9, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Grand Chief [redacted] is unavailable June 7th. Will confirm with President [redacted] and GTC staff on their availability.
E00237	May 9, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Confirming that will meet with President [redacted], and GTC staff at 2 pm. Flight arrives as 12:25 and listed Chance and Hemmera attendees [redacted] will send a draft agenda to be reviewed.
E00238	May 9, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	GTC confirm June 7th meeting. Attending will be TGC [redacted] and GTC Staff: [redacted]
E00248	May 21, 2019	Email	Out	Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Site Visit/Field Work	Required to consult under geoscience license guideline to inform TGC that field work is planned July 10-24, 2019. Will be based out of Eagle Plains Lodge with helicopters. Will be flying to remote outcrop locations through out Eagle Plains Basin to extract rock samples with geological hammer. No mechanical tools will be used.
E00463	June 3, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Meeting invitation and agenda. All call-in details included for participants that need to call in.
E00467	June 4, 2019	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Just to confirm, the meeting is 1500-1700 Mountain time? 1400-1600 Pacific time, correct? On the agenda, we suggest two additional items would be useful to include: 1. Process for reviewing Gwich'in Project Effects 2. Economic Opportunity and Cooperation Agreement(s) Update (Reference Section 8.0 of the Communications and Consultation Plan).
E00468	June 4, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	The time is actually 2-4 pm MST. Does that work for you? Our flight lands at 12:25pm, so we would have to rush to make a 1pm meeting. Please let me know if you and your colleagues are still able to meet from 2-3pm.
E00464	June 4, 2019	Email	In	Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I cannot take part in this meeting. I will try to have someone available. We are having trouble opening the agenda
E00465	June 4, 2019	Email	Out	Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	We worked with GTC to plan this meeting a few weeks ago and were under the impression that you could attend. Sorry for the miscommunication. This last minute meeting invitation was just to share the agenda as we through everyone had already been informed of the meeting. I have re-attached the agenda for you.
E00466	June 4, 2019	Email	Out	Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Meeting invitation and agenda. All call-in details included for participants that need to call in.
E00294	June 5, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Project Description/Activities	Draft Project Description and presentation for meeting attached. Please distribute to those attending the meeting.
E00473	June 5, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Project Description/Activities	Attached Draft Project Description and the presentation for tomorrow's meeting. Please distribute electronically among those who are attending the meeting. We will bring paper copies of the Draft Project Description and the presentation for all attending the meeting. It is not an expectation that meeting attendees will have time to read through the whole document.
E00469	June 5, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Project Description/Activities	Clarifying meeting time will be 2-4pm MST, and updated agenda.
E00474	June 5, 2019	Email	Out	Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Project Description/Activities	Attached is the meeting material for this afternoon. Are you still planning to call in?
E00414	June 7, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	We have not left Old Crow yet, and are anticipating being a bit late for our 2pm meeting. I will let you know when we land in Inuvik and the time we anticipate being at your office
E00415	June 7, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thanks, I will watch for your update message
E00416	June 7, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	We just landed. Will probably be there around 2:10
E00417	June 7, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Ok
E00475	June 7, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	We are just driving into town. Will be there by 2:30 at the latest.
E00291	June 9, 2019	Email	Out	Nihtat Gwich'in Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Meeting with council not fixed yet, but between July 8 - 11. We hope to meet with the individual councils representing the communities under the GTC umbrella (Ft. McPherson, Tsiigehtchic, Aklavik and Inuvik). July 10th was proposed for the next meeting. Unclear whether with GTC alone or with some or all of the other councils too. Otherwise will travel to each of the communities to meet with the councils individually which will add to the time and may complicate the schedule. We are advised that the GTC officials will be organizing this.
E00263	June 10, 2019	Email	Out	Nihtat Gwich'in Council	[redacted]	[redacted]	[redacted]	Project Description/Activities Engagement/Consultation Information Sharing	Attached Draft Project Description

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00292	June 10, 2019	Email	In	Nihtat Gwich'in Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	A meeting with NGC would need to be in the evening, as council works full time. Will try to set it up with whatever Tribal is doing as well. Can you provide a project description, so I can review.
E00289	June 14, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Site Visit/Field Work	Attached details for First Nation's participation in Chance's fieldwork this summer. Still finalizing dates and logistics. Role profiles are in attachment, and aiming to have dates finalized next week. Please give thought to potential participants.
E00270	June 14, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thanks for meeting. Asking about meetings with Council during July 9-11, and possibility of combining meetings with various councils to help with travel and accommodations. Richard looking at flights, and hoping to plan meetings. Would like to confirm timing and locations of meetings.
E00407	June 16, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement	I'll be in Yellowknife from Monday to Wednesday, so I could speak to you late in the day Wednesday or Thursday afternoon.
E00260	June 17, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Site Visit/Field Work Engagement/Consultation	Dates set for participation in Field Surveys. Proposing following logistics for First Nation participation: 1) Each FN with territory overlapping project area can have up to two members participate 2)Work will be physically demanding, require hiking steep, rugged terrain and thick bush, requiring average or above-average fitness to participate 3)Limited spots for participants due to helicopter constraints ad availability at Eagle Plains Hotel, so please respond as soon as possible to [redacted]) to confirm availability 4) Participants should arrive on start date, but not mandatory to stay for duration of field study 5) all travel, including flights, vehicle travel to Eagle Plains Hotel, ad stay in Hotel must be booked by the First Nation and billed to Chance. Table of Opportunities by date. Purpose of participation will be to observe fieldwork and gain first hand understanding of the research. Deadline for Vegetation Survey # 1 is June 19th.
E00271	June 17, 2019	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Working on firming up meeting dates around July 10th. Will confirm as soon as possible.
E00272	June 17, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thank you. Will awai[redacted] e-mail
E00273	June 18, 2019	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	In Yellowknife. Gwich'in presently engaged in Self-Government negotiations with Canada and NWT. Team has meetings with DGO Councils with Indian Act Band Councils for the period of July 8th - July 14th. Asking for other date possibilities. Suggests July 3-5 or around July 15th.
E00274	June 18, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Will canvas Chance/Hemmera to see what availability is. Fieldwork scheduled for July, ending about July 25/26. Maybe July 29,30,31, Aug 1, or after the VG GA perhaps between Aug 12-16 or Aug 19-23. Will advise of other conflicts once hearing back from others.
E00264	June 19, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Information Sharing	Link to shape files for Chance's project area as discussed in Inuvik.
E00408	June 19, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement	I assume this should be 2019 rather than 2018?
E00479	June 19, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement	Yes, sorry for the mistakes. All dates are summer 2019
E00481	June 20, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Information Sharing Engagement/Consultation	Attached Meeting Summary of June 7th meeting between Gwich'in Partners and Chance
E00255	June 24, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Fish Information Sharing	Attached notice letter regarding DFO licence application for Environmental Dynamics Inc's fish studies
E00347	June 27, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Confirming that the window will work for arranging meetings with the Gwich'in Presidents and Councils will be Aug 19-23 week. At present I have confirmed a meeting with the Gwichya Gwich'in Council in Tsiigehtchic for 17:00 Aug 19 and with Ehdiitat Gwich'in Council in Aklavik 17:00 Aug 21. I'll try to build the Fort McPherson and Inuvik meetings around these foundation dates
E00397	June 27, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thank you for making arrangements. I'm copying my colleagues so they are in the loop for planning purposes.
E00315	June 27, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Fish Information Sharing	Revisions from EDI for their DFO Application, see Attached
E00398	June 28, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Here is the schedule, with Nihtat Gwich'in Council in Inuvik to be worked in yet. Aug 19, 5pm - Gwichya Gwich'in Council in Tsiigehtchic, Aug 21, 6pm - Ehdiitat Gwich'in Council in Aklavik, Aug 22, 6pm - Tetlit Gwich'in Council in Fort McPherson. Timing for the meeting with EGC in Aklavik has been pushed back an hour at the request of the EGC President and Council. This will allow us to have a dinner meeting. We can arrange to travel over to Aklavik in the afternoon of August 21 and stay over in Aklavik that night following the dinner meeting and then return to Inuvik the next morning on the 22nd. At that time we will need to journey directly to Fort McPherson for the meeting that we have scheduled there for 18:00 on Thursday, August 22 with the TGC President [redacted] and his Council members.
E00399	June 28, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thank you. We will do our best to make it work. We may need some help with logistics so arrangements can be made.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00400	June 28, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	We will be able to provide the logistics help needed to make it all work out.
E00401	July 9, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Meeting Coordination/Planning	Regarding the four meetings with the DGOs, do you think it would be possible to schedule a community open house/ short information session in combination with these meetings? I know how much work goes into coordinating the meetings and travel, and it would be beneficial to do as much as possible in each community. I think we could either host an open house in the hour or two prior to the meetings with the presidents and board members or perhaps invite community members to the meetings. Please advise on what you think may be appropriate and possible given our short time in each community.
E00402	July 9, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Meeting Coordination/Planning	DGO's would be open to making the meetings open to community members. We discussed that with them last week. Id suggest we go that route.
E00403	July 9, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Meeting Coordination/Planning	Thank you for helping to make arrangements. Are you able to confirm the meeting with the NGC during that week as well?
E00404	July 9, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Meeting Coordination/Planning	NGC has confirmed 6 pm August 20. That meeting will be here at the GTC Boardroom. [redacted] (Manager of Regional Coordination and Capacity) and [redacted] (Nation Building and Governance Advisor) will be working with us on the arrangements for these meetings and at least one will be in attendance at each DGO meeting.
E00405	July 9, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Meeting Coordination/Planning	Thanks. How is it best to advertise to community members? We can prepare posters and then have someone in the community post them either online or around the community
E00406	July 9, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Meeting Coordination/Planning	If you can prepare the posters and send us an electronic version as well, we can coordinate the dissemination.
E00484	July 9, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Site Visit/Field Work	Have you had any interest for participation in the Chance field surveys? Below I've highlighted the surveys there's still time to participate in.
E00409	July 12, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Further to our phone conversation, boat transport option from Inuvik to Aklavik ad back will work according to the proprietor [redacted] who is a member of the EGC. [redacted] advises if the meeting were extended until 9pm, return would be no problem. . The advantage of doing the round trip in the same day is that the team could all return to the hotel in Inuvik and would have some clear time to rest and caucus during the following day in advance of departing for Fort McPherson. Please let me know what you diced for transportation, so we can reserve [redacted] vessel.
E00410	July 12, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thanks. I will get back to you early next week on the decision. How do we pay for the boat?
E00411	July 12, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	For payment, we would do a purchase order for the service and then rebill you later.
E00412	July 15, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Meeting Coordination/Planning	Please proceed with booking the boat for our meeting in Aklavik. I have copied my travelling colleagues and [redacted] who will handle the preparation of the PO and processing of the invoice. Please let us know if [redacted] should continue to deal with you for the PO or if there is another person that is better to receive it. For ground transport to Tsiigehtchic and Ft McPherson, we will be a group of 5 and will have posters and other handout material. Should, we plan to rent our own vehicle, or can we catch a lift with your group? We intend on returning to Inuvik from Tsiigehtchic and Ft McPherson following the meetings. We are not going to charter flights as previously suggested. I will have limited e-mail access until July 22, so please respond to everyone so some processes can be handled in my absence.
E00413	July 16, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Meeting Coordination/Planning	[redacted]
E00328	July 16, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Hemmera has prepared draft reports on the Implementation of the Communications and Engagement Plan for both Gwich'in Partners and Chance to review. This report summarizes meeting we have had since completing the plan. Please make any desired revisions to the document in tracked changes and send back to me to finalize. Once I have incorporated the changes, I will send final versions to both parties to sign. Please have revisions in by July 26, then I will finalize, get them signed and submit to Yukon Government for July 31.
E00329	July 24, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Following up to see if GTC is planning to provide feedback on the draft reports on the Implementation of the Communication and Engagement Plan. Looking for feedback by Friday. Please let me know if you are providing feedback or have any questions.
E00330	July 25, 2019	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Yes, we will be providing feedback, but it will not be available to you on Friday, but rather likely by end of day Monday
E00492	July 25, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thank you. End of day on Monday works for me.
E00499	July 25, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Attached are Chance's edits to the Draft Plan Implementation report
E00534	July 30, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thanks for the revised Implementation Summary. I've asked [redacted] to review it before I sign it. She may not have it for me until tomorrow.
E00535	July 30, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thanks for letting me know. Tomorrow before noon works well.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00529	July 30, 2019	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I've reviewed the draft Implementation Summary I've reviewed the draft Implementation Summary and agree that it well reflects the implementation of the GTC-Chance Communications and Consultation Plan over the past year. I do have a few minor change suggestions that I would suggest be made to the text of the Summary, after which I'd be pleased to sign it on behalf of the Gwich'in Partners. 1.Where references are made to "staff" or to "technical staff," it would be more accurate in my view to change this reference to "senior officials." This would be consistent to the protocol used by the GNWT in the context of the NWT Intergovernmental Council when distinguishing "senior officials" from "political leaders." The senior officials are not providing technical advice on project details. They provide substantive and strategic advice to their respective political leaders in accordance with their role as permanent officials of their respective governments; 2.On page 2, please add a bullet reference to "business and employment and training opportunities for Gwich'in businesses and Gwich'in Comprehensive Land Claim Agreement (GCLCA) Participants." This has and will continue to be an important and priority topic for discussion as we move in the future towards negotiating a "Cooperation Agreement"; 3.On page 6, Re Chance following through on the Gwich'in Partners' new consultation protocol you could note that the GTC has worked with Chance to schedule meetings in each Gwich'in community to discuss the project for the week of August 19, 2019. You could also note that the Gwich'in Partners have expressed appreciation to Chance for Chance's embracing this consultation protocol that the Gwich'in Partners have developed.
E00530	July 30, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I have incorporated your suggested changes and removed the draft watermarks in the attached version. This version is ready for you to sign. Once I have your signed version, I will have Chance sign the report and include you in the submission to YG.
E00537	July 31, 2019	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I've discussed with Carolyn and there are a few further items that we would like revised, then we can sign it. Page 2 – RE Gwich'in Partners, GTC Grand Chief and President [redacted] should be added to the list of Gwich'in Partners members; Page 3, para 2 – please revise the text of this sentence as follows: "…also discussed the Chance proposal for a Confidentiality Agreement." Page 3 – Nov 15 Meeting – please change "Government Building" to Chief Jim Koe Building. Page 5 – June 7 Meeting – same thing, change "Government Building" to Chief Jim Koe Building. Page 7 – Signature Line – Please change out my name and title and put: [redacted]
E00538	July 31, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thank you. I have made the changes in the attached version. Please let me know if there are more changes, or consider it the final version for signing
E00539	July 31, 2019	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	The document is now with [redacted] who will sign it before the end of the day. I did a proofread and made a couple of small changes: 1)Page 6, para 2 – I changed the reference to "TGC Primary and Secondary Use Lands" to "Tetlit Gwich'in…". 2)Also page 6, I corrected the wording in the first bullet under 4.0 to align the word with the proper tense.
E00540	July 31, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thanks for catching those two additional changes. Cindy from Chance is coming to our office at 3:20, to sign reports on behalf of Chance. Do you think that you could send the final version by then?
E00541	July 31, 2019	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Here is the signed copy
E00542	July 31, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thank you
E00558	August 18, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Attached Draft Working Agenda for Chance and GTC meeting August 20. Please let me know of any revisions
E00441	August 21, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Trip to Aklavik is a go. There is no funeral today in Aklavik, see you at 13:40.
E00442	August 26, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement/Consultation	Here are the sign in sheets from last week.
E00443	August 26, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement/Consultation	Thanks
E00447	September 3, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Attached is the draft summary of our meeting August 20, 2019 in Inuvik for review. Please let me know of any revisions.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00487	September 9, 2019	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Cooperation Agreement	An action from the August 20 meeting was to re-send a memo and draft cooperation agreement template created last Decembers. No changes have been made to the document since it was originally shared with GTC. Some items may be outdated given conversations that have taken place between GTC and Chance.
E00561	September 10, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Traditional Knowledge and Use Education and Training Interviews	Have been working with David on community engagement and consultation for a proponent project's environmental assessment. We are now moving into the interview stage in communities and doing a Traditional Knowledge and Traditional Land Use workshop. David suggested I get in touch with you to discuss the research licences and agreements. Are you available this week to discuss our approach to the research and applications as an initial conversation. I will explain more about the project and Hemmera's role.
E00567	September 10, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Information Sharing	Are you able to provide a current list of Ehdiitat Gwich'in Council's president and board members? You provided us a list of names for other DGO's, but not for EGC.
E00562	September 11, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Traditional Knowledge and Use Education and Training Interviews	I suggest we meet tomorrow. Let me know what time you are available
E00563	September 11, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Traditional Knowledge and Use Education and Training Interviews	Please let me know how the conversation goes
E00564	September 11, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Traditional Knowledge and Use Education and Training Interviews	I've sent a meeting invite for 11:30 your time tomorrow. Please let me know if this works or suggest an alternate time.
E00585	September 11, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Is it ok if I send the telephone information to call in to Kristi Benson?
E00565	September 18, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Traditional Knowledge and Use Education and Training Interviews	I'm attaching a letter that GSCI drafted to YESAB that I mentioned in our telephone conference Set 12.
E00566	September 19, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Traditional Knowledge and Use Education and Training Interviews	Thank you for sharing the GSCI letter with us. Apologies for missing it in our review of the YESAB documents
E00586	November 14, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Information Sharing	Since speaking in September, [redacted] and I have been working on our application to Aurora College Research Ethics Committee for the Chance Oil and Gas Environmental Assessment Research Program. We are planning to submit our application on November 26th. Do you think it would be beneficial to have another meeting to discuss our final application? [redacted] and I could briefly present our proposed research plan for discussion and feedback to increase your familiarity with the proposed plan and also to provide us with the opportunity to make changes before it is reviewed by the REC. Perhaps November 21/22 you would like to have phone meeting?
E00587	November 19, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Information Sharing	Can we set up a meeting for Friday November 22nd, at 1:15 pm?
E00588	November 22, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Information Sharing	Please see attached Project Summary. During our meeting this afternoon, we are hoping to go over these details and discuss next steps with you.
E00589	November 22, 2019	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Information Sharing	I would like to request that [redacted] be part of the call also
E00590	November 22, 2019	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Information Sharing	[redacted] s welcome. Please share the Skype information below with her.
E00842	January 12, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation Information Sharing	My apologies for the delay in sharing this draft meeting summary. Let me know if you have any revisions you'd like me to make. Then I can combine those revisions and share an updated version of the summary. I have also attached some documents that were referred to during the meeting: •the Communications and Consultation Plan between Gwich'in Partners and Chance •Chance's draft project description for the Eagle Plains Exploration Program (project for Executive Committee screening level).
E00603	January 28, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Project Description/Activities Regulatory Process	Chance will be applying to the Yukon Government very shortly to extend the tenure of Exploration Permit 20. Application will be for maximum allowable under the Oil and Gas Act of 5 years. This permit has one suspended well at McParlon A-25 which we hope to use for fluid disposal of any produced water associated with the proposed exploration project. We are at an intermediate stage of discussions with the Manager of Oil and Gas Operations with Yukon to extend the suspended well status on the suspended wells at Eagle Plain. Manager has indicated hat Chance will need to do some physical assessments of the legacy wells to confirm the integrity of the wells before granting an extension. Assessments will require access to 3 suspended wells at SDL M-08, G-08, and J-19 and well as M-59 in order to do the work. A service rig, cement pumping equipment, and wireline services are expected to be used to conduct the assessments. Anticipate taking temperature measurements in wells to evaluate permafrost depth. The program is expended to take 1-2 months. This is a winter operation and will be done during the winter of 2020-2021 and may require Designated Office screening b y YESAB. We will provide more information as soon as we can.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00645	March 23, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Information Sharing	Chance Oil and Gas (COG) has several initiatives on the go, some of which are time sensitive and all require engagement with the affected First Nations. The following is a summary of these initiatives: 1.Application to the Yukon Government to get tenure extension on Exploration Permit 0020 which is set to expire on August 30, unless extended. This permit is located mostly in the Traditional Territory of the Vuntut Gwichin, but a portion is in the Secondary Use Area of the Tetlit Gwich'in and in the overlap area with the Na-cho Nyak Dun Traditional Territory. There is a suspended well in this Permit at McParlon A-25 which has ongoing value to COG. 2.There are several suspended wells at the Chance Significant Discovery License (SDL 022) and one at the Blackie SDL 021 which the Yukon Government requires COG to undertake some maintenance work. This activity will require an impact assessment by the Designated Office (DO) of YESAB in Dawson prior to permissions being granted by Yukon to undertake the work. The plan is to submit to the DO the program in the next month or so with the objective of being able to do the work over approximately a 6 week to two month period in the winter of 2020-2021. This is a regulatory requirement made by the Manager of Oil and Gas Operations with the Yukon Government. Importantly for your knowledge, there is no indication that these suspended wells have any problems, but they are wells that were drilled in the 1960's so the regulator has asked for work to be done in order to be able to continue the suspended status of these wells. 3.Continuing engagement with respect to the multi-well drilling and seismic data acquisition project that has been described to you in the past couple of years. In view of the COVID 19 outbreak, travel and face to face get togethers are not appropriate, if not prohibited, so we will have to make arrangements to exchange information in writing, electronically and by conference call. There is quite a geographic spread for all of us to manage and I look forward to hearing your preferences for engagement. Also, I understand that there have been some changes to a number of staff positions with the GTC and I am not sure exactly who we should be engaging on the COG file. If I have missed anyone on this email, please advise us and forward this email to the appropriate individuals.
E00648	March 26, 2020	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Information Sharing	In addition to [redacted], the following are the updated GTC staff contacts: [redacted], Interim Chief Operating Officer [redacted], Director of Lands and Resources godlove.ngeh@gwichintribal.ca [redacted], Intergovernmental Relations, Communications Coordinator
E00649	March 26, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Information Sharing	[redacted] Please let us know your thoughts about continued discussions on various items I described in my email below sent earlier this week.
E00672	May 25, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Project Description/Activities DO Project	Chance Oil and Gas Limited is preparing a proposal for well maintenance work in the Eagle Plains. Please see the attached letter meant to initiate engagement and to provide initial project information. Please let me know if you have any issues opening the attachment
E00683	June 9, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	So sorry I meant to include you in this email.
E00684	June 9, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	DO Project Meeting Coordination/Planning	Yes GTC is compiling input and comments based o the letter that was circulated. We should be able to send you something by the end of this week.
E00685	June 9, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Thank you for the quick response and we look forward to GTC input and comments!
E00681	June 9, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Hope all is well and everyone staying healthy. I just wanted to follow up with you and your team to see if you have any questions or comments about our project description for the well maintenance program that we are going to submit with Dawson DO soon. We would be happy to arrange a call if you guys are interested and we can provide an overview of our objective of doing this project.
E00763	June 9, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	I just wanted to follow up with you and your team to see if you have any questions or comments about our project description for the well maintenance program that we are going to submit with Dawson DO soon. We would be happy to arrange a call if you guys are interested and we can provide an overview of our objective of doing this project.
E00776	June 9, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Hope all is well and everyone staying healthy. I just wanted to follow up with you and your team to see if you have any questions or comments about our project description for the well maintenance program that we are going to submit with Dawson DO soon. We would be happy to arrange a call if you guys are interested and we can provide an overview of our objective of doing this project.
E00777	June 10, 2020	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Good day. Thank you for this email. Yes an update call would be great on your maintenance plan. Anytime after 3:45 pm MT would be a good time to set up a call.
E00686	June 10, 2020	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Good day. Thank you for this email. Yes an update call would be great on your maintenance plan. Anytime after 3:45 pm MT would be a good time to set up a call. Ty

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00687	June 10, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Thank you so much for your response! [redacted] let us know that GTC is currently compiling input and comments. Once we have that feedback, I can coordinate a day and time that works for everyone. A time after 3:45 pm MT shouldn't be a problem.
E00690	June 12, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	DO Project Information Sharing	[redacted] please find attached input for this work from GTC's departments of Lands and Resources, Cultural Heritage and Economic Development. We thank you for giving us the opportunity to provide input/comments on this work. Please if you have any questions related to our input, do not hesitate to contact me.
E00695	June 18, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	For ease of planning and coordination - Are you able to determine some dates and times that work for yourself, Leslie Blake, and anyone else that GTC would want to participate? Then I can coordinate Chance and Hemmera participants on my end.
E00694	June 18, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	My apologies for the delay in getting back to you. Thank you so much for providing your feedback (attached for everyone's reference). Chance and Hemmera are currently working on providing a response to GTC. My colleague, [redacted] is leading that piece and he hopes to share a draft tomorrow or early next week. If we are able to respond by early next week, we were wondering if it would be possible to arrange a conference call for a time later in the week in order to facilitate further discussion. Perhaps either the afternoon of June 25th (next Thursday) or June 26th (next Friday)?
E00696	June 18, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning Information Sharing Project Description/Activities	As requested, I've attached the draft Project Description for the well maintenance program. The summary information attached to our initial engagement letter was based on this larger document.
E00787	June 24, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	I just wanted to send a quick update. We're a little delayed on drafting a response to GTC's comments, [redacted] is working on the draft and we'll get it to GTC as soon as we can. Then hopefully we can work on scheduling a date/time for a conference call.
E00788	June 24, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	Engagement/Consultation DO Project	Thanks and no problem
E00780	July 9, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Attached is a memo prepared by Chance and Hemmera in response to input received from GTC.We would be more than happy to arrange a conference call for further discussion. If that is something GTC and TGC are interested in, perhaps we can schedule a time for mid to late next week?
E00781	July 9, 2020	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Thank you, please we will review this internally first and contact you early to mid-next week for a possible conference call to discuss this if it works well for you.
E00786	July 9, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project Meeting Coordination	Thank you, and that definitely works for us.
E00709	July 13, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Hemmera has prepared a draft report on implementation of Gwich'in Partners and Chance Engagement and Communication Plan for Gwich'in Partners and Chance to review. This report summarizes meetings/correspondance that have occurred between Gwich'in Partners and Chance since completing the 2019 Annual Report. I have attached the draft as a Word Document, if both Gwich'in Partners and Chance could make revisions to that document in tracked changes, that would assist me in creating a final version. If there are any issues that arise between parties' revistion, we can address them via e-mail or a quick call. Once revisions have been incorporated and the document is considered final by Gwich'in Partners and Chance, I will send the final version to both parties to sign. I have also attached, as a pdf, a draft of Gwich'in Partners and Chance's Engagement Log which functions as Appendix D for the report. Please complete reveiws by Friday, July 24th. Reminder that reports need to be signed and submitted to YG on July 31st.
E00782	July 17, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	I hope you had a good week! I wanted to touch base with you and see how things are going?
E00783	July 17, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	Engagement/Consultation DO Project	[redacted] we are fine, we are having an internal discussion today in relation to your submission and a call with you and your team next week would be great. Let me know a date to have a call to discuss your reply to our submission.
E00784	July 17, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project Meeting Coordination	I've checked with [redacted] and we have a few windows we can propose for next week: Tues July 21, Wed July 22. Let me know if any of these dates/times work on your end. If not, I can try to find openings Thursday/Friday. Are you able to coordinate having [redacted] participate?
E00789	July 21, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project Meeting Coordination	I will be sending out an invite to everyone a little later this morning. However, I was wondering if it would be possible for you provide any information on the topics/themes that GTC would like to discuss? It will help me draft a rough agenda, but it will also help me strategize which of Chance's other consultants I should try to include. For example, we have a consultant from Environmental Dynamics Inc. that could speak to any wildlife topics if that's something GTC would like to focus on.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00761	July 21, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	This is a conference call to discuss Chance's proposed Well Maintenance Work. Attached is a draft agenda for our call. If you have any proposed revisions please let me know. I've also attached the memo prepared by Chance in response to theinput received by GTC.
E00785	July 21, 2020	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]		[redacted]	Engagement/Consultation DO Project Meeting Coordination	Please we will do Wednesday 3:30 - 5 pm. And send metting inited to those copied in this e-mail, including myself.
E01189	July 22, 2020	Meeting - Teleconference		Gwich'in Tribal Council		[redacted]	[redacted]	DO Project Engagement/Consultation	The purpose of this meeting is for Chance Oil and Gas (Chance) and Gwich'in Partners to continue their discussion with respect to Chance's proposed Eagle Plain Well Maintenance Project. Chance will also take this opportunity to provide an overview of changes to the project design that have occurred as a result of engagement activities and refinement during proposal development.
E00746	July 24, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I wanted to check in and see how your review of the draft engagement report was going? My apologies for not doing this sooner in the week. Despite my typo below, these reports are due to Yukon Government July 31, 2020. Not 2019, there is no time travel involved.
E00765	July 24, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Attached is a draft copy of Chance Oil and Gas (Chance)'s YESAB Project Proposal for the Eagle Plains Well Maintenance Project. In order for Chance to get all its approvals in hand before thw winter season, Chance's application will need to be submitted very shortly after sending this draft to you. At this time, our goal is to submit the Project Proposal middle of next week. I remember from our June phone call that [redacted] had inquired about a Wildlife Management Plan. As it happens, all mitigation measures with respect to wildlife and caribou is located within the body of the proposal. I wanted to flag that for your attention. As this document has not gone through Hemmera's formatting procedure, it is absent of some of the figures and appendices. However, I've attached the the Spill Response Plan which will be Appendix B. Chance continues to be committed to engaging with the Gwich'in Tribal Council. Should you wish to discuss the proposed Project in more detail, please don't hesitate to contact Chance or Hemmera.
E00747	July 29, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Will GTC be able to provide comments today or tomorrow? For your information, I've attached the comments I received from [redacted]. He also pointed out that the Engagement Log (Appendix D) didn't include records of the community meetings in Tsiigehtchic, Inuvik, Aklavik and Ft McPherson last year between Aug 19 and 22. So I'm make sure that's fixed as well. my goal is to get the draft notes from last week's meeting to GTC and Chance before the end of the week.
E00748	July 29, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	Engagement Reports/OIC Requirements	Thank you, we plan to send our commentts tomorrow.
E00750	July 30, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I've received comments back from GTC and Chance. Chance wanted to make sure that Appendix D included line items for each of the community meetings held last August (i.e., community meetings referenced in the report). Those line items are being added to the log and the is log currently being re-formatted for Appendix D. Revisions that GTC provided that were editorial (e.g., mistaken dates, awkward wording), I've gone through an accepted. I've provided some additional text for Chance review that I believe may address GTC's comments. Richard can you review my additions and let me know if they are acceptable? Additionally, can you provide any text for GTC's comment with respect to training and employment? Please leave everything in track changes and put your decisions in comment bubbles. Once [redacted] has finished the task bolded above, the document can be returned to GTC for a another review.
E00751	July 30, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Sorry I missed your call (I'm working from home today), but thank you for your message. I appreciate your comments and they helped me with some text I've added. I gave [redacted] a call and was able to tidy up things from his perspective. Would you be able to review the document attached and delete comments you feel have been addressed by either text I've added to the document or my comment in response.
E00752	July 30, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	Engagement Reports/OIC Requirements	Thank you please, we are fine with the comments and you can go ahead and have a clean version to meet your submission deadline and send our copy as well.
E00753	July 30, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thanks for the quick turn around. I've attached a PDF of the clean version. [redacted] are you able to print off the signature page and stick handle that piece on your end? Then send a scanned copy to Greg for his signature. By then the formatting should be done for Appendix D and I can compile the complete document. I will send that to the Gwich'in Partners and Chance prior to sending an email to YG.
E00755	July 30, 2020	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I have sent to my COO [redacted] who can even sign electronically if he is around now.
E00749	July 30, 2020	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]		[redacted]	Engagement Reports/OIC Requirements	Please find attached the engagement plan with GTC's comments. Please note that there are additional comments at the end of the document.
E00756	July 31, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	Engagement Reports/OIC Requirements	Signed attached.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00757	July 31, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	Engagement Reports/OIC Requirements	Thank you [redacted] greatly appreciated please.
E00758	July 31, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thank you very much! I really appreciate your help and efforts getting this report across the finish line. I will be sending it to YG shortly.
E00759	July 31, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO) YG	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Please see attached for the 2020 Annual Report on the Implementation of the Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan.
E00760	August 3, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Attached is a draft summary of our call on July 22nd. I had meant to get this out last week, but engagement reports ate up my time. Let me know if you have any revisions and I will do my best to compile them.
E00869	August 28, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	DO Project Engagement/Consultation	Email read receipt
E00910	August 28, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities	Further to Richard's email dated August 7th (attached), Chance Oil and Gas (Chance) has made a few revisions to their Project Description for the Designated Office Evaluation of their proposed Well Maintenance Program. As a result of those changes, Hemmera has also revised the effects assessment sections of the Project Proposal. Below are the reasons for the revision that have been provided to us by Chance and a brief summary of the amendment itself: 1.Ongoing conversations between Chance and Yukon Government, Oil and Gas Branch (YG) have necessitated changes. While Chance was previously of the impression wells could continue to be suspended, YG is now directing Chance to conduct inspection and maintenance activities for all eight suspended wells and then abandon those wells or bring them into active status (i.e., end the period of well suspension). Chance is now proposing to abandon six wells (i.e., M-59, M-08, J-19, G-08, B-73, and H, 28) and to bring the remaining two wells (i.e., A-25 and E-78) into active status as deep-injection wells. Waste fluid produced during the abandonment of the six wells can then be disposed of via injection into the deep-injection wells. No oil or gas is expected to be produced from the two wells proposed to be activated; they would specifically be used for disposal of waste fluid from activities associated with these maintenance activities. (See sections 2.1.4 and 2.1.5 for further description) 2.At this time, Chance cannot confirm whether it will use the Eagle Plains Hotel or the existing Chance Camp for housing workers over the duration of the Project. The decision to utilize the Eagle Plains Hotel or the Chance Camp will be made when the Project schedule is finalized. It will also have to take into consideration the Hotel's ability to accommodate Chance workers over the full duration of the Project as well as COVID-19 related self-isolation requirements at that time. As a result both options are considered in the effects assessment for the housing of the project workforce. (See sections 2.2 and 2.3 for further description) 3.When the Chance field team were at Eagle Plain early August, they observed that the route used to access M-59 would require realignment of the final portion of Blackie Winter Road. The section of the original route that proceeds north for the final kilometer is not ideal for traffic due to steeper terrain. The steeper route would result in a significant risk to the trucks bearing heavy loads, fuel supply, and other fluid handling shipments. Chance is proposing shifting the final portion of Blackie Winter Road east of the original route in order to attain a much gentler gradient. (See section 2.1.1 and Figure 2-1 for further description) Each of the amendments above are described with additional detail within the attached revised Project Proposal. As previously, not all appendices are complete yet but will be
E01034	August 28, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	DO Project Engagement/Consultation Project Description/Activities	Thanks please
E01030	September 2, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	DO Project Engagement/Consultation Project Description/Activities	Please find attached the document with GTC's final comments based on the meeting we had with Chance oil and Gas in July. I know you circulated another project document with additional information on the Eagle Plain Well maintenance work and we will review it and see if our input is different from what we have provided in this document. And if that will be the case, then we will provide additional input. In addition, I have ben told that one of our Renewable Resources Council members in Fort McPherson (Tetlit Gwich'in) would like to meet with Chance Oil and Gas. Once I get his information, I will send to you so that Chance Oil and Gas can arrange a meeting with him.
E01031	September 3, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Project Description/Activities	Thank you for sending this updated version of your comments. I've forwarded it to Chance and the rest of my Hemmera team. We'll review it, but for now we'll hold off on any follow-up, where/if required. This way your team can have time to review the revised project proposal and collect your feedback. Then we can coordinate a conference call if you'd like. We appreciate you providing any specific contact information for the Renewable Resource Council in Fort McPherson. Once we have that, we'll connect with them to schedule a meeting.
E01032	September 3, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	DO Project Meeting Coordination/Planning	Thank you very much
E01033	September 10, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning Information Sharing	I was wondering if you would be able to forward the contact information for the Renewable Resource Council members in Fort McPherson? Alternatively, if you'd be able to coordinate a conference call? I'm not sure if you were planning on attending or not? Having GTC and RRC staff members would be perfect. Timing wise, a conference call for sometime next week (Sept 14-18) would be best for Chance staff, but they could accommodate the following week (Sept 21-25) if needed.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E01035	September 10, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	DO Project Meeting Coordination/Planning Information Sharing	Thank you please, I have not yet gotten any name(s) but would follow up and can coordinate that if they are willing.
E00875	September 10, 2020	Email	In	Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Meeting Coordination/Planning	Accepted meeting for July 22 - Chance Oil and Gas - Proposal for Well Maintenance Work (Engagement with Gwich'in Partners)
E00902	September 15, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Project Description/Activities	Since my email dated August 28th, Hemmera has been in the final stages of concluding the revised DO Project Proposal for Chance's Well Maintenance program. We have appreciated your feedback and worked to include that into the application. As you know, Chance's timeline for completing this work was tied to compliance with regulations, so in an effort to ensure that the maintenance activities could occur this winter Chance needed to submit the application last week. It was submitted late Friday evening and today Hemmera received confirmation that the project was on the YESAB registry. We acknowledge that you may have future comments on the project as it progresses through the YESAB process. We continue to look forward to hearing your views and are happy to hold additional meetings to discuss and answer any questions you may have. Please see the link to the registry here: Project 2020-0151 Eagle Plains Well Maintenance and Winter Activities
E00865	September 16, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	DO Project Engagement/Consultation	Email read receipt
E00906	November 2, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	After further consideration of the proposed Project (Eagle Plains Well Maintenance and Winter Activities) activities and the requirements of the Yukon Oil and Gas Act, Chance Oil and Gas Ltd. (Chance) has determined that changes are required to the Project submitted to the Dawson Designated Office on September 11, 2020 (Project #2020-0151). As such, Chance has decided to withdraw its Project proposal and will be informing the Yukon Environment and Socio-Economic Assessment Board today, November 2, 2020. Chance intends to incorporate changes into a revised Project proposal. Once the revised proposal has been drafted, Chance will notify you by sharing a draft and requesting a meeting to discuss the changes further. After Chance has discussed those changes with the Gwich'in Tribal Council and Tetlit Gwich'in Council, the Project proposal will be finalized and resubmitted to the Dawson Designated Office. Chance understands and appreciates that making changes to this Project a second time is requesting additional effort and capacity of the Gwich'in Tribal Council and Tetlit Gwich'in Council. Chance looks forward to continuing to work with the Gwich'in Tribal Council and Tetlit Gwich'in Council, and Chance will do its best to ease this process.
E00851	November 4, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	I want to congratulate you both for your recent election victories and we look forward to working with you in the future. I think that Chance Oil and Gas has established a good working relationship with the Gwich'in Tribal Council and Designated Gwich'in Organizations and we hope to continue building on this relationship. I understand that you have been in touch with [redacted] already so I thought I would reach out to introduce myself so we can initiate discussions about our plans and proposed activities. Godlove has been engaged with us during the past year so is generally current with our plans so can brief you prior to any conversation that we have with you. We do need to engage again to discuss some changes that we are proposing to a well maintenance project at Eagle Plain. Overall, Chance Oil and Gas is involved in exploration activities in northern Yukon and has plans to expand this effort in the future. A multi-year exploration project in an area of interest within the exploration land that Chance currently holds covers about 2,400 sq kms of area. This project could involve drilling up to 30 exploration wells, shooting up to 1,500 sq kms of 3D seismic and up to 2,000 linear kms of 2D seismic, and undertaking extended flow testing of any discoveries has been proposed and information has been provided to all the affected First Nations including the GTC and the DGO's. When it is convenient, we would like to meet with you, probably virtually by Zoom or Microsoft Teams given the COVID 19 situation.
E00849	November 9, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	I have feedback from Hemmera and my colleagues. It looks like Monday morning next week works for all of us. How does 9-11 am work for you and your colleagues? I can arrange with [redacted] at Hemmera to save this time, send out meeting invitations and connection details and a draft agenda for you to consider.
E00850	November 9, 2020	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	I am available to meet next Monday from 9-11am.
E00852	November 9, 2020	Email	In	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Mahsi' (thanks) for reaching out and introducing yourself. Yes myself and Greg had a quick discussion in October. I have also copied [redacted] who is our acting COO to make him aware of the request. We may have some time on Monday, November 16th if that works. We look forward to meeting with your team and discussing your proposed activities at Eagle Plain.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E00853	November 9, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Great to hear from you. Next Monday works for me and my colleagues. I would like to include others who are helping with various processes like YESAB submissions and Communication and Engagement such as consultants at Hemmera in Whitehorse. GTC government staff will already be familiar with the folks at Hemmera. I will check with them on their availability to participate and let you know. Are you able to use Microsoft Teams for a virtual meeting? I suggest that we allow up to two hours to introduce you both to plans we have for work at Eagle Plains. In the near term, we are under an order from the Yukon Government regulator to undertake maintenance of 8 suspended wells operated by Chance. There is no evidence of any problems with these wells, but Yukon law specifies that suspended wells must be put into operation or abandoned after a period of inactivity. Our plan is to preserve for future use five of the suspended wells, but three will likely have to be abandoned. In the longer term we have plans to undertake a small scale, multi-year exploration drilling and seismic data acquisition program in an area of interest within the existing exploration permits held by Chance. Information about both these projects has been provided to your staff over the past couple of years. We are underway with updating the maintenance project to include extended flow testing of three wells to assess the productive capability and hopefully measure the resource size as part of the program. I will confirm the availability of the Hemmera advisors as quickly as I can. January 16 is pretty open for [redacted] and me.
E00877	November 10, 2020	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Meeting Coordination/Planning	Accepted meeting for November 16 - Gwich'in Tribal Counce and Chance Oil and Gas Meeting
E00878	November 10, 2020	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Meeting Coordination/Planning	Accepted meeting for November 16 - Gwich'in Tribal Counce and Chance Oil and Gas Meeting
E00879	November 10, 2020	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Meeting Coordination/Planning	Accepted meeting for November 16 - Gwich'in Tribal Counce and Chance Oil and Gas Meeting
E00880	November 10, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	DO Project Engagement/Consultation Meeting Coordination/Planning	Accepted meeting for November 16 - Gwich'in Tribal Counce and Chance Oil and Gas Meeting
E00998	November 10, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Meeting Coordination/Planning	Here is the meeting invite with Teams/call-in details for the Gwich'in Tribal Council and Chane Oil and Gas call next week. Hemmera will draft an agenda and send it out for participants to review.
E00847	November 13, 2020	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Please include [redacted] (copied) to your CC list for this project. Thanks!
E00876	November 13, 2020	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Accepted meeting for November 16 - Gwich'in Tribal Counce and Chance Oil and Gas Meeting
E00881	November 13, 2020	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Accepted meeting for November 16 - Gwich'in Tribal Counce and Chance Oil and Gas Meeting
E00846	November 13, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning DO Project	Attached is a draft agenda for the meeting on Monday (Nov 16th). Please let me know if you have any changes you'd like me to make.
E00843	November 16, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	DO Project Meeting Coordination/Planning Information Sharing	Please can you send to me the detailed project Richard just presented to share with my leadership.
E00844	November 16, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Project Description/Activities	I've attached the original email Hemmera sent to GTC back in June 2019. It includes the draft project description for Chance's Eagle Plains Exploration Project and a presentation that Chance gave to the GTC team at that time. This project will go through a YESAB Executive Committee level screening. Since you and your team started this year, Richard may have mentioned the "Executive Committee" project in passing, but Chance (and Hemmera) haven't been actively engaging on it. We've been focused on Chance's Eagle Plains Well Maintenance Project (or subsequently called Eagle Plains Well Maintenance and Winter Activities) which will be going through the YESAB Designated Office in Dawson City. That is the proposal we've been engaging with you on for the past few months. It's this project that has changed a couple times and which Chance withdrew from YESAB a couple weeks ago. As soon as the revised draft (including project description and effects assessment) for this project is completed, Hemmera will get a copy to GTC. As Nathan mentioned on the call, he's hoping for sometime this week. Hopefully my additional comments here aren't too unsolicited. It may end up being repetitive for you, but I will be attaching the draft project description for Chance's Eagle Plains Exploration Project again when I send out the notes from today's meeting. I'll also attach other documents that were referenced during the call, for ease of reference.
E00845	November 16, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	DO Project Engagement/Consultation Project Description/Activities	Thank you very much
E00848	November 16, 2020	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities	Will do! Moving forward, regardless of whether emails pertain to Chance's Designated Office project (Well Maintenance and Winter Activities) or its Executive Committee level project (Eagle Plains Exploration), I'll be sure to cc you both!

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E01194	November 16, 2020	Meeting - Teleconference		Gwich'in Tribal Council		[redacted]	[redacted]	DO Project Engagement/Consultation Project Description/Activities	The purpose of this meeting was to introduce Chance Oil and Gas and its projects to Gwich'in Tribal Council's (GTC) new leadership.
E00987	November 16, 2020	Email	In	Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	Declined: Gwich'in Tribal Council and Chance Oil and Gas Meeting
E00859	November 19, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	DO Project Engagement/Consultation	Email read receipt
E00891	November 19, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Project Description/Activities	Further to my email dated November 2nd (attached) and our meeting November 16th with the Gwich'in Tribal Council, Chance Oil and Gas (Chance) has revised its Project Proposal (including updated Project Description and Effects Assessment) for Designated Office Evaluation. Below is the key project component that has changed: •Extended Flow Testing: After maintenance activities are complete and depending on wellbore integrity (as confirmed through maintenance activities), Chance proposes to conduct Extended Flow Testing (EFT) on up to three of the wells which have the highest potential for natural gas reserve. The reason for this change is to allow Chance to gather important information about the nature of the natural gas resource accumulation and its productive capability. a.Wells proposed for EFT are M-59, M-08, and J-19 (see PDF attached for Figure 2-1). Please note, Figure 2-1 is currently being updated to reflect this change. b.Revert up to three wells to suspended status (if the EFT results prove to have sufficient resource). c.Abandon three to six wells (the three remaining wells (G-08, B-73, and H-28) will be abandoned and up to additional three wells may be abandoned if wellbore integrity is not confirmed or if EFT results prove insufficient resources). •Timelines: If work cannot be completed this winter season (due to low snow pack, COVID considerations, or permitting delays), Chance will complete the project during the winter of December 2021 to March 2022. Additional detail is within the attached revised Draft Project Proposal. While revisions were made throughout the document, Section 2.1.3 is the substantive addition with respect to EFT. We've attached both a clean version and a version with tracked changes to facilitate your review. Given the very short time frame for winter work, Chance will be submitting the application to YESAB on Friday, November 20th. Hemmera anticipates the GTC and Tetlit Gwich'in Council requiring additional discussions with Chance to review these changes and look forward to scheduling a meeting where we can discuss these matters further to support your future submissions to the YESAA process.
E00860	November 20, 2020	Email	In	Gwich'in Tribal Council	[redacted]		[redacted]	DO Project Engagement/Consultation	Email read receipt
E01023	November 20, 2020	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities Engagement/Consultation	I need to amend my email sent yesterday. While Chance would like to submit as soon as possible, the submission will be delayed until mid next week. If the Gwich'in Tribal Council and/or the Tetlit Gwich'in Council has any immediate concerns, please contact us and we'll make scheduling a meeting a priority.
E00894	November 20, 2020	Email	In	Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning Engagement/Consultation	Declined Meeting for November 16 - Gwich'in Tribal Council and Chance Oil and Gas Meeting
E00896	January 19, 2021	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	A brief update on Chance's proposed Eagle Plains Well Maintenance and Extended Flow Testing project is provided below: •Project was submitted to the Dawson District Office (DO) December 24, 2020. •Adequacy Review started December 29, 2020 and was extended January 11, 2021. oThe Adequacy Review period was extended for 21 days due to the complexity of the Project. •Dawson DO issued an Information Request on January 15, 2021 Chance is currently working on its response to Information Request 1 which you can find here. Additionally, here is the link to the project's page on the YESAB registry: 2020-0197.
E01099	April 7, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I will in Ontario that week to deal with the sale of and move out from our place in Muskoka. I am tied up on April 26 all day and between 10:00 am and noon Calgary time on April 27 for a Board meeting. The rest of the week is open for me.

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E01064	April 7, 2021	Email	Out	Gwich'in Tribal Council Tetlit Gwich'in Council (DGO)	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Hemmera is currently resuming work on Chance's Executive Committee project titled Eagle Plains Exploration Program. Seeing as it's been quite some time since Chance and the Gwich'in Tribal Council (GTC) and the Tetlit Gwich'in Council (TGC) have discussed this particular project, Chance was hoping to schedule a meeting. Some items that Chance would like to discuss are: •a refresher of the draft project description •update of events since Chance last engaged on the ExCom project •anticipated timeline for submission to YESAB, and •GTC and TGC's preferences/guidance for engagement with its government and its citizens over the coming months. Do you have any availability the week of April 26th – 30th?
E01100	April 15, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I wanted to touch base on the request below and see if you had any availability to meet the week of April 26th – 30th or perhaps the following week. Also, my apologies[redacted]. I did not include you in my original email sent April 7th.
E01053	April 16, 2021	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I am out of office, returning Monday, June 14, 2021. I will be checking my e-mail and do my best to get back to you as soon as I can. *Automatic reply*
E01105	April 20, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I just sent a placeholder to you which can be forwarded to others. I'll update and clean up the invite closer to the meeting.
E01101	April 26, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I noticed on the GTC website that there have been some changes in staff. Would yourself and [redacted] be the correct people to contact now to discuss the request below (i.e., request for a meeting)?
E01182	April 26, 2021	Voice Message	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Voice message summary [redacted] calling from GTC. I will send you an email. [redacted] if you would like to call me back.
E01102	April 27, 2021	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	You are correct. However, I am only in an acting capacity until the new Lands Manger starts, which is May 10th. I would like to request that we meet when the new Lands Manager starts and involve Grand Chief [redacted] and Deputy Grand Chief [redacted] well in the meeting. I've checked with their Executive Assistant and the dates for a meeting would be the afternoons on May 19th-22nd (1-5 pm). I am hoping one of these time slots for you and your team. If not, please advise if that is not possible.
E01103	April 28, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I've heard back from the Chance team and we're wondering if we could book a meeting for Friday May 21st at 2:00pm (Mountain time). If that time still works for GTC, I can send a placeholder for everyone's calendars. Closer to the date I can reach out again to make sure the time still works.
E01104	April 28, 2021	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Yes, that time works for us. Looking forward to our discussions.
E01084	April 30, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Here is a placeholder for the Chance/GTC meeting in May. Feel free to forward it to anyone that needs to attend on GTC's side. Closer to the date, I will confirm the that the date/time still works for everyone involved, set up the call-in info, and work on an agenda.
E01163	April 30, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I just sent a placeholder to you which can be forwarded to others. I'll update and clean up the invite closer to the meeting.
E01106	May 18, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning Project Description/Activities	I wanted to check in and see if meeting this Friday was still possible?
E01164	May 19, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	As few weeks ago I was working with [redacted] schedule a meeting between Chance and GTC. She mentioned a new Lands and Resources Manager starting. We tentatively booked a meeting for this Friday, but I wanted to confirm that it still works for everyone on your end.
E01157	May 20, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Attached is the draft project description that Chance shared with GTC way back in June/July 2019. We presented this to each of the DGOs and Gwich'in communities then as well. I've also attached a draft agenda for the meeting. We can make changes later today once we confirm the date/time and attendees on your end
E01165	May 20, 2021	Email	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Chief and Deputy Grand Chief are out of the office until next week. I spoke to [redacted] and it was suggested that we reschedule for either next week or the week following that. I will try and narrow a meeting date down for you that will work for everyone on our end. Hopefully, I can get a date to you by Friday, if not early next week, when everyone is back in the office.
E01166	May 20, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I'll cancel the invite for tomorrow. Would you be able to see if you can find a time that works fo[redacted] as well?
E01176	May 20, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Meeting invite: We are going to re-schedule this meeting.
E01177	May 20, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Has there been any suggestion about an alternative time?

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary
E01178	May 20, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted] is going to coordinate on GTC's end and then let us know some dates and times that work. Aiming for next week, maybe the week after.
E01181	May 25, 2021	Voice Message	In	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Voice message summary: Follow-up on the next meeting, I was able to secure a date for June 3rd from 2-2:30. Would you want to send out the meeting request or if that would come from you with an updated agenda. You can call or email me back if that works for you.
E01155	May 26, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Meeting Invite: Chance and GTC to meet and discuss Chance's proposed Eagle Plains Exploration Project. Draft agenda to be sent tomorrow.
E01161	May 26, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I was able to connect with Chance and meeting next Thursday June 3rd from 2:00 to 3:30 (Mountain time) works on our end. Just to confirm though, you meant Mountain Time right? I can send out the invite (to you to start with) and then you can forward it to folks on your end. Then I'll follow up the invite with the draft agenda to all attendees
E01156	May 27, 2021	Email	Out	Gwich'in Tribal Council	[redacted]	[redacted]	[redacted],	Meeting Coordination/Planning	Attached is a draft agenda for the Chance/GTC meeting next week. Please let me know if you have any changes you would like me to make.

APPENDIX 2-B-24. January 26, 2023, Meeting Summary

Eagle Plains Exploration Project – Reintroduction Meeting Minutes

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January 26, 2023

Project No.: 323

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Prepared For

Chance Oil and Gas Limited
Vuntut Gwitchin First Nation
Gwitchin Tribal Council
First Nation Na-Cho Nyäk Dun

Prepared By

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CONSULTING

Document details

Project Name	Eagle Plains Exploration Project
Document Title	Draft Reintroduction Meeting Minutes
Project No.	323
Date	January 26, 2023

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1. Reintroduction Meeting Details

Table 1 below outlines details of the Reintroduction Meeting.

Table 1: Reintroduction Meeting Details

Topic	Action Description
Date	• January 26, 2023
Time	• 2:00 pm – 5:00 pm
Location	• Fairmont Waterfront, 900 Canada Pl, Vancouver, British Columbia V6C 3L5

Attendees	• Chance Oil and Gas Limited (Chance)
	  • [redacted] (Chairman and CEO)
	  • [redacted] (President)
	  • [redacted] (Regulatory, Environmental and Community Relations Coordinator)
	  • [redacted] (Vice President, joined by telephone)
	• First Nation Na-Cho Nyäk Dun (NND)
	  • Chief [redacted]
	  • [redacted] Implementation & Governance Manager
	• Gwitchin Tribal Council (GTC)
	  • Grand Chief [redacted]
	  • President [redacted], Tetlit Gwitchin Designated Gwitchin Organization
	  • [redacted], External Consultant, Lands and Resources Department, GTC
	  • [redacted]., Gwitchin Development Corporation Chief Executive Officer (CEO)
	  • [redacted], Executive Assistant, GTC
	• Two Worlds Consulting
	  • [redacted] (Facilitator Support)
	  • [redacted] (Facilitator)
	• Vuntut Gwitchin First Nation (VGFN)
	  • Chief [redacted]
	  • [redacted], Intergovernmental Relations Coordinator
	  • [redacted], Executive Director

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2. Reintroduction Meeting Discussion

Chief [redacted] led a welcome prayer.

[redacted] provided a safety share and initiated introductions. [redacted] shared that he is based out of Yellowknife and looks forward to learning and listening from everyone during the meeting. Grand Chief [redacted] said he has been in his role for 2.5 years and noted he has been involved in the mining industry for many years. Grand Chief [redacted] shared how his ancestors followed caribou in the Eagle Plains area. He noted the importance of this area to his people today. Grand Chief [redacted] added that he is interested in understanding more about the Eagle Plains Exploration Project (the Project) and Chance Oil and Gas Limited's (Chance) next steps [redacted] was born and raised in Inuvik and often drives through the Eagle Plains area. She noted interest in learning more about the objectives of today's meeting. Richard said he was born in Treaty Seven Territory and is the founding shareholder of Chance (previously known as Northern Cross (Yukon) Limited) [redacted] shared that the name Chance is taken from the Chance sandstone in the Eagle Plain sedimentary basin where oil was first discovered in Yukon in 1959 [redacted] thanked everyone for joining the meeting and said he looked forward to establishing a collaborative, constructive, and respectful relationship with all the participating First Nations. Willard noted he is a Gwitchin citizen born in Tetlit Territory. [redacted] is currently an Advisor for the Lands and Resources Department at Gwitchin Tribal Council (GTC). [redacted] expressed interest in learning more about the Project and shared he had been in his role for 13 months [redacted] said she is a Yukon Gwitchin member who was raised by her grandfather. She has been with Chance for 10 years and is based in Whitehorse, Yukon. [redacted] shared that he is Red River Métis and the Executive Director of the Vuntut Gwitchin First Nation (VGFN). Chief [redacted] was born and raised in Old Crow and noted a background in oil and gas, self-government agreements, land protection and management, and early negotiations. Chief [redacted] said she was previously the Minister of Environment and had extensive experience dealing with oil and gas licensing and permitting. Chief [redacted] also shared that her intention at today's meeting was to listen and create an open dialogue around intentions [redacted] introduced herself and noted she is the Intergovernmental Relations Coordinator for VGFN. Chief [redacted] introduced himself. [redacted] introduced himself and welcomed everyone to the meeting.

[redacted] reviewed the agenda and asked everyone to share proposed changes or suggestions.

[redacted] noted [redacted] from Chance had joined the meeting via speaker phone.

Chief [redacted] said the proposed agenda topics are not where they need to be. Chief [redacted] shared that the Indigenous Nation attendees had intricate technical knowledge of the Project area. Chief [redacted] noted the Indigenous leaders at today's meeting had an internal briefing prior to this meeting. Chief [redacted] asked [redacted] what her role was during the meeting and if Two Worlds Consulting (TWC) was participating in the Project's Impact Benefit Agreement (IBA) process. [redacted] said TWC is not supporting the Project's IBA process and was recently hired to support the Project's engagement scope of work including meeting facilitation and notetaking. [redacted] added that TWC staff were happy to step out at any time if discussions related to the IBA process

were going to take place. Chief [redacted] noted that Grand Chief [redacted] opening comments highlighted the importance of the Project area to all northern Indigenous Nations. She added that the Project's existing IBAs are maturing, and further discussions related to IBAs will be required.

Chief [redacted] shared community concerns for wells that exist on the Project site and the Yukon's definition of employment and income opportunities in the *Yukon Oil and Gas Act*. Other Project-related concerns shared by Chief [redacted] included impacts to the environment, Treaty and Aboriginal Rights, extent of engagement, how Chance plans to engage going forward, permits with First Nation Na-Cho Nyäk Dun (NND), the vision to push north, the removal of 5 northern permits with respect to hydraulic and conventional methodologies, land, water, fish, and caribou protections, and the Executive Committee stage. Chief [redacted] also noted there are outstanding engagement protocols to establish to sustainably build integrity and trust with Elders and communities. She expressed interest in understanding potential request for land use permits to potentially develop or maintain existing lands including and involvement in related discussions. Chief [redacted] noted the importance of re-establishing relationships with all northern Indigenous Nations and acknowledged the history that exists between meeting attendees. Added that the Project area is used by all northern Indigenous Nations and looks forward to having collective conversations going forward to establish new opportunities and protect their inherent rights. Chief Frost [redacted] Chance to clarify their engagement approach going forward (e.g., when do they want to meet, what information is needed etc.). Chief [redacted] said ethical and responsible partnerships that respect people, and the environment are the foundation to how the northern Indigenous Nations govern themselves. They have lived off the land for generations and Chance will need to communicate differently with their people going forward. Acknowledged that trust and integrity is currently lacking at the community-level. Chief [redacted] said her role as Chief is the voice of the people, to deliver messages on behalf of the people to Chance and advance how Chance can move forward in a respectful manner. Chief [redacted] noted Chance had not signed previous agreements with the northern Indigenous Nations. Stated they are not closed for business but are interested in sustainable opportunities rooted in the laws of the land and that is the laws of the people. Chief [redacted] looked forward to identifying priorities to move this process forward.

[redacted] thanked Chief [redacted] for her comments and said Chance is exploring for natural gas and oil resources in the Project area using permits that have already been awarded. He said Chance is looking to understand how each northern Indigenous Nation wishes to be engaged and the best way to share information. [redacted] said Chance is open to economic and environmental stewardship partnerships. He shared that Chance is proposing to conduct smaller-scale exploration activities over a longer period of time to minimize potential environmental impacts and maximize potential Project-related benefits. [redacted] shared that Yukon Government has mandated Chance to conduct further investigations of existing suspended wells dating back to the 1950s/1960s. He said hydrocarbons have been discovered in some suspended wells. Richard noted Chance hired consultants such as EDI, Palmer, and Ausenco (previously Hemmera) to assess potential Project-related effects to the Eagle Plains Basin and support Chance's Environmental Assessment Application to the Yukon Environmental Socio-economic Assessment Board (YESAB). Richard noted Chance has a lot of information to share with the northern Indigenous Nations and would like to further engage each Indigenous Nation to better understand issues that should be addressed through mitigation and/or prevention measures. He added there are up to 30 new exploration wells to be drilled, up to 1,500 square kilometres of

new 3-D seismic data acquisition and up to 2,000 kms of new 2-D seismic data acquisition. Drilling results will determine long-term natural gas/oil extraction within the existing exploration permit areas. [redacted] added that the exploration activities would take place during the winter seasons over an 8–10-year period depending on results as the program unfolds. The exact drilling locations have not yet been determined. [redacted] noted that no hydraulic fracking would take place because the anticipated drilling will evaluate resource potential in geological formations that are not expected to need hydraulic fracturing. He said the camp is located at KM 325 on Dempster Highway and can accommodate around 75 people [redacted] added that the drilling program will occur sequentially rather than all at once. He also shared that natural gas/oil resources from the Project would support local energy security, economic independence, economic diversification, and a reduction of cumulative greenhouse gas (GHG) emissions by transporting fuel over shorter distances.

[redacted] added he had been involved in the Eagle Plains since 1959 and noted the landscape is unique compared to other northern landscapes because there are no lakes, the terrain supports exploration/extraction equipment, and it will be easier to build roads without significantly damaging the environment.

Grand Chief [redacted] noted that he was recording the meeting for GTC's internal minute keeping and requested permission from all meeting attendees. All meeting attendees agreed to the recording. Grand Chief [redacted] said he struggled with the open-ended agenda and thought it was paternalistic. Expressed interest in more structured agendas to avoid wasting anyone's time and to supporting things moving forward. Grand Chief [redacted] said meetings were had with Chance during the COVID-19 pandemic. He suggested a certain level of transparency, respect, and integrity was required to move forward. Grand Chief [redacted] noted he expects transparency, respect, and integrity from anyone working within their Traditional Territory and said there is water under the bridge in terms of this Project.

[redacted] asked Grand Chief [redacted] if the agenda felt vague. Grand Chief [redacted] responded that the agenda felt a bit vague and shared that GTC agendas included an opening prayer, introduction, meeting content, action items, and next steps. Noted members will quickly share if too much was included in the meeting agenda. Grand Chief [redacted] said he had previously heard what [redacted] shared and preferred meetings with a presentation / opportunity to review maps/leases to understand what is being discussed. Grand Chief [redacted] noted GTC represents four Gwitchin councils, and Chance maps reference one of these councils. Grand Chief [redacted] added that the GTC expects Chance to engage all Gwitchin communities/Indian Band Act councils. Noted GTC will support bringing together the right group of people and expressed interest in visiting the Project's camp. Grand Chief [redacted] shared that the Project is in an area where Gwitchin people harvest caribou. Noted compensation should be the last topic of discussion, and instead discussions should be focused on the management of the land, water, resources, environment, and air. Grand Chief [redacted] suggested Chance simplify future meeting agendas and appreciated the effort to move forward together.

[redacted] said she heard there is an interest in building trust and integrity as well as understanding of historic use in and around the Project. She summarized that historic wells and current and future permitting, involving Elders, inherent rights, employment and economic opportunities, respectful and collaborative relationships, community level engagement timelines, and the

protection of land, water, and air resources are important topics to be discussed at future meetings. Erin asked meeting attendees if she heard them correctly. Grand Chief [redacted] added that the key values mentioned were respect, transparency, accountability, and integrity.

Chief [redacted] shared that it is unfortunate how things have gotten to this point and acknowledged the historical relationship between Chance and northern Indigenous Nations. He noted that he was one of four NND Chiefs to go through this process and felt like little had been accomplished to date. He suggested the northern Indigenous Nations wanted to get to work for their children and future generations. Noted the importance of getting right down to the basic facts. Chief [redacted] added that they need to keep a sharp eye on the issue from a political point of view and bring in politicians as needed and move quickly back to the technical folks. He said it is time to put the politics to the side. Shared the politicians are like the star at the top of a Christmas tree and will let information filter down. Chief [redacted] noted the discussions with Chance had been ongoing over the past 12 years. Emphasized the importance of straightening the politics and focusing on arrangements. Chief [redacted] suggested everyone move forward without going back over the past 12 years of deliberations. Noted NND has not had a large role in the Project to date and that the northern Indigenous Nations will charge hell with a snowball together. Thanked everyone for the opportunity to speak.

[redacted] asked if there was anything else that anyone wanted to add to the discussion. Chief [redacted] reflected on the process and the Project. Noted [redacted] had been involved in the region for a long time. Chief [redacted] said her people are fighting for refuge and noted pristine areas and it's significant to use as the refuges. Chief [redacted] said the previous Project application triggered an Executive Committee review and could not determine if there were any adverse effects to the Porcupine caribou herd because of proposed development in the region. She shared the importance of being more confident in numbers and determinations in the YESAB consultation and engagement process. Chief [redacted] expressed concern for the YESAB process. Specifically, caribou, environment, climate change, assessment planning, monitoring and evaluation, triggers for stopping and advancing work, inherent rights, and the full scope/development of the Project. Expressed interest in a broader agreement with Chance to set the bar higher than the *Yukon Oil and Gas Act* and influence Project triggers and remedies to consider environmental vulnerabilities (e.g., halting project operations). Chief [redacted] acknowledged how fragile the environment is currently, especially around climate change and the pressure of resource development. Added that the northern Indigenous Nations want to participate collaboratively in the Project to ensure it is well managed and not going to create long-term environmental degradation. Suggested this approach will create a degree of control for the Gwitchin people which is important for quantifying significant adverse impacts. Noted the significance of assessment, data, management, and planning work. Chief [redacted] said the northern Indigenous Nations will share their interests/concerns with Chance and will stop the process from advancing if it does consider local Indigenous Knowledge. Noted the importance of listening to Elders and their teachings to inform Project management, planning, and decision-making. Chief [redacted] added the importance of upholding sustainability objectives and expects Chance to work more responsibly.

[redacted] shared interest in having a full dialogue on issues, concerns, and values with the northern Indigenous Nations. Noted the Project's intention is to minimize impacts and hopefully create benefits too. Acknowledged that this exchange is required. [redacted] said he felt like Chance was previously delivering information in a one-way direction and hopes to have more of

[redacted] TWC kindly requests Chief [redacted] review and clarify this sentence to make sure it adequately captures what was being shared.

an exchange. Noted Chance is unable to react without feedback and looks forward to doing whatever it takes to address the concerns identified by the northern Indigenous Nations.

Grand Chief [redacted] acknowledged Gwitchin Treaty rights to harvest, including the rights to access to support their harvesting. Noted these rights come with the responsibility to legally and spiritually be stewards of their Traditional Territory. Shared a story about the late Elder [redacted], who travelled by dogsled in the 1960s in and around the Peel River area. Grand Chief [redacted] said the late Elder [redacted] saw smoke and assumed it was a camp. As he approached the smoke, he realized it was a drill rig. This was a troubling experience because late Elder [redacted] did not know who these people were or what they were doing on the land. This experience laid the groundwork for Gwitchin people to form the Gwitchin Comprehensive Land Claim Agreement (GCLCA) to prevent future incidents like this in their Traditional Territory. Grand Chief [redacted] explained the GCLCA was signed in 1991 and this agreement set a principle that non-Indigenous people, businesses, government, or elected agencies were not able to do anything in our Traditional Territory without speaking with the original inhabitants of the land. Noted this includes having the right to say no and share standards around what they are willing to allow. Grand Chief [redacted] shared porcupine caribou is the main concern for GTC as well as impacts to water, air, and the overall ecosystem (which is very fragile). Grand Chief [redacted] said he was not a fan of the term 'traditional knowledge' because it refers to the past, and Gwitchin Knowledge is current. He noted Gwitchin Knowledge Studies help Gwitchin people develop a record of their knowledge for community use purposes and stated the importance of respecting the intellectual property of such information. Expressed interest in advancing discussions around historic and current use of the land and impacts to Treaty rights and access. Grand Chief [redacted] shared that the Gwitchin standard is high for a good a reason.

[redacted] asked Chief [redacted] what collaboration looks like to her community. Chief [redacted] responded that she is at today's meeting to share the perspectives of her community and the standards they are trying to uphold. Noted these standards were established through their laws and agreements. Chief [redacted] said Chance had heard community feedback for over 20 years. Noted the northern Indigenous Nations are not interested in discussing only monetary compensation or relationships. They want to protect the land, water, air, and caribou. Chief [redacted] said there are outstanding questions to be answered around water, hydrology, and the assessment of oil and gas. These conversations will also include the Yukon Government. Chief [redacted] confirmed she had shared how her community would like to see this process move forward and preferred not to speak to her personal feelings. Chief [redacted] asked [redacted] to clarify what he meant by one-way conversation and lacking information. She said this comment was unclear because there is an established process through YESAB to obtain information. Requested further clarification from Chance. [redacted] said Chance has hired consultants to support their assessment and the Project has an interest from learning from the First Nations. [redacted] said he hears about Section 35 rights and mentioned he is looking to understand what those rights are and how the Project could potentially infringe on those rights. [redacted] added that the Chance had conducted baseline studies and offered to provide this information with the First Nations. Expressed interest in receiving First Nation feedback on what Chance has learned to help guide how they develop and manage the Project until conclusion. [redacted] said Chance is trying to develop a pathway to support conversations that will take place under a cooperation agreement including a terms-of-reference. He noted that previously this process did not go far and explained Chance is following this process because it was how mining companies in the Yukon

had moved forward their proposed projects. [redacted] asked the group to confirm if there is a different way of doing it.

Grand Chief [redacted] said he was surprised by the comment [redacted] made about not understanding legal rights. He said the courts look at collaborative agreements and IBAs to clarify the muddy waters. Grand Chief [redacted] said their rights have evolved over the last 30 years. Stated each Indigenous Nation has the inherent right to self-government in their Traditional Territories. Grand Chief [redacted] said if they seem sensitive it is because Chance is looking to occupy a part of their Traditional Territory and as a sovereign nation, they must review that. Noted it would take another 20 years to get an idea of rights. Grand Chief [redacted] expressed interest in clearly understanding timelines to convey this information back to the community level. Noted the Chiefs are spokespeople that have a responsibility to explain to their people what is being proposed. He said the support of Gwitchin will not be possible if he is unable to explain the Project to his people. Grand Chief [redacted] said he used to this type of back-and-forth dialogue. Noted there is often a desire to hold your cards close to your chest for fear of liability. He suggested Chance create frank and open discussions because that is what matters to the Gwitchin people. Shared that some people in the community may be upset around work being conducted in this area. Grand Chief [redacted] asked Chance if they will stop operations if the caribou migrate to the Project area. He explained that is the baseline of what Gwitchin people will expect and the community will also be interested in understanding what Chance is doing in the area to protect caribou and other species. Grand Chief [redacted] acknowledged some effort had been made to protect caribou. As a leader, Grand Chief [redacted] said he needs to be able to answer these questions from the community.

[redacted] said Chance loves feedback and had information to share. Noted Chance is looking to better understand how the northern Indigenous Nations would like to be engaged and how Chance should proceed after today.

Meeting attendees took a break between 3:50 pm – 4:05 pm.

[redacted] said Chief [redacted] wants the whole life cycle of Eagle Plains examined, and it is difficult for Chance because the Project is currently exploratory and does not go beyond that. Shared that the Project will determine if there is anything worth pursuing. If there something worth pursuing is found, then that is a better time to establish economic partnerships since the nature of the resource to be developed will be better understood [redacted] noted that Chief [redacted] understands this process because of the Victoria Gold project. [redacted] reiterated that the proposed Project is the first stage involving 30 wells to get an idea around what resources are available in the Eagle Plains for everyone. He added that pipelines and other works required after exploration will be considered later. [redacted] said Chance is willing to risk their money and assume that it might not work out, but they really hope that it will. Suggested the northern Indigenous Nations may regret getting into something now if it turns out differently because at this stage there is not enough information to move on. [redacted] said the northern Indigenous Nations can evaluate how the Project goes including how the terrain is treated and improvements needed to protect the environment better. [redacted] said Chance is focused on this first stage (exploration). He said that is hoping the northern Indigenous Nations will help Chance with that. Noted exploration is high risk in terms of very uncertain outcomes related to resource determination and they will not want to participate in that. Suggested involvement beyond exploration will be different, including a payoff for all the northern Indigenous Nations.

[redacted] said the exploration phase will create opportunities for businesses and these opportunities will continue even expand into development if the project proceeds beyond exploration.

Grand Chief [redacted] respectfully said they are not interested in any kind of payoff and said that [redacted] comment about payoff was offensive. [redacted] responded that he meant there would be an opportunity to be a full partner in the Project. Grand Chief [redacted] said they have different expectations and are interested in being full partners now. Expressed interest in understanding the nature of the operation and how and understood the long period of time between initial investment. Grand Chief [redacted] shared GTC experienced the false prospect of the Mackenzie Valley Pipeline. Shared that he felt the discussion was not getting anywhere productive and suggested Yukon Government attend the next meeting. Grand Chief [redacted] requested the meeting conclude. Chief [redacted] and Chief [redacted] agreed with Grand Chief [redacted] request to stop the meeting. Chief [redacted] added that they had addressed the major points and want further deliberation with Yukon Government present. Chief [redacted] added that the northern Indigenous Nations have an obligation to the Yukon Environmental and Socioeconomic Assessment Board (YESAB) as well and will take this time to reflect. Noted the importance of fully understanding what is involved in exploration, including the end product. Chief [redacted] said they want to know they did everything possible to protect the environment. Stated the Charter is intrinsic to everything they do. It is founded on Gwitchin ways. Chief [redacted] thanked everyone for making space for this conversation to happen and shared her appreciation.

[redacted] thanked everyone and said Chance would work on pulling together a summary of engagement topics and associated timelines. Noted the clock is ticking on land tenures. Chief [redacted] confirmed their awareness of the clock ticking and suggested the northern Indigenous Nations will get back to Chance with their perspectives [redacted] added that [redacted] booked accommodation in Old Crow in March at Porcupine Camp. Expressed that finding accommodation in Old Crow is a challenge.

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3. Reintroduction Meeting Action Items & Next Steps

Table 2 below details action items and next steps identified during the Reintroduction Meeting.

Table 2: Reintroduction Meeting Action Items & Next Steps

Topic	Action Description	Responsible	Estimated Date
Meeting Minutes	• Review and provide comment on Draft Reintroduction Meeting Minutes with Two Worlds Consulting.	All	February 20, 2023
Meeting Minutes	• Incorporate meeting attendees' feedback on the Draft Reintroduction Meeting Minutes and share a finalized version of the minutes with all attendees for their records.	Two Worlds Consulting	March 1, 2023 (or approximately 2 weeks after receiving feedback from meeting participants)
Meeting Agendas	• Create simplified agendas for future meetings.	Chance	Ongoing
Meeting Format	• Utilize visual aids such as presentation slides and maps during future meetings.	Chance	Ongoing
Next Steps	• Share perspectives with Chance.	GTC, NND, VGFN	TBC

APPENDIX 2-B-25. May 16, 2023, Open House Summary Report

GWICH'IN TRIBAL COUNCIL AND CHANCE OIL AND GAS LIMITED:
INUVIK COMMUNITY OPEN HOUSE SUMMARY REPORT (MAY 16, 2023)



Figure 1: Inuvik (May 2023).

Introduction

Chance Oil and Gas Limited (Chance) is proposing the Eagle Plains Exploration Project (Project) to gain a deeper understanding of the economic viability of oil and natural gas reserves within the Eagle Plains Basin. Proposed project activities are scheduled to take place over for up to 10 years. These activities include:

- Constructing approximately up to 1,500 square kilometers of new 3D seismic lines.
- Constructing approximately up to 2,000 square kilometers of 2D seismic lines.
- Drilling up to 30 wells (5-8 wells per year) during the winter to evaluate the presence of oil and natural gas resources.

Chance is currently preparing its Project Proposal for submission to the Yukon Environmental Socio-economic Assessment Board's (YESAB) Executive Committee in February 2024.

Chance invited Gwich'in Tribal Council (GTC) Participants (Gwich'in Participants) and residents of Inuvik to a Project Overview Open House (Open House) in Inuvik on Tuesday, May 16, 2023. The objectives of the Open House were to:

- Strengthen the relationship and enhance communications between Gwich'in Participants, residents of Inuvik, and Chance.
- Share Project information to support Gwich'in Participants and residents of Inuvik prepare and present views on information shared.

This report summarizes the Open House event including the location, invitation, details, and feedback.

Event Location

The Open House was hosted at the Nihtat Gwich'in Council Board Room in Inuvik, Northwest Territories.

Open House Invitation

On May 11, 2023, Chance sent an event invitation poster to GTC staff to post in Inuvik facilities. This invitation was targeted to Gwich'in Participants and residents of Inuvik (Appendix A). Chance shared the Open House invitation via a rolling advertisement with a local radio station. The invitation provided key information such as event purpose, event location and time, and Chance contact information to share questions and/or feedback about the Open House or the Project.



Figure 2: Open House advertisement at the Nihtat Gwich'in Government building in Inuvik.

Open House Participation

Open house participants included:

- Chance Project Team[1]:
  - Chance.
  - Environmental Dynamics Inc. (EDI).
  - Ecofor; and
  - Two Worlds Consulting (TWC).
- Gwich'in Participants.
- GTC Staff; and
- Residents of Inuvik.

Open House Details

The Open House was held on May 16, 2023, from 4:00 pm to 8:00 pm MDT. Open House attendees[2] were asked to sign-in upon arrival and were given a Project handout (Appendix B). The Project handout included a Project overview, information on the Project assessment process, and proposed Project consultation and engagement activities. Open House attendees who signed in were added to a draw for an opportunity to win door prizes (see page 5 for more information on draw prizes). In total, there were 6 Open House attendees.

Chance posted Photo Permission Posters (Appendix C) around the Nihtat Gwich'in Council Board Room. These posters indicated that Chance would be taking photos at the Open House and that the photos would be used by Chance in public-facing materials. The posters also welcomed Open House attendees to advise facilitators from TWC if they preferred that they and/or their children not be photographed. No Open House attendees requested not to be photographed.

Chance set up posterboards (Appendix D) around the Nihtat Gwich'in Council Board Room to share Project information with Open House attendees. Chance representatives were available to respond to comments and questions while Open House attendees reviewed the posterboards. Posterboards included:

- Eagle Plains Exploration Project
  - This poster included a high-level project description, project benefits to the Yukon, a project map (also showing First Nations' Traditional Territories and Settlement Lands, permit zones, Peel Watershed Planning Region, North Yukon

[1] The Chance Project Team wore name tags to identify their names and the organization they represented.
[2] Open house attendees refers to Gwich'in Participants, GTC Staff, and residents of Inuvik.

Planning Region, and Dawson Planning Region), and a summary of the YESAB Executive Committee assessment process.

- Heritage Resource Management Program
    - This poster included a description of the Project's Heritage Resource Overview Assessment, Heritage Resource Impact Assessment, Systematic Data Recovery Excavation, and current heritage resources management work within the Project area.
- Permafrost and Terrain Mapping
    - This poster included background information on permafrost in the Project area, how terrain and permafrost information inform the project design, surficial geology mapping, and next steps for permafrost data gathering.
- Porcupine Caribou Herd
    - This poster included information on habitat mapping, seasonal ranges based on historic use of the area, caribou distribution and movement, key existing information, and the Project's *Linear Features Study*.
- Wildlife and Habitat Mapping
    - This poster included an ecological land classification plot location map, and information on species such as birds, moose, and American marten in the project area.
- Fisheries and Water
    - This poster identified key findings from fish and aquatic studies, and information on fish sampling locations, water quality, and hydrology.
- Information about Chance, Jobs, and Training.
    - This poster included a Chance company profile, examples of project-related jobs, and related training requirements.
- Chance's Seismic Exploration Program
    - This poster included information on seismic technology, seismic programs, the difference between 2D and 3D seismic, and how Chance is planning to reduce potential seismic-related impacts.

Chance contracted a resident of Inuvik to prepare dinner for Open House attendees. Dinner was served at 5:30 pm MDT. Chance began the Open House by providing a Project Overview Presentation (Appendix E). Open House attendees were encouraged to ask questions about and share comments on the Project during and after the presentation. Chance staff drew prize winners[3] throughout the Open House. Door prizes included:

[3] Open House prize winners had to be present at the time their name was drawn. If an individual was not present at the time their name was drawn, a new name was drawn.

- Two Air North gift cards (eligible for freight and flight).

All Open House attendees were offered Ecofor lanyards and pens.

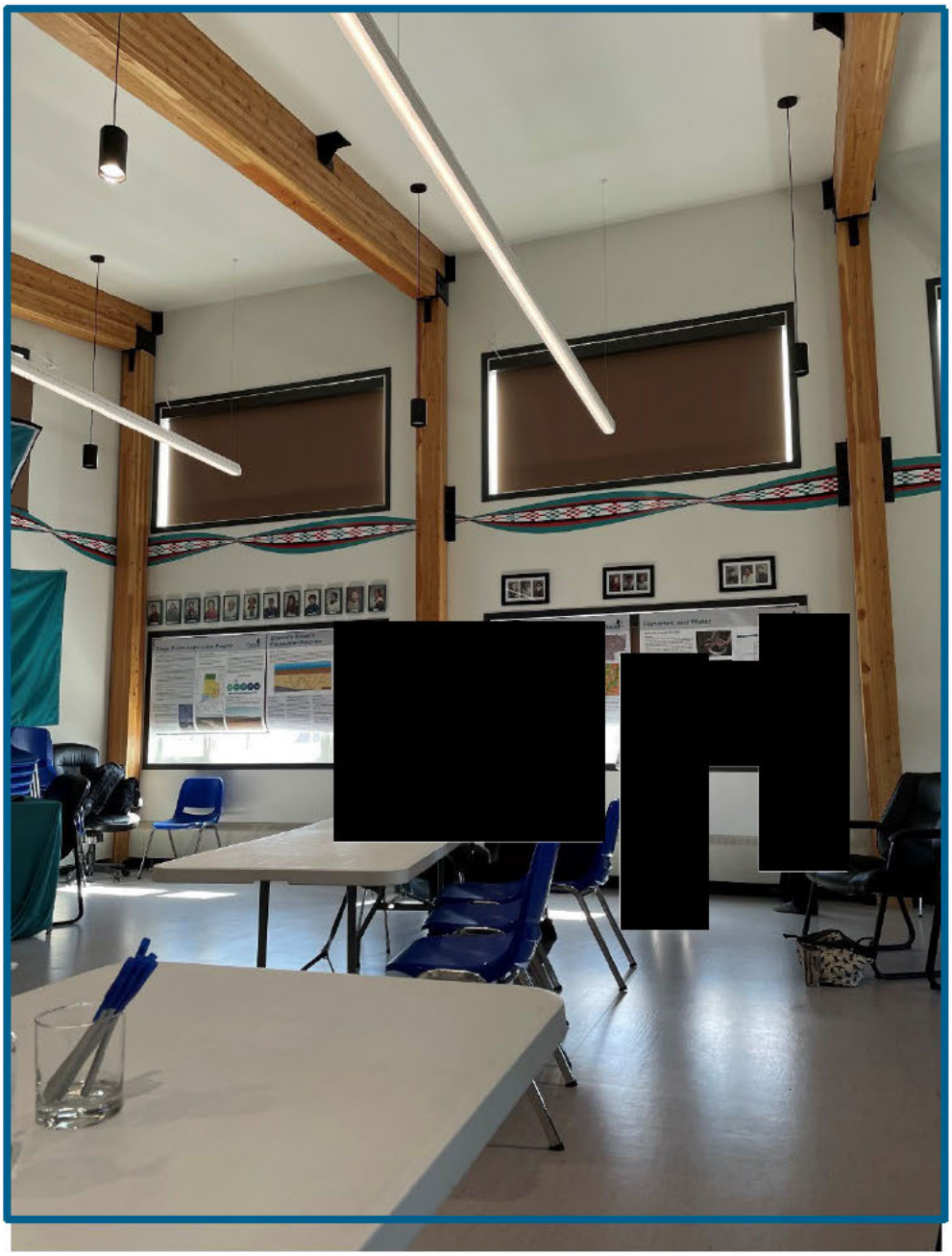

Figure 3: Chance Project Team discussing posterboard information at the Open House with event attendees.

Chance asked Open House attendees to complete the Open House Feedback Form (Appendix F) prior to leaving the event. This form asked attendees:

- How they heard about the Open House.
- How they would rate the Open House.
- If they were able to share their thoughts, ideas, and knowledge during the Open House in a comfortable manner.
- If the Open House helped them learn more about Chance and the Project.
- What they liked most about the Open House and what could be improved upon at future Open House events.
- If they had any additional comments or questions about Chance, the Project, and/or the Open House.
- If they wanted to receive project updates including information on future engagement events.

Open House Feedback Form results are summarized in the Open House Feedback section of this report. Four feedback forms were submitted at the Open House.

Open House Feedback

Table 1 summarizes feedback shared at the Open House by Gwich'in Participants and residents of Inuvik.

Table 1: Open House Feedback

Feedback Topic	Feedback Shared	Chance's Response to Feedback Shared
Wildlife	Asked if the Project considered potential effects to frogs.	Project activities are primarily in winter when frogs will be dispersed and hibernating below the soil surface. Due to primary winter activities and minimal soil disturbance, Project interactions with frogs are expected to be negligible and were not evaluated further.
	Asked if the Project considered potential effects to invertebrates including water insects.	Due to primary winter activities and minimal soil disturbance, Project interactions with invertebrates are expected to be negligible and were not evaluated further.
	Asked if the Project researched how to avoid high quality moose habitat.	The Chance Project Team confirmed that moose habitat had been studied. Added that potential Project-related effects to moose habitat, and mitigation measures to address those effects, would be described in the Project Proposal.
	Suggested Chance monitor wildlife after any damages to permafrost.	The Chance Project Team acknowledged the comment and confirmed there would be ongoing wildlife monitoring throughout the Project.
	Suggested Chance monitor where caribou are standing, as they are always moving.	The Chance Project Team shared they have been working with Porcupine Caribou Herd collar data from the Porcupine Caribou Technical Committee to better understand potential Project-related effects to the Porcupine Caribou Herd.
	Noted that Porcupine Caribou Herd will stick around for a two-week period.	
	Asked if Chance is planning to put collars on moose.	The Chance Project Team confirmed they are not planning to put collars on moose.
	Noted Project activities are not when birds are there, but chickadees may be there.	The Chance Project Team acknowledged the comment and that there may be some overwintering birds in the RSA.

	Noted that the Project area is not good for grizzlies and asked about protection measures for black bears.	Due to primary winter activities and minimal soil disturbance, Project interactions with black bears are expected to be negligible. The Chance Project Team said the Project will avoid active den sites if any are identified.
Vegetation	Asked if there are any berries in the Project area.	The Chance Project Team acknowledged there are berries in the Project area.
	Asked what the difference is between old growth forests and new forests.	The Chance Project Team confirmed that old growth forests are considered areas with trees over 100 years old and newer forests have trees less than 100 years old.
Project Design	Asked about mercury and fire effects on well heads.	The Chance Project Team said no mercury or fire effects are expected.
	Asked Chance to clarify what dog legged means.	The Chance Project Team clarified that the term dog legged referred to crocked or bent. This term was used in reference to the proposed seismic activities for the Project versus more traditional grid seismic lines from the 1990s. A dog-legged method is proposed to reduce potential Project-related effects to predator-prey relationships.
	Asked where Project sewage will go (e.g., river, lake, or land).	The Chance Project Team said all wastewater and sewage will be collected in tanks approved by the Canadian Standards Association and transported offsite for disposal at an approved facility in Fort McPherson.
	Asked about the end users of oil and gas products from the Project.	The Chance Project Team confirmed end users of a potential future extraction project are expected to be folks and businesses from Yukon and Northwest Territories. Confirmed any future extraction Project would undergo an environmental assessment. Confirmed this Project has no end-use product and focuses on exploration.

	Asked how Chance collects seismic data.	The Chance Project Team confirmed seismic data is collected by technology called geophones. Added that geophones are placed in the ground and then picked up by helicopter and taken to a lab for data analysis.
	Asked if Chance is only drilling in the winter.	The Chance Project Team confirmed that Project drilling activities will occur only in the winter.
	Asked how many wells there are so far.	The Chance Project Team confirmed there are six existing wells in the Eagle Plains area. Added that Chance is proposing to drill up to 30 wells over a 10-year period.
	Asked how Chance reclaims well sites.	The Chance Project Team said progressive reclamation will be ongoing throughout the Project. Added that wells will be plugged and covered to support natural revegetation.
Employment	Asked if the Project will be good for young people looking for work.	The Chance Project Team acknowledged the comment and expressed interest to share potential Project-related employment and training opportunities with youth, when available.
	Suggested Chance discuss job opportunities at the high school.	
Community Wellbeing	Asked about potential Project-related effects to Inuvik and mentioned increased community investments could influence their decision-making around extending their existing work contract in Inuvik.	The Chance Project Team confirmed they hired Two Worlds Consulting to assess potential Project-related effects to communities. Added that this assessment is still underway and will be described in the Project Proposal.
	Noted Inuvik needs more community amenities such as Tim Hortons.	The Chance Project Team acknowledged the comment.
	Shared difficulty access fresh produce in the spring after the ice road closes.	The Chance Project Team acknowledged the comment.
Water Quality	Asked if water is monitored for residue.	The Chance Project Team said that water quality will be characterized for the effects assessment.

Heritage Resources	Mentioned the importance of protecting archaeological, historical, and paleontological sites	The Chance Project Team responded that any archaeological and heritage resource discoveries in the Project area will be protected from Project related impacts.
	Someone said the Borden number is a coordinate and known archaeological site that is not to be disturbed.	The Chance Project Team acknowledged the comment. Confirmed potentially affected First Nations would be contacted if archaeological and heritage resources are discovered to follow appropriate protection protocols.
Permafrost and Surficial Geology	Asked how much closer the drill got in areas where permafrost was burned from fire.	The Chance Project Team responded that vegetation affected by wildfire will grow back in 100 to 200 years. Shared that drilling occurs only in the winter and the ground will be frozen. The surface hole may encounter an interval of up to 20 meters that is not bedrock but unconsolidated water saturated soil and ice that is solid only because it is frozen during the winter. Confirmed sensitive permafrost areas will be avoided.
Consultation and Engagement	Suggested Chance advertise future community engagement events in Inuvik at the post office, churches, and the grocery store.	The Chance Project Team acknowledged the comment.
	Asked if Chance is talking to Elders. Added that it is important to listen and follow what Elders say as they have wisdom and know what they are talking about. Noted Elders are not on Facebook. Mentioned the importance of knowing both sides of the story to the best decision is made.	The Chance Project Team acknowledged the comment.

Open House Closing

Chance appreciated the opportunity to host the Open House in Inuvik and learn more about Project-related interests, concerns, and feedback from Gwich'in Participants and residents of Inuvik.

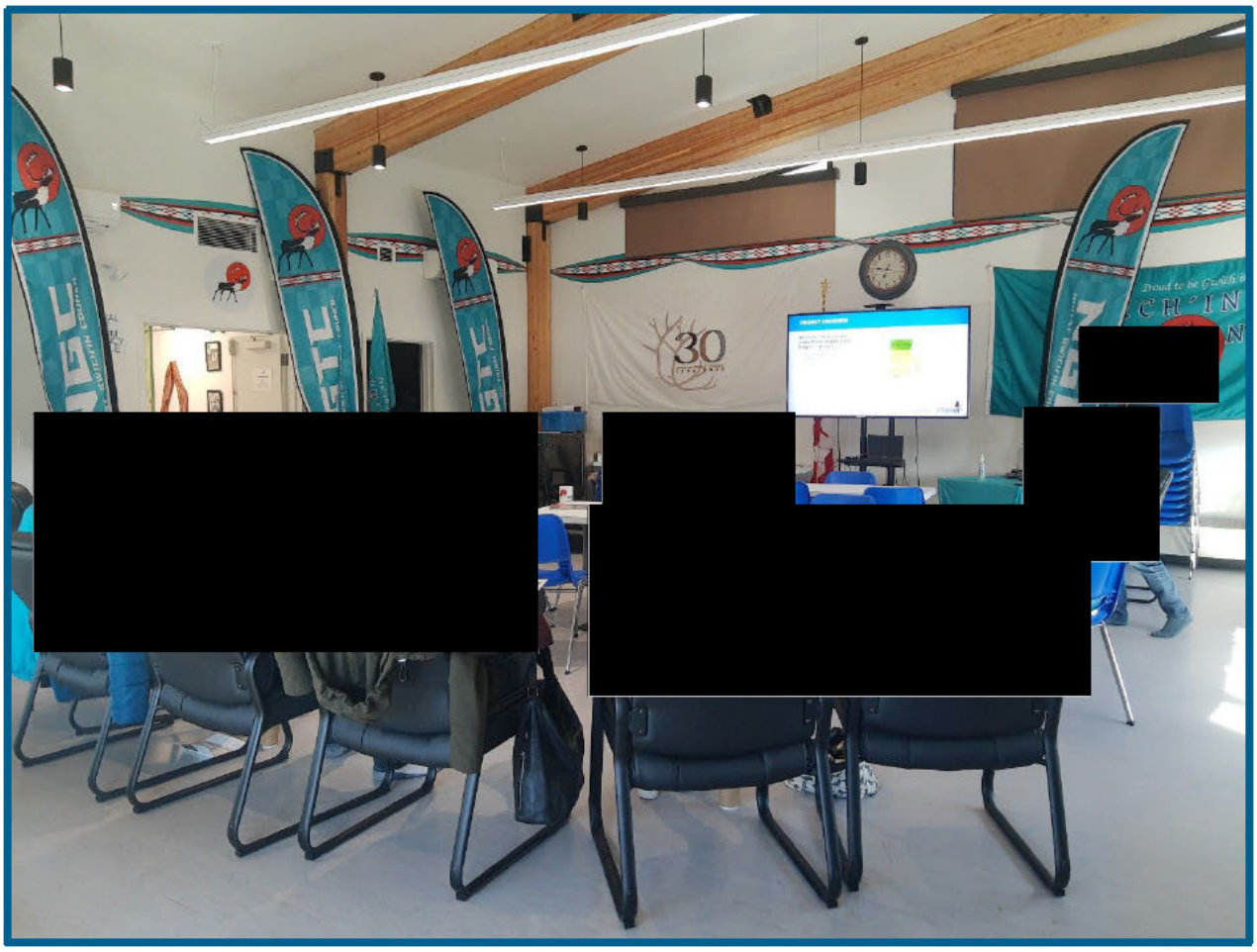

Figure 4: Chance presenting at the Open House.

APPENDIX A

Chance
OIL AND GAS LIMITED

OPEN HOUSE

TUESDAY, MAY 16, 2023

Come learn about Chance Oil and Gas Ltd.'s proposed Eagle Plains Exploration Project! There will be a presentation and opportunities to provide feedback & get involved!

DOORS OPEN FROM 4:00 PM – 8:00 PM

NIHTAT GWICH'IN COUNCIL BOARD ROOM

DOOR PRIZES | FOOD | FREE ENTRANCE

For more information, please contact:
Greg Charlie (e: gcharlie@chanceyukon.ca, p: 867.456.7805) or Cindy Dickson (e: cdickson@chanceyukon.ca, p: 867.456.7805).

APPENDIX B

Eagle Plains Exploration
Project Update - May 2023

Chance
OIL AND GAS LIMITED



Eagle Plains Exploration Project Location

Who is Chance?
What Do We Plan to Do?

- Exploration company focused on assessing Yukon's oil and natural gas potential
- Hoping for government and community support to explore in the Eagle Plains area
- If approved, investigation would include drilling more wells and carrying out seismic surveys for up to 10 years
- Small scale, to provide steadier long-term jobs and contracts to local residents and businesses
- Once investigations are complete, we would know how much oil vs. how much gas, and whether it's economical to proceed to development
- No fracking anticipated, now or later

What We've Been Working On in 2022/2023

- Refining our plans for how to address concerns related to sensitive environmental factors including caribou
- Preparing to start the regulatory process
- Understanding what information regulators and communities want and need
- Collecting scientific data to understand effects and create options for how to manage effects
- Preparing to show communities our plans before entering the regulatory process in 2023







Where and How We Hope to Engage

- Old Crow, Dawson, Mayo, Inuvik, and Whitehorse
- Respect community preferences on timing, approach
- Share our draft plans, get feedback, adjust/amend plans

What Do Our Plans Look Like for Restarting the Regulatory Process?

Relationship-building, Information-sharing

Engagement 1
What is the Project

Engagement 2
What are Project effects, and how could we mitigate them?

Regulatory process begins

When:
May 15 – 18, 2023

Where:
Old Crow, Fort McPherson, Inuvik

With whom:
Vuntut Gwitchin First Nation (VGFN), Gwich'in Tribal Council, and members of the communities of Old Crow, Inuvik, Fort McPherson

What we hope to discuss:
- Who is Chance, what do we stand for?
- What is exploration?
- What is Chance's plan?
- How do communities wish to engage with Chance?
- Methods of engagement:
  - Meetings with leadership
  - Community open houses

When:
June 12 – 15, 2023

Where:
Old Crow, Mayo, Dawson, Inuvik, Whitehorse

With whom:
Vuntut Gwitchin First Nation (VGFN), First Nation Na-cho Nyak Dun (FN NND), Tr'ondëk Hwëch'in (TH), Gwich'in Tribal Council, and members and businesses of the communities of Old Crow, Mayo, Dawson, Inuvik

What we hope to discuss:
- What are the potential positive and negative effects of exploration?
- What are community concerns?
- How could Chance address these concerns?
- Methods of engagement:
  - Meetings with leadership
  - Community open houses
  - Socio-economic interviews

Yukon Environmental and Socioeconomic Assessment Board (YESAB) begins

- The Project will be assessed under YESAB's Executive Committee process
- YESAB will see how Chance has reflected the results of Engagement 1 and Engagement 2 in its submission documents
- Under *Yukon Environmental and Socioeconomic Assessment Act (YESAA 2003)*, YESAB may engage First Nations and communities as needed. Typically, YESAB hosts multiple public comment periods
- Chance will work with YESAB to support their efforts to engage First Nations and communities on the Project
- Chance will be available to share information, listen and learn

CHANCE OIL AND GAS LIMITED

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Cell (867) 333-0010

Calgary Office:
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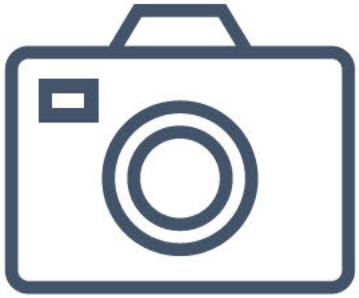
Calgary, AB T2R 1L5
Telephone (403) 699-0055
Fax (403) 699-0044

Greg Charlie
gcharlie@chanceyukon.ca
Cindy Dickson
cdickson@chance.yukon.ca

APPENDIX C

Chance
OIL AND GAS LIMITED

Photo Consent



Photos will be taken at today's event. These images will be used by Chance Oil and Gas Limited in public-facing materials.

If you prefer for you or your child not to be photographed, please speak to the Open House facilitators from Two Worlds Consulting.

APPENDIX D

Eagle Plains Exploration Project

Chance Oil and Gas Limited Overview

Chance Oil and Gas Limited (Chance) is an exploration company focused on assessing oil and natural gas potential in Yukon. Chance was incorporated on September 19, 1994 and has offices in Whitehorse and Calgary.

What is the proposed Eagle Plains Exploration Project?

Chance is proposing a drilling and seismic exploration project ("Eagle Plains Exploration Project" or "Project") to better understand oil and natural gas resources in the Eagle Plain Basin. Chance will conduct the following activities over a period of up to 10 years:

- Construct 1,500 square kilometers (km²) of new 3D seismic lines (i.e., pathways created by removing vegetation to support Project activities)
  - Seismic lines will be constructed over multiple programs (i.e., not all at once)
- Construct 2,000 km² of 2D seismic lines
  - Seismic lines to be constructed during one or multiple of the 3D seismic programs
- Drill up to 30 wells to evaluate the presence of oil and natural and gas resources
  - Drilling to be conducted during the winter
  - Drilling approximately 5-8 wells per year
- Conduct extended flow testing on up to 20 wells to understand how much oil and/or natural gas each well can produce over time
  - This information will help Chance understand if it is economical to propose a new project focused on extracting available oil and natural gas resources in the Project area.

What are the benefits of oil and natural gas to the Yukon?

If the Project finds it is economical and feasible to extract, the proposed Project will:

- Provide less carbon intensive oil and natural gas supply to Yukon, parts of Canada, and other regions across the world
- Create employment and procurement opportunities for First Nations and local/regional businesses
- Reduce local and regional reliance on oil and natural gas resources from other areas in Canada and across the world
- Improve local and regional energy security
- Offset the use of carbon-intensive diesel in Yukon using natural gas for power generation.



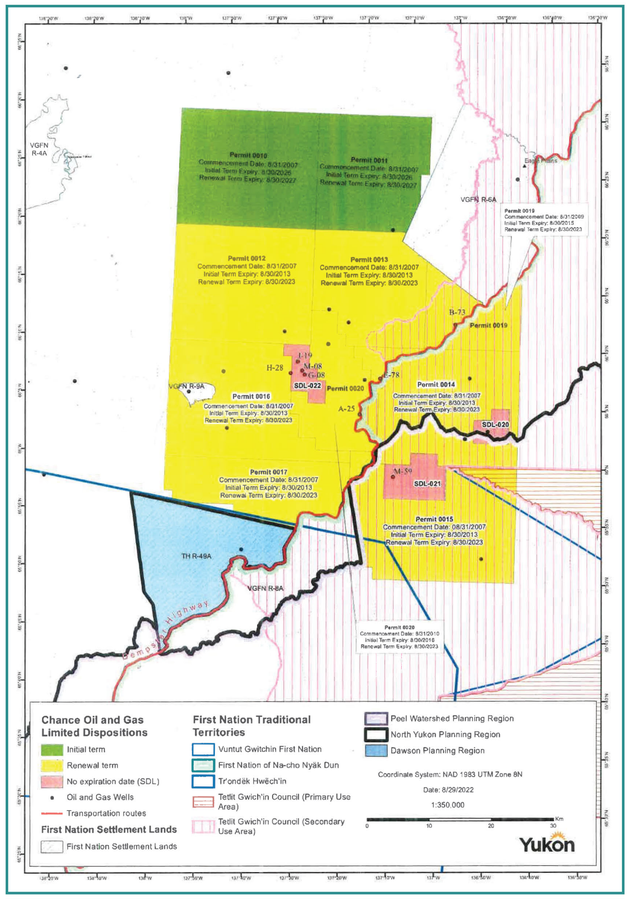
Chance Rig

Where is the Project?

The proposed Project is approximately 2,400 km² located in the territories of:

- First Nation of Na-Cho Nyäk Dun
- Tetlit Gwich'in Council Secondary Use Area
- Vuntut Gwitchin First Nation.

Chance Oil and Gas Limited Dispositions and Wells



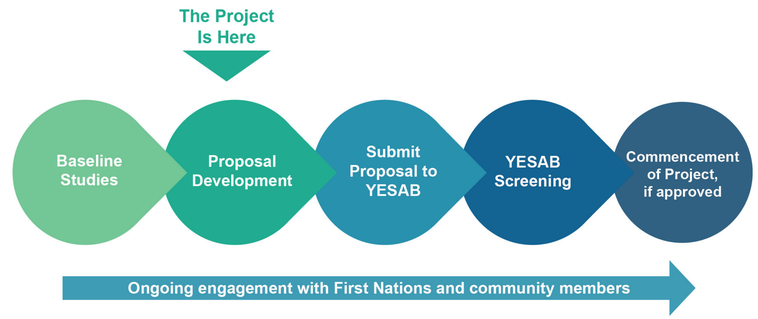


Chance Rig and Camp

What regulatory process does the Project fall under?

The proposed Project will be assessed by the Executive Committee of the Yukon Environmental and Socioeconomic Assessment Board (YESAB), under the *Yukon Environmental and Socioeconomic Assessment Act (YESAA)*. Chance is planning to submit a Project Proposal to YESAB in late 2023. The Project Proposal will reflect feedback from First Nations and community members as well as baseline research conducted by Chance between 2019 – 2023. First Nations and community members will have an opportunity to comment on the Project Proposal in engagement processes and during the YESAB assessment process. Chance will engage First Nations and community members during all stages of the YESAB assessment process.

YESAB Process



First Nation Engagement

Chance appreciates the opportunity to engage and learn from potentially affected First Nations. Chance will incorporate feedback shared during ongoing engagement with First Nations to the Project Proposal and other plans. Chance will provide ongoing Project updates with interested First Nations throughout the life of the Project.



Eagle Plain Basin

Heritage Resource Management Program

Introduction

On behalf of Chance Oil and Gas Ltd. (Chance), Ecofor Consulting Ltd. (Ecofor) has been developing a Heritage Resource Management Program for the Eagle Plains Exploration Project (Project) since 2021. The goals of the Heritage Resource Management Program are to assess the heritage resource potential and sensitivity within the Project Area and make recommendations for the ongoing management of heritage resources. The Heritage Resource Management Program includes three main types of assessments:

1. Heritage Resource Overview Assessment (HROA)

- An HROA involves a desktop review (no fieldwork) including reading through past documents, databases, and maps of the physical/environmental and cultural/historical setting within the Project Area. Information gathered during the desktop review is used to identify known heritage resource sites and predict areas of high potential for undocumented heritage resource sites. The HROA considers landscape features (e.g. mountains, hills, valleys), visible surroundings, closeness to natural resources (e.g. water and food gathering areas), and distance to previously recorded heritage resource sites to determine high potential for undocumented heritage resource sites. Indigenous Knowledge and Traditional Land Use data are also used to enhance the HROA, when available.

2. Heritage Resource Impact Assessment (HRIA)

- An HRIA is the first phase of field study within a Heritage Resource Management Program. It involves visits to any known heritage resource sites that may be affected by exploration activities and the areas of elevated potential identified in the HROA. Specific HRIA tasks include:
  - Pedestrian survey to identify surficial heritage resources and areas with potential for underground heritage resources
  - Shovel testing in areas with confirmed potential for underground heritage resources
  - Documentation of all shovel test locations and heritage resource sites encountered during the HRIA
  - Reporting of all documented heritage resource sites encountered during the HRIA to First Nations, Chance, and the Yukon Government Heritage Resource Unit.

3. Systematic Data Recovery Excavation (SDR)

- An SDR program is used when the Project cannot avoid affecting a heritage resource site. The goal of the SDR program is to mitigate impacts to the site area by collecting detailed site data to develop a strong understanding of the site. Specific SDR tasks include:
  - Shovel testing within the known site area to determine the site boundaries and identify underground heritage resources
  - Excavation of 1 m x 1 m excavation units, arranged as blocks, trenches, or individual units, to recover heritage resource materials
  - Detailed documentation of all heritage resources encountered during the SDR program
  - Reporting of all documented heritage resource sites encountered during the SDR program to First Nations, Chance, and the Yukon Government Heritage Resource Unit.

Heritage Resource Management Program Details

Previous Heritage Resource Management Work Within the Project Area

The Project Area has not been extensively explored for heritage resources, but a few studies have assessed portions of the current footprint. These studies include three permitted HRIAs related to previous oil and gas exploration and one HRIA related to a fibre optic cable project along the Dempster Highway. Three non-permitted studies have also been completed in association with the fibre optic project along the Dempster Highway, including a HROA, an Indigenous Knowledge/Traditional Land Use study, and an update to the original HROA. These studies have identified seven archaeological sites and one Yukon Historic Sites Inventory site.

[redacted]

Current Heritage Resource Management Work Within the Project Area

The Project's Heritage Resource Management Program work began in 2021. An HROA was completed in early 2022. This review identified several thousand areas of high potential for surface and underground heritage resource sites within the 2,400 km^2 area Ecofor archaeologists studied.

In 2022, Ecofor conducted an HRIA program within a 625 km^2 subsection of the Project Area where a new seismic and drilling program has been proposed. A Vuntut Gwitchin First Nation member participated in this HRIA. Work included a helicopter survey throughout this area, a survey on foot, and shovel testing at 12 locations. In total, 228 shovel tests were completed. Shovel tests at location E10 led to the recording of archaeological site [redacted] This site has been flagged as a no-work area. If future phases of the Project are unable to avoid the site area, an SDR program may be considered. No heritage resources were discovered at the other shovel test locations.

Chance and Ecofor will continue to develop the Heritage Resource Management Program. Further HRIA studies are planned for summer 2023. This work will help inform heritage resources management needs of proposed Project activities.

[redacted]

Heritage Resource Management Program

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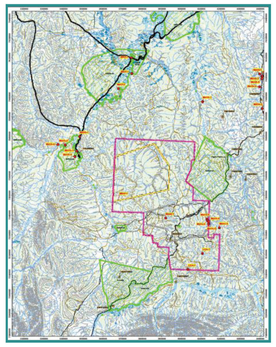

Eagle Plains Overview Map

Heritage Resource Management Program Details

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[redacted]

Permafrost and Terrain Mapping

Background Information on Permafrost

Continuous permafrost is frozen ground that remains below 0°C for more than 2 years. Chance Oil and Gas Ltd's (Chance) proposed Eagle Plains Exploration Project (Project) is entirely within a zone of continuous permafrost. The depth of permafrost below the ground surface varies across the Eagle Plains landscape and throughout the year. Permafrost can be more or less sensitive to disturbances (e.g., drilling), depending on a number of factors, such as ground temperature, ice content, and soil type. Permafrost warmer than -2°C is more likely to thaw as a result of local, minor disturbances to the ground surface, whereas cooler permafrost will likely not thaw from minor disturbances.

Chance needs to understand the terrain and permafrost conditions of the Project Area to design the Project. This information is key for identifying the best areas for the Project's access roads and well pads, for locating gravel for road construction, and for the in-ground placement of drill cuttings. Palmer has mapped the geology of the top layer of ground (what is above the bedrock, also called the surficial geology), determined the state of permafrost throughout the Project Area, and created maps identifying suitable locations for Chance's proposed oil and natural gas exploration activities.

Palmer installed sensors, using a drill that can be carried in a helicopter, to measure ground temperature and frozen/thawed state in the top 1 m of the ground in suitable locations.



Helicopter slinging drill



Drilling with lightweight Talon drill

How Terrain and Permafrost Information Informs the Project

The active layer is the part of the ground that thaws in the summer and refreezes in the winter. Palmer's drilling work shows that the active layer is 0.45 to 0.9 m thick in fine-grained soils, below wetlands, and in valley bottoms. In coarse-grained soils, it is more than 0.9 m thick. Areas recently burned by wildfire have active layers that are more than 1 m thick, possibly much more.



Field Testpit

Ice content information is important, as ground containing lots of ice is more sensitive to disturbances (e.g., drilling) and recovers less quickly than ground containing less ice. Areas with high to moderate amounts of ice were found within wetlands and fine-grained soils. The ice content in these areas makes up more than 20% of the soil, but ice amounts vary a lot and are not the same throughout the soil. Ground with low amounts of ice, (less than 10% of the soil) were found within weathered sandstone bedrock near the surface and within coarse-grained layers of material that can be found alongside fine-grained layers of material containing more ice. Palmer concludes that ground ice content in the Project Area is highly variable (i.e., the amount of ice underground is not the same everywhere). Palmer upgraded the oil and natural gas exploration suitability maps to account for different permafrost conditions.

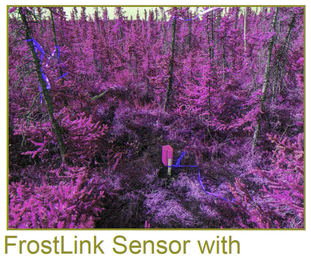
Palmer first collected data from the ground temperature sensors in summer 2022. Cold, stable permafrost was identified in areas with lots of ice on the valley bottom and in a few other areas. One site on a northeast slope within the Project Area has a ground temperature of 3.8°C at 1 m depth, and temperatures are likely similar at locations on similar slopes. Palmer was unable to measure the ground temperatures at 1 m depths at two locations because the equipment malfunctioned.

In places where the shrubs and trees were burned by wildfire 18 years ago, the active layer is more than 1 m thick (and may have thawed down to bedrock) and the 1 m ground temperature is -0.2°C. Permafrost is unlikely to return to its former possible shallower depths due to the site conditions (a lack of vegetation), so permafrost is considered to be naturally disappearing at this site.

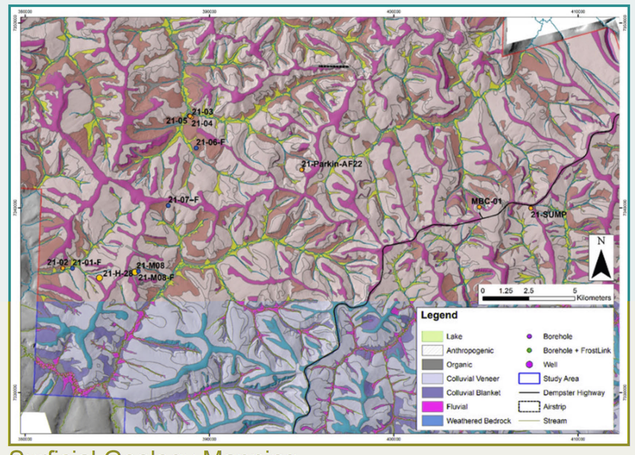
Cold, stable permafrost is preferred for proposed Project activities. Areas with large amounts of ice can either be avoided or protected through appropriate actions. Areas where permafrost is naturally becoming deeper because trees and brush were lost to wildfire should be left to naturally recover (i.e., allow permafrost to slowly re-establish itself) or actions can be taken to help keep the ground cold (e.g., adding an insulating cover to perform the same function as vegetation or installing a thermal management device). Such mitigation would likely result in faster permafrost recovery of these areas.



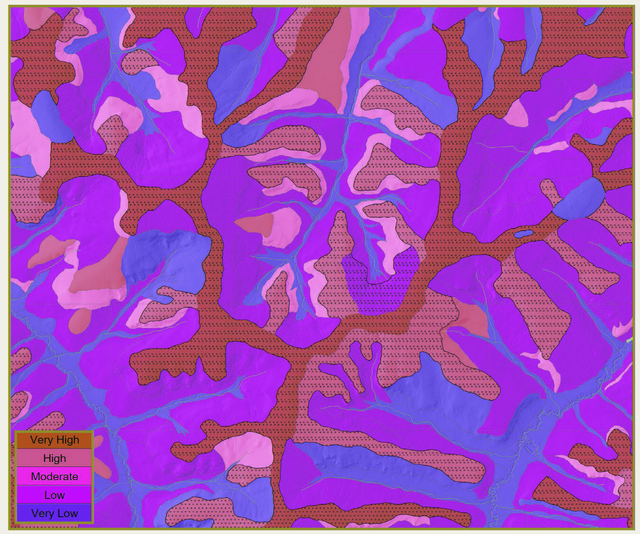
FrostLink Sensor with Plastic Housing



FrostLink Sensor with Steel Housing



Surficial Geology Mapping



Road and Wellpad Suitability for Exploration

Suitability is determined based on surficial geology, permafrost conditions, and drainage. Very high and high suitability are favourable for establishing access roads and wellpads, low and very low suitability are unfavourable for establishing access roads and wellpads. The exploration suitability map assumes no mitigation. Exploration activity that needs to cross less suitable areas can be done responsibly through appropriate mitigation.

Next Steps

Next steps include gathering data from two sensors installed in 2022, replacement of malfunctioning sensors, and installation of six new sensors in summer 2023. The new sensor design is more durable and waterproof and is expected to perform better in the harsh climate.

Porcupine Caribou Herd

Overview

The Porcupine Caribou Herd's annual range extends over large portions of northern Yukon and northeast Alaska. Environmental Dynamics Inc. (EDI) conducted habitat, movement, and linear features studies to:

- Better understand the Eagle Plains Exploration Project (Project) Area with regards to Porcupine Caribou
- Support the assessment of potential Project-related effects to Porcupine Caribou
- Identify ways for the Project to reduce potential Project-related effects to Porcupine Caribou.

Key Existing Information

- The Project overlaps a small proportion of the Porcupine Caribou Herd's late fall and winter ranges
- Based on the past 30 years of data collected from collars placed on caribou to track their movement using GPS, less than 3% of the Porcupine Caribou Herd typically occurs within the Project Area
- Late-fall and winter are less-sensitive periods for Porcupine Caribou
  - During these seasons, Porcupine Caribou are typically in good body condition and are free of insects and other stressors
  - Late-fall and winter are not associated with critical life stages, such as breeding or calving.



Example caribou habitat in Eagle Plains with lots of terrestrial lichen

Habitat Mapping

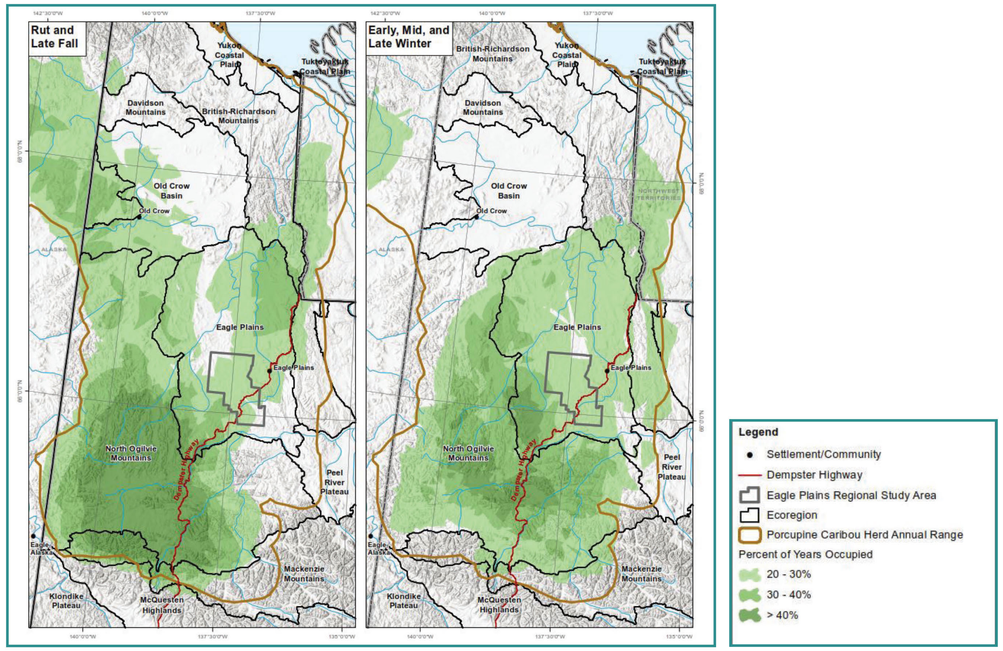
EDI modeled Porcupine Caribou habitat using collar data from the Porcupine Caribou Management Board and vegetation mapping. These models describe the amount, quality, and distribution of important late-fall and winter Porcupine Caribou habitat across the Project Area. Lichen cover was the primary driver of habitat selection by caribou.

Caribou Distribution and Movement

EDI used collar data and studies conducted by the Porcupine Caribou Technical Committee to better understand how much of the Project Area overlaps with the late-fall and winter ranges and movement routes of the Porcupine Caribou Herd.

- Caribou tend to move an average of 8.7 km per day in late-fall and 4.4 km per day in the winter.
- Porcupine Caribou spent half as much time in the Project Area during the late-fall and winter than other parts of their late-fall and winter ranges.

Seasonal Ranges Based on Historic Use



Linear Features Study

Linear features (e.g., roads, powerlines, and trails) can affect how people and wildlife move across the landscape as well as predator-prey relationships. EDI studied existing linear features in the Project Area to evaluate vegetation recovery on linear features and how those lines are used by people and wildlife.

- There are three main types of linear features associated with past oil and gas exploration activities in the Eagle Plains: winter roads, 2D seismic lines (i.e., pathways created by removing vegetation to support oil and gas exploration activities) (5-8 m wide), and 3D seismic lines (1.5-3 m wide)
- Most 2D seismic lines are from oil and gas exploration activities that took place between the 1950s to 1990s
  - 75% of these seismic lines have vegetation growing back with similar species and densities as the nearby vegetation that wasn't disturbed
  - 22% of these seismic lines have vegetation growing back at a faster rate, and are now larger than nearby vegetation that wasn't disturbed
- All 3D lines were created in the winter of 2014, and showed signs of normal regrowth
  - Line of sight down 3D lines was not expected to offer substantial advantage to hunters and/or predators compared to line of sight through areas that were undisturbed
- Signs of caribou or moose use were observed on all types of linear features
- Other than the Dempster Highway, no human use was observed on linear features in winter.



Line of sight down a seismic line in the Eagle Plains



Aerial view of a seismic line in the Eagle Plains

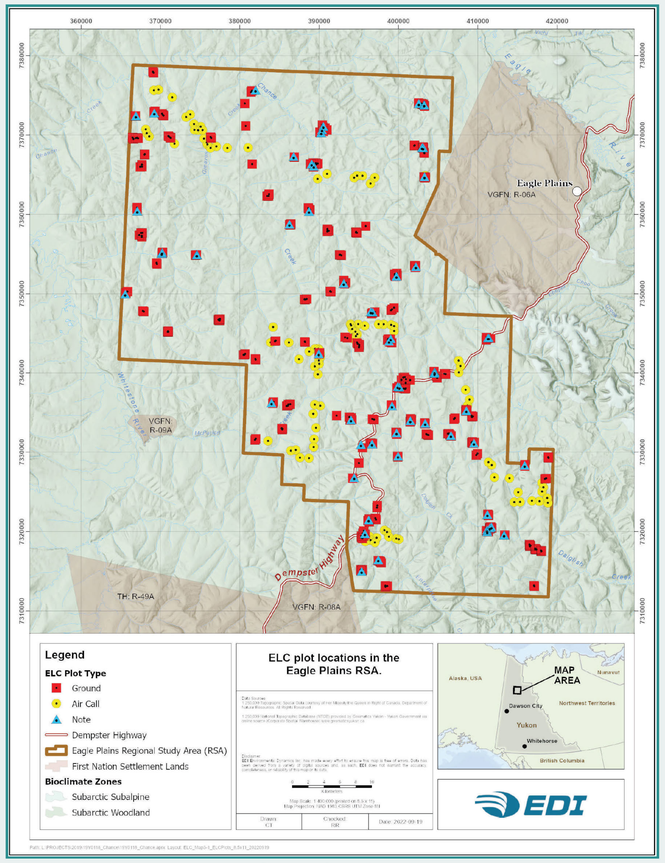
Wildlife and Habitat Mapping

Overview

Chance Oil and Gas Limited (Chance) is committed to protecting wildlife and habitat during the proposed Eagle Plains Exploration Project (Project). Many types of wildlife occur in the Project Area at different times of year. Environmental Dynamics Inc. (EDI) has been gathering information on a number of key species in the Project Area. Field studies, best management practices, working with Indigenous land users and Traditional Knowledge holders, and consultation with communities will help make informed decisions about protecting the environment and wildlife throughout the life of the Project.

Ecological Land Classification - Habitat Mapping

The Yukon Environmental Socio-economic Assessment Board requires that a project proposal have an area-wide ecosystem map. This mapping identifies any rare or sensitive ecosystems in the Project Area and can be used for wildlife habitat mapping. Both ecosystem and habitat mapping can be tools to measure potential Project-related impacts and disturbances to habitat types. They can also be used to reduce potential Project-related effects. EDI completed ecosystem mapping across the Project Area following Yukon standards for Ecological Landscape Classification.



Ecological Landscape Classification Plot Locations

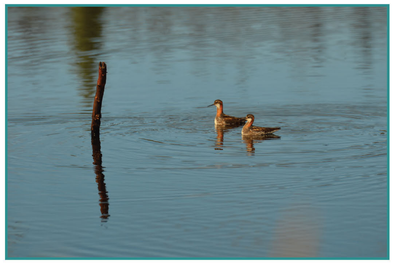
Birds

Due to the remote location of the Project Area, existing knowledge on bird presence was limited. EDI conducted point count surveys and wetland bird surveys in the Project Area in June 2019. A total of 52 species of birds were detected, including four species at risk: Red-necked Phalarope, Common Nighthawk, Olive-sided Flycatcher, and Rusty Blackbird. The number of species and total bird abundance were both well-distributed across the habitats of the Project Area. Most birds are expected to be absent from the Project Area during winter months.


Lincolns Sparrow


Rock Ptarmigan


Spotted Sandpiper


Red-necked Phalarope

American Marten

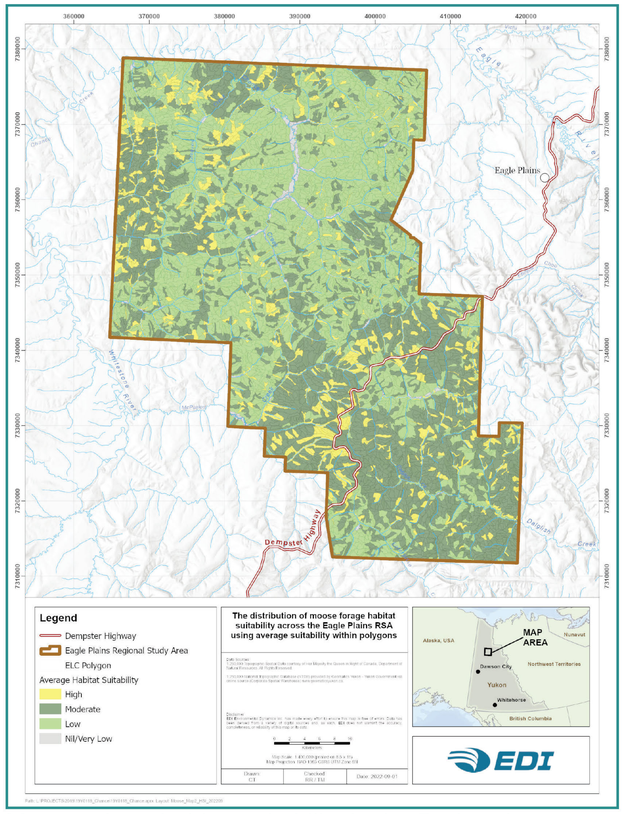
Marten is an indicator species for mature and old forest values and is important to local communities as a furbearer. EDI developed a habitat model to understand the amount, quality, and distribution of habitat for this species. The majority (60%) of the Project Area is made up of low-quality habitat. High-quality habitat, found in 16% of the Project Area, is associated with mesic, spruce-dominant ecosites in mature to old forests.

Moose

Formal population surveys of moose have not been conducted in the Project Area but local knowledge suggests that, while moose densities in Eagle Plains are relatively low compared to areas in southern Yukon, they are relatively high compared to other areas in northern Yukon. Winter is the most limiting season for moose due to reduced food availability and greater energy demands from cold temperatures and the extra effort to travel through snow. EDI developed a habitat model to understand winter moose habitat amount, quality, and distribution in the Project Area. The model identified widespread moderate- and low-quality habitat, with only a small amount of high-quality habitat present.



Willow shrubs browsed by moose in the Project Area



Moose winter habitat suitability in the Project Area

Fisheries and Water

Fish and Aquatic Studies

Overview

There is very little information available on fish populations in the Eagle Plains Area. In order to gain a better understanding of where and when fish are there, EDI conducted studies in 2019 and 2020. These studies included compiling historic info, assembling available spatial data on streams, conducting field studies in 2019-2020, and developing a model that could be used to tell the chances of fish being present in streams in the Project Area. Field studies occurred in July/August 2019, when the presence of fish was expected to be its highest, and again in March 2020, when the availability of overwintering fish habitat was expected to be at its lowest.

Key Findings

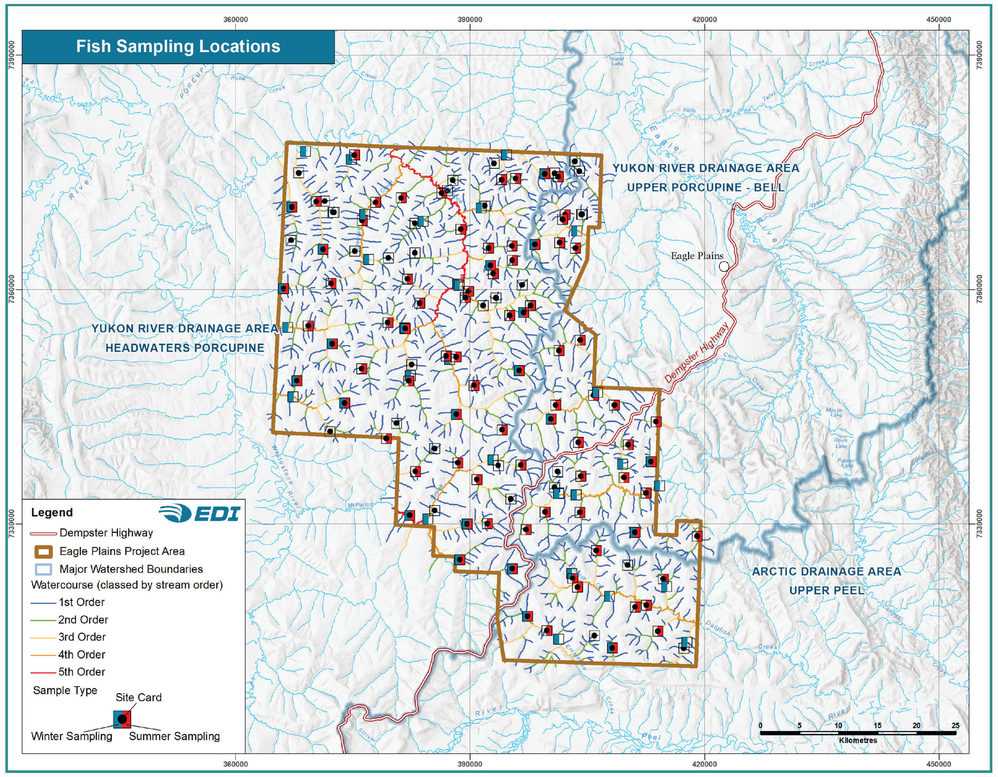
- Six species of fish were observed within or immediately next to the Project Area. This included Arctic grayling, slimy sculpin, longnose sucker, burbot, round whitefish, and lake whitefish. All of these species, with the exception of lake whitefish, were observed during the summer 2019 fish surveys.
  - During the summer, Arctic grayling were around the most. They were the only species found in all types of streams.
- Larger streams generally had better habitat for fish such as higher water volume and better water quality (e.g., dissolved oxygen levels). EDI found that the bigger the stream, the more likely the fish were there.
- During winter, fish habitat becomes very limited due to reduced water flow and reduced water quality. Smaller streams had no water in the winter. In bigger streams, water was limited to deeper pools and dissolved oxygen levels were too low to support overwintering fish.



Arctic Grayling caught during fish sampling



Electrofishing sampling during summer 2019



The 'order' is the type of stream, 1 is the smallest and 5 is the biggest. Clear sitecards mean that no sampling was done in 2019/2020, but there is historic information that was used in the study.

Water Quality and Hydrology

Overview

The project area contains 1,467 streams, many of which are smaller headwater streams. During summer 2019 and winter 2020, EDI collected water samples from five locations within the Project Area and five locations downstream. Eight of these sites match regional sites previously sampled by Yukon Government Water Resources Branch. EDI then combined the water quality data they collected with historic data available from Environment and Climate Change Canada, Yukon Government Water Resources Branch, and Water Survey of Canada.



Example of brown-stained water that is common in streams within the Project Area



Example of a stream in the Project Area

Key Information and Findings

- Surface water quality was similar across the Project Area. Surface water was generally neutral to slightly acidic, typical for boggy northern landscapes. Turbidity (concentration of suspended sediments) changed from stream to stream, likely as a result of melting permafrost causing slumping of stream banks.
- Some metal concentrations, including aluminum, cadmium, copper, iron, and manganese, were present throughout the Project Area at levels higher than Environment Guidelines. Select metals like arsenic and selenium also exceeded guidelines in isolated samples. Given the lack of development near sampling locations, these high levels of metals are likely naturally occurring.
- Dissolved oxygen is consistently low in all streams surveyed in the Project Area during the winter. It is suspected that most fish migrate out of the Project Area in the winter, to areas where the water conditions better support their survival.

Information about Chance, Jobs, and Training

Chance's Company Profile

Chance Oil and Gas Ltd. (Chance) is a Canadian-owned private company incorporated in the Yukon. Chance's head office is located in Calgary, but its team members are based in both Calgary and Whitehorse.

Key Members of Chance's Team:

- Mike Chernoff, Chairman and CEO
- Richard Wyman, President
- Greg Charlie, VP Government and Community Relations
- Cindy Dickson, Regulatory, Environmental and Community Relations Director
- Lynn O'Neil, Corporate Secretary

Chance's Exploration Objectives

The business plan of the company is to explore for, and in the future potentially develop, oil and natural gas resources in Eagle Plains to help meet the energy needs of the Yukon and/or other markets.

Chance's exploration objectives includes:

- Drill up to 30 wells to evaluate resource potential
- Undertake the exploration program on a small scale over a long period of time (i.e., up to 10 years) in order to minimize environmental and social impacts
- Operate as continuously as possible to provide steady employment, to become more efficient over time, and to reduce costs and disruptions associated with starting up and shutting down
- Involve local and regional businesses
- Discover sufficient oil and natural gas resources to support future development of oil and gas.


Worker at camp


Operator



Annual inspection of bottom suspended wells

Some Examples of Jobs

Drilling Program

- Wellsite Supervisor
- Service Rig
- Security
- Wireline Crew
- Slickline Crew
- Truck drivers/operators (Water Tank, Vacuum Truck, Picker / Bed Truck, Fuel Truck)
- Flow Test Crews
- Tool hand
- Cementing Crew
- Wildlife Monitor
- Heritage Monitor
- Road/Trail Construction and Maintenance

Seismic Program

- Line Preparation Supervisor
- Equipment Operators
- Survey Coordinator
- Surveyor
- Source Preparation Supervisor
- Equipment Helpers
- Cruisers
- Slashers
- Packers
- Water Truck Driver
- Line Crew
- Wildlife Monitor
- Heritage Monitor
- Road/Trail Construction and Maintenance

General Camp Operations

- Nurse Practitioner/Medic
- Camp Cooks
- Office Staff
- Camp attendants
- Maintenance and Cleaning Staff

Project Workforce

Chance's workforce is limited by the size of its camp. The Chance Camp can hold a maximum of 75 - 80 people. It's also possible that additional workers could stay at Eagle Plains Hotel.

Chance will work with First Nations to maximize their involvement. One of Chance's main objectives is to provide as much work and contracts to First Nation / Yukon partners as possible.

Training Requirements

Basic training required by all project workers:

- Workplace Hazardous Materials Information System (WHMIS)
- Hydrogen Sulphide Alive
- Wildlife Awareness
- Emergency First Aid/Wilderness First Aid Training
- Common Safety Orientation

Additional and advanced training (varies by job position):

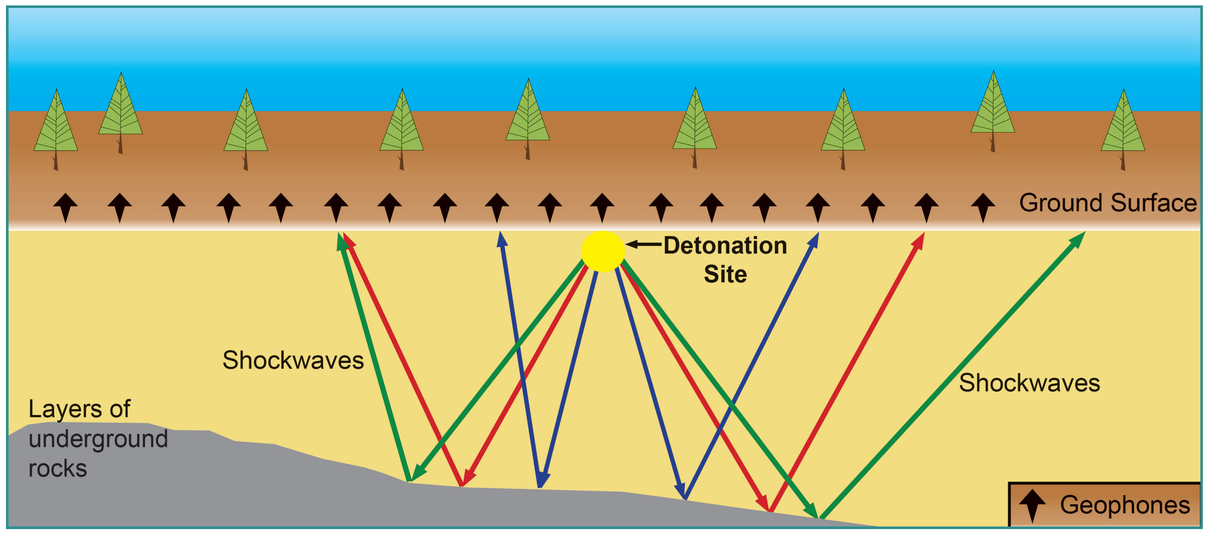
- Food Safe
- ATV
- Chainsaw (Level 1)
- Transportation of Dangerous Goods
- Wildlife/Environmental monitoring training
- Driving licenses (Class 1 and 3)
- Well Service Blowout Prevention
- Confined Space Entry and Monitor
- Fall Protection from Rig Work
- Oilfield Driver Awareness


Annual inspection of bottom suspended wells

Chance's Seismic Exploration Program

What is Seismic?

Seismic technology is used to record and study the earth's layers. Explosives are put in a hole underground (approximately 6m deep) and then that hole is sealed. When the explosives go off, the only sound heard above ground is a dull thud. That sound is similar to that of a passing diesel truck and only lasts about one second. The explosion sends shocks waves down into the ground. Those shock waves bounce back in a variety of different ways off the layers of underground rock. They are then recorded on the surface using equipment called geophones. Information recorded by geophones allows experts to create images of the layers of rock underground and find areas in the earth that may have oil or gas.



How seismic technology works. In this example it is 2D seismic because it is a single line.

Seismic Programs

Chance's seismic programs will help identify the general depths and locations of oil and gas reserves below the surface. Having this information will help decide the best locations for wells and help reduce the number of wells needed for exploration. The seismic programs propose up to 1500 km² of 3D seismic and 2000km of 2D seismic. The programs will take up to 5 to 10 years.

What is the difference between 2D and 3D?

2D seismic data is gathered by putting the geophones and shooting holes with dynamite in one line. 2D seismic is less expensive and needs less lines. They are measured by certain lengths (e.g., 2000 km of 2D seismic).

3D seismic data is gathered by spreading out the geophones in a grid pattern. The source lines (where dynamite is used) will run north/south direction while the receiver lines (geophones) will run east/west director. This is why 3D seismic is measured in area (e.g., 1500 km^2). 3D seismic provides a 3D understanding of the earth's layers. This provides better information on where the oil and gas are located.

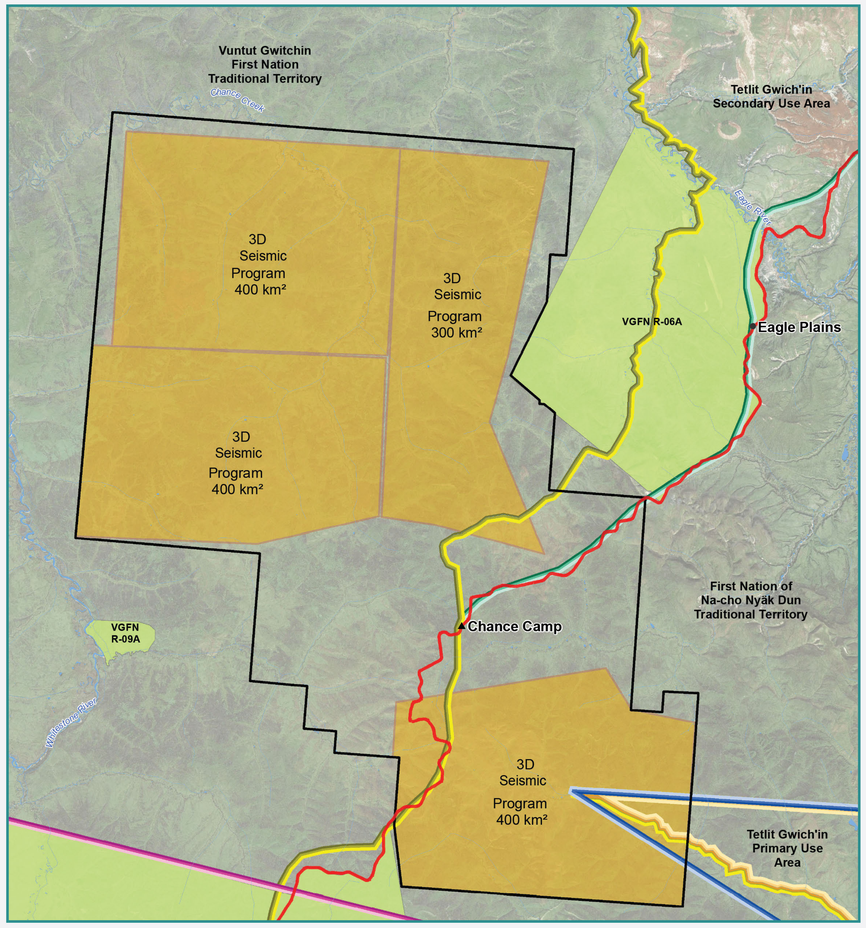
2D lines and 3D lines can overlap each other and take place in the same area.

Reducing Disturbances

In order to reduce the impact of the seismic lines on the environment, Chance will:

- Use old lines, previously burnt areas, and natural open areas, instead of clearing vegetation
- Prepare lines in winter to protect ground cover and vegetation.
- Use zigzags and curves in the lines to make them harder to see and reduce predator line-of-sight.
- Using rough mulching, which only takes off branches of trees. The trunk and roots are left intact to preserve the forest.
- Doglegs will be used where lines meet roads so they can't easily be seen by drivers.
- Remote detonate in summer to avoid times when caribou are present and to maximize hours worked.

Chance Project Area Yukon 3D Seismic Areas



Legend

- Chance Camp
- Chance Project Area
- 3D Seismic Program Area
- Dempster Highway
- Watercourse
- Waterbody
- Protected Area

First Nation Traditional Territories

- First Nation of Na-cho Nyäk Dun
- Tetlit Gwich'in Primary Use Area
- Tetlit Gwich'in Council Secondary Use Area
- Tr'ondëk Hwëch'in
- Vuntut Gwitchin First Nation

First Nation Settlement Lands

- Surface and Subsurface Rights

APPENDIX E

Chance Oil and Gas Limited's Eagle Plains Exploration Project

Community Open House

May 2023



DRAFT AGENDA

1. Introductions
2. Chance Oil and Gas Limited Overview
3. Project Overview
4. Next Steps
5. Questions and Answers



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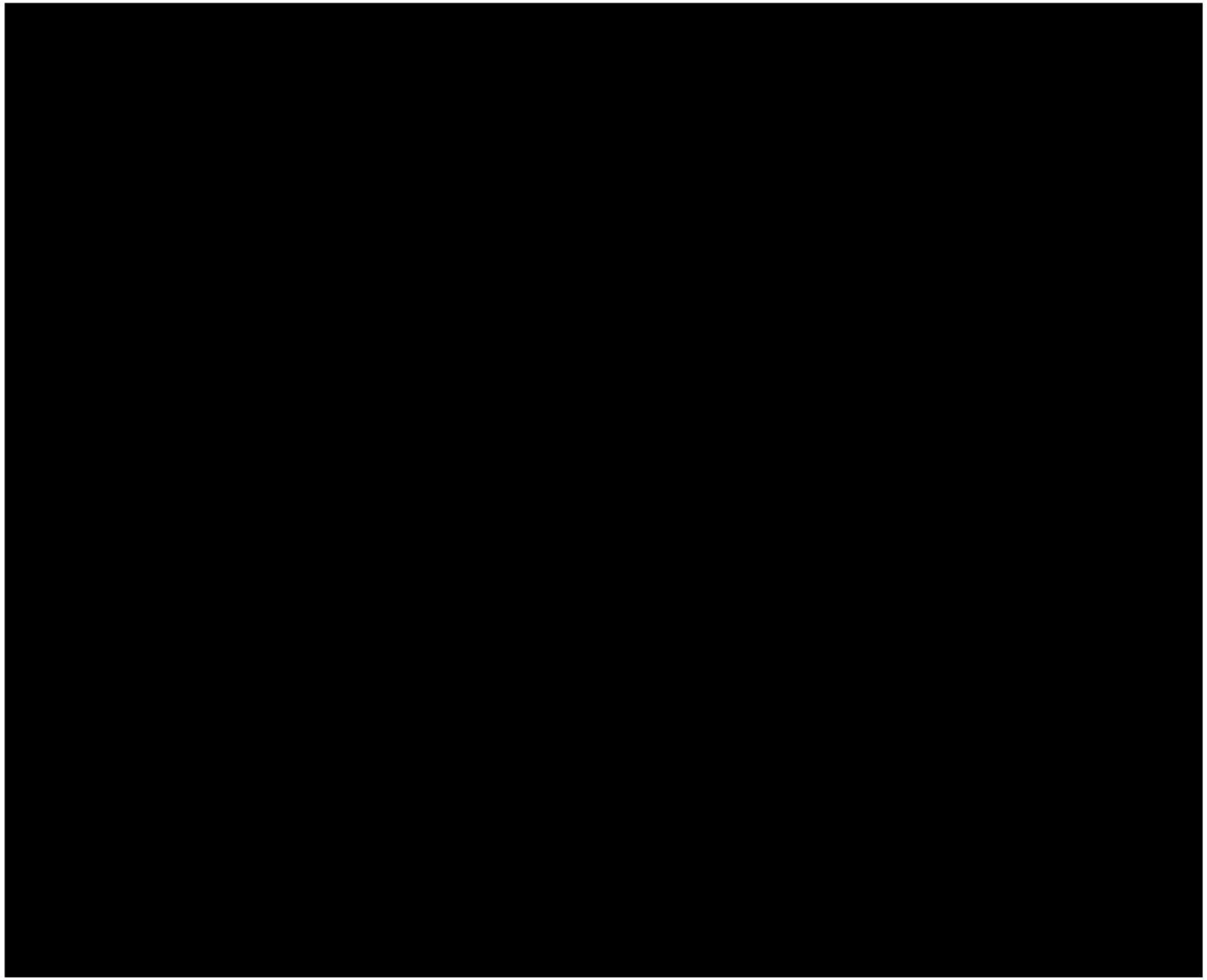
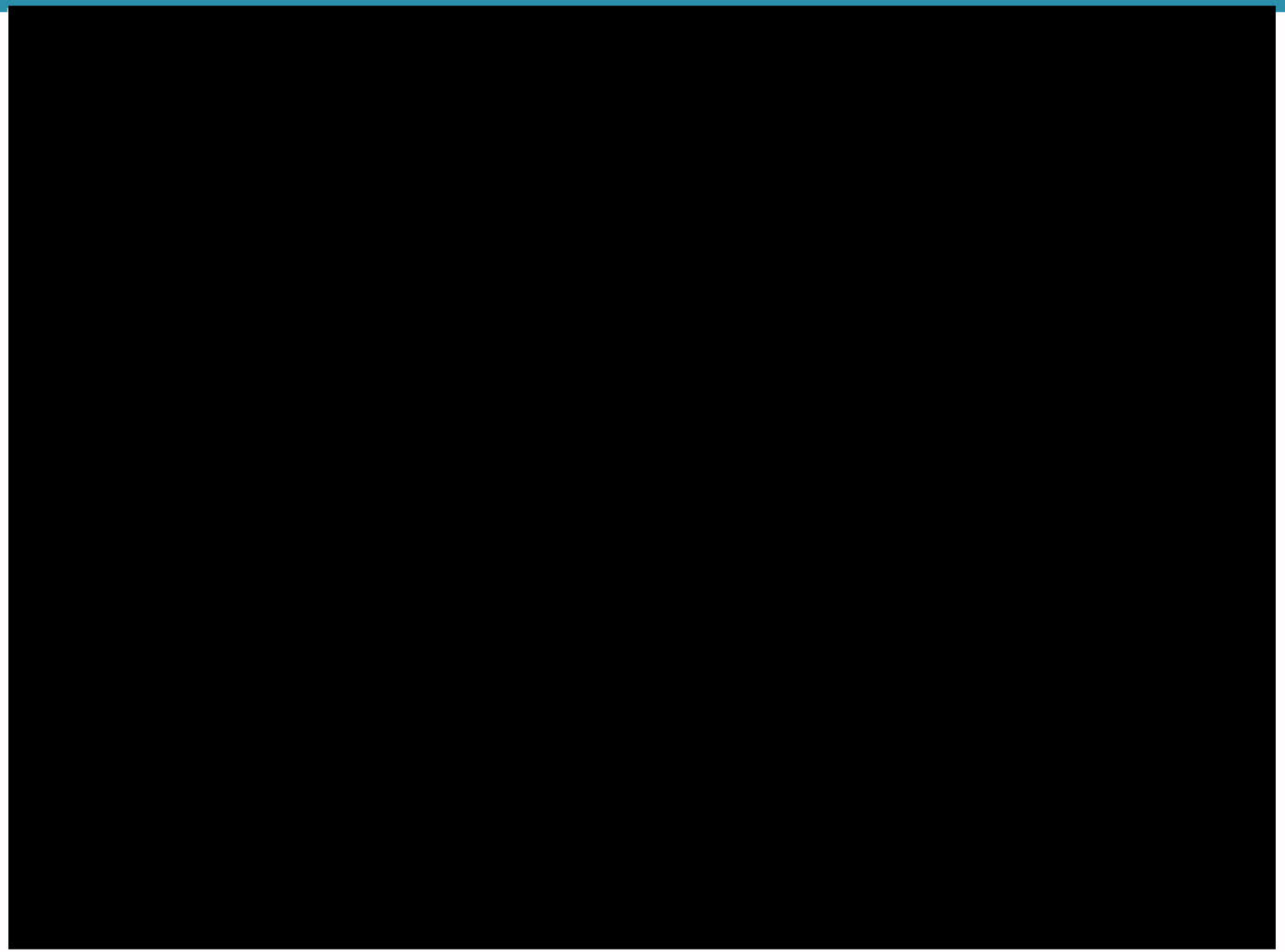
INTRODUCTIONS



INTRODUCTIONS



INTRODUCTIONS



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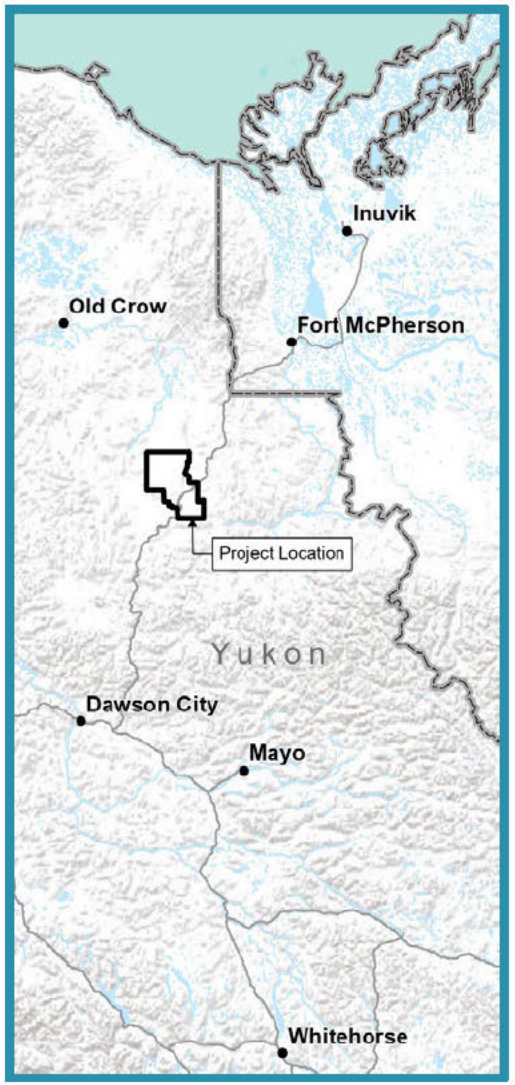
CHANCE OIL AND GAS LIMITED OVERVIEW

Background Information

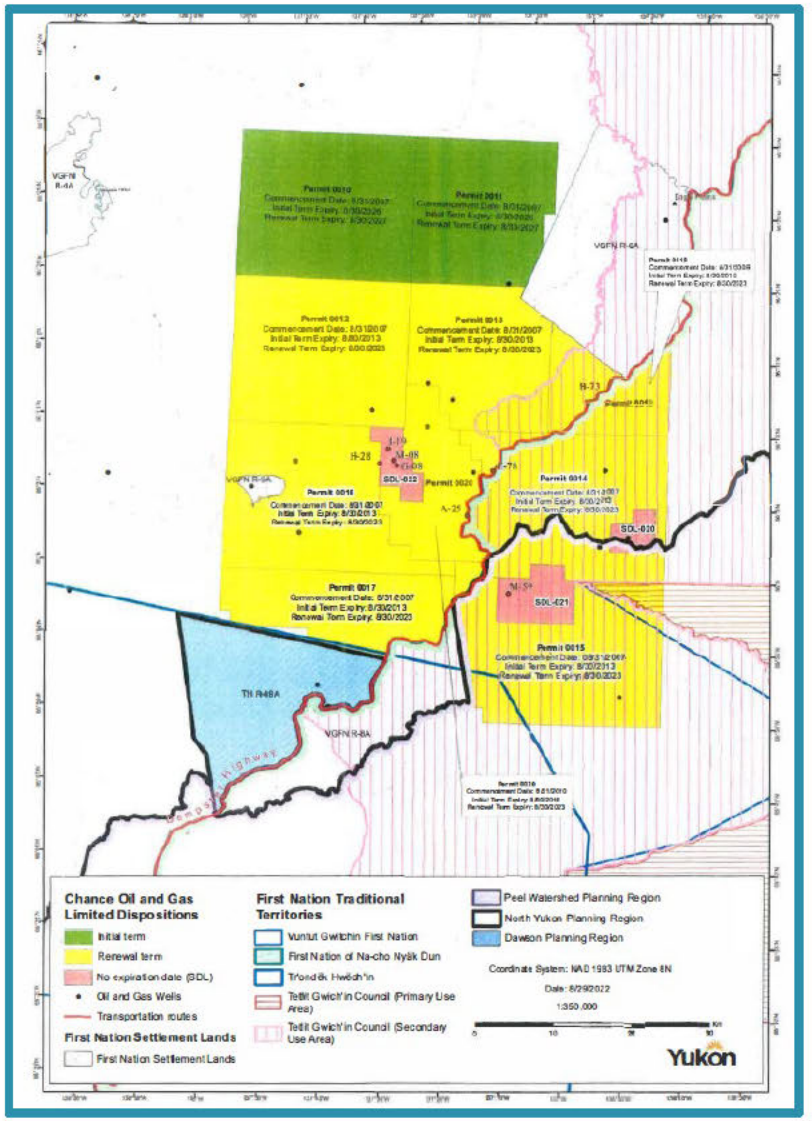
- Incorporated on September 19, 1994
- Offices in Whitehorse and Calgary
- Exploration company focused on assessing oil and natural gas potential in Yukon



PROJECT OVERVIEW

Where is the proposed Eagle Plains Exploration Project ("Project")?

- The proposed Project is located in the territories of:
  - First Nation of Na-Cho Nyäk Dun
  - Gwich'in Tribal Council
  - Tr'ondek Hwech'in
  - Vuntut Gwitchin First Nation



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PROJECT OVERVIEW

What is it the proposed Project?

- Drilling and seismic exploration project to better understand oil and natural gas resources in the Eagle Plain Basin
    - If sufficient oil and/or natural gas resources are discovered, Chance will propose to conduct a future extraction project
    - Any future project will undergo additional assessment, consultation, and engagement



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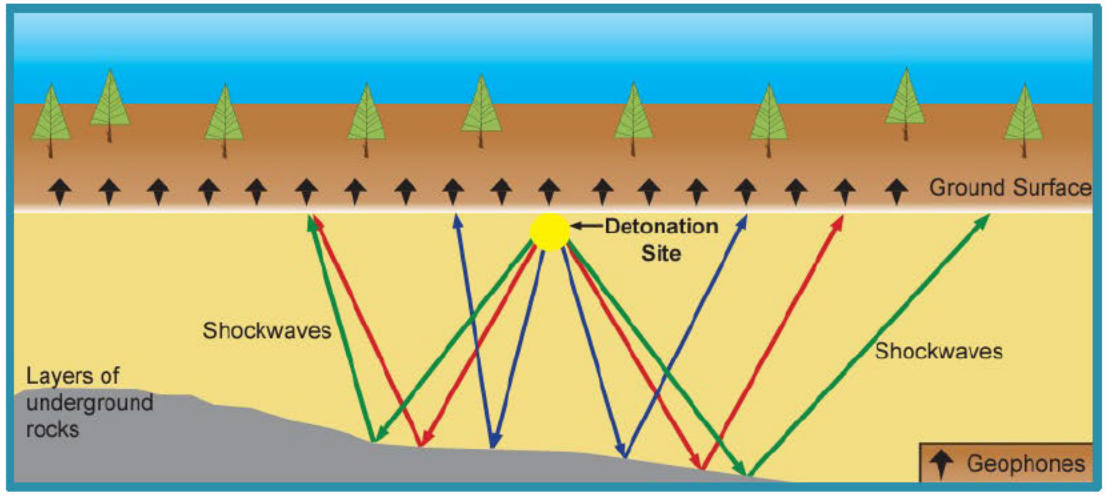
PROJECT OVERVIEW

How is Chance proposing to evaluate oil and natural gas resources in the Eagle Plain Basin?

- Seismic programs will help identify the general depths and locations of oil and gas reserves below the surface. Chance will use this information to:
  - Decide the best locations for wells
  - Reduce the number of wells needed for exploration
- The seismic programs include:
  - 1,500 sq kms of new 3D seismic to be undertaken over the course of several programs
  - 2,000 kms of 2D seismic could be integrated into one or more of the 3D seismic programs



Seismic technology *is used to record and study the earth's layers. Explosives are put in a hole underground (approximately 6m deep) and then that hole is sealed. When the explosives go off, the only sound heard above ground is a dull thud. The explosion sends shocks waves down into the ground. Those shock waves bounce back in a variety of different ways off the layers of underground rock. They are then recorded on the surface using equipment called geophones. Information recorded by geophones allows experts to create images of the layers of rock underground and find areas in the earth that may have oil or gas.*

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PROJECT OVERVIEW

How is Chance proposing to evaluate oil and natural gas resources in the Eagle Plain Basin?

- Drill up to 30 wells to evaluate presence oil and natural gas resources
    - Drilling to be conducted during the winter
    - Drilling approx. 5–8 wells / year
- Conduct extended flow testing on up to 20 wells to understand how much oil and/or natural gas each well can produce over time
    - This information will help Chance understand if it is economical to propose a new project focused on extracting available oil and natural gas resources in the Project area



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PROJECT OVERVIEW

What other Project activities are required to support the proposed drilling program?

- Use of existing Chance camp
  - Capacity: 75 – 80 people
- Use of an existing airstrip
- Construction of winter access roads
- Construction of a winter airstrip



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PROJECT OVERVIEW

What is the purpose of the Project?

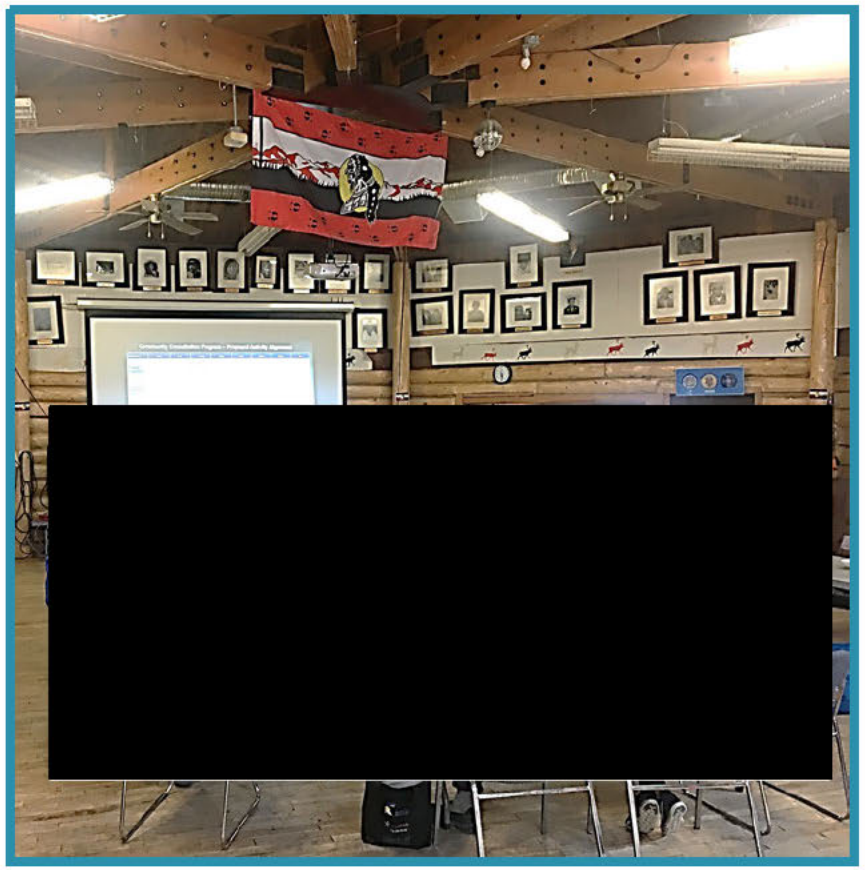
- Provide less carbon intensive oil and natural gas supply to Yukon, parts of Canada, and other regions across the world
- Reduce local and regional reliance on oil and natural gas resources from other areas in Canada and across the world
- Improve local and regional energy security
- Offset the use of carbon-intensive diesel in Yukon using natural gas for power generation
- Create employment and procurement opportunities for First Nations and local/regional businesses



PROJECT OVERVIEW

What regulatory process does the proposed Project fall under?

- The proposed Project will be assessed by the Executive Committee of the Yukon Environmental Socioeconomic Assessment Board (YESAB)
- Per the *Yukon Environmental Socioeconomic Assessment Act*, Chance is planning to submit a Project Proposal to YESAB in Q4, 2023
    - This proposal will reflect feedback from First Nations and community members as well as baseline research conducted by Chance between 2019 – 2023
- First Nations and community members will have an opportunity to comment on the proposal in engagement processes and during the YESAB assessment process
- Chance will engage First Nations and community members during all stages of the YESAB assessment process



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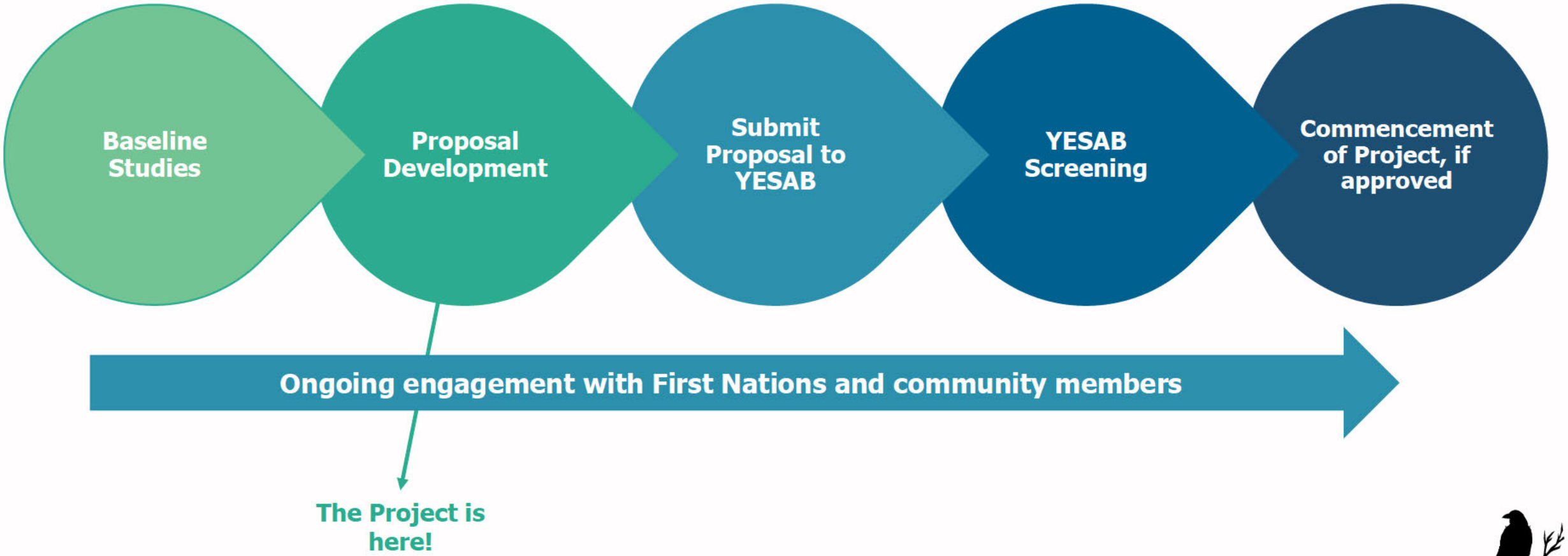
PROJECT OVERVIEW

Where in the YESAB process is the proposed Project?



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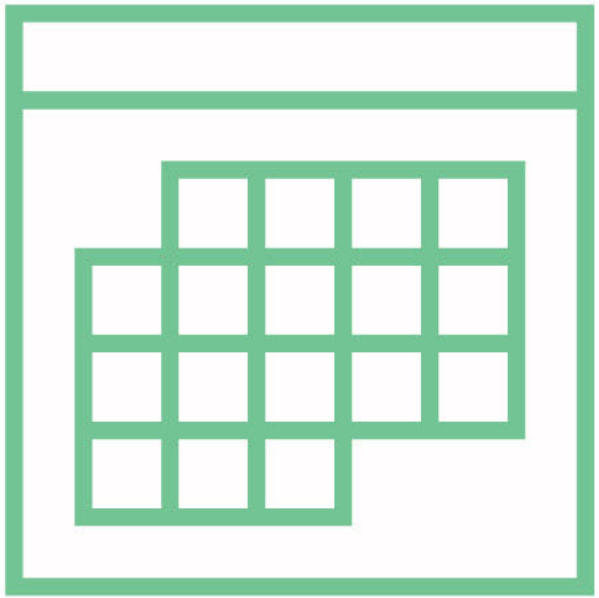
PROJECT OVERVIEW

If the Project is approved, when will it start and finish?

- The proposed Project is expected to last up to 10 years and is expected to start within 12 months of YESAB approval



PROJECT OVERVIEW

What work has Chance done to understand potential Project-related impacts to the environment and communities?

- Chance hired consultants to conduct baseline studies (e.g., wildlife baseline study and socio-economic baseline study) in 2018/19 and updated these studies in 2022/23
    - Chance refined initial Project plans to reflect feedback shared through previous engagement sessions and learned through baseline studies



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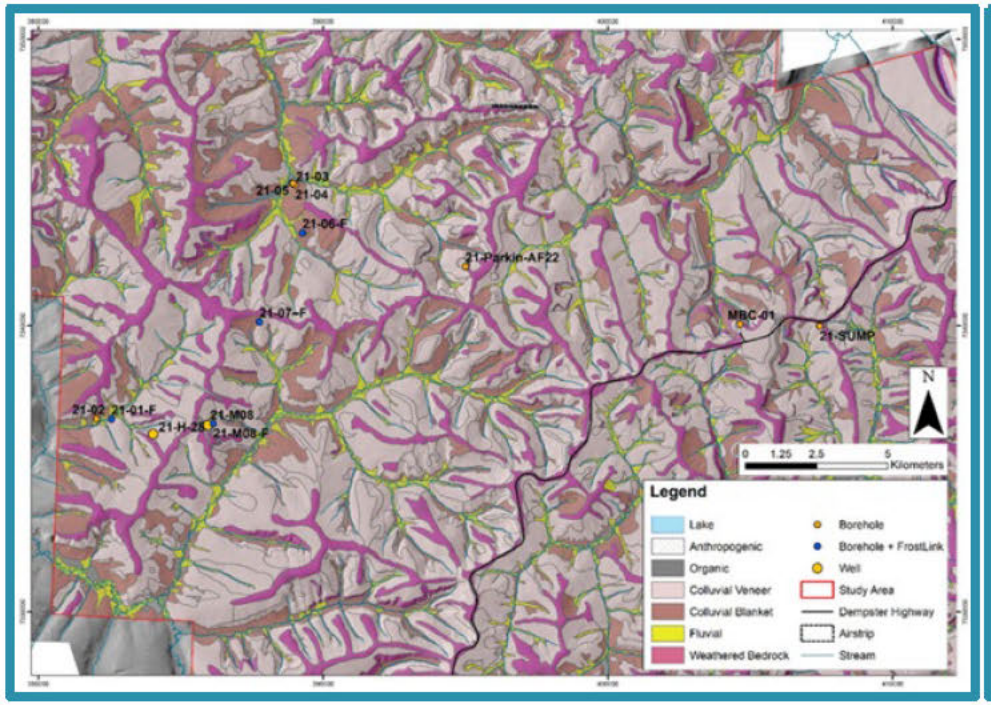
PROJECT OVERVIEW

Terrain Baseline Information

- Palmer has mapped surficial geology of the Project Area
  - Mapping using air photos, satellite images, LiDAR data
  - Fieldwork, including shallow drilling
  - Surficial geology maps created







PROJECT OVERVIEW

Permafrost Baseline Information

- Permafrost is frozen ground that remains below 0°C for more than 2 years
- Palmer described permafrost in core collected from drilling
- Installed temperature sensors in the ground







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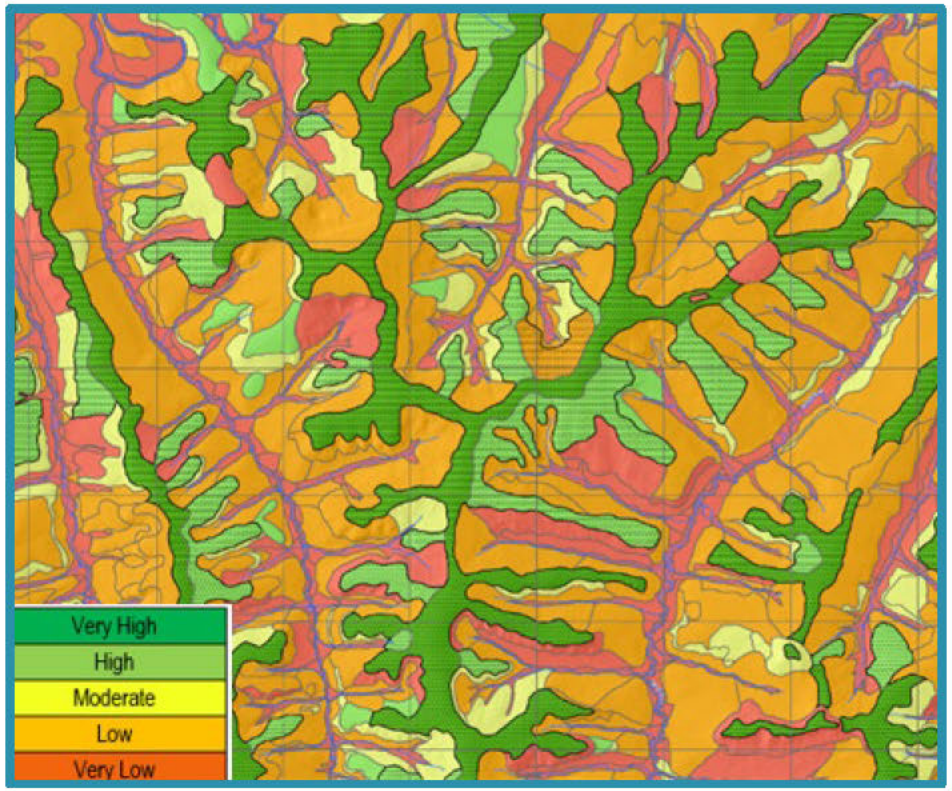
PROJECT OVERVIEW

Permafrost Baseline Information

- Created an exploration suitability map
  - Based on surficial geology
  - Updated with permafrost information
- Depth to the top of permafrost ranges from 0.45 m to more than 1 m
  - Depends mainly on material type, drainage and existing disturbance from forest fire and human activities
- The amount of ice in the soil is variable
  - Depends mainly on grain size
- Permafrost is cold and stable, except where forest fires have occurred
- Colder permafrost is preferred for Project activities



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What We Heard: First Nation Permafrost Feedback

- **Asked about drilling effects on permafrost**

Chance's response:

  - Permafrost is mostly within the bedrock in the drill holes – no effects
  - Above bedrock (top 20 m of ground), drilling fluids could warm permafrost
    - Refrigeration tubing to be installed in drill holes to keep the near surface material frozen while using drilling fluids
    - Once drilling ceases, well remains frozen in place
  - At surface, any disturbance would be localized and limited to only centimetres of thaw settlement
    - To be avoided by:
      - Drilling in winter, when the ground is frozen
      - Insulating ground with at least 10 cm of packed snow
      - Selecting ground with low amounts of ice and bedrock near surface (following exploration suitability map recommendations)



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What We Heard: First Nation Permafrost Feedback

- **Asked about permafrost thaw effects on exploration equipment, such as sinking drills and wells**

Chance's response:

  - Surface thaw settlement will be minimized
  - Wells are drilled into bedrock and are 700 m to >2500 m deep
    - Bedrock cannot move, so drills cannot move or sink
    - None of the earlier wells have moved since drilling (first well installed in 1959)



What We Heard: First Nation Permafrost Feedback

- **Asked if permafrost thaw causes animals and illnesses previously frozen to resurface**

  Chance's response:

  - Permafrost thaw will be minimized
  - Near surface thaw has already occurred naturally due to forest fire in the northwest portion of the Project Area and dangerous microbes have not been a problem

- **Asked if permafrost thaw causes pipes to break**

  Chance's response:

  - There will be no pipes in the ground during oil and gas exploration
  - Permafrost thaw will be minimized



PROJECT OVERVIEW

Next Steps – Permafrost Work

- Install more ground temperature sensors
- Retrieve ground temperature data from all sensors after one year



PROJECT OVERVIEW

Water Quality and Surface Flows Baseline Information

- Compiled historic data and conducted field surveys
- Project area contains 1,467 streams, very few lakes and ponds
- Typical for boggy, northern landscapes and climate
    - High water flows during spring melt
    - Most smaller streams dewater or freeze in winter
    - Neutral to slightly acidic, brown-stained
    - Extensive silt deposits indicate high sediment loads during spring freshet
    - Low nutrient levels on average
    - Many metals present naturally at levels above Canadian Council of Ministers of the Environment's guidelines





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PROJECT OVERVIEW

Fish Baseline Information

- Conducted electrofishing and minnow trapping surveys in summer, underwater camera surveys in winter
- Used data to model the probability of fish presence in all streams
- Clear patterns of fish distribution and habitat availability in summer and winter
- Most streams in the area are low gradient with silty streambeds
    - Moderate habitat where larval and juvenile fish find food and shelter
    - Poor spawning habitat for most fish species
- Six species of fish observed in or adjacent to the Project area:
    - Arctic grayling were the most abundant and widespread species
    - No salmon were captured or documented in the study area





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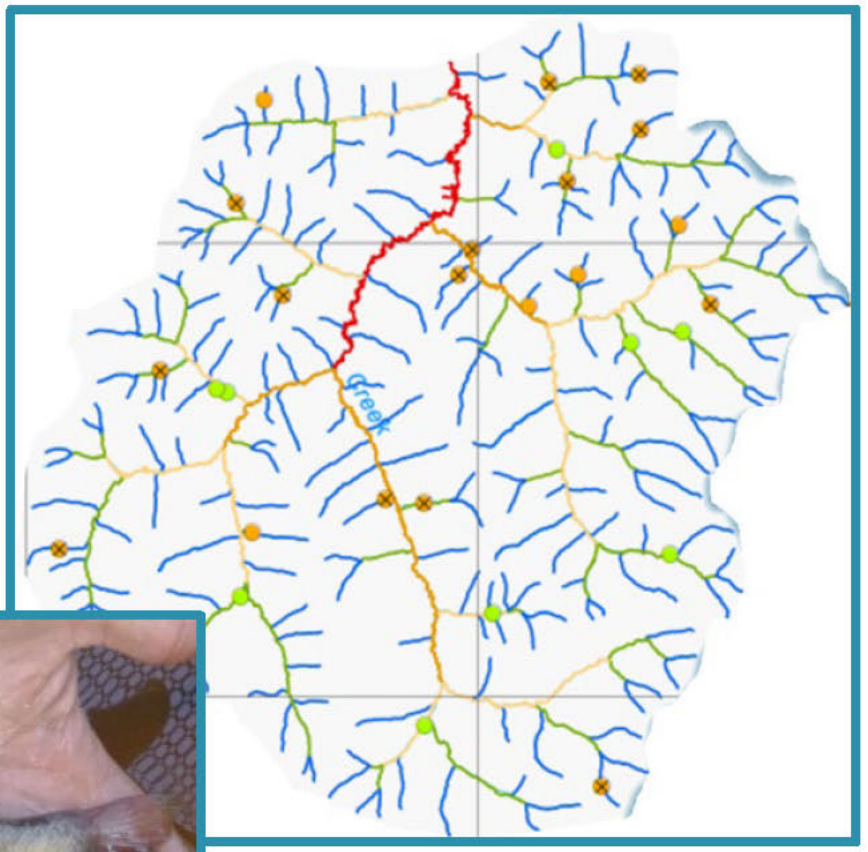
PROJECT OVERVIEW

Fish Baseline Information – Summer

- Fish presence in summer was strongly related to stream order (size):
  - 1st order streams (smallest) had very low probability of fish occurrence (<8%)
  - 2nd order streams had about 50% fish occurrence
  - 3rd order and greater had high probability of fish occurrence (>90%)







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PROJECT OVERVIEW

Fish Baseline Information – Winter

- During winter, fish habitat becomes very limited
  - Most smaller streams had no water in the winter or were frozen
  - In larger streams, water was present in some deeper pools
  - Dissolved oxygen levels were too low to support overwintering fish

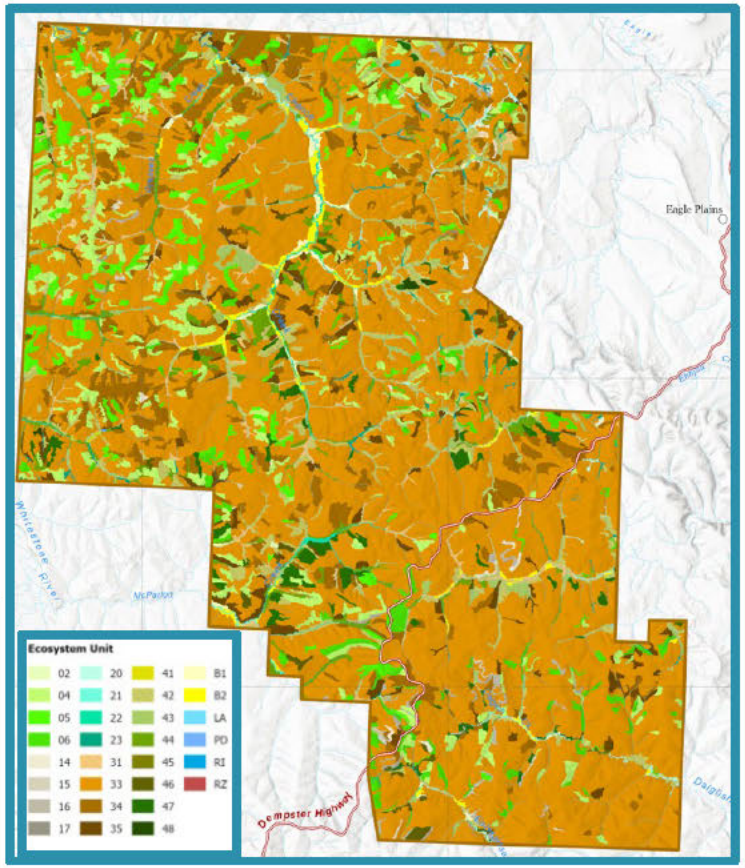
- Most fish appear to migrate downstream to overwinter in larger rivers outside of the Project Area



PROJECT OVERVIEW

Vegetation Baseline Information

- Mapped ecological communities across the Project Area
  - Used a combination of satellite imagery and field sampling
- Area is dominated by moist and wet ecosystems
  - Most common ecosystem is moist spruce – Labrador tea
- Majority of Project Area is 'shrub' stage (<8 m [24 ft] tall)
- Only 1% of the Project Area is old forest









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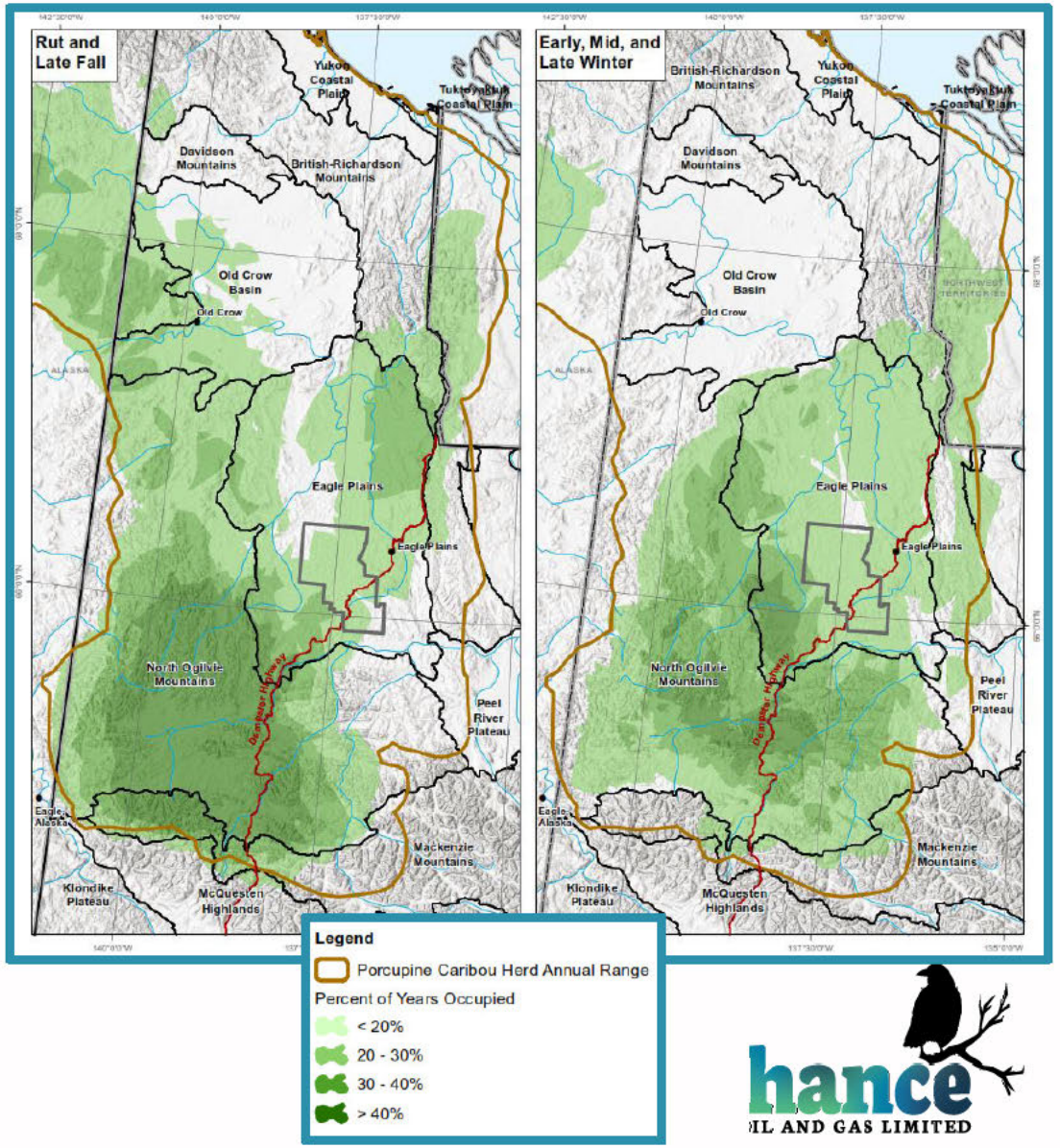
PROJECT OVERVIEW

Wildlife Baseline Information – Porcupine Caribou Herd (PCH)

- Studied habitat selection, movements, and linear features to better understand the herd's use of the Project area

- The Project Area overlaps with a small proportion of the PCH late-fall and winter ranges
  - Rut/Late Fall range (6%)
  - Winter range (7%)

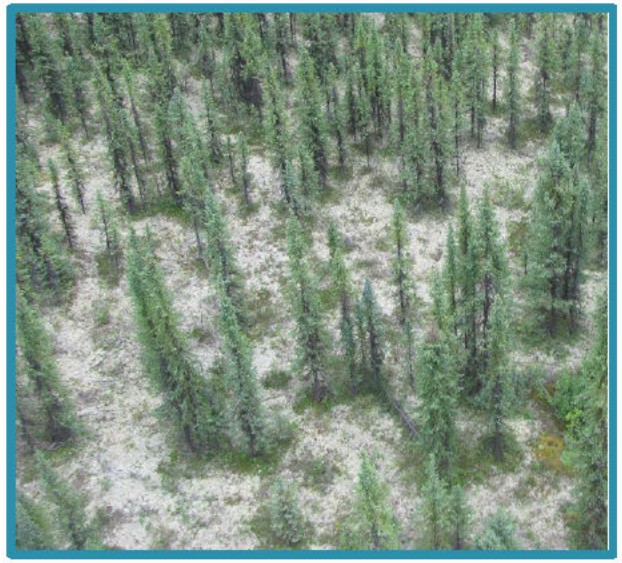
- Rut/Late Fall and Winter Seasons are considered to be the least-sensitive periods for the herd

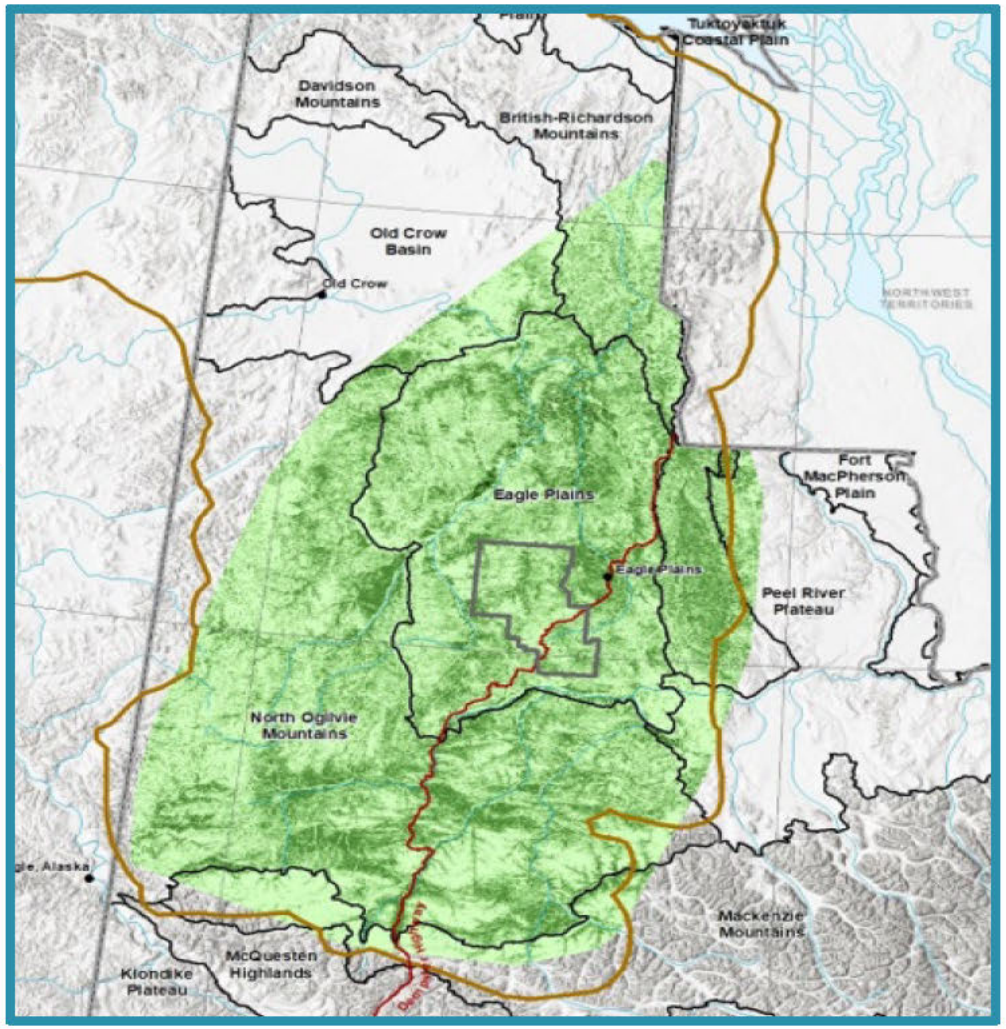


PROJECT OVERVIEW

Wildlife Baseline Information – PCH Habitat Selection

- Habitat selection by the PCH was assessed in Rut/Late Fall and Winter using GPS collar data
- Lichen cover was the primary driver of PCH habitat selection in these seasons





Wildlife Baseline Information – PCH Movements

- Caribou rarely stay in one area for more than a couple of days
  - Caribou that used the Project Area spent less than 15% of the season there

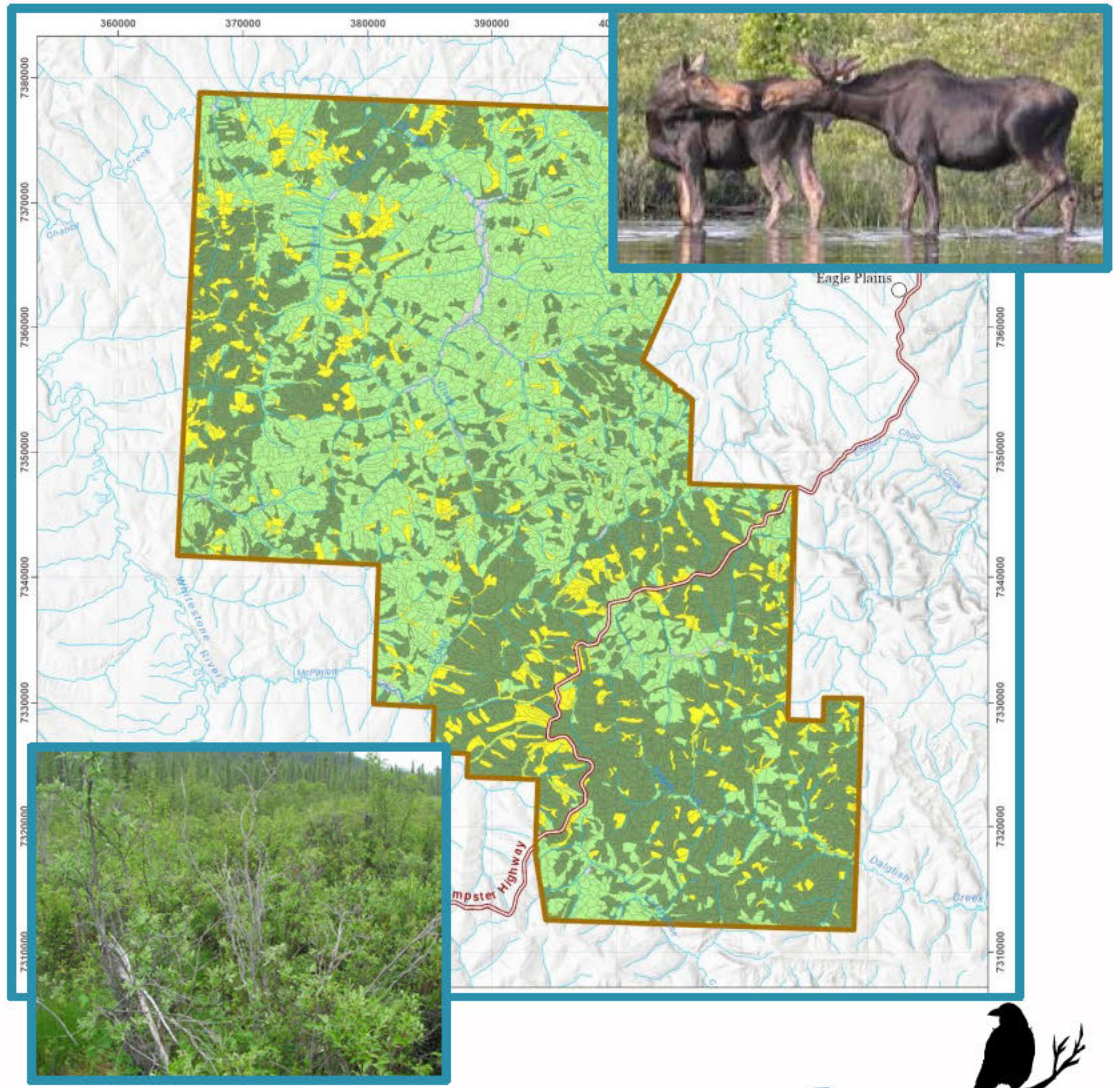
Season	Daily Travel Rates (km/day)	Residency Time (days)
Rut/Late Fall (30 days)	8.7	4.5
Winter (120 days)	4.4	13.9



PROJECT OVERVIEW

Wildlife Baseline Information – Moose

- Environment Yukon believes the population is high compared to other areas in northern Yukon
- Moose are present in Project Area year-round
- Winter is the most limiting season
  - Limited food availability
  - Elevated energetic costs
- Limited high-quality habitat present in the Project Area:
  - High (yellow) = 12%; riparian shrublands, regen burn (wet)
  - Moderate (dark green) = 43%; regenerating burns (mesic)
  - Low (light green) = 44%; undisturbed spruce stands



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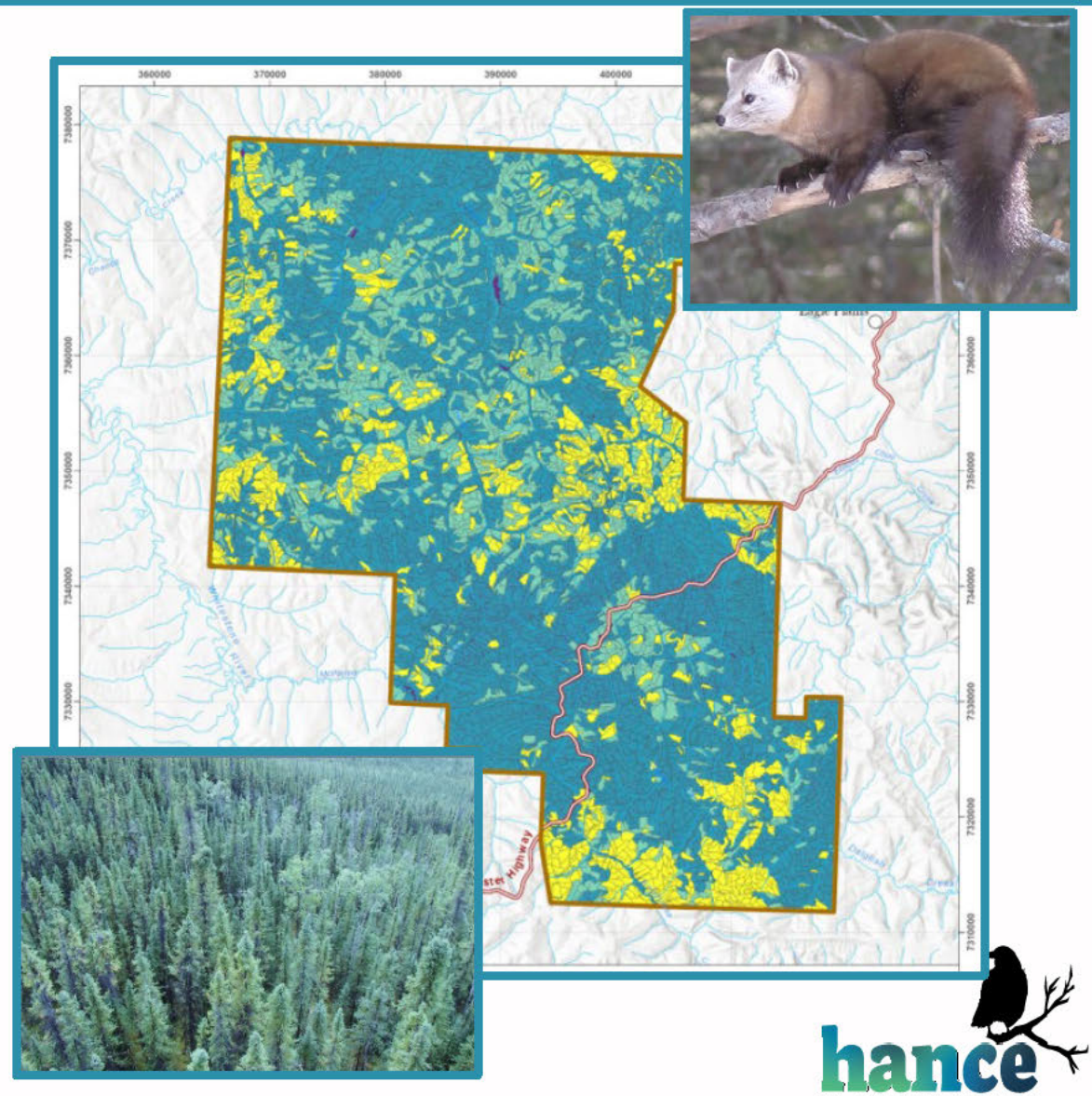
PROJECT OVERVIEW

Wildlife Baseline Information – American Marten

- Harvest rates suggest a moderate-sized population
- Present in the Project area year-round
- Associated with mature forest structure like large trees, snags, coarse woody debris
- Use vegetation and coarse woody debris to access small mammals under the snow in winter
- The majority of the Project Area is low-quality habitat:
    - High (yellow) = 16%; mesic, mature spruce forest
    - Moderate (light blue) = 23%; wetter and younger forest
    - Low (dark blue) = 60%; regenerating burns, wetlands, and stunted, open, black spruce areas



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PROJECT OVERVIEW

Wildlife Baseline Information – Birds

- 128 bird species have the potential to occur in the Project area based on range and habitat
  - 52 species detected during Project surveys
  - 19 additional species have been detected historically
- Eight species of conservation concern have been observed in the Project Area
  - Horned Grebe
  - Red-necked Phalarope
  - Peregrine Falcon
  - Gyrfalcon
  - Short-eared Owl
  - Common Nighthawk
  - Olive-sided Flycatcher
  - Bank Swallow
  - Rusty Blackbird
- No threats to these species on breeding grounds in the Project Area
- Most birds are absent from the Project Area in the winter months



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WHAT WE HEARD

What We Heard: First Nation Water, Wildlife, and Terrestrial Feedback

- Asked about downstream effects to salmon
- Asked about invasive species along the Dempster Highway
- Asked about seasonal effects to fish and fish habitat
- Asked about Project-related effects to surface water quality
- Recommended a holistic approach to assessing Project-related effects to water
- Noted importance of moose, Porcupine caribou, and wildlife ecosystems
- Asked if wolverines have been studied



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PROJECT OVERVIEW

Heritage Resources Baseline Information

- Types of heritage resource studies:
    - Heritage Resource Overview Assessment (HROA)
        - Desktop study that creates an inventory of known heritage resource sites within a study area and identifies areas of potential (AOPs) for the presence of undocumented heritage resource sites
    - Heritage Resource Impact Assessment (HRIA)
        - Field-based study aimed at ground truthing and testing AOPs that overlap with proposed work areas
    - Systematic Data Recovery (SDR) Excavations
        - Excavations aimed at mitigating impacts to sites that will be impacted by development activities

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Heritage Resources Baseline Information

Review of previous heritage resource studies:

- An Overview Archaeological and Traditional Land Use Impact Assessment for the Anderson Resources Ltd. Eagle Plains 2000-2002 Seismic Survey Program (00-21ASR)
- Archaeological and Traditional Land Use Overview Impact Assessment for Anderson Exploration Ltd's Eagle Plains 2001 Drilling and seismic Survey Program, Northern Yukon. Preliminary Report (Permit No. 01-07ASR)
- A Heritage Resources Impact Assessment Conducted Under Permit 07-04ASR on Proposed Drill Site Locations, Development Roads, and Borrow Sources, Extended Production Test Program, Eagle Plains Basin, on Behalf of Northern Cross (Yukon) Ltd.
- 2008 Heritage Resources Impact Assessment and Heritage Resources Overview Assessment of the Northern Cross Extended Production Test Program Area in Eagle Plains Basin Conducted Under Permit 08-06ASR
- 2012 Heritage Resources Overview Assessment for Selected Portions of Permits No. 7 and 9, Eagle Plains, on Behalf of Northern Cross (Yukon) Ltd.
- Heritage Resources Impact Assessment of a Proposed Seismic Exploration Program at Eagle Plains, Conducted on Behalf of Northern Cross (Yukon) Ltd. (13-16ASR)
- Heritage Resource Overview Assessment: Eagle Plains Basin Exploration Project (2022)
- Heritage Resource Impact Assessment: Eagle Plains Basin Exploration Project (2022)

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Heritage Resources Baseline Information

Review of previous heritage resource studies:

- An Overview Archaeological and Traditional Land Use Impact Assessment for the Anderson Resources Ltd. Eagle Plains 2000-2002 Seismic Survey Program (00-21ASR)
- Archaeological and Traditional Land Use Overview Impact Assessment for Anderson Exploration Ltd's Eagle Plains 2001 Drilling and seismic Survey Program, Northern Yukon. Preliminary Report (Permit No. 01-07ASR)
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- Heritage Resource Overview Assessment: Eagle Plains Basin Exploration Project (2022)
- Heritage Resource Impact Assessment: Eagle Plains Basin Exploration Project (2022)

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PROJECT OVERVIEW

Heritage Resources Baseline Information

- Heritage Resource Overview Assessment: Eagle Plains Basin Exploration Project (2022)
    - Review of physical/environmental setting, cultural/historical setting
    - Review of previous heritage resource studies and known archaeological and historical site inventories
    - Development of a heritage resource potential model

PROJECT OVERVIEW

Heritage Resources Baseline Information

- Physical/environmental setting - Looking for well-defined landforms and heritage features such as:
    - Terraces
    - Knolls
    - Ridgelines
    - Cabins
    - Depressions
    - Stone features
- Cultural/historical setting
    - Modern and archaeological indigenous cultures
    - Historic period events, settlements, etc.

PROJECT OVERVIEW

Heritage Resources Baseline Information

- Review of known archaeological and historical site inventories
- Six archaeological sites within exploration area: LlVc-1, LlVd-1, MaVc-4, MaVc-5, MaVc-6, and MaVe-1
    - All stone tool scatters
    - Twenty-six more known archaeological sites within 50 km of exploration area
- One Yukon Historic Sites Inventory (YHSI) site within exploration area: 116I/03/001 - Tth'an Dhidlii Njik Dalgish Creek Resource Area
    - Historically significant cultural landscape
    - Thirteen more known YHSI sites within 50 km of exploration area
- Three palaeontological sites within ~20 km of the exploration area, but none inside the boundary

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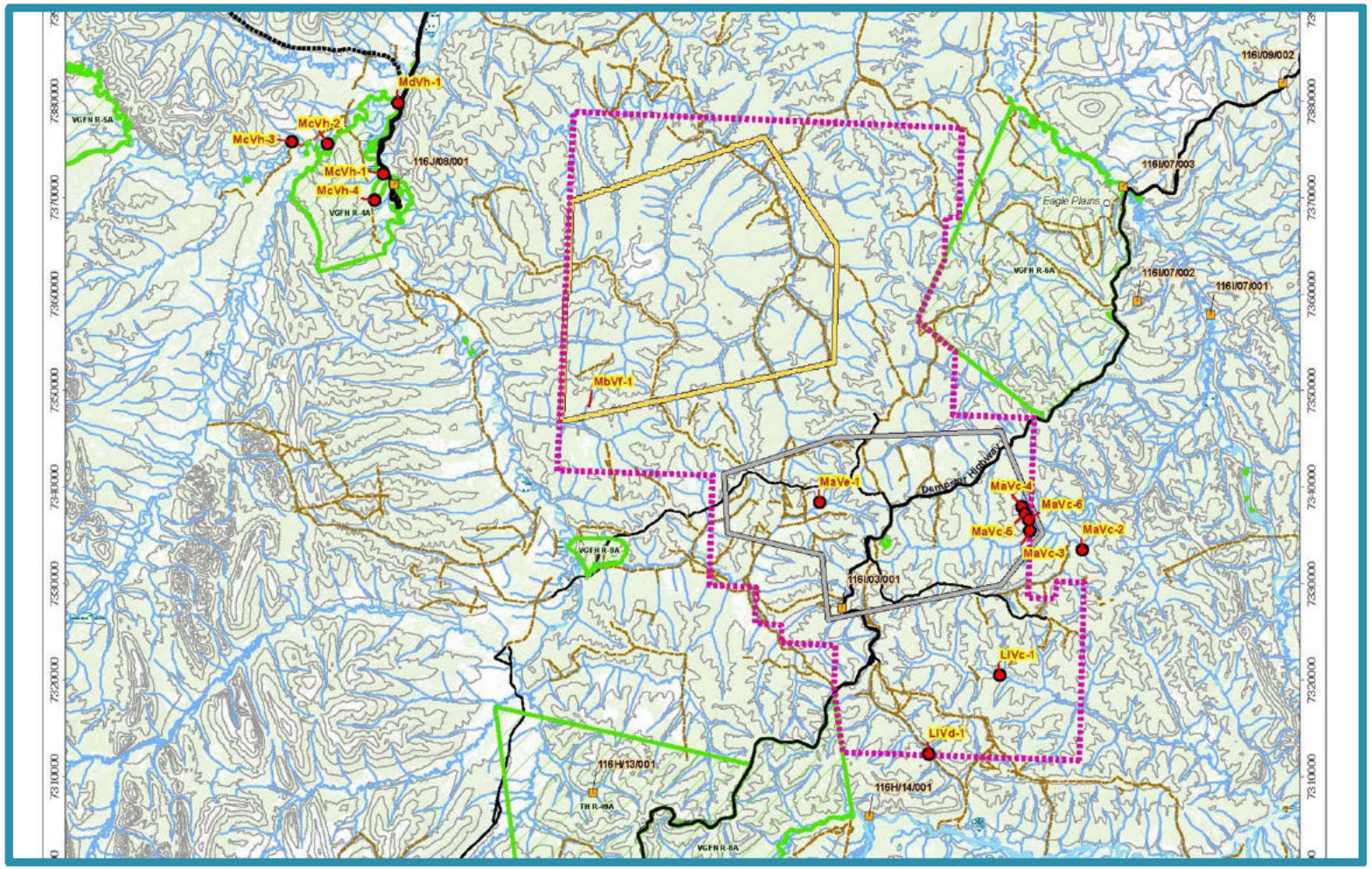
PROJECT OVERVIEW

Heritage Resources Baseline Information



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Heritage Resources Baseline Information

- Heritage Resource Potential Model for Undocumented Sites
- First created using computer mapping software that analyzed high resolution elevation data to identify landscape features that heritage resource sites are commonly found upon
  - Relatively coarse results
  - Computer paints with a broad brush
- The computer-generated model was then manually refined by Ecofor archaeologists focus on only the

PROJECT OVERVIEW



PROJECT OVERVIEW



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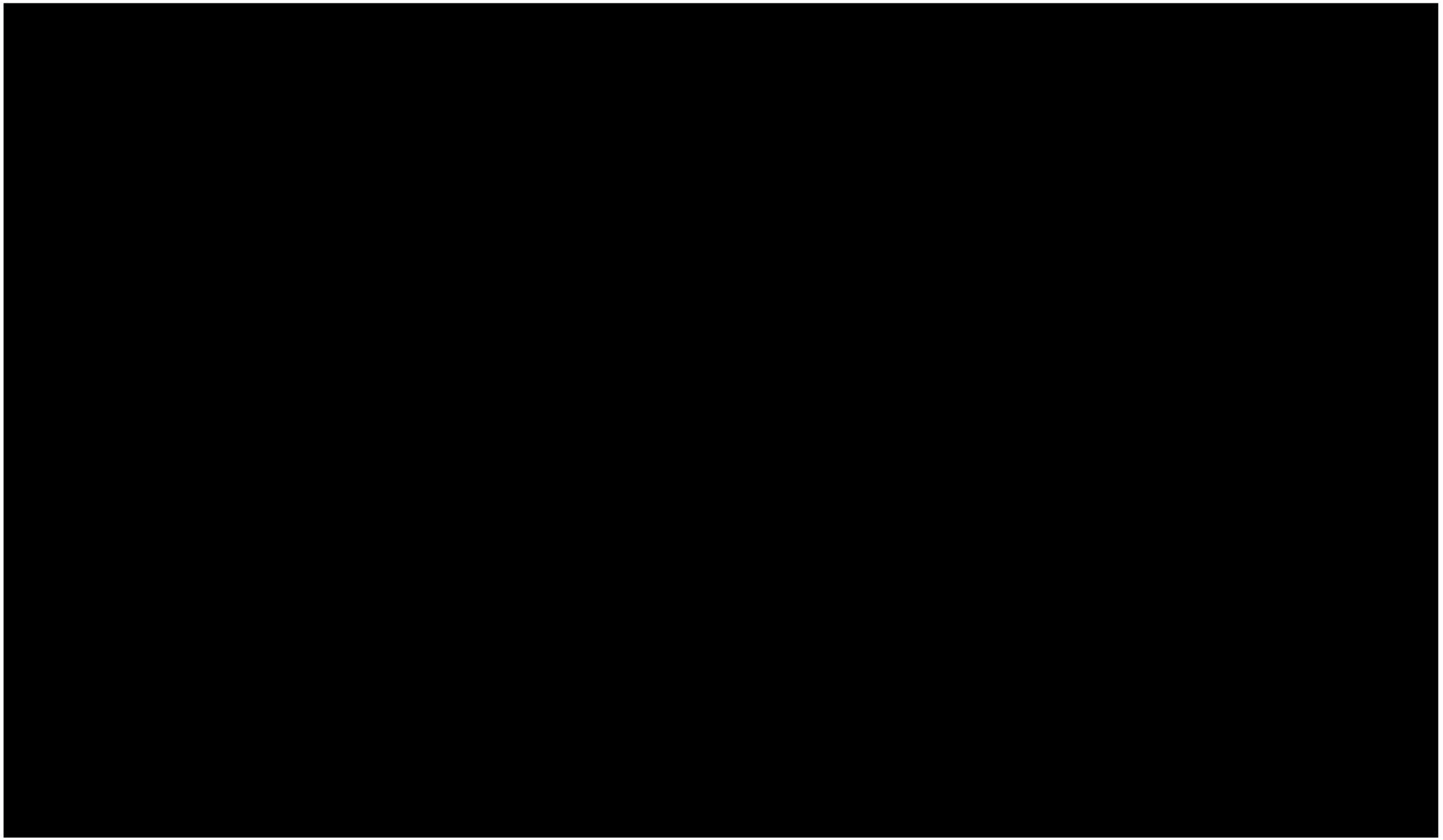
PROJECT OVERVIEW



PROJECT OVERVIEW

Heritage Resources Baseline Information

- Summer 2022 HRIA Program
  - A 10-day HRIA program was conducted between July 26 - August 2, 2022
  - The HRIA focused on a 625 km2 subsection of the Project Area where a new seismic and drilling program has been proposed
  - Field crew included Ecofor archaeologists and a VGFN participant

PROJECT OVERVIEW



PROJECT OVERVIEW



Heritage Resources Baseline Information

- Summer 2022 HRIA Program
  - HRIA work included:
    - A helicopter survey throughout this area to identify the best areas or heritage resource potential
    - A survey on foot to confirm potential in areas of potential identified from the helicopter
    - Shovel testing at 12 locations

Heritage Resources Baseline Information

- Summer 2022 HRIA Program
    - In total, 228 shovel tests were completed
    - Shovel tests at location E10 led to the recording of archaeological site [redacted]
    - This site has been flagged as a no-work area

PROJECT OVERVIEW



PROJECT OVERVIEW



PROJECT OVERVIEW

Heritage Resources Baseline Information



PROJECT OVERVIEW

Heritage Resources Baseline Information



PROJECT OVERVIEW



Heritage Resources Baseline Information

- Summer 2023 HRIA Program
  - Ecofor and Chance plan to continue developing the Eagle Plains Basin Exploration Project Heritage Resource Management program
  - Additional HRIA fieldwork will be conducted under Yukon Archaeological Sites Regulations Permit 23-03ASR

NEXT STEPS

What is next?

- Chance is planning to engage First Nations and community members on the following topics prior to submission of the Project Proposal in May and June 2023:
    - Valued Components (VCs) such as fish and fish habitat
    - Baseline Results
    - Socio-economics
    - Indigenous Knowledge
    - Effects and Mitigations (e.g., spill prevention measures)
    - Management Plans (e.g., caribou management plan)
- Chance to continue incorporating feedback shared during ongoing engagement with First Nations and community members to the Project Proposal and other plans
- Chance to provide ongoing Project updates with interested Open House attendees (e.g., notification of Project Proposal submission to YESAB)



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NEXT STEPS

What is next? Continued…

- Chance to conduct a survey for heritage resources this summer
- Chance to complete Project effects assessments
- Chance to engage with Yukon Government on the Project



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Questions & Answers



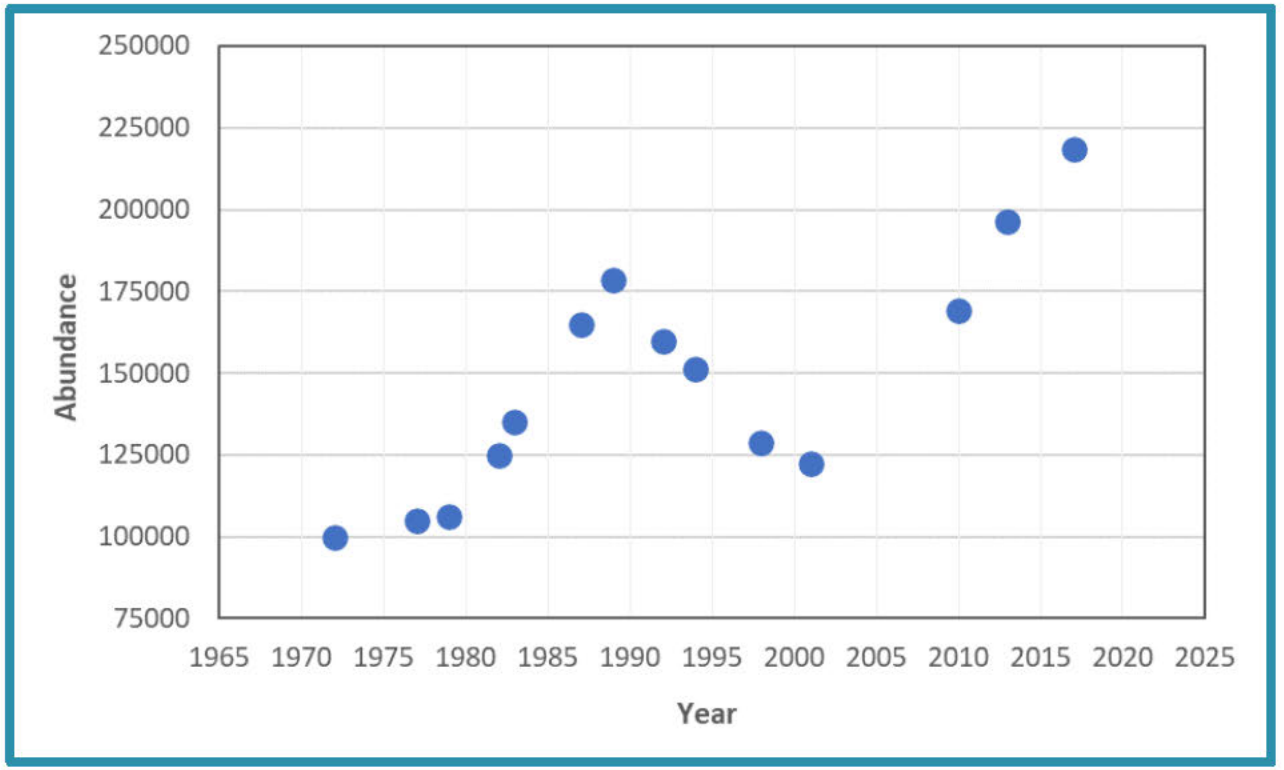
Thank you for your time!

We look forward to continue learning from and working with you to support your involvement in the Project and address/mitigate any concerns you may have about the Project.

ADDITIONAL DETAILS

Porcupine Caribou Herd

- Population has increased over the last two decades
  - Large population fluctuations are a key ecological trait of barren-ground caribou
  - Over 50 years of monitoring the herd has not exhibited population fluctuations as large as other herds



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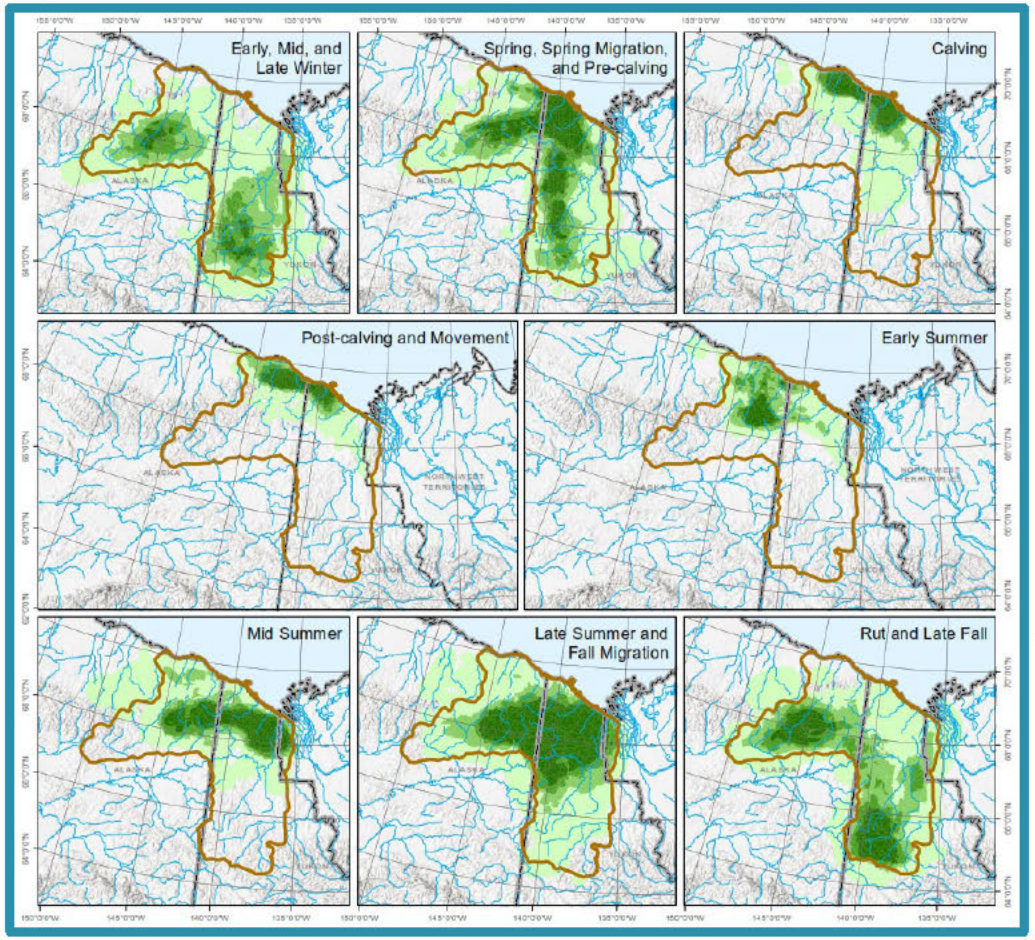
ADDITIONAL DETAILS

Porcupine Caribou Herd

- Porcupine caribou make long-distance migrations among seasonal ranges





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ADDITIONAL DETAILS

Porcupine Caribou

- Late fall and winter are the least sensitive seasons for the herd
- Relative sensitivity of the Porcupine Caribou Herd during 8 key life cycle seasons:

Season	Dates	Sensitivity*
Early, Mid, and Late Winter	Dec. 1 – Mar. 31	4
Spring, Spring Migration, and Pre-Calving	Apr. 1 – May 31	3
Calving	June 1 – 10	1
Post-Calving and Movement	June 11 – 30	1
Early Summer	July 1–15	2
Mid Summer	July 16 – Aug. 7	2
Late Summer and Fall Migration	Aug. 8 – Oct. 7	3
Rut and Late Fall	Oct 8 – Nov 30	4

*1 = highest sensitivity, 4 = lowest sensitivity

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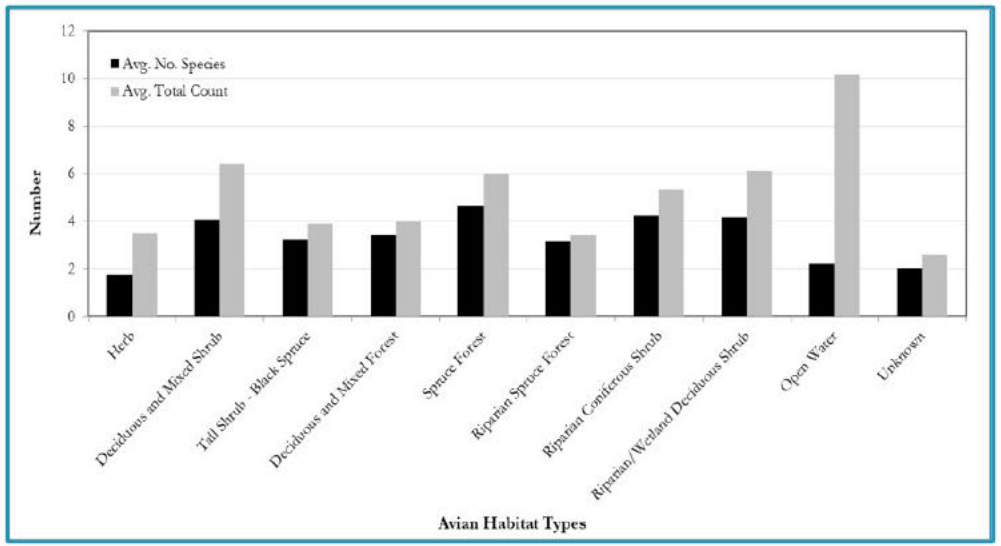
ADDITIONAL DETAILS

Birds

- Compiled existing information and conducted field surveys
  - Terrestrial songbird surveys (91 sites)
  - Pond/wetland surveys (19 sites)
  - Cliff-nesting raptor habitat was assessed; none present
- Number of species and total bird abundance were both well-distributed across habitat types





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APPENDIX F

May 16, 2023
Open House Feedback Form

Chance Oil and Gas Limited (Chance) would like to learn about your experience at the Open House. Responses shared in this Open House Feedback Form will be used by Chance to help inform Project decision-making, Project design, and the assessment of potential Project-related effects to community members. Responses will remain anonymous in any Project materials (e.g., reports to the Yukon Environmental Socio-economic Assessment Board). Thanks in advance for taking time to complete the Open House Feedback Form!

1. How did you hear about the Open House? **Please check all that apply.**

Radio	Word of Mouth	Social Media	Signage/Poster	Other:
○	○	○	○	○

If you selected 'Other', please explain below.

2. Overall, how would you rate this Open House on a scale from 1 (Very Unsatisfied) to 5 (Very Satisfied)? **Please check one and explain your response below.**

Very Unsatisfied 1	Unsatisfied 2	Ok 3	Satisfied 4	Very Satisfied 5
○	○	○	○	○

3. Were you able to share your thoughts, ideas, and knowledge during the Open House in a comfortable manner? **Please check one and explain your response below.**

Yes	No	I don't know
○	○	○

4. Did the Open House help you learn more about Chance Oil & Gas and the proposed Eagle Plains Project? **Please check one and explain your response below.**

Yes	No	I don't know
○	○	○

3. What did you like most about the Open House? What could we do better to improve future Open House events? **Please briefly explain your response below.**

4. Please feel free to share any comments or questions that you may have about the Chance Oil & Gas, the Eagle Plains Project, and/or the Open. We value your comments.

Thank you for taking the time to share your experience with us.

We hope to see you at the next Open House!

If you would like to receive Project updates including information on future engagement events, please list your contact details below:

Name: _____

Phone: _____

Email: _____

APPENDIX 2-B-26. May 17, 2023, Meeting Summary

Eagle Plains Exploration Project
May 17, 2023 Meeting Minutes

Session Details	
Event:	Eagle Plains Exploration Project ("Project") Update Meeting
Date / Time:	May 17, 2023 (8:45 am MST – 9:45 am MST)
Participants:	Gwich'in Tribal Council (GTC): • Grand Chief [redacted] • [redacted], Manager Lands & Resources Gwich'in Development Corporation (GDC): • [redacted]., Chief Executive Officer Chance Oil and Gas (Chance): • [redacted], Regulatory, Environmental and Community Relations Coordinator • [redacted], Vice President Government and Community Relations Environmental Dynamics Inc. (EDI): • [redacted], Deputy Chief Executive Officer and Senior Biologist Ecofor: • [redacted], Senior Archaeologist, Permit Holder Palmer: • [redacted], Senior Geoscientist Two Worlds Consulting (TWC): • [redacted], Engagement Specialist • [redacted], Engagement Specialist

Objectives

1. Provide a Project update (timeline, regulatory process, engagement etc.)
2. Understand GCT and GDC's engagement preferences going forward.
3. Provide an overview on the May 16, 2023 Open House in Inuvik.

Discussion

Welcome

- Grand Chief [redacted] welcomed the Chance Project Team and noted GTC had prepared breakfast for all meeting attendees.

Open House Overview

- Grand Chief [redacted] asked about the Open House event Chance held the night prior at the Nihtat Gwich'in Council boardroom.
- [redacted] shared there were a total of six attendees at the Open House and the event included a catered dinner. She noted that the attendees asked a lot of great questions. [redacted] added that Chance gave a presentation on the Project, including engagement next steps, and received feedback from Open House attendees on how to attract a larger turnout for future engagement events.
- Grand Chief [redacted] shared that six attendees was average for engagement events in Inuvik.

Project Updates

Engagement

- [redacted] shared an update on Chance's engagement with Vuntut Gwitchin First Nation. Noted the Project Team had travelled from Old Crow, YT to Inuvik, NT. [redacted] expressed that Chance is hoping to sit down with Vuntut Gwitchin First Nation in Old Crow to develop a formalized schedule for meetings and Project milestones (e.g., Chance's Project Proposal submission to the Yukon Environmental Socio-economic Assessment Board (YESAB).
- [redacted] noted that Chance is looking to submit their Project Proposal to YESAB's Executive Committee by the end of December 2023.
- [redacted] shared that Chance's engagement with First Nations was delayed due to the COVID-19 pandemic.
- [redacted] shared information on Chance's land permit extensions. Noted Chance is requesting a 5-year permit extension for the Project Area. If approved, the permit would be valid between 2023 - 2027.
- [redacted] expressed Chance's interest in engaging GTC members from Aklavik. Proposed supporting members' travel from Aklavik to Inuvik or that Chance's Project Team could travel to Aklavik by charter plane.
- Grand Chief [redacted] noted [redacted] (phonetic spelling) operates a water taxi to Aklavik for same-day travel. He added that engagement in each community is different. Grand Chief [redacted] shared that there is not a lot of engagement in Tsiigehtchic, that approximately 8 – 12 people will attend engagement events in Aklavik, and that typically there is an overflow of attendees in Fort McPherson. Grand Chief [redacted] also noted younger people in the community tend to stay away from politics.

Archaeology and Heritage Resources

- [redacted] shared information on Ecofor's archaeology and heritage work in and around the proposed Project.
- [redacted] noted Ecofor had conducted a 10-day field program including field testing. During this field program, Ecofor identified one new archaeological site. Their assessment concluded this site was probably a short-term occupation site.
- [redacted] said Ecofor would be conducting more fieldwork.
- Grand Chief [redacted] suggested [redacted] reach out to [redacted], GTC Cultural Heritage Director, to include potential members for Indigenous Knowledge gathering purposes.

Discussion

Welcome

- Grand Chief [redacted] asked what protocols are in place in the event a burial site is discovered. [redacted] explained that the Project is required to follow a chance find process to mitigate the site or completely avoid it. Chief [redacted] requested that he be contacted if a burial site is discovered and to ensure the Project creates an opportunity to engage an Elder because they may know of the site and can provide guidance to respectfully protect the site.
- [redacted] confirmed archaeology and heritage mitigation plans would be included in Chance's Project Proposal.
- [redacted] asked if the Project Proposal also includes a contact list if something is found. [redacted] said Chance will include a contact list in the Project Proposal. Noted the First Nations will be part of that list.

Permafrost

- [redacted] provided a permafrost update. She noted that Palmer will install six sensors in summer 2023, in addition to the already installed six sensors.
- [redacted] said the terrain in the Project Area is sensitive. There are ridgetops, valleys, and slopes.
- [redacted] said Palmer has mapped good areas for the proposed exploration activities, as well as areas to be avoided.
- [redacted] explained that directional drilling will stay on high ground.
- [redacted] asked if there are buffers where work activities are adjacent to a sensitive area. [redacted] explained that the Project activities will not be adjacent to high sensitivity areas.
- [redacted] asked how deep the permafrost sensors can test? Shirley confirmed the sensors reach up to a 1 metre depth.
- [redacted] noted areas affected by forest fires are typically low sensitivity (i.e., sandy areas that do not hold water or ice well).
- [redacted] said the permafrost is different in Eagle Plains compared to the Mackenzie Delta.
- [redacted] said Palmer's work will help guide Chance to protect vegetation during the winter.
- [redacted] asked if Chance is still planning to bury drilling materials? [redacted] confirmed Chance is still planning to build Mix Bury and Cover (MBC) sumps (for material that comes out of drilling). Greg added that cuttings will be relatively clean and monitored by regulators. [redacted] said Chance had been monitoring another MBC sump for reference and it's looking good (e.g., vegetation regrowth).
- [redacted] asked if there are any aquifers down there? [redacted] said there is an aquifer, but the water is not drinking water quality. Leigh-Ann followed up and asked roughly how deep it would be. Greg confirmed the aquifer is approximately 1800 metres below the surface. He said the Yukon University studied the water in this area and concluded the water was not fit for future consumption.
- [redacted] asked if the MBC sumps will be part the suitability in the permafrost baseline study? [redacted] confirmed MBC sumps would be included.

Aquatic, Wildlife, and Terrestrial Ecosystems

- [redacted] gave an overview of aquatic, wildlife, and terrestrial ecosystems.
- [redacted] noted Chance is proposed to cut up to 3-metre-wide seismic lines.
- [redacted] said Chance's proposed annual work for the Project is a small area less than 2% of the Porcupine Caribou Herd range.
- Grand Chief [redacted] recommended the Project Team avoid saying that 2% is a small area. He said community members will need to understand the proper context and then once they have the honest truth, they can determine the impacts. Noted language such as "less than a certain percentage" can be misleading.

Discussion

Welcome

- Grand Chief [redacted] asked [redacted] what the information tells us. [redacted] responded that the information gathered to date helps show where access roads should not be built, and it limits where Chance can conduct certain activities.
- Grand Chief [redacted] asked [redacted] if he had worked with the Porcupine Caribou Management Board and [redacted] confirmed that EDI had worked with the Porcupine Caribou Management Board.
- [redacted] noted Project activities will take place in the winter which will avoid impacts to berries and other vegetation.
- [redacted] shared that EDI also conducted bird surveys.

Project Activities

- [redacted] reviewed Project activities and the purpose of the Project. He noted that oil and natural gas discovered in the Project Area is intended to provide energy security in the north.
- [redacted] shared information on the 2D and 3D seismic lines proposed for the Project. Noted it's a grid system with geophones that are detonated section by section over ten years.
- Grand Chief [redacted] asked what is the 1500 sq km of 2D and 3D?
- Grand Chief [redacted] asked how Chance gets data from the seismic activities? Greg explained geophones that are four to six meters below the surface capture the data. He explained that the geophones are wireless and get picked up by helicopter during the summer months.
- Grand Chief [redacted] asked what Chance does for 2D seismic? Greg said 2D seismic functions the same as 3D seismic, but the lines are further apart than 3D.
- [redacted] asked if there are any predator-prey issues with the seismic lines? [redacted] stated that the possibility of linear features facilitating predation is specifically addressed in their baseline study (linear features study), effects assessment, and mitigation (e.g., minimizing line of sight, dog-legging of seismic lines at major access points, winter operations, etc.). Some studies show seismic lines can facilitate predator movement however, modern seismic activities incorporate doglegged (bent) lines at certain locations to reduce predator-prey line of sight. Meandering line construction selects the path of least resistance and avoids timber larger than 20 – 30 cm in diameter (details provided in the draft Project Description). Height of vegetation can also influence travel speed and sight lines. These issues will be addressed in the Project Proposal (impact assessment).
- [redacted] noted seismic lines now are no longer straight through like they used to be. He added that most of the time trees aren't cut down because they can go around them.
- Grand Chief [redacted] noted the Project Area is moose country.
- [redacted] asked what the Project is using for a water source? Greg said the Project will use Glacier Creek for camp use and Eagle River in the winter for sediment etc. He noted the camp will truck no more than one truckload every week because they recycle drilling fluid. [redacted] said the largest water use is for building the ice road.
- [redacted] asked what Chance does with the water? Truck it out or inject it? Chance said recovered formation water (if any) will be disposed of in deep zone injection wells. Formation water will be disposed of by re-injecting it into a compatible and approved geological formation via an existing Eagle Plains well converted to a deep injection well. Existing suspended wells may be converted to deep-injection wells as needed.

Action Items & Next Steps

Discussion

Welcome

- Chance to contact Chief [redacted] if a burial site is discovered and to ensure the Project creates an opportunity to engage an Elder because they may know of the site and can provide guidance to respectfully protect the site.
- Chance to include a contact list for archaeological and heritage resources discoveries in the Project Proposal for YESAB's Executive Committee.

APPENDIX 2-B-27. August 29, 2023, Meeting Summary

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Meeting Minutes

Subject	Draft Project Overview Meeting
Prepared By	Two Worlds Consulting (TWC)
Groups Involved	Chance Oil and Gas Limited (Chance) Gwich'in Tribal Council (GTC) TWC
Participants	[redacted], VP Government and Community Relations (Chance) [redacted], Transboundary Specialist (GTC) [redacted], Acting Director (GTC) [redacted], Engagement Support (TWC) [redacted], Engagement Support (TWC)
Date/Time	August 29, 2023 10:00 AM – 11:30 AM PST
Copies to	Chance and GTC

Purpose of Meeting

- Chance provided an Eagle Plains Exploration Project (Project) overview to GTC.

Topics Discussed

- Chance overview
- Project overview including information on exploration, design changes, baseline studies, regulatory process, schedule, engagement, proposed next steps

Key Issues Raised / Chance Responses to Issues

- Suggested GTC and Chance develop a Memorandum of Understanding and a Terms of Reference or Cooperation Agreement.
    - Chance agreed.

Actions and Responsible Party

- TWC to send meeting actions and requested information to [redacted] – complete.
- TWC to send invite to reoccurring monthly virtual meeting between Chance and GTC – complete.
- GTC staff to discuss information requests detailed in the email from [redacted] on September 5, 2023 with GTC leadership and share feedback with Chance – in progress.
- GTC and Chance to develop Memorandum of Understanding, Terms of Reference or Cooperation Agreement – in progress; Chance is developing a high-level Collaboration Plan to share with GTC for review and comment per feedback from GTC on October 7, 2023.
- GTC staff to confirm if Grand Chief [redacted] should be copied on all communications between Chance and GTC staff – in progress.

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- Chance to introduce [redacted] to [redacted] (Vuntut Gwitchin First Nation technical advisor) – complete.

Details of Discussion

- Everyone shared introductions.
- [redacted] is interested in producing oil and gas for local consumption. He added that Chance is trying to create economic opportunities within the Yukon and partner with First Nations. [redacted] said he was looking forward to working together with the GTC and asked [redacted] how they wanted to proceed for the rest of the call.
- [redacted] thanked [redacted] for the context and noted they were interested in having a reintroduction meeting because there had been turnover at the GTC office. [redacted] said he is the Acting Director at GTC and hired [redacted] recently to support consultation work. [redacted] explained that [redacted] has a good background in consulting in the north and asked Greg to walk through the presentation.
- [redacted] said Chance has been to Aklavik, Fort McPherson, and Inuvik since the Project started in 2014. [redacted] noted the Project would be assessed by the Executive Committee of the Yukon Environmental Socioeconomic Assessment Board (YESAB).
- [redacted] provided a background on Chance and noted the company started in 1994. He explained Chance is focused on assessing oil and natural gas potential in the Yukon. Greg shared that Chance has offices in Calgary and Whitehorse. Greg shared that Chance has 8 active natural gas and oil wells in the Eagle Plains.
- [redacted] said the Project also overlaps with part of GTC's secondary use area. [redacted] explained that the Project area overlaps with the North Yukon Planning Region (NYPR) and Peel Watershed Planning Region (PWPR). He noted Chance is looking at the guidelines for both planning regions.
- [redacted] shared that the Project proposes more seismic activities in the Eagle Plains area. He added that if the results from the proposed Project deem the oil and natural gas resources economical, then a future extraction project would be proposed. The extraction project would undergo its own assessment under YESAB.
- [redacted] said Chance is proposing to conduct 1500 square kilometers of 3D and 2000 square kilometers of 2D seismic. He added that Chance is proposing to drill up to 30 wells in total, and approximately, 5-7 wells per year. [redacted] said all operations will be in the winter and that ice roads will be built to minimize impacts to wildlife and permafrost. He explained that extended flow testing will also be conducted.
- [redacted] shared information on Chance's existing camp located at kilometer 324 on the Dempster Highway. He said it has a capacity of 75 people. Chance will use the existing airstrip for the Project and will construct winter access roads as well as a fly in camp to accommodate approximately 25 people. [redacted] said Chance may also build a winter airstrip to support bringing crews in from Inuvik, Old Crow, and other interested communities.

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- [redacted] explained the permafrost in the Project area is quite thick and that Chance will utilize sumps to prevent significant melt. He added that the sumps have been working well to date.
- [redacted] shared that Chance will abandon the exploration wells and reclaim the Project area. They are currently working on reclaiming past wells and will be abandoning a few more this year. Other wells will be suspended to get them ready for potential future production.
- [redacted] explained that Chance initially submitted a Project Proposal to the Dawson City Designated Office of YESAB and they deferred the Project to the Executive Committee of YESAB. She explained that the current Project design and activities reflects feedback shared during previous engagement. For example, drilling activities will only take place in winter versus year-round drilling, Chance is utilizing the existing Project footprint, Project activities will be spread over 10 years to support longer-term employment and procurement opportunities, and Chance will utilize low impact seismic technologies. [redacted] said seismic lines are much narrower today than seismic lines created in the 1970s. As a result, Chance is expecting less linear features impacts.
- [redacted] presented baseline studies completed for the Project. She added that Chance conducted additional baseline studies in 2018/2019 and 2023 based on feedback they had received from First Nations and the Dawson City Designated Office. [redacted] offered to share available baseline studies with GTC.
- [redacted] said GTC would appreciate receiving copies of the available baseline studies and today's presentation.
- [redacted] shared she would share a video illustrating proposed Project activities. She noted the video is helpful for people with limited oil and gas experience.
- [redacted] explained that the Project is now at step six of YESAB's Pre-Submission Engagement Process. She said the Project is at step six because it was referred by the Dawson City Designated Office to the Executive Committee. Step six requires Chance to submit a Project Proposal to the Executive Committee. Chance is aiming to submit their Project Proposal in mid-December 2023 and recognized this is an ambitious timeline.
- [redacted] provided an update on engagement activities in 2023. She noted Chance conducted an open house event in Inuvik in May and heard a lot of great feedback from attendees at that event. Eliza explained a planned open house in Fort McPherson the following day was cancelled due to flash flooding. [redacted] shared that Chance is hoping to conduct more open house events in the fall.
- [redacted] asked GTC to share any feedback on engagement preferences or if there are any GTC specific community-based research protocols to follow before conducting socioeconomic baseline interviews. [redacted] explained data available through Statistics Canada is not disaggregated enough to reflect socioeconomic conditions in smaller northern communities. [redacted] asked GTC to confirm if there are people or businesses that Chance should interview.
- [redacted] said Chance has prepared a draft Table of Contents for the Project Proposal.
- [redacted] asked Chance to include questions asked of GTC during this meeting when they send over materials that were discussed. [redacted] said a lot of work still needs to be done and commended Chance for work that had been completed. He said today's meeting was good

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and that they will get back with answers to the questions asked. [redacted] suggested they set up monthly meetings to stay connected.

- [redacted] thanked [redacted] for his comments and said if GTC has specific biophysical Valued Environmental and Socioeconomic Components related questions, that Chance can bring the discipline leads from Environmental Dynamics Inc. and the other consulting companies to the monthly meetings. She reiterated that Chance is happy to focus the monthly meetings to topics GTC is most interested in.
- Greg suggested he introduce [redacted] to [redacted] (technical advisor for Vuntut Gwitchin First Nation). He added Chance would be happy to set up technical meetings with all potentially affected First Nations, if interested. He said Chance wants to engage First Nations on the VESECs (e.g., Porcupine Caribou Herd and permafrost).
- [redacted] explained the logistical challenges of in-person engagement (e.g., finding flights and accommodation for the Project Team and travelling when the ice roads freeze). He expressed interest in more frequent virtual meetings. [redacted] acknowledged that COVID-19 delayed engagement with First Nations. He said that time was used to continue collecting baseline data.
- [redacted] said they recognize that Chance has been doing this for a long time and suggested they develop a Terms of Reference or Cooperation Agreement.
- Greg thanked [redacted] for their time.
- [redacted] requested Chance send information and questions discussed and work on collaboratively developing a Memorandum of Understanding, Terms of Reference, or Cooperation Agreement.

APPENDIX 2-B-28. September 27, 2023, Meeting Summary

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Meeting Minutes

Subject	Monthly Chance-GTC Meeting
Prepared By	Two Worlds Consulting
Groups Involved	Chance Oil and Gas Limited (Chance) Environmental Dynamics Inc. (EDI) Gwich'in Tribal Council (GTC) Two Worlds Consulting (TWC)
Participants	Chance Oil and Gas Limited • [redacted], VP Government and Community Relations • [redacted], Community Engagement and Permitting Environmental Dynamics Inc. • [redacted], Regulatory Specialist and Biologist Gwich'in Tribal Council • [redacted], Lands and Resources Coordinator • [redacted], Transboundary Specialist • [redacted], Acting Director Two Worlds Consulting • [redacted], Engagement Specialist • [redacted], Engagement Support • [redacted], Project Manager
Date/Time	September 27, 2023 1:30 – 2:15 pm PST
Copies to	Chance and GTC

Purpose of Meeting

- The purpose of the meeting was to follow up on action items identified during the August 29, 2023 meeting between Chance and GTC Staff.

Topics Discussed

- Project Proposal review and schedule
- Consultation and engagement activities
- Chance-GTC Collaboration Plan

Key Issues Raised / Chance Responses to Issues

- GTC shared they have ongoing capacity challenges and do not have a lot of technical experts inhouse.
- Chance shared [redacted] (Vuntut Gwitchin First Nation's technical advisor) contact information with GTC [redacted] was in the process of setting up a meeting with all potentially affected First Nations, Chance, Yukon Government, and the Yukon Socioeconomic Assessment Board to discuss capacity funding on October 13, 2023.
- GTC shared the importance of putting things into plain language and summarizing where possible.
    - Chance offered to bring Project Team members to discuss areas of interest to GTC at future monthly meetings (e.g., [redacted] from EDI to discuss the Porcupine Caribou Herd).

Actions and Responsible Party

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- Chance to develop a draft Collaboration Plan for GTC's review and comment – in progress
- Chance to send Eagle Plains Exploration Project (Project) information to [redacted] at GTC – complete
- Chance to send chapters of Project Proposal to Gwich'in Tribal Council as they become available – in progress
- GTC to confirm if Grand Chief[redacted] should be copied on all ongoing communications – in progress

Details of Discussion

Everyone introduced themselves.

[redacted] asked if anyone had any feedback on the meeting agenda before beginning.

[redacted] and [redacted] said there were no additional agenda items.

[redacted] shared the GTC Annual General Assembly (AGA) was happening October 3 – 5, 2023 after being postponed in August 2023 due to the wildfires. He said the AGA location had changed to Inuvik. GTC had no Project updates. [redacted] introduced [redacted] as the GTC lead on the Project and said there are many new staff at GTC. He added that it had been great collaborating with Chance and appreciates the support from TWC. Peter said GTC is looking forward to continuing to work together.

[redacted] asked if there would be any briefing on the Project at the AGA.

[redacted] said GTC Staff will discuss the Project with Grand Chief[redacted]. He added the Project will not be discussed in a lot of detail.

[redacted] asked GTC Staff to confirm if there are any materials that Chance could share to support that discussion.

[redacted] asked if Chance will be able to conduct community-level consultation and engagement activities. He noted Chance were told to cancel a planned community open house event in Fort McPherson in August 2023.

[redacted] said he would mention this to Grand Chief[redacted] at the AGA and noted GTC was holding off consultation and engagement activities until after the AGA.

Greg said the last two weeks of October is a difficult time to travel due to changing environmental conditions. He added it takes time to coordinate the logistics for the Chance Project Team to travel to the Northwest Territories.

[redacted] asked if there was a time in the fall that would work best for Chance to conduct consultation and engagement activities.

[redacted] said Chance will share proposed consultation and engagement dates with GTC. She added that Chance will offer taxi chit money to support the attendance of folks from Aklavik and Tsiigehtchic at events in Fort McPherson and Inuvik.

Greg said Chance wants to get proper feedback from people in the communities including Designated Gwich'in Office representatives, Elders, and youth.

[redacted] asked if Chance would cover expenses for the community members and staff.

[redacted] confirmed that Chance would cover travel expenses including honorarium and fuel to support folks from Aklavik and Tsiigehtchic attend events in Inuvik or Fort McPherson.

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[redacted] aid there are two steps required prior to consultation and engagement activities. He said GTC needs to provide approval for Chance to go into communities and approval on how Chance plans to conduct consultation and engagement activities. Peter requested Chance prepare a high-level Collaboration Plan outlining proposed consultation and engagement activities.

[redacted] said Chance has been and will continue to provide dinner at community open house events. [redacted] noted Chance is looking for GTC to confirm preferences around leadership-specific consultation and engagement activities. She asked GTC Staff to confirm if Grand Chief would like to join the monthly meeting between GTC and Chance.

[redacted] said that virtual consultation and engagement may be possible and asked Chance to include proposed location and format of activities in the Collaboration Plan.

[redacted] said it is helpful to know that virtual is an option.

[redacted] said Chance is interested in a Cooperation Agreement to support the flow of funding to GTC for their involvement in consultation and engagement activities.

[redacted] said GTC wants to set out their intentions to work together. He noted he has experience working on collaboration plans and that this medium allows GTC and Chance can get creative.

[redacted] said Chance is aiming to submit their Project Proposal in February 2024. She added that Chance is looking for feedback on the Project Proposal details from GTC and their technical team. [redacted] asked if GTC would be comfortable receiving documents as they become available or if there is preference to receive the Project Proposal as a bundled-up package.

[redacted] said either way would be okay. She also asked how long the documents are.

[redacted] said that the documents are long and exact page numbers for each chapter are not yet available. Eliza added that the documents could range into the hundreds of pages depending on the topics.

[redacted] confirmed receiving the Project Proposal chapters as they become available would be best.

[redacted] asked if GTC has a preferred technology such as Dropbox or a folder structure to share Project information.

[redacted] said she will work with [redacted], and the EDI Information Technology Team to see what would be the easiest for GTC.

[redacted] said GTC had no preferences around file sharing methods.

[redacted] said they can test out options and see which would work best.

[redacted] said Chance is trying to share information on topics of interest at community open house events. He said Chance will do their best to summarize important topics for the communities and is happy to support the First Nations coordinating their reviews together to help prioritize what information is needed for review and what individual experts are needed at the next session.

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[redacted] said that all sounds great. GTC stated they have ongoing capacity challenges and do not have a lot of technical experts inhouse. Peter shared the importance of putting things into plain language and summarizing where possible.

[redacted] welcomed GTC Staff to forward the monthly meeting invite to anyone else that should be involved.

[redacted] asked the GTC Staff if they had questions on the materials shared so far or if there are any topics of interests to discuss at the next meeting. She added Chance would coordinate to bring the right experts to the table as needed.

[redacted] said that sounded good.

[redacted] asked if there are any GTC-specific community-based research protocols that Chance should be aware of and/or individuals that Chance should interview as part of their socioeconomic assessment in the Project Proposal.

[redacted] said GTC will investigate and get back to Chance. Alicia added that she is feeling very new and is unsure if there are any emails that she is missing.

[redacted] said she will forward the email to [redacted] from the first meeting on baseline studies, links to a Dropbox site with the Project video, and other Project-related information. [redacted] said if anything is unclear, to let Chance know so they can help GTC to understand the proposed Project.

APPENDIX 2-B-29. October 13, 2023, Meeting Summary

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Meeting Minutes

Subject	Consultation and Capacity
Prepared By	Two Worlds Consulting (TWC)
Groups Involved	Chance Oil & Gas (Chance) TWC The Yukon Government (YG) Canadian Northern Economic Development Agency (CanNor) Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) First Nation of Na-Cho Nyak Dun (FNNND) Tr'ondëk Hwëch'in First Nation (TH) Gwich'in Tribal Council (GTC) Vuntut Gwitchin Government (VGG) Yukon Environmental and Socio-economic Assessment Board (YESAB)
Participants	• [redacted] Executive Committee Manager (YESAB) • [redacted] Aboriginal Relations (YG) • [redacted] Major Projects Director (YG) • [redacted] Major Projects Manager (YG) • [redacted] Geothermal & Petroleum Resources Manager (YG) • [redacted] Regional Environment Manager (CIRNAC) • [redacted] Manager (CIRNAC) • [redacted] Project Officer (CanNor) • [redacted] Project Manager (CanNor) • [redacted], Resources & Governance Consultant (FNNND and TH) • [redacted], Lands & resources coordinator (GTC) • [redacted], Technical Advisor (VGG) • [redacted], Caribou Coordinator (VGG) • [redacted] (Chance) • [redacted] (Chance) • [redacted], Regulatory Lead (Chance) • [redacted], Transboundary Specialist (GTC) • [redacted], [redacted], and [redacted] (TWC)
Date/Time	October 13, 2023 from 10:30am – 12:00pm PST
Copies to	[redacted]

Purpose of Meeting

- Discuss Consultation and Capacity

Topics Discussed

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- YESAB Screening Process
- Consultation Plan
- Transboundary Territory

Key Issues Raised / Chance Responses to Issues

- Inquired about international transboundary lands and if there is a plan to address that.
    - Chance stated they are following the YESAB regulations and there is nothing explicitly about international transboundary consultation requirements.
- Noted the need for Nations to receive capacity funding prior to the submission of proposals.
    - CIRNAC stated that NPFP is flexible and can be arranged to support this

Actions and Responsible Party

- VGG to set up all Nations meeting.
- YG to set up meeting with VGG, TH, FNNND, GTC to discuss Consultation Plan after all Nations meeting.
- VGG, TH, FNNND, GTC to follow up with CIRNAC about capacity funding.
- CIRNAC to follow up about Transboundary with US consultation protocol

Details of Discussion

- [redacted] talked about Chance's project proposal. [redacted] discussed Engagement with Chance and the somewhat revised project description. He clarified that this meeting is about the process moving forward and not the project details, as well as to better understand the Nations feelings. John introduced the idea of making a joint consultation plan process to ultimately look at capacity funding for all Nations to meaningfully participate in further engagement. [redacted] clarified that this meeting is to hear the party's perspectives on consultation and capacity and not to talk about the project or project details.
- [redacted] reiterated that this meeting is for consultation discussions. [redacted] described the screening process for YESAB. He stated that YESAB through the screening process checks to see if the proponent has fulfilled consultation duties with communities and First Nations using the four-point test. He clarified YESAB doesn't need consultation records during the screening period, as this is separate from the records of past consultation leading up to the screening period. [redacted] said he is here to answer any further questions about the screening process as the meeting progresses.
- [redacted] asked for clarification about the project history and new regulatory screening process since the project went from Dawson City Designated Office to the Executive Committee. [redacted] continued that with the newer consultation under the Executive Committee how will this change the screening process since the project is referred from the DO?
- [redacted] clarified this is a referred project and now must update under new regulation. He stated Chance is not submitting a new project rather a revised proposal and consultation record to meet new standards.
- [redacted] asked whose regime Chance was under before compared to now and how that has changed the process.
- [redacted] added that Nations are dealing with a proposal that has not been submitted yet and the consultation record only covers what has happened during the DO days.

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- [redacted] stated that First Nations are providing comments but asked [redacted] if Nations should expect face to face discussions to provide input moving forward.
- [redacted] answered yes, this is a possibility. He said YESAB could include Nations in the screening process if needed and desired.
- [redacted] redirected the conversation onto Aboriginal Relations with Yukon Governments
- [redacted] proposed adding to the meeting agenda more discussions regarding the Yukon government. He stated the Yukon Government is a regulator on this project and decision maker on this project and will make recommendation based on the Department of Economic Developments input. [redacted] further explained that the Yukon will lead a consultation under major projects Yukon, with affected Nations and YG will be relying on the screening process which means Nations need to participate in the screening process to inform how treaty rights are affected and how YESAB are taking those impacts and converting to values ultimately to inform decision making. [redacted] continued that the YESAB approach is to engage early in addition to the ongoing screening. He said this meeting is a good time to understand what the consultation process looks like moving forward. He informed that YESAB will be leaning on the Aboriginal Relations to inform and set up that consultation approach. He clarified the assessment itself will be informed by regulators providing technical expertise.
- [redacted] agreed with [redacted] and explained the process further.
- [redacted] explained that YESAB has a less defined consultation process to let it be led more by participants. She explained that YG has been working on multiyear consultation efforts. She invited a discussion of the components that need to be improved in the engagement process. [redacted] stated that she looks forwards to using consultation tools to better inform a process moving forward.
- [redacted] asked if YG is aware of the transboundary areas and how consultation works with Alaskan transboundary lands. He also asked how YG feels about transboundary lands with America.
- [redacted] answered that YG takes transboundary issues seriously but can't confirm if there is a case to reference where an organized Indigenous group in America had transboundary lands with Canada. [redacted] explained that YG has dealt with transboundary within Canada and Provinces more frequently than National transboundary lands.
- [redacted] asked to hear from other Federal representatives on International transboundary protocol.
- [redacted] answered speaking to the federal approach to consultation and the federal participation in these major projects. [redacted] stated that this project may not require federal decision bodies. She clarified that Canada's engagement and duty to consult relies on what is determined through the YESAB screening process.
- [redacted] stated that the Northern Participant Funding Program (NPFP) is designed to assist First Nations in participating in big projects but is limited to 150,000 dollars per fiscal year. He further explained that NPFP is limited to projects that are for sure to go through the assessment process.
- [redacted] asked [redacted] if Nations can't trigger NPFP funding until the proposal is submitted how can Nations get ready for the assessment, as Nations don't want to be left behind. [redacted] asked, if there was a possibility for capacity funding about 2 months before the proposal is submitted.

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- [redacted] answered that CIRNAC tries to be very flexible with this and are open to discussions before submission if things are moving quickly. Shane continued that CIRNAC is looking to maximize participation and readiness.
- [redacted] asked [redacted] if he would be open to assisting in creating a consultation plan
- [redacted] answered that he would be very open to help with a consultation plan. He clarified that Provincial limiting doesn't limit federal funding.
- [redacted] asked If Canada is not a decision body how are transboundary lands addressed with the US for Federal consultation.
- [redacted] asked, for the federal money that is available, is there any documents on the responsibility of proponents to provide capacity funding or is there federal linkage to proponent obligation.
- [redacted] answered, no, federal funding is not linked to proponent responsibility, rather federal funding is supplementary.
- [redacted] asked what Transboundary lands are in question.
- [redacted] clarified that Gwich'in territory extends into Alaskan transboundary lands. [redacted] asked if there is a plan around addressing this.
- [redacted] asked if this is referencing Porcupine Caribou Herd. [redacted] continued that Chance follows YEASB regulations and is concerned over the international regulations being brought into the equation as Chance is following all required regulations that are known.
- [redacted] answered that there are international transboundary Porcupine Caribou Herd relations that he wants clarification on about if there is existing federal protocol for but he just wanted to raise question not to raise concern.
- [redacted] echoed [redacted] and thanked John for clarifying on importance of concern raised.
- [redacted] reiterated that there is no question about FNNND desire to be very involved but the form that will take on how that participation will look he is not sure on. He stated that FNNND is overlapping with TG and that both First Nations want to be involved but have to sort out the details.
- [redacted] stated that Chance has been working with FNNND for a while now and Chance needs to know what level of consultation is required as previous meetings have been postponed and there is not a clear understanding of what FNNND wants consultation wise. [redacted] wanted to get confirmation about level of consultation desired by FNNND. He stated porcupine caribou is common priority amongst all Nations involved and that is known. [redacted] said that Chance would like to schedule meetings with FNNND and asked if [redacted] could help Chance in a timely matter to get some direction on how and when to consult with FNNND as it has been hard in the past. [redacted] recognized that the type and degree of consultation needs to be sorted out on direction that further consultation will take.
- [redacted] answered that there has been some difficulty lately with new governments in both Nations and all new staff causing delays. [redacted] stated that he is working on trying to facilitate more understanding on needs.
- [redacted] stated that he had a few meetings with Chance regarding the proposal and GTC and Chance have a good working relationship, but this relationship doesn't replace the federal duty to consult, and GTC looks forward to discussing that further when the time comes.

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- [redacted] talked about the how the Old Crow meetings back in May discussing the revised project description were delayed due to floods but the but the Mid September meetings in Old Crow were very productive. [redacted] thought it was a good session. [redacted] shared that the VGG perspective is to get ahead of this and have regular meetings with Greg, to keep in touch. John shared that VGG are in support about the proposal being submitted. [redacted] shared that VGG would like to know what the consultation process looks like so VGG can prepare. [redacted] proposed that VGG works together with the other Nations to be more efficient and share resources and to be coordinated in the consultation process. John asked for a First Nations reps only meeting to get organized and so Nations can be active and not passive in the consultation process.
- [redacted] asked if the current project proposal is the final version of the proposal. [redacted] said that the last timeline heard was mid December for probable submission to YESAB. [redacted] asked if FNNND and TH are currently being consulted on the final or work in progress proposal.
- [redacted] answered that Chance has a description of the project in draft from. [redacted] said that the Nations consultation on the project so far has not just been about ticking off a box about rather what people think about the project. [redacted] said that all Nations are going to see the final proposal when it is submitted. [redacted] stated that Chance is looking at a submission in January and said [redacted] can talk to that more.
- [redacted] said that Nations are currently dealing with the draft proposal currently, but the final will be the one that is focused on moving forward.
- [redacted] asked if it can be confirmed that the proposal can be adjusted.
- [redacted] answered that the proposal can be adjusted until submission.
- [redacted] Presented Chance project updates: [redacted] showed slides. [redacted] thanked everyone for attending. He stated Chance is working to meet all four points under YESAB screening. [redacted] stated nothing has really changed from 2014 to the new project. He continued that minor changes were made to First Nations engagement, like seasonal road. [redacted] informed that between now and January 2024 the goal is to submit proposal early to mid February. He stated Chance is happy to do virtual meetings. [redacted] said Chance doesn't want to be throwing big packages at you, Chance wants to make sure that it can be a meaningful conversation. He stated Chance will be doing a document review and that Two Worlds Consulting was hired to support in this endeavour. He finished by saying the meeting held with YESAB about traditional knowledge was critical and Chance wants to capture that Knowledge and use it to influence the submission.
- [redacted] closed the meeting by discussing possible next steps like an all Nation only meeting and a consultation plan with help of YG. [redacted] stated that it was good to hear about support for consultation and about capacity funding as needs are there. He finished by sharing that it might be a good idea to collapse all nations together to save money.

APPENDIX 2-B-30. November 1, 2023, Meeting Summary

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Meeting Minutes

Subject	Monthly Eagle Plains Exploration Project Meeting
Prepared By	Two Worlds Consulting
Groups Involved	Chance Oil and Gas Limited (Chance) Environmental Dynamics Inc. (EDI) Gwich'in Tribal Council (GTC) Two Worlds Consulting (TWC)
Participants	Chance • [redacted], Community Engagement and Permitting • [redacted] VP Government and Community Relations EDI • [redacted], Regulatory Specialist and Biologist GTC • [redacted], Lands and Resources Coordinator • [redacted], Transboundary Specialist TWC • [redacted], Engagement Specialist • [redacted] Socioeconomic Specialist • [redacted] Engagement Support • [redacted] Project Manager
Date/Time	November 1, 2023 2:30 – 3:20 pm MDT
Copies to	Chance and GTC

Purpose of Meeting

- To discuss GTC's involvement in the Eagle Plains Exploration Project (Project) regulatory process.

Topics Discussed

- Project Proposal updates and schedule.
- Consultation and engagement activities.

Key Issues Raised / Chance Responses to Issues

- GTC shared that they are experiencing ongoing capacity challenges.
- GTC shared that any development within the Peel Watershed could trigger a requirement for the Yukon Government to notify the Northwest Territories Government.
- GTC shared concern about cumulative effects in the Peel Watershed and cumulative effects of greenhouse gas emissions.

Actions and Responsible Party

- Chance to share updated open house dates with GTC staff via email.
- Chance to maximize the use of visuals in open house materials.
- Chance to provide the open house advertisement with GTC, once the open house date is confirmed.
- GTC to review and provide comment on the *Draft Collaboration Plan*.
- GTC to confirm if Chance should proceed with conducting an open house in Fort McPherson on December 7, 2023.
- GTC to confirm the best way to advertise the proposed open house in Fort McPherson.
- GTC to confirm if the PDF open house advertisement should be in another file format.

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- GTC to confirm interest in having a more focused discussion on heritage resources with Ecofor (heritage resources consultant for the Project).
- GTC to send [redacted] contact information to Chance.
- GTC to confirm with Chance if there are any communication protocols to follow (i.e., who should be included on emails from Chance).

Details of Discussion

[redacted] welcomed GTC to share Project updates.

[redacted] shared GTC staff plan to meet regularly with GTC leadership about the Project and other items.

[redacted] said that GTC was still in the process of reviewing the *Draft Collaboration Plan* prepared by Chance. GTC will get back to Chance with any comments, questions, and/or feedback very soon.

[redacted] said the proposed open house dates have shifted due to Project team and airline availabilities. She said that Chance is hoping to get confirmation from GTC on these dates. She added that Chance would like to fly into Inuvik on the morning of December 7, 2023. She explained that Chance is hoping to meet with GTC that morning and then take a charter plane to Fort McPherson to conduct an open house event that evening. [redacted] said Chance would leave Inuvik on December 8, 2023 to fly south to Whitehorse.

[redacted] said he had breakfast with GTC Grand Chief that morning. [redacted] said Grand Chief understood the importance for Chance to consult GTC Participants and residents in Fort McPherson. Grand Chief suggested to [redacted] that Chance host an early dinner with a presentation from each specialty group, such as fish and wildlife, engineering, seismic, and permafrost. [redacted] confirmed Chance will reimburse GTC for their time to support hybrid meeting logistics for the proposed open house. [redacted] also shared that Grand Chief recommended Chance bring representatives from Aklavik, Tsiigehtchic, and Fort McPherson to Inuvik in early 2024. [redacted] said Chance would help pay for the travel and accommodation of these representatives.

[redacted] asked for clarification on the proposed December open house date in Fort McPherson.

[redacted] clarified Chance is proposing to conduct an open house in Fort McPherson the evening of December 7, 2023. She added that there would also be space to bring GTC staff on the charter plane to Fort McPherson and return to Inuvik. [redacted] stated that Chance would fly to Whitehorse on December 8.

[redacted] said Chance hopes to conduct a hybrid event on December 7, 2023. He noted if that doesn't work out, then the Project team would travel back to the Northwest Territories in January 2024 for additional in-person consultation and engagement.

[redacted] said the Chance Project Team would like to provide sufficient time to advertise the event to GTC Prticipants and support Chance to plan accordingly. She said that Chance would normally like to provide 2 to 3 weeks of notice of open house events. [redacted] said Chance would provide an advertisement to GTC once the open house date was confirmed.

[redacted] asked if GTC prefers the term 'participants', 'citizens', or 'members'. Noted she had seen variety of terms online and wanted to make sure Chance prepared materials that respected GTC's preferences.

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[redacted] said that 'Gwich'in Participant' is the proper term. He shared that presentations with visuals are appreciated by Gwich'in Participants. He recommended less technical presentations and the use of maps and figures that Gwich'in Participants can ask questions about and provide feedback on.

[redacted] said Chance has a Project video as well. She said that if it's too long to show, Chance can focus on parts of the video most important to GTC. [redacted] thanked [redacted] for the feedback and asked if there is anything else that anyone would like to add. She said if not, she will introduce Daryl to the group.

[redacted] ared that there is a community radio station in Fort McPherson and recommended Chance advertise the open house via the radio. He added that Facebook is a good way to advertise too. He said that he can reach out to the GTC enrollment office, and that they can send the information directly to Gwich'in Participants' emails, pending approval from GTC leadership.

[redacted] said that sounded great. She said that Chance will wait to hear back from GTC for confirmation on the proposed open house date. She said she can send an email confirming the December dates in writing.

[redacted] asked if there will be a Microsoft Teams link for folks to join the open house event that are not located in Fort McPherson.

[redacted] said Chance is happy to support a hybrid event. [redacted] added that Chance is looking for advice from the GTC technical team to support the logistics of a hybrid event.

[redacted] asked if Chance has considered travelling with Starlink. He said his Starlink works very well.

[redacted] asked GTC to confirm if the open house invitation should be shared in a format other than PDF.

[redacted] said he would confirm with the preferred invitation format with one of his communication colleagues.

[redacted] said that if there are any questions regarding the socio-economic process for the Collaboration Plan, [redacted] is here to help.

[redacted] introduced himself. He said that he is leading the socio-economic assessment of the Project Proposal. He said that Chance is assessing the Project's potential impact to land use, transportation and infrastructure, employment and economy, and community health and wellbeing. [redacted] noted Chance is interested in engaging Gwich'in Participants on these topics. He acknowledged Gwich'in Participants travel down the Dempster highway for cultural and traditional use activities. He added that Chance wants to understand the location and seasonality of these activities to understand potential Project-related impacts and possible mitigation measures. He said that there is an opportunity to connect with representatives from GTC to confirm any information that Chance has heard and to fill in gaps where necessary.

[redacted] thanked [redacted] and said it is good to see that Chance is planning to engage with Gwich'in Participants. He said that in the past, GTC has included the cultural and heritage department. He said he will chat with the leadership and bring [redacted] on board to participate. He asked if [redacted] is doing the cultural heritage assessment.

[redacted] said that Ecofor is responsible for the cultural heritage assessment. She said to let Chance know if GTC wants a more focused discussion on heritage with Ecofor.

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[redacted] said he will mention it to the leadership.

[redacted] asked [redacted] to share [redacted] contact information with Chance to coordinate a socio-economic interview with her. He added that Chance can send over consent forms, questions, and themes prior to conducting socio-economic interviews to make the best use of everyone's time.

[redacted] introduced herself as the regulatory lead for the Project. She said that EDI can bring experts as needed to answer any questions around physical and biophysical components of the Project.

[redacted] said that GTC is so busy right now. He said that GTC will take a closer look at the Collaboration Plan soon and provide further feedback.

[redacted] asked if the Project overlaps with the Peel Watershed.

[redacted] confirmed the Project overlaps with the Peel Watershed.

[redacted] noted this that may trigger requirement for Yukon Government to notify the Northwest Territories of the Project, which may affect Chance's current Project timeline.

[redacted] said Chance is prepared to assist the Nations review the Project information in detail. He recognized that the Porcupine Caribou Herd, water drainage system, fish, wildlife, and land and resource use activities such as trapping are priorities for the First Nations. [redacted] added that Chance will still be available after submission of the Project Proposal to discuss and respond to Project-related issues/gaps identified by the First Nations.

[redacted] said that [redacted] is working with all the First Nations and that there is already a meeting scheduled to discuss northern participant funding. He said the meeting will be about how each Nation can benefit from that and increase capacity in the Project's regulatory process. He said that GTC's leadership team knows about this meeting. [redacted] raised that cumulative effects to the watershed are a very important consideration as well. He asked what the total carbon footprint of the Project is. He noted that this is something that GTC would like to investigate as well.

[redacted] thanked [redacted] for his comments.

[redacted] asked if GTC has any communication protocols and if Kanda and Alicia should be copied on all correspondence.

[redacted] said he will let Chance know if GTC has any communication protocols to be followed.

APPENDIX 2-B-31. December 4, 2023, Meeting Summary

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Meeting Minutes

Subject	Monthly Eagle Plains Exploration Project Meeting
Prepared By	Two Worlds Consulting
Groups Involved	Chance Oil and Gas Limited (Chance) Environmental Dynamics Inc. (EDI) Gwich'in Tribal Council (GTC) Two Worlds Consulting (TWC)
Participants	Chance • [redacted], Community Engagement and Permitting • [redacted], VP Government and Community Relations EDI • [redacted], Regulatory Specialist and Biologist GTC • [redacted], Lands and Resources Coordinator • [redacted], Transboundary Specialist TWC • [redacted], Engagement Specialist • [redacted], Engagement Support • [redacted], Project Manager
Date/Time	December 4, 2023 9:30 – 9:55 AM MST
Copies to	Chance and GTC

Purpose of Meeting

- Project updates

Topics Discussed

- Fort McPherson engagement activities
- Socioeconomic research interviews
- Porcupine Caribou Herd Technical Working Group

Key Issues Raised / Chance Responses to Issues

- GTC noted that didn't have a record of anything related to cultural or heritage baseline data in the draft Project Description, but it says that cultural impact studies will be considered.
    - Chance to resend the heritage baseline studies to GTC – complete.

Actions and Responsible Party

- Chance to prepare a slide about Project-related job opportunities for the community engagement events – complete.
- Chance to forward email regarding socioeconomic interviews with GTC – complete.
- Chance to copy [redacted] on all future GTC correspondences – ongoing.
- Chance to send the December 20th meeting recording to GTC – in progress; Chance to share a copy of the Porcupine Caribou Herd Technical Working Group meeting minutes to GTC – in progress.

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- GTC to send Chance personal cell number for Fort McPherson engagement activities – complete.

Details of Discussion

[redacted] requested confirmation from the GTC team if there was anyone else from GTC that wanted to travel with the Chance Project Team to Fort McPherson via charter plane on December 7th. [redacted] asked if TWC should pick [redacted] up in a taxi to the airport with the Project Team.

[redacted] added that the charter is scheduled to leave between 2:00 and 2:30 pm MST. He said that the Project Team will be leaving from the main hangar.

[redacted] said that it sounds like the Project Team will be leaving for the airport after checking in at Capital Suites in Inuvik. She said the Project Team will be waiting for the rest of the team to arrive from Calgary at the Inuvik airport. [redacted] asked if [redacted] would like an email, text, or phone call when the Project Team will be heading to the airport.

[redacted] confirmed that a text or phone call would work. She added that she could drive herself to the airport.

[redacted] said meeting the Project Team at the Inuvik airport at 2:00 pm MST would work. He noted that the Project Team will be leaving Inuvik around 2:30 pm MST. [redacted] added that the flight will take 30minutes and that Chance has arranged rides to and from the Fort McPherson airport to the Hamlet Community Center. [redacted] said the Project Team would be dropped off at the Fort McPherson airport around 8:00 and 8:30 pm MST.

[redacted] stated that it will be just her from GTC. She added that [redacted] and [redacted] are not available.

[redacted] noted that [redacted] is not expected to set up the open house event. She added that the Project Team will be setting up posters around the room, have a sign in sheet upon entry, and a Project handout to give to attendees. She noted that if there are any questions, the Project Team will be there to help. She shared dinner would be provided and stated that while people are eating, the Project Team will play the Project Overview video. She added that after that, there will be a presentation with a question-and-answer period. [redacted] noted that a feedback form will be available for attendees to complete at the end of the event. She also shared Chance draw door prizes at the end of the event.

[redacted] asked if there is anything that will be expected of her and what she should be prepared for.

[redacted] said that questions might be asked about the role that GTC plays with Chance. He added that attendees may want to know how GTC is connected to Chance. He noted that GTC could say that Chance works with GTC so that Gwich'in Participants are aware that Chance is following proper consultation protocols and practices.

[redacted] said that community members may ask about Project-related job opportunities. He requested that the Project Team prepare a slide to let the attendees know what type of opportunities will be available.

[redacted] confirmed Chance would prepare a slide on Project-related job opportunities and mentioned that the Project Team had already gotten requests for information on this topic. He added that the *Indian Act* chief and council will come say hello too. He noted that Chance will have seismic and drilling experts who will be able to answer any technical questions about the Project and job and contract opportunities for the well maintenance program next winter.

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[redacted] thanked GTC and noted the socioeconomic team will conduct interviews with GTC staff while in Inuvik and Fort McPherson. She added that the socioeconomic team is conducting interviews to help fill data gaps for the socioeconomic assessment that is part of the Project Proposal. She said that [redacted] suggested a group interview via email. [redacted] confirmed that the socioeconomic interview program did not include interviewing Gwich'in Participants but is looking for input from GTC staff to support the socioeconomic assessment.

[redacted] asked what day the email was sent out on.

[redacted] said that she will reforward the email to Alicia and Kanda again. She said that the email was sent out last Tuesday (November 28, 2023).

[redacted] asked if [redacted] would like to be copied on everything from the Project Team.

[redacted] onfirmed yes.

[redacted] said that he hasn't seen anything related to First Nations heritage or cultural in the baseline data that's been provided to GTC. He noted that draft Project Description says that cultural impact studies will be considered. He stated that he didn't see any cultural or heritage baseline data.

[redacted] said that Chance has conducted heritage baseline studies. She noted that she could resend the heritage baseline studies to [redacted] by email.

[redacted] said that the Project Proposal that Chance will be submitting to Yukon Environmental Socio-economic Assessment Board will include information on these topics. He noted that the socioeconomic assessment will incorporate publicly available secondary sources of cultural/Traditional knowledge.

[redacted] noted that it is important to include both cultural and heritage information in anything related to GTC. He added that is why he inquired about the baseline data.

[redacted] shared that the Project Team is working with EDI to conduct a fish and wildlife hybrid technical working group meeting on December 20, 2023, with specific focus on the Porcupine Caribou Herd. He added that Vuntut Gwitchin Government requested this meeting. Greg said someone from the Project Team will send an invite shortly. Greg said the meeting would be held in Whitehorse and a virtual attendance option would be provided. He stated that the Project Team hopes GTC can join the meeting He acknowledged the importance of Porcupine Caribou Herd and fur bearing animals to Gwich'in Participants.

[redacted] said the GTC office will be closed as of December 15th and staff will be unavailable to attend the December 20th meeting. Kanda requested that the Project Team record the meeting for GTC.

[redacted] said that Chance can record the meeting and send it to GTC. She asked what day the GTC office opens in January 2024.

[redacted] said he will check.

[redacted] said she is going to resend the socioeconomic assessment email outlining identified secondary sources containing Gwich'in Traditional Knowledge. She requested that GTC give confirmation that the sources can be used in the socioeconomic assessment and Project Proposal. She noted that some are linked to online sources; and some need to be downloaded as a PDF.

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[redacted] said that if it was sent in October, GTC would have missed it.

[redacted] said she will reforward the email to GTC.

[redacted] thanked [redacted]. He noted that Porcupine Caribou Herd is in the Peel Watershed. He stated that GTC is looking to develop a baseline document about the Porcupine Caribou Herd in the Peel Watershed.

[redacted]stated that she will send her personal cell number to get a hold of her.

Chance thanked GTC for their time and expressed excitement for their trip to Fort McPherson.

APPENDIX 2-B-32. December 7, 2023, Open House Summary Report

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Meeting Minutes

Subject	Monthly Eagle Plains Exploration Project Meeting
Prepared By	Two Worlds Consulting
Groups Involved	Chance Oil and Gas Limited (Chance) Environmental Dynamics Inc. (EDI) Gwich'in Tribal Council (GTC) Two Worlds Consulting (TWC)
Participants	Chance • [redacted], Community Engagement and Permitting • [redacted], VP Government and Community Relations EDI • [redacted], Regulatory Specialist and Biologist GTC • [redacted], Lands and Resources Coordinator • [redacted], Transboundary Specialist TWC • [redacted], Engagement Specialist • [redacted], Engagement Support • [redacted], Project Manager
Date/Time	December 4, 2023 9:30 – 9:55 AM MST
Copies to	Chance and GTC

Purpose of Meeting

- Project updates

Topics Discussed

- Fort McPherson engagement activities
- Socioeconomic research interviews
- Porcupine Caribou Herd Technical Working Group

Key Issues Raised / Chance Responses to Issues

- GTC noted that didn't have a record of anything related to cultural or heritage baseline data in the draft Project Description, but it says that cultural impact studies will be considered.
    - Chance to resend the heritage baseline studies to GTC – complete.

Actions and Responsible Party

- Chance to prepare a slide about Project-related job opportunities for the community engagement events – complete.
- Chance to forward email regarding socioeconomic interviews with GTC – complete.
- Chance to copy [redacted] on all future GTC correspondences – ongoing.
- Chance to send the December 20th meeting recording to GTC – in progress; Chance to share a copy of the Porcupine Caribou Herd Technical Working Group meeting minutes to GTC – in progress.

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- GTC to send Chance personal cell number for Fort McPherson engagement activities – complete.

Details of Discussion

[redacted] requested confirmation from the GTC team if there was anyone else from GTC that wanted to travel with the Chance Project Team to Fort McPherson via charter plane on December 7th. [redacted] asked if TWC should pick [redacted] up in a taxi to the airport with the Project Team.

[redacted] added that the charter is scheduled to leave between 2:00 and 2:30 pm MST. He said that the Project Team will be leaving from the main hangar.

[redacted] said that it sounds like the Project Team will be leaving for the airport after checking in at Capital Suites in Inuvik. She said the Project Team will be waiting for the rest of the team to arrive from Calgary at the Inuvik airport. [redacted] asked if [redacted] would like an email, text, or phone call when the Project Team will be heading to the airport.

[redacted] confirmed that a text or phone call would work. She added that she could drive herself to the airport.

[redacted] said meeting the Project Team at the Inuvik airport at 2:00 pm MST would work. He noted that the Project Team will be leaving Inuvik around 2:30 pm MST. [redacted] added that the flight will take 30minutes and that Chance has arranged rides to and from the Fort McPherson airport to the Hamlet Community Center. [redacted] said the Project Team would be dropped off at the Fort McPherson airport around 8:00 and 8:30 pm MST.

[redacted] stated that it will be just her from GTC. She added that [redacted] and [redacted] are not available.

[redacted] noted that [redacted] is not expected to set up the open house event. She added that the Project Team will be setting up posters around the room, have a sign in sheet upon entry, and a Project handout to give to attendees. She noted that if there are any questions, the Project Team will be there to help. She shared dinner would be provided and stated that while people are eating, the Project Team will play the Project Overview video. She added that after that, there will be a presentation with a question-and-answer period. [redacted] noted that a feedback form will be available for attendees to complete at the end of the event. She also shared Chance draw door prizes at the end of the event.

[redacted] asked if there is anything that will be expected of her and what she should be prepared for.

[redacted] said that questions might be asked about the role that GTC plays with Chance. He added that attendees may want to know how GTC is connected to Chance. He noted that GTC could say that Chance works with GTC so that Gwich'in Participants are aware that Chance is following proper consultation protocols and practices.

[redacted] said that community members may ask about Project-related job opportunities. He requested that the Project Team prepare a slide to let the attendees know what type of opportunities will be available.

[redacted] confirmed Chance would prepare a slide on Project-related job opportunities and mentioned that the Project Team had already gotten requests for information on this topic. He added that the *Indian Act* chief and council will come say hello too. He noted that Chance will have seismic and drilling experts who will be able to answer any technical questions about the Project and job and contract opportunities for the well maintenance program next winter.

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[redacted] thanked GTC and noted the socioeconomic team will conduct interviews with GTC staff while in Inuvik and Fort McPherson. She added that the socioeconomic team is conducting interviews to help fill data gaps for the socioeconomic assessment that is part of the Project Proposal. She said that [redacted] suggested a group interview via email. [redacted] confirmed that the socioeconomic interview program did not include interviewing Gwich'in Participants but is looking for input from GTC staff to support the socioeconomic assessment.

[redacted] asked what day the email was sent out on.

[redacted] said that she will reforward the email to Alicia and Kanda again. She said that the email was sent out last Tuesday (November 28, 2023).

[redacted] asked if [redacted] would like to be copied on everything from the Project Team.

[redacted] onfirmed yes.

[redacted] said that he hasn't seen anything related to First Nations heritage or cultural in the baseline data that's been provided to GTC. He noted that draft Project Description says that cultural impact studies will be considered. He stated that he didn't see any cultural or heritage baseline data.

[redacted] said that Chance has conducted heritage baseline studies. She noted that she could resend the heritage baseline studies to [redacted] by email.

[redacted] said that the Project Proposal that Chance will be submitting to Yukon Environmental Socio-economic Assessment Board will include information on these topics. He noted that the socioeconomic assessment will incorporate publicly available secondary sources of cultural/Traditional knowledge.

[redacted] noted that it is important to include both cultural and heritage information in anything related to GTC. He added that is why he inquired about the baseline data.

[redacted] shared that the Project Team is working with EDI to conduct a fish and wildlife hybrid technical working group meeting on December 20, 2023, with specific focus on the Porcupine Caribou Herd. He added that Vuntut Gwitchin Government requested this meeting. Greg said someone from the Project Team will send an invite shortly. Greg said the meeting would be held in Whitehorse and a virtual attendance option would be provided. He stated that the Project Team hopes GTC can join the meeting He acknowledged the importance of Porcupine Caribou Herd and fur bearing animals to Gwich'in Participants.

[redacted] said the GTC office will be closed as of December 15th and staff will be unavailable to attend the December 20th meeting. Kanda requested that the Project Team record the meeting for GTC.

[redacted] said that Chance can record the meeting and send it to GTC. She asked what day the GTC office opens in January 2024.

[redacted] said he will check.

[redacted] said she is going to resend the socioeconomic assessment email outlining identified secondary sources containing Gwich'in Traditional Knowledge. She requested that GTC give confirmation that the sources can be used in the socioeconomic assessment and Project Proposal. She noted that some are linked to online sources; and some need to be downloaded as a PDF.

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[redacted] said that if it was sent in October, GTC would have missed it.

[redacted] said she will reforward the email to GTC.

[redacted] thanked [redacted]. He noted that Porcupine Caribou Herd is in the Peel Watershed. He stated that GTC is looking to develop a baseline document about the Porcupine Caribou Herd in the Peel Watershed.

[redacted]stated that she will send her personal cell number to get a hold of her.

Chance thanked GTC for their time and expressed excitement for their trip to Fort McPherson.

APPENDIX 2-B-33. December 20, 2023, Meeting Summary

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Draft Meeting Minutes

Subject	Technical Working Group – Fish and Wildlife
Prepared By	Two Worlds Consulting
Groups Involved	Chance Oil and Gas (Chance) Environmental Dynamics Inc. (EDI) First Nation of Na-cho Nyäk Dun (NND) Porcupine Caribou Management Board (PCMB) Tr'ondëk Hwëch'in (TH) Two Worlds Consulting (TWC) Vuntut Gwitchin First Nation (VGFN) Yukon Government (YG)
Participants	**Chance Oil and Gas (Chance)** • [redacted], Community Engagement and Permitting • [redacted], Vice President Government and Community Relations **Environmental Dynamics Inc. (EDI)** • [redacted], Senior Biologist • [redacted], Senior Biologist • [redacted], Quantitative Ecologist **First Nation of Na-cho Nyäk Dun (NND)** • [redacted], Advisor **Porcupine Caribou Management Board (PCMB)** • [redacted], Executive Director • [redacted], Chair • [redacted], Minute Taker **Tr'ondëk Hwëch'in (TH)** • [redacted], Advisor **Two Worlds Consulting (TWC)** • [redacted], Engagement Facilitator • [redacted], Engagement Support **Vuntut Gwitchin First Nation (VGFN)** • [redacted] Technical Advisor **Yukon Government (YG)** • [redacted], Caribou Specialist
Date/Time	December 20, 2023, 8:00 to 12:00 am MST
Copies to	All groups involved

Purpose of Meeting

- To provide a Project summary and updates; and share results of Environmental Baseline Studies including preliminary potential effects and mitigation to Fish, Wildlife, Porcupine Caribou Herd, Linear Features, and North Yukon Land Use Planning Conformity.
- A question and answer period followed the information sharing.

Topics Discussed

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- Project summary and updates
- Baseline Studies
- Effects Assessments
- Fish and Fish Habitat
- Wildlife and Wildlife Habitat
- Porcupine Caribou Herd

Key Issues Raised / Chance Responses to Issues

- Participants would like more detail about the Project Proposal and requested Chance to include all activities in the Project proposal. / Chance to review.
- Participant inquired about meandering seismic lines and how operators are informed about the design. / Chance confirmed that there is a design in place and that scouting will occur prior to the work, to understand the density of the forest and to optimize line locations.
- Asked if the Project videos are online. / Chance is developing a webpage.
- Requested more information on Chance's interpretation of disturbance. / Chance responded that key disturbance factors include noise, smells, and human movement/presence, and consider how far away caribou are from the well sites. Chance stated that disturbance is dependent on how the caribou are responding. Studies on Zone of influence are mixed, with various analytical methods, and depending on interpretation can range from no avoidance up to 40 kilometres of avoidance. There are many issues with analytical approaches that are scale dependent, and not often considered by those authors.
- The priority is to not disturb the caribou, but further work is needed to determine what is too much disturbance. Participants inquired about mitigations and if there is anything other than seasonality. / Chance responded that there will be mitigations in place, and there will be direct and indirect effects.
- A participant cautioned about using a 1-kilometrer Zone of Influence (ZOI), and believes the literature will reflect larger zones. Shared that he thinks Chance will have a difficulty finding that in the literature. / Chance responded that the primary reason for the buffer was because of sensory disturbance and that in larger ZOI assessments there is not a clear mechanism that is associated with the level of disturbance. Chance is focused on addressing local scale sensory disturbance within the work area, and that linear avoidance is assumed within the literature on ZOI's. The assessment applies a uniform 75% reduction across the 1-kilometre zone, which is a conservative (i.e., likely over-estimate) of the effect throughout the zone.
- PCTC (Porcupine Caribou Technical Committee) advised against doing the ZOI analysis based on low sample size (few caribou interacting with 3D seismic across the range). / Chance said that they could not ignore existing data and conducted the analysis regardless, and in the end did not rely on a 3D ZOI analysis as it was not conclusive.
- Participants expressed concerns about the ability of the Land Use Planning Council to review the Project for a conformity check, compared to the capacity of the North Yukon Commission. / Chance said that there are knowledgeable people on the council who have been there for a while. Shared that the North Yukon Commission no longer exists.
- Inquired about how Chance will be able to privatize a road. / Chance responded that the Chief Operating Officer can make it a private road. Said that that it is more of a safety concern, and that people are not interested in hunting around the drilling area. The company could grant access to subsistence harvesters, but this may create a safety concern for staff on site.
- Expressed concerns about the lack of communication between Chance and the Executive Committee. These conversations are important.

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- A participant shared concerns that their experience on drill projects, drill sites needed a 24-hour supply of water, which was trucked into the site. Unless technology has changed, that is one example of essential road traffic even if there are caribou in the area. Participant asked if the reduction would be sufficient or not. / Chance does not have the details on what is considered essential road traffic right now, but will include that in the Project Description.
- Participant requested an end of season report, to understand if caribou mitigation efforts worked and is concerned that this is not being considered. / Chance is interested in learning how the caribou are impacted, and that Chance will learn over the project lifecycle (10-year program).
- Participants encouraged ongoing in-person discussion outside of the YESAB review, which, through written format, can become hostile.

Actions and Responsible Party

- No actions.

Details of Discussion

[redacted] (Chance) gave a brief Project summary and added that [redacted] (EDI) would lead the presentation. [redacted] emphasized that the Project is a proposed exploration program and reiterated that the proposed submission of their Project Proposal is February 2024. Chance has been conducting virtual and in person engagement meetings. He mentioned First Nation of Na-Cho Nyäk Dun leadership currently does not want to participate in community engagement. Chance will continue to provide Project information and that engagement will continue with the First Nations and residents of communities. Chance will also share technical reports with First Nations. Chance is proposing a 10-year program.

The group shared a round of introductions.

[redacted] (EDI) stated the exploration area is around 2400 square kilometres, with clearing occurring during the winter and that it will be approximately 1500 square kilometres total of 3D seismic spread over 10 years. He added that there will be 2000 square kilometres of 2D seismic. [redacted] (EDI) noted that the Project is looking at up to 5 wells per year, equivalent to 2 hectares, and a maximum of 30 wells total. He stated that winter operations will last about 1 to 3 years in each area. He added that there will be three Project work areas and winter access roads will be created. He noted that there will be spring and summer seismic activities with helicopter support and extended flow testing. He stated that the seismic work is different than what was done in the 1950s.

[redacted] (Chance) added that extended flow testing occurs during the winter months and a well of interest will be flowed for natural gas and oil to a service rig. He shared that Chance will be abandoning 3 or up to 5 wells next winter.

[redacted] (PCMB) asked if the seismic testing will include installing and retrieving geophones, which was done previously.

[redacted] (Chance) said that it is new to Chance and that they use the same equipment from the seismic program in 2013.

[redacted] (PCMB) mentioned that he knew Chance was working on site.

[redacted] (Chance) stated that the geophones will be flown out when the snow and wildlife are gone in the spring. He added that if the caribou are hanging out, they can employ mitigation measures and hold off detonation and data collection until the caribou migrate north.

[redacted] (NND/TH) asked if this includes surface drilling.

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[redacted] (Chance) said that it would involves drilling a 3-to-5-meter hole, and the charge will be put down and repacked.

[redacted] (NND/TH) inquired if it was helicopter access and if Chance would be setting up a portable drill.

[redacted] (Chance) mentioned that the site is accessible by vehicle and that Chance would transport the drilling equipment. He added that Chance can hold off until late spring to detonate and take samples.

[redacted] (NND/TH) inquired if it was restricted access.

[redacted] (Chance) confirmed that it will be restricted access.

[redacted] (PCMB) stated that in 2013 there were caribou around. If caribou are around when Chance conducts work, will they hold off on the seismic activity?

[redacted] Chance) said Chance would hold off on detonation activities, but this needs to be discussed further. Chance will make these decisions as they occur and depending on how many caribou are in the area. [redacted] does not understand what the criteria is for this. In the baseline data being gathered for the technical review, there is the understanding that the caribou will migrate. He noted that Chance will go back to that location after the caribou move through. He stated that it depends on the number of caribou that are migrating in the winter range. Chance won't know until they do the field work and determine caribou movement through wildlife monitoring.

[redacted] PCMB) said that if there are caribou moving through the area, it won't be just one hundred in the Eagle Plains Basin. It will be a lot more caribou than that. This is what the collared data suggests.

[redacted] (EDI) noted that the Project team wants to have a good understanding of caribou movement. He added that protecting the lichen protects the herd. He noted that this is why activities are occurring in the winter to minimize the impacts. Seismic lines don't have to be straight anymore, and it is not the Project that was proposed in the past. This is a different seismic operation and that the key thing is that it will be spread out over 10 years.

[redacted] (EDI) presented the Baseline Studies Completed slide.

[redacted] (EDI) shared that the Project was bumped up to Executive Committee screening, which required Chance to do several studies.

[redacted] (PCMB) inquired about information on the Executive Committee.

[redacted] (EDI) said that it is a higher level of consultation and requirements. The Executive Committee reviews the Project.

[redacted] (Chance) said that they require additional data and baseline studies. The original Project went to the Yukon Environmental and Socioeconomic Assessment Board (YESAB) Dawson office and four out of six concerns came from it. These concerns put the Chance Project into a higher level of screening.

[redacted] (EDI) stated that field studies from 2019 to 2021 included: ecological mapping, linear features, fish, water, birds, and desktop studies that includes Porcupine Caribou Herd (PCH), moose, and martens. Chance wanted to do a linear features study to feed into the Land Use Plan (LUP) conformity check. He noted that the PCH are in the desktop studies because there is so much information available on them. He added that there were concerns about grizzly bears, but Chance doesn't have information on them.

[redacted] (EDI) presented the Effects Assessment Approach slide.

[redacted] (EDI) said there will be an impact on caribou, and we are assessing the significance of the effects. He added that Chance put the Environmental Assessment in the context of the LUP. He noted that there is more disturbance which is included in the Linear Features Study. The constraint maps help to develop scenarios to figure out future impacts. He noted that the spatial

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scale is relevant to the species. He said that exploration programs typically do not trigger an Executive Committee review. He added that this Project is going through the same review as the Casino mine project. He said that there is enough concern that it triggered an Executive Committee screening. There are always questions about the Project. He stated that Chance can't do an impact assessment without confirmed sites, which is why the Project team is using scenarios.

[redacted] (Chance) stated that Chance is taking an ecological perspective. Chance is trying to do the Project in a sustainable way by using constraints mapping and studies. Chance knows where the Project would like to drill. Chance needs to design winter access that considers constraints and previous disturbances. The Project team has described this to the Executive Committee and to communities to understand that Chance is listening and modifying the Project Proposal. They are not drilling year-round, and Chance's approach is unique and hasn't been done in the Arctic.

[redacted] (PCMB) asked for clarification whether the Project team was talking about next steps in the permitting process and if they had stopped talking about drilling.

[redacted] (EDI) said seismic comes first to identify the drill targets.

[redacted] (PCMB) said drilling is part of the exploration program, but we are talking about seismic right now.

[redacted] (Chance) said that Chance will still have to drill but initially they must get the targets and do the seismic. He added that this is what will help us understand what kind of resources are out there.

[redacted] (PCMB) inquired as to whether seismic would give Chance that information.

[redacted] (Chance) responded that no, it won't. He added that once it is put in a controlled environment, seismic will be used to understand of the layers of rock formation, depth of it, and any anomalies. He noted that drill site locations will be determined in the seismic studies.

[redacted] (PCMB) questioned whether Greg believed seismic and drilling to be one and the same. [redacted] (Chance) stated they are indeed different, and that identifying drill targets requires the seismic work.

[redacted] (PCMB) said [redacted] (EDI) said the drill on the slide was unconventional.

[redacted] (VGFN) asked if the last step in the process is flow testing.

[redacted] (Chance) said that that is correct. Geologists have said there is a 10 to 20% success rate, which means that 3 of 30 wells or 6 of 30 wells may be successful. Currently they do not know how successful they will be, but that there is opportunity. He noted that the business plan is focused on local consumption and that the Yukon needs additional energy. He said that Chance needs to understand what kind of gas there is and flow it. He noted that the flow time is up to six weeks. Chance would like to understand what kind of gas there is.

[redacted]NND/TH) mentioned that even if heating oil is locally sourced, it would need to be refined down south and then shipped back up. To be a local supplier, Chance would still have to ship oil south.

[redacted] (Chance) said that oil would need to be shipped south during the flow tests, but that there is technology to be refined at the site, but that's not a part of this Project.

[redacted] (YG) said that natural gas flow testing would occur for 6 weeks to prove the resource and asked Greg how long it would be with oil.

[redacted] (Chance) said it would require two years for flow testing and that Chance would be awaiting recommendations from YESAB. He added that it is longer for oil than gas. He noted that when the pressure comes up, the oil is a heavier liquid. He said that it takes time to understand it.

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[redacted] (YG) inquired about how long it would need to flow for.

[redacted] (Chance) said that the Project is not able to flow test summer months as Chance does not have all season roads. If there are successful wells, then Chance will need to seek a permit for an all-season road.

[redacted]YG) said that he's trying to understand the level of disturbance and if Chance would have to turn off the tap and begin flow tests in the following year.

[redacted](EDI) stated that that is something that Chance will have to include in the Project description.

[redacted](Chance) said that winter activities will only be 4 to 5 months.

[redacted] (VGG) asked if flaring would occur during flow testing.

[redacted](Chance) said that yes that is why flow testing is shorter because it would include a minimum of 3 weeks of flaring.

[redacted] (YG) expressed concern about how the trucks would be staged up to get the oil.

[redacted](Chance) said that Chance could get him the information. There will be heated storage, and will include 400-barrel trucks to keep the crude oil in. He said that the oil will come into a station area and before it gets taken away, there will be separators. He stated that Chance will probably have to reinject produced water back down into the wells.

[redacted] (VGG) stated that there needs to be more details about the Project Proposal and what activities Chance is proposing. For example, what are the activities associated with flow testing so that it can be evaluated. He noted that if the detail is in the Project Proposal to start with it saves everyone time. Chance will review.

[redacted] (EDI) presented the Land Use Plan Context slide.

[redacted] (EDI) said there are differences between how it works. There is the Integrated Management Area Zone 4 and that this is where it is expected that development will occur in the area. This zone has a higher level of protection than other areas. Even though Chance is looking at development in this area, Chance is looking at a high level of environmental protection. He added that it is likely one of the highest levels of protection with protection covering 37% of late winter and 31% of the fall range.

[redacted] (EDI) presented the Low Impact Seismic slide.

[redacted] (EDI) said Chance will use meandering lines to avoid large trees and to make the lines of sight to be less than 70 meters. There will be small narrow mulchers used for the seismic lines (2.5 m), which will help to protect vegetation. There is low ground pressure equipment over at least 20 cm of packed snow/ice. The vegetation will be pushed over, not cut, which means a faster recovery.

[redacted] (YG) asked if that is 20 centimetres of snowpack.

[redacted] (EDI) confirmed that it is 20 centimetres of snowpack.

[redacted] (Chance) Chance wants 20 centimeters of snowpack for winter roads, and in Chance's mitigation section, it says Chance will strive to get 20 centimeters.

[redacted] (VGG) asked if there is a design in place for meandering seismic lines and how Chance will communicate this to the operator.

[redacted] (EDI) said that that is an excellent question and [redacted] is the expert.

[redacted](Chance) said that scouting will be done in advance to understand the density of the forest, determine the location, and design it based on that information. If there are dense trees on the south side, Chance will design it to go around.

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[redacted] (VGG) asked if Chance would design it.

[redacted] (Chance) responded yes, they go out and walk it before they design it. There was helicopter support in the past to scout areas, to avoid mulching and to decide where to mulch. He noted that Chance will get more information about the criteria.

[redacted]. (YG) said they are trying to avoid site lines from certain lengths.

[redacted](VGG) said that it is up to Chance to design meandering seismic lines.

[redacted] (EDI) said that is how it works operationally.

[redacted](YG) said aerial photos could be helpful.

[redacted] (EDI) noted that Chance does not have any high-definition photos.

[redacted] (YG) said that the Yukon Government has some photos.

[redacted] (EDI) presented the Linear Feature Disturbance slide.

[redacted] (EDI) said that there are indicator levels of linear disturbance. He added that cautionary is 0.75 kilometres/square kilometer and the Regional Study Area (RSA) is 1.79 kilometres/square kilometre (unadjusted), and 0.52 kilometres/square kilometres(adjusted). He said that if the 3D lines are removed, it could be down to 0.48 square kilometers. He added that the background isn't presented too much in the LUP. He noted that Chance is utilizing the cautionary level.

[redacted](YG) said this is all the discussion from the LUP process.

[redacted] (EDI) said that there is a lot of theory around it, and that is why Chance did a linear effects study.

[redacted](YG) said that the numbers came from the caribou work. He said that he was not at the table but talked to people, such as [redacted], after the plan was done.

[redacted] EDI) said that information came out of Alberta, for example, different land uses and species in the area such as wolves preying on moose rather than caribou.

[redacted] (YG) asked what Chance meant by vegetation recovery.

[redacted] (EDI) said that they used the tall shrub stage, which was 2 metres instead of 1.5 metres from the LUP.

[redacted] (EDI) added that the old seismic approach was to cut the vegetation down.

[redacted] (EDI) presented the Environmental Constraints Mapping slide.

[redacted] (EDI) said Chance intends to avoid heritage sites, permafrost/terrain sensitive areas, riparian management areas, priority ELC units, caribou habitat, and moose habitat. He added that directional drilling is good to avoid high quality habitat, another mitigation measure.

[redacted] (Chance) said that Chance needs to get surface distance between 1.5 to 2.0 kilometres. He said that the Project team could stay on top of the hill and still drill in the valley.

[redacted] (VGG) asked if the Project videos are online.

[redacted] (Chance) said that Chance is in the process of developing a webpage.

[redacted] (Chance) said that Chance wants to launch the website before the new year and the February 2024 submission.

[redacted] (EDI) presented the Well Site Scenarios slide.

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[redacted] (EDI) said that the well site locations are unknown. He added that Chance develops scenarios within constraints to the range of potential habitat effects. Chance develops scenarios based on Scenario 1 which is developed by the seismic team.

[redacted] EDI) presented the Project Interactions slide.

[redacted] (EDI) said that there will be direct and indirect habitat interactions. Direct being vegetation clearing and indirect such as sensory disturbance. He added that there are areas where the Project team will avoid human activity. He said that there will be an indirect and direct mortality risk, direct being vehicle collisions and indirect will be due to increased predator access. This is what YESAB brought up in the first review. Chance is trying to reach a balance in the assessment.

[redacted] (PCMB) inquired about Chance's interpretation of disturbance.

[redacted] (EDI) responded that key disturbing factors are noise, smells, and human movement/presence. He added that this depends how far away caribou are from the well sites. He noted, based on mixed results in literature using various analytical methods, some possibly erroneously, that disturbances could result in no avoidance and up to ~40 kilometres of avoidance. He said that it is dependent on how the caribou are responding to the disturbance.

[redacted] (NND/TH) asked if there would be something on the ground at whatever distance it is. He asked what mitigation is there. He added that the concern is not to disturb the caribou, but how much is too much disturbance. He asked if there were other mitigations other than seasonality.

[redacted] (EDI) responded that there is a mitigation. He added that Chance calls them direct and indirect effects.

[redacted] (EDI) presented the Porcupine Caribou slide.

[redacted] (EDI) said that the key resource in the LUP is the caribou. He added that the information that Chance presents on the caribou is far more descriptive than in 2013. He noted that it was important to characterize the caribou. He added that Chance must understand the caribou enough to understand interactions with the Project. He said that Chance can't avoid all locations, and that Chance has looked at potential effects on PCH habitat and movement. He said that when looking at mortality it is challenging to quantify. He added that Chance has looked at residual effects, which are effects that are left over after mitigation is applied and that cannot be addressed.

[redacted] (EDI) presented the Porcupine Caribou – Distribution slide.

[redacted] (EDI) identified the PCH-identified life cycle periods or seasons. He added that there are patterns of occurrence from 1970 to 2016, supplied by PCTC. He said that Chance is looking at rut and winter overlap. He added that there is no doubt that Chance will see the caribou and that they will likely show up some time during the 10 year operation, and when they do, they will show up in large numbers.

[redacted] (EDI) shared movement of the PCH after the 2013/2014 seismic program. He said that the PCH moved through the Project area in 2015. He added that there were 13,000 to 14,000 observations through the cameras. He said that it was evident that they had moved through there. He noted that this has not happened ever since. He said that he is unsure where the PCH are now in the winter.

[redacted] (YG) said that the time where it does split, they used winter ranges in Alaska recently. He added that the challenge is that the PCH may go to the same area for two decades and then never go there again. He noted that he has not seen them in the uplands for two decades but that is where they used to be. He said that it is common to see them overlap with the December range.

[redacted] (EDI) said that there could be richer detail to describe. He said that when the PCH do show up it will be a lot.

[redacted] (YG) said that they do not have detailed GPS data prior to 2015. He added that collared data did not start until 2012.

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[redacted] (EDI) added that before, there were different collars.

[redacted] (YG) confirmed that previously, the location was tracked every day versus now, where you can track every minute of their movement. He added that most survey work occurs during the summer periods. He said that they had late winter data to look at distribution.

[redacted] (EDI) presented the Porcupine Caribou – Movement slide.

[redacted] (EDI) stated that in 2015, caribou travelled through a network of 2D seismic lines, winter roads, and a large 3D seismic grid. He said that the PCH will probably show up in abundance based on the work Chance has done.

[redacted] (YG) said this is late winter data. He added that that is when distribution would be done.

[redacted] (EDI) said that this is why the Project went to the Executive Committee. He added that Chance doesn't know enough about the PCH in the winter. He said that in the baseline effects, the Project can compile that data. He shared that a lot of the information was not available to the Chance team. He noted that if Chance misses anything, that this is what Chance is looking for.

[redacted] (EDI) said that caribou occupy the RSA in less than 20% of previous years. He added that rut/late fall and winter seasons are considered the least biologically sensitive periods for the herd. He said that that doesn't mean that the Project team isn't treating them sensitively, caribou are just less sensitive during these times. Winter is the least sensitive period relative to all seasons. He said that protecting calving grounds is key. He added that this herd keeps going back and other caribou herds are quite different. He noted that, the PCH are in good health this time of year and less sensitive than other times of the year. He shared that this information came from the PCTC report.

[redacted] (EDI) said that they are looking at the movement rate of PCH and what will they be exposed to. He said that based on the PCH collared data, it is evident that they move through the area. He added that it is roughly 4 to 5 days in the rut and late fall or 15 to 16 days in the winter.

[redacted] (EDI) said that the analysis consisted of quantifying daily travel times. He added that Chance characterized the seasonal ranges by dividing the seasonal range into around 2500 square kilometres of cells. He said that after that, they compared the different travel rates and residency times. He noted that the Project can say that the RSA is around half in the late fall and there are about ten days less spent in the winter. He shared that overall, caribou are spending less time in the RSA when they are there.

[redacted] (EDI) said that this is why it is important to characterize what the caribou are doing in the area. He added that they seem to be moving through the area quickly.

[redacted] (YG) asked if Chance is characterizing that their residency will be half of when they are going into the area.

[redacted] (EDI) said that we calculated residency times as an average, and that we are making a relative comparison of residency in the RSA versus the broader seasonal ranges using the collar data. He said that when the Project team is making a comparison of residency times, they are seeing this much of a difference.

[redacted] (YG) said that he is unsure if he would base the data on the limited set of examples, but it does give a sense. He added he would be leaning more on to the seasonal range data (SRD). He shared that the residency of SRD is useful. He said that he would be careful saying that about collared data.

[redacted] (EDI) said that there will be a list of uncertainties in the Environmental Assessment.

[redacted] (EDI) said that the standard error is associated with the ranges. He shared that the seasonal range average is not directly comparable to the RSA and that he is not sure if the seasonal range residency time is the best average to use. He said

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that the composition of the eco ranges is different. He added that they wouldn't expect the same amount of residency time in the RSA.

[redacted] (YG) said that there is a lot of data, around 50 years of movement data for the herd. He added that there is only GPS data for a decade, which isn't that much.

[redacted] (EDI) said that the Project team must move through with some level of confidence. He said that the Project talks about reversibility of effects and if it is reversible.

[redacted] (EDI) presented the Porcupine Caribou – Habitat Selection slide.

[redacted] (EDI) shared a recap of the methods and results for PCH. He said that they used a standard approach to developing these models and used a generalized linear mixed model. He added that it was a 1:10 used-available design. He shared that they are looking at interactions with lichens, and plant functional type layers (e.g., light microlichens, conifer, forbs, deciduous shrubs, graminoids, and evergreen shrubs). He said that it included elevation, slops, aspect, and distance to waterbodies. He added that they did random effects on the caribou year and did a 5-fold cross variation of model predictions. He added that they mapped RSF predictions across seasonal ranges.

[redacted] (EDI) said that they used selection ratios to identify the RSF prediction threshold where the proportion of used locations is greater than available. He added that this corresponds to selected habitat by caribou; these predictions considers the partial effects of all habitat covariates (rather than single covariate coefficients). He shared that they were able to identify four habitat ratings: high, moderate, low, and very low. He said that the selection threshold identified the split between high/moderate and low/very low and that the split between high and moderate was based on midpoint value, the same for low and very low.

A participant asked if this is describing the quality of the habitat or the ratio of use.

[redacted] (EDI) said that it is quantifying selection. He added that when Chance maps that, it has been classified as a habitat with high or moderate rating. He shared that it is selection, not use.

[redacted] (EDI) said that the moderate and high ratings are the areas associated with selected habitat. He shared that that corresponds to caribou using the areas more frequently than what would be expected by random chance. He added that the Project team chose the term 'selected' habitat and didn't want to use 'suitable' habitat because all habitats can potentially be suitable and used by caribou. He said that the habitat ratings are associated with higher macrolichen cover.

[redacted] (YG) asked what the Y-axis on the top graph said.

[redacted] (EDI) responded that it is the proportion of locations. He said that both figures show the same information in a different type of way.

[redacted] (EDI) presented the Caribou / Project Interaction – Review slide.

[redacted] (EDI) shared that the RSA overlaps with the PCH seasonal ranges. He added that the caribou occupy the RSA in less than 20% of years (or approximately 1 in 5 years). He shared that rut/late fall and winter seasons are considered the least sensitive periods for the herd. He added that the exposure period of individual caribou is expected to be 1 to 2 weeks. He said that Chance is looking at the assessment of criteria of seasonal habitats and that they were built into the LUP.

[redacted] (EDI) presented the Potential Habitat Effects slide.

[redacted] (EDI) shared that direct habitat effects refers to areas cleared of vegetation. He said that this affects 2% of selected rut/late fall and winter habitats within the RSA. He added that it affects 0.2% of selected rut/late fall and winter habitats at the Eagle Plains ecoregion scale. He said that the 3D seismic may not create a functional loss if lichen persists. He shared that it should not affect the lichen.

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[redacted] (EDI) shared that the indirect habitat effects refer to sensory disturbance. He added that they did a ZOI study that was applied around all disturbances. He said that they assumed a 75% reduced habitat effectiveness within a 1-kilometer ZOI. He shared that it is hard to quantify the area. He said that it means that there is a 75% chance that caribou are less likely to select the area. He added that annually, about 32% of the RSA experiences sensory disturbance and affects 23% of the selected rut/late fall and winter habitats within the RSA. He said that it affects 5% of selected rut/late fall and winter habitats at the Eagle Plains ecoregion scale. He added that it is a temporary effect which is reversed once activity stops.

[redacted] (YG) asked where 1 kilometre came from.

[redacted] (EDI) said that it is based on the permanent disturbance, which was their own zone of disturbance. He added that they looked to find a balance of something that was reasonable. He said that 1 kilometer seemed like a reasonable measure.

[redacted] (YG) said that activities like helicopter work and safety checks, cause greater disturbance than the mulcher. He added that he cautions using the 1-kilometer buffer. He shared that he thinks Chance will have a hard time supporting that in the literature.

[redacted] (EDI) said that the primary reason was to associate the ZOI with sensory disturbance. He said that in assessments where ZOIs were found to be large, there hasn't been a test or link to a clear mechanism that could lead to such large areas of avoidance. He argues that studies with large ZOIs often capture broad changes in a herd's range distribution rather than local effects of a Project. He added that this assessment is focused on local-scale sensory disturbance which covers the work area. He said that, in the literature, ZOIs are most often quantified as linear avoidance up to the ZOI threshold. This causes the average avoidance effect to be about halfway up the sloped line. He shared that, for this assessment, they applied a uniform 75% reduction across the 1-kilometer buffer.

[redacted] (YG) said there is a potential effect for the whole area. He asked how they could get this into more detail. He said they will be looking at it very closely.

[redacted] (EDI) said that they identified a 2- or 4-kilometre ZOI associated with the 2D seismic lines (including winter roads and trails). However, he stated that they identified attraction (rather than avoidance) to the 3D seismic grid. He added that the 2–4-kilometre ZOIs for historical 2D seismic are small in magnitude. Habitat effectiveness is reduced by 20–40% on the footprint itself, but the average reduction across the ZOI is much smaller.

[redacted] (EDI) asked what the sample size for the 3D seismic sample size analysis was.

[redacted] (EDI) said that he will have to circle back.

[redacted] (YG) said that the PCTC advised against doing that analysis.

[redacted] (EDI) said that Chance did not rely on a 3D ZOI analysis.

[redacted] (YG) said that it was raised. He added that it may or may not be the case, but they don't have the data.

[redacted] (EDI) added that it is not conclusive.

[redacted] (YG) said that's perfect.

[redacted] (EDI) said that Chance expects those comments to come up too and that's why the analysis is there.

[redacted] said that when you talk about all this data, so next year when you are doing the seismic, there is no additional effects to the PCH at that location.

[redacted] (EDI) said that there will be a leftover footprint. He added that there is a linear disturbance that brings in predators.

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A participant said that it seems reasonable for seismic activity, but then there is a well being drilled. They said that the ZOI would be much bigger based on that. They said that there is going to be less of an impact.

[redacted]. (EDI) said that the impact could be up to 1 kilometer, but Chance could revisit that and rethink the details of that too.

[redacted] (EDI) shared that it was 1 kilometer impact for everything sticking to sensory disturbance.

[redacted] (NND/TH) said that if the caribou are discouraged from using the ZOI and activity stops, that they came back through. He added that he doesn't know if there is any information on prolonged activity. He said that they are talking about several winters. He said that if there is a prolonged period of disturbance, he hasn't come across the information. He asked if there is any information on permanent discouragement of using the area, even after the mulching disturbance stops.

[redacted] (EDI) said that he would look at caribou near mine sites and the Central Arctic Herd and how they responded. He said that they looked it on a herd basis, but he is unsure if they respond well. He shared that work has been done on caribou response to roads, and other development. He said he cannot think of whether they responded to any well site. He said thinking about the development in Prudhoe Bay, there was work on the caribou's response to the road and pipeline. He added that they had deemed a 300-meter zone. He said that if it is not fenced off, the caribou will move through.

[redacted] (YG) said Heather did the most recent analysis on that, and their role is to do objective PCTC science. He said it is the calving and post calving information that has not been developed in the last 30 years. He added that it was around 5 or 6 kilometers. He said that it was a tundra environment and oil field, in the summer. He shared that there were many differences.

[redacted] (EDI) said that it is hard to make that comparison of linear disturbance in Alberta to Eagle Plains. He shared that a caribou response to a single well site would need a wealth of data. He said that there are forty well sites out there.

[redacted] YG) said a camera on the well site would be good.

[redacted] (EDI) said that if you look at an oil rig and the caribou herd are going through, there is a clear answer to that.

[redacted] (VGG) asked if the linear thresholds Chance talks about, are based on the proposed linear disturbance.

[redacted] (EDI) said that that is why the planning commission did their own effects strategy.

[redacted](VGG) asked if Chance has talked to anyone at the Yukon Government about cumulative effects or linear features.

[redacted] (YG) said one of the linear things that was discussed was that the threshold is 1.5 meters of wooded vegetation. He added that they just don't know.

[redacted] (Chance) said that the last direction that Chance got was from [redacted] office when she was Deputy Minister and that the challenge is that the environmental groups are challenging the Yukon Government because the proponent is responsible to go to First Nations to work with them to get their permission on conformity checks. He asked if the proponents are responsible for making communities understand the effects.

[redacted] EDI) said that at the community level during our meetings, it has not been a topic of discussion.

[redacted] (VGG) said that it's coming up in another process around cumulative effects. He added that he is curious as it sounds like a lot of that work was based on studies from Alberta. He asked what the underpinning of the analysis is and if there is other information that is new to him.

[redacted] (EDI) said that Chance looked at the line of sight, travel speeds, visibility, and different levels of regeneration. He added that the Project team wanted to inform the planning commission.

[redacted](Chance) said that when Chance made the original submission, their understanding was that the Land Use Planning Council was working with them. He stated that they were told that Chance must figure that out and convince any other affected

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parties. He asked how Chance does that work. Chance completed what it was required to do based on what was agreed to. He said that it is basically an EMR (Energy, Mines, and Resources) office that is just trying to figure it out. He shared that Chance is confused on who will oversee the old studies and disturbance that didn't occur from Chance/Northern Cross.

[redacted] (EDI) added that Chance did their own studies of effects. He added that that is how Chance came up with adjusted numbers.

[redacted] (NND/TH) said that he's come across concerns about the Land Use Planning Council not having the background that the commission has. He added that this is a compounding factor. He said that the council doesn't have a knowledge of history that the commission developed under the treaty, and that the council doesn't have the background to consider a project. He said that there are concerns about the council being capable of having a reliable opinion.

[redacted] (Chance) said that Sam is at the council and has a lot of knowledge and has been there for a while. He shared that there is no North Yukon Commission now.

[redacted] (YG) said that he is interested in talking about mitigations. By focusing on if the herd is coming through, it minimizes the issue. What happens when they do come through. It may be important to get information from the PCTC or Mike Suitor from the Yukon Government. If you hear caribou are coming your way and will be there in 3 days, what will the response be to that data.

[redacted] (EDI) said that they will get into that. He added that the monitoring part is an important part of the assessment.

[redacted] (EDI) presented the Potential Movement Effects slide.

[redacted] (EDI) said that there will be local movement effects such as reduced crossing if there is traffic on roads and seismic lines. Effects to seasonal movements or migrations are unlikely. Long distance movements will mostly be in fall and do not overlap with the bulk of Project activities. Short residency times and fast movement rates through the RSA and caribou travel through network of linear features in the RSA.

[redacted] (YG) said that pertaining to the effect of harvesting activities, there are areas where similar work has been done. A similar migrating effect can be seen and that it is possible that it may change a migration pattern. He said that he doesn't want to discount it.

[redacted] (Chance) asked what the probability is of that occurring.

[redacted] (YG) said that he is unsure exactly. He added that in 2015 it almost happened.

[redacted] (Chance) said that it is easy to tell that they go along the Dempster Highway.

[redacted] (YG) said that humans are travelling the same way the PCH like to because it is the easier travel. He added that it is a scenario that could occur, and it shouldn't be discounted.

[redacted] (PCMB) said that if looking at the probability, what's going to be in place with the PCTC, the people, and what is the plan to respond.

[redacted] (EDI) said that Chance will note it. He asked if it is going to stop them from entering the work area. He stated that Chance is assuming a 75% probability. He said that he is not trying to downplay the potential effects, but it is only an exploration project.

[redacted] (YG) said that YG has programs that shut down for 2 to 3 weeks when the herd hits.

[redacted] (EDI) said that that will certainly happen. He said that the Project team can't operate with thousand caribou around us. He added that it will affect their localized movement.

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[redacted] (EDI) presented the Potential Mortality Effects slide.

[redacted] (EDI) said that direct effects are vehicle collisions, but this is low risk on access roads and seismic lines. He said that by restricting the road, it won't be public access. He stated that the indirect effects are predation and hunting. He added that linear features might give more access to humans.

[redacted] (NND/TH) said that the resource road regulation on the Territorial Roads Land Act should give Chance permission to make the road private. He asked how Chance can use it as a private road. He asked if under the Oil and Gas Act they would be able to say it is a private road. He asked if Chance has had that discussion.

[redacted] (Chance) said that the Chief Operating Officer (COO) can make it a private road. He said that it is more of a safety concern, and no one wants to hunt around the drilling area. He added that it is one thing to give the access to an Indigenous harvester, from a safety point of view there is an issue around the work area buffer.

[redacted] (NND/TH) asked if the COO has the capability to give Chance a private road.

[redacted] Chance) confirmed yes and that they have had a COO do it before.

[redacted] (EDI) said that any predator wants easier access. He shared that it would have a temporary effect, limited to annual work areas where activities pack the snow on linear feature. He added that there aren't resident caribou in the Project area compared to other herds. He said that it is hard to conceptualize.

[redacted] (YG) said that he has seen people using the seismic lines. He said that there is no real monitoring of it. He stated that on predation, it is a different scenario. He shared that it is complicated because there are migratory wolves. He added that the question is if the herd has a major decline. He said that it is being anticipated sooner or later but they don't know.

[redacted] (EDI) said that there is uncertainty around mortality effects. He shared that it is more around Indigenous access, but Chance doesn't know how to move around that.

[redacted] (YG) said that the affected harvest on ZOI basically has a double effect.

[redacted] (EDI) said that as soon as the Project increases predation risk, there will be an increased effect. He added that it is important to increase local awareness there.

[redacted] (YG) said that this can be dealt with in the Project Effects Assessment.

[redacted]. (EDI) said that there is no harvest policy other than the Indigenous Rights to Harvest.

[redacted]. (EDI) presented the General Protection Measures slide.

[redacted] (EDI) said there is environmental constraints mapping to reduce habitat loss. Chance will stay out of this area when caribou are coming. There will be a limited annual footprint, reducing sensory disturbance. There will be access management to reduce mortality risk. People will probably use the winter access. He shared that he doubts that individuals will use the 3D seismic access.

[redacted] (YG) agreed that people likely won't use it as well.

[redacted] (EDI) shared that low impact seismic will help to reduce habitat loss and has been developed over the years. He added that there will be a maximum width of 2.5 meters that will retain ground vegetation. There will be speed limits in place to reduce mortality risk. He emphasized the importance of worker awareness, including reporting any sightings. There will be a caribou interaction response plan. He asked if there is an information database that Chance can use to understand weekly migration patterns.

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[redacted] (YG) said that the YG is trying to get a database in place. He shared that the PCTC updates their website and YG does the updates as they can. He said that the YG has a regulatory meeting that often changes things.

[redacted] (EDI) asked if YG will tell them when the caribou are coming.

[redacted] (YG) said that some companies are required to contact YG on a schedule. The other more likely scenario is just paying attention to the herd. He said the Chief of Mine and Land Use provides emails and the YG provides weekly updates after that. He shared that YG has been doing it for 5 years and it is working well.

[redacted] (EDI) said that there is flexibility with the seismic operation and that it will be Chance's bad luck. He added that Chance can't move the seismic and once a drill is spinning, the Project team can't stop.

[redacted] (NND/TH) said that it is possible to stop the drill.

[redacted] Chance) said that when driving, risks of potential impacts are increased. He added that there are speed controls, traffic controls, and the only traffic would be wildlife monitors.

[redacted] (EDI) said anything that is necessary.

[redacted] (NND/TH) said there was a constant of bringing water in with big trucks when he worked at the mine sites.

[redacted] (EDI) said that once the drill is going, it is not stopping.

[redacted] (PCMB) said that a caribou action response plan has potential, and he knows PCMB would be interested. He said it would be great if Chance could get their caribou information from PCMB and PCTC. He added that it would be good to see something established. If Chance is responding to caribou interactions, it would be nice to have a plan established. It would make sense if there was official communication linkage to be notified. These communications could establish a cooperative protocol. He added that this could help PCMB study the herd.

[redacted] (EDI) said that he wouldn't be able to develop that independently.

[redacted] (Chance) said that he agrees with getting the real data.

[redacted] (YG) said there will always be redundancy on this, and YG is trying to figure that out. He added that there are ways to do it. He said that the challenge for using satellites to track is that there could be several thousand caribou that don't have collars.

[redacted] (EDI) said that he agrees that it is only a small portion.

[redacted] (YG) said that there are 110 collars on the caribou.

[redacted] (EDI) said there is a level of warning from local monitors. He added that there will be a balance of reported observations, onsite. He shared that Chance would have to do aerial surveys.

[redacted] (YG) said there is no need for aerial surveys. He added that it can give you a sense of what you are dealing with and that they did that in 2013.

[redacted] (PCMB) said that it makes her think about how PCMB could help. If there are wildlife monitors around, it would be great to get regular updates on what they are observing. She added that if there is a situation where several caribou are coming to the Project area, the PCMB has connections to the Porcupine Caribou communities to get the word out. PCMB can help communicate things to bring show that we are engaged and that communities can be confident that Chance and PMCB are working together and sharing accurate information. PCMB wants the communities to be comfortable with what is happening. She added that there is the opportunity to look at the PCMB and Chance engagement as a very positive thing.

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[redacted] (EDI) said that this could be something to work on. He said that he agrees on collaboration and that aerial surveys during operation will be good. He shared that he thinks that the project can operate safely. He said that a lot of this relies on the observers being there.

[redacted] (NND/TH) said that with an existing drill site, and caribou in the area, Chance won't be able to shut down the drill. He said that the idea being that traffic could be reduced. He doesn't know where the water is coming from for the drill. He said that in past projects, there was a 24-hour supply of water from the water source to the drill site. He said that unless technology has changed, that is one example of traffic that can't be stopped if there are caribou in the area. He asked if the reduction would be sufficient or not.

[redacted] (EDI) shared that Chance doesn't have the details on what is considered essential road traffic right now. He shared that 5 vehicles a day sounds manageable.

[redacted] (YG) said that his issue is that there are no communications occurring with the Executive Committee. He said that it is important to have these conversations. These conversations will greatly increase Indigenous relations.

[redacted] (PCMB) said that the PCMB represents PCMB from the PCMB Agreement parties. She said that the PCMB isn't a decision-making board, but they can provide input to regulatory processes and review processes. She added that the PCMB knows trust is important with communities and when working with groups that are willing to go over and above what is specified in regulatory decisions. When the PCMB knows that there is an interest in building that trust, if anyone is looking at building positive relationships, it must be a collaborative process. There needs to be transparency and a willingness to work together no matter what the information may be. It is important for PCMB to do that and that the PCMB wants to work together. It is reasonable to say Chance can't shut down a well in production if there is a conversation ahead of time. If they know about these concerns in advance, there could be something in place that incorporates Traditional Knowledge that would address the communities' concerns. She shared that when caribou come and you can't shut down the well, the PCMB knows that that is reasonable, and they can support that. The PCMB can help with mitigation around that. She said not to underestimate the trust with PCMB and that the PCMB wants to work with Chance to do a good job of this. She shared that what happens with the Project will last in people's minds.

[redacted] (NND/TH) said that even if the PCMB aren't a decision maker, they are important.

[redacted] (EDI) said that the next step is mitigation. He said that he has seen a change in the approach by Chance. It comes down to the communication aspect and the seismic program is flexible.

[redacted] (YG) said regarding the effects monitoring piece, that looking at developing a couple of well-focused designs would be helpful. He said that if the exploration project is successful, Chance will get towards a development stage and there won't be any data.

[redacted] (EDI) said that to determine if mitigation is successful, Chance will have to do an experimental approach.

[redacted] (NND/TH) said that they do a report at the end of the season, to understand if it worked. He is amazed that this is not being considered.

[redacted] (EDI) said that this is a 10-year program, and it is Chance's opportunity to learn. He added that Chance wants to understand what the caribou do.

[redacted] (YG) said that the collared data is one scale.

[redacted] (EDI) said that it makes sense to put in effects monitoring.

[redacted] (YG) said that he is happy to work with Chance and discuss with PCTC to provide input. It is going to have to be a collaborative approach somehow.

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APPENDIX 2-B-34. Gwich'in Tribal Council Record of Contact

Gwich'in Tribal Council Pre-Submission Record of Contact (January 1, 2014 - December 20, 2023)

Reference	Date	Communication Method	In / Outgoing	First Nation	Author	Proponent Names	First Nation and/or Organization Names	Subject	Summary	Additional Comments	Attachments
Note: Reference ID formatting and ordering may not be consistent or sequential due to splitting out the Master Record of Contact into First Nation-specific Record of Contacts.											
GTC0225	26-Sep-16	Letter	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Election Congratulations and September 2016 Gwich'in Tribal Council Letter	Richard (Chance) sent a letter to Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) congratulating them on their election to the position of Grand Chief of Gwich'in Tribal Council. Richard (Chance) summarized the Project, and requested to meet with Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council). Richard (Chance) added a summary of key aspects of the Project, partnership opportunities for First Nations, the Judicial Review, and protecting Caribou.	N/A	September 2016 Gwich'in Tribal Council Letter
GTC0224	28-Sep-16	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	*Draft Communication and Engagement Strategy*	Richard (Chance) emailed Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), and attached the Draft Communication and Engagement Strategy for review and comment.	N/A	20160928-Gwich'in Tribal Council0224A
GTC0001	1-Dec-17	Email	Out	Gwich'in Tribal Council,Tetl'it Gwich'in Council	Richard Wyman (Chance)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Chief Wanda Pascal, Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Rick Nielsen (Chance), Shena Shaw (Hemmera), Minister Ranj Pillai of Energy, Mines and Resources	*Draft Communication and Engagement Strategy*	Chance sent a letter to Tetl'it Gwich'in Council and Gwich'in Tribal Council about the Communications and Engagement Plan that Chance wished to develop in partnership with Tetl'it Gwich'in Council and Gwich'in Tribal Council. Provided an introduction of Hemmera and noted Hemmera's support the development of the *Draft Communication and Engagement Strategy*.	N/A	20171201-Gwich'in Tribal Council0001A
GTC0003	9-Jan-18	Phone Call	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Engagement Plan	Chance attempted to call Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) to follow up on the December 1, 2017 letter that was sent to the Gwich'in Tribal Council. Richard (Chance) called at 11:25AM and left a message on the Grand Chief's voicemail.	N/A	N/A
GTC0004	11-Jan-18	Phone Call	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Engagement Plan	Chance attempted to call Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) regarding the December 1, 2017 letter and left another message on their voicemail.	N/A	N/A
GTC0005	11-Jan-18	Phone Call	In	Gwich'in Tribal Council	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Engagement Plan	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) called Chance and stated that they did not receive the December 1, 2017 letter (wrong email address) and asked if Chance could resend it. Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) said they would review the letter and call back to arrange a meeting.	N/A	N/A
GTC0006	12-Jan-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Engagement Plan	Chance re-sent the December 1, 2017 letter to Grand Chief of the Gwich'in Tribal Council via email.	N/A	20171201-Gwich'in Tribal Council0001A
GTC0007	13-Jan-18	Email	In	Gwich'in Tribal Council	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Engagement Plan	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) indicated that they would be at the AME Roundup conference in Vancouver and would be happy to make the time to meet with Chance. Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) noted that they looked forward to establishing an open and direct relationship with Chance.	N/A	N/A
GTC0008	15-Jan-18	Email	Out	Tetl'it Gwich'in Council	Cindy Dickson (Chance)	Cindy Dickson (Chance)	Shawna Nerysoo	Engagement Plan	Chance forwarded an email to the Tetl'it Gwich'in Council with an introductory letter that was sent to Chief Wanda Pascal on December 1, 2017. This letter outlined Chance's desire to engage and develop a Communications and Engagement Plan with Tetl'it Gwich'in Council.	N/A	20171201-Gwich'in Tribal Council0001A
GTC0009	22-Jan-18	Meeting	N/A	Gwich'in Tribal Council	N/A	Richard Wyman (Chance), Greg Charlie (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Introduction Meeting, Communications and Engagement Plan	This was an informal introductory meeting to introduce Chance to Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council). The matters discussed were Chance's desire to build a relationship with Gwich'in Tribal Council and hold meetings in the future to discuss the nature of exploration work planned by Chance. In addition, Chance discussed the creation of a Communications and Engagement Plan as required by Orders in Council (OIC) 2016/169 and Ministerial Order (MO) 2017/37. Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) agreed to consider future meetings with Chance after internal meetings were held with Gwich'in Tribal Council. Chance said they would be in contact to plan future meetings to discuss their exploration plans the development of a Communications and Engagement Plan in partnership with Gwich'in Tribal Council. Inquired about a future meeting with the Gwich'in Tribal Council.	N/A	N/A
GTC0010	27-Feb-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Caroline Lenny, Shena Shaw (Hemmera), Kelly Constable (Hemmera), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Introduction Meeting, Meeting Logistics	Chance sent an email thanking Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) for meeting with Chance on January 22, 2018 during AME Roundup in Vancouver and requested a teleconference and an in-person meeting between Chance and Gwich'in Tribal Council.	N/A	N/A
GTC0011	14-Mar-18	Text Message	Out	Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Communications and Engagement Plan, Meeting Logistics	Chance sent a text message to Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) to set up a call to give them an engagent update and requested to meet on April 12, 2018 in Inuvik.	N/A	N/A
GTC0012	15-Mar-18	Email	In	Gwich'in Tribal Council	Chance	N/A	Gwich'in Tribal Council Chief Operating Officer (COO)	Communications and Engagement Plan, Meeting Logistics	Gwich'in Tribal Council COO sent an email on behalf of Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) indicating her availability to meet on April 12, 2018 with Chance representatives. In response to the question on protocol, Gwich'in Tribal Council is the contact and they will collaborate internally with the Designated Gwich'in Organizations, such as the Tetl'it Gwich'in Council.	N/A	N/A
GTC0013	15-Mar-18	Phone Call	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Communications and Engagement Plan, Meeting Logistics	Chance called Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) about setting up a meeting. Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) and Gwich'in Tribal Council's COO were planning to schedule a meeting with Chance in April to discuss the Communications and Engagement Plan.	N/A	N/A
GTC0014	22-Mar-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Meeting Logistics	Chance sent Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) an email to follow up on recent correspondence and telephone conversations to see if it would be possible to meet with the Gwich'in Tribal Council Board and representatives of the Tetl'it Gwich'in Council on either April 11, 2018 or April 12, 2018 to discuss an Engagement and Communications Plan between Gwich'in Tribal Council,Tetl'it Gwich'in Council, and Chance.	N/A	N/A

GTC0015	23-Mar-18	Email	Out	Gwich'in Tribal Council	Chance	N/A	Gwich'in Tribal Council COO	Meeting Logistics, Communication Protocols	Chance sent an email to reply to the COO to suggest a meeting the afternoon of April 12, 2018 to accommodate airline schedules, if possible. Chance thanked the COO for clarifying protocols for communications with Tetl'it Gwich'in Council and Gwich'in Tribal Council.	N/A	N/A
GTC0016	28-Mar-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Kelly Constable (Hemmera), Rick Nielson, Emily Mann (Hemmera)	Meeting Logistics, Project Map	Chance sent the COO of the Gwich'in Tribal Council a draft agenda for the April 12, 2023 meeting along with a map showing the settlement lands,First Nation Traditional Territories, and the location of the exploration permits and significant discovery licenses owned by Chance.	N/A	Draft April 12, 2023 Meeting Agenda Project Map
GTC0017	4-Apr-18	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	N/A	Gwich'in Tribal Council COO	Meeting Logistics	The COO of the Gwich'in Tribal Council emailed Chance to let Chance know that the Gwich'in Tribal Council is in the process of inviting Tetl'it Gwich'in Council to the April 12, 2018 meeting. Details around capacity funding were discussed.	N/A	N/A
GTC0018	4-Apr-18	Phone Call	Out	Gwich'in Tribal Council	Chance	N/A	Gwich'in Tribal Council COO	Meeting Logistics, Communication Protocols	Chance called the Gwich'in Tribal Council COO to discuss Tetl'it Gwich'in Council's participation in the meeting scheduled for April 12, 2023. The Gwich'in Tribal Council informed Chance that the Tetl'it Gwich'in Council will be attending the meeting between the Gwich'in Tribal Council and Chance. Noted Gwich'in Tribal Council also reached out to other communities under Gwich'in Tribal Council to attend, as they work to have one approach.The Gwich'in Tribal Council informed Chance that the Gwich'in Tribal Council will again approach Yukon Government regarding communication protocol for future reference when working on this file, as the Gwich'in Tribal Council is the body that Chance should be communicating with. There will be discussion with all parties at the April 12, 2018 meeting regarding a one-plan approach.	N/A	N/A
GTC0021	6-Apr-18	Phone Call	Out	Tetl'it Gwich'in Council	Greg Charlie (Chance)	Greg Charlie (Chance)	Shawna Nerysoo	Communications and Engagement Plan, Meeting Logistics	Chance called Tetl'it Gwich'in Council to discuss Chief and Council involvement with the Communications and Engagement Plan. Tetl'it Gwich'in Council was not included in the Gwich'in Tribal Council meeting in Inuvik and invited Chance to their next Council meeting on April 17, 2018 during the evening. Tetl'it Gwich'in Council noted they would need clarity on protocol and who will sign a Communications and Engagement Plan with Chance.	N/A	N/A
GTC0022	9-Apr-18	Phone Call	Out	Tetl'it Gwich'in Council, Chance	Richard Wyman (Chance)	Richard Wyman (Chance)	Carolyn Lennie (Gwich'in Tribal Council)	Meeting Logistics	Chance spoke with the COO of the Gwich'in Tribal Council about the passing of a Gwich'in Participant and leader and whether or not the meeting scheduled for April 12, 2018 would occur. The Gwich'in Tribal Council replied that they would confirm but it seemed most likely the meeting would be deferred and shared there had been three other Gwich'in Participant deaths in the Northwest Territories. Later that day, Chance and the Gwich'in Tribal Council spoke again and discussed the need to reschedule the April 12, 2023 meeting.	N/A	N/A
GTC0023	11-Apr-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Meeting Logistics	Chance emailed Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) to reschedule the meeting and to offer condolences for the passing of a Gwich'in Participant and leader. Chance suggested April 23, 24, or 25, 2018 as alternative dates to meet.	N/A	N/A
GTC0024	16-Apr-18	Text Message	Out	Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Kelly Constable (Hemmera)	Meeting Logistics	Chance sent a text message to Grand Chief of the Gwich'in Tribal Council regarding rescheduling a meeting for April 23, 2018. The response was the office was closed that day and that the Gwich'in Tribal Council would get back to Chance with dates.	N/A	N/A
GTC0025	16-Apr-18	Email	In	Gwich'in Tribal Council	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Carolyn Lennie (Gwich'in Tribal Council), Shena Shaw (Hemmera), Kelly Constable (Hemmera), Rick Nielsen (Chance), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Leslie P. Blake (Gwich'in Tribal Council), Anita Ko, Deanna Drescher, Emily Mann (Hemmera)	Meeting Logistics	Grand Chief of the Gwich'in Tribal Council emailed Chance to reschedule the meeting that was originally set for April 12, 2018 for either the morning of April 24, 2018 or April 25, 2018. The Gwich'in Tribal Council COO would coordinate with the President of the Tetl'it Gwich'in Council and confirm the date and time of the meeting. Later that day Chance and the Gwich'in Tribal Council settled on the Gwich'in Tribal Council's preferred date of April 24, 2018 in the morning.	N/A	N/A
GTC0026	16-Apr-18	Email	Out	Tetl'it Gwich'in Council	Greg Charlie (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	N/A	Meeting Logistics	Chance emailed the Tetl'it Gwich'in Council to inquire about an opportunity to meet with Chief and Council on April 24, 2018 in the late afternoon. Tetl'it Gwich'in Council noted that Chance had been added to the Chief and Council Meeting agenda. Chance later learned that the meeting must be postponed due to the passing of an Elder.	N/A	N/A
GTC0027	17-Apr-18	Email	In	Tetl'it Gwich'in Council	Shawna Neysoo	N/A	Shawna Neysoo	Meeting Logistics	A representative of the Tetl'it Gwich'in Council said the meeting could be re-scheduled for April 24, 2018 at 5:00PM.	N/A	N/A
GTC0028	18-Apr-18	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Greg Charlie (Chance), Cindy Dickson (Chance)	Shena Shaw (Hemmera), Kelly Constable (Hemmera), Rick Nielsen (Chance), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Leslie P. Blake (Gwich'in Tribal Council), Anita Koe, Deanna Drescher, Lynn O'Neil (Chance), Emily Mann (Hemmera)	Meeting Logistics	The Gwich'in Tribal Council confirmed their availability for meeting on April 24, 2018.	N/A	N/A
GTC0029	20-Apr-18	Email	In	Tetl'it Gwich'in Council	Leslie P. Blake (Gwich'in Tribal Council)	N/A	Kelly Constable (Hemmera), Rick Nielsen (Chance), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Anita Koe, Deanna Drescher, Lynn O'Neil (Chance), Emily Mann (Hemmera)	Meeting	The President of the Tetl'it Gwich'in Council sent an email to confirm their attendance at the April 24, 2018 meeting.	N/A	N/A

GTC0030	24-Apr-18	Meeting	Out	Gwich'in Tribal Council	N/A	Richard Wyman (Chance) Greg Charlie (Chance) Cindy Dickson (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) Leslie Blake (Gwich'in Tribal Council) Stephen Charlie (Gwich'in Tribal Council) Leigh-Ann Williams-Jones (Gwich'in Tribal Council) David MacMartin (Gwich'in Tribal Council) Carolyn Lennie (Gwich'in Tribal Council) Kelly Constable (Hemmera)	Meeting	Chance met with Gwich'in Tribal Council and Teetl'it Gwich'in Council to introduce team members and discuss roles and responsibilities; share information on Chance's exploration interests; and allow opportunities for participants to share their views on what they would like this relationship and engagement and communication plan to look like. Key outcomes for this meeting included: agreement to work together on an engagement and communication plan (plan); identification of team members to lead on developing the plan; identify next steps for completing the plan; and understand the Gwich'in Tribal Council relationship with the Tetl'it Gwich'in Council and the Teetl'it Gwich'in Council.	N/A	E01379_24April2018_Gwich'in Tribal Council_TGC_Chance_Meeting_Record_DRAFT
GTC0031	7-May-18	Email	Out	Gwich'in Tribal Council	Kelly Constable (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Kelly Constable (Hemmera), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Leighann Jones, Leslie Blake (Gwich'in Tribal Council), Shena Shaw (Hemmera), Emily Mann (Hemmera)	Meeting	Hemmera sent an email with the following items (as attachments) for review: 1) April 24 2018 Draft Meeting Notes; and 2) A draft Engagement and Communication Plan between Gwich'in Tribal Council, Tetl'it Gwich'in Council, and Chance. They identified that it contains elements related to keeping Teetl'it Gwich'in Council informed as well. If possible, Hemmera asked for a review of item #1 by June 4 and regarding item #2 (Engagement and Communication Plan draft), and asked for would their thoughts. Lastly, Hemmera indicated that the All-Party Meeting of May 22 and 23 was not viable for all parties and would like to know if there is a two-day window in June or July that would work.	N/A	N/A
GTC0032	8-May-18	Email	Out	Tetl'it Gwich'in Council	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Shena Shaw (Hemmera), Kelly Constable (Hemmera), Rick Nielson, Leslie P. Blake (Gwich'in Tribal Council)	Meeting	A representative from Chance sent a representative of Tetl'it Gwich'in Council an email thanking him for meeting with Chance April 24, 2018. Chance requested that the Tetl'it Gwich'in Councilplease let him know what the preference is regarding engagement with the Tetl'it Gwich'in Council related to explaining activities, discussing business and employment opportunities and learning the concerns of the community.	N/A	N/A
GTC0033	8-May-18	Email	Out	Tetl'it Gwich'in Council	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Diane Koe, Delores Vittrekwa, Douglas Wilson, Leslie Blake (Gwich'in Tribal Council), Leslie P. Blake (Gwich'in Tribal Council), Anita Koe	Meeting	A representative from Chance forwarded a letter to Tetl'it Gwich'in Council indicating that Chance had to extend the tenure of the exploration permits due to expire August 30, 2018. He sent a letter and a map and said that Tetl'it Gwich'in Council could contact Chance if they had any questions or comments.	N/A	N/A
GTC0034	8-May-18	Email	Out	Teetl'it Gwich'in Council	Kelly Constable (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Shena Shaw (Hemmera), Shawna Nerysoo, TGC Band Manager, Emily Mann (Hemmera)	Meeting	Hemmera sent an email to the Teetl'it Gwich'in Council with an attached draft version of the meeting notes of April 24, 2018 in Teetl'it Zheh (Fort McPherson), for the Chief and her colleagues to review and provide input in by June 5, 2018.	N/A	April 24, 2018 Meeting Notes
GTC0034	8-May-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Stephen Charlie (Gwich'in Tribal Council), Leighann Jones, Leslie P. Blake (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Meeting	A representative from Chance forwarded a letter to Gwich'in Tribal Council indicating that Chance had to extend the tenure of the exploration permits due to expire August 30, 2018. Chance sent a letter and a map and said that Gwich'in Tribal Council could contact Chance if they had any questions or comments.	N/A	N/A
GTC0035	8-May-18	Email	Out	Teetl'it Gwich'in Council	Kelly Constable (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Shena Shaw (Hemmera), Shawna Nerysoo, Emily Mann (Hemmera)	Meeting	Hemmera sent an email to Teetl'it Gwich'in Council with an attached draft version of the meeting notes of April 24th, 208 in Teetl'it Zheh (Fort McPherson), for the Teetl'it Gwich'in Council and her colleagues to review and provide input in by June 5th, 2018.	N/A	N/A
GTC0036	8-May-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Stephen Charlie (Gwich'in Tribal Council), Leighann Jones, Leslie P. Blake (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Meeting	A representative from Chance forwarded a letter to Gwich'in Tribal Council indicating that Chance had to extend the tenure of the exploration permits due to expire August 30, 2018. Chance sent a letter and a map and said that Gwich'in Tribal Council could contact Chance if they had any questions or comments.	N/A	N/A
GTC0037	9-May-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Kelly Constable (Hemmera), Shena Shaw (Hemmera), Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Meeting	A representative from Chance re-sent an email to the Gwich'in Tribal Council Transboundary Specialist, as their email address was incorrect.	N/A	N/A
GTC0038	11-May-18	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Richard Wyman (Chance), Greg Charlie (Chance)	Carolyn Lennie (Gwich'in Tribal Council)	Meeting	Gwich'in Tribal Council asked Chance if the multi-party meeting in Dawson City had been finalized.	N/A	N/A

GTC0039	11-May-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Shena Shaw (Hemmera), Kelly Constable (Hemmera), Carolyn Lennie (Gwich'in Tribal Council)	Meeting	A representative of Chance sent an email to Gwich'in Tribal Council explaining that the multi-party meeting was no longer scheduled because Chance had not been successful in getting all parties to attend due to other commitments. Chance explained that they were hoping to have this meeting some time in the near future and would advise Gwich'in Tribal Council accordingly. Gwich'in Tribal Council thanked Chance for the quick response.	N/A	N/A
GTC0040	17-May-18	Email	Out	Gwich'in Tribal Council	Kelly Constable (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Stephen Charlie (Gwich'in Tribal Council), Leigh-Ann Jones	Meeting	Hemmera sent the Gwich'in Tribal Council an email to confirm that the May 7, 2018 email was received and to check in with them about the draft meeting notes and draft Engagement and Communications Plan that was sent along. Hemmera also asked if Gwich'in Tribal Council had time for a quick call, or if they wished to have a more detailed teleconference to review these drafts collaboratively.	N/A	N/A
GTC0041	28-May-18	Email	Out	Gwich'in Tribal Council	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Shena Shaw (Hemmera), Stephen Charlie (Gwich'in Tribal Council), Leigh-Ann Jones, Emily Mann (Hemmera)	Meeting	Hemmera sent a follow up email to their May 17, 2018 email regarding an hour of their time to have a teleconference this week to discuss the draft Engagement and Communications Plan. Hemmera asked if they could send a few dates and times that work for their schedules and they would coordinate Hemmera and Chance's availability accordingly.	N/A	N/A
GTC0042	28-May-18	Email	In	Gwich'in Tribal Council	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Stephen Charlie (Gwich'in Tribal Council), Leigh-Ann Jones	Teleconference	A representative from the Gwich'in Tribal Council sent Hemmera an email indicating Gwich'in Tribal Council's availability for a teleconference the following day, May 29, 2018.	N/A	N/A
GTC0043	29-May-18	Email	Out	Gwich'in Tribal Council	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Leighann Jones, Stephen Charlie (Gwich'in Tribal Council), Leighann Jones, Kelly Constable (Hemmera)	Teleconference	A representative from Hemmera sent the Gwich'in Tribal Council an email thanking them for their time and feedback earlier that morning. Attached was an updated draft meeting notes and updated drat Communications and Engagement Plan for their detailed review with the TGC. Hemmera also included a few comments in the Plan for their consideration in their review. Hemmera asked the Gwich'in Tribal Council to please feel free to update Table 1 in the plan with the list of Gwich'in Tribal Council representatives as noted on the call this morning. She thanked them and looked forward to touching base again during the week of June 11, 2018.	N/A	N/A
GTC0044	29-May-18	Teleconference	Out	Gwich'in Tribal Council	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Leighann Jones, Stephen Charlie (Gwich'in Tribal Council), Kelly Constable (Hemmera)	Teleconference	Gwich'in Tribal Council and Chance had a teleconference from 9:00AM - 10:00AM to discuss the draft meeting minutes of April 24, 2018 and the draft Engagement and Communications Plan.	N/A	N/A
GTC0045	8-Jun-18	Email	Out	Gwich'in Tribal Council	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Shena Shaw (Hemmera), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Teleconference	A representative from Hemmera sent an email to the Lands and Resources representative(s) at Gwich'in Tribal Council, asking them if they would like to have a teleconference on June 13 or June 14, 2018. Hemmera asked them to let them know a time frame that worked for them.	N/A	N/A
GTC0046	13-Jun-18	Email	Out	Gwich'in Tribal Council	Kelly Constable (Hemmera)	N/A	N/A	Teleconference	A representative from Hemmera sent an email back to the Lands and Resources representative at Gwich'in Tribal Council on June 13, 2018 thanking them for the quick response.	N/A	N/A
GTC0047	13-Jun-18	Email	In	Gwich'in Tribal Council	N/A	N/A	N/A	Teleconference	A representative for Lands and Resources at Gwich'in Tribal Council sent an email back Hemmera on June 13, 2018, stating that unfortunately this week would not work, due to meetings and work travel. Gwich'in Tribal Council was also gearing up for National Indigenous Peoples Day the following and the Gwich'in Gathering at the end of the month. Gwich'in Tribal Council also said that they were planning on touching base with Hemmera and Gwich'in Tribal Council this to get a tentative meeting date. Gwich'in Tribal Council would let Hemmera know as soon as possible.	N/A	N/A
GTC0048	25-Jun-18	Email	Out	Gwich'in Tribal Council	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Shena Shaw (Hemmera), Kelly Constable (Hemmera), Emily Mann (Hemmera)	Vacation and Teleconference	Hemmera sent the Gwich'in Tribal Council an email letting them know that some of the team at Hemmera would be on vacation starting tomorrow and to please coordinate with a second representative from Hemmera, for the next teleconference, to review the forthcoming version of the Communications and Engagement Plan.	N/A	N/A
GTC0049	27-Jun-18	Email	In	Gwich'in Tribal Council	Gwich'in Tribal Council	N/A	N/A	Version of Communications	A representative from the Gwich'in Tribal Council sent Hemmera an email on June 27, 2017, thanking them for their email and said they would be forwarding their latest version shortly for discussion.	N/A	N/A
GTC0050	28-Jun-18	Email	Out	Gwich'in Tribal Council	Chance	N/A	N/A	Version of Communications	A representative from Chance sent an email to Gwich'in Tribal Council on June 28, 2018, letting them know they look forward to reviewing the latest version and work on finalizing the plan with Gwich'in Tribal Council/TGC.	N/A	N/A
GTC0051	6-Jul-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Shena Shaw (Hemmera), Carolyn Lennie (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kelly Constable (Hemmera), Stephen Charlie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Communications and Engagement Plans	A representative from Hemmera sent the Gwich'in Tribal Council an email to follow up on the Communications and Engagement Plans while her co-worker is out of the office. Hemmera noted that the completed plans are due to the Yukon Government on August 1st, 2018, and as the deadline is fast approaching, we are available to schedule a meeting to discuss the next draft of the Plan. The Chance team is available towards the end of next week and from July 16th-20th, 2018 to meet via teleconference and review the draft.	N/A	N/A
GTC0052	19-Jul-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Shena Shaw (Hemmera), Stephen Charlie (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Communications and Engagement Plans	Chance sent Gwich'in Tribal Council an email to follow-up on the status of the Communications and Engagement Plan and reminded Gwich'in Tribal Council of the August 1, 2018 deadline.	N/A	N/A

GTC0053	20-Jul-18	Email	In	Gwich'in Tribal Council	Stephen Charlie (Gwich'in Tribal Council)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Shena Shaw (Hemmera), Carolyn Lennie (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kelly Constable (Hemmera), Stephen Charlie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Communications and Engagement Plans	Gwich'in Tribal Council sent Chance an email saying they would be available to meet next via teleconference to discuss the Communication and Consultation Plan.	N/A	N/A
GTC0054	20-Jul-18	Email	In	Gwich'in Tribal Council	Stephen Charlie (Gwich'in Tribal Council)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Shena Shaw (Hemmera), Carolyn Lennie (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kelly Constable (Hemmera)	Communications and Engagement Plans	Gwich'in Tribal Council sent an email to Chance saying that had reviewed the Communications and Engagement Plan and were submitting their draft Communications and Consultation Plan for consideration. Gwich'in Tribal Council expressed their willingness to move forward on this file with Chance.	N/A	N/A
GTC0055	20-Jul-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Shena Shaw (Hemmera), Kelly Constable (Hemmera), Stephen Charlie (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Communications and Engagement Plans	Chance sent Gwich'in Tribal Council an email saying they had received the draft Communications and Consultation Plan and that they would review the plan and be in touch with changes. Chance asked Gwich'in Tribal Council when they would be available to meet via teleconference.	N/A	N/A
GTC0056	23-Jul-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Stephen Charlie (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Chance sent Gwich'in Tribal Council a meeting invitation with a draft Agenda.	N/A	N/A
GTC0057	23-Jul-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance)	Shena Shaw (Hemmera), Carolyn Lennie (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kelly Constable (Hemmera), Emily Mann (Hemmera)	Communications and Engagement Plans	Chance sent Gwich'in Tribal Council an email with comments on the Communications and Consultation Plan. Chance communicated that the draft Plan looks fine and asked about section 4.0 and whether there should be a representative from the Tetl'it Gwich'in Council identified as well.	N/A	N/A
GTC0058	27-Jul-18	Teleconference	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Shena Shaw (Hemmera), Kelly Constable (Hemmera), Stephen Charlie (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Communications and Consultation Plan	The purpose of this meeting was to review the Communications and Consultation Plan and to discuss finalizing the Plan in light of the August 1, 2018 deadline with Yukon Government. Meeting Objectives included: • Review the Plan sent via email to Chance and • Agree to next steps to finalize and submit the Plan by the August 1 deadline.	N/A	N/A
GTC0059	30-Jul-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Shena Shaw (Hemmera), Kelly Constable (Hemmera), Stephen Charlie (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Communications and Consultation Plan	Chance sent Gwich'in Tribal Council a follow-up email regarding section 8 of the Communications and Consultation Plan. Chance suggested some revisions for Gwich'in Tribal Council to review and suggested that Gwich'in Tribal Council and chance have a call to discuss the changes on August 31 at 3:30PM MST.	N/A	N/A

GTC0060	30-Jul-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Shena Shaw (Hemmera), Kelly Constable (Hemmera), Stephen Charlie (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Emily Mann (Hemmera)	Communications and Consultation Plan	Chance sent Gwich'in Tribal Council an email of the Communications and Consultation Plan with the changes that were discussed in the , July 27th teleconference. Chance said they would follow-up on Comments regarding Section 8 of the Plan.	N/A	N/A
GTC0061	31-Jul-18	Teleconference	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Shena Shaw (Hemmera), Kelly Constable (Hemmera), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council)	Communications and Consultation Plan	This time was used to review edits to the Gwich'in Tribal Council Chance Communications and Consultation Plan that we sent to Gwich'in Tribal Council by Chance on the afternoon of the July 30, 2018.	N/A	N/A
GTC0062	1-Aug-18	Email	In	Gwich'in Tribal Council	Stephen Charlie (Gwich'in Tribal Council)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Carolyn Lennie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Shena Shaw (Hemmera), Emily Mann (Hemmera)	Communications and Consultation Plan	Gwich'in Tribal Council sent Chance their final edits to the Communications and Consultation Plan and asked to be forwarded a clean copy.	N/A	N/A
GTC0063	1-Aug-18	Email	Out	Gwich'in Tribal Council	Kelly Constable (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Carolyn Lennie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Shena Shaw (Hemmera), Kelly Constable (Hemmera), Emily Mann (Hemmera)	Communications and Consultation Plan	Chance sent Gwich'in Tribal Council a clean copy of the Communications and Consultation Plan as a pdf and as a word document. It was indicated that the Chance team should send an email that they are satisfied with the final version.	N/A	N/A
GTC0064	1-Aug-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Carolyn Lennie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Shena Shaw (Hemmera), Emily Mann (Hemmera)	Communications and Consultation Plan	Chance indicated in writing that they were fine with the final version of the Draft plan and that it should be sent to Minister Pillai.	N/A	N/A
GTC0065	1-Aug-18	Email	Out	Gwich'in Tribal Council	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Shena Shaw (Hemmera), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Kelly Constable (Hemmera), Emily Mann (Hemmera)	Communications and Consultation Plan	Chance sent Gwich'in Tribal Council an updated version 3 of the Plan with suggested wording from Chance. This version of the Plan was meant to be edited by Gwich'in Tribal Council as per the August 1, 2018 discussion. The update version was to be sent back to Chance via email.	N/A	N/A
GTC0066	1-Aug-18	Teleconference	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Shena Shaw (Hemmera), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Emily Mann (Hemmera)	Communications and Consultation Plan	Chance and Gwich'in Tribal Council had a teleconference to discuss final edits to the Communications and Consultation Plan, mail Section 8: Cost and Economic Opportunity. Wording proposed by Gwich'in Tribal Council was agreed to by Chance. The process for submission was also agreed to, Chance would respond formally to the wording of section 8 asking Gwich'in Tribal Council to add the final agreed to text and asking Hemmera to submit the Plan to Yukon Government. It was agreed that nothing needed to be signed. Gwich'in Tribal Council said there was a Chief and Council general meeting in mid-August in which cabinet committee processes are discussed and more information may be requested at this time.	N/A	need to note it
GTC0067	2-Aug-18	Email	In	Gwich'in Tribal Council	N/A	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Carolyn Lennie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Shena Shaw (Hemmera), Stephen Charlie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Communications and Consultation Plan	Gwich'in Tribal Council communicated to chance that they were satisfied with the latest version of the Plan moving forward.	N/A	N/A

GTC0068	8-Aug-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Shena Shaw (Hemmera), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Chance sent Meeting Outcomes and Action Items to Gwich'in Tribal Council for review from the July 27, July 31, and August 1, 2018 teleconferences. These notes were done in the format established by the Communications and Consultation Plan and feedback from Gwich'in Tribal Council was requested on content and format because this was the first time the groups shared notes in this manner.	N/A	N/A
GTC0069	21-Sep-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Shena Shaw (Hemmera), Mike Chernoff (Chance) (Chance), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) , Leslie Blake (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Terms of Reference	Chance emailed Gwich'in Tribal Council in the interest of maintaining a positive momentum created by the creation of the Communications and Consultation Plan. Chance acknowledged that the Plan calls for the creation of a Chance-Gwich'in Communications and Consultation Management Committee that is to be formed within 60 days of completing the Plan, and as a first step, the Committee is to develop a Terms of Reference. Chance asked for Gwich'in Tribal Council's availability to begin discussions on the Committee and suggested a conference call on or before October 1, 2018 to confirm members of the Committee and to begin discussing the Terms of Reference for the Committee. Chance indicated they would like to keep using the services of Hemmera. Chance also enclosed an updated map of disposition in Eagle Plains.	N/A	N/A
GTC0070	21-Sep-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Shena Shaw (Hemmera), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Chance made a correction to a previous email in which there was a typo, specifically indicating a correction to the land tenure extension. The Exploration Permits 0012-0017 were extended to 2023, not 2013 as indicated incorrectly in the previous email.	N/A	N/A
GTC0071	10-Oct-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) , Shena Shaw (Hemmera), Carolyn Lennie (Gwich'in Tribal Council)	Terms of Reference	Chance informed Gwich'in Tribal Council that the first meeting to implement the Engagement and Communications Plan is probably mostly to establish the Management Committee, begin the discussion about the Terms of Reference of the Management Committee, and begin the discussion about the Secretariat that will be supporting the Management Committee including preliminary budget items. Chance attached a copy of the plan for convenience. Chance suggested that the first meeting to kick off implementation should be a conference call. Chance asked Gwich'in Tribal Council to let them know a few options that would work for them and their colleagues at the Gwich'in Tribal Council. Chance stated that once a date was confirmed they could circulate a draft agenda for Gwich'in Tribal Council's review and input.	N/A	N/A
GTC0072	11-Oct-18	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) , Shena Shaw (Hemmera), Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Gwich'in Tribal Council let Chance know that they were available to meet next week anytime. Gwich'in Tribal Council asked Chance to let them know a time to schedule the meeting.	N/A	N/A
GTC0073	15-Oct-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Terms of Reference	Chance sent Gwich'in Tribal Council two documents for the meeting on October 17, 2018 a draft agenda for review and comment, and a draft Terms of Reference for the Gwich'in-Chance Communications and Consultation Management Committee for discussion during the meeting.	N/A	N/A
GTC0074	17-Oct-18	Teleconference	N/A	Gwich'in Tribal Council		Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Communications and Consultation Plan	Chance and Gwich'in Partners met via teleconference to discuss the implementation of the Communications and Consultation Plan	N/A	need to note it
GTC0075	17-Oct-18	Meeting	N/A	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Communications and Consultation Plan	Chance communicated to Gwich'in Tribal Council that it was agreed that an All-Party Meeting would be beneficial after each of the First Nations that have met with Chance.	N/A	N/A

GTC0076	17-Oct-18	Meeting	N/A	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Communications and Consultation Management Committee	Chance and Gwich'in Partners identified members of the Communications and Consultation Management Committee. The Gwich'in Partners members consisted of the following: • Leslie Blake (Gwich'in Tribal Council) • Stephen Charlie (Gwich'in Tribal Council) • David MacMartin (Gwich'in Tribal Council) The Chance members consisted of the following: • Richard Wyman (Chance) • Greg Charlie (Chance) • Cindy Dickson (Chance) If required, it was stated in the Terms of Reference that additional members can be invited to the Management Committee meetings when additional subject matter expertise is needed.	N/A	N/A
GTC0077	24-Oct-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Shena Shaw (Hemmera), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Emily Mann (Hemmera)	Confidentiality Agreement	A representative from Chance sent a draft Confidentiality Agreement for Gwich'in Partners to review and provide feedback. This form of agreement was being shared with the other First Nation Governments who Chance had Engagement and Communications/Consultation Plans with. Since there were at least four and possibly five First Nations who are or could be party to this agreement, it would be great if Gwich'in Partners could accept this form as the common one subject to any specific elements needed by the Gwich'in Tribal Council/TGC to be reflected in this agreement. This draft was prepared by counsel to Chance in Calgary and Chance had inserted one correction and a few Notes to Draft (NTD's) in various sections of the draft agreement to help focus the feedback. Likewise, there were several sections with "•" for each of the parties to complete as applicable. Chance stated that notwithstanding that the Engagement and Consultation Plan serves both the Gwich'in Tribal Council and the TGC, to please advise if a similar approach can be used for this Confidentiality Agreement or if separate agreements need to be in place for each of the Gwich'in Tribal Council and the TGC. Chance asked this because each of the parties would be sharing information, some of which may have to be disclosed to agencies such as YESAB, the Yukon Water Board and other regulatory agencies. Chance said it may therefore be appropriate for "owners" of this shared information to be party to this agreement so any reporting obligations are covered in a satisfactory manner.	N/A	N/A
GTC0078	25-Oct-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Hemmera let Gwich'in Tribal Council know that they had already booked their flights to attend the meeting and wanted to know as soon as possible if Gwich'in Tribal Council could be available for a meeting on November 14 or 15.	N/A	N/A
GTC0079	25-Oct-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Hememra asked Gwich'in Tribal Council if they would be able to meet on the morning of November 15. Chance said that they booked their flights and there would be a fee to change our travel plans so it would be preferable for Chance if Gwich'in Tribal Council could make a meeting on morning of November 15, 2018 work. Chance's scheduled flight was set to depart at 1:45pm, so they could meet until 11:45am or noon on November 15. Chance noted that this time appeared to work for some members of Gwich'in Tribal Council as they had accepted the tentative meeting invite. Chance asked Gwich'in Tribal Council to let them know if this could work for them.	N/A	N/A
GTC0080	25-Oct-18	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	N/A	David MacMartin (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Gwich'in Tribal Council noted that a conflict had arisen for the November 14, 2018 date for them. David (Gwich'in Tribal Council) stated they'd be away on duty travel, and that Stephen (Gwich'in Tribal Council) and themself would need to propose some alternative dates. Gwich'in Tribal Council noted it may be more convenient to hold the first meeting in Whitehorse due to the fact Stephen and that they had two occasions coming up where they needed to travel to Whitehorse. David said they'd confer further on this with Stephen and that Gwich'in Tribal Council would get back to Hemmera shortly.	N/A	N/A
GTC0081	29-Oct-18	Email	In	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Gwich'in Tribal Council told Hemmera that they would get back to Chance on the matter of the meeting on November 15, 2018 the afternoon of October 29, 2018.	N/A	N/A
GTC0082	29-Oct-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Hemmera followed up on the meetings scheduled for November 14 and 15, 2018. Recognizing that some members of Gwich'in Tribal Council would be unavailable on the 14, Hemmera asked if they would be able to meet on the morning of the 15th. The Chance team had already scheduled flights and there was a fee to change them if Chance and Gwich'in Tribal Council cannot make the 15th work. Hemmera asked to let them know as soon as Gwich'in Tribal Council can about meeting on the 15th.	N/A	N/A
GTC0083	31-Oct-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Carolyn Lennie (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council)	Meeting	Hemmera followed up on a phone conversation. Hemmera stated that Chance would prefer to meet on the morning of November 15, if members of Gwich'in Tribal Council are able to meet that day. Chance would like to know as soon as possible if that day can work, if not, we can discuss a meeting later in the month. Hemmera would be in touch later in the week to try and finalize the date.	N/A	N/A
GTC0084	1-Nov-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Leslie P. Blake (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Hemmera thanked Gwich'in Tribal Council for confirming availability for the November 15, 2018 meeting and decided to go ahead with the meeting as scheduled. Hemmera stated they would confirm the meeting scheduler and send out an agenda. Hemmera also CC'd the president of the Tetlit Gwichin Council and the Chief of Gwich'in Tribal Council and asked the Gwich'in Tribal Council representative if they would be joining.	N/A	N/A
GTC0085	1-Nov-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance)	Carolyn Lennie (Gwich'in Tribal Council)	Meeting	A representative of Chance said they had a commitment in Whitehorse the afternoon of November 15 so would not be able to travel to Inuvik. Instead they would be able to participate by telephone and would need a number to call to join in.	N/A	N/A
GTC0086	1-Nov-18	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Stephen Charlie (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	A Gwich'in Partners representative informed Chance that members of Gwich'in Partners were available to meet on November 15.	N/A	N/A

GTC0087	7-Nov-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council)	Meeting	Hemmera sent Gwich'in Tribal Council the draft meeting agenda for the next week's meeting between Chance and Gwich'in Partners. Gwich'in Tribal Council could contact Hemmera if they would like to add anything to the Agenda.	N/A	N/A
GTC0088	13-Nov-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Hemmera thanked Gwich'in Tribal Council for informing them that a Tetlit Gwichin representative could not attend the meeting.	N/A	N/A
GTC0089	13-Nov-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Shena Shaw (Hemmera), Bobbie Jo Greenland Morgan, Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council)	Meeting	In preparation for the Chance and Gwich'in Tribal Council meeting on morning, Hemmera attached a few documents that were either on the Agenda for discussion, or could help to inform discussion. • NEW permit map – Chance has relinquished Permit 0005 as reflected in the attached map • Chance and Gwich'in Partners Communications and Consultation Plan for reference • Management Committee Terms of Reference with the addition of the Management Committee Members • Draft Confidentiality Agreement • The meeting Agenda Hemmera stated that if anyone could not attend in person, call-in details were included in the meeting invitation and are also in the Agenda.	N/A	N/A
GTC0090	13-Nov-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Hemmera asked Gwich'in Tribal Council if Leslie Blake (Gwich'in Tribal Council) would be joining the November 15 meeting, and if he would be joining by teleconference or in person.	N/A	N/A
GTC0091	13-Nov-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Hemmera thanked Gwich'in Tribal Council for confirming the attendance of Tetlit Gwichin Council at the November 15 meeting by teleconference.	N/A	N/A
GTC0092	13-Nov-18	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	N/A	Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	A representative from Gwich'in Tribal Council informed Hemmera that a representative from Tetl'it Gwich'in Councilwould not be available for the meeting on November 15.	N/A	N/A
GTC0093	13-Nov-18	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	N/A	Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	A representative from Gwich'in Tribal Council asked Hemmera if Chance and Gwich'in Tribal Council should proceed with the meeting given that Les and David are both absent and they are part of the committee. Carolyn (Gwich'in Tribal Council) stated that there was agreement at the last meeting that Gwich'in Tribal Council and TGC were to be at all meetings.	N/A	N/A
GTC0094	13-Nov-18	Email	In	Gwich'in Tribal Council	Carloyn Lennie	N/A	Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	A representative from Gwich'in Tribal Council emailed Hemmera to say that they would confirm the attendance via teleconference of a representative of Tetl'it Gwich'in Councilat the next meeting.	N/A	N/A
GTC0095	14-Nov-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Hemmera informed Gwich'in Tribal Council that they would still like to meeting given the absence of two members from the Committee. It was suggested that the conversation be limited to more procedural matters and that Chance could share information about their exploration project planning that could be passed along. Chance suggested touching base when they landed in Inuvik at 12:30am.	N/A	N/A
GTC0096	14-Nov-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Hemmera informed Gwich'in Tribal Council that they had just arrived in Inuvik and were still keen to meet on November 15. Chance suggested that they could adjust the agenda or stick to more procedural matters on each topic.	N/A	N/A
GTC0097	14-Nov-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Hemmera confirmed with Gwich'in Tribal Council that it was great they could still meet on November 15.	N/A	N/A
GTC0098	14-Nov-18	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	N/A	Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	A representative from Gwich'in Tribal Council confirmed that Gwich'in Tribal Council could meet on November 15th.	N/A	N/A
GTC0099	14-Nov-18	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	N/A	Carolyn Lennie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Travels	A representative from Gwich'in Tribal Council said thanks to Hemmera and safe travels.	N/A	N/A
GTC0100	15-Nov-18	Meeting	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	Parties presented and discussed changes to the Communications and Consultation Plan.	N/A	N/A
GTC0101	15-Nov-18	Meeting	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	Details around capacity funding were discussed.	N/A	N/A
GTC0102	15-Nov-18	Meeting	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	Parties discussed an All-Party Meeting on February 1, 2018. Parties agreed to meeting next on December 14.	N/A	N/A
GTC0103	15-Nov-18	Meeting	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	Chance raised some initial objectives as well. These included but are not limited to environmental stewardship and monitoring, all parties having common advisors, and as much continuous project activity as possible.	N/A	N/A
GTC0104	15-Nov-18	Meeting	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	When discussing meeting frequency for the Committee, it was decided that the Committee could meet more frequently than once per season when it is needed and at least once per season as specified in the Communications and Consultation Plan. Changes were made the Committee's terms of reference.	N/A	N/A
GTC0105	15-Nov-18	Meeting	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	Initial objectives for the Cooperation Agreement were brainstormed. Gwich'in Partners' initial objectives included but are not limited to identifying opportunities for employment and training, scholarships, and capacity funding.	N/A	N/A

GTC0106	15-Nov-18	In-Person Meeting	N/A	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Diane, Baxter, Stephen Charlie (Gwich'in Tribal Council),	Communications and Consultation Plan	The purpose of this meeting was to further discuss the implementation of the Communications and Consultation Plan and next steps between Gwich'in Partners and Chance. Specifically, the following items were discussed: •Chance's short-term exploration project plans •Chance-Gwich'in Communications and Consultation Management Committee (Committee) Terms of Reference •Confidentiality Agreement •Cooperation Agreement Objectives •Annual reporting to Yukon Government •All-Party Meeting Meeting Objectives were the following: • Confirm the roles and responsibilities of the Management Committee and review the draft Terms of Reference • Review the Confidentiality Agreement • Discuss each party's objectives for the Cooperation Agreement • Discuss Chance's reporting obligations to Yukon Government on the implementation of the Communications and Consultation Plan • Discuss an All-Party Meeting in early 2019	N/A	N/A
GTC0107	21-Nov-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Bobbie Jo Greenland Morgan, Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council), Shena Shaw (Hemmera), Emily Mann (Hemmera)	Terms of Reference, Consultation Plan	To follow-up on action items from the last Gwich'in Tribal Council-Chance meeting, Chance attached two items. 1. The Communications and Consultation Plan with the addition of a signature section, and, in a footer on each page, the date the Plan was created and page numbers. 2. The Draft Terms of Reference with a new table outlining Committee members' titles, and current contacts, a line saying Order Designates are to attend meetings if committee members are unavailable, and references to sections of the Plan. Chance stated that if Gwich'in Tribal Council was happy with the Plan's signature page, to please feel free to sign it and scan it back to Chance. For the Terms of Reference, if Gwich'in Tribal Council was ok with the latest round of changes and did not have any further changes, they could add in the Gwich'in Partner's logo and remove the draft watermark to finalize this document as well. Chance stated they were also in the process of developing the Draft Cooperation Agreement with sections to be filled in and they'd have this to Gwich'in Tribal Council shortly.	N/A	N/A
GTC0108	23-Nov-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Hemmera followed up on items Chance and Gwich'in Partners discussed in the meeting the previous week, where Chance was interested in planning an All-Party Meeting for February 1st, 2019, and would like to invite Gwich'in Partners. Hemmera noted that the event was still tentatively scheduled, however, they wanted to provide more information as we have looked into the details further. An All-Party Meeting is meant to bring together Gwich'in Tribal Council, Tetlit Gwich'in Council, VGFN, NND, TH, and Yukon Government to discuss matters related to Chance's upcoming exploration project. The following topics are being proposed for the agenda: • An overview of the First Nations' and Chance's work with the Engagement Plans over the past year; • North Yukon Regional Land Use Plan; • Yukon Oil and Gas Act; • In-camera First Nations session to discuss collaboration and leadership; and • Chance's exploration project plans and expected YESAB application process. We would like to host the meeting in Vancouver on February 1st, 2019, the day after AME Roundup (BC's Annual Mining Conference). We are hoping that scheduling this meeting immediately after this widely attended conference will allow for maximum participation. Chance will fund three members from each First Nation for travel to and from Vancouver, and for accommodation for two nights. Chance is anticipating that the First Nations representatives who attend the meeting will be: • The Chief; • The staff member managing the Chance file; and • The Director of Lands and Resources, or another staff member who has been working closely with Chance. Hemmera stated that they were still in the early stages of planning this event, but wanted to let you know in advance so that the date could be reserved. They said they were happy to have further conversations regarding your attendance and meeting logistics. Representatives who were interested to attend the meeting could contact Emily at Hemmera via call or email at any time if there were questions. Emily's contact information was included.	N/A	N/A
GTC0109	26-Nov-18	Email	In	Gwich'in Tribal Council	Stephen Charlie (Gwich'in Tribal Council)	N/A	Stephen Charlie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting notes	A Gwich'in Tribal Council representative asked Chance to forward a copy of the notes from the last two meetings.	N/A	N/A
GTC0110	27-Nov-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Shena Shaw (Hemmera), Calista Morrison (Hemmera), Stephen Charlie (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Diane, Baxter, David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	Hemmera sent the Meeting Outcomes and Action Items for the last two Chance and Gwich'in Tribal Council meetings, as well as the revised Terms of Reference, and revised Communications and Consultation Plan. Hemmera stated for recipients to use the revised Terms of Reference with that day's date as they had updated some contact information in the Membership Table. Hemmera said that once both parties had approved the new "Signature of the Parties" section of Communications and Consultation Plan as well as the addition of the date and page numbers, to let them know so they could facilitate the scanning and signing of the document. Hemmera was also working on the Draft Cooperation Agreement that contained section headings and suggested draft content and was aiming to send that our shortly.	N/A	N/A

GTC0111	29-Nov-18	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Shena Shaw (Hemmera), Emily Mann (Hemmera), Calista Morrison (Hemmera), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) , Leslie Blake (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council)	Meeting	Chance forwarded a description of the exploration objectives that they have for their exploration permits in Eagle Plain and also provided a couple of scenarios to undertake the work for Gwich'in Partners review and consideration. Chance asked that Gwich'in Tribal Council please pass this on to anybody else who was working on this file. Chance also asked that in case they were not using the correct email addresses for Leslie Blake (Gwich'in Tribal Council), to please forward this to their correct email and to let Chance know what email address was the best one for us to use going forward. Chance said that if Gwich'in Tribal Council had any questions or comments, to please let Chance know.	N/A	N/A
GTC0112	4-Dec-18	Email	In	Gwich'in Tribal Council	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Richard Wyman (Chance)	Emily Mann (Hemmera), Carolyn Lennie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Bobbie Jo Greenland Morgan	Meeting	A Gwich'in Tribal Council representative forwarded the preferred email address of President of the Tetlit Gwitchin Council, Lesley Blake. The email address was appydad2003@yahoo.ca.	N/A	N/A
GTC0113	12-Dec-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Emily Mann (Hemmera)	Meeting	To prepare for the December 14 meeting, Hemmera sent Gwich'in Tribal Council a brainstorming document for the Cooperation Agreement to start the discussion. That document contained thoughts expressed in the last meeting as well as a draft template for the Cooperation Agreement. Also attached was a draft working agenda.	N/A	N/A
GTC0114	14-Dec-18	Meeting	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	Parties to sign Communications and Consultation Plan	N/A	N/A
GTC0115	14-Dec-18	Meeting	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	Final edits to the Engagement Plan were reviewed and approved by Gwich'in Tribal Council and Chance. Hemmera inquired as to whether the Plan should include a signatory line for the President of Tetlit Gwich'in Council. Following a side bar, Gwich'in Tribal Council decided against including an additional signatory line for the President of Tetlit Gwich'in Council. Complete final changes to the Communications and Consultation Plan as they were discussed in the meeting: •Fix page numbers •Remove dates from signatory line •Remove Tetlit signatory line	N/A	N/A
GTC0116	14-Dec-18	Meeting	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	Final edits to the TOR were reviewed and approved by Gwich'in Tribal Council and Chance. Hemmera requested Gwich'in Tribal Council send their logo.	N/A	N/A
GTC0117	14-Dec-18	Meeting	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	Chance proposed having the Confidentiality Agreement finalized and signed prior to the All-Party Meeting Feb 1st, 2019. Finalizing this agreement with enable Chance to discuss additional details of negotiations with Yukon Government. Parties agreed the Confidentiality Agreement should be finalized prior to additional work on the Cooperation Agreement. Finalizing the Confidentiality Agreement will facilitate greater information sharing and benefit the development of the Cooperation Agreement.	N/A	N/A
GTC0118	14-Dec-18	Meeting	N/A	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council)	Implementation of the Communications and Consultation Plan	The purpose of this meeting was to further discuss the implementation of the Communications and Consultation Plan. Chance also hoped to discuss the All-Party Meeting scheduled for February 1st, 2019. The following items were discussed: •Review and discuss the draft Cooperation Agreement; •Finalize the Communications and Consultation Management Committee Terms of Reference; •Discuss changes and signing of the Communications and Consultation Plan; •Discuss any changes and next steps for the Confidentiality Agreement; and •Discuss logistics and draft agenda of the All-Party Meeting. Meeting Objectives were the following: •Understand each parties' commitments and objectives for the Cooperation Agreement; •Finalize the Terms of Reference; •Finalize the Communications and Consultation Plan; •Discuss Gwich'in Tribal Council's review of the Confidentiality Agreement and next steps; and •Provide a planning and logistics update for the All-Party Meeting.	N/A	N/A

GTC0119	14-Dec-18	Meeting	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	Gwich'in Tribal Council expressed appreciation to Chance for sending the Project Description. Parties discussed how the timeframe/evolution of the project (exploration activities) and Cooperation Agreement should be sequenced. Parties also discussed the purpose of the Cooperation Agreement and/or its objectives: •Allow for flexibility •Help achieve and meet consultation adequacy •Recognize and address significance of the Porcupine Caribou Herd and other resources •Parties work collaboratively when engaging with Yukon Government •Steady progress in engagement and project activities Additional comments made with respect to objectives for the Cooperation Agreement were: •The agreement is meant to provide certainty of process, not certainty of outcome •Building in the concept that Chance has garnered Gwich'in Tribal Council support for the process moving forward •Both parties see the agreement as a framework for ongoing interactions between Chance and Gwich'in Tribal Council	N/A	N/A
GTC0120	14-Dec-18	Email	Out	Gwich'in Tribal Council	Emily Mann (Hemmera)	N/A	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Emily Mann (Hemmera)	Communications and Consultation Plan	Hemmera sent Grand Chief of Gwich'in Tribal Council a copy of the Communications and Consultation Plan for them to sign. Chance said that once Gwich'in Tribal Council had signed the Plan, Chance would also sign the Plan and then Hemmera would send the final version to both parties.	N/A	N/A
GTC0121	15-Dec-18	Meeting	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	Parties to sign Communications and Consultation Plan	N/A	N/A
GTC0122	16-Dec-18	Meeting	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	Hemmera provided an overview of the All-Party Meeting and draft agenda.	N/A	N/A
GTC0123	20-Dec-18	Email	In	Gwich'in Tribal Council	Stephen Charlie (Gwich'in Tribal Council)	N/A	David MacMartin (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Emily Mann (Hemmera)	Request	A representative from Gwich'in Partners informed Chance that they would get back to Chance on the meeting request sometime that afternoon.	N/A	N/A
GTC0124	24-Dec-18	Email	Out	Gwich'in Tribal Council	Calista Morrison (Hemmera)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Emily Mann (Hemmera), Shena Shaw (Hemmera), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Meeting Summary	Email sent with Draft Meeting Summary of the Chance and Gwich'in Partners December 14, 2018 Meeting. Meeting Objectives were the following: • Understand each parties' commitments and objectives for the Cooperation Agreement; • Finalize the Terms of Reference; • Finalize the Communications and Consultation Plan; • Discuss Gwich'in Tribal Council's review of the Confidentiality Agreement and next steps; and • Provide a planning and logistics update for the All-Party Meeting. Key Meeting Outcomes: Gwich'in Tribal Council expressed appreciation to Chance for sending the Project Description. Parties discussed how the timeframe/evolution of the project (exploration activities) and Cooperation Agreement should be sequenced. Parties also discussed the purpose of the Cooperation Agreement and/or its objectives: • Allow for flexibility • Help achieve and meet consultation adequacy • Recognize and address significance of the Porcupine Caribou Herd and other resources • Parties work collaboratively when engaging with Yukon Government (Yukon Government) • Steady progress in engagement and project activities Chance proposed having the Confidentiality Agreement finalized and signed prior to the All-Party Meeting Feb 1st, 2019. Parties agreed the Confidentiality Agreement should be finalized prior to additional work on the Cooperation Agreement. Final edits to the TOR were reviewed and approved by Gwich'in Tribal Council and Chance. Final edits to the Engagement Plan were reviewed and approved by Gwich'in Tribal Council and Chance. Hemmera provided an overview of the All-Party Meeting and draft agenda.	N/A	N/A
E00076	8-Jan-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera, Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Bobbie Jo Greenland -Morgan	Engagement/Consultation Confidentiality Agreement	Hemmera followed up from December 14, 2018 Meeting. Attached Communications and Consultation Plan for signing, and Draft Confidentiality Agreement.	N/A	E00076_190211_Chance Follow-up
E00024	9-Jan-19	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Engagement/Consultation	Gwich'in Tribal Council Chance Communication and Consultation plan was attached and signed.	N/A	E00024_190207_RE_ Chance Follow-up_1
E00025	9-Jan-19	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Carolyn Lennie (Gwich'in Tribal Council)	Hemmera	Meeting Coordination/Planning	Gwich'in Tribal Council discussed costs to be covered with Hemmera.	N/A	E00025_190207_RE_ Chance Follow-up_2
E00026	9-Jan-19	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Carolyn Lennie (Gwich'in Tribal Council)	Hemmera	Meeting Coordination/Planning	Gwich'in Tribal Council discussed honoraria amounts with Hemmera.	N/A	E00026_190207_RE_ Chance Follow-up_3
E00051	9-Jan-19	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Carolyn Lennie (Gwich'in Tribal Council)	Hemmera	Meeting Coordination/Planning	Gwich'in Tribal Council confirmed honorarium for Leslie Blake (Gwich'in Tribal Council) for Hemmera to consider.	N/A	E00051_190208_Re_ Honorarium
E00062	9-Jan-19	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	Carolyn Lennie (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council)	Engagement/Consultation	Richard (Chance) attached signed Communications and Consultation Plan.	N/A	E00062_190208_Signed Gwich'in Tribal Council-Chance Communication and Consultation Plan

E00088	9-Jan-19	Email	Out	Gwich'in Tribal Council	Hemmera	Carolyn Lennie (Gwich'in Tribal Council)	Hemmera	Meeting Coordination/Planning	Hemmera asked Gwich'in Tribal Council about honorarium clarification.	N/A	E00088_100212_Honorarium_1
E00100	9-Jan-19	Email	Out	Gwich'in Tribal Council, Tetl'it Gwich'in Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Lynn O'Neil (Chance), Cindy Dickson (Chance)	Carolyn Lennie (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Meeting Coordination/Planning	Hemmera discussed travel details for All-Party Meeting, proposed flights, costs covered, and other travel details.	N/A	E00100_190212_RE_ Chance all party Meeting_3
E00104	9-Jan-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Carolyn Lennie (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Confidentiality Agreement	Hemmera asked Gwich'in Tribal Council and Chance for an update on Confidentiality Agreement.	N/A	E00104_190212_RE_ Chance Follow-up_1
E00105	9-Jan-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Carolyn Lennie (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Meeting Coordination/Planning	Hemmera informed Gwich'in Tribal Council about the costs Chance would cover for each First Nation for the All-Party Meeting.	N/A	E00105_190212_RE_ Chance Follow-up_2
E00106	9-Jan-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Carolyn Lennie (Gwich'in Tribal Council)	Meeting Coordination/Planning	Hemmera and Gwich'in Tribal Council discussed per diem and honoraria.	N/A	E00106_190212_RE_ Chance Follow-up_3
E00121	9-Jan-19	Email	Out	Gwich'in Tribal Council	Hemmera	Carolynn Lennie	Hemmera	Meeting Coordination/Planning	Hemmera stated to Gwich'in Tribal Council that they would let Richard (Chance) know about Leslie's (Gwich'in Tribal Council) honorarium.	N/A	E00121_190212_RE_ Honorarium_2
E00132	9-Jan-19	Phone Call	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Carolyn Lennie (Gwich'in Tribal Council)	Meeting Coordination/Planning	Hemmera called Gwich'in Tribal Council regarding attendance for the All-Party Meeting.	N/A	N/A
E00092	10-Jan-19	Email	Out	Gwich'in Tribal Council	Hemmera	Carolyn Lennie (Gwich'in Tribal Council)	Hemmera	Meeting Coordination/Planning	Hemmera asked Gwich'in Tribal Council about All-Party Meeting logistics and asked for clarification.	N/A	E00092_190212_Per Diem Payment
E00028	11-Jan-19	Email	In	Tetl'it Gwich'in Council, Tr'ondëk Hwëch'in, First Nation of Na-cho Nyäk Dun, Gwich'in Tribal Council, Vuntut Gwitchin First Nation Yukon Government	Leslie Blake (Gwich'in Tribal Council)	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Dawna Hope, Catherine Mallon, Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender, Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), John Fox (Yukon Government), Derek Fraser (Yukon Government)	Meeting Coordination/Planning	Leslie (Gwich'in Tribal Council) confirming attendance to All-Party Meeting in Vancouver.	N/A	E00028_190207_Re_ Chance Oil and Gas all party Meeting Draft Working Agenda_1
E00063	11-Jan-19	Email	Out	Tetl'it Gwich'in Council	Hemmera	Hemmera	Leslie Blake (Gwich'in Tribal Council)	Meeting Coordination/Planning	Hemmera contacted Leslie (Gwich'in Tribal Council) about their travel plans for Vancouver.	N/A	E00063_190208_RE_ Chance Oil and Gas all party Meeting Draft Working Agenda_2
E00030	14-Jan-19	Email	In	Tetl'it Gwich'in Council	Leslie Blake (Gwich'in Tribal Council)	Hemmera	Leslie Blake (Gwich'in Tribal Council)	Meeting Coordination/Planning	Leslie (Gwich'in Tribal Council) contacted Hemmera and confirmed attendance.	N/A	E00030_190207_RE_ Chance Oil and Gas all party Meeting Draft Working Agenda_3
E00138	14-Jan-19	Phone Call	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Carolyn Lennie (Gwich'in Tribal Council)	Meeting Coordination/Planning	Hemmera called Gwich'in Tribal Council regarding logistics of the All-Party Meeting.	N/A	N/A
E00019	15-Jan-19	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Carolyn Lennie (Gwich'in Tribal Council)	Hemmera	Meeting Coordination/Planning	Gwich'in Tribal Council confirmed to Hemmera that Bobbie Jo, Leslie, and Stephen from Gwich'in Tribal Council would be attending the All-Party Meeting. They discussed travel arrangements.	N/A	E00019_190206_RE_ Chance all party Meeting_4

E00053	15-Jan-19	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Carolynn Lennie, Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Meeting Coordination/Planning	Gwich'in Tribal Council thanked Richard (Chance).	N/A	E00053_90208_RE_ Signed Gwich'in Tribal Council-Chance Communication and Consultation Plan
E00141	18-Jan-19	Phone Call	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Kaylynn Koe	Meeting Coordination/Planning	Hemmera called Gwich'in Tribal Council regarding the logistics of flights and accommodation for the All-Party Meeting.	N/A	N/A
E00006	19-Jan-19	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Carolyn Lennie (Gwich'in Tribal Council), Kaylynn Koe	Hemmera	Meeting Coordination/Planning	Carolyn (Gwich'in Tribal Council) connected Kaylynn (Gwich'in Tribal Council) and Emily (Hemmera) for making travel arrangements.	N/A	E00006_190206_Change Oil & Gas
E00027	21-Jan-19	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Carolyn Lennie (Gwich'in Tribal Council)	Hemmera	Meeting Coordination/Planning	Gwich'in Tribal Council confirmed attendees to All-Party Meeting in Vancouver.	N/A	E00027_190207_RE_ Chance Follow-up_4
E00079	21-Jan-19	Email	Out	Gwich'in Tribal Council	Hemmera	Kaylynn Koe	Hemmera	Meeting Coordination/Planning	Hemmera followed up with Gwich'in Tribal Council about accommodations and details for All-Party Meeting February 1, 2019.	N/A	E00079_190211_Chance Oil and Gas all party Meeting_1
E00034	22-Jan-19	Email	In	Gwich'in Tribal Council	Kaylynn Koe	Kaylynn Koe	Hemmera	Meeting Coordination/Planning	Gwich'in Tribal Council confirmed travel details of attendees with Hemmera and confirmed pricing.	N/A	E00034_190207_RE_ Chance Oil and Gas all party Meeting_1
E00111	22-Jan-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Kaylynn Koe	Meeting Coordination/Planning	Hemmera stated they would send cost of Westmark to Gwich'in Tribal Council.	N/A	E00111_190212_RE_ Chance Oil and Gas all party Meeting_1
E00112	22-Jan-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Kaylynn Koe	Meeting Coordination/Planning	Hemmera sent cost of Westmark to Gwich'in Tribal Council.	N/A	E00112_190212_RE_ Chance Oil and Gas all party Meeting_2
E00035	23-Jan-19	Email	In	Gwich'in Tribal Council	Kaylynn Koe	Kaylynn Koe	Hemmera	Meeting Coordination/Planning	Kaylynn (Gwich'in Tribal Council) said to Hemmera that they would forward to finance.	N/A	E00035_190207_RE_ Chance Oil and Gas all party Meeting_2
E00021	24-Jan-19	Email	In	Gwich'in Tribal Council, Tetl'it Gwich'in Council	Stephen Charlie (Gwich'in Tribal Council)	Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Hemmera	Meeting Coordination/Planning	Stephen (Gwich'in Tribal Council) said to Hemmera that they were reviewing document, and that Gwich'in Tribal Council would speak to it next week.	N/A	E00021_190206_RE_ Chance Confidentiality Agreement
E00074	24-Jan-19	Email	Out	Gwich'in Tribal Council, Tetl'it Gwich'in Council	Hemmera	Stephan Charlie, David MacMartin (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Hemmera	Confidentiality Agreement Meeting Coordination/Planning	Hemmera followed up with Gwich'in Tribal Council on the Draft Confidentiality Agreement and the All-Party Meeting.	N/A	E00074_190211_Chance Confidentiality Agreement
E00075	24-Jan-19	Email	Out	Gwich'in Tribal Council, Tetl'it Gwich'in Council	Hemmera	Kaylynn Koe, Leslie Blake (Gwich'in Tribal Council)	Hemmera	Meeting Coordination/Planning	Kaylynn (Gwich'in Tribal Council) sent Hemmera confirmation for Vancouver hotel.	N/A	E00075_190211_Chance February_ 1 Meeting - Coast Hotel Confirmation Code
E00022	25-Jan-19	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Leslie Blake (Gwich'in Tribal Council)	Hemmera	Leslie Blake (Gwich'in Tribal Council), Kaylynn Koe	Meeting Coordination/Planning	Leslie (Gwich'in Tribal Council) said they would no longer be attending the All-Party Meeting.	N/A	E00022_190206_Re_ Chance February_ 1 Meeting - Coast Hotel Confirmation Code_1
E00023	25-Jan-19	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Kaylynn Koe	Leslie Blake (Gwich'in Tribal Council), Kaylynn Koe	Hemmera	Meeting Coordination/Planning	Kaylynn (Gwich'in Tribal Council) notified Hemmera they were cancelling Leslie's (Gwich'in Tribal Council) hotels, and indicated that Grand Chief Bobbie Jo and Director of Lands will still be attending on behalf of Gwich'in Tribal Council.	N/A	E00023_190207_RE_ Chance February_ 1 Meeting - Coast Hotel Confirmation Code_2
E00102	25-Jan-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera	Stephen Charlie (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), David Mac Martin	Confidentiality Agreement Meeting Coordination/Planning	Hemmera provided notice of travel, and discussion of Draft Confidentiality Agreement signing.	N/A	E00102_190212_RE_Chance_Confidentiality_Agreement
E00103	25-Jan-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera	Leslie Blake (Gwich'in Tribal Council), Kaylynn Koe	Meeting Coordination/Planning	Hemmera sent a response to Leslie (Gwich'in Tribal Council) about not being able to attend the All-Party Meeting.	N/A	E00103_190212_RE_ Chance February_ 1 Meeting - Coast Hotel Confirmation Code
E00087	29-Jan-19	Email	Out	Gwich'in Tribal Council	Hemmera	Kaylynn Koe	Hemmera	Meeting Coordination/Planning	Hemmera sent Kaylynn (Gwich'in Tribal Council) the confirmation number for hotel for Stephen (Gwich'in Tribal Council).	N/A	E00087_190212_FW_ Westmark Whitehorse Hotel - Stephen Charlie (Gwich'in Tribal Council) Confirmation Number

E00058	30-Jan-19	Email	In	Gwich'in Tribal Council	Kaylynn Koe	Kaylynn Koe	Hemmera	Meeting Coordination/Planning	Kaylynn (Gwich'in Tribal Council) and Hemmera discussed questions about Westmark confirmation.	N/A	E00053_90208_RE_ Signed Gwich'in Tribal Council-Chance Communication and Consultation Plan
E00127	30-Jan-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Kaylynn Koe	Meeting Coordination/Planning	Hemmera indicated to Kaylynn (Gwich'in Tribal Council) that they had booked a room, and would cancel double reservation.	N/A	E00127_190212_RE_ Westmark Whitehorse Hotel - Stephen Charlie (Gwich'in Tribal Council) Confirmation Number_2
E00059	31-Jan-19	Email	In	Gwich'in Tribal Council	Kaylynn Koe	Kaylynn Koe	Hemmera	Meeting Coordination/Planning	Discussion of flights/hotels and possible double bookings.	N/A	E00059_190208_RE_ Westmark Whitehorse Hotel - Stephen Charlie (Gwich'in Tribal Council) Confirmation Number_2
E00126	1-Feb-19	Email	In	Gwich'in Tribal Council	Kaylynn Koe	Hemmera	Kaylynn Koe	Meeting Coordination/Planning	Thank you, hope meeting goes well.	N/A	E00125_190212_RE_ Westmark Whitehorse Hotel - Stephen Charlie (Gwich'in Tribal Council) Confirmation Number
E00128	1-Feb-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Kaylynn Koe	Meeting Coordination/Planning	Confirmed only 1 room booked.	N/A	E00128_190212_Re_ Westmark Whitehorse Hotel - Stephen Charlie (Gwich'in Tribal Council) Confirmation Number_3
GTC0125	1-Feb-19	Meeting	In /Out	Gwich'in Tribal Council, First Nation of Na-Cho Nyäk Dun, Vuntut Gwitchin First Nation	N/A	N/A	N/A	Meeting Coordination/Planning	Chance hosted the All-Party Meeting on February 1, 2019.	N/A	N/A
E00060	2-Feb-19	Email	In	Gwich'in Tribal Council	Kaylynn Koe	Kaylynn Koe	Hemmera	Meeting Coordination/Planning	Thank you for follow up.	N/A	E00060_190208_RE_ Westmark Whitehorse Hotel - Stephen Charlie (Gwich'in Tribal Council) Confirmation Number_3
E00008	4-Feb-19	Email	In	Gwich'in Tribal Council	Kaylynn Koe	Kaylynn Koe	Hemmera	Meeting Coordination/Planning	Details around capacity funding were discussed.	N/A	E00008_190206_FW_ Westmark Whitehorse Hotel - Stephen Charlie (Gwich'in Tribal Council) Confirmation Number
E00061	4-Feb-19	Email	In	Gwich'in Tribal Council	Kaylynn Koe	Kaylynn Koe	Hemmera	Meeting Coordination/Planning	Details around capacity funding were discussed.	N/A	E00061_190208_RE_ Westmark Whitehorse Hotel - Stephen Charlie (Gwich'in Tribal Council) Confirmation Number_4
E00125	4-Feb-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Kaylynn Koe	Meeting Coordination/Planning	Details around capacity funding were discussed.	N/A	E00125_190212_RE_ Westmark Whitehorse Hotel - Stephen Charlie (Gwich'in Tribal Council) Confirmation Number
E00129	4-Feb-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Kaylynn Koe	Meeting Coordination/Planning	Details around capacity funding were discussed.	N/A	E00129_190212_RE_ Westmark Whitehorse Hotel - Stephen Charlie (Gwich'in Tribal Council) Confirmation Number_4
E00150	4-Feb-19	Phone Call	In	Gwich'in Tribal Council	Kaylynn Koe	Hemmera	Kaylynn Koe	Meeting Coordination/Planning	Gwich'in Tribal Council called Chance regarding reimbursement for All-Party Meeting expenses.	N/A	N/A
E00161	18-Feb-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera	Stephen Charlie (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), David Mac Martin	Confidentiality Agreement	Asking about status of Gwich'in Tribal Council's review of Confidentiality Agreement.	N/A	E00161_190401_RE_ Chance Confidentiality Agreement_2
E00162	18-Feb-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera	Stephen Charlie (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), David Mac Martin	Confidentiality Agreement	Gwich'in Tribal Council under impression that Communication and Consultation Plan was adequate in addressing all immediate confidentiality Concerns at this stage. If a Project matter arose that Chance believed needed further reassurance of confidentiality, that concerns would be discussed at that time.	N/A	E00162_190401_RE_ Chance Confidentiality Agreement_1
E0141850	18-Feb-19	Community Event	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	N/A	Chance called the Hamlet of Teetl'it Zheh (Fort McPherson) and the caterers to let them know the open house was postponed out of respect for the community due to the sudden loss of two of its Members.	N/A	N/A
E00159	8-Mar-19	Email	In	Gwich'in Tribal Council	Louise Nazon	Hemmera, Lynn O'Neil (Chance)	Louise Nazon	Meeting Coordination/Planning	Louise looking for guidance on invoicing for expenses for January meeting.	N/A	E00159_190401_FW_ Recovery of expenses for Bobbie Jo Greenland Morgan and Stephen Charlie (Gwich'in Tribal Council)
E00156	12-Mar-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Louise Nazon	Meeting Coordination/Planning	Contact info for Emily and times available.	N/A	E00156_190401_RE_ Recovery of expenses for Bobbie Jo Greenland Morgan and Stephen Charlie (Gwich'in Tribal Council)_1

E00157	12-Mar-19	Email	In	Gwich'in Tribal Council	Louise Nazon	Hemmera	Louise Nazon	Meeting Coordination/Planning	Will get back to Emily ASAP.	N/A	E00157_190401_RE_ Recovery of expenses for Bobbie Jo Greenland Morgan and Stephen Charlie (Gwich'in Tribal Council)_2
E00155	19-Mar-19	Email	In	Gwich'in Tribal Council	Louise Nazon	Hemmera	Louise Nazon	Meeting Coordination/Planning	attached invoice for recovering Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) and Stephen Charlie (Gwich'in Tribal Council)'s costs.	N/A	E00155_190401_RE_ Recovery of expenses for Bobbie Jo Greenland Morgan and Stephen Charlie (Gwich'in Tribal Council)_3
E00160	19-Mar-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera	Stephen Charlie (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), David Mac Martin	Confidentiality Agreement	Once Richard is back in the office (March 2019), will touch base about Confidentiality Agreement.	N/A	E001960_190401_RE_ Chance Confidentiality Agreement_3
E00164	26-Mar-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Caroline Lennie	Tenures/Dispositions/Permits	Request to extend tenure on Exploration Permits 0006-0011 and 0019 at Eagle Plains.	N/A	E00164_190401_Notice of Tenure Extension Request
E00158	27-Mar-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Louise Nazon	Meeting Coordination/Planning	Confirming receipt of invoice. Bobbie Jo's hotel rate was higher than agreed upon. Stephen Charlie (Gwich'in Tribal Council)'s is correct, but Bobbie Jo's should have been $165 at Pan Pacific.	N/A	E00158_190401_RE_ Recovery of expenses for Bobbie Jo Greenland Morgan and Stephen Charlie (Gwich'in Tribal Council)
E00234	8-May-19	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Greg Charlie (Chance)	Carolyn Lennie (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Meeting Coordination/Planning	Gwich'in Tribal Council and Tetl'it Gwich'in CouncilPresident would like to confirm availability to meet on June 5, 2019 for an update on Chance's activities. Grand Chief Bobbie Jo, Tetl'it Gwich'in CouncilPresident Leslie Blake (Gwich'in Tribal Council) and Erika Tizya-Tramm (Gwich'in Tribal Council) will be in attendance. David MacMartin (Gwich'in Tribal Council) will confirm his attendance after May 16, 2019.	N/A	E00234_RE_ Chance Oi8l & Gas Update Meeting_June 5th_2
E00235	8-May-19	Email	Out	Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance)	Carolyn Lennie (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Meeting Coordination/Planning	Apologies for wrong date. Will be in Old Crow June 6, 2019 and can be in Inuvik June 7, 2019. Please let me know if that date works.	N/A	E00234_RE_ Chance Oi8l & Gas Update Meeting_June 5th_2
E00236	9-May-19	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Greg Charlie (Chance)	Carolyn Lennie (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Meeting Coordination/Planning	Grand Chief Bobbie Jo is unavailable June 7, 2019. Will confirm with President Les and Gwich'in Tribal Council staff on their availability.	N/A	E00234_RE_ Chance Oi8l & Gas Update Meeting_June 5th_2
E00237	9-May-19	Email	Out	Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance) Hemmera, Cindy Dickson (Chance)	Carolyn Lennie (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Meeting Coordination/Planning	Confirming that will meet with President Les, and Gwich'in Tribal Council staff at 2 pm. Flight arrives as 12:25 and listed Chance and Hemmera attendees. Emily will send a draft agenda to be reviewed.	N/A	E00234_RE_ Chance Oi8l & Gas Update Meeting_June 5th_2
E00238	9-May-19	Email	In	Gwich'in Tribal Council	Carolyn Lennie (Gwich'in Tribal Council)	Greg Charlie (Chance) Hemmera, Cindy Dickson (Chance)	Carolyn Lennie (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council)	Meeting Coordination/Planning	Gwich'in Tribal Council confirm June 7, 2019 meeting. Attending will be Tetl'it Gwich'in CouncilPresident Leslie P. Blake (Gwich'in Tribal Council) and Gwich'in Tribal Council Staff: David MacMartin (Gwich'in Tribal Council) and Erika Tizya-Tramm (Gwich'in Tribal Council).	N/A	E00238_RE_ Chance Oi8l & Gas Update Meetiing_June 5th_1
E00248	21-May-19	Email	Out	Tetl'it Gwich'in Council	Greg Charlie (Chance)	Greg Charlie (Chance) Richard Wyman (Chance)	Leslie Blake (Gwich'in Tribal Council)	Site Visit/Field Work	Required to consult under geoscience license guideline to inform Tetl'it Gwich'in Councilthat field work is planned July 10-24, 2019. Will be based out of Eagle Plains Lodge with helicopters. Will be flying to remote outcrop locations through out Eagle Plains Basin to extract rock samples with geological hammer. No mechanical tools will be used.	N/A	E00248_FW_ Geological Mapping program Consultation_1
E00463	3-Jun-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Leslie Blake (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), Erika Tizya, Carolyn Lennie (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning	Meeting invitation and agenda. All call-in details included for participants that need to call in.	Attachment: 190603_Gwich'in Tribal Council_Chance_Meeting Agenda for June 7_DRAFT.docx	E00461_Gwich'in Tribal Council and Chance - Exploration Project Meeting_1
E00464	4-Jun-19	Email	In	Tetl'it Gwich'in Council	Leslie Blake (Gwich'in Tribal Council)	Hemmera	Leslie Blake (Gwich'in Tribal Council)	Meeting Coordination/Planning	I cannot take part in this meeting. I will try to have someone available. We are having trouble opening the agenda.	N/A	E00464_RE_ Gwich'in Tribal Council and Chance - Exploration Project Meeting
E00465	4-Jun-19	Email	Out	Tetl'it Gwich'in Council	Hemmera	Hemmera	Leslie Blake (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning	We worked with Gwich'in Tribal Council to plan this meeting a few weeks ago and were under the impression that you could attend. Sorry for the miscommunication. This last minute meeting invitation was just to share the agenda as we through everyone had already been informed of the meeting. I have re-attached the agenda for you.	Attachment: 190603_Gwich'in Tribal Council_Chance_Meeting Agenda for June 7_DRAFT.docx	E00464_RE_ Gwich'in Tribal Council and Chance - Exploration Project Meeting

E00466	4-Jun-19	Email	Out	Tetl'it Gwich'in Council	Hemmera	Hemmera	Anita Koe	Engagement/Consultation Meeting Coordination/Planning	Meeting invitation and agenda. All call-in details included for participants that need to call in.	Attachment: 190603_Gwich'in Tribal Council_Chance_Meeting Agenda for June 7_DRAFT.docx	E00466_Gwich'in Tribal Council and Chance - Exploration Project Meeting_2
E00467	4-Jun-19	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Dwayne Semple, Carolyn Lennie (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council)	Meeting Coordination/Planning	Just to confirm, the meeting is 1500-1700 Mountain time? 1400-1600 Pacific time, correct? On the agenda, we suggest two additional items would be useful to include: 1. Process for reviewing Gwich'in Project Effects 2. Economic Opportunity and Cooperation Agreement(s) Update (Reference Section 8.0 of the Communications and Consultation Plan).	N/A	E00467_RE_ Draft Agenda for Gwich'in Tribal Council-Chance Skype Meeting
E00468	4-Jun-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Dwayne Semple, Carolyn Lennie (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning	The time is actually 2-4 pm MST. Does that work for you? Our flight lands at 12:25pm, so we would have to rush to make a 1pm meeting. Please let me know if you and your colleagues are still able to meet from 2-3pm.	N/A	E00467_RE_ Draft Agenda for Gwich'in Tribal Council-Chance Skype Meeting
E00294	5-Jun-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning Project Description/Activities	Draft Project Description and presentation for meeting attached. Please distribute to those attending the meeting.	Attachments: 190605_Chance Oil and Gas Eagle Plains Project Description, 190604_Chance_Presentation_ProjectDescription+ExCom_Gwich'in Tribal CouncilInuvik_v0.4	E00294_Meeting Material for Chance Meeting June 7
E00469	5-Jun-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Anita Koe	Meeting Coordination/Planning Project Description/Activities	Clarifying meeting time will be 2-4pm MST, and updated agenda.	Attachment: 190605_Gwich'in Tribal Council_Chance_Meeting Agenda for June 7	E00469_Gwich'in Tribal Council and Chance - Exploration Project Meeting_3
E00473	5-Jun-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning Project Description/Activities	Attached Draft Project Description and the presentation for tomorrow's meeting. Please distribute electronically among those who are attending the meeting. We will bring paper copies of the Draft Project Description and the presentation for all attending the meeting. It is not an expectation that meeting attendees will have time to read through the whole document.	Attachments: 190605_Chance Oil and Gas Eagle Plains Project Description.pdf; 190604_Chance_Presentation_ProjectDescription+ExCom_Gwich'in Tribal CouncilInuvik_v0.4.pdf	E00473_Meeting Material for Chance Meeting June 7_1
E00474	5-Jun-19	Email	Out	Tetl'it Gwich'in Council	Hemmera	Hemmera	Anita Koe	Meeting Coordination/Planning Project Description/Activities	Attached is the meeting material for this afternoon. Are you still planning to call in?	Attachments: 190605_Chance Oil and Gas Eagle Plains Project Description.pdf; 190604_Chance_Presentation_ProjectDescription+ExCom_Gwich'in Tribal CouncilInuvik_v0.4.pdf	E00474_Fw_ Meeting Material for Chance Meeting June 7
E00414	7-Jun-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning	We have not left Old Crow yet, and are anticipating being a bit late for our 2pm meeting. I will let you know when we land in Inuvik and the time we anticipate being at your office.	N/A	E00414_RE_ Meeting with Chance_2
E00415	7-Jun-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Meeting Coordination/Planning	Thanks, I will watch for your update message.	N/A	E00414_RE_ Meeting with Chance_2
E00416	7-Jun-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Meeting Coordination/Planning	We just landed. Will probably be there around 2:10.	N/A	E00416_RE_ Meeting with Chance_1
E00417	7-Jun-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera	David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning	Ok.	N/A	E00416_RE_ Meeting with Chance_1

E00475	7-Jun-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning	We are just driving into town. Will be there by 2:30 at the latest.	N/A	E00475_Re_ Meeting with Chance_2
GTC0126	7-Jun-19	Meeting	In / Out	Gwich'in Tribal Council		N/A		Meeting Coordination/Planning	Chance met with Gwich'in Tribal Council leadership for a meeting.	N/A	N/A
GTC0226	10-Jun-19	Email	Out	Gwich'in Tribal Council	Cindy Dickson (Chance), Richard Wyman (Chance), Greg Charlie (Chance)		Emily Mann (Hemmera), Jozef, Calista Morrison (Hemmera), Shena Shaw (Hemmera)	Draft Project Description	Emily M. emailed Jozef and cc'd Richard (Chance), Cindy D., Greg C., Calista M., Shena S., and attached a Draft Project Description.	N/A	N/A
E00270	14-Jun-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	David MacMartin (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Meeting Coordination/Planning	Thanks for meeting. Asking about meetings with Council during July 9-11, 2019 and possibility of combining meetings with various councils to help with travel and accommodations. Richard looking at flights, and hoping to plan meetings. Would like to confirm timing and locations of meetings.	N/A	E00267_Fw_ Gwich'in Council Meetings in July
E00289	14-Jun-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council)	Site Visit/Field Work	attached details for First Nation's participation in Chance's fieldwork this summer. Still finalizing dates and logistics. Role profiles are in attachment, and aiming to have dates finalized next week. Please give thought to potential participants.	Attachment: Chance FN Participant Information	E00289_Gwich'in Partners' participation in Chance Fieldwork
E00407	16-Jun-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera	David MacMartin (Gwich'in Tribal Council)	Engagement	I'll be in Yellowknife from to , so I could speak to you late in the day or afternoon.	N/A	E00407_Re_ Gwich'in Partners' participation in Chance Fieldwork_1
E00260	17-Jun-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Todd Mahon (Environmental Dynamics Inc.)	David MacMartin (Gwich'in Tribal Council)	Site Visit/Field Work Engagement/Consultation	Dates set for participation in Field Surveys. Proposing following logistics for First Nation participation: 1) Each FN with territory overlapping Project area can have up to two members participate 2)Work will be physically demanding, require hiking steep, rugged terrain and thick bush, requiring average or above-average fitness to participate 3)Limited spots for participants due to helicopter constraints ad availability at Eagle Plains Hotel, so please respond as soon as possible to Emily or Calista (Hemmera) to confirm availability 4) Participants should arrive on start date, but not mandatory to stay for duration of field study 5) all travel, including flights, vehicle travel to Eagle Plains Hotel, ad stay in Hotel must be booked by the First Nation and billed to Chance. Table of Opportunities by date. Purpose of participation will be to observe fieldwork and gain first hand understanding of the research. Deadline for Vegetation Survey # 1 is June 19th.	Attachment: Chance FN Participant Information	E00260_Chance Field Surveys-Gwich'in Tribal Council
E00271	17-Jun-19	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	David MacMartin (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Meeting Coordination/Planning	Working on firming up meeting dates around July 10, 2019. Will confirm as soon as possible.	N/A	E00267_Fw_ Gwich'in Council Meetings in July
E00272	17-Jun-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	David MacMartin (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Meeting Coordination/Planning	Thank you. Will await David's email.	N/A	E00267_Fw_ Gwich'in Council Meetings in July
E00273	18-Jun-19	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	David MacMartin (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Meeting Coordination/Planning	In Yellowknife. Gwich'in presently engaged in Self-Government negotiations with Canada and NWT. Team has Meetings with DGO Councils with Indian Act Band Councils for the period of July 8th - July 14th. Asking for other date possibilities. Suggests July 3-5 or around July 15th.	N/A	E00267_Fw_ Gwich'in Council Meetings in July

E00274	18-Jun-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	David MacMartin (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Meeting Coordination/Planning	Will canvas Chance/Hemmera to see what availability is. Fieldwork scheduled for July, ending about July 25/26. Maybe July 29,30,31, August 1, or after the VG GA perhaps between August 12-16 or August 19-23. Will advise of other conflicts once hearing back from others.	N/A	E00267_Fw_ Gwich'in Council Meetings in July
E00264	19-Jun-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council)	Information Sharing	Link to shape files for Chance's Project area as discussed in Inuvik.	N/A	E00264_Chance Project Area Shape File
E00408	19-Jun-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera	David MacMartin (Gwich'in Tribal Council)	Engagement	I assume this should be 2019 rather than 2018?	N/A	E00408_Re_ Meeting with Gwich'in Councils___Boat to Aklavik1
E00479	19-Jun-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	David MacMartin (Gwich'in Tribal Council)	Engagement	Yes, sorry for the mistakes. All dates are summer 2019.	N/A	E00479_RE_ Gwich'in Partners' participation in Chance Fieldwork
E00481	20-Jun-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Leslie Blake (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council)	Engagement Information Sharing Engagement/Consultation	Attached meeting summary of June 7th meeting between Gwich'in Partners and Chance.	attached: 190620_DRAFT Gwich'in Partners-Chance Jun 7 Meeting Outcomes and Action Items_v0.2.docx	E00481_Meeting summary for Review
E00255	24-Jun-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council)	Fish Information Sharing	Attached Notice Letter regarding DFO Licence Application for Environmental Dynamics Inc's Fish Studies.	Attachment: DFO license application Gwich'in Tribal Council	E00255_Notice Letter_ DFO application for upcoming fish studies
E00315	27-Jun-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Fish Information Sharing	Revisions from EDI for their DFO Application, see attached.	Attachment: 190627_Gwich'in Tribal Council_Notice Letter_DFO Permit_WithRevisions and peel_watershed_fish_habitat_assessment	E00315_RE_ Notice Letter_ DFO application for upcoming fish studies (3)
E00347	27-Jun-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Richard Wyman (Chance)	David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning	Confirming that the window will work for arranging meetings with the Gwich'in Presidents and Councils will be August 19-23 week. At present I have confirmed a Meeting with the Gwichya Gwich'in Council in Tsiigehtchic (Arctic Red River) for 17:00 August 19 and with Ehdiitat Gwich'in Council in Aklavik 17:00 August 21. I'll try to build the Teetl'it Zheh (Fort McPherson) and Inuvik Meetings around these foundation dates.	N/A	E00347_Fwd_ Meeting with Gwich'in Councils - NOTE FORWARDED MSG
E00397	27-Jun-19	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning	Thank you for making arrangements. I'm copying my colleagues so they are in the loop for planning purposes.	N/A	E00397_Re_ Meeting with Gwich'in Councils_8
E00398	28-Jun-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning	Here is the schedule, with Nihtat Gwich'in Council in Inuvik to be worked in yet. August 19, 5pm - Gwichya Gwich'in Council in Tsiigehtchic (Arctic Red River), August 21, 6pm - Ehdiitat Gwich'in Council in Aklavik, August 22, 6pm - Tetl'it Gwich'in Councilin Teetl'it Zheh (Fort McPherson). Timing for the meeting with EGC in Aklavik has been pushed back an hour at the request of the EGC President and Council. This will allow us to have a dinner meeting. We can arrange to travel over to Aklavik in the afternoon of August 21 and stay over in Aklavik that night following the dinner Meeting and then return to Inuvik the next morning on the 22nd. At that time we will need to journey directly to Teetl'it Zheh (Fort McPherson) for the meeting that we have scheduled there for 18:00 on , August 22 with the Tetl'it Gwich'in CouncilPresident Les Blake and his Council members.	N/A	E00398_RE_ Meeting with Gwich'in Councils_7
E00399	28-Jun-19	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Meeting Coordination/Planning	Thank you. We will do our best to make it work. We may need some help with logistics so arrangements can be made.	N/A	E00399_Re_ Meeting with Gwich'in Councils_6
E00400	28-Jun-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Meeting Coordination/Planning	We will be able to provide the logistics help needed to make it all work out.	N/A	E00400_RE_ Meeting with Gwich'in Councils_5
E00401	9-Jul-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Todd Mahon (Environmental Dynamics Inc.)	Engagement Meeting Coordination/Planning	Regarding the four meetings with the DGOs, do you think it would be possible to schedule a community open house/short information session in combination with these meetings? I know how much work goes into coordinating the meetings and travel, and it would be beneficial to do as much as possible in each community. I think we could either host an open house in the hour or two prior to the meetings with the presidents and board members or perhaps invite community members to the meetings. Please advise on what you think may be appropriate and possible given our short time in each community.	N/A	E00401_RE_ Meeting with Gwich'in Councils_4
E00402	9-Jul-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Todd Mahon (Environmental Dynamics Inc.)	Engagement Meeting Coordination/Planning	DGO's would be open to making the meetings open to community members. We discussed that with them last week. I'd suggest we go that route.	N/A	E00401_RE_ Meeting with Gwich'in Councils_4

E00403	9-Jul-19	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Todd Mahon (Environmental Dynamics Inc.)	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Engagement Meeting Coordination/Planning	Thank you for helping to make arrangements. Are you able to confirm the meeting with the NGC during that week as well?	N/A	E00403_RE_ Meeting with Gwich'in Councils_3
E00404	9-Jul-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Todd Mahon (Environmental Dynamics Inc.)	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Engagement Meeting Coordination/Planning	NGC has confirmed 6 pm August 20. That meeting will be here at the Gwich'in Tribal Council Boardroom. Eleanor Jerome (Manager of Regional Coordination and Capacity) and Amber Keegan (Gwich'in Tribal Council) (Nation Building and Governance Advisor) will be working with us on the arrangements for these meetings and at least one will be in attendance at each DGO meeting.	N/A	E00404_RE_ Meeting with Gwich'in Councils_2
E00405	9-Jul-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Todd Mahon (Environmental Dynamics Inc.)	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Engagement Meeting Coordination/Planning	Thanks. How is it best to advertise to community members? We can prepare posters and then have someone in the community post them either online or around the community.	N/A	E00405_RE_ Meeting with Gwich'in Councils_1
E00406	9-Jul-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Todd Mahon (Environmental Dynamics Inc.)	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Engagement Meeting Coordination/Planning	If you can prepare the posters and send us an electronic version as well, we can coordinate the dissemination.	N/A	E00405_RE_ Meeting with Gwich'in Councils_1
E00484	9-Jul-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Todd Mahon (Environmental Dynamics Inc.)	David MacMartin (Gwich'in Tribal Council)	Site Visit/Field Work	Have you had any interest for participation in the Chance field surveys? Below I've highlighted the surveys there's still time to participate in.	N/A	E00484_RE_ Chance Field Surveys_2
E00409	12-Jul-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	Meeting Coordination/Planning	Further to our phone conversation, boat transport option from Inuvik to Aklavik ad back will work according to the proprietor, Eddie Greenland, who is a member of the EGC. The cost would be $1200 each way, round trip $2400. Eddie advises if the Meeting were extended until 9pm, return would be no problem. The advantage of doing the round trip in the same day is that the team could all return to the hotel in Inuvik and would have some clear time to rest and caucus during the following day in advance of departing for Teetl'it Zheh (Fort McPherson). Please let me know what you diced for transportation, so we can reserve Eddie's vessel.	N/A	E00409_RE_ Meeting with Gwich'in Councils___Boat to Aklavik_4
E00410	12-Jul-19	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	David MacMartin (Gwich'in Tribal Council), Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	Meeting Coordination/Planning	Thanks. I will get back to you early next week on the decision. How do we pay for the boat?	N/A	E00410_RE_ Meeting with Gwich'in Councils___Boat to Aklavik_3
E00411	12-Jul-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Richard Wyman (Chance)	David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning	For payment, we would do a purchase order for the service and then rebill you later.	N/A	E00408_Re_ Meeting with Gwich'in Councils___Boat to Aklavik1
E00412	15-Jul-19	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance), Lynn O'Neil (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning	Please proceed with booking the boat for our meeting in Aklavik. I have copied my travelling colleagues and Lynn who will handle the preparation of the PO and processing of the invoice. Please let us know if Lynn should continue to deal with you for the PO or if there is another person that is better to receive it. For ground transport to Tsiigehtchic (Arctic Red River) and Ft McPherson, we will be a group of 5 and will have posters and other handout material. Should we plan to rent our own vehicle, or can we catch a lift with your group? We intend on returning to Inuvik from Tsiigehtchic (Arctic Red River) and Ft McPherson following the meetings. We are not going to charter flights as previously suggested. I will have limited email access until July 22, so please respond to everyone so some processes can be handled in my absence.	N/A	E00408_Re_ Meeting with Gwich'in Councils___Boat to Aklavik1
E00328	16-Jul-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance) Cindy Dickson (Chance), Greg Charlie (Chance)	David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Hemmera has prepared draft reports on the Implementation of the Communications and Engagement Plan for both Gwich'in Partners and Chance to review. This report summarizes Meeting we have had since completing the plan. Please make any desired revisions to the document in tracked changes and send back to me to finalize. Once I have incorporated the changes, I will send final versions to both parties to sign. Please have revisions in by July 26, then I will finalize, get them signed and submit to Yukon Government for July 31.	N/A	E00328_RE_ Plan Implementation Report for Review
E00413	16-Jul-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Richard Wyman (Chance), Lynn O'Neil (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	David MacMartin (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	Meeting Coordination/Planning	We'll proceed with reserving the boat transport. Contact person here for Lynn to deal with on the PO will be Amber Keegan (Gwich'in Tribal Council), our Nation Building and Governance Advisor, who is working with me on the Chance engagements?	N/A	E00413_RE_ Meeting with Gwich'in Councils___Boat to Aklavik_1
E00329	24-Jul-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance) Cindy Dickson (Chance), Greg Charlie (Chance)	David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Following up to see if Gwich'in Tribal Council is planning to provide feedback on the draft reports on the Implementation of the Communication and Engagement Plan. Looking for feedback by . Please let me know if you are providing feedback or have any questions.	N/A	E00328_RE_ Plan Implementation Report for Review

E00330	25-Jul-19	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera Greg Charlie (Chance), Richard Wyman (Chance)	David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Yes, we will be providing feedback, but it will not be available to you on , but rather likely by end of day .	N/A	E00328_RE_ Plan Implementation Report for Review
E00492	25-Jul-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Thank you. End of day on works for me.	N/A	E00492_RE_ Plan Implementation Report for Review_2
E00499	25-Jul-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David Mac Martin, Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Attached are Chance's edits to the Draft Plan Implementation report.	attached: 190715_DRAFT Plan Implementation Report_TH_RMW.docx	E00499_FW_ Draft Annual Report of Engagement and Consultation with Gwich'in Tribal Council and Tetl'it Gwich'in Councillor Yukon Government
E00529	30-Jul-19	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council), Dwayne Semple, Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	I've reviewed the draft Implementation summary I've reviewed the draft Implementation summary and agree that it well reflects the implementation of the Gwich'in Tribal Council-Chance Communications and Consultation Plan over the past year. I do have a few minor change suggestions that I would suggest be made to the text of the summary, after which I'd be pleased to sign it on behalf of the Gwich'in Partners. 1.Where references are made to "staff" or to "technical staff," it would be more accurate in my view to change this reference to "senior officials." This would be consistent to the protocol used by the GNWT in the context of the NWT Intergovernmental Council when distinguishing "senior officials" from "political leaders." The senior officials are not providing technical advice on Project details. They provide substantive and strategic advice to their respective political leaders in accordance with their role as permanent officials of their respective governments; 2.On page 2, please add a bullet reference to "business and employment and training opportunities for Gwich'in businesses and Gwich'in Comprehensive Land Claim Agreement (GCLCA) Participants." This has and will continue to be an important and priority topic for discussion as we move in the future towards negotiating a "Cooperation Agreement"; 3.On page 6, Re Chance following through on the Gwich'in Partners' new consultation protocol you could note that the Gwich'in Tribal Council has worked with Chance to schedule Meetings in each Gwich'in community to discuss the Project for the week of August 19, 2019. You could also note that the Gwich'in Partners have expressed appreciation to Chance for Chance's embracing this consultation protocol that the Gwich'in Partners have developed.	N/A	E00529_RE_ Draft Annual Report of Engagement and Consultation with Gwich'in Tribal Council and Tetl'it Gwich'in Councillor Yukon Government_1
E00530	30-Jul-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council), Dwayne Semple, Erika Tizya-Tramm (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	I have incorporated your suggested changes and removed the draft watermarks in the attached version. This version is ready for you to sign. Once I have your signed version, I will have Chance sign the report and include you in the submission to Yukon Government.	attached: 190730_Plan Implementation Report_Gwich'in Partners.docx	E00529_RE_ Draft Annual Report of Engagement and Consultation with Gwich'in Tribal Council and Tetl'it Gwich'in Councillor Yukon Government_1
E00534	30-Jul-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera	David MacMartin (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Thanks for the revised Implementation summary. I've asked Carolyn to review it before I sign it. She may not have it for me until tomorrow.	N/A	E00534_RE_ Timing
E00535	30-Jul-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	David MacMartin (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Thanks for letting me know. Tomorrow before noon works well.	N/A	E00534_RE_ Timing
E00537	31-Jul-19	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera	David MacMartin (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	I've discussed with Carolyn and there are a few further items that we would like revised, then we can sign it. Page 2 – RE Gwich'in Partners, Gwich'in Tribal Council Grand Chief and President Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) should be added to the list of Gwich'in Partners members; Page 3, para 2 – please revise the text of this sentence as follows: "…also discussed the Chance proposal for a Confidentiality Agreement." Page 3 – Nov 15 Meeting – please change "Government Building" to Chief Jim Koe Building. Page 5 – June 7 Meeting – same thing, change "Government Building" to Chief Jim Koe Building. Page 7 – Signature Line – Please change out my name and title and put: Carolyn Lennie (Gwich'in Tribal Council)	N/A	E00537_RE_ Draft Annual Report of Engagement and Consultation with Gwich'in Tribal Council and Tetl'it Gwich'in Councilfor Yukon Government_2
E00538	31-Jul-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Thank you. I have made the changes in the attached version. Please let me know if there are more changes, or consider it the final version for signing.	attached: 190731_Plan Implementation Report_Gwich'in Partners.docx	E00537_RE_ Draft Annual Report of Engagement and Consultation with Gwich'in Tribal Council and Tetl'it Gwich'in Councilfor Yukon Government_2
E00539	31-Jul-19	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	The document is now with Carolyn who will sign it before the end of the day. I did a proofread and made a couple of small changes: 1)Page 6, para 2 – I changed the reference to "Tetl'it Gwich'in Council Primary and Secondary Use Lands" to "Tetlit Gwich'in…". 2)Also page 6, I corrected the wording in the first bullet under 4.0 to align the word with the proper tense.	N/A	E00539_RE_ Draft Annual Report of Engagement and Consultation with Gwich'in Tribal Council and Tetl'it Gwich'in Councilfor Yukon Government_3
E00540	31-Jul-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Thanks for catching those two additional changes. Cindy from Chance is coming to our office at 3:20, to sign reports on behalf of Chance. Do you think that you could send the final version by then?	N/A	E00539_RE_ Draft Annual Report of Engagement and Consultation with Gwich'in Tribal Council and Tetl'it Gwich'in Councilfor Yukon Government_3

E00541	31-Jul-19	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Dwayne Semple, Erika Tizya-Tramm (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Here is the signed copy.	attached: Plan Implementation Report_Gwich'in Partners	E00541_RE_ Gwich'in Tribal Council Signed Copy of Gwich'in Tribal Council-Chance Consultation Plan Annual Report
E00542	31-Jul-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Dwayne Semple, Erika Tizya-Tramm (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Thank you.	N/A	E00541_RE_ Gwich'in Tribal Council Signed Copy of Gwich'in Tribal Council-Chance Consultation Plan Annual Report
E00558	18-Aug-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning	Attached Draft Working Agenda for Chance and Gwich'in Tribal Council Meeting August 20. Please let me know of any revisions.	attached: 190814_Gwich'in Tribal Council_MeetingAgenda)August20	E00558_Gwich'in Tribal Council and Chance August 20 Meeting Agenda
E01254	19-Aug-19	Community Event	N/A	Gwich'in Tribal Council	N/A	Chance, Hemmera	Gwich'in Participants	Engagement/Consultation	Meeting summary [update topics from Meeting summary]	Sign in sheet available	E01253_190819_Chance_GGC_August19SignInSheet.pdf
GTC0204	19-Aug-19	Community Event	N/A	Gwich'in Tribal Council, Chance, Residents of Tsiigehtchic	N/A	N/A	Gwich'in Participants	Open House	Chance held a community open house event in Tsiigehtchic, Northwest Territories.	N/A	N/A
GTC0205	19-Aug-19	Survey Form	In	Gwich'in Tribal Council, Chance, Residents of Tsiigehtchic	Mavis Clark	N/A	Mavis Clark	Open House - Survey Form	Open House attendee submitted comments or concerns on comment sheets.	N/A	N/A
GTC0209	19-Aug-19	Survey Form	In	Gwich'in Tribal Council, Chance, Residents of Tsiigehtchic	N/A	N/A	Not applicable	Open House - Survey Form	Open House attendee left remarks in a comment sheet from the Open House in Tsiigehtchic on August 19, 2019. They noted concerns regarding wildlife monitors, environmental monitors, compensation packages, explosion, and spills.	N/A	N/A
E01255	20-Aug-19	Community Event	N/A	Gwich'in Tribal Council	N/A	Chance, Hemmera	Gwich'in Participants	Engagement/Consultation	Chance held an open house in Inuvik.	N/A	N/A
E00441	21-Aug-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Richard Wyman (Chance) Hemmera	David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning	Trip to Aklavik is a go. There is no funeral today in Aklavik, see you at 13:40.	N/A	N/A
E01253	21-Aug-19	Community Event	N/A	Gwich'in Tribal Council	N/A	Chance, Hemmera	Gwich'in Participants	Engagement/Consultation Project Description/Activities Regulatory Process Caribou	Meeting summary	N/A	N/A
GTC0206	21-Aug-19	Survey Form	In	Gwich'in Tribal Council, Chance, Residents of Aklavik	N/A	N/A	Not applicable	Open House - Survey Form	An Open House attendee left remarks in a comment sheet from the open house held in Aklavik on August 21, 2019.	N/A	N/A
GTC0207	21-Aug-19	Community Event	N/A	Gwich'in Tribal Council, Chance, Residents of Aklavik	N/A	N/A	David MacMartin (Gwich'in Tribal Council), Robert Buckle, Terry Semple, M. Edwards, Amber Keegan (Gwich'in Tribal Council), Randy Edwards, Ian Matari, Danny Greenland, Lloyd Petrie	Not applicable	Chance held a community open house event in Aklavik.	N/A	N/A
GTC0208	21-Aug-19	Survey Form	In	Gwich'in Tribal Council, Chance, Residents of Aklavik	N/A	N/A	Not applicable	Open House - Survey Form	An Open House attendee left remarks in a comment sheet from the open house held in Aklavik on August 21, 2019.	N/A	N/A
E01256	22-Aug-19	Community Event	N/A	Gwich'in Tribal Council	N/A	Chance, Hemmera	Gwich'in Participants	Engagement/Consultation Project Description/Activities Regulatory Process Education and Training	Chance held an open house in Fort McPherson. No meeting summary was available at the time of Project Proposal submission.	Sign in sheet available	E01256_190822_Chance_Tetlit Gwich'in Council_August22SignInSheet.pdf
E00442	26-Aug-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	David MacMartin (Gwich'in Tribal Council) Amber Keegan (Gwich'in Tribal Council)	Meeting Coordination/Planning	Here are the sign in sheets from last week.	attached: Inuvik2019August20Sign-InSheet.pdf, Tsiigehtchic (Arctic Red River)2019August19Sign-InSheet.pdf, Aklavik2019August21Sign-InSheet.pdf, FortMcPherson2019August22Sign-InSheet.pdf	E00441_RE_ Sign-In Sheets from August Meetings

E00443	26-Aug-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera	David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning	Thanks.	N/A	E00442_Sign-In Sheets from August Meetings
E00447	3-Sep-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance) Cindy Dickson (Chance), Greg Charlie (Chance)	David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	Engagement/Consultation	Attached is the draft summary of our meeting August 20, 2019 in Inuvik for review. Please let me know of any revisions.	attached: 190829_Gwich'inPartners_Chance_August 20Meeting_Outcomes +ActionItems_DRAFT v0.2	E00447_Gwich'in Tribal Council and Chance August 20_ 2019 Draft Meeting summary for Review
E00487	9-Sep-19	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	Cooperation Agreement	An action from the August 20 meeting was to re-send a memo and draft cooperation agreement template created last Decembers. No changes have been made to the document since it was originally shared with Gwich'in Tribal Council. Some items may be outdated given conversations that have taken place between Gwich'in Tribal Council and Chance.	attached: 2018.12.12 Cooperation Agreement - Intro Brainstorming and Template.docx	E00487_Gwich'in Tribal Council and Chance August 20 2019 Meeting Action Item_ Re-send Dec 2018 Cooperation Agreement Memo
E00561	10-Sep-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Sharon Snowshoe (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council)	Traditional Knowledge and Use Education and Training Interviews	Have been working with David on Community Engagement and Consultation for a proponent Project's Environmental Assessment. We are now moving into the interview stage in communities and doing a Traditional Knowledge and Traditional Land Use workshop. David suggested I get in touch with you to discuss the research licences and agreements. Are you available this week to discuss our approach to the research and applications as an initial conversation. I will explain more about the Project and Hemmera's role.	N/A	E00560_Chance Community Research(1)
E00567	10-Sep-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	David MacMartin (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	Information Sharing	Are you able to provide a current list of Ehdiitat Gwich'in Council's president and board members? You provided us a list of names for other DGO's, but not for EGC.	N/A	E00567_EGC Council Members
E00562	11-Sep-19	Email	In	Gwich'in Tribal Council	Sharon Snowshoe (Gwich'in Tribal Council)	Hemmera	Sharon Snowshoe (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning	I suggest we meet tomorrow. Let me know what time you are available.	N/A	E00562_RE_ Chance Community Research(2)
E00563	11-Sep-19	Email	In	Gwich'in Tribal Council	David MacMartin (Gwich'in Tribal Council)	Hemmera	Sharon Snowshoe (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning	Please let me know how the conversation goes.	N/A	E00562_RE_ Chance Community Research(2)
E00564	11-Sep-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Sharon Snowshoe (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council)	Meeting Coordination/Planning	I've sent a meeting invite for 11:30 your time tomorrow. Please let me know if this works or suggest an alternate time.	N/A	E00564_RE_ Chance Community Research(3)
E00585	11-Sep-19	Email	In	Gwich'in Tribal Council	Sharon Snowshoe (Gwich'in Tribal Council)	Hemmera	Sharon Snowshoe (Gwich'in Tribal Council)	Meeting Coordination/Planning	Is it ok if I send the telephone information to call in to Kristi Benson (Gwich'in Tribal Council)?	N/A	E00585_RE_ Chance Community Research(1)
E00565	18-Sep-19	Email	In	Gwich'in Tribal Council	Sharon Snowshoe (Gwich'in Tribal Council)	Hemmera	Sharon Snowshoe (Gwich'in Tribal Council), Kristi Benson (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council)	Traditional Knowledge and Use	I'm attaching a letter that GSCI drafted to YESAB that I mentioned in our telephone conference September 12.	E00565_YESAB 2014-0112 GSCI letter	E00565_RE_ Chance Community Research(4)
E00566	19-Sep-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Sharon Snowshoe (Gwich'in Tribal Council), Kristi Benson (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council)	Traditional Knowledge and Use	Thank you for sharing the GSCI letter with us. Apologies for missing it in our review of the YESAB documents.	N/A	E00566_RE_ Chance Community Research(5)
E00586	14-Nov-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Sharon Snowshoe (Gwich'in Tribal Council)	Information Sharing	Since speaking in September, Calista and I have been working on our application to Aurora College Research Ethics Committee for the Chance Environmental Assessment Research Program. We are planning to submit our application on November 26th. Do you think it would be beneficial to have another meeting to discuss our final application? Calista and I could briefly present our proposed research plan for discussion and feedback to increase your familiarity with the proposed plan and also to provide us with the opportunity to make changes before it is reviewed by the REC. Perhaps November 21/22 you would like to have phone meeting?	N/A	E00585_RE_ Chance Community Research(1)
E00587	19-Nov-19	Email	In	Gwich'in Tribal Council	Sharon Snowshoe (Gwich'in Tribal Council)	Hemmera	Sharon Snowshoe (Gwich'in Tribal Council)	Information Sharing	Can we set up a meeting for November 22nd, at 1:15 pm?	N/A	E00586_Re_ Chance Community Research(2)
E00588	22-Nov-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Sharon Snowshoe (Gwich'in Tribal Council)	Information Sharing	Please see attached Project summary. During our meeting this afternoon, we are hoping to go over these details and discuss next steps with you.	attached: 191121_REC_Project summary_v0.6_EM	E00587_RE_ Chance Community Research(3)
E00589	22-Nov-19	Email	In	Gwich'in Tribal Council	Sharon Snowshoe (Gwich'in Tribal Council)	Hemmera	Sharon Snowshoe (Gwich'in Tribal Council)	Information Sharing	I would like to request that Kristi Benson (Gwich'in Tribal Council) be part of the call also.	N/A	E00588_RE_ Chance Community Research(4)
E00590	22-Nov-19	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Sharon Snowshoe (Gwich'in Tribal Council)	Information Sharing	Kristi is welcome. Please share the Skype information below with her.	N/A	E00588_RE_ Chance Community Research(4)

E00842	12-Jan-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Ken Smith (Gwich'in Tribal Council), Kristine McLeod (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Godlove Suh Ngeh (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Kristi Benson (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Sharon Snowshoe (Gwich'in Tribal Council)	Engagement/Consultation Information Sharing	My apologies for the delay in sharing this draft Meeting summary. Let me know if you have any revisions you'd like me to make. Then I can combine those revisions and share an updated version of the summary. I have also attached some documents that were referred to during the Meeting: •the Communications and Consultation Plan between Gwich'in Partners and Chance •Chance's draft Project description for the Eagle Plains Exploration Program (Project for Executive Committee screening level).	N/A	Attachments: 201130_Gwich'in Tribal Council-Chance_Meetingsummary_Nov16_DRAFTv0.3.docx, 190605_Chance Oil and Gas Eagle Plains Project Description.pdf, 20190109_Communications and Consultation Plan_Final_Signed.pdf
E00603	28-Jan-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance)	David MacMartin (Gwich'in Tribal Council), Bobby Jo Greeland-Morgan, Leslie Blake (Gwich'in Tribal Council), Carolyn Lennie (Gwich'in Tribal Council)	Tenures/Dispositions/Permits DO Project Engagement/Consultation	Chance will be applying to the Yukon Government very shortly to extend the tenure of Exploration Permit 20. Application will be for maximum allowable under the Oil and Gas Act of 5 years. This permit has one suspended well at McParlon A-25 which we hope to use for fluid disposal of any produced water associated with the proposed exploration Project. We are at an intermediate stage of discussions with the Manager of Oil and Gas Operations with Yukon to extend the suspended well status on the suspended wells at Eagle Plain. Manager has indicated hat Chance will need to do some physical assessments of the legacy wells to confirm the integrity of the wells before granting an extension. Assessments will require access to 3 suspended wells at SDL M-08, G 08, and J-19 and well as M-59 in order to do the work. A service rig, cement pumping equipment, and wireline services are expected to be used to conduct the assessments. Anticipate taking temperature measurements in wells to evaluate permafrost depth. The program is expended to take 1-2 months. This is a winter operation and will be done during the winter of 2020-2021 and may require Designated Office screening by YESAB. We will provide more information as soon as we can.	N/A	E00603_FW_ Suspended wells and Exploration Permit 20_2
E00645	23-Mar-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) , James Thorbourne (Gwich'in Tribal Council), Leslie P. Blake (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	Information Sharing	Chance (COG) has several initiatives on the go, some of which are time sensitive and all require engagement with the affected First Nations. The following is a summary of these initiatives: 1.Application to the Yukon Government to get tenure extension on Exploration Permit 0020 which is set to expire on August 30, unless extended. This permit is located mostly in the Traditional Territory of the Vuntut Gwichin, but a portion is in the Secondary Use Area of the Tetlit Gwich'in and in the overlap area with the Na-cho Nyak Dun Traditional Territory. There is a suspended well in this Permit at McParlon A-25 which has ongoing value to COG. 2. There are several suspended wells at the Chance Significant Discovery License (SDL 022) and one at the Blackie SDL 021 which the Yukon Government requires COG to undertake some maintenance work. This activity will require an impact assessment by the Designated Office (DO) of YESAB in Dawson prior to permissions being granted by Yukon to undertake the work. The plan is to submit to the DO the program in the next month or so with the objective of being able to do the work over approximately a 6 week to two month period in the winter of 2020-2021. This is a regulatory requirement made by the Manager of Oil and Gas Operations with the Yukon Government. Importantly for your knowledge, there is no indication that these suspended wells have any problems, but they are wells that were drilled in the 1960's so the regulator has asked for work to be done in order to be able to continue the suspended status of these wells. 3. Continuing engagement with respect to the multi-well drilling and seismic data acquisition Project that has been described to you in the past couple of years. In view of the COVID 19 outbreak, travel and face to face get togethers are not appropriate, if not prohibited, so we will have to make arrangements to exchange information in writing, electronically and by conference call. There is quite a geographic spread for all of us to manage and I look forward to hearing your preferences for engagement. Also, I understand that there have been some changes to a number of staff positions with the Gwich'in Tribal Council and I am not sure exactly who we should be engaging on the COG file. If I have missed anyone on this email, please advise us and forward this email to the appropriate individuals.	Attachment:Chance_Permits_geoscience_9Sept2019.pdf	E00645_Chance Oil and Gas Update_Gwich'in Tribal Council
E00648	26-Mar-20	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	James Thorbourne (Gwich'in Tribal Council)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	James Thorbourne (Gwich'in Tribal Council), Bobbie Jo Greenland - Morgan, Leslie P. Blake (Gwich'in Tribal Council) Amber Keegan (Gwich'in Tribal Council), Godlove Suh Ngeh (Gwich'in Tribal Council)	Information Sharing	In addition to Bobbie Jo Greenland Morgan and Les Blake, the following are the updated Gwich'in Tribal Council staff contacts: James Thorbourne (Gwich'in Tribal Council), Interim Chief Operating Officer, Godlove Suh Ngeh (Gwich'in Tribal Council), Director of Lands and Resources godlove.ngeh@gwichintribal.ca, and Amber Keegan (Gwich'in Tribal Council), Intergovernmental Relations, Communications Coordinator.	N/A	E00648_Chance Oil and Gas Update_Gwich'in Tribal Council(1)
E00649	26-Mar-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	James Thorbourne (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Leslie P. Blake (Gwich'in Tribal Council), Amer Keegan, Godlove Suh Ngeh (Gwich'in Tribal Council)	Information Sharing	Thanks James. Please let us know your thoughts about continued discussions on various items I described in my email below sent earlier this week.	N/A	E00649_Chance Oil and Gas Update_Gwich'in Tribal Council(2)
E00672	25-May-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Godlove Ngeh, Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Project Description/Activities DO Project	Chance is preparing a proposal for well maintenance work in the Eagle Plains. Please see the attached letter meant to initiate engagement and to provide initial Project information. Please let me know if you have any issues opening the attachment	Attachment: 200522_Chance_Well Maintenance_Initiation_of_Engagement_Gwich'in Tribal Council_FINAL_signed_map	E00672_Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Gwich'in Partners)
E00681	9-Jun-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance) Richard Wyman (Chance), Hemmera, Cindy Dickson (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) , James Thorbourne (Gwich'in Tribal Council), Leslie P. Blake (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning	Hope all is well and everyone staying healthy. I just wanted to follow up with you and your team to see if you have any questions or comments about our Project description for the well maintenance program that we are going to submit with Dawson DO soon. We would be happy to arrange a call if you guys are interested and we can provide an overview of our objective of doing this Project.	N/A	E00681_Chance DO Well Maintenance

E00683	9-Jun-20	Email	Out	Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance)	Godlove Ngeh	DO Project Meeting Coordination/Planning	So sorry I meant to include you in this email.	N/A	E00683_RE_ Chance DO Well Maintenance (11)
E00684	9-Jun-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Greg Charlie (Chance)	Godlove Ngeh Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) , James Thorbourne (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning	Yes Gwich'in Tribal Council is compiling input and comments based o the letter that was circulated. We should be able to send you something by the end of this week.	N/A	E00683_RE_ Chance DO Well Maintenance (11)
E00685	9-Jun-20	Email	Out	Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance) Richard Wyman (Chance), Hemmera, Cindy Dickson (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) , James Thorbourne (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning	Thank you for the quick response and we look forward to Gwich'in Tribal Council input and comments!	N/A	E00683_RE_ Chance DO Well Maintenance (11)
E00763	9-Jun-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance) Richard Wyman (Chance), Hemmera, Cindy Dickson (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) , James Thorbourne (Gwich'in Tribal Council), Leslie P. Blake (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning	I just wanted to follow up with you and your team to see if you have any questions or comments about our Project description for the well maintenance program that we are going to submit with Dawson DO soon. We would be happy to arrange a call if you guys are interested and we can provide an overview of our objective of doing this Project.	N/A	E00763_Chance DO Well Maintenance.msg
E00776	9-Jun-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance) Richard Wyman (Chance), Hemmera, Cindy Dickson (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	DO Project; Meeting Coordination/Planning	Hope all is well and everyone staying healthy. I just wanted to follow up with you and your team to see if you have any questions or comments about our Project description for the well maintenance program that we are going to submit with Dawson DO soon. We would be happy to arrange a call if you guys are interested and we can provide an overview of our objective of doing this Project.	N/A	E00776_Re: Chance DO Well Maintenance.msg
E00686	10-Jun-20	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Leslie Blake (Gwich'in Tribal Council)	Greg Charlie (Chance) Richard Wyman (Chance), Hemmera, Cindy Dickson (Chance)	Leslie Blake (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) , James Thorbourne (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning	Good day. Thank you for this email. Yes an update call would be great on your maintenance plan. Anytime after 3:45 pm MT would be a good time to set up a call.	N/A	E00686_Re_ Chance DO Well Maintenance (8)
E00687	10-Jun-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Leslie Blake (Gwich'in Tribal Council), Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council) , James Thorbourne (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning	Thank you so much for your response! Godlove let us know that Gwich'in Tribal Council is currently compiling input and comments. Once we have that feedback, I can coordinate a day and time that works for everyone. A time after 3:45 pm MT shouldn't be a problem.	N/A	E00687_RE_ Chance DO Well Maintenance
E00777	10-Jun-20	Email	In	Gwich'in Tribal Council	Leslie Blake (Gwich'in Tribal Council)	Greg Charlie (Chance) Cindy Dickson (Chance), Hemmera, Richard Wyman (Chance)	Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council)	DO Project; Meeting Coordination/Planning	Good day. Thank you for this email. Yes an update call would be great on your maintenance plan. Anytime after 3:45 pm MT would be a good time to set up a call.	N/A	E00776_Re_Chance DO Well Maintenance (34).msg
E00690	12-Jun-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	Godlove Sug Ngeh, James Thorbourne (Gwich'in Tribal Council)	DO Project Information Sharing	Please find attached input for this work from Gwich'in Tribal Council's departments of Lands and Resources, Cultural Heritage and Economic Development. We thank you for giving us the opportunity to provide input/comments on this work. Please if you have any questions related to our input, do not hesitate to contact me.	N/A	E00690_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Gwich'in Partners) (5)
E00694	18-Jun-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Godlove Ngeh, Leslie Blake (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning	My apologies for the delay in getting back to you.Thank you so much for providing your feedback (attached for everyone's reference). Chance and Hemmera are currently working on providing a response to Gwich'in Tribal Council. My colleague, Nathan Aasman, is leading that piece and he hopes to share a draft tomorrow or early next week. If we are able to respond by early next week, we were wondering if it would be possible to arrange a conference call for a time later in the week in order to facilitate further discussion. Perhaps either the afternoon of June 25th (next) or June 26th (next)?	Attachment: Gwich'in Tribal Council's input and comments to Chance Oil and Gas Well Maintenance Project	E00694_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Gwich'in Partners) (2)
E00695	18-Jun-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Godlove Sug Ngeh	DO Project Meeting Coordination/Planning	For ease of planning and coordination - Are you able to determine some dates and times that work for yourself, Leslie Blake (Gwich'in Tribal Council), and anyone else that Gwich'in Tribal Council would want to participate? Then I can coordinate Chance and Hemmera participants on my end.	N/A	E00695_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Gwich'in Partners) (1)
E00696	18-Jun-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Godlove Sug Ngeh, Leslie Blake (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning Information Sharing Project Description/Activities	As requested, I've attached the draft Project Description for the well maintenance program. The summary information attached to our initial engagement letter was based on this larger document.	Attachment: 200522_Chance_DO_ProjectDescription_DRAFT	E00696_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Gwich'in Partners)
E00787	24-Jun-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	Engagement/Consultation DO Project	I just wanted to send a quick update. We're a little delayed on drafting a response to Gwich'in Tribal Council's comments. Nathan Aasman is working on the draft and we'll get it to Gwich'in Tribal Council as soon as we can. Then hopefully we can work on scheduling a date/time for a conference call.	N/A	N/A

E00788	24-Jun-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	Engagement/Consultation DO Project	Thanks and no problem	N/A	N/A
E00780	9-Jul-20	Email	Out	Gwich'in Tribal Council, Tetl'it Gwich'in Council	Hemmera	Hemmera Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council)	DO Project; Meeting Coordination/Planning	Attached is a memo prepared by Chance and Hemmera in response to input received from Gwich'in Tribal Council. We would be more than happy to arrange a conference call for further discussion. If that is something Gwich'in Tribal Council and Tetl'it Gwich'in Council are interested in, perhaps we can schedule a time for mid to late next week?	N/A	E00780_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Gwich'in Partners) (13)
E00781	9-Jul-20	Email	In	Gwich'in Tribal Council, Tetl'it Gwich'in Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council)	DO Project; Meeting Coordination/Planning	Thank you, please we will review this internally first and contact you early to mid-next week for a possible conference call to discuss this if it works well for you.	N/A	E00781_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Gwich'in Partners) (6E).msg
E00786	9-Jul-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance) Cindy Dickson (Chance), Greg Charlie (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), Leslit Blake, James Thorbourne (Gwich'in Tribal Council)	Engagement/Consultation DO Project Meeting Coordination	Thank you, and that definitely works for us.	N/A	N/A
E00709	13-Jul-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Morgan Greenland, Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Hemmera has prepared a draft report on implementation of Gwich'in Partners and Chance Engagement and Communication Plan for Gwich'in Partners and Chance to review. This report summarizes Meetings/correspondence that have occurred between Gwich'in Partners and Chance since completing the 2019 Annual Report. I have attached the draft as a Word Document, if both Gwich'in Partners and Chance could make revisions to that document in tracked changes, that would assist me in creating a final version. If there are any issues that arise between parties' revision, we can address them via email or a quick call. Once revisions have been incorporated and the document is considered final by Gwich'in Partners and Chance, I will send the final version to both parties to sign. I have also attached, as a pdf, a draft of Gwich'in Partners and Chance's Engagement Log which functions as Appendix D for the report. Please complete reviews by , July 24th. Reminder that reports need to be signed and submitted to Yukon Government on July 31st.	Attachments: 200713_Plan Implementation Report_Gwich'inPartners_DRAFTv0.3.docx, 200713_AppendixD_ Gwich'in Tribal Council_Engagement Log_DRAFT.pdf	E00709_DRAFT 2020 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review(0)
E00782	17-Jul-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	Engagement/Consultation DO Project	I hope you had a good week! I wanted to touch base with you and see how things are going?	N/A	E00781_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Gwich'in Partners) (6E).msg
E00783	17-Jul-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	Engagement/Consultation DO Project	Thank you, we are fine, we are having an internal discussion today in relation to your submission and a call with you and your team next week would be great. Let me know a date to have a call to discuss your reply to our submission.	N/A	E00781_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Gwich'in Partners) (6E).msg
E00784	17-Jul-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	Engagement/Consultation DO Project Meeting Coordination	I've checked with Richard and we have a few windows we can propose for next week: Tues July 21, Wed July 22. Let me know if any of these dates/times work on your end. If not, I can try to find openings /. Are you able to coordinate having Leslie Blake (Gwich'in Tribal Council) participate?	N/A	N/A
E00761	21-Jul-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Shena Shaw (Hemmera), Andrew MacPhail, Nathan Aasman, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Joy O'Neill (Gwich'in Tribal Council), Sharon Snowshoe (Gwich'in Tribal Council), Kristi Benson (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Yun Ting Gung	Engagement/Consultation DO Project	This is a conference call to discuss Chance's proposed Well Maintenance Work. attached is a draft agenda for our call. If you have any proposed revisions please let me know. I've also attached the memo prepared by Chance in response to the input received by Gwich'in Tribal Council.	Attachment: 200708_Response to Gwich'in Tribal Council Comments_v.o1.docx ; 200721_Gwich'in Tribal Council-Chance_MeetingAgenda_July22_v0.1_DRAFT.docx	E00761_Chance Oil and Gas - Proposal for Well Maintenance Work (Engagement with Gwich'in Partners).msg
E00785	21-Jul-20	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Joy O'Neill (Gwich'in Tribal Council), Sharon Snowshoe (Gwich'in Tribal Council), Kristi Benson (Gwich'in Tribal Council), Kanda Gnama, Yun Ting Fung	Engagement/Consultation DO Project Meeting Coordination	Please we will do 3:30 - 5 pm. And send meeting invited to those copied in this email, including myself.	N/A	N/A
E00789	21-Jul-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	Engagement/Consultation DO Project Meeting Coordination	I will be sending out an invite to everyone a little later this morning. However, I was wondering if it would be possible for you provide any information on the topics/themes that Gwich'in Tribal Council would like to discuss? It will help me draft a rough agenda, but it will also help me strategize which of Chance's other consultants I should try to include. For example, we have a consultant from Environmental Dynamics Inc. that could speak to any wildlife topics if that's something Gwich'in Tribal Council would like to focus on.	N/A	N/A

E01189	22-Jul-20	Meeting	N/A	Gwich'in Tribal Council		Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera, Todd Mahon (Environmental Dynamics Inc.) (EDI)	Leslie Blake (Gwich'in Tribal Council), Godlove Suh Ngeh (Gwich'in Tribal Council), Joy O'Neill (Gwich'in Tribal Council), Kristi Benson (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Yun Ting Fun	DO Project Engagement/Consultation	The purpose of this Meeting is for Chance (Chance) and Gwich'in Partners to continue their discussion with respect to Chance's proposed Eagle Plain Well Maintenance Project. Chance will also take this opportunity to provide an overview of changes to the Project design that have occurred as a result of engagement activities and refinement during proposal development.	N/A	E01189_200729_Gwich'in Tribal Council-Chance_Meetingsummary_July22_DRAFTv0.1.docx
E00746	24-Jul-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Morgan Greenland, Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	I wanted to check in and see how your review of the draft engagement report was going? My apologies for not doing this sooner in the week. Despite my typo below, these reports are due to Yukon Government July 31, 2020. Not 2019, there is no time travel involved.	N/A	E00746_DRAFT 2020 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review
E00765	24-Jul-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement/Consultation DO Project	attached is a draft copy of Chance (Chance)'s YESAB Project Proposal for the Eagle Plains Well Maintenance Project. In order for Chance to get all its approvals in hand before the winter season, Chance's application will need to be submitted very shortly after sending this draft to you. At this time, our goal is to submit the Project Proposal middle of next week. I remember from our June phone call that Kristen had inquired about a Wildlife Management Plan. As it happens, all mitigation measures with respect to wildlife and caribou is located within the body of the proposal. I wanted to flag that for your attention. As this document has not gone through Hemmera's formatting procedure, it is absent of some of the figures and appendices. However, I've attached the Spill Response Plan which will be Appendix B. Chance continues to be committed to engaging with the Gwich'in Tribal Council. Should you wish to discuss the proposed Project in more detail, please don't hesitate to contact Chance or Hemmera.	Attachment: 200724_Chance_YESAB_PP_DRAFT.docx.; Spill Response Plan.docx	E00765_Chance Eagle Plains Well Maintenance Project - Draft YESAB Project Proposal (4).msg
E00747	29-Jul-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Will Gwich'in Tribal Council be able to provide comments today or tomorrow? For your information, I've attached the comments I received from Richard. He also pointed out that the Engagement Log (Appendix D) didn't include records of the community Meetings in Tsiigehtchic (Arctic Red River), Inuvik, Aklavik and Ft McPherson last year between August 19 and 22. So I'm make sure that's fixed as well. my goal is to get the draft notes from last week's Meeting to Gwich'in Tribal Council and Chance before the end of the week.	N/A	E00747_RE_ DRAFT 2020 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review
E00748	29-Jul-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Thank you, we plan to send our comments tomorrow.	N/A	E00748_RE_ DRAFT 2020 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (1)
E00749	30-Jul-20	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	Godlove Sug Ngeh, James Thorbourne (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Please find attached the engagement plan with Gwich'in Tribal Council's comments. Please note that there are additional comments at the end of the document.	Attachment: 200713_Engagement Plan_AnnualReport_Gwich'inPartners_DRAFTv0.3 (003.)docx	E00749_RE_ DRAFT 2020 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (2)
E00750	30-Jul-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	I've received comments back from Gwich'in Tribal Council and Chance. Chance wanted to make sure that Appendix D included line items for each of the community Meetings held last August (i.e., community Meetings referenced in the report). Those line items are being added to the log and the is log currently being re-formatted for Appendix D. Revisions that Gwich'in Tribal Council provided that were editorial (e.g., mistaken dates, awkward wording), I've gone through an accepted. I've provided some additional text for Chance review that I believe may address Gwich'in Tribal Council's comments. Richard can you review my additions and let me know if they are acceptable? Additionally, can you provide any text for Gwich'in Tribal Council's comment with respect to training and employment? Please leave everything in track changes and put your decisions in comment bubbles. Once Richard has finished the task bolded above, the document can be returned to Gwich'in Tribal Council for a another review.	Attachments: 200730_Engagement Plan_AnnualReport_Gwich'inPartners_DRADTv.0.4.docx and 200713_AppendixD_Gwich'in Tribal Council_Engagement Log_DRAFT.pdf	E00750_RE_ DRAFT 2020 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (3)
E00751	30-Jul-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Sorry I missed your call (I'm working from home today), but thank you for your message. I appreciate your comments and they helped me with some text I've added. I gave Richard a call and was able to tidy up things from his perspective. Would you be able to review the document attached and delete comments you feel have been addressed by either text I've added to the document or my comment in response.	Attachment: 200730_Engagement Plan_AnnualReport_Gwich'inPartneers_DRAFTv0.5.docx	E00751_RE_ DRAFT 2020 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (4)
E00752	30-Jul-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera Richard Wyman (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Thank you please, we are fine with the comments and you can go ahead and have a clean version to meet your submission deadline and send our copy as well.	N/A	E00752_RE_ DRAFT 2020 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (5)
E00753	30-Jul-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Thanks for the quick turn around. I've attached a PDF of the clean version. Godlove, are you able to print off the signature page and stick handle that piece on your end? Then send a scanned copy to Greg for his signature. By then the formatting should be done for Appendix D and I can compile the complete document. I will send that to the Gwich'in Partners and Chance prior to sending an email to Yukon Government.	Attachment: 200730_Engagement Plan_AnnualReport_Gwich'inPartneers_FINAL.pdf	E00753_RE_ DRAFT 2020 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (6)
E00755	30-Jul-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera Richard Wyman (Chance), Greg Charlie (Chance)	Godlove Sug Nge, James Thorbourne (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	I have sent to my COO(James) who can even sign electronically if he is around now.	N/A	E00755_RE_ DRAFT 2020 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (7)
E00756	31-Jul-20	Email	In	Gwich'in Tribal Council	James Thorbourne (Gwich'in Tribal Council)	Hemmera	James Thorbourne (Gwich'in Tribal Council), Godlove Suh Ngeh (Gwich'in Tribal Council), Sharon Snowshoe (Gwich'in Tribal Council), Joy O'Neill (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Signed attached.	Attachment: 200730_Engagement Plan_AnnualReport_Gwich'inPartners_FINAL_JTSigned.pdf	E00756_Re_ DRAFT 2020 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (8)

E00757	31-Jul-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Sharon Snowshoe (Gwich'in Tribal Council), Joy O'Neill (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Thank you James, greatly appreciated please.	N/A	E00757_RE_ DRAFT 2020 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (9)
E00758	31-Jul-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Sharon Snowshoe (Gwich'in Tribal Council), Joy O'Neill (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Thank you very much! I really appreciate your help and efforts getting this report across the finish line. I will be sending it to Yukon Government shortly.	N/A	E00758_RE_ DRAFT 2020 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (10)
E00759	31-Jul-20	Email	Out	Gwich'in Tribal Council, Tetl'it Gwich'in Council, Yukon Government	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Derek Fraser (Yukon Government) (Yukon Government), Godlove Suh Ngeh (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Please see attached for the 2020 Annual Report on the Implementation of the Gwich'in Partners and Chance Communications and Consultation Plan.	Attachment: 200730_EngagementPlan_AnnualReport_GwichinPartners_FINALwAppendixD_Signed.pdf	E00759_2020 Annual Report - Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan
E00760	3-Aug-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Todd Mahon (Environmental Dynamics Inc.)	Godlove Sug Ngeh, Leslie Blake (Gwich'in Tribal Council), Joy O'Neill (Gwich'in Tribal Council), Kristi Benson (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Yun Ting Fung	Engagement/Consultation DO Project	attached is a draft summary of our call on July 22nd. I had meant to get this out last week, but engagement reports ate up my time. Let me know if you have any revisions and I will do my best to compile them.	Attachment: 200729_Gwich'in Tribal Council-Chance_Meetingsummary_July 22_DRAFTv0.1.docx	E00760_Chance Oil and Gas - Proposal for Well Maintenance Work (Engagement with Gwich'in Partners)
E00869	28-Aug-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	DO Project Engagement/Consultation	Email read receipt	N/A	E00869_Read_ Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED (71)
E00910	28-Aug-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), Jame Thorbourne, Leslie Blake (Gwich'in Tribal Council)	DO Project Project Description/Activities	Further to Richard's email dated August 7th (attached), Chance made revisions to their Project Description for the Designated Office Evaluation of their proposed Well Maintenance Program. As a result of those changes, Hemmera has also revised the effects assessment sections of the Project Proposal. Below are the reasons for the revision that have been provided to us by Chance and a brief summary of the amendment itself: Ongoing conversations between Chance and Yukon Government, Oil and Gas Branch (Yukon Government) have necessitated changes. While Chance was previously of the impression wells could continue to be suspended, Yukon Government is now directing Chance to conduct inspection and maintenance activities for all eight suspended wells and then abandon those wells or bring them into active status (i.e., end the period of well suspension). Chance is now proposing to abandon six wells and to bring the remaining two wells into active status as deep-injection wells. Waste fluid produced during the abandonment of the six wells can then be disposed of via injection into the deep-injection wells. No oil or gas is expected to be produced from the two wells proposed to be activated; they would specifically be used for disposal of waste fluid from activities associated with these maintenance activities. 2) At this time, Chance cannot confirm whether it will use the Eagle Plains Hotel or the existing Chance Camp for housing workers over the duration of the Project. The decision to utilize the Eagle Plains Hotel or the Chance Camp will be made when the Project schedule is finalized. It will also have to take into consideration the Hotel's ability to accommodate Chance workers over the full duration of the Project as well as COVID-19 related self-isolation requirements at that time. As a result both options are considered in the effects assessment for the housing of the Project workforce. 3) When the Chance field team were at Eagle Plain early Augustus, they observed that the route used to access M-59 would require realignment of the final portion of Blackie Winter Road. The section of the original route that proceeds north for the final kilometer is not ideal for traffic due to steeper terrain. The steeper route would result in a significant risk to the trucks bearing heavy loads, fuel supply, and other fluid handling shipments. Chance is proposing shifting the final portion of Blackie Winter Road east of the original route in order to attain a much gentler gradient.	N/A	E00910_Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED (74)
E01034	28-Aug-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Richard Wyman (Chance), Hemmera	James Thorbourne (Gwich'in Tribal Council) (Gwich'in Tribal Council), Sharon Snowshoe (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leslie P. Blake (Gwich'in Tribal Council), Joy O'Neill (Gwich'in Tribal Council)	DO Project Engagement/Consultation Project Description/Activities	Thanks please	N/A	E01034_RE_ Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED (70).msg

E01030	2-Sep-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	James Thorbourne (Gwich'in Tribal Council) (Gwich'in Tribal Council), Sharon Snowshoe (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leslie P. Blake (Gwich'in Tribal Council), Joy O'Neill (Gwich'in Tribal Council)	DO Project Engagement/Consultation Project Description/Activities	Please find attached the document with Gwich'in Tribal Council's final comments based on the Meeting we had with Chance in July. I know you circulated another Project document with additional information on the Eagle Plain Well maintenance work and we will review it and see if our input is different from what we have provided in this document. And if that will be the case, then we will provide additional input. In addition, I have ben told that one of our Renewable Resources Council members in Teetl'it Zheh (Fort McPherson) (Tetlit Gwich'in) would like to meet with Chance. Once I get his information, I will send to you so that Chance Oil and Gas can arrange a Meeting with him.	N/A	E01030_RE_ Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED (53).msg
E01031	3-Sep-20	Email	Out	Gwich'in Tribal Council	Hemmera	Richard Wyman (Chance), Hemmera	James Thorbourne (Gwich'in Tribal Council) (Gwich'in Tribal Council), Sharon Snowshoe (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leslie P. Blake (Gwich'in Tribal Council), Joy O'Neill (Gwich'in Tribal Council)	DO Project Engagement/Consultation Project Description/Activities	Thank you for sending this updated version of your comments. I've forwarded it to Chance and the rest of my Hemmera team. We'll review it, but for now we'll hold off on any follow-up, where/if required. This way your team can have time to review the revised Project Proposal and collect your feedback. Then we can coordinate a conference call if you'd like. We appreciate you providing any specific contact information for the Renewable Resource Council in Teetl'it Zheh (Fort McPherson). Once we have that, we'll connect with them to schedule a Meeting.	N/A	E01030_RE_ Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED (53).msg
E01032	3-Sep-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Richard Wyman (Chance), Hemmera	James Thorbourne (Gwich'in Tribal Council) (Gwich'in Tribal Council), Sharon Snowshoe (Gwich'in Tribal Council), Amber Keegan (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leslie P. Blake (Gwich'in Tribal Council), Joy O'Neill (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning	Thank you very much	N/A	E01030_RE_ Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED (53).msg
E00875	10-Sep-20	Email	In	Tetl'it Gwich'in Council	Leslie Blake (Gwich'in Tribal Council)	Hemmera	Leslie Blake (Gwich'in Tribal Council)	DO Project Engagement/Consultation Meeting Coordination/Planning	Accepted Meeting for July 22 - Chance - Proposal for Well Maintenance Work (Engagement with Gwich'in Partners)	N/A	E00875_Accepted_ Chance Oil and Gas - Proposal for Well Maintenance Work (Engagement with Gwich'in Partners)
E01033	10-Sep-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning Information Sharing	I was wondering if you would be able to forward the contact information for the Renewable Resource Council members in Teetl'it Zheh (Fort McPherson)? Alternatively, if you'd be able to coordinate a conference call? I'm not sure if you were planning on attending or not? Having Gwich'in Tribal Council and RRC staff members would be perfect. Timing wise, a conference call for sometime next week (Sept 14-18) would be best for Chance staff, but they could accommodate the following week (Sept 21-25) if needed.	N/A	E01030_RE_ Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED (53).msg
E01035	10-Sep-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning Information Sharing	Thank you please, I have not yet gotten any name(s) but would follow up and can coordinate that if they are willing.	N/A	E01035_RE_ Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED.msg
E00902	15-Sep-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	DO Project Engagement/Consultation Project Description/Activities	Since my email dated Augustus 28th, Hemmera has been in the final stages of concluding the revised DO Project Proposal for Chance's Well Maintenance program. We have appreciated your feedback and worked to include that into the application. As you know, Chance's timeline for completing this work was tied to compliance with regulations, so in an effort to ensure that the maintenance activities could occur this winter Chance needed to submit the application last week. It was submitted late evening and today Hemmera received confirmation that the Project was on the YESAB registry. We acknowledge that you may have future comments on the Project as it progresses through the YESAB process. We continue to look forward to hearing your views and are happy to hold additional Meetings to discuss and answer any questions you may have. Please see the link to the registry here: Project 2020-0151 Eagle Plains Well Maintenance and Winter Activities	N/A	E00902_Chance DO Project (Well Maintenance) - YESAB Registry Information (51)
E00865	16-Sep-20	Email	In	Gwich'in Tribal Council	James Thorbourne (Gwich'in Tribal Council)	Hemmera	James Thorbourne (Gwich'in Tribal Council)	DO Project Engagement/Consultation	Email read receipt	N/A	E00865_Read_ Chance DO Project (Well Maintenance) - YESAB Registry Information (49)
E00906	2-Nov-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	DO Project Engagement/Consultation	After further consideration of the proposed Project (Eagle Plains Well Maintenance and Winter Activities) activities and the requirements of the Yukon Oil and Gas Act, Chance Ltd. (Chance) has determined that changes are required to the Project submitted to the Dawson Designated Office on September 11, 2020 (Project #2020-0151). As such, Chance has decided to withdraw its Project Proposal and will be informing the YESAB today, November 2, 2020. Chance intends to incorporate changes into a revised Project Proposal. Once the revised proposal has been drafted, Chance will notify you by sharing a draft and requesting a Meeting to discuss the changes further. After Chance has discussed those changes with the Gwich'in Tribal Council and Tetlit Gwich'in Council, the Project Proposal will be finalized and resubmitted to the Dawson Designated Office. Chance understands and appreciates that making changes to this Project a second time is requesting additional effort and capacity of the Gwich'in Tribal Council and Tetlit Gwich'in Council. Chance looks forward to continuing to work with the Gwich'in Tribal Council and Tetlit Gwich'in Council, and Chance will do its best to ease this process.	N/A	E00906_Chance DO Proposal Withdrawal - Gwich'in Tribal Council and Tetlit Gwich'in Council Notification

E00851	4-Nov-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance)	Ken Smith (Gwich'in Tribal Council), Kristine McLeod (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning	I want to congratulate you both for your recent election victories and we look forward to working with you in the future. I think that Chance has established a good working relationship with the Gwich'in Tribal Council and Designated Gwich'in Organizations and we hope to continue building on this relationship. I understand that you have been in touch with Greg already so I thought I would reach out to introduce myself so we can initiate discussions about our plans and proposed activities. Godlove has been engaged with us during the past year so is generally current with our plans so can brief you prior to any conversation that we have with you. We do need to engage again to discuss some changes that we are proposing to a well maintenance Project at Eagle Plain. Overall, Chance is involved in exploration activities in northern Yukon and has plans to expand this effort in the future. A multi-year exploration Project in an area of interest within the exploration land that Chance currently holds covers about 2,400 sq kms of area. This Project could involve drilling up to 30 exploration wells, shooting up to 1,500 sq kms of 3D seismic and up to 2,000 linear kms of 2D seismic, and undertaking extended flow testing of any discoveries has been proposed and information has been provided to all the affected First Nations including the Gwich'in Tribal Council and the DGO's. When it is convenient, we would like to meet with you, probably virtually by Zoom or Microsoft Teams given the COVID 19 situation.	N/A	E00851_FW_ Congratulations and Introduction (3)
E00849	9-Nov-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	Ken Smith (Gwich'in Tribal Council), Kristine McLeod (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning	I have feedback from Hemmera and my colleagues. It looks like morning next week works for all of us. How does 9-11 am work for you and your colleagues? I can arrange with Calista at Hemmera to save this time, send out Meeting invitations and connection details and a draft agenda for you to consider.	N/A	E00849_Virtual Meeting November 16
E00850	9-Nov-20	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Kristine McLeod (Gwich'in Tribal Council)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	Ken Smith (Gwich'in Tribal Council), Kristine McLeod (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning	I am available to meet next from 9-11am.	N/A	E00850_RE_ Virtual Meeting November 16
E00852	9-Nov-20	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Ken Smith (Gwich'in Tribal Council)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance)	Ken Smith (Gwich'in Tribal Council), Kristine McLeod (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning	Mahsi' (thanks) for reaching out and introducing yourself. Yes myself and Greg had a quick discussion in October. I have also copied James Thorbourne (Gwich'in Tribal Council) who is our acting COO to make him aware of the request. We may have some time on , November 16th if that works. We look forward to Meeting with your team and discussing your proposed activities at Eagle Plain.	N/A	E00852_FW_ Congratulations and Introduction (2)
E00853	9-Nov-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Richard Wyman (Chance)	Richard Wyman (Chance) Greg Charlie (Chance), Cindy Dickson (Chance)	Ken Smith (Gwich'in Tribal Council), Kristine McLeod (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning	Great to hear from you. Next works for me and my colleagues. I would like to include others who are helping with various processes like YESAB submissions and Communication and Engagement such as consultants at Hemmera in Whitehorse. Gwich'in Tribal Council government staff will already be familiar with the folks at Hemmera. I will check with them on their availability to participate and let you know. Are you able to use Microsoft Teams for a virtual Meeting? I suggest that we allow up to two hours to introduce you both to plans we have for work at Eagle Plains. In the near term, we are under an order from the Yukon Government regulator to undertake maintenance of 8 suspended wells operated by Chance. There is no evidence of any problems with these wells, but Yukon law specifies that suspended wells must be put into operation or abandoned after a period of inactivity. Our plan is to preserve for future use five of the suspended wells, but three will likely have to be abandoned. In the longer term we have plans to undertake a small scale, multi-year exploration drilling and seismic data acquisition program in an area of interest within the existing exploration permits held by Chance. Information about both these Projects has been provided to your staff over the past couple of years. We are underway with updating the maintenance Project to include extended flow testing of three wells to assess the productive capability and hopefully measure the resource size as part of the program. I will confirm the availability of the Hemmera advisors as quickly as I can. January 16 is pretty open for Greg, Cindy and me.	N/A	E00853_FW_ Congratulations and Introduction
E00877	10-Nov-20	Email	In	Gwich'in Tribal Council	Kristi Benson (Gwich'in Tribal Council)	Hemmera	Kristi Benson (Gwich'in Tribal Council)	DO Project Engagement/Consultation Meeting Coordination/Planning	Accepted Meeting for November 16 - Gwich'in Tribal Council and Chance Meeting	N/A	E00877_Accepted_ Gwich'in Tribal Council and Chance Oil and Gas Meeting (33)
E00878	10-Nov-20	Email	In	Gwich'in Tribal Council	Kristine McLeod (Gwich'in Tribal Council)	Hemmera	Kristine McLeod (Gwich'in Tribal Council)	DO Project Engagement/Consultation Meeting Coordination/Planning	Accepted Meeting for November 16 - Gwich'in Tribal Council and Chance Meeting	N/A	E00878_Accepted_ Gwich'in Tribal Council and Chance Oil and Gas Meeting (34)
E00879	10-Nov-20	Email	In	Gwich'in Tribal Council	Ken Smith (Gwich'in Tribal Council)	Hemmera	Ken Smith (Gwich'in Tribal Council)	DO Project Engagement/Consultation Meeting Coordination/Planning	Accepted Meeting for November 16 - Gwich'in Tribal Council and Chance Meeting	N/A	E00879_Accepted_ Gwich'in Tribal Council and Chance Oil and Gas Meeting (35)
E00880	10-Nov-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	DO Project Engagement/Consultation Meeting Coordination/Planning	Accepted Meeting for November 16 - Gwich'in Tribal Council and Chance Meeting	N/A	E00880_Accepted_ Gwich'in Tribal Council and Chance Oil and Gas Meeting (36)
E00998	10-Nov-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Ken Smith (Gwich'in Tribal Council), Kristine McLeod (Gwich'in Tribal Council) James Thorbourne (Gwich'in Tribal Council), Godlove Suh Ngeh (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Kristi Benson (Gwich'in Tribal Council)	DO Project Engagement/Consultation Meeting Coordination/Planning	Here is the meeting invite with Teams/call-in details for the Gwich'in Tribal Council and Chane Oil and Gas call next week. Hemmera will draft an agenda and send it out for participants to review.	N/A	E00998_Gwich'in Tribal Council and Chance Oil and Gas Meeting.msg

E00846	13-Nov-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Ken Smith (Gwich'in Tribal Council), Kristine McLeod (Gwich'in Tribal Council) James Thorbourne (Gwich'in Tribal Council), Godlove Suh Ngeh (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Kristi Benson (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning DO Project	attached is a draft agenda for the Meeting on (Nov 16th). Please let me know if you have any changes you'd like me to make.	N/A	E00846_Gwich'in Tribal Council and Chance Oil and Gas Meeting - Draft Agenda
E00847	13-Nov-20	Email	In	Gwich'in Tribal Council	Kristi Benson (Gwich'in Tribal Council)	Hemmera	Kristi Benson (Gwich'in Tribal Council), Sharon Snowshoe (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning	Please include Sharon Snowshoe (Gwich'in Tribal Council) (copied) to your CC list for this Project. Thanks!	N/A	E00847_FW_ Gwich'in Tribal Council and Chance Oil and Gas Meeting - Draft Agenda
E00876	13-Nov-20	Email	In	Gwich'in Tribal Council	Kanda Gnama (Gwich'in Tribal Council)	Hemmera	Kanda Gnama (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning	Accepted meeting for November 16 - Gwich'in Tribal Council and Chance meeting	N/A	E00876_Accepted_ Gwich'in Tribal Council and Chance Oil and Gas Meeting (32)
E00881	13-Nov-20	Email	In	Gwich'in Tribal Council	Sharon Snowshoe (Gwich'in Tribal Council)	Hemmera	Sharon Snowshoe (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning	Accepted meeting for November 16 - Gwich'in Tribal Council and Chance meeting	N/A	E00881_Accepted_ Gwich'in Tribal Council and Chance Oil and Gas Meeting
E00843	16-Nov-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning Information Sharing	Please can you send to me the detailed Project Richard just presented to share with my leadership.	N/A	E00843_Please can you send to me the detailed Project Richard just presented to share with my leadership_.msg
E00844	16-Nov-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	DO Project Engagement/Consultation Project Description/Activities	I've attached the original email Hemmera sent to Gwich'in Tribal Council back in June 2019. It includes the draft Project description for Chance's Eagle Plains Exploration Project and a presentation that Chance gave to the Gwich'in Tribal Council team at that time. This Project will go through a YESAB Executive Committee level screening. Since you and your team started this year, Richard may have mentioned the "Executive Committee" Project in passing, but Chance (and Hemmera) haven't been actively engaging on it. We've been focused on Chance's Eagle Plains Well Maintenance Project (or subsequently called Eagle Plains Well Maintenance and Winter Activities) which will be going through the YESAB Designated Office in Dawson City. That is the proposal we've been engaging with you on for the past few months. It's this Project that has changed a couple times and which Chance withdrew from YESAB a couple weeks ago. As soon as the revised draft (including Project description and effects assessment) for this Project is completed, Hemmera will get a copy to Gwich'in Tribal Council. As Nathan mentioned on the call, he's hoping for sometime this week. Hopefully my additional comments here aren't too unsolicited. It may end up being repetitive for you, but I will be attaching the draft Project description for Chance's Eagle Plains Exploration Project again when I send out the notes from today's Meeting. I'll also attach other documents that were referenced during the call, for ease of reference.	N/A	E00844_RE_ Please can you send to me the detailed Project Richard just presented to share with my leadership_ (1).msg
E00845	16-Nov-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	DO Project Engagement/Consultation Project Description/Activities	Thank you very much	N/A	E00845_RE_ Please can you send to me the detailed Project Richard just presented to share with my leadership_.msg
E00848	16-Nov-20	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Kristi Benson (Gwich'in Tribal Council), Sharon Snowshoe (Gwich'in Tribal Council)	DO Project Project Description/Activities	Will do! Moving forward, regardless of whether emails pertain to Chance's Designated Office Project (Well Maintenance and Winter Activities) or its Executive Committee level Project (Eagle Plains Exploration), I'll be sure to cc you both!	N/A	E00848_RE_ Gwich'in Tribal Council and Chance Oil and Gas Meeting - Draft Agenda
E00987	16-Nov-20	Email	In	Tetl'it Gwich'in Council	Leslie Blake (Gwich'in Tribal Council)	Hemmera	Leslie Blake (Gwich'in Tribal Council)	DO Project Engagement/Consultation	Declined: Gwich'in Tribal Council and Chance Meeting	N/A	E00987_Declined_ Gwich'in Tribal Council and Chance Oil and Gas Meeting (23)
E01194	16-Nov-20	Meeting	N/A	Gwich'in Tribal Council		Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), Deputy Grand Chief Kristine McLeod (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Sharon Snowshoe (Gwich'in Tribal Council), Kristi Benson (Gwich'in Tribal Council), Godlove Suh Ngeh (Gwich'in Tribal Council)	DO Project Engagement/Consultation Project Description/Activities	The purpose of this meeting was to introduce Chance and its Projects to Gwich'in Tribal Council's (Gwich'in Tribal Council) new leadership.	N/A	201130_Gwich'in Tribal Council-Chance_Meetingsummary_Nov16_DRAFTv0.3.docx
E00859	19-Nov-20	Email	In	Gwich'in Tribal Council	Godlove Suh Ngeh (Gwich'in Tribal Council)	Hemmera	Godlove Suh Ngeh (Gwich'in Tribal Council)	DO Project Engagement/Consultation	Email read receipt	N/A	E00859_Read_ Chance Designated Office Project Proposal - Revised Draft for Sharing with Gwich'in Partners (29)

E00891	19-Nov-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	DO Project Engagement/Consultation Project Description/Activities	Further to my email dated November 2nd (attached) and our Meeting November 16th with the Gwich'in Tribal Council, Chance (Chance) has revised its Project Proposal (including updated Project Description and Effects Assessment) for Designated Office Evaluation. Below is the key Project component that has changed: •Extended Flow Testing: After maintenance activities are complete and depending on wellbore integrity (as confirmed through maintenance activities), Chance proposes to conduct Extended Flow Testing (EFT) on up to three of the wells which have the highest potential for natural gas reserve. The reason for this change is to allow Chance to gather important information about the nature of the natural gas resource accumulation and its productive capability. a.Wells proposed for EFT are M-59, M-08, and J-19 (see PDF attached for Figure 2-1). Please note, Figure 2-1 is currently being updated to reflect this change. b.Revert up to three wells to suspended status (if the EFT results prove to have sufficient resource). c.Abandon three to six wells (the three remaining wells (G-08, B-73, and H-28) will be abandoned and up to additional three wells may be abandoned if wellbore integrity is not confirmed or if EFT results prove insufficient resources). •Timelines: If work cannot be completed this winter season (due to low snow pack, COVID considerations, or permitting delays), Chance will complete the Project during the winter of December 2021 to March 2022. Additional detail is within the attached revised Draft Project Proposal. While revisions were made throughout the document, Section 2.1.3 is the substantive addition with respect to EFT. We've attached both a clean version and a version with tracked changes to facilitate your review. Given the very short time frame for winter work, Chance will be submitting the application to YESAB on , November 20th. Hemmera anticipates the Gwich'in Tribal Council and Tetlit Gwich'in Council requiring additional discussions with Chance to review these changes and look forward to scheduling a Meeting where we can discuss these matters further to support your future submissions to the YESAA process.	N/A	E00891_Chance Designated Office Project Proposal - Revised Draft for Sharing with Gwich'in Partners
E00860	20-Nov-20	Email	In	Gwich'in Tribal Council	James Thorbourne (Gwich'in Tribal Council)	Hemmera	James Thorbourne (Gwich'in Tribal Council)	DO Project Engagement/Consultation	Email read receipt	N/A	E00860_Read_ Chance Designated Office Project Proposal - Revised Draft for Sharing with Gwich'in Partners
E00894	20-Nov-20	Email	In	Tetl'it Gwich'in Council	Leslie Blake (Gwich'in Tribal Council)	Hemmera	Leslie Blake (Gwich'in Tribal Council)	DO Project Meeting Coordination/Planning Engagement/Consultation	Declined Meeting for November 16 - Gwich'in Tribal Council and Chance Meeting	N/A	E00894_Declined_ Gwich'in Tribal Council and Chance Oil and Gas Meeting
E01023	20-Nov-20	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council),	DO Project Project Description/Activities Engagement/Consultation	I need to amend my email sent yesterday. While Chance would like to submit as soon as possible, the submission will be delayed until mid next week. If the Gwich'in Tribal Council and/or the Tetlit Gwich'in Council has any immediate concerns, please contact us and we'll make scheduling a meeting a priority.	N/A	E01023_RE_ Chance Designated Office Project Proposal - Revised Draft for Sharing with Gwich'in Partners.msg
E00896	19-Jan-21	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council)	DO Project Engagement/Consultation	A brief update on Chance's proposed Eagle Plains Well Maintenance and Extended Flow Testing Project is provided below: •Project was submitted to the Dawson District Office (DO) December 24, 2020. •Adequacy Review started December 29, 2020 and was extended January 11, 2021. oThe Adequacy Review period was extended for 21 days due to the complexity of the Project. •Dawson DO issued an Information Request on January 15, 2021 Chance is currently working on its response to Information Request 1 which you can find here. Additionally, here is the link to the Project's page on the YESAB registry: 2020-0197.	N/A	E00896_Chance DO Project_ Eagle Plains Well Maintenance and Extended Flow Testing (Gwich'in Partners Update)
E01064	7-Apr-21	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council) (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council) (Gwich'in Tribal Council)	Meeting Coordination/Planning Engagement/Consultation	Hemmera is currently resuming work on Chance's Executive Committee Project titled Eagle Plains Exploration Program. Seeing as it's been quite some time since Chance and the Gwich'in Tribal Council (Gwich'in Tribal Council) and the Tetlit Gwich'in Council (Tetlit Gwich'in Council) have discussed this particular Project, Chance was hoping to schedule a meeting. Some items that Chance would like to discuss are: •a refresher of the draft Project description •update of events since Chance last engaged on the ExCom Project •anticipated timeline for submission to YESAB, and •Gwich'in Tribal Council and Tetlit Gwich'in Council's preferences/guidance for engagement with its government and its citizens over the coming months. Do you have any availability the week of April 26th – 30th?	N/A	E01064_Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Gwich'in Tribal Council and Tetlit Gwich'in Council.msg
E01099	7-Apr-21	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Hemmera, Richard Wyman (Chance),Greg Charlie (Chance), Cindy Dickson (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council)	Meeting Coordination/Planning	I will in Ontario that week to deal with the sale of and move out from our place in Muskoka. I am tied up on April 26 all day and between 10:00 am and noon Calgary time on April 27 for a Board Meeting. The rest of the week is open for me.	N/A	E01099_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Gwich'in Tribal Council and Tetl'it Gwich'in Council(1).msg
E01100	15-Apr-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Godlove Suh Ngeh (Gwich'in Tribal Council), James Thorbourne (Gwich'in Tribal Council), Leslie P. Blake (Gwich'in Tribal Council)	Meeting Coordination/Planning	I wanted to touch base on the request below and see if you had any availability to meet the week of April 26th – 30th or perhaps the following week. Also, my apologies Leslie. I did not include you in my original email sent April 7th.	N/A	E01100_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Gwich'in Tribal Council and Tetl'it Gwich'in Council(2).msg
E01053	16-Apr-21	Email	In	Gwich'in Tribal Council	Kanda Gnama (Gwich'in Tribal Council)	Hemmera	Kanda Gnama (Gwich'in Tribal Council) (Gwich'in Tribal Council)	Meeting Coordination/Planning	I am out of office, returning , June 14, 2021. I will be checking my email and do my best to get back to you as soon as I can. *Automatic reply*	N/A	E01053_Automatic reply_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Gwich'in Tribal Council and Tetlit Gwich'in Council.msg
E01105	20-Apr-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Diane Baxter (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Esther Ross-Kendi (Gwich'in Tribal Council)	Meeting Coordination/Planning	I just sent a placeholder to you which can be forwarded to others. I'll update and clean up the invite closer to the meeting.	N/A	E01105_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Gwich'in Tribal Council and Tetl'it Gwich'in Council(6).msg

E01101	26-Apr-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Diane Baxter (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council)	Meeting Coordination/Planning	I noticed on the Gwich'in Tribal Council website that there have been some changes in staff. Would yourself and Kanda be the correct people to contact now to discuss the request below (i.e., request for a Meeting)?	N/A	E01100_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Gwich'in Tribal Council and Tetl'it Gwich'in Council(2).msg
E01182	26-Apr-21	Phone Call	In	Gwich'in Tribal Council	Diane Baxter (Gwich'in Tribal Council)	Hemmera	Diane Baxter (Gwich'in Tribal Council)	Meeting Coordination/Planning	Voice message summary: Hi Calista, it's Diane calling from Gwich'in Tribal Council. I will send you an email. My phone 867-777-7924 if you would like to call me back.	8677777900_20210526_123017.wav	E01182_Voice Message attached from 8677777900 - name unavailable(1).msg
E01102	27-Apr-21	Email	In	Gwich'in Tribal Council	Diane Baxter (Gwich'in Tribal Council)	Hemmera	Diane Baxter (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council)	Meeting Coordination/Planning	You are correct. However, I am only in an acting capacity until the new Lands Manger starts, which is May 10th. would like to request that we meet when the new Lands Manager starts and involve Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) and Deputy Grand Chief Kristine McLeod (Gwich'in Tribal Council) as well in the Meeting. I've checked with their Executive Assistant and the dates for a Meeting would be the afternoons on May 19th-22nd (1-5 pm). I am hoping one of these time slots for you and your team. If not, please advise if that is not possible.	N/A	E01102_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Gwich'in Tribal Council and Tetl'it Gwich'in Council(3).msg
E01103	28-Apr-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Diane Baxter (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council)	Meeting Coordination/Planning	I've heard back from the Chance team and we're wondering if we could book a Meeting for May 21st at 2:00pm (Mountain time). If that time still works for Gwich'in Tribal Council, I can send a placeholder for everyone's calendars. Closer to the date I can reach out again to make sure the time still works.	N/A	E01103_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Gwich'in Tribal Council and Tetl'it Gwich'in Council(4).msg
E01104	28-Apr-21	Email	In	Gwich'in Tribal Council	Diane Baxter (Gwich'in Tribal Council)	Hemmera	Diane Baxter (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Esther Ross-Kendi (Gwich'in Tribal Council)	Meeting Coordination/Planning	Yes, that time works for us. Looking forward to our discussions.	N/A	E01104_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Gwich'in Tribal Council and Tetl'it Gwich'in Council(5).msg
E01084	30-Apr-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance),	Diane Baxter (Gwich'in Tribal Council)	Meeting Coordination/Planning	Here is a placeholder for the Chance/Gwich'in Tribal Council Meeting in May. Feel free to forward it to anyone that needs to attend on Gwich'in Tribal Council's side. Closer to the date, I will confirm the that the date/time still works for everyone involved, set up the call-in info, and work on an agenda.	N/A	E01084_FW_ Placeholder - Chance and Gwich'in Tribal Council Meeting re Eagle Plains Exploration Project (ExCom).msg
E01163	30-Apr-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Diane Baxter (Gwich'in Tribal Council) (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council) (Gwich'in Tribal Council), Esther Ross-Kendi (Gwich'in Tribal Council) (Gwich'in Tribal Council)	Meeting Coordination/Planning	I just sent a placeholder to you which can be forwarded to others. I'll update and clean up the invite closer to the meeting.	N/A	E01163_FW_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Gwich'in Tribal Council and Tetlit Gwich'in Council.msg
E01106	18-May-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Diane Baxter (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Esther Ross-Kendi (Gwich'in Tribal Council) (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning Project Description/Activities	I wanted to check in and see if meeting this was still possible?	N/A	E01106_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Gwich'in Tribal Council and Tetl'it Gwich'in Council(7).msg
E01164	19-May-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Meeting Coordination/Planning	As few weeks ago I was working with Diane to schedule a Meeting between Chance and Gwich'in Tribal Council. She mentioned a new Lands and Resources Manager starting. We tentatively booked a meeting for this , but I wanted to confirm that it still works for everyone on your end.	N/A	E01163_FW_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Gwich'in Tribal Council and Tetlit Gwich'in Council.msg
E01157	20-May-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Meeting Coordination/Planning Project Description/Activities	attached is the draft Project description that Chance shared with Gwich'in Tribal Council way back in June/July 2019. We presented this to each of the DGOs and Gwich'in communities then as well. I've also attached a draft agenda for the meeting. We can make changes later today once we confirm the date/time and attendees on your end	N/A	E01157_Chance - Eagle Plains Exploration Project (Draft Project Description for Executive Committee Screening) + draft Meeting agenda.msg
E01165	20-May-21	Email	In	Gwich'in Tribal Council	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Hemmera	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Meeting Coordination/Planning	Chief and Deputy Grand Chief are out of the office until next week. I spoke to Diane and it was suggested that we reschedule for either next week or the week following that. I will try and narrow a meeting date down for you that will work for everyone on our end. Hopefully, I can get a date to you by , if not early next week, when everyone is back in the office.	N/A	E01165_RE_ Chance - Eagle Plains Exploration Project (Draft Project Description for Executive Committee Screening) + draft Meeting agenda (3).msg
E01166	20-May-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Meeting Coordination/Planning	I'll cancel the invite for tomorrow. Would you be able to see if you can find a time that works for Leslie Blake (Gwich'in Tribal Council) as well?	N/A	E01166_RE_ Chance - Eagle Plains Exploration Project (Draft Project Description for Executive Committee Screening) + draft Meeting agenda.msg
E01176	20-May-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Diane Baxter (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Meeting Coordination/Planning	Meeting invite: We are going to re-schedule this Meeting.	N/A	E01176_RE_ Placeholder - Chance and Gwich'in Tribal Council Meeting re Eagle Plains Exploration Project (ExCom) (2).msg
E01177	20-May-21	Email	Out	Gwich'in Tribal Council	Richard Wyman (Chance)	Hemmera, Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Diane Baxter (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Meeting Coordination/Planning	Has there been any suggestion about an alternative time?	N/A	E01176_RE_ Placeholder - Chance and Gwich'in Tribal Council Meeting re Eagle Plains Exploration Project (ExCom) (2).msg

E01178	20-May-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera, Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Diane Baxter (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Meeting Coordination/Planning	Leigh-Ann is going to coordinate on Gwich'in Tribal Council's end and then let us know some dates and times that work. Aiming for next week, maybe the week after.	N/A	E01178_RE_ Placeholder - Chance and Gwich'in Tribal Council Meeting re Eagle Plains Exploration Project (ExCom).msg
E01181	25-May-21	Phone Call	In	Gwich'in Tribal Council	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Hemmera	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Meeting Coordination/Planning	Voice message summary: Follow-up on the next meeting, I was able to secure a date for June 3rd from 2-2:30. Would you want to send out the Meeting request or if that would come from you with an updated agenda. You can call or email me back if that works for you.	8677777900_20210525_084315.wav	E01181_Voice Message attached from 8677777900 - name unavailable.msg
E01155	26-May-21	Email	Out	Gwich'in Tribal Council	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	Leigh-Ann Williams-Jones (Gwich'in Tribal Council) (Gwich'in Tribal Council)	Meeting Coordination/Planning	Meeting Invite: Chance and Gwich'in Tribal Council to meet and discuss Chance's proposed Eagle Plains Exploration Project. Draft agenda to be sent tomorrow.	N/A	E01155_Chance and Gwich'in Partners Meeting re Eagle Plains Exploration Project (ExCom) (1).msg
E01161	26-May-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Meeting Coordination/Planning	I was able to connect with Chance and meeting next June 3rd from 2:00 to 3:30 (Mountain time) works on our end. Just to confirm though, you meant Mountain Time right? I can send out the invite (to you to start with) and then you can forward it to folks on your end. Then I'll follow up the invite with the draft agenda to all attendees	N/A	E01161_Chance_Gwich'in Tribal Council Meeting.msg
E01156	27-May-21	Email	Out	Gwich'in Tribal Council	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	Leigh-Ann Williams-Jones (Gwich'in Tribal Council) (Gwich'in Tribal Council), Kristine McLeod (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council)	Meeting Coordination/Planning	attached is a draft agenda for the Chance/Gwich'in Tribal Council Meeting next week. Please let me know if you have any changes you would like me to make.	N/A	E01156_Chance and Gwich'in Partners Meeting re Eagle Plains Exploration Project (ExCom).msg
E01199	2-Jun-21	Email	Out	Gwich'in Tribal Council	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Diane Baxter (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kristine McLeod (Gwich'in Tribal Council), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leslie P. Blake (Gwich'in Tribal Council)	Project Description/Activities Engagement/Consultation Meeting Coordination/Planning	I'm just re-sending this invite with the final agenda. Also, just in case there are any internet problems, I'm attaching a pdf of the presentation Chance will be running through tomorrow.	210527_Gwich'in Tribal Council-Tetlit Gwich'in Council-Chance_MeetingAgenda_May21_DRAFT_vFinal.docx 210414_Chance_ProjectDescription_April2021.pdf	E01199_Chance and Gwich'in Partners Meeting re Eagle Plains Exploration Project (ExCom).msg
E01236	2-Jun-21	Email	In	Gwich'in Tribal Council	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Hemmera, Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning	Please see attached agenda for tomorrow's meeting, with the inputs that you had requested.	210527_Gwich'in Tribal Council-Tetlit Gwich'in Council-Chance_MeetingAgenda_May21_DRAFT_v0.2.docx	E01236_RE_ Chance and Gwich'in Partners Meeting re Eagle Plains Exploration Project (ExCom) (4).msg
E01237	2-Jun-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera, Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council)	Engagement/Consultation Meeting Coordination/Planning	I'll attach this to the meeting invite!	N/A	E01237_RE_ Chance and Gwich'in Partners Meeting re Eagle Plains Exploration Project (ExCom).msg
GTC0127	3-Jun-21	Meeting	Out	Gwich'in Tribal Council	N/A	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Diane Baxter (Gwich'in Tribal Council)	Meeting	The purpose of this meeting was for Chance (Chance) to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin, and for Chance to provide updates regarding baseline information gathered by consultants (Environmental Dynamics Inc. (EDI), Peer Solutions, Palmer) and Parties discussed next steps with community engagement and consultation schedules for the Gwich'in Tribal Council (Gwich'in Tribal Council) and communities (Inuvik, Aklavik, Teetl'it Zheh (Fort McPherson), Tsiigehtchic (Arctic Red River).	N/A	E01203_2106017_Chance-Gwich'in Tribal Council_MeetingSummary_v0.3
E01227	7-Jun-21	Email	Out	Gwich'in Tribal Council	Cindy Dickson (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance), Hemmera	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Information Sharing	I have this report on mix-bury cover. I am still searching the YOR to see if this was uploaded in 2013.	K 58 Mix-Bury Cover Suitability Report.pdf	E01227_Mix-Bury Cover Suitability Report.msg
E01203	17-Jun-21	Email	Out	Gwich'in Tribal Council	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Diane Baxter (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kristine McLeod (Gwich'in Tribal Council), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council)	Project Description/Activities Engagement/Consultation Meeting Coordination/Planning	attached is a draft meeting summary for the Chance/Gwich'in Tribal Council Meeting that took place on June 3rd. Please review the Meeting summary and let me know if there are any changes you would like me to make. I have also attached Chance's presentation slides and the 2019 Project description.	2106017_Chance-Gwich'in Tribal Council_Meetingsummary_v0.3.docx 190605_ChanceOilandGasEaglePlainsProjectDescription_V3.pdf 210414_Chance_ProjectDescription_April2021.pdf	E01203_Chance and Gwich'in Partners Meeting re Eagle Plains Exploration Project (ExCom) - June 3 Meeting summary.msg
E01205	30-Jun-21	Email	Out	Gwich'in Tribal Council	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Project Description/Activities Information Sharing	At our last meeting, Chance mentioned sharing baseline information from Palmer (i.e., Palmer's report and mapping on permafrost, terrain, and suitability mapping). I've attached the main memo/report from Palmer. However, to say the appendices are big, is a massive understatement (like 250MB)! Each appendix contains 14 maps and is nearly impossible to open and view because of its size. So I've had our formatting folks break everything down so that there is only one map per pdf. It makes for a lot of documents to share, but this way you'll actually be able to open them and move around in them. I'm going to have my co-worker send the maps separately using Hemmera's file sharing site. You should receive a notification email for that later today or tomorrow. If you think this will be an issue on your end (with your internet, etc.), please let me know. Because we can put the information on USB drive and mail them to you.	Palmer_RPT_Eagle Plains Terrain Permafrost_DRAFT_25January2021.pdf	E01205_Chance Eagle Plains Exploration Project - Baseline information on terrain_ permafrost_ and suitability maps.msg

E01228	30-Jun-21	Email	Out	Gwich'in Tribal Council	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Hemmera	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Information Sharing	Here is the Chance information from Palmer (permafrost, terrain, and suitability mapping). They are very large files so let me know if you have any troubles opening them. They should have also sent directly to your email from our file sharing account. Appendix B Suitability Map. Appendix A Surficial Geology.	Included links to file share site	E01228_Palmer Permafrost Files.msg
E01214	16-Jul-21	Email	Out	Gwich'in Tribal Council	Hemmera	Hemmera, Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leslie P. Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Hemmera has prepared a draft report on the implementation of the Gwich'in Partners and Chance Communications and Consultation Plan for Gwich'in Tribal Council (Gwich'in Tribal Council), Tetlit Gwich'in Council (Tetlit Gwich'in Council), and Chance to review. This report summarizes meetings/correspondence that have occurred between Gwich'in Tribal Council, Tetlit Gwich'in Council, and Chance since completing the 2020 Annual Report. I have attached the draft as a word document. If parties could make revisions to that document in tracked changes, that would assist me in creating a final version. If there are any issues that arise between the parties' revisions, we can address them via email and/or a quick call. Once revisions have been incorporated and the document is considered final by the parties, I will send the final version to both parties to sign. Either later today, or , I will send a follow-up email with a draft of Gwich'in Tribal Council, Tetlit Gwich'in Council, and Chance's Engagement Log which will serve as Appendix D. Please note, for Section 4.0 Plans for Ongoing Engagement and Next Steps, I carried forward outstanding items from last year's engagement report. If you would like me to proceed differently, just let me know.	E01214_210716_EngagementPlan_2021AnnualReport_Gwich'inPartners_v0.3.docx	E01214_DRAFT 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review.msg
E01342	19-Jul-21	Email	In	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Hemmera, Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Thanks for the attached. Gwich'in Tribal Council will review and provide feedback as soon as possible.	N/A	E01342_RE_ DRAFT 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (2).msg
E01343	19-Jul-21	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	As mentioned in my email on , attached is a copy of Chance's Engagement Log which will serve as Appendix D.I look forward to your comments on the draft Annual Report.	E01343_210714_ChanceCommunicationLog_v7Gwich'in Tribal Council.pdf E01343_210716_EngagementPlan_2021AnnualReport_Gwich'inPartners_v0.3.docx	E01343_RE_ DRAFT 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (3).msg
E01341	20-Jul-21	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leslie Blake (Gwich'in Tribal Council), Hemmera	Engagement Reports/OIC Requirements	The report prepared by Hemmera looks like a pretty thorough summary of engagement between the Gwich'in Tribal Council, its Gwich'in partners and Chance. Looks good to me	N/A	E01341_RE_ DRAFT 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review.msg
E01346	22-Jul-21	Email	Out	Tetl'it Gwich'in Council, Gwich'in Tribal Council	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leslie Blake (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Something I thought I'd flag is that we'll need to update the Name and Position for the Gwich'in Tribal Council representative on the signing page. I left it generic in the draft I sent. Last year James Thorbourne (Gwich'in Tribal Council) signed as the COO, but I know he's not in that role anymore.	N/A	E01346_RE_ DRAFT 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review.msg
E01211	23-Jul-21	Email	Out	Gwich'in Tribal Council	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Information Sharing	attached are some ground photos that Greg took of Devon Sump. The pictures are of the area that was part of the mix burry cover program of Devon Drilling work from in 2004. Located 50 m inland from KM 336 on Dempster Highway. These pictures are from the edge of the sump. The sump is in the yellow grassy part and it is approx. 50 m x 50 m. Greg mentioned that it has been tested by Yukon Government over the years and, for clarity, Chance doesn't have any connections to it. If you have any other questions, we might be able to help, but they should likely be directed to Derek Fraser (Yukon Government) at the Yukon Government (Derek.Fraser@yukon.ca).	IMG_2068.JPEG IMG_2066.JPEG IMG_2067.JPEG IMG_2069.JPEG E01211-DevonSump.pdf	E01211_Devon Sump Pictures.msg
E01377	28-Jul-21	Email	Out	Gwich'in Tribal Council	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance),	Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	I thought I would check-in. Has Gwich'in Tribal Council/Tetl'it Gwich'in Council been able to review the engagement report? I'm hoping that we can have it reviewed, and hopefully signed by a Gwich'in Tribal Council/Tetl'it Gwich'in Council representative, by the end of the week. Usually the reports are due July 31st, however Yukon Government has allowed us to submit on , August 3rd. Greg and Richard are actually up in Eagle Plains this week, but I've asked Greg to set aside some time next to sign/finalize the report. Let me know if there is anything I can do to help and/or if you think this timeline might not work. We can work on some alternative plans/ideas.	N/A	E01377_RE_ DRAFT 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (7).msg
E01378	2-Aug-21	Email	Out	Gwich'in Tribal Council	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance),	Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	I just left you a voicemail Leigh-Anne. Sorry I keep missing you! In my voicemail I mentioned a Plan B, if we're not able to connect. As Chance must submit their engagement reports to Yukon Government today, I can submit the report to Yukon Government as a DRAFT. I can remove the signing page, keep DRAFT in the title, and keep the DRAFT watermark on the report. Additionally, in my email to Yukon Government, which will cc Gwich'in Tribal Council, I can indicate that the DRAFT report does not incorporate possible revisions from Gwich'in Tribal Council. If I don't hear from Gwich'in Tribal Council before 2:00 pm (Yukon Time), I'll proceed as outlined above.	E01378_210714_ChanceCommunicationLog_v7Gwich'in Tribal Council.pdf E01378_210716_EngagementPlan_2021AnnualReport_Gwich'inPartners_v0.3.docx	E01378_RE_ DRAFT 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (6).msg
E01379	3-Aug-21	Email	In	Gwich'in Tribal Council	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	N/A	Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Hemmera	Engagement Reports/OIC Requirements	I am currently away from the office. I apologize for not getting back to you before leaving. I can provide Gwich'in Tribal Council feedback and signature on (August 9) if that works. I agree with the DRAFT option until I can provide you with Gwich'in Tribal Council's official feedback. Just as a side note, in the recommendations of the report regarding revising the communication plan, Chance suggests a revision to include Teetl'it Zheh (Fort McPherson) Band. As per the reasons highlighted in a meeting with Chance, back in 2018 when we first drafted the communication protocol, Gwich'in Tribal Council will continue to only include Gwich'in Tribal Council and the Tetlit Council and not the band office in our communication protocol. I will send you the meeting minutes from that 2018 Meeting, as soon as I'm back in the office. I apologize for the inconvenience.	N/A	E01379_RE_ DRAFT 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (4).msg

GTC0128	3-Aug-21	Email	Out	Gwich'in Tribal Council	Greg Charlie (Chance)	Richard Wyman (Chance), Greg Charlie (Chance)	Grand Chief Ken Kyikavichik (Gwich'in Tribal Council)	Meeting and Cooperation Agreement	Greg (Chance) emailed Ken (Gwich'in Tribal Council) and cc'ed Richard (Chance), stating thanks for meeting for breakfast. Greg stated for the cooperation agreement, Chance could provide Gwich'in Tribal Council with the first draft of some objectives for Chance and continue with a next steps including schedules and Gwich'in Tribal Council representation.	N/A	N/A
GTC0129	3-Aug-21	Email	Out	Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	Grand Chief Ken Kyikavichik (Gwich'in Tribal Council)	Cooperation Agreement Discussion	Greg (Chance) emailed Ken (Gwich'in Tribal Council) and cc'ed Richard (Chance) stating thanks for meeting the last week or so. Greg stated they wanted to follow up with Ken with regards the conversation about having a Cooperation Agreement with Gwich'in Tribal Council. What Chance can propose is the provision of a first draft of some of Chance's objectives for Chance and continue with a next steps i.e. schedules and Gwich'in Tribal Council representation.	N/A	20210803-Gwich'in Tribal Co
E01380	30-Aug-21	Email	In	Gwich'in Tribal Council	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	N/A	Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Please see attached for Gwich'in Tribal Council feedback. As I mentioned in my previous email (below), Gwich'in Tribal Council will not revisit the inclusion of Band Offices in the Gwich'in Partners and Chance Communications and Consultation Plan for the reasons highlighted in the April 24th, 2018 Meeting (attached).	E01379_24April2018_Gwich'in Tribal Council_Tetlit Gwich'in Council_Chance_Meeting_Record_DRAFT E01379_210802_EngagementPlan_DRAFT 2021AnnualReport_Gwich'inPartners_Gwich'in Tribal Council Feedback.pdf	E01379_RE_ DRAFT 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (4).msg
E01381	8-Sep-21	Email	Out	Gwich'in Tribal Council	Hemmera	N/A	Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Hemmera	Engagement Reports/OIC Requirements	Apologies for the delay in getting back to you. Thanks for the feedback! That language was added last year when I was working with Godlove on finalizing the 2020 Report. My approach was carrying forward those 2020 items, so I really appreciate your feedback. On page 4 I'll change "Updating/revising Plan to include all DGOs, as well as Band Offices, and to revisit the Meeting frequency of Chance and the Gwich'in Partners" to "Updating/revising Plan to include all DGOs, to reflect current Gwich'in Tribal Council governance structure, and to revisit the Meeting frequency of Chance and the Gwich'in Partners." I've removed reference to the Band Offices. Is it acceptable to leave the reference to "all DGOs"?	N/A	E01381_RE_ DRAFT 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (3).msg
E01382	9-Sep-21	Email	In	Gwich'in Tribal Council	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	N/A	Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Hemmera	Engagement Reports/OIC Requirements	Thank you! Yes, please do leave the DGO reference in, as it aligns with our organizational communication procedures.	N/A	E01382_RE_ DRAFT 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review (2)
E01383	9-Sep-21	Email	Out	Gwich'in Tribal Council	Hemmera	N/A	Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Hemmera	Engagement Reports/OIC Requirements	Alright! I'll make that change to the report and then send it back to you and Chance for finalization. Will you be signing off on it Leigh-Ann? Greg will be signing on behalf of Chance.	N/A	E01383_RE_ DRAFT 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Review.msg
E01360	10-Sep-21	Email	In	Gwich'in Tribal Council	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), Hemmera	Engagement/Consultation	Could you please change the signature for Gwich'in Tribal Council to Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), to maintain consistency on the file.	E01360_210910_EngagementPlan_2021AnnualReport_Gwich'inPartners_v0.5wAppD.pdf	E01360_210910_EngagementPlan_2021AnnualReport_Gwich'inPartnRE_ 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Finalization.msg
E01361	10-Sep-21	Email	Out	Gwich'in Tribal Council	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council)	Engagement/Consultation	No problem at all. attached is updated version for signing.	N/A	E01360_210910_EngagementPlan_2021AnnualReport_Gwich'inPartnRE_ 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Finalization.msg
E01373	10-Sep-21	Email	Out	Gwich'in Tribal Council	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council)	Engagement/Consultation	After receiving some feedback from Gwich'in Tribal Council, I was able to make the following changes to the Engagement Report: •On page 4 I changed "Updating/revising Plan to include all DGOs, as well as Band Offices, and to revisit the Meeting frequency of Chance and the Gwich'in Partners" to "Updating/revising Plan to include all DGOs, to reflect current Gwich'in Tribal Council governance structure, and to revisit the Meeting frequency of Chance and the Gwich'in Partners." •Removed the draft watermark and DRAFT from the title of the document. •Added the signature boxes. Leigh-Ann, I put your name on the signing page. If that's alright, please sign and send a scanned copy to Greg. Then I'll share a final copy with yourselves and Derek Fraser (Yukon Government) at Yukon Government.	E01373_210910_EngagementPlan_2021AnnualReport_Gwich'inPartners_v0.5wAppD.pdf	E01373_Annual Report of Gwich'in Partners and Chance Engagement Activities - For Finalization.msg
E01386	6-Dec-21	Email	In	Gwich'in Tribal Council	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Hemmera	Regulatory Process Information Sharing	Our department is starting to plan for the new year and I was wondering if there are any updates with regards to Chance. Based on the Report submitted in September, there are no engagement plans for the Well Maintenance and Extended Flow Testing Project. However, there appears to be a list of upcoming engagement activities for the Eagle Plains Exploration Project. Can you please give us an update on the status on these Projects? When is YESAB expected to complete its review for the Well Maintenance and Extended Flow Testing Project? When is Chance expecting to submit the Eagle Plains Exploration Project Proposal to YESAB?	N/A	E01386_RE_ 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Finalization.msg

E01387	15-Dec-21	Email	Out	Gwich'in Tribal Council	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council)	Regulatory Process Information Sharing	Hemmera responded to Gwich'in Tribal Council's December 6, 2023 questions: •Work on the Eagle Plains Exploration Project is ongoing. Chance is currently focusing its efforts on revising/updating the Project Description (i.e., previous version was dated 2019 and shared with Gwich'in Tribal Council). This process is being greatly informed by the current YESAB process for the Well Maintenance and Extended Flow Testing Project. •For the Eagle Plains Exploration Project, Chance's consultants are working on finalizing baseline reports for wildlife, fish, etc. Once those are complete, Chance will share copies. •For the Eagle Plains Exploration Project, Chance will likely be entering YESAB's Pre-Submission Engagement (PSE) process. PSE comes into effect March 1, 2022. Some additional information about that process can be found here. Chance is working with Hemmera and its other consultants to build out a revised schedule for the ultimate Project Proposal submission to YESAB. •For the Well Maintenance and Extended Flow Testing Project, the Public Comment period has ended and Chance/Hemmera is preparing the response to Information Request #4. This should be submitted to YESAB before Christmas.	N/A	E01386_RE_ 2021 Annual Report of Gwich'in Partners and Chance Engagement Activities - For Finalization.msg
GTC0222	17-Dec-21	Email	Out	Vuntut Gwitchin First Nation, Gwich'in Tribal Council, Tr'ondëk Hwëch'in, First Nation of Na-cho Nyäk Dun	Greg Charlie (Chance)	Mike Chernoff (Chance) (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Engagement/Consultation	Please see attach a formal letter to Minister Streicker and if you guys have any questions, please don't hesitate to contact myself via email or call my cell.	N/A	E01364_FW_ Land Tenure Request (2).msg E01363_Government of Yukon Land Tenure Extension Request.pdf
GTC0130	20-Jan-22	Email	Out	Gwich'in Tribal Council, Vuntut Gwitchin First Nation, First Nation of Na-Cho Nyäk Dun, Chance, Ecofor	Tim Bennett (Ecofor)	Richard Wyman (Chance), Greg Charlie (Chance), Calista Morrison (Hemmera)	Ty Heffner (Yukon Government), Megan Williams (Vuntut Gwitchin First Nation), Sharon Snowshoe (Gwich'in Tribal Council), heritagemgr@nndfn.com, James Mooney (Ecofor)	Eagle Plains Basin Exploration Project HROA	Tim (Ecofor) emailed Ty (Yukon Government), Megan (Vuntut Gwitchin First Nation), Sharon (Gwich'in Tribal Council), Heritage Manager of NND, and cc'd James M., Richard (Chance), Greg (Chance) and Calista (Hemmera) attaching a link to the Eagle Plains Basin Exploration Project Heritage Resource Overview Assessment (HROA).	N/A	Eagle Plains Basin Exploration Project Heritage Resource Overview Assessment (HROA)
GTC0131	3-Jun-22	Email	Out	Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Tom Weegar, Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Meeting	Greg (Chance) emailed Ken (Gwich'in Tribal Council) to request a meeting. Chance indicated it would good for the parties to jointly develop an agreement on how to proceed with consultation on YESAA process. Greg said they do currently have an engagement and communication agreement already, this will expand more clearly on ecological values and economic opportunities discussion and help with feedback from citizens in the related communities. Greg requested a date in July for face to face meeting if Gwich'in Tribal Council was available. Chance was conducting some field work at Eagle Plains on July 23 - 26, so they recommended a , July 21 meeting in Inuvik.	N/A	20220603-Gwich'in Tribal Council
GTC0132	7-Jun-22	Email	Out	Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Tom Weegar, Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Cooperation Agreement Discussion	Greg (Chance) emailed Ken (Gwich'in Tribal Council) and cc'd Tom (Gwich'in Tribal Council), Leigh-Ann (Gwich'in Tribal Council), and Richard (Chance) to attach a draft of the Cooperation Agreement to begin discussions on it. Greg indicated they are available at camp km 324 on , July 26 2022 if Gwich'in Tribal Council is interested.	N/A	20220607-Gwich'in Tribal Council 20220608-Gwich'in Tribal Council-letter to Grand Chief Kyikavichik letter to Grand Chief Kyikavichik
E01446	14-Sep-22	Email	In	Gwich'in Tribal Council	Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Richard Wyman (Chance), Tom Weeger, Geg Charlie, Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) Roy Erasmus (Gwich'in Tribal Council) Jr. (Gwich'in Tribal Council)	Gwich'in Tribal Council	Engagement/Consultation	Leigh-Ann (Gwich'in Tribal Council) responded to Richard's (Chance) email to Grand Chief Kyikavichik (Gwich'in Tribal Council). She said she would coordinate with her group at Gwich'in Tribal Council and get back to him with potential dates for this Meeting. She also said a tour of the area would be a great benefit for the Gwich'in Tribal Council group, especially representatives from the community of Teetl'it Zheh (Fort McPherson).	N/A	E01434 - FW Cooperation Agreement Discussion
GTC0133	29-Nov-22	Email	Out	Gwich'in Tribal Council, Vuntut Gwitchin First Nation, First Nation of Na-Cho Nyäk Dun, Chance, Ecofor	Tim Bennett (Ecofor)	N/A	Ty Heffner (Yukon Government), Megan Williams (Vuntut Gwitchin First Nation), Sharon Snowshoe (Gwich'in Tribal Council), heritagemgr@nndfn.com, James Mooney (Ecofor)	Eagle Plains Exploration Project 2022 HRIA Interim Report (22-22ASR)	Tim (Ecofor) emailed Ty (Yukon Government), Megan (Vuntut Gwitchin First Nation), Sharon (Gwich'in Tribal Council), Heritage Manager of NND, and cc'd James M (Ecofor) attaching a pdf of the Eagle Plains Exploration Project 2022 Heritage Resource Impact Assessment (HRIA) Interim Report (22-22ASR).		Eagle Plains Exploration Project 2022 Heritage Resource Impact Assessment (HRIA) Interim Report (22-22ASR)
E014781	5-Dec-22	Email	In	Gwich'in Tribal Council	Tara Kyikavichik (Gwich'in Tribal Council)	Greg Charlie (Chance), Cindy Dickson (Chance)	Chance Oil and Gas Limited	Engagement/Consultation	Tara (Gwich'in Tribal Council) sent Greg (Chance) a reply, indicating the only time Grand Chief Kyikavichik (Gwich'in Tribal Council) is available	N/A	E01468 - RE February Meeting
E014781	5-Dec-22	Email	In	Gwich'in Tribal Council	Tara Kyikavichik (Gwich'in Tribal Council)	Cindy Dickson (Chance), Greg Charlie (Chance)	Tara Kyikavichik (Gwich'in Tribal Council)	Engagement	Tara (Gwich'in Tribal Council) sent Greg (Chance) a reply, indicating the only time Grand Chief Kyikavichik (Gwich'in Tribal Council) was available to meet.	N/A	E01468 - RE February Meeting
E014781	5-Dec-22	Email	In	Gwich'in Tribal Council	Tara Kyikavichik (Gwich'in Tribal Council)	Cindy Dickson (Chance), Greg Charlie (Chance)	Tara Kyikavichik (Gwich'in Tribal Council)	Engagement	Tara (Gwich'in Tribal Council) sent Greg (Chance) a reply, indicating the only time Grand Chief Kyikavichik (Gwich'in Tribal Council) was available to meet.	N/A	E01468 - RE February Meeting
E014790	4-Jan-23	Email	Incoming	Gwich'in Tribal Council	Tara Kyikavichik (Gwich'in Tribal Council)	Greg Charlie (Chance), Cindy Dickson (Chance), Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Chance Oil and Gas Limited	Meeting Coordination/Planning	Tara (Gwich'in Tribal Council) confirmed Gwich'in Tribal Council's attendance at the January 26, 2023 meeting in Vancouver. Noted Angela Tripathy (Gwich'in Tribal Council) (Gwich'in Tribal Council CEO), Leigh-Ann Williams-Jones (Gwich'in Tribal Council) (Gwich'in Tribal Council Lands and Resources Manager), Willard Hagen (Gwich'in Tribal Council) (External Consultant for the Gwich'in Tribal Council Lands and Resources Department), and herself (Gwich'in Tribal Council Environmental Assessment Manager) would be present.	N/A	E01481 - RE Vancouver Meeting
E014802	19-Jan-23	Email	Outgoing	Gwich'in Tribal Council	Cindy Dickson (Chance)	Richard Wyman (Chance), Greg Charlie (Chance)	Chance Oil and Gas Limited	Meeting Coordination/Planning	Cindy (Chance) let Richard (Chance) and Greg (Chance) know that Chief Pauline Frost (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) sent an email indicating she is trying to fit in our January 26 meeting into her schedule.	N/A	N/A

E014804	20-Jan-23	Email	Outgoing	Gwich'in Tribal Council	Cindy Dickson (Chance)	Tara Kyikavichik (Gwich'in Tribal Council), Greg Charlie (Chance), Leigh-Ann Williams-Jones (Gwich'in Tribal Council),	Gwich'in Tribal Council	Meeting Coordination/Planning	Cindy (Chance) sent Tara (Gwich'in Tribal Council) the draft January 26, 2023 meeting agenda and address details for the meeting as well as dinner.	N/A	N/A
E014805	23-Jan-23	Email	Incoming	Gwich'in Tribal Council	Tara Kyikavichik (Gwich'in Tribal Council)	Cindy Dickson (Chance), Greg Charlie (Chance), Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Chance Oil and Gas Limited	Meeting Coordination/Planning	Tara (Gwich'in Tribal Council) sent Cindy (Chance) a list of January 26th, 2023 Gwich'in Tribal Council meeting participants.	N/A	E01493 - RE Vancouver Meeting
E014810	26-Jan-23	Meeting - In Person	N/A	First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, Two Worlds Consulting, Vuntut Gwitchin First Nation	N/A	Cindy Dickson (Chance), Greg Charlie (Chance), (joined by telephone), Mike Chernoff (Chance) (Chance), Richard Wyman (Chance)	Adrienne Hill (First Nation of Na-cho Nyäk Dun), Chief Pauline Frost (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Elizabeth Staples (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Erin Prelypchan (Two Worlds Consulting), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), James Smith (Vuntut Gwitchin First Nation) President Abe Wilson (Gwich'in Tribal Council) (Gwich'in Tribal Council), Roy Erasmus (Gwich'in Tribal Council) Jr. (Gwich'in Tribal Council), Tara Kyikavichik (Gwich'in Tribal Council), Willard Hagen (Gwich'in Tribal Council)	Engagement	Chance hosted an in-person meeting with leadership and technical advisors from First Nation of Na-Cho Nyäk Dun Gwich'in Tribal Council, and Vuntut Gwitchin First Nation in Vancouver. The purpose of the meeting was to re-establish collaborative working relationships, discuss engagement preferences going forward, and provide a Project update.	N/A	N/A
E014814	1-Feb-23	Email	Outgoing	Gwich'in Tribal Council	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	President Abe Wilson (Gwich'in Tribal Council), Adrienne Hill (First Nation of Na-cho Nyäk Dun), Chief Pauline Frost (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), Elizabeth Staples (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Erin Prelypchan (Two Worlds Consulting), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), James Smith (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Mike Chernoff (Chance), Roy Erasmus (Gwich'in Tribal Council), Tara Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council)	Engagement	Richard W. emailed Chief Pauline Frost (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), and Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun) and stated Chance had commissioned Environmental Dynamics Inc. and Palmer Environmental to cover several studies to gather and evaluate baseline environmental data. Chance stated heritage resource studies have begun by Ecofor. Chance noted Chance has retained supervision of drilling and completions, well maintenance, and follow testing activities help from Mountford Consulting; Peer Solutions for seismic program design and project management; TetraTech for civil engineering advice; Ausenco for preparing YESAB submission documents and project management; and Two Worlds Consulting for engagement and communication processes and gathering socio-economic data to complete YESAB submissions. Chance stated that all information that is gathered can be shared with the Nations and their feedback is welcome. Chance noted that Chance intended to extend the Land Tenure of Exploration Permits that are due to expire August 30, 2023. Chance stated a Benefits Agreement needs to be completed by First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Vuntut Gwitchin First Nation. Chance said that accommodation in Old Crow is difficult to arrange and Chance had tentatively arrange accommodation on March 7, 2023 in Old Crow and March 8 to 9, 2023 in Inuvik and Fort McPherson for consideration. Chance noted no meetings in Mayo or other communities in the Yukon have been committed to.	N/A	E01506 - Fwd Chance Oil Gas - March Sessions
E014818	13-Feb-23	Email	Incoming	Gwich'in Tribal Council	Angela Tripathy (Gwich'in Tribal Council)	Greg Charlie (Chance)	Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), Tara Kyikavichik (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council),	Engagement/Consultation	Angela (Gwich'in Tribal Council) sent Greg (Chance) an email thanking him for reaching out to Gwich'in Tribal Council and requesting to meet on February 8, 2023 and February 9, 2023, but recommended a meeting between Gwich'in Tribal Council and Chance occurs prior to any public community-based engagement and be in accordance with the Plan.	N/A	E01507 - RE Chance Oil Gas - March Sessions

E018819	14-Feb-23	Email	Outgoing	Gwich'in Tribal Council	Greg Charlie (Chance)	Cindy Dickson (Chance)	Angela Tripathy (Gwich'in Tribal Council), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), Tara Kyikavichik (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council)	Engagement	Greg (Chance) sent an email to Angela (Gwich'in Tribal Council) apologizing for requesting a community meeting he was reaching out to keep communication open and there was no CEO at the time.	N/A	E0141860 - Land Tenure Extension Request
E0141860	7-Mar-23	Email	Outgoing	First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, Tr'ondëk Hwëch'in, Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Cindy Dickson (Chance), Richard Wyman (Chance)	Aparna Verma (Yukon Government), Chief Pauline Frost (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Derek Fraser (Yukon Government), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), Honorable John Streicker (Yukon Government), Mike Chernoff (Chance) (Chance), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Engagement	Greg (Chance) emailed Honorable John Streicker (Yukon Government) (Minister of Energy, Mines and Resources) and cc'ed Chance and Yukon Government representatives as well as Chief Pauline Frost (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Grand Chief Ken Kyiachivik (Gwich'in Tribal Council), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) (First Nation of Na-cho Nyäk Dun), and Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in) (TH) providing the Land Tenure extension request. Chance stated to contact Chance if there are any questions.	N/A	E01515 - Land Tenure Extension Request 2023 Land Tenure Extension Request.pdf (312.19 KB)
E014827	7-Mar-23	Email	Outgoing	Gwich'in Tribal Council	Greg Charlie (Chance)	Mike Chernoff (Chance) (Chance),Richard Wyman (Chance), Cindy Dickson (Chance)	Honorable John Streicker (Yukon Government), Derek Fraser (Yukon Government), Aparna Verma (Yukon Government), Patricia Randall (Unknown), Chief Pauline Frost (Vuntut Gwitchin First Nation), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council) Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun)	Tenures/Dispositions/Permits	Greg (Chance) sent Honorable John Streicker (Yukon Government) (Minister of Energy, Mines and Resources) a letter regarding land tenure extension for Exploration Permits 0012-0017, and 0020 ("EP's").	N/A	2022 Heritage Resource Impact Assessment (HRIA) Final Report (22-22ASR).
GTC0135	15-Mar-23	Email	Outgoing	Gwich'in Tribal Council, Vuntut Gwitchin First Nation, First Nation of Na-Cho Nyäk Dun	Tim Bennett (Ecofor)	N/A	Ty Heffner (Yukon Government), Megan Williams (Vuntut Gwitchin First Nation), Sharon Snowshoe (Gwich'in Tribal Council), heritagemgr@ First Nation of Na-Cho Nyäk Dunfn.com, James Mooney (Ecofor)	Eagle Plains Exploration Project 2022 HRIA FINAL Report (22-22ASR)	Tim Bennett (Ecofor) emailed Megan (Vuntut Gwitchin First Nation), Sharon (Gwich'in Tribal Council), Heritage Manager of First Nation of Na-Cho Nyäk Dun, and cc'd James Mooney (Ecofor) attaching a link to the Eagle Plains Oil and Gas 2022 Heritage Resource Impact Assessment (HRIA) Final Report (22-22ASR).	N/A	20220324-Gwich'in Tribal Council
GTC0136	24-Mar-23	Email	Outgoing	Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance)	Tara Kyikavichik (Gwich'in Tribal Council)	Meeting	Greg (Chance) emailed Tara (Gwich'in Tribal Council) regarding a meeting on May 5, 2022 that has been postponed. Greg indicated they would be in Inuvik next to and would like to meet with Grand Chief Kyikavichik (Gwich'in Tribal Council) if they are available on March 31, 2023 at 2:00PM or March 31, 2023 3:15PM to discuss the YESAB submission for the Project.	N/A	E01521 - Letter from Minister Streicker E01522 - 23.03.30_LTR_Greg Charlie (Chance) (002)
E0141832	3-Apr-23	Email	Incoming	Gwich'in Tribal Council	Sabrin-Jean Fred	Greg Charlie (Chance), Mike Chernoff (Chance) (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Moira Lassen, Chief Pauline Frost (Vuntut Gwitchin First Nation), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), Aparna Verma (Yukon Government), Patricia Randall (Unknown), Derek Fraser (Yukon Government)	Tenures/Dispositions/Permits	Sabrina-Jean (Yukon Government) sent Greg (Chance) an email with an attached letter from Minister Streiker regarding Land Tenure Extension Request, Oil and Gas Permits 0012-0017, 0019 and 0020.	N/A	E01526 - Community Engagement Session

E0141837	14-Apr-23	Email	Outgoing	Gwich'in Tribal Council	Greg Charlie (Chance)	Cindy Dickson (Chance)	Angela Tripathy (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Erin Prelypchan (Two Worlds Consulting)	Engagement	Greg (Chance) sent an email to Angela (Gwich'in Tribal Council) and Leigh-Ann (Gwich'in Tribal Council) to let them know he had a planned breakfast meeting with Grand Chief Kyikavichik (Gwich'in Tribal Council) and was told to email them both about Chance's travel plans for Inuvik and Teetl'it Zheh (Fort McPherson).	N/A	E01526 - Community Engagement Session
E0141837	14-Apr-23	Email	Outgoing	Gwich'in Tribal Council	Greg Charlie (Chance)	Angela Tripathy (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Erin Prelypchan (Two Worlds Consulting), Cindy Dickson (Chance)	Gwich'in Tribal Council	Meeting Coordination/Planning	Greg (Chance) sent an email to Angela (Gwich'in Tribal Council) and Leigh-Ann (Gwich'in Tribal Council) to let them know he has breakfast with Grand Chief Kyikavichik (Gwich'in Tribal Council) and was told to email them both about the travel plan for Inuvik and Teetl'it Zheh (Fort McPherson).	N/A	E01529 - Water Board decision
E0141839	25-Apr-23	Email	Outgoing	Gwich'in Tribal Council	Richard Wyman (Chance)	Derek Fraser (Yukon Government), Aparna Verma (Yukon Government), Greg Charlie (Chance), Cindy Dickson (Chance)	Yukon Government	Designated Office Project	Richard (Chance) sent Derek (Yukon Government) and Aparna (Yukon Government) an email to let them know that Chance camp needs to undergo further YESAB screening to obtain a new water license allowing Chance to dispose of waste.	N/A	N/A
GTC0137	9-May-23	Email	Outgoing	Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance)	Peter Csicsai (Gwich'in Tribal Council), John Bailey (Vuntut Gwitchin First Nation), Eliza Bethune (Two Worlds Consulting)	Chance Submission to YESAB	Greg (Chance) emailed Peter (Gwich'in Tribal Council), John Bailey (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) and cc'd Eliza (Two Worlds Consulting) requesting a meeting on the submission and application details for Chance. Greg (Chance) indicated from a technical level there will potentially be same priorities for Vuntut Gwitchin First Nation and Gwich'in Tribal Council. Noted Chance would be happy to coordinate the information sharing. Greg requested Gwich'in Tribal Council reach out if they have questions or comments.	N/A	E01542 - Re Inuvik Advertisements
E0141847	11-May-23	Email	Outgoing	Gwich'in Tribal Council	Cindy Dickson (Chance)	newnorth.ca	newnoeth.ca	Meeting Coordination/Planning	Cindy (Chance) sent information to the rolling ads channel in Inuvik to run during prime time every day until the Open Houses in Inuvik and Fort McPherson.	N/A	E01543 - RE Advertising for May 11 12 13 14th 15th 2023
GTC0228	11-May-23	Radio/Flyer Advertisement	Incoming	Gwich'in Tribal Council	Chance	Cindy Dickson (Chance)	Gwich'in Tribal Council	Information Sharing	Chance sent event invitation posters to Gwich'in Tribal Council staff to post in Inuvik and Fort McPherson facilities. The invitations were targeted to Gwich'in Participants and residents of Inuvik and Fort McPherson. Chance shared the Open House invitations via a rolling advertisement with a local radio station. The invitations provided key information such as event purpose, event location and time, and Chance contact information to share questions and/or feedback about the Open House or the Project.	N/A	N/A
E0141850	15-May-23	Phone	N/A	Gwich'in Tribal Council	Cindy Dickson (Chance)	N/A	Hamlet of Teetl'it Zheh (Fort McPherson) Staff Member (name not available)	Engagement	Cindy (Gwich'in Tribal Council) called the Hamlet of Teetl'it Zheh (Fort McPherson) and the caterers to let them know the Open House was postponed out of respect for the community due to the sudden loss of two of its members and flash flooding in the area.	N/A	N/A
E0141852	16-May-23	Community Event	N/A	Gwich'in Tribal Council	N/A	Cindy Dickson (Chance), Greg Charlie (Chance)	Eliza Bethune (Two Worlds Consulting), Mike Setterington (Environmental Dynamics Inc.) (Environmental Dynamics Inc.), Rebecca DeLorey (Two Worlds Consulting), Shirley McCuaig (Palmer), Tim Bennett (Ecofor)	Engagement	Chance held a community Open House event in Inuvik at the Nihtat Gwich'in Council Board Room from 4:00PM– 8:00PM MST. Six community members attended this event. Open House attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to Open House attendees. This presentation included a question-and-answer period as well as a draw for two Air North tickets.	N/A	N/A
E0141851	17-May-23	Meeting - In Person	N/A	Gwich'in Tribal Council	N/A	Cindy Dickson (Chance), Greg Charlie (Chance)	Eliza Bethune (Two Worlds Consulting), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Mike Setterington (Environmental Dynamics Inc.) (Environmental Dynamics Inc.), Rebecca DeLorey (Two Worlds Consulting), Roy Erasmus (Gwich'in Tribal Council) Jr. (Gwich'in Tribal Council), Shirley McCuaig (Palmer), Tim Bennett (Ecofor)	Engagement	Grand Chief Kyikavichik (Gwich'in Tribal Council) and staff from the Gwich'in Development Corporation (GDC) hosted the Project Team (Chance, Environmental Dynamics Inc., Ecofor, Palmer, and Two Worlds Consulting) for a Project update meeting at the Gwich'in Tribal Council Inuvik office. The purpose of the 1-hour meeting was to discuss Project-related information including schedule, baseline data, upcoming environmental monitoring, Gwich'in Tribal Council's engagement preferences, and the May 16, 2023 Open House event.	N/A	N/A
E0141852	17-May-23	Community Event	N/A	Gwich'in Tribal Council	N/A	N/A	N/A	Engagement	Chance planned to conduct an in-person community Open House event in Teetl'it Zheh (Fort McPherson). This event was cancelled due to flash flooding in the Teetl'it Zheh (Fort McPherson) area.	N/A	N/A
GTC0139	9-Jul-23	Email	Incoming	Gwich'in Tribal Council	Peter Csicsai (Gwich'in Tribal Council)	Greg Charlie (Chance)	Alicia McRae, Peter Csicsai (Gwich'in Tribal Council), Eliza Bethune (Two Worlds Consulting)	Chance Submission to YESAB	Peter (Gwich'in Tribal Council) emailed Greg (Chance) and John (Vuntut Gwitchin First Nation), and cc'd Eliza (Two Worlds Consulting) and Alicia (Gwich'in Tribal Council) confirming a meeting on the submission and application details would be good. Peter proposed mid to late September for meeting. Peter noted Alicia is with Gwich'in Tribal Council and is from their technical team.	N/A	20230713-GTC0140 20230713-GTC0140A

GTC0140	13-Jul-23	Email	Outgoing	Gwich'in Tribal Council	Greg Charlie (Chance)	N/A	Leigh-Ann Williams-Jones (Gwich'in Tribal Council), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), Jennifer Shalagan (Environmental Dynamics Inc.)	Engagement	Greg (Chance) emailed Grand Chief Kyikavchik (Gwich'in Tribal Council) Leigh-Ann, and Jennifer (Environmental Dynamics Inc.) and provided a draft Project Description. Chance requested that Grand Chief Kyikavchik share with the Gwich'in Tribal Council team. Chance stated they can discuss next steps at the August 3, 2023 meeting. Chance noted that they are preparing community engagement events in Old Crow, Inuvik, Tsiigehtchic, and Teetl'it Zheh (Fort McPherson) during the August 22, 2023 week. Chance stated they will reach out to Ehdiitat Gwich'in Council in Aklavik to get direction on participation in the Community Engagement process. Chance said to not hesitate to contact Greg or Jennifer if there are any questions.	N/A	20230713-GTC0141
GTC0141	13-Jul-23	Email	Outgoing	Gwich'in Tribal Council	Cindy Dickson (Chance)	N/A	President Mavis Clark	Engagement	Cindy (Chance) emailed President Mavis Clark (Gwich'in Tribal Council) and stated Chance would like to update the community about the Project Proposal that is being prepared for YESAB. Chance stated they would like to rent the gym and hire cooks to prepare a dinner. Chance asked if Gwich'in Tribal Council would like Chance to go to Tsiigehtchic on August 23, 2023 to meet the team and follow up with a community update and dinner. Chance stated there would be around 9 Project Team representatives in total and each person has prepared independent research studies and reports on a range of topics. Chance stated they have a draft Project Description to share.	N/A	20230714-GTC0142 20230714-GTC0142A
GTC0142	14-Jul-23	Email	Outgoing	Gwich'in Tribal Council	Greg Charlie (Chance)	Jennifer Shalagan (Environmental Dynamics Inc.), Cindy Dickson (Chance)	President Abe Wilson (Gwich'in Tribal Council) (Gwich'in Tribal Council), David Krutko	Engagement	Greg (Chance) emailed President Wilson (Gwich'in Tribal Council), David (Gwich'in Tribal Council), Jenn (EDI), and Cindy (Chance) and provided a draft Project Description. Chance requested that President Wilson share with the Tetlit Gwich'in team. Chance stated they can discuss next steps on August 24, 2023 when they visit in Teetl'it Zheh (Fort McPherson). Chance introduced Jennifer and stated she is the lead in the submission process for YESAB. Chance stated they hope to set up a meeting on August 24, 2023 around 2:00PM. Chance noted they have included Cindy and requested that President Wilson let Chance know who Cindy can contact to set up a meeting. Chance said to not hesitate to contact Greg or Jennifer (EDI) if there are any questions.	N/A	20230717-GTC0143 20230717-GTC0143A
GTC0143	17-Jul-23	Email	Outgoing	Gwich'in Tribal Council	Cindy Dickson (Chance)	Greg Charlie (Chance), Lynn O'Neil (Chance)	Eliza Bethune (Two Worlds Consulting), Berna (no last name)	Engagement	Cindy (Chance) emailed Berna (Gwich'in Tribal Council) and cc'd Lynn (Chance), Greg (Chance), and Eliza (Two Worlds Consulting) about catering logistics for the Open House. Chance stated there is around 9 to 10 people in their group and will provide a Project update. Chance noted they will send a poster to put up in the community.	N/A	20230719-GTC0144
GTC0144	19-Jul-23	Email	Outgoing	Gwich'in Tribal Council	Cindy Dickson (Chance)	Greg Charlie (Chance), Lynn O'Neil (Chance)	Eliza Bethune (Two Worlds Consulting), Berna (no last name)	Engagement	Cindy (Chance) emailed Berna (Gwich'in Tribal Council) and cc'd Lynn (Chance), Greg (Chance), and Eliza (Two Worlds Consulting) stating Chance had to cancel the school gym rental. Chance said they didn't know Air North cancelled their regular flight on the day they were supposed to travel. Chance stated they will have to cancel this part of the Open House and offered to cover travel from Tsiigehtchic (Arctic Red River) to Teetl'it Zheh (Fort McPherson) on August 24, 2023 for the Open House to be held there. Details around capacity funding were discussed. Chance confirmed they would send the time of the Open House, once confirmed. Chance asked Gwich'in Tribal Council to provide the correct email addresses for Chief Phillip Blake and President Mavis Clark.	N/A	20230719-GTC0145
GTC0145	19-Jul-23	Email	Outgoing	Gwich'in Tribal Council	Cindy Dickson (Chance)	N/A	President Mavis Clark	Engagement	Cindy emailed President Mavis Clark (Gwich'in Tribal Council) and stated Chance had to cancel the proposed Open House on August 23, 2023 in Tsiigehtchic. Chance stated independent research studies and reports have been prepared and a draft Project Description. Details around capacity funding were discussed. Chance confirmed they would send the time of the Open House, once confirmed.	N/A	20230719-GTC0146
GTC0146	19-Jul-23	Email	Outgoing	Gwich'in Tribal Council	Cindy Dickson (Chance)	Greg Charlie (Chance)	Eliza Bethune (Two Worlds Consulting), Chief Phillip Blake	Engagement	Cindy emailed Chief Phillip Blake and cc'd Greg (Chance) and Eliza (Two Worlds Consulting) and invited Chief Phillip Blake to an Open House in Teetl'it Zheh (Fort McPherson) on August 24, 2023 for a Project update. Chance stated independent research studies and reports have been prepared and a draft Project Description. Details around capacity funding were discussed. Chance confirmed they would send the time of the Open House, once confirmed.	N/A	20230728-GTC0147
GTC0147	28-Jul-23	Email	Outgoing	Gwich'in Tribal Council	Cindy Dickson (Chance)	N/A	Berna (no last name), Eliza Bethune (Two Worlds Consulting)	Engagement	Cindy (Chance) emailed Berna (Gwich'in Tribal Council) and cc'd Eliza (Two Worlds Consulting) thanking Gwich'in Tribal Council for calling back.	N/A	N/A
GTC0148	23-Aug-23	Email	Incoming	Gwich'in Tribal Council	Grand Chief Ken Kyikavichik (Gwich'in Tribal Council)	Greg Charlie (Chance)	Angela Tripathy (Gwich'in Tribal Council), Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council) (Gwich'in Tribal Council), Maggie Crump (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council)	Engagement	Grand Chief Kyikavichik (Gwich'in Tribal Council) emailed Peter (Gwich'in Tribal Council), Greg (Chance), and cc'd Angela (Gwich'in Tribal Council) and Maggie (Gwich'in Tribal Council) providing an e-introduction. Gwich'in Tribal Council stated Greg wanted to coordinate engagement in the Gwich'in Tribal Council regarding the Project, specifically with Teetl'it Zheh (Fort McPherson).	N/A	N/A
GTC0149	28-Aug-23	Email	Incoming	Gwich'in Tribal Council	Peter Csicsai (Gwich'in Tribal Council)	Greg Charlie (Chance)	Alicia McRae, Angela Tripathy (Gwich'in Tribal Council), Maggie Crump (Gwich'in Tribal Council)	Engagement	Peter (Gwich'in Tribal Council) emailed Greg (Chance) and cc'd Angela (Gwich'in Tribal Council), Maggie (Gwich'in Tribal Council), and Alicia (Gwich'in Tribal Council) stating Gwich'in Tribal Council looked forward to working together. Peter stated to let him know when Greg had time for an introduction call.	N/A	N/A
GTC0150	29-Aug-23	Meeting - In Person	Incoming	Gwich'in Tribal Council	N/A	Greg Charlie (Chance)	Eliza Bethune (Two Worlds Consulting), Haylee Dlouhy (Two Worlds Consulting), Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council)	Engagement	Chance held a virtual meeting with Gwich'in Tribal Council. The purpose of the meeting was to re-introduce the Project description and discuss proposed engagement activities with Gwich'in Participants and Gwich'in Tribal Council leadership.	N/A	20230905-GTC0151
GTC0151	5-Sep-23	Email	Outgoing	Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance)	Peter Csicsai (Gwich'in Tribal Council), John Bailey (Vuntut Gwitchin First Nation), Eliza Bethune (Two Worlds Consulting)	Chance Submission to YESAB	Greg (Chance) emailed Peter (Gwich'in Tribal Council), John (Vuntut Gwitchin First Nation) and cc'd Eliza (Two Worlds Consulting) stating Greg thought they could have a meeting in the near future on the YESAB submission and application details for the Project. Greg stated they look forward working with Gwich'in Tribal Council and asked if Gwich'in Tribal Council had any ideas for meetings please let them know and Greg would be happy to coordinate the sessions.	N/A	20230905-GTC0182A 20230905-GTC0182B 20230905-GTC0182C 20230905-GTC0182D

GTC0182	5-Sep-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting)	YESAB Meeting Summary & Follow Up Aug Action Items	Eliza (Two Worlds Consulting) emailed Alicia (Gwich'in Tribal Council), Kanda (Gwich'in Tribal Council), Peter (Gwich'in Tribal Council), and cc'd Jennifer Shalagan (Environmental Dynamics Inc.), Greg (Chance), Cindy (Chance), Richard (Chance), Kevin (Two Worlds Consulting) providing requested Project information and meeting materials such as: August 3, 2023 presentation; Draft Project overview video; August 23, 2023 Meeting Minutes; a plain language 2D and 3D seismic definition; Linear features baseline data; Wildlife baseline data; Socioeconomic baseline data; Andrea Wilson (Yukon Government) (Yukon Government) (Yukon government Project representative) contact details. Noted Chance would like to receive direction from Gwich'in Tribal Council leadership on the following items: Is leadership interested in meeting with Chance regularly to discuss the Project; how should Chance procced with community engagement; are there any community-based research protocols that Chance should follow to inform primary socio-economic baseline data collection; how much time does leadership need to review the draft Project Proposal; and does leadership have any preference around the incorporation of Indigenous Knowledge in the draft Project Proposal. Eliza (Two Worlds Consulting) outlined the action items identified during the meeting.	N/A	20230907-GTC0153
GTC0153	7-Sep-23	Email	Incoming	Gwich'in Tribal Council	Chance	Greg Charlie (Chance)	Eliza Bethune (Two Worlds Consulting) John Bailey (Vuntut Gwitchin First Nation) Alicia McRae	Chance Submission to YESAB	Peter (Gwich'in Tribal Council) replied to Greg (Chance) and John (Vuntut Gwitchin First Nation) and cc'd Eliza (Two Worlds Consulting) and Alicia (Gwich'in Tribal Council) stating Gwich'in Tribal Council would be interested in meeting. This future meeting would be in mid to late September.	N/A	20230907-GTC0154
GTC0154	7-Sep-23	Email	Incoming	Gwich'in Tribal Council	Peter Csicsai (Gwich'in Tribal Council)	N/A	Eliza Bethune (Two Worlds Consulting)	Meeting	Peter (Chance) emailed Eliza (Two Worlds Consulting) with a tentative response to a meeting titled, 'Gwich'in Tribal Council & Chance Update Meeting Series'.	N/A	N/A
	19-Sep-23	Email	Incoming	Gwich'in Tribal Council	John Bailey (Vuntut Gwitchin First Nation)	Greg Charlie (Chance) Cindy Dickson (Chance)	John Bailey (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) Bailey, Andrea Wilson (Yukon Government), Brian Macdonald (Yukon Government), Keith Maguire (Yukon Government), Katie Fraser (Tr'ondëk Hwëch'in), executivedirector@First Nation of Na-Cho Nyäk Dunfn.com, lands.director@First Nation of Na-Cho Nyäk Dunfn.com, Jim Taggart (Unknown), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Bryony Mcintyre (Yukon Government), Laura Melvin (Yukon Environmental Socio-economic Assessment Board), Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council), Brandon Roebuck (Government of Canada), Elizabeth Staples (Vuntut Gwitchin First Nation), McGarry Selbee (First Nation of Na-cho Nyäk Dun), Jennifer Shalagan (Environmental Dynamics Inc.), Eliza Bethune (Two Worlds Consulting)	Executive Committee Screening	John (Vuntut Gwitchin First Nation) invited Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, and Gwich'in Tribal Council to a meeting with the Yukon Government, Chance, and Yukon Environmental Socio-economic Assessment Board regarding the Yukon Environmental Socio-economic Assessment Board Executive Committee screening for the Project. John (Vuntut Gwitchin First Nation) requested individuals RSVP if they were available for a virtual meeting at 10:30AM on , October 13th.	N/A	N/A
	21-Sep-23	Email	Outgoing	Gwich'in Tribal Council	Greg Charlie (Chance)	Greg Charlie (Chance) Cindy Dickson (Chance)	John Bailey (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) Bailey, Andrea Wilson (Yukon Government), Brian Macdonald (Yukon Government), Keith Maguire (Yukon Government), Katie Fraser (Tr'ondëk Hwëch'in), executivedirector@First Nation of Na-Cho Nyäk Dunfn.com; lands.director@First Nation of Na-Cho Nyäk Dunfn.com; Jim Taggart (Unknown), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Bryony Mcintyre (Yukon Government), Laura Melvin (Yukon Environmental Socio-economic Assessment Board), Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council), Brandon Roebuck (Government of Canada), Elizabeth Staples (Vuntut Gwitchin First Nation), McGarry Selbee (First Nation of Na-cho Nyäk Dun), Jennifer Shalagan (Environmental Dynamics Inc.), Eliza Bethune (Two Worlds Consulting)	Executive Committee Screening	Greg (Chance) emailed and stated thanks for organizing a meeting with the parties. Chance stated their team will be available for this meeting and will send out a presentation ahead of time.	N/A	20230925-GTC0156
GTC0155	25-Sep-23	Email	Incoming	Gwich'in Tribal Council	Alicia McRae	N/A	Eliza Bethune (Two Worlds Consulting)	Accepted: FW: Gwich'in Tribal Council & Chance Oil and Gas Update Meeting Series	Alicia (Gwich'in Tribal Council) accepted the meeting series invite from Eliza (Two Worlds Consulting) for a meeting called, 'Gwich'in Tribal Council & Chance Oil and Gas Update Meeting Series'.	N/A	20230925-GTC0157
GTC0156	25-Sep-23	Email	Incoming	Gwich'in Tribal Council, Vuntut Gwitchin First Nation	Alicia McRae	Greg Charlie (Chance)	Elizabeth Staples (Vuntut Gwitchin First Nation), Peter Csicsai (Gwich'in Tribal Council)	Executive Committee Screening	Alicia (Gwich'in Tribal Council) emailed Greg (Chance), Elizabeth (Vuntut Gwitchin First Nation) and cc'd Peter (Gwich'in Tribal Council) requesting to be added to the email distribution list, since Alicia (Gwich'in Tribal Council) is the new Land and Resource Coordinator at Gwich'in Tribal Council. Alicia (Gwich'in Tribal Council) confirmed their availability for the October 13, 2023 meeting.	N/A	20230925-GTC0158

GTC0157	25-Sep-23	Email	Outgoing	Gwich'in Tribal Council, Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Alicia McRae, Elizabeth Staples (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Eliza Bethune (Two Worlds Consulting), Cindy Dickson (Chance), Peter Csicsai (Gwich'in Tribal Council)	Executive Committee Screening	Greg (Chance) emailed Alicia (Gwich'in Tribal Council), Elizabeth (Vuntut Gwitchin First Nation), Eliza (Two Worlds Consulting), Cindy (Chance), and Peter (Gwich'in Tribal Council) stating Alicia (Gwich'in Tribal Council) will be added to the email distribution list.	N/A	20230925-GTC0159
GTC0158	25-Sep-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Alicia McRae, Peter Csicsai (Gwich'in Tribal Council), Eliza Bethune (Two Worlds Consulting), Kanda Gnama (Gwich'in Tribal Council), Kevin Simpson (Two Worlds Consulting), Haylee Dlouhy (Two Worlds Consulting)	Gwich'in Tribal Council & Chance Oil and Gas Update Meeting Series	Eliza (Two Worlds Consulting) emailed Alicia (Gwich'in Tribal Council), Peter (Gwich'in Tribal Council), Kanda (Gwich'in Tribal Council), Greg (Chance), Cindy (Chance), Haylee (Two Worlds Consulting), and cc'd Kevin (Two Worlds Consulting) and Richard (Chance), forwarding them an invite for Teams Meeting series titled, 'Gwich'in Tribal Council & Chance Oil and Gas Update Meeting Series'.	N/A	20230925-GTC0160
GTC0159	27-Sep-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Alicia McRae, Peter Csicsai (Gwich'in Tribal Council), Eliza Bethune (Two Worlds Consulting), Kanda Gnama (Gwich'in Tribal Council), Kevin Simpson (Two Worlds Consulting)	YESAB Meeting Summary & Follow Up Aug Action Items	Eliza (Two Worlds Consulting) emailed Peter (Gwich'in Tribal Council), Kanda (Gwich'in Tribal Council), and Alicia (Gwich'in Tribal Council), and cc'd Kevin (Two Worlds Consulting), Greg (Chance), Richard (Chance), Cindy (Chance), Jennifer (Environmental Dynamics Inc.) attaching a draft agenda for Gwich'in Tribal Council's review.	N/A	20230925-GTC0161
GTC0160	27-Sep-23	Email	Incoming	Gwich'in Tribal Council	Kanda Gnama (Gwich'in Tribal Council)	N/A	Eliza Bethune (Two Worlds Consulting)	Automatic Reply - YESAB Meeting Summary & Follow Up Aug Action Items	Kanda (Gwich'in Tribal Council) emailed Eliza (Two Worlds Consulting) with an automatic email stating that they are out of office until October 2, 2023.	N/A	20230925-GTC0162
GTC0161	27-Sep-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Alicia McRae, Peter Csicsai (Gwich'in Tribal Council), Eliza Bethune (Two Worlds Consulting), Kanda Gnama (Gwich'in Tribal Council), Kevin Simpson (Two Worlds Consulting), Haylee Dlouhy (Two Worlds Consulting)	YESAB Meeting Summary & Follow Up Aug Action Item	Eliza (Two Worlds Consulting) emailed Alicia (Gwich'in Tribal Council) and cc'd Kanda (Gwich'in Tribal Council), Peter (Gwich'in Tribal Council) and cc'd Greg (Chance), Cindy (Chance), Richard (Chance), Kevin (Two Worlds Consulting), Haylee (Two Worlds Consulting), and Jennifer (Environmental Dynamics Inc.) thanking them for taking the time to meet that afternoon. Eliza (Two Worlds Consulting) forwarded the email from September 5 2023 regarding requested Project information and materials.	N/A	20230925-GTC0163
GTC0162	27-Sep-23	Email	Incoming	Gwich'in Tribal Council	Alicia McRae	N/A	Eliza Bethune (Two Worlds Consulting)	YESAB Meeting Summary & Follow Up Aug Action Item	Alicia (Gwich'in Tribal Council) emailed Eliza (Two Worlds Consulting) thanking them for the email and documentation, and stated they will review the information shared in the email sent on September 5, 2023 soon.	N/A	20230925-GTC0164
GTC0163	3-Oct-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance) Cindy Dickson (Chance)	Alicia McRae, Peter Csicsai (Gwich'in Tribal Council), Eliza Bethune (Two Worlds Consulting), Kanda Gnama (Gwich'in Tribal Council), Kevin Simpson (Two Worlds Consulting), Haylee Dlouhy (Two Worlds Consulting)	Draft Collaboration Plan Update	Eliza (Two Worlds Consulting) emailed Kanda (Gwich'in Tribal Council), Alicia (Gwich'in Tribal Council), Peter (Gwich'in Tribal Council), and cc'd Greg (Chance), Cindy (Chance), Kevin (Two Worlds Consulting), Haylee (Two Worlds Consulting), and Jennifer (Environmental Dynamics Inc.)to inform Gwich'in Tribal Council that Chance is developing a Collaboration Plan, which will be ready soon for review.	Not applicable	N/A
GTC0164	4-Oct-23	Email	Outgoing	Gwich'in Tribal Council	Alicia McRae	Greg Charlie (Chance) Cindy Dickson (Chance)	Alicia McRae, Peter Csicsai (Gwich'in Tribal Council), Eliza Bethune (Two Worlds Consulting), Kanda Gnama (Gwich'in Tribal Council), Kevin Simpson (Two Worlds Consulting), Haylee Dlouhy (Two Worlds Consulting)	Draft Collaboration Plan Update	Alicia (Gwich'in Tribal Council) emailed Eliza (Two Worlds Consulting), Kanda (Gwich'in Tribal Council), Peter (Gwich'in Tribal Council) and cc'd Greg (Chance), Cindy (Chance), Kevin (Two Worlds Consulting), Haylee (Two Worlds Consulting) and Jennifer (Environmental Dynamics Inc.)to thank Eliza (Two Worlds Consulting) for the notice and stated they look forward to reviewing the draft Collaboration Plan.	N/A	20231010-ALLNATIONS 20231010-ALLNATIONS-All-Party Meeting on COGL Project ExComm assessment consultation.13.10.2023
GTC0165	6-Oct-23	Phone Call	Incoming	Gwich'in Tribal Council	Alicia Wilson	Greg Charlie (Chance)	Alicia Wilson	Engagement	Alicia (Gwich'in Tribal Council) shared that President Abe Wilson (Gwich'in Tribal Council) was no longer the Teeltl'it Gwich'in Council President per the Annual General Assembly (AGA). Greg (Chance) thanked Alicia for sharing this update and confirmed Chance is interested in conducting in-person community engagement in Teetl'it Zheh (Fort McPherson) and Inuvik. Alicia suggested Chance provide financial support for Gwich'in Tribal Council staff to help coordinate hybrid meeting logistics at in-person events in Teetl'it Zheh (Fort McPherson) and Inuvik. She noted Zoom worked well for the AGA. She noted there was a good virtual turnout for the AGA and that Gwich'in Participants were asked to pre-register and received protected link to access the hybrid AGA.	N/A	N/A

GTC0166	10-Oct-23	Email	Incoming	Vuntut Gwitchin First Nation, Gwich'in Tribal Council, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun	Elizabeth Staples (Vuntut Gwitchin First Nation)	Greg Charlie (Chance) Cindy Dickson (Chance)	Shane Kilpatrick (Government of Canada), Kim Pawley (Government of Canada), Carey Sibbald (Government of Canada), Krista Magee (Government of Canada), Jennifer Walsh (Government of Canada), Alicia McKae (Gwich'in Tribal Council), Maggie Crump (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council), Brian MacDonald, Keith Maguire (Yukon Government) (Yukon Government), Andrea Wilson (Yukon Government), Tiffani Fraser (Yukon Government), Jim Taggart (Unknown) (Yukon Government), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), and John Bailey (Vuntut Gwitchin First Nation).	Meeting	Elizabeth Staples (Vuntut Gwitchin First Nation)emailed Vuntut Gwitchin First Nation, Gwich'in Tribal Council, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Chance, and Two Worlds Consulting forwarding them a meeting invite for October 13, 2023. Elizabeth attached an agenda.	N/A	20231017-GTC0171
Reference ID unavailable	13-Oct-23	Meeting	N/A	Gwich'in Tribal Council	Elizabeth Staples (Vuntut Gwitchin First Nation)	Greg Charlie (Chance) Cindy Dickson (Chance)	Shane Staples (Government of Canada), Kim Pawley (Government of Canada), Carey Sibbald (Government of Canada), Krista Magee (Government of Canada), Jennifer Walsh (Government of Canada), Alicia McKae (Gwich'in Tribal Council), Maggie Crump (Gwich'in Tribal Council), Kanda Gnama (Gwich'in Tribal Council) (Gwich'in Tribal Council), Brian Macdonald (Yukon Government), Keith Maguire (Yukon Government) (Yukon Government), Andrea Wilson (Yukon Government) (Yukon Government), Tiffani Fraser (Yukon Government), Jim Taggart (Unknown) (Yukon Government), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), and John Bailey (Vuntut Gwitchin First Nation).	October 13 Meeting	A meeting was had between Chance, Vuntut Gwitchin First Nation, Gwich'in Tribal Council, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, the Yukon Government, Crown-Indigenous Relations and Northern Affairs Canada, Environmental Dynamics Inc., and Two Worlds Consulting. They discussed consultation activities for the Project and capacity funding opportunities to support First Nations' involvement in the Project's regulatory process.	N/A	Draft August 29, 2023 Meeting Minutes
GTC0171	17-Oct-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai	Traditional Knowledge Sources for Gwich'in Tribal Council's Review, Comment, and Permission for Use	Eliza (Two Worlds Consulting) emailed Alicia (Gwich'in Tribal Council) and cc'd Kanda (Gwich'in Tribal Council), Peter (Gwich'in Tribal Council), Jennifer Shalagan (Environmental Dynamics Inc.), Greg (Chance), Cindy (Chance), Richard (Chance), Kevin (Two Worlds Consulting) and stated Two Worlds Consulting on behalf of Chance has identified some existing secondary sources of Traditional Knowledge for Gwich'in Tribal Council's review, comment, and permission for use. The table below lists secondary sources related to Gwich'in Tribal Council that, based on Chance's understanding, may contain Traditional Knowledge related to the Project area. Chance requested Gwich'in Tribal Council's feedback including any protocols or guidance for the use of Traditional Knowledge and permission to use the listed secondary sources by , October 27, 2023. Chance invited Gwich'in Tribal Council to share any additional Traditional Knowledge sources that may not be listed to help inform the development of the socio-economic assessment and Project Proposal. Eliza also shared that if Gwich'in Tribal Council would like to use alternative submission options for certain Traditional Knowledge sources, Chance would be happy to meet and discuss further.	N/A	N/A
GTC0172	19-Oct-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting)	Draft Meeting Minutes and Collaboration Plan	Eliza (Two Worlds Consulting) emailed Kanda (Gwich'in Tribal Council), Alicia (Gwich'in Tribal Council), Peter (Gwich'in Tribal Council), and cc'd Greg (Chance), Cindy (Chance), Kevin (Two Worlds Consulting), Richard (Chance), and Jennifer (Environmental Dynamics Inc.) attaching meeting minutes from August 29, 2023 and September 27, 2023; and the Collaboration Plan. Eliza (Two Worlds Consulting) stated the Chance Project Team is setting up First Nation-specific restricted access file sharing sites and the link will be shared soon.	N/A	N/A
GTC0173	23-Oct-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.)	File Sharing Site Information and Access Instructions	Eliza (Two Worlds Consulting) emailed Peter (Gwich'in Tribal Council), Alicia (Gwich'in Tribal Council), Kanda (Gwich'in Tribal Council) and cc'd Greg (Chance), Cindy (Chance), Richard (Chance), Kevin (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.) and provided the steps to access the Gwich'in Tribal Council (Gwich'in Tribal Council) file sharing site.	N/A	N/A

GTC0174	16-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting)	Dec 7 Fort McPherson Open House Confirmation Request	Eliza (Two Worlds Consulting) emailed Kanda G, Alicia (Gwich'in Tribal Council), and cc'd Kevin (Two Worlds Consulting), Cindy (Chance), Greg (Chance), Richard (Chance), Peter (Gwich'in Tribal Council), Jennifer (Environmental Dynamics Inc.), stating that Gwich'in Tribal Council's team received approval from Gwich'in Tribal Council's leadership to meet in-person with Gwich'in Tribal Council leadership in Inuvik on December 7, 2023 in the late morning/early afternoon. Eliza also requested Gwich'in Tribal Council to approve Chance conducting an Open House event with Gwich'in Participants in Fort McPherson on December 7, 2023 between 4:00PM – 8:00PM. Eliza (Two Worlds Consulting) attached meeting minutes from November 1, 2023 for Gwich'in Tribal Councils review and comment.	N/A	N/A
GTC0176	16-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting)	Dec 7 Fort McPherson Open House Confirmation Request	Eliza (Two Worlds Consulting) emailed Kanda (Gwich'in Tribal Council), Alicia (Gwich'in Tribal Council), and cc'd Kevin (Two Worlds Consulting), Cindy (Chance), Greg (Chance), Richard D., Peter (Gwich'in Tribal Council), Jennifer (Environmental Dynamics Inc.) requesting approval from Gwich'in Tribal Council for Chance to meet in person with Gwich'in Tribal Council leadership in Inuvik on December 7th in the late morning/early afternoon. Additionally, to conduct an Open House event with Gwich'in Participants in Fort McPherson on December 7, 2023 between 4:00PM – 8:00PM MDT. Eliza (Two Worlds Consulting) requested confirmation on the proposed consultation and engagement activities for booking flights and venues. Eliza (Two Worlds Consulting) attached meeting minutes from November 1, 2023.	N/A	N/A
GTC0177	21-Nov-23	Email	Incoming	Gwich'in Tribal Council	Alicia McRae	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting)	Dec 7 Fort McPherson Open House Confirmation Request	Alicia (Gwich'in Tribal Council) emailed Eliza (Two Worlds Consulting), Kanda (Gwich'in Tribal Council), and cc'd Kevin (Two Worlds Consulting), Cindy (Chance), Richard (Chance), Peter (Gwich'in Tribal Council), Jennifer (Environmental Dynamics Inc.), apologizing for the delay in their answer. Alicia (Gwich'in Tribal Council) stated Gwich'in Tribal Council would have their answer regarding the requested information for the Fort McPherson Open House by end of day November 22, 2023.	N/A	N/A
GTC0178	22-Nov-23	Email	Incoming	Gwich'in Tribal Council	Alicia McRae	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting)	Dec 7 Fort McPherson Open House Confirmation Request	Alicia (Gwich'in Tribal Council) emailed Eliza (Two Worlds Consulting), Kanda (Gwich'in Tribal Council) and cc'd Kevin (Two Worlds Consulting), Cindy (Chance), Greg (Chance), Richard (Chance), Peter (Gwich'in Tribal Council), and Jennifer (Environmental Dynamics Inc.) stating that no one from the Gwich'in Tribal Council leadership team was available to meet on the date of December 7, 2023. Alicia (Gwich'in Tribal Council) stated the leadership team was open to looking at another set of dates for a meeting in the new year. Alicia (Gwich'in Tribal Council) requested dates be proposed. Alicia (Gwich'in Tribal Council) stated she will be able to attend the Open House on December 7, 2023 at Fort McPherson.	N/A	N/A
GTC0179	22-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting)	Canceled: Gwich'in Tribal Council & Chance Oil and Gas Update Meeting Series	Eliza (Two Worlds Consulting) emailed Peter (Gwich'in Tribal Council), Kanda (Gwich'in Tribal Council), Greg (Chance), Cindy (Chance), Haylee (Two Worlds Consulting), Alicia (Gwich'in Tribal Council), Jennifer (Environmental Dynamics Inc.), stating that that day's meeting was canceled and they would reschedule.	N/A	N/A
GTC0180	24-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting)	Hybrid Open House Question	Eliza (Two Worlds Consulting) emailed Alicia (Gwich'in Tribal Council) and cc'd Kanda (Gwich'in Tribal Council), Peter (Gwich'in Tribal Council), Jennifer Shalagan (Environmental Dynamics Inc.), Greg (Chance), Cindy (Chance), Richard (Chance), Kevin (Two Worlds Consulting) and stated they are preparing a 1-page advertisement for the Open House event in Fort McPherson on December 17, 203. Eliza (Two Worlds Consulting) asked if Gwich'in Tribal Council would prefer Chance create a Zoom link for the event and include the Zoom information in the 1-pager to support participation of Gwich'in Participants in Tsiigehtchic and Aklavik. Eliza (Two Worlds Consulting) asked if there was a format that Gwich'in Tribal Council prefers to receive the 1-pager.	N/A	N/A
GTC0181	24-Nov-23	Email	Incoming	Gwich'in Tribal Council	Alicia McRae	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting)	Hybrid Open House Question	Alicia (Gwich'in Tribal Council) emailed Eliza (Two Worlds Consulting) and cc'd Kanda (Gwich'in Tribal Council), Peter (Gwich'in Tribal Council), Greg (Chance), Cindy (Chance), Kevin (Two Worlds Consulting) stating they have no preference as to the format of the advertisement. Alicia requested Two Worlds Consulting include a Zoom link on the poster and provide a link online somewhere easily accessible for those who wish to join online.	N/A	N/A
GTC0183	27-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting), Haylee Dlouhey (Two Worlds Consulting)	Meeting and Baseline Reports	Eliza (Two Worlds Consulting) emailed Alicia (Gwich'in Tribal Council), Greg (Chance), Cindy (Chance), Kevin (Two Worlds Consulting), Haylee (Two Worlds Consulting), Kanda (Gwich'in Tribal Council), stating they had rescheduled the November monthly meeting. Eliza (Two Worlds Consulting) stated that they can touch base on about the December 7, 2023 Open House. Eliza (Two Worlds Consulting) attached links for the baseline reports on Ecological and Landscape Classification Mapping, Fish and Fish Habitat, and Surface Water Quality and Hydrology.	N/A	N/A
GTC0184	27-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Alicia McRae	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting), Haylee Dlouhey (Two Worlds Consulting)	Meeting Schedule	Alicia (Gwich'in Tribal Council) emailed Eliza (Two Worlds Consulting), Greg (Chance), Cindy (Chance), Jennifer (Environmental Dynamics Inc.), Kevin (Two Worlds Consulting), Haylee (Two Worlds Consulting), and Kanda (Gwich'in Tribal Council) stating they can meet on December 4, 2023, but not at 9:00 AM PST. Alicia (Gwich'in Tribal Council) requested to meet between 10:00 AM to 1:00 PM MST.	N/A	N/A
GTC0185	27-Nov-23	Email	Incoming	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting), Haylee Dlouhey (Two Worlds Consulting)	Meeting Schedule	Eliza (Two Worlds Consulting) emailed Alicia (Gwich'in Tribal Council), Greg (Chance), Cindy (Chance), Jennifer (Environmental Dynamics Inc.), Kevin (Two Worlds Consulting) Haylee (Two Worlds Consulting), Kanda (Gwich'in Tribal Council), and cc'd Peter (Gwich'in Tribal Council) asking if Alicia (Gwich'in Tribal Council) and Kanda (Gwich'in Tribal Council) are available to meet with the Chance Project Team on December 4, 2023 at 9:00 AM PST to discuss the Project.	N/A	N/A

GTC0186	27-Nov-23	Email	Incoming	Gwich'in Tribal Council	Alicia McRae	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting), Haylee Dlouhey (Two Worlds Consulting)	Meeting and Baseline Reports	Alicia (Gwich'in Tribal Council) emailed Eliza (Two Worlds Consulting), Greg (Chance), Cindy (Chance), Jennifer (Environmental Dynamics Inc.), Kevin (Two Worlds Consulting), Haylee (Two Worlds Consulting), and Kanda (Gwich'in Tribal Council) and cc'd Peter (Gwich'in Tribal Council) stating that 9:00AM - 9:30AM on December 4, 2023 would work for a meeting. Alicia (Gwich'in Tribal Council) stated they would review the baseline reports.	N/A	N/A
GTC0187	27-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Daryl Harrison (Two Worlds Consulting), Peter Csicsai (Gwich'in Tribal Council), Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting)	Interview Request	Jorge (Two Worlds Consulting) emailed Peter (Gwich'in Tribal Council) and cc'd Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting) requesting an interview with Gwich'in Tribal Council regarding current cultural, commercial, and recreational land and resource use in the Eagle Plains area. Two Worlds Consulting would also like to discuss Gwich'in Tribal Council's community's existing socio-economic conditions and interests. Jorge (Two Worlds Consulting) stated that the interview can be conducted in person or virtually. Jorge (Two Worlds Consulting) stated that the Two Worlds Consulting team would be in Inuvik on , December 7, and would be available to meet for an in-person interview from 11:00AM onwards.	N/A	N/A
GTC0188	28-Nov-23	Email	Incoming	Gwich'in Tribal Council	Peter Csicsai (Gwich'in Tribal Council)	N/A	Daryl Harrison (Two Worlds Consulting), Peter Csicsai (Gwich'in Tribal Council), Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Jamie Koe (Gwich'in Tribal Council)	Interview Request	Peter (Gwich'in Tribal Council) emailed Jorge (Two Worlds Consulting), Alicia (Gwich'in Tribal Council), and cc'd Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), and Jamie (Gwich'in Tribal Council) requesting Jorge (Two Worlds Consulting) contact Alicia (Gwich'in Tribal Council) regarding the interview request. Alicia (Gwich'in Tribal Council) is the lead on the Project. Peter (Gwich'in Tribal Council) stated that January would be better for the interview. Peter (Gwich'in Tribal Council) stated it might be efficient to coordinate Gwich'in Tribal Council's feedback by combining the discussions.	N/A	N/A
GTC0189	28-Nov-23	Email	Incoming	Gwich'in Tribal Council	Sharon Snowshoe (Gwich'in Tribal Council)	N/A	Daryl Harrison (Two Worlds Consulting), Peter Csicsai (Gwich'in Tribal Council), Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Sharon Snowshoe (Gwich'in Tribal Council)	Interview Request	Sharon (Gwich'in Tribal Council) emailed Jorge (Two Worlds Consulting) and cc'd Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting) and asked if Jorge (Two Worlds Consulting) is asking if they are asking to speak with a rep from the Department of Culture & Heritage about their culture and heritage research activities or is Two Worlds Consulting doing a Traditional Knowledge study.	N/A	N/A
GTC0190	29-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Daryl Harrison (Two Worlds Consulting), Peter Csicsai (Gwich'in Tribal Council), Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Jamie Koe (Gwich'in Tribal Council)	Interview Request	Jorge (Two Worlds Consulting) emailed Peter (Gwich'in Tribal Council), Alicia (Gwich'in Tribal Council) and cc'd Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), and Jamie K (Gwich'in Tribal Council) stating that they can organize a group meeting for the interviews. Jorge (Two Worlds Consulting) stated they will reach out to Alicia to plan a meeting with her for the interview. Jorge (Two Worlds Consulting) stated that they understand that Peter (Gwich'in Tribal Council) is located in Victoria, so Two Worlds Consulting can schedule an in-person interview in early January.	N/A	N/A
GTC0192	29-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Daryl Harrison (Two Worlds Consulting), Peter Csicsai (Gwich'in Tribal Council), Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Sharon Snowshoe (Gwich'in Tribal Council)	Interview Request	Jorge (Two Worlds Consulting) emailed Sharon (Gwich'in Tribal Council) and cc'd Daryl (Two Worlds Consulting) Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting) stating Two Worlds Consulting is not conducting a Traditional Knowledge Study. Jorge (Two Worlds Consulting) is trying to fill the information gaps Two Worlds Consulting identified during their desktop research regarding the current socio-economic conditions related to the Chance Eagle Plains Project, as well as land and resource usage in the Eagle Plains. Jorge (Two Worlds Consulting) is trying to meet with Gwich'in Tribal Council staff that may know about these subjects.	N/A	N/A
GTC0193	29-Nov-23	Email	Incoming	Gwich'in Tribal Council	Kristi Benson (Gwich'in Tribal Council)	N/A	Sharon Snowshoe (Gwich'in Tribal Council), Jorge Soler-Cruz (Two Worlds Consulting), Kristi Benson (Gwich'in Tribal Council)	Interview Request	Kristi (Gwich'in Tribal Council) emailed Sharon (Gwich'in Tribal Council) and Jorge (Two Worlds Consulting), stating they are responding on behalf of Sharon. Noted Sharon would be available to attend the Open House on December 7, 2023 in Fort McPherson. Kristi (Gwich'in Tribal Council) stated they want to speak to Jorge (Two Worlds Consulting).	N/A	N/A
GTC0194	29-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Sharon Snowshoe (Gwich'in Tribal Council), Jorge Soler-Cruz (Two Worlds Consulting), Kristi Benson (Gwich'in Tribal Council)	Interview Request	Jorge (Two Worlds Consulting) emailed Kristi (Gwich'in Tribal Council), and Sharon (Gwich'in Tribal Council) requesting the best time to meet on December 7, 2023 so they could send a calendar invite.	N/A	323-Chance-FortMcPhersonDec7Advertisement-20231127
GTC0197	29-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance), Cindy Dickson (Chance)	Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council), Cindy Dickson (Chance), Kevin Simpson (Two Worlds Consulting), Alicia McRae, Eliza Bethune (Two Worlds Consulting)	Hybrid Open House Question	Eliza (Two Worlds Consulting) emailed Alicia (Gwich'in Tribal Council), cc'd Kanda (Gwich'in Tribal Council), Peter (Gwich'in Tribal Council), Cindy (Chance), Greg (Chance), Kevin (Two Worlds Consulting), and attached a 1-page Chance Fort McPherson Open House advertisement. Eliza (Two Worlds Consulting) requested Alicia (Gwich'in Tribal Council) post this advertisement on Gwich'in Tribal Council platforms.	N/A	N/A

GTC0229	29-Nov-23	Community Event Flyer and Radio Advertisement	Incoming	Gwich'in Tribal Council	Chance	Cindy Dickson (Chance)	Gwich'in Tribal Council	Open House Advertisement	Chance sent an event invitation poster on November 29, 2023 to Gwich'in Tribal Council staff to post in Fort McPherson facilities. This invitation was targeted to Gwich'in Participants and residents of Fort McPherson. Chance shared the Open House invitation via a rolling advertisement with a local radio station. The invitation provided key information such as event purpose, event location and time, and Chance contact information to share questions and/or feedback about the Open House or the Project. The invitation also provided a virtual event option for Gwich'in Participants in Aklavik and Tsiigehtchic.	N/A	N/A
GTC0198	29-Nov-23	Email	Incoming	Gwich'in Tribal Council	Alicia McRae	Greg Charlie (Chance), Cindy Dickson (Chance)	Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council), Cindy Dickson (Chance), Kevin Simpson (Two Worlds Consulting), Alicia McRae, Eliza Bethune (Two Worlds Consulting)	Open House Advertisement	Alicia (Gwich'in Tribal Council) emailed Eliza (Two Worlds Consulting) and cc'd Kanda (Gwich'in Tribal Council), Peter (Gwich'in Tribal Council), Cindy (Chance), Greg (Chance), and Kevin (Two Worlds Consulting) and stated that since the advertisement for the Open House is now allowed on Gwich'in Tribal Council platforms, since it was not a Gwich'in Tribal Council produced document and/or a Gwich'in Tribal Council-held event. Alicia (Gwich'in Tribal Council) recommended Two Worlds Consulting post these around the community and have someone in Inuvik post these around the community as well.	N/A	N/A
GTC0199	29-Nov-23	Email	Incoming	Gwich'in Tribal Council	Alicia McRae	Greg Charlie (Chance), Cindy Dickson (Chance)	Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council), Cindy Dickson (Chance), Kevin Simpson (Two Worlds Consulting), Alicia McRae, Eliza Bethune (Two Worlds Consulting)	Open House Advertisement	Greg (Chance) emailed Alicia (Gwich'in Tribal Council), Eliza (Two Worlds Consulting) and cc'd Kanda (Gwich'in Tribal Council), Peter (Gwich'in Tribal Council), Cindy (Chance), and Kevin (Two Worlds Consulting), and stated that their contacts had posted the advertisement in Fort McPherson.	N/A	N/A
GTC0200	29-Nov-23	Email	Incoming	Gwich'in Tribal Council	Alicia McRae	Greg Charlie (Chance), Cindy Dickson (Chance)	Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council), Cindy Dickson (Chance), Kevin Simpson (Two Worlds Consulting), Alicia McRae, Eliza Bethune (Two Worlds Consulting)	Open House Advertisement	Alicia (Gwich'in Tribal Council) emailed Greg (Chance), Eliza (Two Worlds Consulting), and cc'd Kanda (Gwich'in Tribal Council), Peter (Gwich'in Tribal Council), Cindy (Chance), and Kevin (Two Worlds Consulting), thanking Greg (Chance) for confirmation of the advertisements being sent out.	N/A	N/A
GTC0201	29-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance), Cindy Dickson (Chance)	Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council), Cindy Dickson (Chance), Kevin Simpson (Two Worlds Consulting), Alicia McRae, Eliza Bethune (Two Worlds Consulting)	Open House Advertisement	Eliza (Two Worlds Consulting) emailed Alicia (Gwich'in Tribal Council), Greg (Chance), and cc'd Kanda (Gwich'in Tribal Council) Peter (Gwich'in Tribal Council), Cindy (Chance), Kevin (Two Worlds Consulting), and said thanks to Greg (Chance) for confirming the advertisements had been sent out.	N/A	N/A
GTC0195	30-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Sharon Snowshoe (Gwich'in Tribal Council), Jorge Soler-Cruz (Two Worlds Consulting), Kristi Benson (Gwich'in Tribal Council)	Interview Request	Jorge (Two Worlds Consulting) emailed Kristi (Gwich'in Tribal Council) and Sharon (Gwich'in Tribal Council) and requested confirmation if Sharon (Gwich'in Tribal Council) is based in Fort McPherson or Inuvik, since it would affect their meeting and meeting time.	N/A	N/A
GTC0196	30-Nov-23	Email	Incoming	Gwich'in Tribal Council	Sharon Snowshoe (Gwich'in Tribal Council)	N/A	Sharon Snowshoe (Gwich'in Tribal Council), Jorge Soler-Cruz (Two Worlds Consulting), Kristi Benson (Gwich'in Tribal Council)	Interview Request	Sharon (Gwich'in Tribal Council) emailed Jorge (Two Worlds Consulting), Kristi (Gwich'in Tribal Council), and cc'd Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), Daryl (Two Worlds Consulting) stating they are based in Fort McPherson.	N/A	N/A
GTC0202	30-Nov-23	Email	Outgoing	Gwich'in Tribal Council	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Sharon Snowshoe (Gwich'in Tribal Council), Kristi Benson (Gwich'in Tribal Council), Jorge Soler-Cruz (Two Worlds Consulting)	Interview Request and Open House	Jorge (Two Worlds Consulting) emailed Sharon (Gwich'in Tribal Council), Kristi (Gwich'in Tribal Council), and cc'd Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), and Daryl (Two Worlds Consulting) requesting confirmation they can meet in person before the Open House for the socio-economic interview. Jorge (Two Worlds Consulting) stated they can also meet virtually on December 7, 2023 if needed.	N/A	N/A
GTC0203	1-Dec-23	Email	Incoming	Gwich'in Tribal Council	Kirsti Benson	N/A	Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Sharon Snowshoe (Gwich'in Tribal Council), Kristi Benson (Gwich'in Tribal Council), Jorge Soler-Cruz (Two Worlds Consulting)	Interview Request	Kristi (Gwich'in Tribal Council) emailed Jorge (Two Worlds Consulting), Sharon (Gwich'in Tribal Council), and cc'd Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), and Daryl (Two Worlds Consulting) requesting Sharon (Gwich'in Tribal Council) and Kristi (Gwich'in Tribal Council) be a part of the same socio-economic interview.	N/A	N/A

GTC0210	1-Dec-23	Email	Outgoing	Gwich'in Tribal Council	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Sharon Snowshoe (Gwich'in Tribal Council), Kirsti Benson, Jorge Soler-Cruz (Two Worlds Consulting)	Interview Timeline	Jorge (Two Worlds Consulting) emailed Kristi (Gwich'in Tribal Council) and Sharon (Gwich'in Tribal Council) and cc'd Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), and Daryl (Two Worlds Consulting) confirming more details about the socio-economic interview timelines would be provided when available so a meeting can be scheduled with both Sharon (Gwich'in Tribal Council) and Kristi (Gwich'in Tribal Council)	N/A	N/A
GTC0175	4-Dec-23	Email	Incoming	Gwich'in Tribal Council	Alicia McRae	Greg Charlie (Chance)	Eliza Bethune (Two Worlds Consulting), Alicia McRae	Contact Information	Alicia (Gwich'in Tribal Council) emailed Eliza (Two Worlds Consulting) and Greg (Chance) providing their phone number.		
GTC0211	4-Dec-23	Email	Outgoing	Gwich'in Tribal Council	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Sharon Snowshoe (Gwich'in Tribal Council), Kirsti Benson, Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting)	Interview Timeline	Jorge (Two Worlds Consulting) emailed Kristi (Gwich'in Tribal Council) and Sharon (Gwich'in Tribal Council) and cc'd Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), and Daryl (Two Worlds Consulting) requesting confirmation of availability from Kristi (Gwich'in Tribal Council) and Sharon (Gwich'in Tribal Council) to attend the Open House in Fort McPherson on December 7, 2023.	N/A	N/A
GTC0211	4-Dec-23	Email	Incoming	Gwich'in Tribal Council	Kirsti Benson,	N/A	Sharon Snowshoe (Gwich'in Tribal Council), Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting)		Kristi (Gwich'in Tribal Council) emailed Jorge (Two Worlds Consulting) confirming availability for December 7, 2023.	N/A	N/A
GTC0212	5-Dec-23	Email	Incoming	Gwich'in Tribal Council	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Peter Csicsai (Gwich'in Tribal Council), Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting)	Interview Scheduling	Peter (Gwich'in Tribal Council) emailed Jorge (Two Worlds Consulting) and Alicia (Gwich'in Tribal Council) and cc'd Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), and Jamie K. agreeing with Jorge (Two Worlds Consulting) on the plans to organize a group meeting for the interviews, reach out to Alicia to about a socio-economic interview in early January 2024.	N/A	N/A
GTC0213	05-Dec-23	Email	Outgoing	Gwich'in Tribal Council	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Jorge Soler-Cruz (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Kanda Gnama (Gwich'in Tribal Council)	Interview Request	Jorge (Two Worlds Consulting) emailed Kanda (Gwich'in Tribal Council) and cc'd Rebecca (Two Worlds Consulting), Eliza (Two Worlds Consulting), and Daryl (Two Worlds Consulting), requesting an interview regarding health and wellness in their community.	N/A	N/A
GTC0214	6-Dec-23	Email	Outgoing	Gwich'in Tribal Council	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Sharon Snowshoe (Gwich'in Tribal Council), Kirsti Benson, Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting)	Interview Time Confirmation	Jorge (Two Worlds Consulting) emailed Sharon (Gwich'in Tribal Council)requesting confirmation that Sharon (Gwich'in Tribal Council) was available for the 3:00PM socio-economic interview time.	N/A	N/A
GTC0214	6-Dec-23	Email	Incoming	Gwich'in Tribal Council	Sharon Snowshoe (Gwich'in Tribal Council)	N/A	Kirsti Benson, Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting)	Interview Time Confirmation	Sharon (Gwich'in Tribal Council) emailed Jorge (Two Worlds Consulting) and Kristi (Gwich'in Tribal Council) and cc'd Daryl H, Eliza (Two Worlds Consulting), and Rebecca (Two Worlds Consulting) confirming availability for the interview time.	N/A	N/A
GTC0215	7-Dec-23	Email	Outgoing	Gwich'in Tribal Council	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Jorge Soler-Cruz (Two Worlds Consulting), Alicia McRae, Eliza Bethune (Two Worlds Consulting)	Interview Request	Jorge (Two Worlds Consulting) emailed Alicia (Gwich'in Tribal Council) and cc'd Eliza (Two Worlds Consulting) requesting an interview regarding health and wellness in the Gwich'in Tribal Council community.	N/A	N/A
GTC0216	7-Dec-23	Email	Incoming	Gwich'in Tribal Council	Alicia McRae	N/A	Jorge Soler-Cruz (Two Worlds Consulting), Alicia McRae, Eliza Bethune (Two Worlds Consulting)	Interview Availability	Alicia (Gwich'in Tribal Council) emailed Jorge (Two Worlds Consulting) and cc'd Eliza (Two Worlds Consulting) confirming availability for a socio-economic interview.	N/A	N/A

GTC0220	7-Dec-23	Community Event	N/A	Gwich'in Tribal Council	N/A	Cindy Dickson (Chance)	Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Mike Setterington (Environmental Dynamics Inc.) (Environmental Dynamics Inc.), Tim Bennett (Ecofor), Roberta Adams (Palmer), Clive Mountford, Daryl Robbins, Alicia McRae, Gwich'in Participants	Community Open House Event	Chance held a community Open House event in Fort McPherson at the Tetlit' Zheh Fort McPherson Hamlet Chamber from 4:00PM to 8:00PM MST. Open House attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to the Open House attendees. The Open House event had door prizes that were drawn throughout the event which included 2 Air North gift cards, 2 Co-op grocery gift cards, and Ecofor packages. Representatives at the Open House from the Project Team included Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting) (Two Worlds Consulting), Haylee Dlouhy (Two Worlds Consulting) (Two Worlds Consulting), Mike Setterington (Environmental Dynamics Inc.) (Environmental Dynamics Inc.) (Environmental Dynamics Inc.), Tim Bennett (Ecofor) (Ecofor), Roberta Adams (Palmer) (Palmer), Clive Mountford (Mountford Consulting), Daryl Robbins (Peer Solutions), and Cindy Dickson (Chance) (Chance). Alicia (Gwich'in Tribal Council) also joined the Project Team at the Open House event.	N/A	N/A
GTC0217	8-Dec-23	Email	Incoming	Gwich'in Tribal Council	Sharon Snowshoe (Gwich'in Tribal Council)	N/A	Sharon Snowshoe (Gwich'in Tribal Council), Kirsti Benson, Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting)	Traditional Knowledge and Engagement Process	Sharon (Gwich'in Tribal Council) emailed Jorge (Two Worlds Consulting) and Kristi (Gwich'in Tribal Council) and cc'd Eliza (Two Worlds Consulting), Daryl (Two Worlds Consulting), and Rebecca (Two Worlds Consulting) providing information on the process of gathering and using Gwich'in Knowledge for an assessment. The process includes the developer signing a research agreement, conducting primary and secondary research as needed, and interviews with land users. Sharon (Gwich'in Tribal Council) stated that engagement with the Department of Culture and Heritage did not constitute gathering Gwich'in Traditional Knowledge and land use information.	Kristi B. to review and sign consent form.	20231215-GTC0219A
GTC0218	15-Dec-23	Email	Outgoing	Gwich'in Tribal Council	Kevin Simpson (Two Worlds Consulting)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Peter Csisai, Kevin Simpson (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting)	Secondary Traditional Knowledge Source Review Request	Kevin (Two Worlds Consulting) emailed Alicia (Gwich'in Tribal Council) and Kanda (Gwich'in Tribal Council) and cc'd Peter (Gwich'in Tribal Council), Greg (Chance), Cindy (Chance), Eliza (Two Worlds Consulting), and Jorge (Two Worlds Consulting), asking if either Alicia (Gwich'in Tribal Council) or Kanda (Gwich'in Tribal Council) had reviewed the list of publicly available Traditional Knowledge sources for Gwich'in Tribal Council, and noted that Gwich'in Tribal Council would have the opportunity to make sure the information is characterized once the Project Proposal was drafted.	N/A	20240104-GTC0221A 20240104-GTC0221B 20240104-GTC0221C 20240104-GTC0221D
GTC0219	15-Dec-23	Email	Outgoing	Gwich'in Tribal Council	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Sharon Snowshoe (Gwich'in Tribal Council), Kirsti Benson, Alicia McRae, Kanda Gnama (Gwich'in Tribal Council), Jorge Soler-Cruz (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting)	Traditional Knowledge and Engagement Process	Jorge (Two Worlds Consulting) emailed Sharon (Gwich'in Tribal Council) and Kristi (Gwich'in Tribal Council) and cc'd Alicia (Gwich'in Tribal Council), Kanda (Gwich'in Tribal Council), Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), and Kevin (Two Worlds Consulting) stating that Two Worlds Consulting was not collecting information for a Traditional Knowledge or Traditional Land Use study, but instead was confirming publicly available information on current socio-economic conditions in the Eagle Plains area, including current land and resource use activities of Gwich'in Participants which will be submitted to the YESAB. Jorge stated that Two Worlds Consulting was meeting monthly with staff from Gwich'in Tribal Council Land and Resource Use Department to discuss the Project, who recommended that Two Worlds Consulting contact Sharon to discuss the questions in the socio-economic information collection program, and that anyone from the Gwich'in Tribal Council Heritage Team could remove consent for use of any information once Two Worlds Consulting provides a summary of the interviews for review. Jorge stated that Two Worlds Consulting previously requested review and approval from Gwich'in Tribal Council of publicly available secondary Traditional Knowledge sources, which would be used to inform existing socio-economic conditions, potential Project-related effects, and possible mitigation or enhancement measures. Jorge asked Kristi (Gwich'in Tribal Council) to sign the consent form.	N/A	N/A

APPENDIX 2-B-35. Consultation and Engagement Letter - document not available at time of submission.

APPENDIX 2-B-36. Draft *Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan* – document not available at time of submission.

APPENDIX 2-B-37. Exploration Permit Areas Map – document not available at time of submission.

APPENDIX 2-B-38. Extension of Exploration Tenure Permits Letter – document not available at time of submission.

APPENDIX 2-B-39. *Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan* – document not available at time of submission.

APPENDIX 2-B-40. Final *Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan* – document not available at time of submission.

APPENDIX 2-B-41. Chance's permitted Project Footprint Map – document not available at time of submission.

APPENDIX 2-B-42. *Gwich'in Partners and Chance Oil and Gas Limited Communications and Consultation Plan* – document not available at time of submission.

APPENDIX 2-B-43. Draft *Terms of Reference (TOR)* – document not available at time of submission.

APPENDIX 2-B-44. Draft *Terms of Reference* (Version 2) – document not available at time of submission.

APPENDIX 2-B-45. Draft *Project Description*

YESAB PROJECT PROPOSAL

DRAFT PROJECT DESCRIPTION

Eagle Plains Well Maintenance

Chance Oil and Gas Limited

Prepared for:

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Prepared by:

Hemmera Envirochem Inc.
2237–2nd Avenue, Suite 230
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May 22, 2020
File No. 104709-01

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LIST OF ACRONYMS AND ABBREVIATIONS

List of Acronyms	
Acronym	**Definition**
BOP	Blowout Preventer
DO	Designated Office
DFO	Fisheries and Oceans Canada
mKB	Meters below Kelly bushing
SCVF	Surface casing vent flow
YESAA	Yukon Environmental and Socio-Economic Act
YESAB	Yukon Environmental and Socio-Economic Assessment Board

1.0 INTRODUCTION

Chance Oil and Gas Limited (Chance) is proposing to conduct routine maintenance on eight of its suspended wells near Eagle Plains, Yukon (the "Project"). Government of Yukon, Oil and Gas Branch (the "Regulator"), has notified Chance that well maintenance is required in order to maintain the suspended well status on four of the wells: NCY McParlon A-25, NCY Ehnjuu Choo B-73, NCY East Chance E-78 and NCY West Chance H-28. Wells Canoe River Chance J-19, Socony Mobil WM Blackie No 1 M-59, Socony Mobil WM Chance YT No 1 YT G-08, and Western Minerals Chance YT No 1 M-08 will also undergo maintenance work. A suspended well is considered a well that is not producing and has been safely secured. With a well in suspension, there is potential to restart production later. This differs from well abandonment where the well is permanently shut down, plugged, the well head is removed and is considered safe and secure by regulators (CAPP, 2019). Well maintenance activities, also known as well workovers, include the following activities:

- Pressure testing to confirm integrity of the casing and well head valves;
- Removal of equipment in the well bores such as tubing and plugs;
- Wireline investigations to measure temperatures and cement integrity and to convey any perforating equipment; and
- Remedial work such as cement squeezes and possible well abandonment.

To facilitate movement of maintenance equipment and crews to the well sites, the project will require re-establishment of the Chance and Blackie winter roads.

The proposal is being submitted to the Yukon Environmental and Socio-economic Assessment Board (YESAB) for an assessment under the *Yukon Environmental and Socio-economic Act* (YESAA). This is required in order to obtain the necessary permits and authorizations to perform the work.

1.1 Proponent Contact Information

The Project proponent for the assessment under the *Yukon Environmental and Socio-economic Assessment Act* (YESAA) is Chance Oil and Gas Ltd. The Proponent has retained Hemmera to prepare and submit the Project Proposal to the DO office in Dawson.

The Proponent contact information is:

Greg Charlie, Vice President
Chance Oil and Gas Ltd.
Suite 202, 208 Main Street
Whitehorse, Yukon, Y1A 2A9
Email: gcharlie@chanceyukon.ca

The Agent contact information is:

Hemmera Envirochem Inc.
Andrew MacPhail, Project Manager
230 - 2237 2nd Avenue

Whitehorse, Y1A 0K7 Yukon
Email: andrew.macphail@hemmera.com

The preferred method of communication for the Proponent and Agent is via email. The Agent authorization form has been submitted to the Designated Office as part of the Project Proposal documents.

1.2 Location

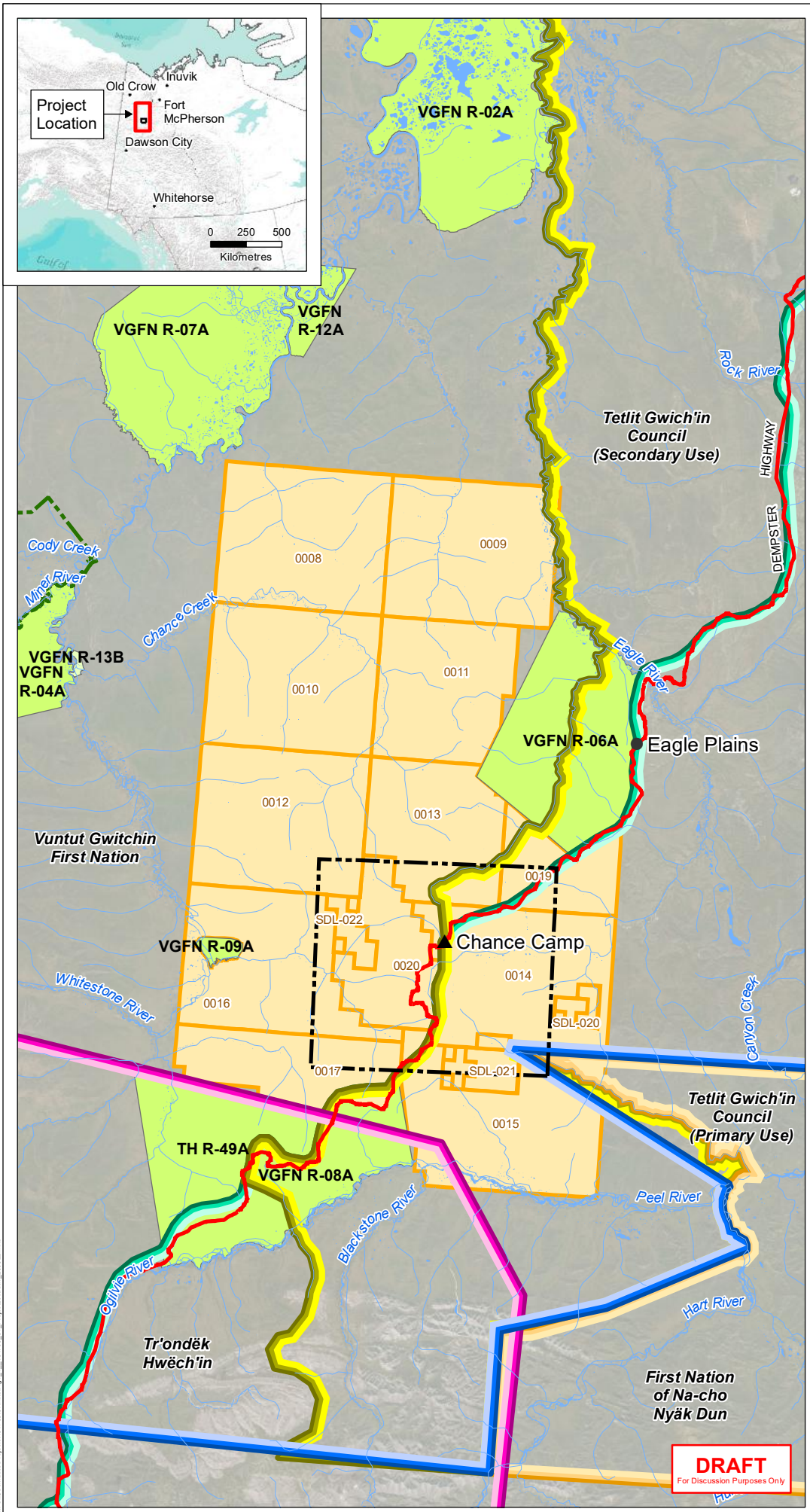
The Project is located 30 to 70 km south of Eagle Plains Hotel, in northeast Yukon (**Figure 1.1**). The exploration wells requiring maintenance are detailed in **Table 2.1** and **Figure 1.2**.

Seven of the wells are located in the upper reaches of the Porcupine River watershed on the west side of the Dempster Highway and one is located in the upper reaches of the Peel River watershed on the east side of the Dempster Highway. The nearest watercourse of the wells located in the Porcupine watershed are McParlon Creek which has two tributaries framing the south and western sides of the Chance Significant Discovery License and Ehnjuu Choo Creek. The watercourse nearest the Blackie M-59 well is Dalgleish Creek which flows into the Ogilvie River. There are no water bodies (i.e., lakes or ponds) in the area of proposed activity.

The Dempster Highway transects the area of proposed activity and provides the all season access to the Blackie winter road, the Chance winter road, and the suspended wells at McParlon A-25 and Ehnjuu Choo B-73 which are located immediately adjacent to the Dempster Highway. The nearest outpost is the Eagle Plains Hotel and Highway Maintenance Base which is located approximately 30 to 70 km north of the locations where the workovers are planned to occur. (**Figure 1.2**)

The latitude and longitude coordinates for the proposed Project are:

NW:	66.20808719	(lat/northing)	-137.6280058	(long/easting)
NE:	66.21832565	(lat/northing)	-136.9320243	(long/easting)
SW:	65.96218433	(lat/northing)	-137.6037058	(long/easting)
SE:	65.97269282	(lat/northing)	-136.9164459	(long/easting)



Eagle Plains Exploration Project
Yukon

Project Location

Legend

- Chance Camp
- Project Area
- Dempster Highway
- Watercourse
- Waterbody
- Oil and Gas Dispositions
- Protected Area

First Nation Traditional Territories

- First Nation of Na-cho Nyäk Dun
- Tetlit Gwich'in Council (Primary Use Area)
- Tetlit Gwich'in Council (Secondary Use Area)
- Tr'ondëk Hwëch'in
- Vuntut Gwitchin First Nation

First Nation Settlement Lands

- Surface Rights
- Surface and Subsurface Rights

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

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- Aerial Image: ESRI World Imagery
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104709-01	Production Date: May 22, 2020	Figure 1.1

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1.2.1 First Nations

The proposed Project is located in the following First Nations and Indigenous groups' traditional territories (**Figure**):

- First Nation of Na-Cho Nyäk Dun (FNNND)
- Gwich'in Gwich'in Tribal Council (GTC)
- Vuntut Gwitchin First Nation (VGFN)

The proposed Project area is north of the Tr'ondëk Hwëch'in First Nation Traditional Territory and Settlement Land. The Traditional Territories and Settlement Land blocks in the vicinity of the Project are detailed on **Figure 1.1**.

1.2.2 Yukon Environmental and Socio-Economic Assessment Act (YESAA) Triggers

The proposed Project requires an evaluation by a Yukon Environmental and Socio-economic Assessment Board (YESAB) Designated Office (DO) because:

1. The project location is in the Yukon;
2. Schedule 1, Part 3, Oil and Natural Gas, Item 2:
    a. *On other than an Indian reserve, drilling, operation, modification, decommissioning or abandonment of, or other activity in relation to, an oil or natural gas well or seismic shot hole, but not including a hole drilled to obtain geological information.*
3. Schedule 1, Part 13, Miscellaneous, Item 13:
    a. On Crown land or settlement land, levelling, grading, clearing cutting or snow ploughing of a route that provides access to land for the purposes of a geophysical, geological or engineering survey.

The Project is located near Eagle Plains, Yukon and it is understood that the Dawson Designated Office will carry out the evaluation.

1.3 Permits and Licenses / Regulatory Requirements

Over the past several years Chance has operated in Eagle Plains, Yukon. The site is authorized under a suite of project approvals including:

- Type B Water Licence (MN12-061-1);
- Land Use Permits (LUP 2012-F507, LUP2012-F510);
- Oil and Gas Dispositions (0008 to 0017, 0019 and 0020, SDL-020, SDL-021, and SDL-022);
- Dempster Highway Development Authorization;
- Air Emissions Permit (60-035);
- Waste Management Permit (81-044);
- Camp Permits (Health and Social Services, Permit to Operate);
- Camp Lease with Energy Mines and Resources, Government of Yukon; and
- Various highway access and work within the right-of-way, specifically permit 1735 for camp 325.

1.4 Alternatives

The well maintenance work is mandated by the Regulator and there are no alternatives to complete the required work. There are no alternatives for winter road construction as there are already previously existing winter roads that will be re-opened and utilized (Chance and Blackie). This approach reduces the potential effects associated with constructing new access to the well sites.

2.0 PROJECT DESCRIPTION

2.1 Project Activities

This section provides an overview of the proposed Well Maintenance Program. There are two main components to the Project that include:

- Routine maintenance of suspended wells (well workover); and
- Re-establishment of the Chance winter road and Blackie winter road.

The well maintenance activities proposed are being conducted in order to satisfy a direct order from Government of Yukon, Oil and Gas Branch. Accessory activities, such as construction and re-establishment of the winter roads, is required to access the suspended well sites and complete the maintenance of each well. A letter outlining the order from the Government of Yukon, Oil and Gas Branch is provided in **Appendix A**. Locations for each of the wells is provided in **Table 2.1** and **Figure 2.1**. Location of the winter roads are also provided in **Figure 2.1**.

2.2 Well Maintenance

The following section describes the work proposed at each of the wells. Each of the wells is deemed suspended by the Yukon Oil and Gas and Drilling Production Regulations (OGDPR) (is not producing and safely secured). Well maintenance is required to continue to meet the OGDPR suspended well status regulations. Well servicing equipment may include a service rig, wireline truck and cementing trucks along with the associated support equipment. All equipment will be mobilized to each of the wells on a sequential basis (one at a time) to complete the required maintenance work (downhole suspension, wellbore fluid replacement, replace substandard equipment). The eight wells that require maintenance include:

- Socony Mobil WM Blackie No 1 M-59 (M-59);
- Western Minerals Chance YT No 1 M-08 (M-08);
- Canoe River Chance YT J-19 (J-19);
- Socony Mobil WM Chance YT No 1 YT G-08 (G-08);
- NCY McParlon A-25 (A-25);
- NCY Ehnjuu Choo B-73 (B-73);
- NCY West Chance H-28 (H-28); and
- NCY East Chance E-78 (E-78).

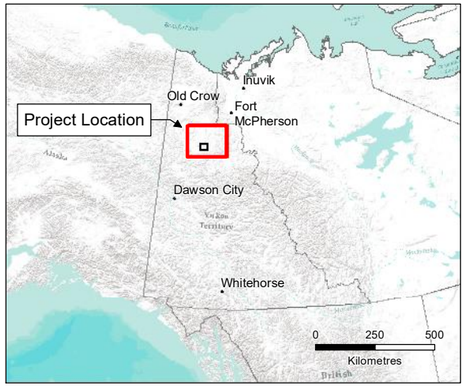
A description of the planned activities at each well is summarized in the following sections.

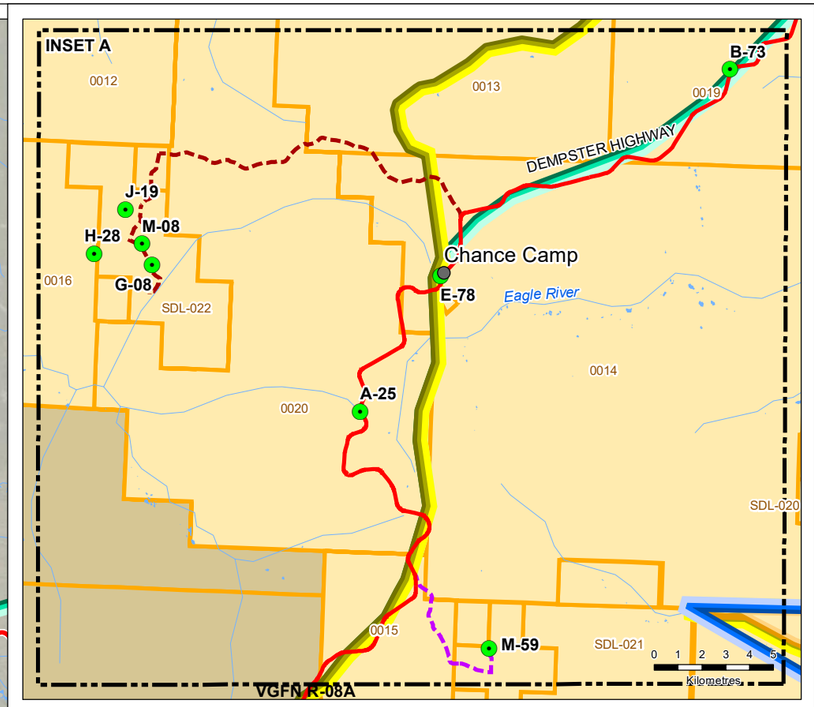
Table 2.1: Well Locations

Well Name	Location	
	Latitude	Longitude
Socony Mobil WM Blackie No 1 YT M-59	65° 58’ 54.93.9” N	137° 18’ 58.2” W
Western Minerals Chance YT No 1 M-08	66° 07’ 46.0” N	137° 31’ 27.3” W
Canoe River Chance YT J-19	66° 08’ 31.0” N	137° 32’ 27.0” W
Socony Mobil WM Chance YT No 1 YT G-08	66° 07’ 18.1” N	137° 30’ 50.8” W
NCY McParlon A-25	66° 04’ 10.3” N	137° 18’ 58.2” W
NCY Ehnjuu Choo B-73	66° 12’ 10.3” N	136° 59’ 01.5” W
NCY West Chance H-28	66° 07’ 29.8” N	137° 34’ 05.6” W
NCY East Chance E-78	66° 07’ 18.5” N	137° 14’ 46.8” W

Eagle Plain Well Maintenance
Yukon

Project Location





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For Discussion Purposes Only

Legend

- Wellsite
- Project Area
- Dempster Highway
- Blackie Winter Road
- Chance Winter Road
- Trails/Access
- Oil and Gase Seismic Lines
- Watercourse
- Waterbody
- Oil and Gas Dispositions within Project Area
- Oil and Gas Dispositions outside Project Area
- Protected Area

First Nation Traditional Territories

- First Nation of Na-cho Nyäk Dun
- Tetlit Gwich'in Council (Primary Use Area)
- Tetlit Gwich'in Council (Secondary Use Area)
- Tr'ondëk Hwëch'in
- Vuntut Gwitchin First Nation

First Nation Settlement Lands

- Fee Simple
- Surface Rights
- Surface and Subsurface Rights

Notes

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104709-01	Production Date: May 22, 2020	Figure 2.1

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2.2.1.1 Socony Mobil WM Blackie No 1 YT M-59, Western Minerals Chance YT No 1 M-08, Canoe River Chance YT J-19, and Socony Mobil WM Chance YT No 1 YT G-08

A pressure test is conducted to ensure the integrity of the wellhead and the existing casing in the wellbore. The well will then undergo surface casing vent flow and gas migration testing. Surface casing vent flow (SCVF) is a condition where fluid or gas is flowing from the surface casing vent assembly. A well that has a leak, or a well integrity problem may exhibit signs of SCVF. Gas migration tests are conducted to determine if the well has a gas migration problem. For the purpose of this test, gas migration can be defined as the movement of gas from a subsurface zone to surface through a barrier that should prevent its movement, whether this barrier is natural (overburden, shale) or artificial (cement sheath, external casing packed, pipe joints etc.). It should be noted that during annual inspections, no SCVF has ever been detected.

Once the pressure testing, surface casing vent flow testing and gas migration testing is complete, the service rig, support equipment and wireline will be moved to the wellsite. A blowout preventer (BOP) will be installed on the well. Blowout preventers are specialized pressure-control equipment attached to the wellhead to seal, control and monitor oil and gas wells to prevent the uncontrolled release of crude oil or natural gas while operations are occurring on the well. A temperature log will then be conducted to a depth of 300 meters below Kelly bushing (mKB). The temperature log is interpreted by looking for anomalies, or departures, from the reference gradient. This reference gradient might be the geothermal gradient, a log recorded before production or started, or a log recorded with the well shut in. Most anomalies are related to the entry of fluids into the borehole or fluid exit into the formation. Following the temperature log, a cement bond log will be run. The cement log is a log that uses the variations in amplitude of an acoustic signal travelling down the casing wall between a transmitter and receiver to determine the quality of cement bond on the exterior casing wall. The fundamental principal is that the acoustic signal will be more attenuated in the presence of cement than if the casings were uncemented. The cement log is used to identify sections of the well bore that will need interventions to isolate porous formations from adjacent formations.

To isolate a formation from an adjacent formation, the casing will be perforated at the appropriate depth with a wireline conveyed perforating gun. Tubing will then be used to inject cement through the perforations in sufficient quantity to ensure adjacent formations are isolated from each other, at which point pressure will be applied from surface to force the cement into the perforations. Once the cement has cured, the cement will be pressure tested as per the Yukon Oil and Gas and Drilling Production Regulations. The process is then repeated until all formations are isolated from one another and pressure tested. The isolation operations will begin with the deepest non-isolated formation and progress to the shallowest non-isolated formation. Once all the testing/isolation procedures are complete, the tubing will be pulled from the well, a new well head assembly will be installed, and the well head will be pressure tested once more. The service rig and all support equipment will then be removed from the site.

Additional activities at M-59 include installation of a wellhead that conforms to the OGDPR regulation. In addition, for G-08 and J-19, the tubing and packer will be removed during the workover following completion of gas migration testing and temperature log will not be conducted.

2.2.1.2 NCY McParlon A-25, NCY Ehnjuu Choo B-73, NCY West Chance H-28, and NCY East Chance E-78

A pressure test is conducted to ensure the integrity of the wellhead and the existing casing in the wellbore. The well will then undergo surface casing vent flow and gas migration testing. SCVF is a condition where fluid or gas is flowing from the surface casing vent assembly. A well that has a leak, or a well integrity problem may exhibit signs of SCVF. Gas migration tests are conducted to determine if the well has a gas migration problem. For the purpose of this test, gas migration can be defined as the movement of gas from a subsurface zone to surface through a barrier that should prevent its movement, whether this barrier is natural (overburden, shale) or artificial (cement sheath, external casing packed, pipe joints etc.). It should be noted that during annual inspections, no SCVF has ever been detected on any of the wells.

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The wellbore fluid will be sampled and tested to determine if the fluid meets the OGDPR regulations. After the wellbore fluid is tested and if necessary, a service rig may be moved in to replace the well fluid to conform to the Yukon Oil and Gas and Drilling Production Regulations 99(a) and 99(b). A wellbore fluid test is a test or series of tests, performed to check that no undesirable reactions occur with a specific fluid. The testing process may include checks for compatibility with other treating fluids, wellbore fluids, reservoir fluids, and the reservoir formation. No other activities are anticipated at these wells.

2.2.1.3 Equipment

Equipment required for well maintenance is described below in **Table 2.2**. Equipment will be stored on site mainly on trucks and flatbed trailers. Some items such as the boiler and cement tanks will be placed on the ground on skids.

Table 2.2: Equipment required

Component	Description
Boilers	Used extensively in very cold and Arctic climates for preventing equipment and fluids from freezing.
Light Towers	Light towers will be required on the wellsites as the operations will run 24 hours a day
Construction Equipment	Challenger cats, D6 cats, snow cats, graders, snow making equipment, water trucks and drags will be utilized during the initial phase of the project to prepare the roads and well pads for the operations
Light trucks	Pickup trucks will be used for transportation of work crews, fuel and other supplies.

Component	Description
Vacuum truck	Used for removal and transportation of wastewater and sewage from the medic/first aid traler for disposal.
Cement	Cement storage and mixing for use in wells.
Medic / Office Trailers	Essential personnel trailers which serve as offices. All office trailers will have self-contained sewage storage and sewage will be moved periodically to the sewage lagoon at the Chance camp at Km 324
Flare Tank and Flare	Flare used to burn combustible gas from the well. The flare tank is a reservoir to ensure the flare does not starve of combustible gases.
Fuel Storage	Fuel for use for equipment including service rig, pumps, generators, etc. Bulk fuel will be staged at the Chance camp at Km 324 and daily needs will be distributed via pickup trucks with slip tanks during crew changes.
Garbage and Incinerator	Storage area for waste and incinerator to dispose of food waste.
General Storage	Storage and laydown area for equipment needed on site.
Main Workover Fluid Storage	Location where all the fluid additive materials are stored. Normally these materials are delivered on pallets neatly stacked and shrink wrapped to protect them during the truck journey north.
Tubing Storage	Tubing will be stored on location until required to be run in the hole.
Cement Bins	Large tanks, normally upright, fully enclosed and pressurized, where cement products are stored. Cement is pneumatically pumped from the tank into the cementing unit.
Pumps	Pumps used to circulate the fluid down the pipe, around and up the annular space between the pipe and the casing to surface.
Service Rig Structure	Components required to service the well, including: • Sub-structure, or base, to which the derrick (i.e. framework to support drilling apparatus) is fixed • Derrick that supports the draw works and handling equipment • Draw works that lifts and lowers the handling equipment in the derrick/mast to run pipe in and out of the hole • Blowout preventers, which are pressure control equipment that can hydraulically shut in a well in the event of unplanned influxes of formation fluids into the wellbore
Water Storage and Water Treatment	Water storage tank and treatment containers to provide potable water for the rig crew and personnel.

2.2.2 Winter Road Construction

2.2.2.1 Site Access

By road, the Project is accessed via the Dempster Highway. The majority of highway traffic comes from the south bringing supplies and personnel from Whitehorse, YT; however, some traffic comes from the north (Fort MacPherson and Inuvik, NWT).

Wells H-28, J-19, M-08, G-08 and H-28 will be accessed by re-establishing the Chance winter road. Wells A-25 and B-73 are located immediately adjacent to the highway, and already have access routes with rig matting in place. Well M-59 will require the construction of the new Blackie winter road. The Blackie winter road is approximately 6.5 km in length and approximately 8-10 m in width. The Chance winter road is 25

km long and 8-10 m in width (**Figure 2.1**). The total surface area of the both the Chance winter road and Blackie winter road is 1,875 m^2.

2.2.2.2 Winter Road Construction Methods

Winter road construction will utilize similar techniques as previously applied by Chance in previous assessments (YESAB # 2006-0237, 2006-0285, 2007-0219, 2008-0047 and 2012-0140). Before any winter road construction will proceed, a minimum snow depth of 10 cm will be verified to ensure there is sufficient snow cover to protect the ground surface from tires or tracks of vehicles. To promote snow compaction in the early winter, the Chance winter road and Blackie winter road will be driven with snowmobiles and snowcats in late fall/early winter. Upon construction, if the snow depth (minimum of 10 cm) is not sufficient in certain areas, additional snow will be trucked in to fill those areas. This helps to ensure adequate protection to surface vegetation and duff. In the event this is required, snow will be removed from appropriate locations in the immediate vicinity of the winter road (i.e. surrounding area that has ample snow coverage) and added to the snowpack of the winter road.

Once the snow depth is adequate (i.e. 10 cm or greater in depth without compaction), vegetation along the routes will be cleared using a bulldozer and mulcher. The bulldozer blade will be raised off the ground such that it does not cut the tops of hummocks, tussocks or high spots. The vegetation removed will be mulched with a track mounted mulcher and distributed on the road. The mulch helps keeps the soil in place while protecting the root system of ground-cover plants and natural grasses. Any trees or large brush encountered will be broken at the ground surface to avoid tearing the surface organic layer thereby reducing the chance of thawing ice-rich mineral soil beneath. The likelihood of large trees or brush is low on the Chance winter as the road was last used in April 2014. Where it is safe and practical, standing live or dead trees along the route that provide wildlife habitat will be saved.

Following vegetation removal, the surface of the road will be constructed using accumulated snow to construct berms on the road margins and filling the space at the roads edge with snow and water trucked from approved sources. A combination of snowcats and bulldozers using drags will be used to push and compact the snow along the access routes. To ensure the roads ability to safely support the service rig and other heavy loads, all construction activities will be supervised by a qualified geotechnical engineer.

The same methods will be utilized to establish well sites and clear any vegetation surrounding the well site for equipment and site infrastructure. It is anticipated approximately 1,000 m^2 of vegetation will be cleared.

2.2.2.3 Water Withdrawal

Water sources will include the Eagle River and the Ogilvie River. The water will be used to make ice for the winter road(s) and will be trucked from the source to the point of use. The ice is built up along the entire length of the lease road to ensure stability. Each truckload holds approximately 30 m^3 and it is anticipated a truck can probably complete 4 to 6 deliveries per day. No more than 300 m^3 of water will be withdrawn daily. All water withdrawal will be conducted following DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 2020).

2.2.2.1 Watercourse Crossings

The roads are designed to have as few water crossings as possible by following previously travelled trails and roads located on ridges or higher areas above to stay out of wetter lower elevation areas. All water

bodies will be treated as fish bearing and be constructed following Fisheries and Oceans Canada's (DFO) Operational Statement on Ice Bridges and Snowfill (DFO 2007).

Vegetation near or within riparian zones will be preserved to the greatest extent possible. No deleterious substances will be allowed to enter any watercourse. Machinery will be clean and inspected for leaks prior to working near a watercourse. Servicing of equipment and refueling will occur such that if a spill were to occur, it would not enter the water. Additionally, a Spill Contingency Plan (see Appendix B) and emergency spill kit will be on site and available for all work crews.

2.2.2.2 Maintenance

Maintenance of winter access routes may include low ground pressure vehicles (e.g. snowcats), a road grader equipped with a wing snow plow and some water application. Grading may be required over certain stretches and depressions along the roads filled with snow, to smooth the surface.

In the event that natural snowfall is below the minimum required depth to construct and maintain the winter roads, snow making may be used to make up the shortfall. This is a contingent consideration and could require up to 300 cubic meters (m^3) of water per day for a short period of time (a few days to a week). The sources of water include the Eagle River and the Ogilvie River. The water to be used to make snow and ice the winter road(s) will be trucked from the source to the point of use. At maximum, something between 20 and 30 truckloads per day are needed. The actual number of trucks being used will be less since a truck can probably complete 4 to 6 deliveries per day. Generally low snowpack is only an issue during the early part of winter so this provision would only apply on a contingent basis during the months of November, December and January. The timing for making artificial snow will depend on how late in the winter season winter road construction begins. If, for example, in late December there is little or no snowfall or snow accumulation on the ground, snow making could ensure a sufficient snow base to commence winter road construction. Snow can only be made when the ambient temperature drops to zero degrees centigrade.

2.2.2.3 Equipment

Equipment will be required for clearing, grading, water transport, and material transport. Light equipment for personnel, fuel and other supply transport will be required periodically during construction and well maintenance.

It is anticipated that Challenger cats, D6 cats, snow cats, graders, snow making equipment, water trucks and drags will be the primary construction equipment. Pickup trucks will be used for transportation of work crews, fuel and other supplies. Water trucks will be used for transport of water from the Eagle River and the Ogilvie River to the Project. Flatbed trailers would be used to transport equipment and larger supplies.

2.2.3 Access Control

Chance understands that increased winter access into the area is of significant concern to VGFN, local residents, trappers and outfitters. As the envisioned winter road will connect to the public road network, gates will be placed that will restrict access to the road. Gates will be constructed of heavy materials and located such that there are obstacles on either side as much as possible (i.e. heavy forest) to restrict vehicle access.

2.2.4 Anticipated Road Use

The majority of the traffic volumes include mobilizing the service rig and site infrastructure, the setup of the service rig will take approximately one day to complete at each well site. A total of eleven flatbed truck loads will be required to mobilize equipment into each well site. Once a site is established (i.e. maintenance equipment set up), traffic will include approximately 1-2 pickup trucks (for supplies and personnel), 1 water truck and one fuel truck. The fuel and water trucks will come to the project site approximately every three days or as demand dictates.

All vehicles will be equipped with radio communication and any traffic on the roads will be radio controlled. Unauthorized vehicles will not be allowed on the winter roads and the roads will be restricted from public access.

2.2.5 Reclamation

The Project proposes to construct up to 6.5 km of winter road to one existing well site (M-59), and re-open (i.e. clear existing vegetation to allow for winter road construction) the Chance Access Road for J-19, M-08, G-08 and H-28. Wells A-25, E-78 and B-73 are located immediately adjacent to the highway, and already have access routes with rig matting in place.

Reclamation activities will aim to return the site as closely as possible to its pre-project condition. These activities are intended to effectively:

- Leave the site clean following project completion;
- Remove all garbage, petroleum products, and equipment; and
- Prevent long-term erosion/slumping and promote successful revegetation of disturbed areas.

As discussed in **Section 2.1.3**, access to each of the roads will be restricted during operations and following the completion of the proposed activities. This will ensure that the road can fully melt, without any potential for more disturbance from outside users.

2.2.6 Camp Facilities

The Eagle Plains Hotel, located at kilometer 371 of the Dempster Highway, has been operating since the late 1970's and provides a variety of services including hotel facilities, accommodations (64 people during peak use), restaurant, lounge, public washroom, laundromat and service garage. The hotel is a recognized tourist destination and provides support services to the Government of Yukon, Department of Highways and Public Works, Eagle Plains Maintenance Camp. The hotel will serve as accommodations for up to 36 Chance staff from December to April of 2021. It is anticipated ten people will always be on site, with up to 17 at any one time (including personnel on standby at the hotel) and up to 25 during rig mobilization. The hotel is located approximately 44 km north of the previously established camp and airstrip (YOR 2013-0067-099-1). Using the lodge as accommodation during the Project will lead to an additional three to four vehicles on the Dempster Highway per day. It is anticipated both emergency airstrips located at about KM 325, adjacent to Chance's camp (Figure 1-2) and KM 389 north of Eagle Plains for a small number of crew changes during the program. Two to four shift changes are anticipated over the duration of the project.

A small medic/first aid trailer equipped with a heater may be installed at the wellsite being where work over operations are occurring to provide refuge for workers and essential first aid supplies. Sewer facilities and

water will be available in the trailer. All wastewater and sewage will be collected in tanks and transported offsite for disposal in the approved sewage lagoon at the Chances camp.

2.2.7 Fuel Storage

A Spill Contingency Plan has been developed and is provided in Appendix B. The plan outlines the procedures to be followed in the event of a petroleum product spill during all phases of the project. Safety procedures for personnel and proper equipment usage during such operations are discussed in this plan

Fuel will be stored in portable tanks (i.e. slip tanks) and tanker trucks and will not exceed 8000 litres in aggregate. Fuel storage will only occur during periods necessary for the road construction and well maintenance and will be removed upon completion. All fuel caches will be located a minimum of 60 m from the high water mark of any nearby watercourse.

Fuel will be transported in tidy tanks or by tanker truck, as required. A fuel spill contingency plan will be posted at all storage areas and fueling stations.

2.2.8 Waste Management

All garbage and recyclable materials will be taken off site and disposed of at a licensed disposal facility.

Once all the testing/isolation procedures are complete, the tubing will be pulled from the J-19 and G-08 wells. If it is deemed that it is still usable, it will be stored at Chance's camp and if not, it will be transported to approved disposal facilities in Yukon, Alberta or British Columbia. Cement waste and wastewater will be collected and transported to an approved disposal facility.

2.3 Project Schedule / Temporal Scope of Activities

Construction of the winter roads and well maintenance is anticipated to occur during the winter of 2020/2021. Initial site visits would occur in late November or early December of 2020, timed to meeting the minimum snowpack, to pack the access routes with snowmobiles. Winter road construction is anticipated to occur in late December to February. Well maintenance activities are anticipated to take approximately up to 70 days to complete the work at all eight wells. It is anticipated that well maintenance activities will commence in February and be completed by mid-April.

APPENDIX 2-B-46. *Eagle Plains Environmental Studies 2018*

Eagle Plains Environmental Studies 2018

Chance Oil & Gas is conducting environmental studies in summer 2019 to collect data on fish, water, permafrost, vegetation and wildlife to support its proposal to conduct exploration activities in the Eagle Plains project area. Chance welcomes participation of local First Nation citizens and traditional knowledge holders in these programs.

All projects will require varying degrees of hiking in steep, rugged terrain and thick bush under production-oriented work conditions. Participants will require average to above average fitness to participate in the work, depending on the survey.

Chance regrets that opportunities for participation in the field studies are limited due to safety and logistical considerations, and all interested citizens may not be able to participate. The logistics of participation in the studies are still being finalized, however, there will be approximately spots for two participants from each First Nation with Traditional Territory overlapping the project area. Travel to and from Eagle Plains Hotel will need to be coordinated by each First Nation.

In addition to these field programs, Chance will be holding a number of community meetings, to provide an opportunity for First Nation citizens, who cannot participate in the field programs to be able to comment on the proposed program.

Access to all work sites will primarily be by helicopter out of Eagle Plains. A small number of sites will be accessed off the Dempster Highway.

A short description of each survey is provided, below.

Bird Surveys

Bird surveys will follow standard 'point count' methods that involve recording all the birds the observers hear and see from an observation station during a 10-minute survey period. Stations are located 500-1500 m apart and are accessed via hiking. This work is very production oriented in order to meet sample size requirements during the relatively short 'dawn chorus' when birds are singing and requires above average fitness to hike quickly between stations. Total hiking distance of 5-10 km per day through rugged terrain and thick bush will be required. The daily work shift is 2:30 am to noon. Participants should have a set of binoculars to get the most out of the survey, but they are not absolutely required.

Vegetation Surveys

Vegetation surveys are being conducted to verify ecosystem/habitat maps and to survey for rare plants. Work will be split over 2 shifts. The daily shift in round 1 will be from 4am to 3pm, to coordinate helicopter use with bird surveys. The shift during the second round is a more civilized 7am-6pm. The work will consist of 15-45-minute vegetation plots where the surveyors record plant occurrences, site conditions, and wildlife sign and habitat. Successive plots will be accessed by a combination of hiking and heli bumps. Participants will need to hike 3-6 km per day through rugged terrain and thick bush, requiring average fitness. No special gear is required.

Seismic Line Study

The purpose of the seismic line study is to document the degree of vegetation regeneration on old lines from past exploration programs 1950-2000's and to characterize the characteristics of new lines (i.e. from 2014) and how they may affect wildlife. The details of survey methodology are still being developed but will likely consist of ~15 minute vegetation plots at multiple spots along different seismic lines. Successive plots will be accessed by a combination of hiking and heli bumps. Participants will need to hike 3-6 km per day through rugged terrain and thick bush, requiring average fitness. No special gear is required.

Aquatic Surveys

Fish and water surveys are being conducted to improve knowledge of fish distribution and water conditions across the proposed project area. Surveys at each site will include electrofishing, stream site descriptions, and water sampling. Each site will take 45-90-minutes to complete. Access to most sites will be via helicopter with a relatively short walk to the stream (i.e. <300m). However, some sites may require hikes of up to 1km to get into.

Chest waders are required to participate in the fish and water surveys.

Required Field Gear for all projects includes:

- Sturdy hiking boots (second pair for when the first get wet is recommended)
- Rain gear
- Appropriate layers of clothes
- Personal first aid/survival kit
- Bug hat/insect repellent
- Hat
- Backpack or cruisers vest
- Bear spray (*Note that EDI does not permit firearms to be carried in the field or brought to a work site).

APPENDIX 2-B-47. DFO License Application Notice Letter

Chance Oil and Gas Limited
Suite 1000, 340 – 12th Avenue SW
Calgary, AB T2R 1L5
T: 587.390.4136

June 14, 2019

Gwich'in Tribal Council
1-3 Council Crescent, Box 1509
Inuvik, Northwest Territories X0E 0T0

Attention: David MacMartin, Director, Intergovernmental Relations

Dear David MacMartin,

Re: DFO License Application Notice

The purpose of this letter is to provide notice to Gwich'in Partners of the intention of Environmental Dynamics Inc. (EDI) to submit an Application for a *License to Fish for Scientific, Experimental, Education, or Public Display Purposes, Under Section 52 of the Fishery (General) Regulations.* Chance Oil and Gas Limited (Chance) has contracted EDI to perform fish studies, among other environmental studies, within the project area described in the Draft Project Description delivered to Gwich'in Partners on June 7, 2019.

The fish studies are scheduled to take place from July 1, 2019 to July 10, 2019 pending approval of the DFO license. Please see attached for EDI's application and list of watersheds and species for the permit.

If any questions should arise regarding the license application or EDI's field work, please contact Emily Mann at Hemmera and she will coordinate a reply.

Sincerely,

Greg Charlie
Vice President Government and Community Relations
867.456.7805
gcharlie@chanceyukon.com

CC: Leslie Blake, President Tetlit Gwich'in Council

Fisheries and Oceans Canada | Pêches et Océans Canada

APPLICATION FOR A LICENCE TO FISH FOR SCIENTIFIC, EXPERIMENTAL, EDUCATIONAL or PUBLIC DISPLAY PURPOSES, UNDER SECTION 52 OF THE FISHERY (GENERAL) REGULATIONS *(Yukon /Transboundary Rivers Area)*

(Check one)
- ☐ SCIENTIFIC PURPOSES *
- ☐ EXPERIMENTAL PURPOSES**
- ☐ EDUCATIONAL PURPOSES***
- ☐ PUBLIC DISPLAY PURPOSES****

(see footnote for descriptions)

(Check one, and provide the additional info if required)
- ☒ New Application
- ☐ Renewal of previous year's licence — Previous Licence #:
- ☐ Amendment to a current licence — Current Licence #:

Yes ☐ No ☒ Do you have an Animal-Use protocol approved by a CCAC-accredited animal care committee? *(http://www.ccac.ca/en_/standards/guidelines)*

1. Please briefly describe the purpose of your application request. If this is an amendment to a previous license, briefly describe the requested changes to the original license.

The Chance Oil and Gas Project Area covers approximately 2,500 km^2 and includes 1,467 streams. Very little fisheries data exists for the proposed Project Area, with the most recent (limited) sampling occurring in 2001. EDI Environmental Dynamics Inc. proposes to conduct fish sampling on streams from each order throughout the Project Area. Fish sampling will mostly be conducted using electrofishing methods, with beach seining where necessary on 4th or 5th order streams. Electrofishing effort will be approximately 100-300 meters and for a minimum of 400 seconds in order to adequately sample each site. The length of stream sampled will be proportional to the stream width (i.e., narrow creeks will be sampled for longer distance than wide creeks). Sites will be sampled a minimum of 100 m upstream from the nearest confluence. The planned target of sites is 50, with an allowance up to 100.

2. Indicate the desired start and end date for the requested licence/permit. (Licence/permits may only be issued for up to one year.)

Start Date: 2019-07-01 End Date: 2019-10-01

Details (Specify sampling periods, if applicable): *Sampling is intended to begin in mid-July, but may require subsequent sampling.*

3. Applicant Information:

Legal Name of Applicant: Petra Szekeres Date of Birth: 1990-07-24

Organization or School: EDI Environmental Dynamics Inc.

Street Address/Unit#: 2195 Second Avenue City: Whitehorse

Province/Territory: Yukon Postal Code: Y1A 3T8

Phone: (867) 393-4882 Fax: Email: pszekeres@edynamics.com

Cell:

List individuals that will be assisting with the activity, DOB is required. *(Attach additional page if needed)*

	Legal Name	Date of Birth (YY/MM/DD)		Legal Name	Date of Birth (YY/MM/DD)
1)	Jonathan Lowey	90/12/07	6)	Scott Cavasin	86/09/05
2)	Dawn Hansen	88/10/11	7)	Ben Schonewille	82/07/14
3)	Joel MacFabe	85/09/17	8)		
4)	Annina Altherr	94/10/20	9)		
5)	Pat Tobler	72/08/24	10)		

4. SAMPLING PROGRAM - METHODS/LOCATION/SPECIES/DETAILS/OBJECTIVE etc..

Details of where the sampling is to occur, and the gear being used (*Provide detailed information including when, where, and how much sampling will occur)*

Name of River/Stream/Lake/Creek *(use a separate line for each waterbody)* **Watershed codes:** *search http://cmnmaps.ca/fiss_yukon/*	Detail of each sampling method *(ie. #trap nights, electrofishing seconds, # and duration of net sets, mesh size, etc. per sampling site etc. Also specify details of multiple sampling periods if applicable)*
See attached.	

Include species and life stage. Specify planned upper limit of sample size, maximum number and species of specimens that will be retained (if any). (Details not provided in specified fields, to be completed in "Additional Details" below.)

Species *(attach additional page if needed)*	Life stage	# of Fish Sampled	# of Fish Retained	# Estimates of Mortalities	Specify location of all mortalities and/or # retained
Arctic grayling	subadult/adult	200	0	5	
Arctic grayling	juvenile	200	0	10	
Slimy sculpin	subadult/adult	200	15	25	5 Peel w/s, 5 Bell w/s, 5 Whitestone w/s
Round whitefish	subadult/adult	100	0	10	
Lake whitefish	subadult/adult	100	0	10	
Longnose sucker	subadult/adult	100	0	10	

Details (Explain the purpose of retaining mortalities and/or lethal samples):	For the 15 retained slimy sculpin, the purpose is to provide DNA samples (fin clips) for the University of Montana to identify additional potential conservation units (subspecies, species) for a North America wide project. These individuals will ideally be chosen from any incidental mortalities and will only be retained in the event of no incidental mortalities. If there are any incidental mortalities of other species they will also have fin clips submitted to support this initiative.

Additional details (attach additional page if needed).

Include as much detail as possible including your research activities, methods of collection provide details, disposition of the specimens details of regarding release methods and location, and precautions that will be taken to avoid fish mortality. Provide information on handling of non target species if appropriate. etc..

Sites will be chosen to cover the spatial extent of the Project Area to provide a general understanding of fish distribution in different ordered streams. Each stream site will have a Site Card completed as well as fish sampling and in-situ water quality will be taken. Fish sampling will mostly be conducted using electrofishing methods, with beach seining where necessary on 4th or 5th order streams. Electrofishing effort will be approximately 100-300 meters and for a minimum of 400 seconds in order to adequately sample each site. The length of stream sampled will be proportional to the stream width. Sites will be sampled a minimum of 100 m upstream from the nearest confluence. In-situ water quality will be taken at each site, which includes the collection of temperature (degrees Celsius), pH, dissolved oxygen (mg and %), and specific conductivity (µS/cm). All fish captured will be identified to species and enumerated; up to 10 individuals from each species caught will be measured at each site before being returned to the water. Handling and air exposure will be kept to a minimum for all fish.

Footnotes:
* Scientific Purposes includes: Salvage (for fish collection associated with in-stream works etc.); Environmental Impact assessment (pre and/or post development project monitoring); Inventory (species abundance and distribution and/or presence/absence study)
** Experimental Purposes: Research (i.e.. fish collection as part of a experimental procedure, or research to determine how fish populations respond to habitat manipulations)
*** Educational Purposes: Training
**** Public Display Purposes: Samples for display purpose

Applications are to be submitted to:

Attn: Area Licensing Manager

By Mail: 100-419 Range Road
Whitehorse, YT
Y1A 3V1
Fax: (867)393-6738
or
Email: YTLicence@dfo-mpo.gc.ca

PRIVACY NOTICE STATEMENT
The information you provide on this form is collected under the authority of the Fishery General Regulations for the purpose of issuing a licence for scientific, experimental, educational or public display purposes. The information may be used for program planning or management, reporting, audit, administration purposes or disclosed to other government departments or agencies, within other divisions or branches of the institution, with provincial, territorial or foreign government or First Nation organizations as applicable. Failure to provide this personal information may result in your licence being denied. You have the right to the correction of, access to, and protection of, your personal information under the Privacy Act and to file a complaint with the Privacy Commissioner of Canada over DFO's handling of your information. Personal information collected through the processing of your application is described in DFO Personal Information Banks and can be accessed and assessed for accuracy. For more information visit Info Source www.infosource.gc.ca.

5. RELATED LINKS INFORMATION ETC

Collection Period: Sensitive timing periods in aquatic environments in Yukon and transboundary waters can be found at: http://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/index-eng.html. If you plan to sample using instream methods during sensitive periods, we suggest you describe means by which you will mitigate any negative effects.

Transfer or Transplant of Live fish/eggs/milt: Any transfer of live fish into fish habitat and transfer of live fish to a fish rearing facility, requires a permit from the Federal/Provincial/Territorial Introductions and Transfers Committee. Applications and contacts can be found at:
BC - http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/intro-trans/process-processus-eng.html
Yukon – http://www.pac.dfo-mpo.gc.ca/yukon/trans-eng.html

Species At Risk: Research into any species listed in the Species At Risk Act (SARA) requires a permit issued under SARA. Application forms can be found at: http://www.dfo-mpo.gc.ca/species-especes/permits-permis/permits-eng.htm

Canadian Council on Animal Care (CCAC): DFO is a member of the Canadian Council on Animal Care (CCAC) and has committed at the Ministerial level to follow the entire CCAC program in Departmental activities in research, teaching and testing with vertebrate animals. Nearly all universities and colleges in Canada follow this program as well. It is expected that if DFO financial or human resources are involved in the work under this requested licence, or if the applicant is based at an institution having a CCAC-accredited Animal Care Committee, then evidence of an approved Animal Use Protocol (AUP) will be submitted with this application, and CCAC guidelines will be adhered to in any work with live vertebrates. The issuing authority for this licence accepts the CCAC's exemptions for certain animal-use activities as not requiring an approved AUP. More information about the CCAC program is at *www.ccac.ca.*

Note: - Use of carbon dioxide/CO2 (e.g. Alka-Seltzer tablets) to immobilize fish for sampling should not be done without a continuous supply of oxygen, with levels of both gases monitored and regulated.
- Clove-oil products are not regulator-approved in Canada, as a fish anaesthetic.

Aquatic Invasive Species: To prevent the introduction of aquatic invasive species there are a few simple things that can be considered:
a) Before leaving an area: Drain water from boat, trailer and gear, remove all plant parts and mud and.
b) before entering another water body: Wash all your gear including waders with soapy water.
For Further Information:
http://www.dfo-mpo.gc.ca/science/environmental-environnement/ais-eae/index-eng.htm
or
http://www.env.gov.yk.ca/animals-habitat/invasivespecies.php

Fish Sampling Permit for Chance Oil and Gas: Watersheds and Species

Table 1. Watersheds

Name of River/Stream/Lake/Creek	Detail of each sampling method
Chance Creek and tributaries (81809544)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Greaves Creek and tributaries (81809544052517)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
McParlon Creek and tributaries (81840641)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Dalglish Creek and tributaries (210873536)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Enterprise Creek and tributaries (210962555)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Whitestone River tributaries (818; between McParlon and Chance)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Tributary to Eagle River (81517952593396)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Tributary to Eagle River (81517952563022)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Tributary to Eagle River (8151795256302216321)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Tributary to Porcupine River (8151795256302216321)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.

Table 2. Fish Species

Species	Life stage	# of fish sampled	# of fish retained	# estimates of mortalities
Arctic grayling	sub adult/adult	200	0	5
Arctic grayling	juvenile	200	0	10
Slimy sculpin	sub adult/adult	200	0	10
Round whitefish	sub adult/adult	100	0	10
Lake whitefish	sub adult/adult	100	0	10
Longnose sucker	sub adult/adult	100	0	10

APPENDIX 2-B-48. Fieldwork Email

From: [redacted]
Sent: May 21, 2019 9:53 AM
To: [redacted]@gwichin.nt.ca
Cc: Richard Wyman [redacted]@chanceyukon.ca>
Subject: Geological Mapping program Consultation

H[redacted],

Hope all going well this spring! We are required to consult under the geoscience licence guideline to inform TGC that we are planning a field work from July 10th – 24th, 2019. We will based out of Eagle Plains Lodge with helicopter. The following is basic geological mapping operation we will perform in Eagle Plains Basin;

We will be flying to remote outcrop locations through out the Eagle Plains Basin to extract rock sample with geological hammer. There will be no mechanical tools used in this field work.

Please let me know if you have any questions or comments and can be reach by telephone or email.

We look forward to your response.

Mahsi cho,

[redacted]
VP Government and Community Relations
Suite 202, 208 Main Street
Whitehorse, YT Y1A 2A9
Office: 867.456.7805
Cell: 867.3330010

Chance
OIL AND GAS LIMITED

APPENDIX 2-B-49. Gwich'in Social and Cultural Institute YESAB Letter

Gwich'in Social & Cultural Institute

www.gwichin.ca

Head Office
P.O. Box 46
Tsiigehtchic, NT X0E 0B0
Tel: (867)953-3613
Fax: (867)953-3820
[redacted], Heritage Researcher

Executive Director Office
P.O. Box 30
Fort McPherson, NT X0E 0J0
(867) 952-2524
(867) 952-2238
[redacted], Executive Director

Language Office
P.O. Box 54
Fort McPherson, NT X0E 0J0
(867)952-2377
(867)952-2433
[redacted], Language Manager

Research Office
Suite 202B, 4912-49 St.
Yellowknife, NT X1A 1P3
(867)669-9743
(867)669-7733
[redacted] Research Director

Dawson Designated Office, YESAB
Yukon Y0B 1G0
Via email: dawson.do@yesab.ca

January 22, 2015

To Whom It May Concern,

Re: Eagle Plains Multi-Well Exploration Program - Northern Cross (Yukon) Ltd.

We have reviewed the above application against our heritage databases, and we have the following concerns.

1. There has been no Traditional Use/Traditional Knowledge study conducted, to the knowledge of the GSCI, with the Gwich'in participants who use this area or have knowledge of it. Without a traditional use study, the effects on traditional use cannot be assessed. In addition, integrating traditional and scientific knowledge into impact assessments is considered best practice, but traditional knowledge is held by land users and must be gathered in targeted studies. Traditional Use and Traditional Knowledge studies with Gwich'in participants are covered by a TK Policy (http://www.gwichin.ca/TheGwichin/traditional.html).
2. The GSCI has not been afforded the opportunity to fully review the development proposal against existing cultural and heritage data. This review would provide the proponent with more detailed information for use in planning and mitigation, and would be done at the cost of the proponent.
3. This project will contribute to climate change. Climate change is causing changes to the land (for example, retrogressive thaw slumps), the weather, and the animals upon which the Gwich'in depend for food. Climate change is affecting the ability of the Gwich'in to travel on and use the land for traditional pursuits.
4. The size of the project is of great concern to the GSCI. The high number of wells proposed, the establishment of new roads, in particular new all-season roads, are of particular concern.

5. The Porcupine caribou herd is invaluable to the Gwich'in. This herd has always been a key resource for the Teetł'it Gwich'in, and due to the decline in other herds (Bluenose-West and Cape Bathurst herds), the Porcupine herd is also of great importance to Gwich'in from other communities. The project is located within the winter range of the Porcupine caribou herd. The GSCI has concerns that the development itself will affect the caribou by changes to the land, and will also change the way harvesters are accessing the herd.
6. The GSCI is concerned about leakage into the surrounding waterways. The headwaters of several important rivers are located within or nearby the development location.
7. The GSCI is concerned about the development of an extensive network of not only temporary but permanent roads, and how this activity might affect the water and fish in the area.
8. There are a number of traditional Teetł'it Gwich'in trails which cross the development. Traditional trails are associated with an increase in archaeological sites, many of which are unrecorded. Trails also indicate traditional use – in this case, winter use for hunting and trapping.
9. The area has been recorded as being of traditional use for hunting moose, barren-ground and woodland caribou, and had Teetł'it Gwich'in traplines.
10. Wolverine, a species designated of Special Concern by COSEWIC, was a particular focus of Teetł'it Gwich'in trappers in the area, suggesting there is likely particularly good habitat for wolverines.
11. The headwaters of Tth'an Dhidlii Njik ("Bone-they are scattered around-creek," also known as Dalglish Creek) is within the development. As the name suggests, this creek is known to the Teetł'it Gwich'in to have paleontological remains.

As with any application, if archaeological or heritage materials are encountered during development within the Gwich'in Settlement Area, all work must cease immediately as required by law, and the appropriate authorities (including the GSCI) must then be contacted.

Sincerely,

[redacted]
Executive Director, GSCI

C.C.

APPENDIX 2-B-50. *Project Summary Draft for Research Ethics Review Application*

Aurora Research Institute
Project Summary

Draft for Research Ethics Review Application

Instructions: Provide a brief (no more than 2 pages) summary of the purpose, objectives, and aims of the research. Describe your methodology and what will be required of the human participants. Please use language that can be understood by a non-specialist. (Note: The Committee may refuse to review applications with summaries exceeding 2 pages).

Community Research Summary

Purpose: This research is being conducted to inform the Chance Oil and Gas Limited (Chance) Eagle Plains Exploration Project (the Project) Proposal to Yukon Environmental and Socio-Economic Assessment Board (YESAB) for an Executive Committee level screening. The proposed Project is an oil and gas exploration project located in Eagle Plains Basin.

Background: The *Yukon Environmental and Socio-economic Assessment Act* (YESAA) requires that social and economic impacts of the Project be analysed, along with environmental impacts, to assess how the Project may affect the people who use the Project Area, live near to the Project Area, and/or whose Traditional Territory overlaps the Project Area. YESAA defines "socio-economic effects" as "effects on economies, health, culture, traditions, lifestyles, and heritage resources." YESAB's Executive Committee is required to "give full and fair consideration to scientific information, traditional knowledge and other information provided to it" (YESAA 2015).

Approach: Hemmera Envirochem Inc. (Hemmera) has been retained by Chance to conduct the socio-economic impact assessment for the Project. Hemmera is also managing the Project Proposal to YESAB and is working with consultants across a variety of disciplines to develop the Project Proposal.

To conduct the socio-economic impact assessment, Hemmera will be doing two complementary studies to collect primary data. Each study will be conducted in Inuvik, Aklavik, Tsiigehtchic, and Fort McPherson.

1. Socio-Economic Interviews (Socio-Ec Interviews) with service providers

2. Traditional Knowledge and Traditional Use Workshops (TK/TU Workshops).

Study 1: Socio-Economic Interviews

Objective: To learn how the proposed Project may positively or negatively affect the socio-economic conditions of communities near to the project footprint.

Methodology: Semi-structured, open-ended interviews will be conducted using an interview guide. Interviews will be approximately an hour in length and be conducted in a manner that meets the participants needs in terms of location, time, and language. If a translator is required for an interview to be conducted, additional time will be allotted to the interview, and a translated interview summary will be prepared by the translator in both languages for approval by the participant and for use by the researchers. Interview summaries will be created after each interview and shared with the interviewee via phone or email to provide the interviewee with an opportunity to make sure the summary is accurate and approve its content.

Recruitment: In each community, Hemmera will seek to interview representatives of the following organizations.

- RCMP and Conservation Officers
- Nursing Stations
- Primary and secondary school educators, and Yukon College, or other training facilities

- Utility service providers
- Business owners and operators
- First Nations Government including the Gwich'in Councils and the Band Offices in each community
- Renewable Resources Councils

To recruit participants, Hemmera will use publicly available contact information and contact potential participants to see if they are willing to participate. Hemmera will also work with GTC, band offices, DGOs and Renewable Resources Councils over phone or email to identify potential participants and contact them.

Study 2: TK/TU Interviews

Objective: To gather Traditional Knowledge and Traditional Use information about the Project Area, with an emphasis on use and access to the Porcupine Caribou Herd.

Methodology: A TK/TU workshop will be conducted with Elders and Traditional Knowledge holders who will be openly invited to participate in the study in each community. The workshop will be half a day to a full day in length. Participants will be guided by a trained facilitator to share TK/TU information. Notes will be taken during the workshop and participant specific contribution summaries will be created and reviewed with each participant via phone or email to provide each participant with the opportunity to approve their contributions before they are used. Workshop participants will receive a Honoraria or gift card as compensation for their time.

Advertising and Recruitment: Hemmera will work with the GTC, DGOs, and the Renewable Resources Councils to invite Elders and Traditional Knowledge Holders to participate in the workshops. Advertisements will be placed in communities and Elder and Traditional Knowledge Holders will be contacted with an invitation to participate.

Hemmera's Practices to be Applied to both Study 1 and Study 2

Informed Consent: Before each interview begins and before the workshop begins participants will be guided through an informed consent form.

Quality Assurance and Quality Control: All documents that are produced by the research team for submission to Aurora College, GTC, community members, or are produced for use in workshops will be reviewed by one of Hemmera's socio-economic and TK/TU technical experts for alignment with Aurora College and GTC research guidelines as well as environmental assessment best practices.

Data Storage, Confidentiality and Anonymity: Data will be protected through storage methods and managed such that sensitive information remains confidential and/or the anonymity of community contributors is protected. Digital copies of qualitative data (e.g. interviews, workshop findings, etc.) will be stored in a password protected file on Hemmera's server. Hard copies of interview material will be stored in locked file cabinets in Hemmera's Whitehorse office. Participant information will be confidential and used only for the YESAB report. If participants wish to have their contributions archived, information will be shared with the GTC archive. Participant information will be kept anonymous in reports unless participants indicate they would like to be mentioned by name.

APPENDIX 2-B-51. Initiation of Engagement for Eagle Plain Well Maintenance Project Letter

May 22, 2020

Gwich'in Tribal Council

1-3 Council Crescent
Box 1509
Inuvik, NT
X0E 0T0

Attention: [redacted]**, Director of Lands and Resources**

Re: Initiation of Engagement for Eagle Plain Well Maintenance Project

The purpose of this letter is to inform the Gwich'in Tribal Council of Chance Oil and Gas Limited's (Chance) proposed project for Eagle Plain Well Maintenance (the Project), and to initiate Chance's engagement with the Gwich'in Tribal Council for the Project. An email was sent to the Gwich'in Tribal Council on Monday March 23rd from [redacted] that briefly mentioned the Project. In accordance with the Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan, this letter is intended to provide a more formal introduction.

Government of Yukon, Department of Energy, Mines and Resources, Oil and Gas Resources Branch, has directed Chance to assess the integrity of, and conduct maintenance on, eight suspended wells in the Eagle Plain area. Government of Yukon has also indicated that this maintenance work is required in order for Chance to receive an extension of the suspended status of the eight wells. The wells in question are M-59, M-08, J-19, G-08, A-25, B-73, H-28, and E-78.

The maintenance work will require re-establishment of two winter access roads (i.e., Chance Winter Road and Blackie Winter Road), mobilization of a service rig and related equipment, preparation of the well site areas, well maintenance, de-mobilization of service rig and related equipment, and lastly, decommissioning of winter access roads. Re-establishment of winter roads will begin as soon as there is sufficient snow during the winter of 2020/2021. Well maintenance activities will commence in late January or early February 2021 and are anticipated take approximately 70 days to complete.

This Project triggers a Yukon Environmental and Socio-economic Assessment Board (YESAB) Designated Office (DO) evaluation and will also require a Land Use Permit for the construction of the winter access roads. Chance has hired Hemmera Envirochem Inc. (Hemmera) to manage its Dawson DO submission, manage the Land Use Permit application, and support all engagement activities with the Gwich'in Tribal Council and Yukon First Nations. Currently, Chance and Hemmera are in the planning phase of the Project.

The Project and all proposed Project activities are within the Tetlit Gwich'in Secondary Use Area of the Gwich'in Settlement Region as well as the traditional territories of the First Nation of Na-cho Nyäk Dun and the Vuntut Gwitchin First Nation. The proposed Project area is north of the Tr'ondëk Hwëch'in Traditional Territory. In accordance with guidance from YESAB, Chance would like to discuss any potential impacts

that the Gwich'in Tribal Council believes may arise as a result of the Project and what Chance could do to address them. Specific information on any measures you believe could be taken to address potential impacts would assist in our understanding and Project development. Additional Project details have been attached to this letter for your convenience. A copy of the Draft Project Description can be provided upon request.

Given recent developments with respect to the COVID-19 Virus, we understand that meeting in-person is not an option. Chance is committed to addressing any concerns you may have and would be more than happy to work with you via conference call, email, or any other method you prefer. We also respect that your government and its people have many competing priorities at this time and appreciate any feedback you wish to provide. Please let us know if there is anything Chance can do to facilitate and ease the burden of this process.

Thank you for your time and attention.

[redacted]

VP Government and Community Relations
Chance Oil and Gas Limited
202 – 208 Main Street
Whitehorse, Yukon Y1A 2A9
Email: gcharlie@chanceyukon.ca
Office: 867-456-7805
Cell: 867-333-0010

CC

[redacted], Gwich'in Tribal Council

[redacted] Tetlit Gwich'in Council

Additional Project Information

1.1 Project Overview

The proposed Well Maintenance Program (Project) is comprised of two main components:

- Routine maintenance of suspended wells; and
- Construction of new winter roads and maintenance of previously existing roads.

A map depicting the location of the wells as well as the winter roads is attached.

1.2 Types of Maintenance Activities and Tests

Wellhead Inspection: The wellhead is the equipment on the surface used to maintain safe operation and manage the flow of oil and gas. A wellhead inspection is conducted to ensure all surface equipment is in good condition and operating as required (e.g., providing a barrier against hydrocarbon leakage, reliable in emergency situations). This inspection is conducted in accordance with the standard Yukon Government Oil and Gases Resources Well Inspection Report.

Pressure Test: A test to determine the strength or fracture pressure of the rock around a borehole (i.e., the formation). During the test, the well is shut in (i.e., process of isolating the well where the master valve and casing valves are closed) and fluid is pumped into the wellbore to gradually increase the pressure that the formation experiences. At a certain pressure, fluid will enter the rock surrounding the borehole, either moving through permeable paths in the rock or by creating a space by fracturing the rock. The results of a pressure test indicate the maximum pressure that may be applied to the well during drilling operations.

Surface Casing Vent Flow (also referred to as a "Bubble Test") and Gas Migration Tests: When a well is drilled, it must be cased with steel pipe to provide stability to the wellbore and to ensure fluids are contained within the well. Multiple casings are used within a well. The shallowest casing is the surface casing. The surface casing isolates usable groundwater from the well and stabilizes the well. After the casing is installed, cement is pumped in the space between the casing and the geological materials that surround the wellbore, as well as between casings, in order to achieve a seal. Surface Casing Vent Flow involves the movement of gas, in rare cases liquid, between the surface casing and the next string of casing upward and out of the surface casing vent assembly. Gas Migration is the flow of gas outside the surface casing of a well and may be tested by doing a soil vapor survey.

Temperature Log: A detailed depth-related record of temperature. The temperature log is interpreted by looking for anomalies from a baseline (i.e., a log recorded before production or recorded with the well shut in). Temperature logs have many applications, with the most common being to identify areas where the wellbore is taking in fluid, to evaluate a cement or hydraulic fracture treatment, and to locate casing leaks. A temperature log tends to reflect the behavior of a well over a longer time period than other measurements.

Cement Log: A log that uses the variations in amplitude of an acoustic signal travelling down the casing wall between a transmitter and receiver to determine of the quality of cement bond on the exterior casing wall.

Hydraulically Isolate Formations: An activity where the casing is perforated at the appropriate depth. Tubing is then used to inject cement through the perforations (i.e., holes in the casing and cement that allows cement to flow from the well into the surrounding formation) in sufficient quantity to ensure hydraulic isolation. Then pressure is applied from surface to force the cement into the perforations. Once the cement has cured, the cement will be pressure tested as per the *Yukon Oil and Gas and Drilling Production Regulations*. This process is repeated until all formations are hydraulically isolated and pressure tested. These operations begin with the deepest non-isolated formation and progress to the shallowest non-isolated formation. Once all the isolation/testing procedures are complete, the tubing will be pulled from the well, a new well head assembly will be installed, and the well head will be pressure tested once more.

Wellbore fluid test: A test, or series of tests, performed to check that no undesirable reactions occur with a specific fluid. The testing process may include checks for compatibility with other treating fluids, wellbore fluids, reservoir fluids, and the reservoir formation.

1.3 Well Maintenance Activities

The following table describes the tests proposed for each well:

Table 1: Well Maintenance Activities

Well Name	Wellhead Inspection	Pressure Test	Surface Casing Vent Flow	Gas Migration	Temperature Log	Cement Bond Log	Hydraulically isolate formations	Well Bore Fluid Test
Socony Mobil WM Blackie No 1 M-59	-	X	X	X	X	X	X	-
Western Minerals Chance YT No 1 M-08	-	X	X	X	-	X	X	-
Canoe River Chance YT J-19	X	X	X	X	X	X	X	-
Socony Mobil WM Chance YT No 1 YT G-08	X	X	X	X	X	X	X	-
NCY Ehnjuu Choo B-73	X	X	X	X	X	X	X	-
NCY West Chance H-28	X	X	X	X	X	X	X	-
NCY McParlon A-25	X	-	X	X	X	-	-	X
East Chance E-78	X	-	X	X	X	-	-	X

1.4 Personnel and Equipment Needed

The Eagle Plains Hotel will serve as accommodations for up to 36 personnel from November 2020 to April of 2021. It is anticipated ten people will always be on site, with up to 17 at any one time (including personnel on standby at the hotel) and up to 25 during rig mobilization.

Equipment required for well maintenance and winter road construction is described below (Table 2).

Table 2: Equipment required for Well Maintenance

Equipment	Description
Boilers	Boilers are used in cold, Arctic climates for preventing equipment and fluids from freezing.
Cement	Cement storage and mixing for use in wells.
Cement Bins	Large tanks, normally upright, fully enclosed and pressurized, where cement products are stored. Cement is pneumatically pumped from the tank into the cementing unit.
Medic/Office Trailers	Essential personnel trailers which serve as offices.
Flare Tank and Flare	A flare is used to burn combustible gas from the well. The flare tank is a reservoir to ensure the flare does not run out of combustible gases.
Fuel Storage	Portable tanks will be used to store fuel on site.
Garbage and Incinerator	An incinerator will be used to dispose of food waste. All garbage and recyclable materials will be taken off site and disposed of at a licensed disposal facility. All wastewater and sewage will be transported offsite for disposal at an approved facility.
General Storage	Storage and laydown area for equipment needed on site.
Main Workover Fluid Storage	Fluid additives will be stored on pallets that are stacked and shrink wrapped.
Tubing Storage	Trailer for storing pipes until they are required.
Pumps	Pumps are used to circulate the fluid down the pipe and then back up to the surface in the ring-shaped space between the pipe and the casing.
Service Rig	The Service Rig includes a base, a derrick, equipment for lifting/lowering equipment into the pipe, and blowout preventers.
Water Storage and Water Treatment	Water storage tank and treatment containers to provide potable water for the rig crew and personnel.
Vehicles	It is anticipated that standard sized bulldozers, graders, snowcats, and water trucks will be the primary vehicles. Pickup trucks will be used for transportation of work crews, fuel and other supplies. Water trucks will be used for transport of water from the Eagle River and Ogilvie River to the Project. Flatbed trailers would be used to transport equipment and larger supplies. A total of eleven flatbed truck loads will be required to mobilize equipment into each well site.

1.5 Winter Road

Wells H-28, J-19, M-08, G-08 and H-28 will be accessed using the previously existing Chance Access Road. Wells A-25 and B-73 are located immediately adjacent to the highway and already have access routes. Well M-59 will require the construction of approximately 11 km winter road to access the site mostly by reactivating a long disused winter access route. Winter road construction will utilize similar techniques as previously applied in previous assessments (YESAB # 2006-0237, 2006-0285, 2007-0219, 2008-0047, and 2012-0140).

Winter roads required for the Project are designed to have as few water crossings as possible. All water bodies, that maybe crossed, will be treated as fish bearing and winter roads will be constructed following

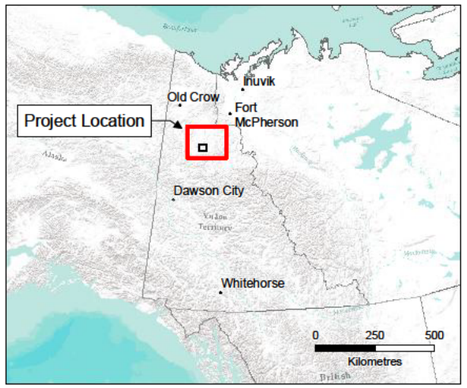
Fisheries and Oceans Canada's (DFO) Operational Statement on Ice Bridges and Snowfill (DFO 2007). Water needed to make ice and/or snow will be trucked from the Eagle River and/or Ogilvie River. Gates will be placed at the entrance of Chance and Blackie Winter Road to restrict access.

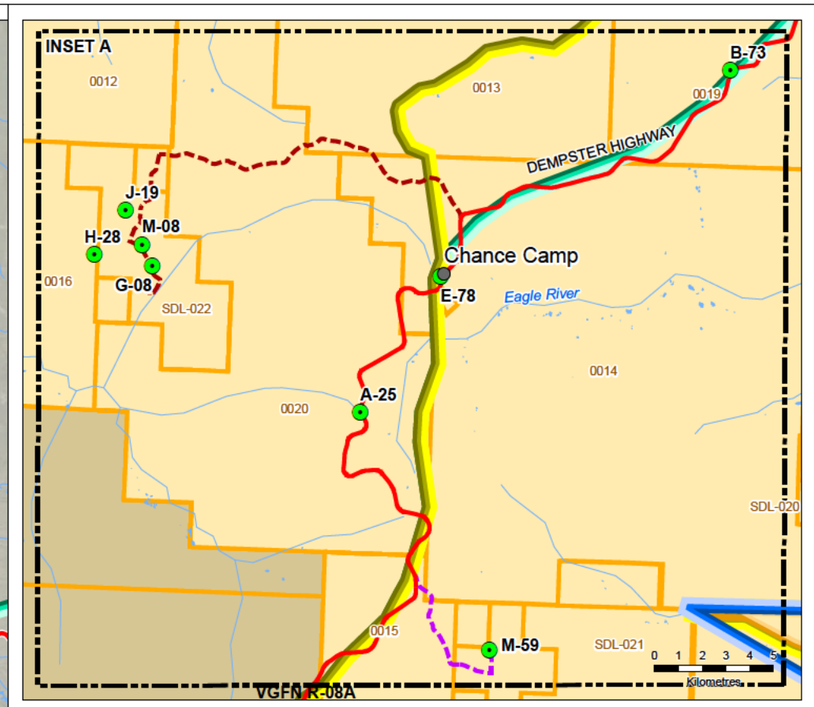
1.6 Project Timelines

Construction of the winter roads and well maintenance is anticipated to occur during the winter of 2020/2021. Initial site visits would occur in late November or early December 2020 to pack snow along the access routes with snowmobiles. Winter road construction is anticipated to occur in late January and February 2021. Well maintenance activities are anticipated to commence in late February and take approximately 70 days to complete the work at all eight wells.

Eagle Plain Well Maintenance
Yukon

Project Location





DRAFT
For Discussion Purposes Only

Legend

- Wellsite
- Project Area
- Dempster Highway
- Blackie Winter Road
- Chance Winter Road
- Trails/Access
- Oil and Gase Seismic Lines
- Watercourse
- Waterbody
- Oil and Gas Dispositions within Project Area
- Oil and Gas Dispositions outside Project Area
- Protected Area

First Nation Traditional Territories

- First Nation of Na-cho Nyäk Dun
- Tetlit Gwich'in Council (Primary Use Area)
- Tetlit Gwich'in Council (Secondary Use Area)
- Tr'ondëk Hwëch'in
- Vuntut Gwitchin First Nation

First Nation Settlement Lands

- Fee Simple
- Surface Rights
- Surface and Subsurface Rights

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licensed under the Open Government Licence - Yukon
- Aerial Image: ESRI World Imagery
- Inset Basemap: ESRI World Terrain Base

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Hemmera
An Ausenco Company

Chance
OIL AND GAS LIMITED

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APPENDIX 2-B-52. *Draft 2020 Annual Report on the Implementation of Gwich'in Partners and Chance Oil and Gas Communications and Consultation Plan* – document not available at time of submission.

APPENDIX 2-B-53. Draft *Project Description* Comments – document not available at time of submission.

APPENDIX 2-B-54. Draft *Project Description*

DRAFT PROJECT DESCRIPTION

Eagle Plains Exploration Project

Prepared for:

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Version 1
July 2023

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
2D	two-dimensional
3D	three-dimensional
AER	Alberta Energy Regulator
ARD	acid rock drainage
ATV	all-terrain vehicles
BOPD	barrels of oil per day
Chance	Chance Oil and Gas Ltd.
CPF	Central Processing Facility
CSA	Canadian Standards Association
DFO	Department of Fisheries and Oceans Canada
DHDA	Dempster Highway Development Area
DST	drill stem test
EC	conductivity
EDI	EDI Environmental Dynamics Inc.
EFT	extended flow test
eLMS	Electronic License Management System
ESA	Environmental Site Assessment
GIS	Geographic Information System
GPS	Global Positioning System
GR	gamma ray
HSE	Health, Safety and Environment
IMA	Integrated Management Area
LiDAR	Light Detecting and Ranging
LIS	Low Impact Seismic
LMU	Land Management Unit
LTS	Leaning Tree Stand
MBC	Mix Bury Cover
N	nitrogen
Na	sodium
NE	northeast
NRCAN	Natural Resources Canada
NYRLUP	North Yukon Regional Land Use Plan
NWT	Northwest Territories
OH&S	Occupational Health and Safety
Project	Eagle Plains Exploration Project

Acronym / Abbreviation	Definition
PWRLUP	Peel Watershed Regional Land Use Plan
SAR	sodium adsorption ratio
SCVF	surface casing vent flow
SDS	Safety Data Sheets
SW	southwest
UV	ultraviolet
YESAB	Yukon Environmental and Socio-economic Assessment Board
YOGA	Yukon *Oil and Gas Act*, SY 2019, c.6

SYMBOLS AND UNITS OF MEASURE

Symbol / Unit of Measure	Definition
º	degrees
%	percent
cm	centimetre
“	inch
dS/m	decisiemens per metre
gpm	gallons per minute
ha	hectare
kg	kilogram
km	kilometre
km/km²	kilometres per square kilometre
km²	square kilometre
km/hr	kilometers per hour
kPa	kilopascals
L	litre
lb	pound
m	metre
m²	square metre
m^3	cubic metre
m^3/day	cubic metre per day
mg/L	milligrams per litre
mg/kg	milligrams per kilogram
mm	millimetre
mKB	metres Kelly-Bushing below the surface

1 INTRODUCTION

The proposed Eagle Plains Exploration Project (Project) is located in the Eagle Plains area, between the Ogilvie and Richardson Mountain ranges in the Yukon**.** The Project encompasses a 2,386 square kilometre (km²) area in north-central Yukon, centred approximately 605 kilometres (km) north of Whitehorse and 40 km south and west of the Eagle Plains Hotel, along the Dempster Highway (**Map 1-1**).

Chance Oil and Gas Ltd. (Chance) is the Project Proponent. The Project consists of two phases:

1. Exploration Phase; and
2. Reclamation and Closure Phase.

Within the Exploration Phase, there are three principal components:

1. a seismic exploration program.
2. an oil and gas exploration drilling program; and
3. a drill stem test (DST) and extended flow testing (EFT) at select wells.

1.1 PROJECT LOCATION

The Project is located within the southern part of Eagle Plain Sedimentary Basin in northern Yukon, northeast of Dawson City and southwest of the Yukon/Northwest Territories (NWT) border (**Map 1-1**). The main camp (Chance Camp) is located at km 325 of the Dempster Highway.

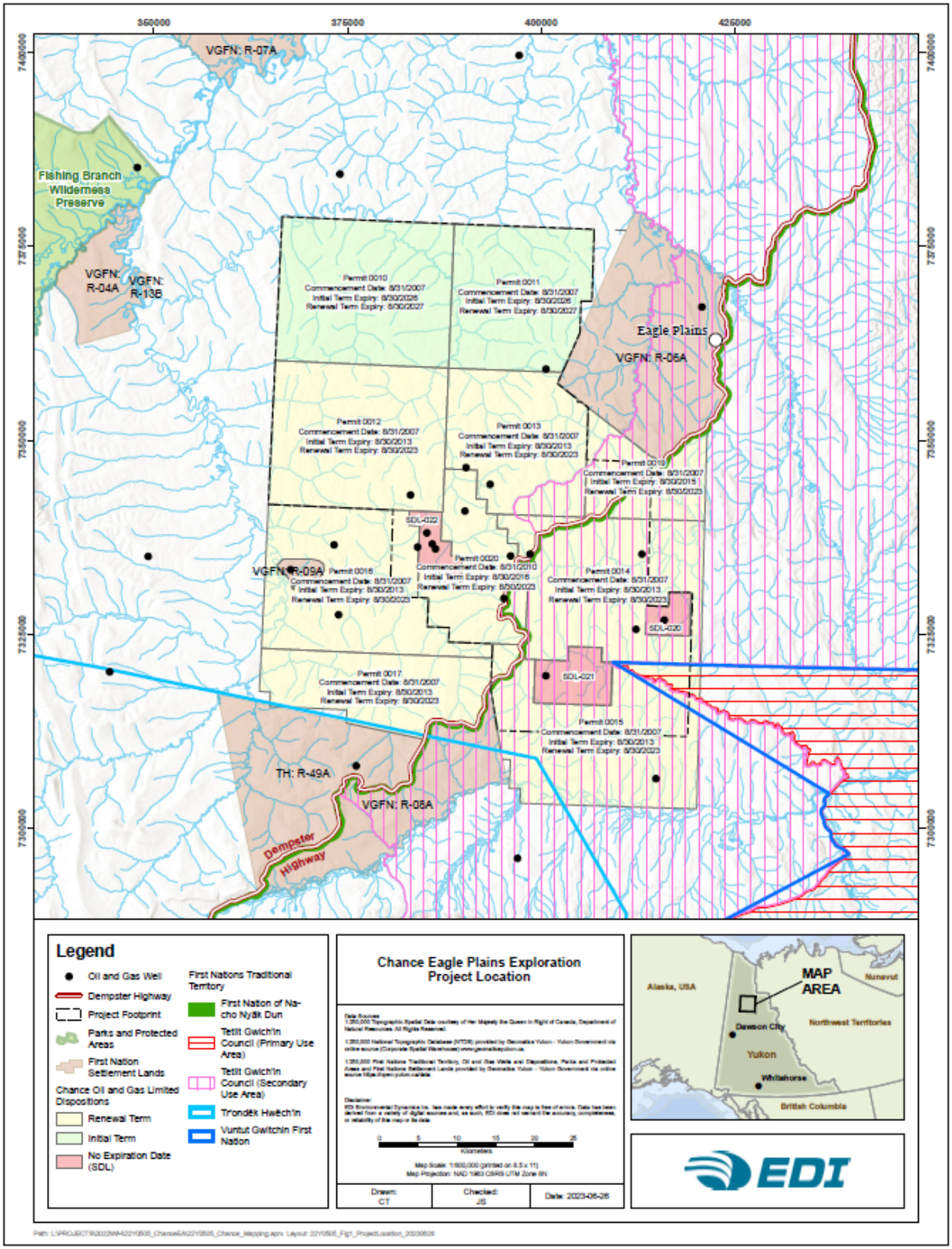
The Project overlaps the Traditional Territories of four First Nations. Most of the Project is within the Traditional Territory of the Vuntut Gwitchin First Nation. The southeastern portion is in an area of overlapping Traditional Territories of the Tetlit Gwich'in Council, Tr'ondëk Hwëchin, the First Nation of Na-Cho Nyäk Dun, and Vuntut Gwitchin First Nation. The Project does not fall within any First Nation Settlement Lands and borders the east and southwest portions of the Vuntut Gwitchin First Nation Settlement Lands.

1.1.1 Exploration History

The Project occurs within the Eagle Plains sedimentary basin, north of the Ogilvie River and west of the Richardson Mountains. The basin contains proven natural gas and oil reserves (Government of Yukon 2019), including 4.6 billion cubic metres (m³) of gas and 3.2 million m³ of oil (Hannigan 2014).

The Project area has had intermittent periods of oil and gas exploration since the 1950s. That activity has established winter roads, seismic lines, and exploratory well sites across parts of the current RSA. Approximately 40 exploration wells have been drilled in the Eagle Plains sedimentary basin. Eight wells are currently being maintained in suspended status, and the remaining wells have been plugged and abandoned. Seismic exploration has included approximately 10,000 km of two-dimensional (2D) lines (mostly before 1985), and about 325 km² of three-dimensional (3D) seismic was conducted in 2013/2014 (Northern Cross (Yukon) Ltd. 2014).

Chance has completed Project-related baseline studies, including surface and groundwater, permafrost, aquatics and fish, vegetation, wildlife, socio-economic, and heritage resources.



Map 1-1. Eagle Plains Exploration Project location.

1.2 DOCUMENT PURPOSE

This document provides an overview of the Project, its location and details about the phases, principal and accessory components, and scheduling. The Draft Project Description outlines a proposed program that will build on past exploration to better define the extent, amount and quality of oil and gas deposits in the area. Under the program, Chance proposes conducting additional 2D and 3D seismic data acquisition programs and drilling up to 30 exploratory wells over ten years. Depending on the drilling program results, EFT, lasting up to two years, may be conducted at wells where crude oil or natural gas are discovered to determine the quantity, quality and extent of the oil and gas deposit(s). The existing winter road network will be expanded to support the seismic, drilling, and flow testing programs. Most of the work and all the new land disturbance will occur in the winter (e.g., seismic line clearing and drilling). Work outside of the winter includes aerial-supported seismic recordings, and EFT may also occur during summer.

The information in this document is conceptual and intended to provide a level of detail supporting discussions on the draft Project Description with potentially affected First Nations, residents of local communities, and stakeholders. Development of this draft document is based on the *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (YESAB 2005), specifically Part 1, Section 5.0 Project Description.

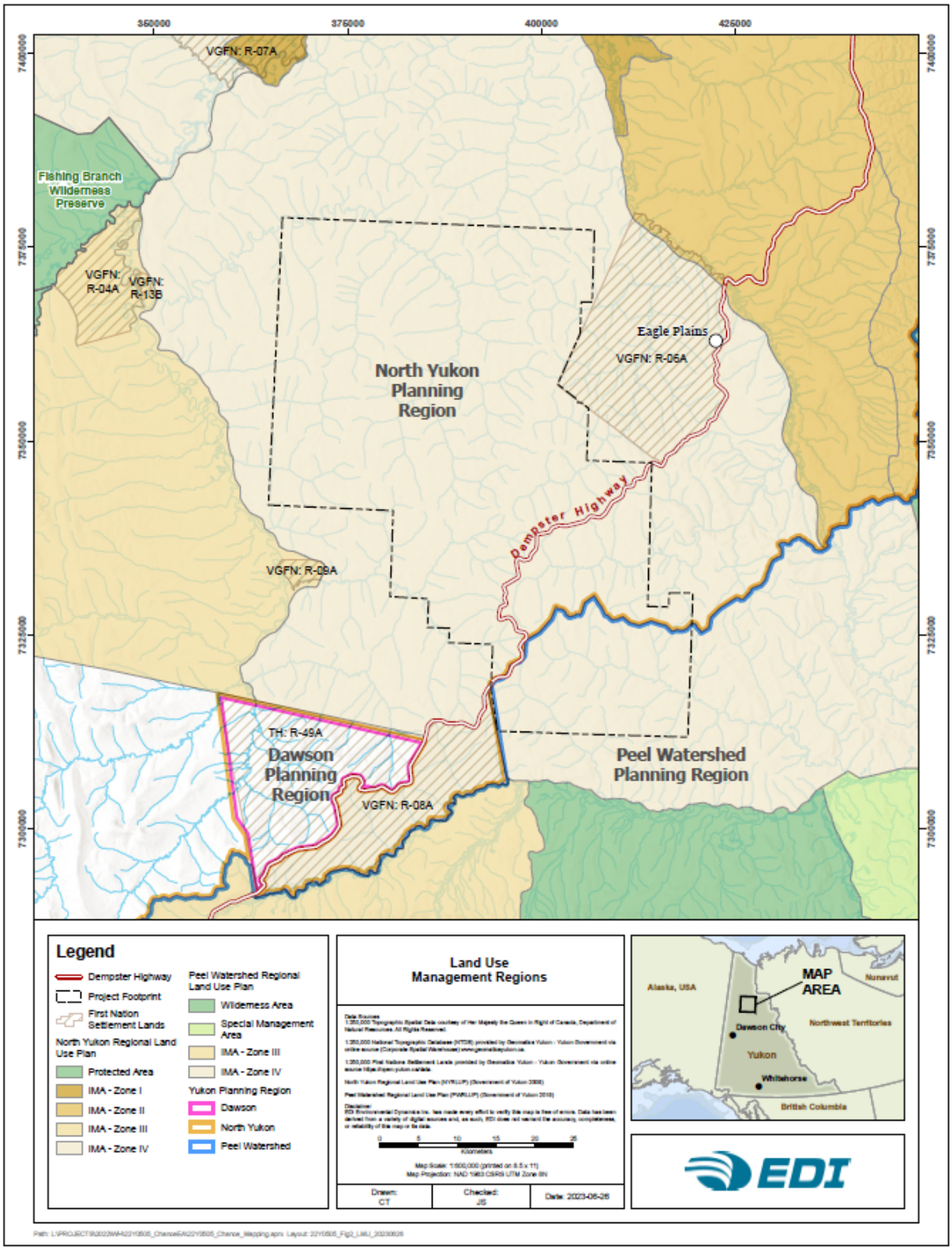
1.3 REGULATORY CONTEXT

The Project is subject to a screening by the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee, as stated in the *Designated Office Evaluation Report* issued on February 9, 2016 (Project Number: 2014-0112). Development of this draft Project Description is based on the *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (YESAB 2005), specifically Part 1, Section 5.0 Project Description. Given that the regulatory framework and process, as developed by YESAB, has changed since the issuance of the Evaluation Report, Chance will collaborate with the Executive Committee on determining the appropriate regulatory process and required project information going forward, including potential environmental and socio-economic effects assessment information.

Detailed Project design and implementation procedures will be developed following Project approvals. Design, methods, or procedural changes will conform to the commitments made by Chance and the terms and conditions stated in Decision Document(s) resulting from the YESAB Executive Committee screening process, once defined. A complete list of required federal and territorial permits, licences, approvals, and assessments will be clarified with the appropriate regulatory agencies as the Project proceeds through the defined permitting and regulatory process.

1.4 RELEVANCE TO LAND USE PLANS

The Project is located within the North Yukon Planning Region and Peel Watershed Planning Region. The Project is, therefore, subject to the approved *North Yukon Regional Land Use Plan* (NYRLUP) (Vuntut Gwitchin Government and Yukon Government 2009) and the *Peel Watershed Regional Land Use Plan* (PWRLUP) (Peel Watershed Planning Commission 2019) (**Map 1-2**).



Map 1-2. Eagle Plains Project and Land Use Planning Units (LMUs).

Each First Nation government has provided input to and approved the Regional Land Use Plan(s) on their Traditional Territory under the respective First Nation Final Agreements.

1.4.1 North Yukon Regional Land Use Plan

The Project lies mainly within the North Yukon Planning Region and is subject to the North Yukon Regional Land Use Plan (NYRLUP). The NYRLUP was created to protect the natural and cultural resources of the region while allowing sustainable economic development opportunities (Vuntut Gwitchin Government and Yukon Government 2009). It provides management direction for using public and settlement lands based on four principles: sustainable development, precautionary principle, conservation, and adaptive management. The NYRLUP divides the Planning Region into 23 Landscape Management Units (LMU), classified into three categories: protected area, integrated management area (IMA), and community area. IMAs are further classified into four zones: Zone 1 (lowest development), Zone II (low development), Zone III (moderate development), and Zone IV (highest development). IMA zones are classified based on the area's sensitivity to landscape disturbance, ecological and cultural values, risk of significant impacts, and level of acceptable change. The RSA is a Zone IV IMA with lower ecological and cultural values in a moderately sensitive biophysical setting. Subsequently, Zone IV IMAs allows for the highest development level to occur.

The NYRLUP encourages results-based management and uses cumulative effects indicators to determine if goals and objectives are met. Results-based management allows for innovation and creativity in land-use strategies and approaches. The two cumulative effects indicators included in the NYRLUP are direct surface disturbance and linear density. The NYRLUP guidelines for Zone IV IMAs are 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density (Vuntut Gwitchin Government and Yukon Government 2009). However, as surface disturbances and linear features reach a level of functional recovery and become part of the continuous landscape, they can be subtracted from the total amount of disturbed area (Vuntut Gwitchin Government and Yukon Government 2009). The NYRLUP suggests using a height of 1.5 m for woody vegetation in forested areas, as vegetation above this height would likely no longer allow for travel or access by humans or wildlife and is, therefore, considered functionally recovered. Activities considered exempt from functional disturbance restrictions are (1) new linear features less than 1.5 m wide; (2) land-use activities that occur on frozen water bodies; (3) winter work with no required clearing of trees; and (4) winter work that uses existing disturbances and linear features.

1.4.2 Peel Watershed Regional Land Use Plan

The southeastern corner of the Project lies within the Peel Watershed Planning Region (PWPR) and is subject to the Peel Watershed Regional Land Use Plan (PWRLUP) (Peel Watershed Planning Commission 2019). Like the NYRLUP, the PWRLUP was established to provide management direction and ensure long-term sustainable development in the Planning Region. The PWRLUP was founded on three main themes: environmental protection, social considerations, and economic development. It follows a similar framework as the NYRLUP. The PWPR is divided into 16 LMUs, each with similar ecological characteristics, planning issues, and management intent. Each LMU is categorized by a land-use designation system. Conservation Areas are managed to protect ecological and cultural resources, while IMAs are 'working' landscapes where new development and surface disturbance may be allowed. IMAs are further classified into Zones, which correspond to the level of allowable development with comparable justification as the NYRLUP. The RSA

is part of LMU 7 (Dalglish Creek), classified as an IMA Zone IV, allowing for the highest level of development.

Like the NYRLUP, the PWRLUP encourages results-based management and uses the same cumulative effects indicators, surface disturbance and linear density to inform decisions. The PWRLUP cautionary and critical indicators are identical to the NYRLUP: 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density. As surface disturbances reach a level of functional recovery and no longer enable travel or access by wildlife and people, they can be subtracted from the total amount of disturbed area. The PWRLUP suggests using a 1.5 m woody vegetation height as a threshold for functional recovery in forested or shrubland areas. In areas dominated by low-growing vegetation, a feature could be considered functionally recovered when covered by native species roughly the same height and composition as the surrounding vegetation. To be considered as "functionally recovered," features must have similar sediment and run-off compared to background levels, roughly match original contours, and have no human-brought materials on the site. Exceptions to the linear density calculation are identical to those outlined in the NYRLUP.

1.5 BASELINE DATA AND MANAGEMENT PLANS

Baseline environmental information and data are required for proposed oil and gas projects submitted to the YESAB Executive Committee for screening under the *Yukon Environmental and Socio-economic Assessment Act, S.C. 2003, c.7* (Government of Canada 2003) (*YESAA*), and applications submitted for other permits and licences. To receive authorization for the Eagle Plains Project to proceed, the Project must be evaluated under *YESAA*.

Environmental baseline reports describing current conditions and outlining specific objectives, as identified in YESAB's *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (YESAB 2005), have been prepared and will be included in the Project proposal submission and following the regulatory process moving forward, once defined. A series of management plans are under development by Chance to provide additional information on infrastructure design and component-specific activities, including follow-up monitoring. These plans will be further developed to include any input from potentially affected First Nations, residents of communities, territorial and federal government departments, and recommendations from the YESAB Executive Committee.

1.6 COLLABORATION WITH FIRST NATIONS AND COMMUNITIES

Chance is committed to developing collaborative working relationships with potentially affected First Nations through the ongoing consultation and engagement process, including the Tetlit Gwich'in Council, Tr'ondëk Hwëchin, the First Nation of Na-Cho Nyäk Dun, and Vuntut Gwitchin First Nation, and residents of nearby communities. The Draft Project Description is one of the multiple opportunities for leadership, individuals, and groups within these communities to share comments, concerns, and recommendations regarding Project activities. Chance will work to incorporate feedback shared on the Project to maximize Project-related benefits for potentially affected First Nations and residents of communities, to address concerns and mitigate potentially adverse effects.

2 PROJECT OVERVIEW

This section provides a summary of the proposed program. Subsections provide additional details on the seismic and exploratory drilling programs, the DST and EFT, accessory Project components, reclamation and closure information, and an overview of Project components and schedule.

The Project area comprises approximately 2,400 km² of oil and gas claims on either side of the Dempster Highway south and west of the Eagle Plains Hotel. The Project and its principal components are exploratory and have been designed to confirm the quality, quantity, and areal extent of any accumulations of hydrocarbons. Hydraulic fracturing is not proposed as part of the Project. Chance intends to conduct Project activities over ten years, primarily during the winter, from winter 2025 to winter 2035.

The Project consists of two phases:

1. Exploration Phase; and
2. Reclamation and Closure Phase.

The key Exploration Phase activities are outlined in **Table 2-1** and the key Reclamation and Closure Phase activities are outlined in **Table 2-2**

Table 2-1. Summary of key Exploration Phase activities.

Project Activity	Key Construction Phase Activity
Engagement	Ongoing engagement with First Nations.
	Ongoing engagement with community residents.
Main Camp	Opening the camp — mobilization of equipment and personnel
	The camp will house the drilling and seismic crew and other support services.
	Construction of the Central Processing Facility (CPF) (once extended flow tests [EFTs] are proposed)
Tree Clearing and Grubbing	Salvage during the winter, before the construction of the winter access roads
Winter Road Construction	Winter roads are required for seismic and well drilling, so will be the first activities of a winter operation.
Seismic Exploration	Access road construction
	Seismic line construction, hazard identification, cutting, surveying, etc.
	Line preparation and drilling
	Data acquisition and recording
Exploration Well site Construction	Well site pads will be constructed using snow, water to freeze the site, a protective liner and rig mats.
Drilling	Up to 30 pads will be constructed and used for exploration drilling over the 10-year life of the Project.
	Remote sump access for drilling mud and rock cutting disposal
	Stripped drilling fluid will be disposed of at deep zone injection wells located at Eagle Plain.
	Completing drill stem tests

Project Activity	Key Construction Phase Activity
	Acid stimulation and completion of wells for testing
Well Testing	Facilities to be installed, as needed, for testing and extended well tests.
	Routine maintenance of facilities, production equipment and well bores, as needed
	Gas is to be flared off, and oil is placed in storage tanks. Recovered formation water (if any) will be disposed of in deep zone injection wells.
Accessory Activities	Winter road construction
	Construction of a winter-use airstrip
	Vehicle traffic related to drilling and construction activities
	Water use permit for lease and winter road construction and waste disposal at the camp
	Baseline data collection and environmental monitoring
	Maintaining and snow-clearing roads and leases
	Water permit use for boilers during winter drilling

Table 2-2. Summary of key Reclamation Phase and Closure Phase activities.

Project Activity	Key Reclamation Phase Activity
Engagement	Ongoing engagement with First Nations.
	Ongoing engagement with community residents.
Seismic Lines	Low impact seismic, narrow construction, stem bending, natural regeneration
Well Suspension	Wells that have successfully undergone EFT will be suspended pending future development approval.
Well Abandonment	Unsuccessful wells and wells not used for disposal will be abandoned when testing or production phases are complete.
	Testing facilities are to be removed from each site.
Mix Bury Cover (MBC) Sump Site Reclamation	The site will be reclaimed as per AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023)
Central Processing Facility	Upon complete field decommissioning activities, the removal of the Central Processing Facility will occur.
Well Site Reclamation	Well site equipment will be removed.
	Area will be allowed to revegetate naturally.
Accessory Activities	Discussions with regulators (as necessary) before reclamation work to determine whether there should be changes to the Plan
	Annual monitoring until vegetation regrowth is deemed satisfactory
	Conduct a Phase 1 Environmental Site Assessment (ESA) for each location.
	Obtain Regulatory Closure approval.

2.1 EXPLORATION

2.1.1 Seismic

Seismic exploration uses a compressional seismic p-wave (like an ultrasound) to remotely image rock layers beneath the surface. The technology measures the reflected energy waves (p-waves), akin to multiple echoes from each rock layer, to identify geological settings where oil and natural gas might be located. This imaging allows geophysicists and geologists to map the subsurface structure of rock formations that could contain hydrocarbons and help pinpoint areas of the greatest potential for drilling a successful well.

Small dynamite charges in shallow holes, called shot holes, are used to create the p-waves that reflect off the various rock layers underground; the reflected p-waves are recorded by very sensitive devices called geophones (that can even detect wind or the footsteps of people passing by). The small dynamite charges within each shot hole force the explosive energy downward through the various rock layers. A seismic detonation of one kilogram (kg) is comparable to the sound of a passing diesel truck and is only 0.5 seconds in duration. The time it takes to receive the reflected sound wave from the detonation tells geophysicists and geologists where the rock layers are, based on where the sound-conducting properties of the rocks change. Very little sound or vibration is perceptible at the surface by anything other than the geophones.

The seismic exploration program will consist of up to 1,500 km² of 3D Low Impact Seismic (LIS) data acquisition and up to 2,000 km of 2D LIS data acquisition. Seismic exploration relies on the geophones placed in a single line (2D) or along multiple, usually parallel, lines (3D). The 2D program may be undertaken as a single program or several smaller programs; the 3D program will be conducted as several programs of 400–700 km² areas. The winter seismic programs will minimize terrain, terrestrial and aquatic environmental effects. The seismic recording will take place in summer to minimize ground disturbance and allow for decreased Health, Safety and Environment (HSE) concerns.

2.1.2 Drilling

The exploratory drilling program consists of up to seven wells, drilled sequentially each year, to a maximum of 30 wells over 10 years. The well locations will be selected based on existing geological and geophysical data, data from previously drilled wells, data from the seismic program, and data from the wells drilled as part of this program.

The exploratory drilling program is planned to begin in winter 2025/2026. Three to five wells may be drilled during the winter, depending on their proximity to the Dempster Highway. Access to initial well sites will be via winter access roads. The well sites will be prepared using winter access methods and rig matting. The winter timing and access location will minimize ground disturbance and potential effects on permafrost and vegetation.

The sequence in which wells are drilled for the exploration program depends on previous drilling success, EFT results, data collected from the seismic exploration program, weather, and road conditions. The ongoing process of interpreting seismic data will allow Chance to understand better the geological setting and size/geometry of potential prospects.

If crude oil or natural gas are discovered in sufficient quantities, Chance will conduct EFT at that well. A maximum of 30 wells may have EFT. The EFT at an individual well can last from several months to several winter seasons, depending on the well and whether the discovery is principally crude oil or natural gas. At a maximum annual drilling rate, with all drilled wells deemed suitable for EFT, 10 wells could be undergoing EFT at any time for this Project.

Once a well has been drilled and tested to determine whether oil and gas reservoirs were encountered, Chance will decide whether to complete the well[1] and conduct EFT or safely and securely abandon the well and reclaim the well site. Once the well completion determination has been made, the drill rig will be removed from the well site and proceed to the next exploratory drilling location.

2.1.2.1 Extended Flow Testing

The EFT provides data on fluid composition, reservoir properties, areal extent, and pressure, both during the EFT and as it builds up following the flow period of the EFT.

If Chance decides to proceed with EFT at a well site, it will be reconfigured to support EFT. A completion, or service rig, will be moved to the site to install the EFT equipment in the well. At the depth where oil or gas has been identified, the cemented in-place steel casing is perforated for fluid to flow out of the geologic formation and into the well.

Some combination of natural gas, crude oil, and formation water (i.e., very deep non-potable groundwater that is usually saline, located in the same rock formation as the oil and gas deposit) are usually extracted during EFT. Fluids produced during EFT will be separated and measured in mobile units on the well pad. Natural gas may be flared but preferentially used as fuel for process heating, mechanical power, and onsite power generation. Formation water will be disposed of by re-injecting it into a compatible and approved geological formation via an existing Eagle Plains well converted to a deep injection well. Existing suspended wells may be converted to deep-injection wells as needed.

2.2 RECLAMATION AND CLOSURE

Progressive reclamation and closure activities are ongoing during the Exploration Phase. This includes the reclamation of winter roads, abandoned well pads, seismic lines, and clearings due to accessory activities. As this Project primarily involves winter activities (except for seismic recording), reclamation will mostly rely on low impact seismic, stem bending, and natural regeneration, intending to minimize ground surface disturbance. A Conceptual Reclamation and Closure Plan will detail reclamation, abandonment, and closure activities.

2.3 ACCESSORY PROJECT COMPONENTS

Additional activities required to support the principal Project components are as follows:

[1] Completion of the well at this stage involves inserting steel pipe, referred to as casing, into the well bore and injecting cement into the annular space between the outside of the casing and the native rock formations to set the casing in place and to prevent any fluids in the rock formation from flowing to surface uncontrolled, and capping the well with a series of valves, referred to as the wellhead, or Christmas Tree.

- Construct a series of Mix Bury Cover (MBC) sumps covering an area of up to approximately 6.4 hectares (ha) to dispose of drill cuttings. These sumps are in an area adjacent to the existing Devon sump (which pre-dates Chance) at km 336 of the Dempster Highway, which has been identified as a suitable location.
- Construct winter access roads.
- Construct an airstrip for seasonal (winter) use on the Chance Winter Road location west of the Dempster Highway.
- Mobilize equipment, supplies, and personnel to the Project and Project area.
- Use the existing Chance Camp at km 325 of the Dempster Highway to house up to 75 workers on a rotational shift basis, and occasionally use the Eagle Plains Hotel,.
- Use a remote fly-in camp near the proposed East Greaves and West Greaves Winter Trails, roughly 40 km from the Chance Camp, to accommodate approximately 25 operations personnel.
- Construct a Central Processing Facility (CPF) at the existing Chance Camp, which will allow Chance to store, further treat/separate fluid produced during EFT and transfer it to trucks for disposal. The additional processing enabled by the CPF will stabilize the crude oil, as required for future truck transport to an appropriate approved crude marketing point.

2.4 SCHEDULE

The Project will enter the YESAB Executive Committee Screening Process by 2024, aiming to have all necessary permitting and approvals by mid-2025. Chance plans to begin exploration activities as early as late 2025, and the Project is planned for up to 10 years. The progress of each component and accessory activity will be scheduled, located, and timed to accommodate factors such as remoteness, weather, seasonal operations, and lack of resourcing, including finding qualified oilfield staff in the region. Certainty around schedule and outcome will be gained as initial data is analyzed from the first few wells that are drilled and had EFT and subsequently from the seismic program. The timing of the three principal Project components and accessory activities is shown in **Table 2-3.**

Exploration activity can start as early as December 2025 and continue for up to 10 years. Scheduling detail is provided for the first three years. The data collected during those initial years will strongly influence future activities' timing, location, and intensity. The schedule only generally accounts for operational interruptions such as severe weather, geological re-interpretation, equipment breakdown or other delays beyond the operator's control.

Chance will engage potentially-affected First Nations and residents of communities throughout the life of the Project.

In summary, Chance will conduct a seismic program staged over five to eight years and drill up to 30 wells over the course of the 10-year Project starting the winter of Project approval. Due to the limitations of the camp and the Eagle Plains Hotel, the exploration work will be undertaken in a logical sequence alternating between drilling and seismic. If a well is successful (i.e., if there is a discovery of crude oil or natural gas in sufficient quantities), Chance will conduct an EFT for up to two years on that particular well.

Table 2-3. Project component and accessory activities timing.

Component	Timing	Details (as needed)
Seismic Exploration Program	except for seismic data recording, the seismic programs will occur during the winter and alternating with the drilling activities due to capacity constraints at the camp.	Subject to this limitation, seismic programs could occur during the 10-year exploration period.
Drilling Exploration Program	alternating with seismic programs initially, starting during the winter months (October through April).	Drilling may be interspersed with accessory activities such as preparing/decommissioning access to well sites, mobilizing/demobilizing equipment, and reclamation activities.
EFT program	timing will depend on the exploration drilling results, primarily the discovery of crude oil or natural gas, and the capacity of the 75-person camp to accommodate the necessary crews.	The EFT will be staggered across the Project area, but it is expected that one or more EFTs will happen in the Project area during the winter operating season.
MBC sumps or pods construction	will occur in every season that drilling is happening, and sumps will be built on an as-needed basis to dispose of drill cuttings	
Airstrip and CPF construction	will likely occur within the first or second winter season.	
Reclamation	will be ongoing throughout the Project's life.	

3 PROJECT DETAILS

Information provided below for each Project component includes its location, key design features, and the results of any relevant investigations to establish site conditions (e.g., seismicity, geotechnical parameters), where applicable. An overview of each Project component and associated activities is described in **Table 3-1.**

The principal Project components in the Exploration Phase are:

1. seismic exploration program.
2. drilling exploration program; and
3. extended flow testing program.

All three components are intended to operate simultaneously, sequentially, or alternatively. The data collected during each program contributes to a more robust characterization of the geological setting in the Project area. A better understanding of the geological setting allows Chance to identify prospects showing potential for oil and gas reserves to accumulate. A combination of existing data and data from seismic exploration, new drilling, and EFT will evaluate these prospects.

The proposed seismic exploration program, consisting of up to 1,500 km² of 3D LIS seismic and up to 2,000 km of 2D LIS seismic, is intended to further identify and map oil and gas prospects where the potential for hydrocarbons to accumulate exists in the Project area. The 3D seismic program will likely be undertaken in a series of smaller areas of 400–700 km² areas and undertaken in a sequential, alternating program with drilling activities. The 2D seismic program could be conducted at once, or as a series of smaller areas connected to a broader program execution strategy.

The exploration drilling program will occur 24 hours per day, seven days per week, once underway, during the winter. When using one drilling rig, Chance will drill one well at a time and up to seven wells per year. Additional wells could be drilled if two rigs are being used. When hydrocarbon resources are discovered (either natural gas or crude oil), Chance will conduct EFT to gather data about the nature of the resource accumulation and its productive capability, which will be used to determine future development plans for each location. EFT timelines vary between wells with a primarily natural gas discovery and wells with a primarily crude oil discovery as follows:

- EFT on wells with a primarily natural gas discovery: maximum of one to two months; and,
- EFT on wells with a primarily crude oil discovery: maximum of two years.

EFT is typically conducted continuously (i.e., 7 days a week, 24 hours a day) until complete; once EFT has begun on a well, pausing or ceasing EFT is logistically challenging and time intensive. Up to 10 wells may be undergoing EFT concurrently, based on the proposed exploration drilling schedule, and up to 30 wells may undergo EFT over the life of the Project, depending on hydrocarbon resource discovery.

The Project does not include hydraulic fracturing.

Table 3-1. Project components and activities overview.

Project Component	Activities
General Project Overview	• Exploration activities for crude oil and natural gas in the Eagle Plains area: ▫ 2D and 3D seismic exploration ▫ Exploration well drilling, flow testing, suspension, decommissioning, and abandonment. ▫ Successful wells will be suspended but may be brought forward in future development project proposals. • Use of existing Chance camp to store equipment and supplies and to house personnel: ▫ Water use up to 20 cubic metres per day (m³/day) (for washing, showers, toilets, etc.). Bottled drinking water will be supplied to the camp ▫ Use and maintenance of existing wastewater treatment facilities ▫ 75-person capacity • Transport of goods, materials, and personnel to/from the Project area and within the Project area. • Project components will occur sequentially at each new well site over the 10-year Project term as follows: ▫ Initial mobilization of equipment to the Project site. ▫ Construction of required infrastructure. ▫ Well site development, drilling, testing, decommissioning, and abandonment. ▫ Progressive reclamation. ▫ Final closure and reclamation. • Ongoing engagement with First Nations. • Ongoing engagement with local community residents.
Seismic Exploration	• Establishment of seismic line mulching areas: ▫ Up to 1,500 km² of 3D seismic (2.75 m wide source lines, 1.75 m wide receiver lines all mulched) ▫ Up to 2,000 km of 2D seismic (2.75 m wide) • Global Positioning System (GPS) Survey of receiver points and source points • Low Impact Seismic (LIS) tracked air hammer drilling of seismic shot holes • Explosives storage (magazines), transportation, and use (1 kilogram [kg] per source point) • Recording with wireless system. Helicopter use for deployment and recovery of recording equipment and conducting data recording.
Drilling Exploration	• Winter establishment of up to 30 well sites, each approximately 1.44 hectares (ha) within the Project area ▫ Site levelling using packed snow or ice and rig matting as required • Installation of surface infrastructure on drill sites including: ▫ Drill rig ▫ Mud tanks, pumps, and mud mixing and separation systems ▫ Power generators ▫ Boilers ▫ Flare tanks and flare stack ▫ Blowout preventer accumulator system ▫ Fuel storage

Project Component	Activities
	▫ Cement mixing and storage ▫ Storage bins for rock cuttings removed from the drilling mud ▫ Trailers for offices, first aid, rig crew sleeping quarters, water storage and treatment, sewage storage, and food waste incinerator. • Drilling wells up to 2,500 m deep ▫ Wells drilled sequentially, one to two wells at a time, up to seven wells per year ▫ Use of low-toxicity, water-based mud system ▫ Use of an average of 15 cubic metres (m^3) and up to a maximum of 100 m^3 of water per operating day for drilling ▫ Disposal of drill cuttings into individual Mix Bury Cover (MBC) sumps or pods approximately 300 m^3 over an area of 800 square metres (m^2) (estimated volume of drill cuttings for one well) ▫ Disposal of approximately 200 m^3 of drilling mud in MBC • Drill Stem Tests (DST): one or more on each well at depths where formations with the potential to produce crude oil or natural gas were encountered. ▫ Potential acid stimulation using approximately 5–10 m^3 of a weak concentration of hydrochloric acid (10-20 percent [%]) ▫ Production and separation of fluids recovered from the well during the DST(s). ▫ Flaring natural gas, separation of crude oil and any produced formation water. • Disposal of formation water, saline fluids, liquid faction of drilling fluids and rig wash underground in deep-injection wells converted from existing suspended wells or wells drilled as part of this Project.
Extended Flow Testing (EFT)	• Installation of surface and subsurface equipment and facilities to enable EFT including: ▫ Casing of entire wellbore and perforation of the casing at zones of interest ▫ Packer, tubing, and downhole measurement gauges ▫ Wellhead valve assembly ▫ Flare tank and flare stack ▫ Separator vessel, treating vessel, and storage tanks ▫ Appropriate artificial lift systems (e.g., pumps) ▫ Heaters ▫ Dehydrators ▫ Flow lines ▫ Metering equipment ▫ Portable generators • Conduct EFTs on up to 30 wells ▫ May be completed within a few weeks at a predominantly natural gas bearing zone or may require up to 2 years for a predominantly crude oil-bearing zone. ▫ Separation of natural gas, crude oil, and formation water ▫ Production of crude oil and transportation of produced crude oil from the site to markets. ▫ Using natural gas on site for process heating, storage tanks and other vessels used, fueling artificial lifting to assist crude oil production, or compression of natural gas to be used in other areas of the operation such as fuel to heat the camp. ▫ Flaring natural gas during EFT if unable to use on site.

Project Component	Activities
	• Disposal of formation water, saline fluids, liquid faction of drilling fluids and rig wash underground in deep-injection wells converted from existing suspended wells or wells drilled as part of this Project.
Well Maintenance (Workovers)	• Suspended wells are inspected annually, and active wells are subject to servicing on an as-needed basis to address operational issues that interrupt the EFT, requiring mobilization and installation of a service rig to the well site to remedy the problem. • Maintenance activities include: ▫ Wellhead Inspection Pressure Test of surface wellhead valves ▫ Surface Casing Vent Flow test ▫ Gas Migration test ▫ Repair or replace pumping equipment ▫ Clear blockages to fluid flow that can develop during EFT ▫ Replace worn-out downhole equipment ▫ Set up EFT in other formations within the same wellbore ▫ Suspend or abandon wells after EFT
Access Roads	• Construction of winter trail access for exploratory well drilling, DST, EFT, and seismic program access and execution. • Clearing woody vegetation along identified route above the surface of the snow. • Minimum of 10 centimetres (cm) of packed snow accumulation, packing snow and, in some sections, spreading water to create ice on the ground surface. • 8–10 m wide with wider pullouts of 16–20 m spaced every 5 kms to allow for passing traffic. • The total length of winter access roads per season will vary based on locations identified for exploration drilling each winter; new well sites will be accessed using existing/previously used routes as much as possible to minimize new clearing and linear disturbance. ▫ Each season, a maximum of 125 km of new (previously uncleared or used more than ten years ago) winter access roads will be created. ▫ Approximately 15% of the roads will be built on previously disturbed ground (old roads, cutlines, etc.) ▫ A maximum of 200 km of winter access roads (new winter access + previously cleared winter access) will be active each season. • Clearing of vegetation.
Mix Bury Cover (MBC) Construction and Operation	• Construction of MBC sump approximately 6.4 ha total in area to dispose of drill cuttings and drilling by-products. ▫ The sump will be excavated as disposal volume is required to minimize potential permafrost exposure (possibly in narrow compartments oriented east-west to maximize shading). ▫ Each MBC “pod” will be 800 m^2 and contain the drill cuttings from one well; only one pod at a time will be active/excavated. ▫ A typical well produces up to 300 m^3 of drill cuttings for disposal; development of the MBC would parallel the rate of exploration drilling (i.e., typically 1,500 m^3 of drill cuttings for disposal each year) • Removal and stockpile of organic cover material and silts for use in reclamation.
Central Processing Facility (CPF)	• Construction of CPF adjacent to the camp, which would include: ▫ Multi-stage and multi-phase separators ▫ Heat treatment

Project Component	Activities
	▫ Vapour and gas collection system for flares or to provide fuel for camp use ▫ Processing of crude oil to stabilize and meet specifications for truck transport ▫ Storage of approximately 3,180 m³ of crude oil ▫ Storage of approximately 119 m³ of formation water • Fuel storage facility ▫ 151,000 L diesel fuel ▫ 24,000 L propane • Storage and use of chemicals and reagents: ▫ Hydrochloric acid (10% to 20% concentration) ▫ Methanol ▫ Additives to prevent corrosion of oilfield processing and handling equipment ▫ Demulsifiers to be used in treating fluids to better separate oil from formation water • Bulk explosive compound to store dynamite for seismic exploration.
Airstrip	• Construction of an airstrip approximately 1,500 m long located at about km 4 along the Chance winter road from the Dempster Highway intersection • Airstrip use throughout the Project life, approximately two flights per week. • Aviation fuel storage
Water Use	• Use of up to 300 m³ of water per day (or per permitted limits) for making snow to build winter trails, ice roads and temporary well sites, not exceeding 10% of the instantaneous flow from the following extraction points: ▫ Year-round extraction from the Eagle River, Ogilvie River, and Whitestone River. ▫ Seasonal extraction from Glacier Creek and Fly Camp. • Use up to 20 m³ of water daily (for washing, showers, toilets, etc.); bottled drinking water will be supplied to the camp. • Construction of a water reservoir at the camp for water storage and use during low water periods.
Transportation	• Use Dempster Highway, North Klondike Highway, and Alaska Highway to access Project site. • Approximate offsite traffic on public roads between the site and supply points is estimated to be: ▫ 7–10 water trucks and up to 3 fuel trucks per week. ▫ 8–9 lightweight service vehicles per week as needed. • Onsite traffic on Proponent-controlled roads is estimated to be: ▫ Fuel and water deliveries at a rate of 5-8 trucks per week. ▫ Lightweight service vehicles daily to transport personnel and gear from camp to well sites.
Camp and Workforce	• Up to 75 people on-site during all Project components. • Continued use of existing 75-person Chance Camp, located at km 325 of the Dempster Highway. ▫ Existing waste management and disposal facilities. ▫ Existing wastewater treatment infrastructure. • Use Eagle Plains Hotel to accommodate personnel overflow for short periods, if required.

Project Component	Activities

Reclamation and Closure	• Progressive abandonment and reclamation of unsuccessful wells.
	  ▫ Installation of cement plugs across all porous/permeable zones within the wellbore, across the base of each casing section and including an overlapping portion below the surface casing with the base of the surface casing.
	  ▫ Cutting a surface portion of well casing(s) off at least 1 m below ground level and welding steel plates to cap the casing.
	• Progressive decommissioning and reclamation of access routes when they are no longer necessary.
	• Well suspension or abandonment at the end of Project.
	• Decommissioning and reclamation of the MBC sump area and airstrip at the end of the Project.

3.1 SEISMIC EXPLORATION PROGRAM

3.1.1 Seismic Data and Drill Locations

Seismic uses a compressional seismic p-wave (like an ultrasound) to remotely image layers of rock beneath the surface. The technology measures the reflected energy waves to identify geological settings where oil and natural gas might be deposited. This imaging allows geophysicists and geologists to map the subsurface structure of rock formations that could potentially contain hydrocarbons. The placement and orientation of these layers help to pinpoint the area with the greatest potential to drill a successful well.

Source points use small dynamite charges in shallow holes to create the p-waves that reflect off the various rock layers underground like an echo to be recorded by highly sensitive recording devices called geophones. The detonations used to create the seismic wave are contained within the hole to force the energy downward through the various rock strata. A seismic detonation of 1 kg creates a dull thud that can be heard only near the hole. It is comparable to a passing diesel truck for ½ second duration. As the energy bounces back to the surface, the geophones detect the seismic waves and record the data **Figure 3-1.** The time it takes to receive the sound wave from the detonation tells geophysicists and geologists where the rock properties change, helping to find the oil and gas deposits. Very little reflected energy is perceptible at the surface by anything other than the highly sensitive geophones.

Once all source points have been detonated in sequence, the data are processed and analyzed. The interpretation of the seismic data can give geophysicists detailed cross-sections (2D seismic lines) and multi-dimensional graphics (3D seismic programs) of the sub-surface area. This information is combined with previously known information about the rock types within the area and their properties, such as hardness, density and porosity, to support drilling locations for wells. The decision to drill wells or acquire additional seismic is determined by the amount and quality of the data available (**Figure 3-2**).

Decisions to drill wells or acquire additional seismic data is an ongoing process to define the resource potential in a particular geological formation or geographic region and is a combination of geological and geophysical efforts. The process includes ongoing seismic acquisition and geological evaluation as the wells are drilled and production capabilities are examined.

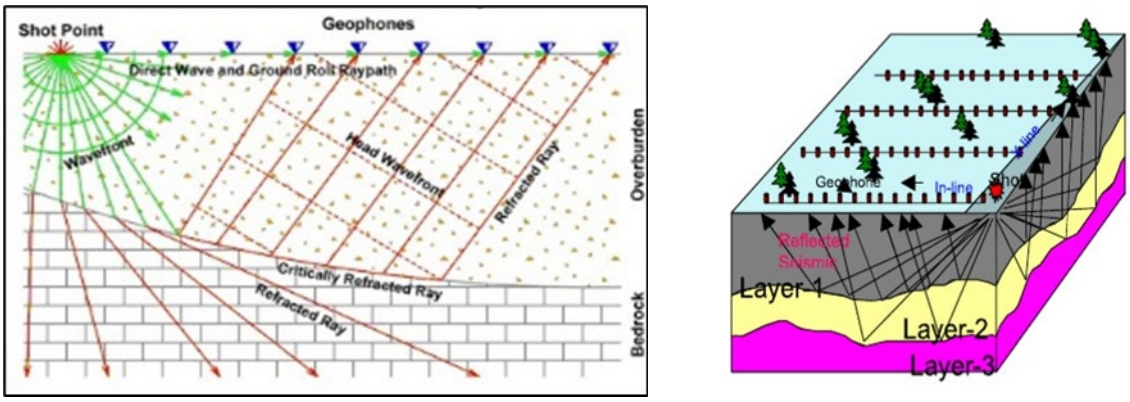


Figure 3-1. A graphic example of the reflection seismic exploration data collection process.

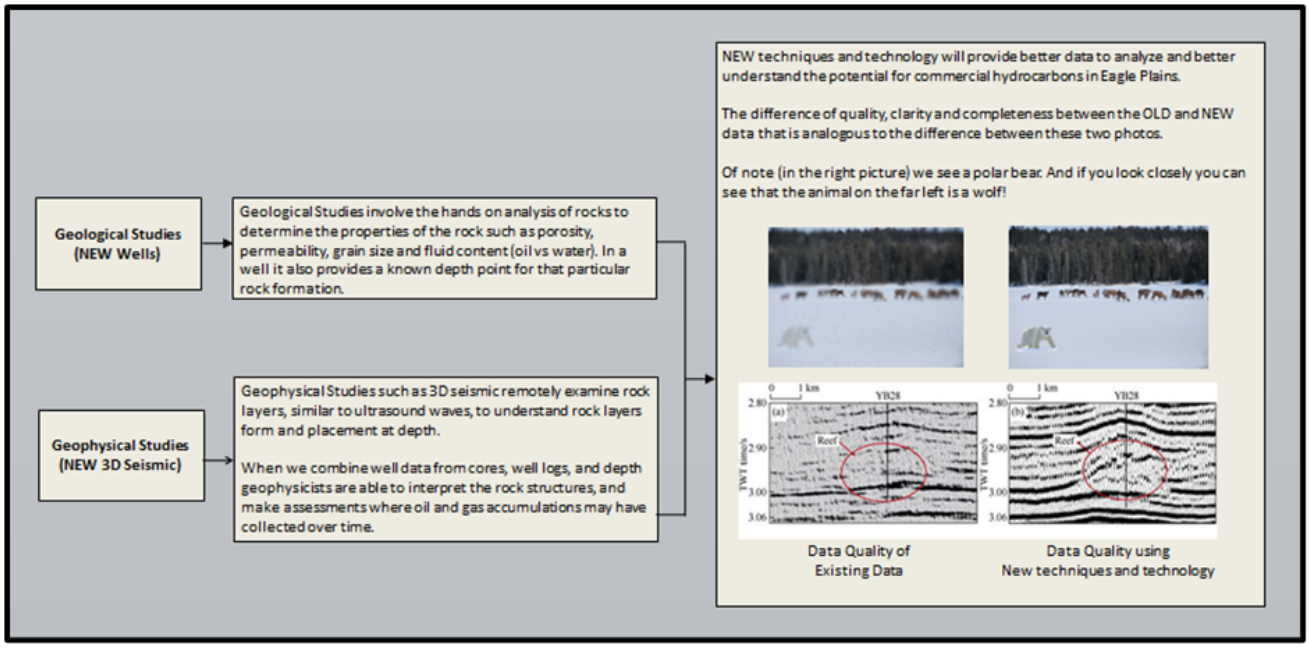


Figure 3-2. Example geological and geophysical studies.

3.1.1.1 Seismic Data

Seismic data is required in the Eagle Plains Basin to understand the area's complex geology. Modern seismic techniques will provide high-quality information about the geology of Eagle Plains while minimizing environmental effects. The proposed area for seismic exploration consists of about 1,500 km² of new 3D and 2,000 km of new 2D reflection seismic exploration within Chance's exploration permit area. **Map 3-1** illustrates the extent of the exploration area. However, the location of each annual seismic program, whether 2D or 3D, will be determined by analyzing the exploration drilling results and how seismic may help determine the knowledge of the basin. Low Impact Seismic 2D programs can be used to determine the extent or edge of a prospect, and LIS 3D will show more detail.

Depending on available accommodations, personnel, and equipment, the seismic data will likely be acquired in several discrete programs of approximately 400–700 km² areas. Year-round operations will enable resource allocation by completing line preparation during the winter and conducting the recording activities during the summer using heli-portable operations. Lines will be prepared in winter when snow is present, and the ground is frozen. Winter ground preparation will protect the active layer and underlying permafrost and preserve saplings and small shrubs. Year-round operations will enable larger portions of the seismic program to be completed with reduced disruption within the Project area.

For LIS 3D, a design is created by a professional 3D designer. For the Eagle Plains area, receiver lines will have an east/west orientation, and source lines will be oriented north/south. The spacing between points is determined by the level of data resolution required to image the shallowest rock formation of interest. It is estimated to vary between 40 and 50 m since the geology at Eagle Plains dips from the northeast (NE) to the southwest (SW). For a given layer of rock, it will be physically shallower in the NE part of the basin and deeper in the SW. The receiver lines will be mulched with the narrowest mulch head size (1.75 m wide), allowing for safe travel by foot, snowmobile or ATV and will run roughly parallel to other meandering receiver lines spaced approximately 200 m apart. The north-south source lines will be mulched (2.5 m wide) to allow access for the tracked drills that make the shot holes. The source lines run roughly parallel to other meandering source lines approximately 300 m apart. For LIS 2D, the geophones and sources are located within the same meandering, about 2.5 m wide, line.

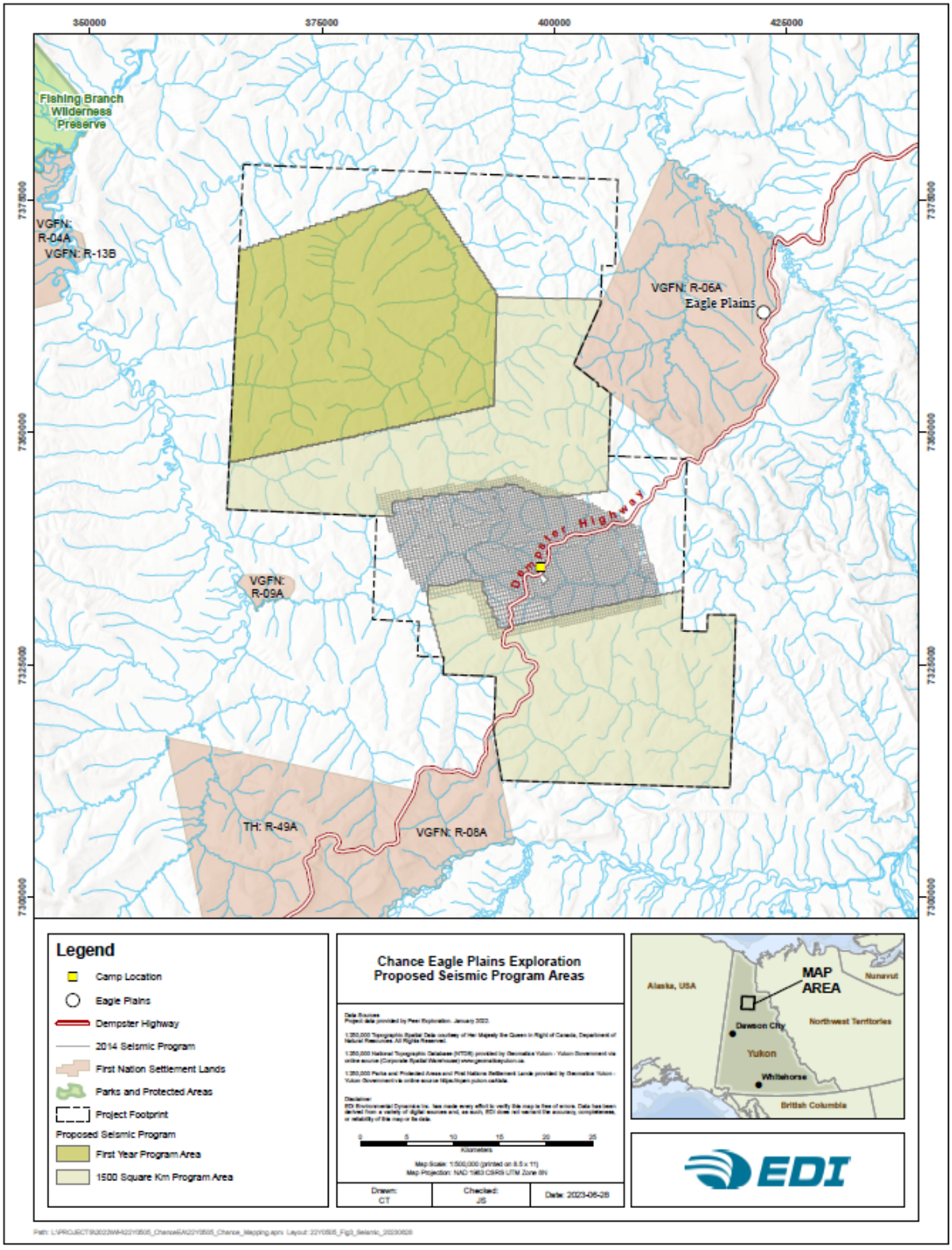
During the recording process, each source point is detonated separately upon the initiation of a radio signal directed by the field operator called a “shooter”. The shooter is positioned at least 30 m from the active station and can survey the surrounding environment to observe detonation safety. The source point that will be detonated is in the source “swath” area and provides a center point for the recording patch. A recording “patch” is the area of live (active) geophones that are closest to the source point swath area (within 3,000 m). Upon detonation of the source point within the swath, the geophones in the recording patch collect the data. For the Eagle Plains area, the patch size is comprised of 16 lines containing 140 geophones each (**Figure 3-3**). The patch ensures that far offset distances are greater than the depth of target formation; therefore, the data will encompass areas large enough to prevent gaps in the data. The patch is moved digitally and physically as the shooter travels from east to west and then north to south. Geophones are continually picked up from the recorded area and moved to the next area ahead of the recording patch.

As seismic program data will be acquired over several years, naturally occurring fires are likely in the area. Several fires have occurred in the Eagle Plains basin, and approximately 60% of the Project area has been burned. The most recent wildfire occurred in 2017, burning 294 km² within Chance’s exploration permits 0010 and 0012 (**Map 3-2**).

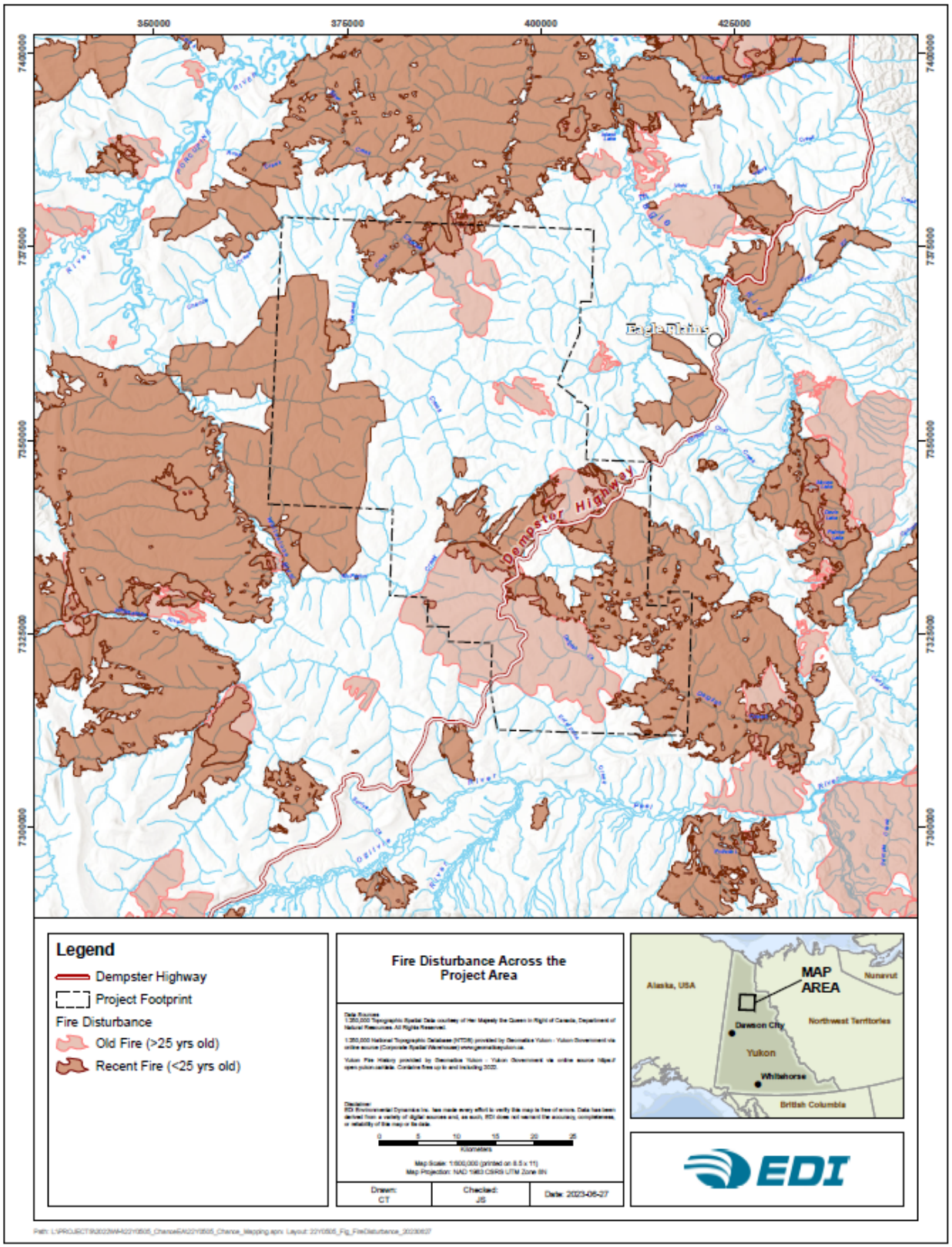
Each year that a seismic program with be conducted, an analysis of mitigation strategies is undertaken, and appropriate strategies are implemented to reduce the environmental effects in the area. One example is using existing burn areas rather than clearing new vegetation where possible. The proposed first-year seismic program was designed considering the existing open meadow and burn areas. Lines traversing these areas will not disturb live vegetation and should not be regarded as a functional disturbance. Regrowth in these areas will also be monitored to gauge the natural regeneration conditions in the area. Previous LIS seismic line disturbances will continue to be, analyzed to ensure that current methods of line

preparation provide optimal conditions for regrowth in the Eagle Plains area. Ecological, permafrost and historical data have been extensively gathered and incorporated into the operations plan.

Seismic operations are planned for year-round operations in the year that they are to be conducted, based on length of time required to conduct each component of the program and the limited personnel, equipment, and accommodations available in the Eagle Plains area. The line preparation (access trail construction, line cutting, surveying, and drilling) will be conducted during the winter months (December through April) under frozen ground conditions and recording would then follow in the summer months (July through September) (**Figure 3-3**).



Map 3-1. Proposed seismic program area in the Eagle Plains Project Area.



Map 3-2. Forest fire burn areas in Eagle Plains.

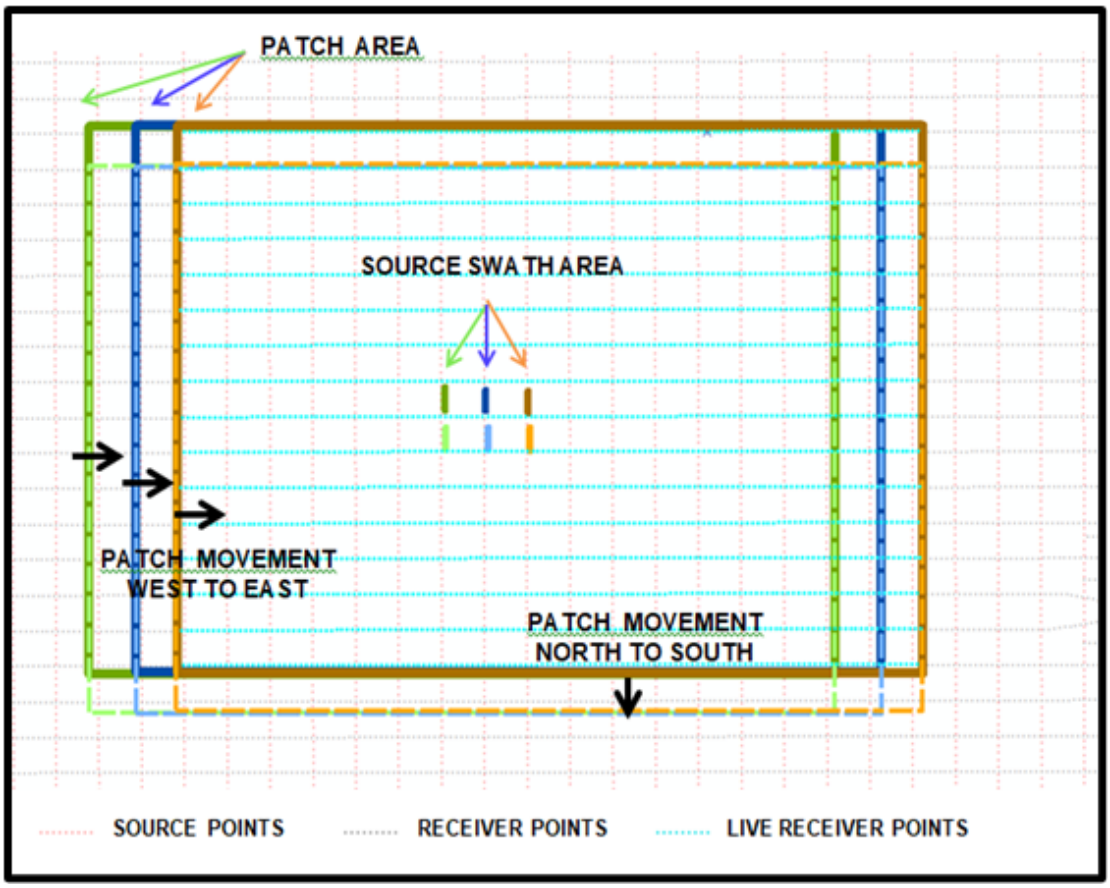


Figure 3-3. Proposed seismic patch size and movement throughout the Program area.

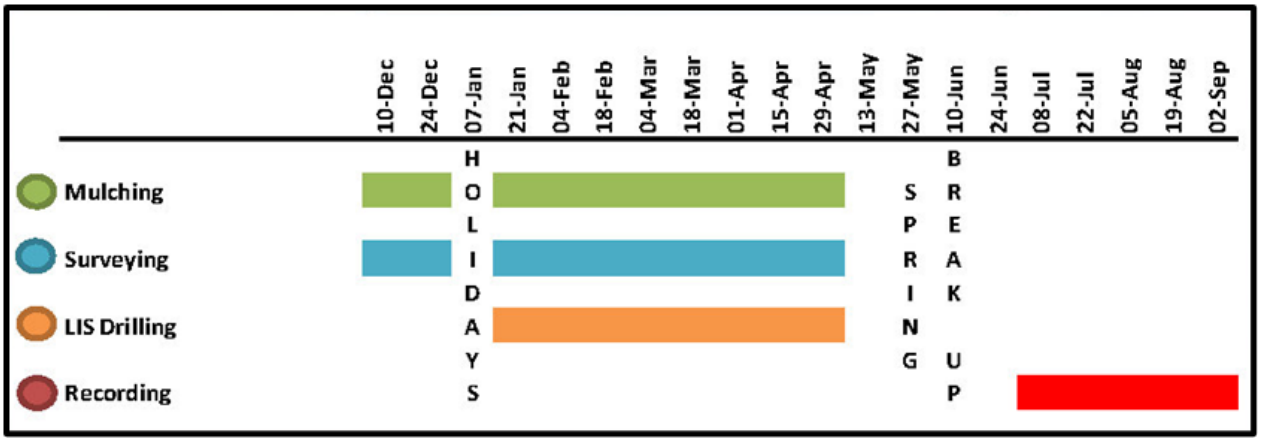


Figure 3-4. Proposed year-round schedule in Eagle Plains.

3.1.1.2 Seismic Line Construction

The historical seismic data in the Eagle Plains area consists of “Legacy” 2D seismic lines and the “Modern” LIS 3D seismic program conducted in 2013–2014. The methods used to construct the Legacy 2D lines included 6–10 m wide lines in straight (linear) patterns that cross the landscape. These lines are visible today mainly due to the use of bulldozers to remove over/understory — clearing methods and wider lines that are not required in modern LIS practices. Modern LIS line construction methods use narrow line widths that meander and create non-linear line disturbances. Bulldozers are no longer used in seismic line construction; smaller and narrower mulchers are now used to support the preservation of the active layer and reduced vegetation removal.

Line preparation will use the LIS methods, reducing the landscape footprint. This technique creates meandering source and receiver lines that limit the line of sight to less than 70 m, which minimizes any predator (e.g., wolf) line of sight for prey. The LIS method also ensures that the line can avoid removing larger timber that shelters under canopy vegetation by adjusting the meander of the line to avoid larger trees and mature vegetation.

3.1.1.3 Constraint and Sensitive Habitat Identification and Mitigation

Before line preparation, a detailed line-by-line spatial analysis (area examination) is performed using a combination of air photos, Light Detecting and Ranging (LiDAR), field scout information, Geographic Information System (GIS) information, First Nation cultural inputs and heritage studies, permafrost studies and flora and fauna assessments. Existing disturbances, burn areas, and natural open areas will be used rather than create new cutting where possible. Topography, natural drainage, and runoff patterns will be considered when developing the seismic design to prevent impediments to water flow. All lines will have offsets to protect sensitive habitats. Streams and rivers will be avoided except for crossings at access points. Doglegs will be used where lines intersect major access routes to reduce visibility and use as access.

Planning the seismic, winter access, and well pad sites considered water, landscape, landform (e.g., permafrost), vegetation and habitat sensitivities to disturbance. A “Constraints Map” exercise was conducted to identify especially sensitive or high quality environmental and heritage values where project work should be avoided. Constraints include areas that are sensitive for environmental, cultural, or safety reasons. In seismic exploration, the term “constraints” is often referred to as “hazards”. Examples of environmental values in Eagle Plains include permafrost areas, high-value wildlife habitat, wetlands, riparian areas, and heritage sites. Management measures applied with the constraints map include complete avoidance of project development/activities within the mapped areas and a range of other types of mitigations where avoidance is not possible — examples include rig matting, winter work, LIS, etc.

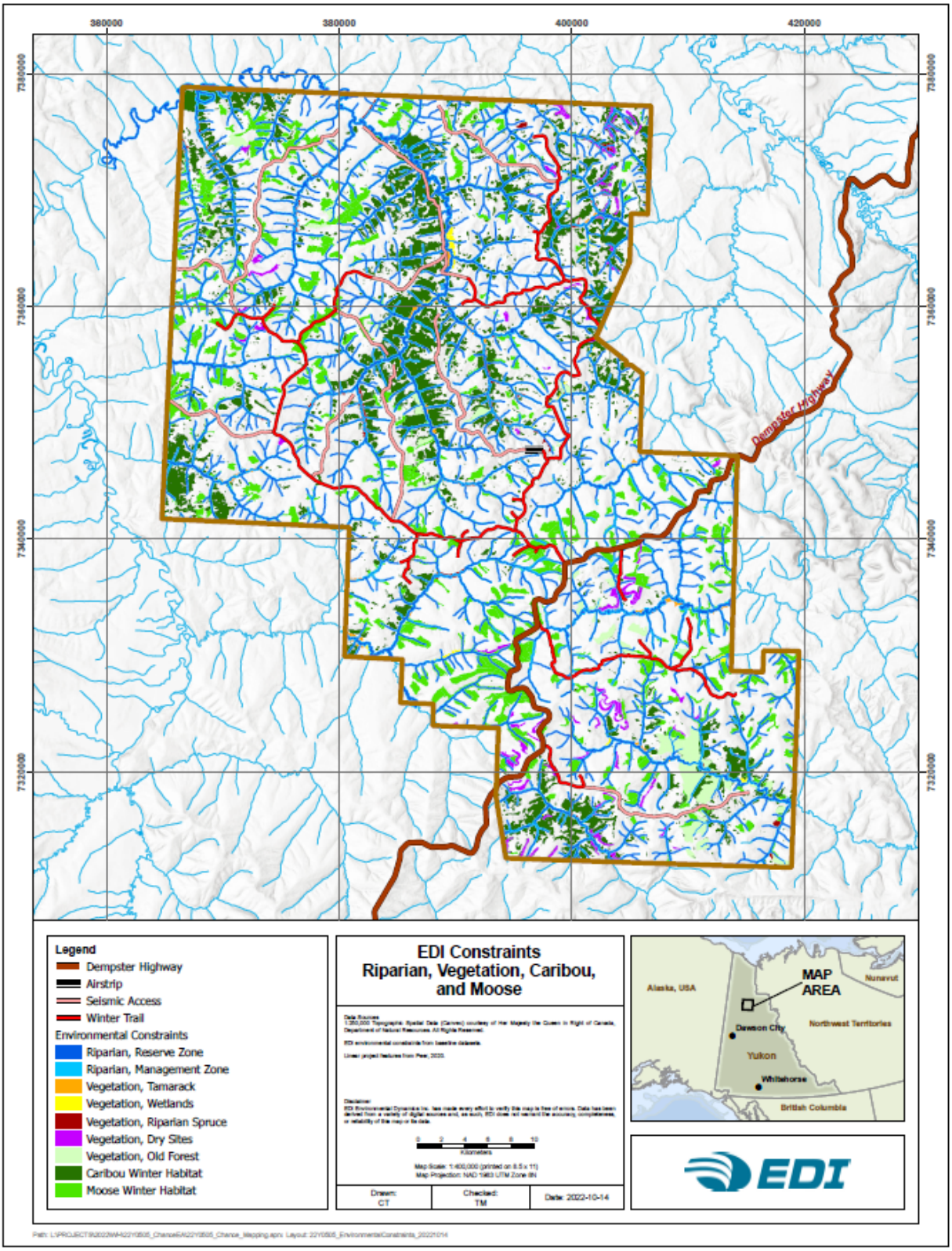
Developing and applying a constraints map for environmental and heritage sites is especially useful when certain project features cannot be preplanned (i.e., mapped), which is the case for multiple features in the Eagle Plains Project. Since Chance cannot plan exactly where Project features will occur as exploration proceeds, identifying high value areas where Project features cannot occur is a good approach to mitigating potential effects.

Details of the constraints mapping approach will be provided in the environmental assessment portion of the Project Description. Several important landscape and ecological features were considered, but the key features built into the constraints map (**Map 3-3**) included the following:

- Surface water and fish were considered by creating no-disturbance buffers in riparian areas to higher order streams where fish are likely present in the summer.
- Vegetation was considered by identifying sensitive Ecological Landscape Classification units including dry sites, riparian spruce sites, tamarack sites, and unique wetland sites.
- Moose habitat included high-rated forage sites.
- Heritage sites and high heritage potential identified by the Yukon Government, First Nations, or site-specific surveys.
- Caribou high value forage habitat.

The avoidance priority considering all constraints is as follows:

1. Heritage sites;
2. Permafrost/terrain sensitive areas;
3. Riparian management areas;
4. Priority ELC units;
5. Caribou habitat; and,
6. Moose habitat.



Map 3-3. Constraints Riparian, Vegetation, Caribou, and Moose.

Pre-flagging may be conducted to identify Pand mark line locations containing riparian areas, difficult terrain, hazards or constraints, historical/archeological areas, animal features and facilities. This is done by personnel on the ground marking the line locations and areas of concern for the mulchers and chainsaw operators to follow or avoid. These areas will be added to the Project map and used to plan each area's activities strategically. Decisions can be made to delay progress in certain areas due to wildlife presence or to employ different equipment that would be better suited to the terrain in that area. In addition, geofences can be created to monitor activities near “Hot Spots” which are areas of concern that personnel must avoid. Handheld GPS units support accurate line placement and automatically notify management when the mechanical equipment approaches a “Hot Spot” or stations encroach on any buffered zones or areas. Personnel trained to monitor the production crew’s location based on the GIS data gathered during the pre-flagging stage to ensure designated equipment and personnel in the area are safe.

3.1.1.4 Line Preparation — Cutting

A combination of mulchers and operators with chainsaws will prepare source and receiver lines that will be closely monitored and quality controlled. Mulchers (**Photo 3-1)** are equipped with GPS units with seismic line data to allow the operator to follow a pre-planned course. Mulcher operators have detailed information on the area’s pre-identified hazards or constraints, culturally sensitive locations, flora and fauna setbacks, and course derivations, and the operator takes care when approaching these areas of concern. Lines will be doglegged (or bent) at locations crossing any major access trails and open clearings to reduce the visual identification of access points into the program area. Meandering line construction chooses the path of least resistance and avoids timber larger than 20 to 30 cm in diameter (**Photo 3-2** and **Photo 3-3**). This technique reduces the line of sight down line to less than 70 m. Studies conducted on the 2014 3D seismic program found that the average off-line sight line was 46 m due to the region's sparse tree density and large burn areas.

Source lines will be mulched to 2.5 m wide (**Photo 3-2**) to accommodate tracked LIS drill vehicles, and receiver lines will be 1.75 m wide (**Photo 3-3**) to accommodate snowmobiles, ATVs and personnel. A minimum of 10 cm of packed snow will be left online to mitigate possible damage to vegetation or permafrost. Riparian areas and lines containing pokers or leaners will be hand cleared with chainsaws.

The seismic line preparation will be done using rough mulching: a technique that removes the branches but leaves the tree's stem intact. This technique is useful in leaving evenly distributed coarse, woody debris allowing for more rapid decomposition of the fallen timber while enabling the new vegetation to propagate through the mulch (**Photo 3-4**). The mulcher heads are set to high blade, leaving the active layer undisturbed and soil or permafrost unaffected. The mulch also protects the root system of young timber from heat, cold, drought and erosion. Rough mulching makes lines narrower, creating more natural lines with weakly defined cut-width edges.

The Eagle Plains Basin has few watercourses of substantial size. Most watercourses are intermittent and have little or no year-round fish-bearing potential as they freeze to the bottom in winter. The most notable watercourses are Chance Creek and Greaves Creek (in the North), McParlon Creek (Central) and Dalglish and Enterprise Creeks (in the South). The Whitestone River is west of and outside of the Project area.

Since creeks in the program area freeze to the bottom in winter, no “major” watercourse crossings will be required. A major watercourse crossing is any stream or river that will not freeze to the bottom or the water flow is too great to sustain a snow fill crossing. Crossings are categorized as mechanical (equipment crossing) or foot crossing. The mechanical crossings (**Figure 3-5)** will be constructed using snow fills and may require a water truck to make snow and freeze in the crossing. Water crossings are first packed with clean snow pushed from the creek surface to the crossing location. This prevents woody debris from contaminating the creek during spring melt. The snow is then hardened using a water truck to form ice to strengthen crossing integrity with the weight of the equipment. Snow fills in both creeks and drainage areas will preserve the integrity of the banks for adequate water flow and run-off. All crossings will be removed before spring break-up to allow obstruction-free drainage. All snow fills will be constructed following the Department of Fisheries and Oceans (DFO) *Code of Practice: Ice Bridges and Snow Fills* (September 2022) (Government of Canada 2022).

Riparian areas are also examined and added to the program map. Since riparian areas provide key resources for wildlife and bank stability, mechanical equipment is restricted to a 55 m setback from the bank edge. This setback protects vegetation disturbance in the area and makes sure source holes terminate at a safe distance to avoid flowing holes (**Figure 3-6)**.



Photo 3-1. A 2.5 m wide mulcher.



Photo 3-2. A 2014 3D source 2.5 m wide line in the Project Area.



Photo 3-3. A 2014 3D receiver 1.75 m wide line.



Photo 3-4. 2019 photo showing 2014 3D source line construction and deadfall from wildfire.
Note: minimal disturbance to the active layer and minimal mulch produced.

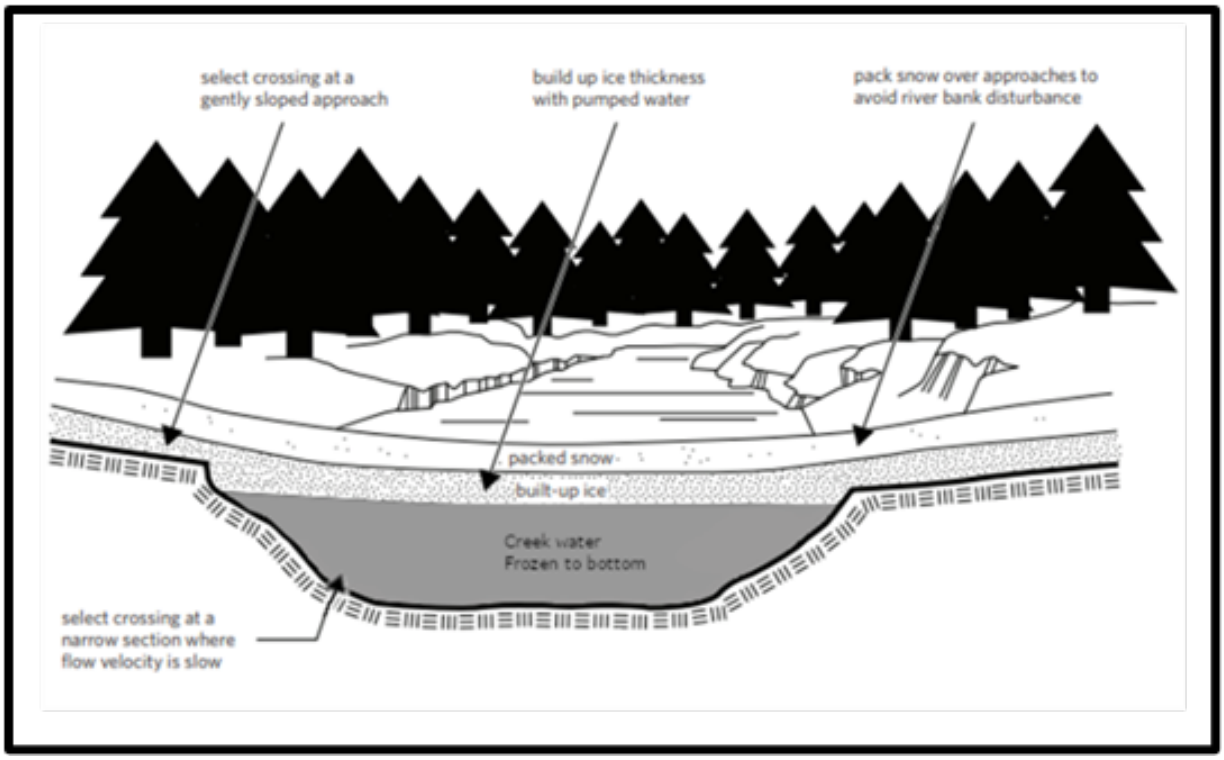


Figure 3-5. Typical creek crossing in Eagle Plains. Creeks are crossed at a 90-degree angle to banks to preserve bank stability.

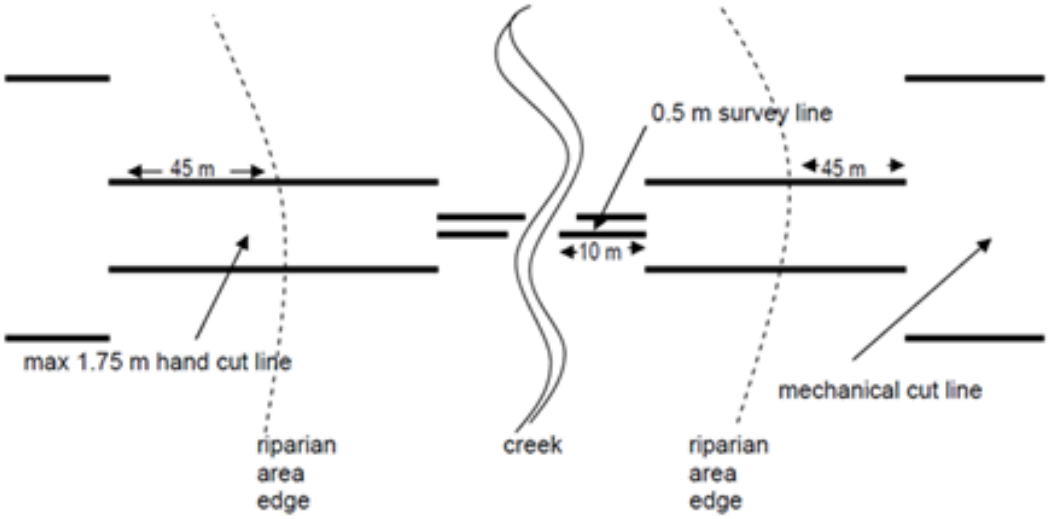


Figure 3-6. Riparian area diagram with cutting and mechanical equipment setbacks.

3.1.1.5 Line Preparation — Surveying

Once there are a sufficient number of source and receiver lines cut to allow the next stage of the seismic program to occur, surveyors then travel the source lines using all-terrain vehicles (ATVs) and snowmobiles to survey and mark each drill location of the source holes; and on receiver lines they mark the receiver points where the recording crew will place the wireless geophones.

Surveyors also add to the hazard/sensitive site assessment map as they record their GPS data. These data include:

- riparian areas;
- difficult terrain;
- historical/archeological areas;
- animal sites/features;
- facilities;
- hazard identification;
- proper line placement;
- movement around thick bush;
- refining cutting requirements; and,
- flag all hazards or constraints and riparian areas.

3.1.1.6 Line Preparation — Drilling

Once source points are surveyed, narrow-tracked LIS drills (**Photo 3-5)** are deployed to drill a 10 cm diameter, 6 m deep hole at each location. For the proposed seismic programs in Eagle Plains, the source points will be spaced along the source lines at approximately a 50 m interval.

No water was required to drill the source holes during the 2014 seismic program, and cuttings were easily reloaded into the hole chamber after the dynamite was placed at the bottom of the hole. Source holes are loaded with 1 kg of dynamite to be later detonated by the recording crew (this is called pre-loading). As

provincial/territorial and federal legislation requires, each source point is plugged with drill cuttings (soil, rocks, etc.) brought up to the surface from the drill stem). An industry-approved plug is inserted into the hole at a minimum depth of 30 cm below the surface and then filled to the surface with more drill cuttings.

Peer and the industry's explosive providers are aware of the regulations under the federal *Transportation of Dangerous Goods Act, S.C. 1992, c. 34* (Government of Canada 1992) and strictly adhere to those regulations. Explosives will only be transported in approved magazines and by individuals trained in transporting dangerous goods. Natural Resources Canada (NRCAN) regulates and controls all aspects of explosive possession and transportation through magazine licenses which are renewed annually. The new Electronic License Management System (eLMS) allows up-to-date management of all explosive purchases, transport, and incidents to ensure explosives are tracked and safely stored. The two types of magazines that will be used to store explosives are as follows:

Maxam Type 9 Magazines (Photo 3-6):

- There are two compartments — dynamite and detonator.
- Type 9 magazines are lined with 7/8" Armortex (Bullet Proofing and Blast Resistant). Dimensions are 58" wide x 144" long x 66" high.
- Doors are high security and built as per NRCAN Regulations and issued a Federal Tag #.
- There will be two different sizes of skidded Type 9 magazines which will store up to 3,000 kg of explosives and 5,000 detonators, depending on packaging. There are also wheeled Type 9 magazines built to the same specifications but with reduced capacities.
- Construction from the outer skin to inside is:
  - ¼" steel plate;
  - 7/8" Armortex; and,
  - ¼" plywood interior.
- Weight is 7,500 pounds (lbs).
- These magazines are transported by either small custom-built tandem axle trailers, tandem axle recovery/tow truck with a flat bed or any truck trailer unit such as a low boy.

Maxam Type 4 Magazines:

- Single-compartment magazine;
- Various sizes — 8' wide x 12' long x 7' high with a capacity 7,500 kg;
- High-security door construction as per NRCAN Regulations and issued a Federal Tag #;
- Construction from the outer skin to inside is:
  - ¼" steel plate;
  - 3" gravel;
  - ¾" plywood interior.
- Weigh 18,000 lbs; and,
- These magazines are transported with either a tandem axle recovery/tow truck with a flat bed or any truck unit such as a low boy.



Photo 3-5. Narrow Low Impact Seismic (LIS) drills.



Photo 3-6. Explosives magazine storage (Maxam Type 9).

3.1.1.7 Data Acquisition — Recording

Recording the seismic program consists of two stages: laying out and picking up equipment on the receiver lines; and detonation at each source hole.

Geophone "Lay-out"/ "Pick-up" — Line crew members place the geophones (**Photo 3-7**) and associated equipment at each receiver point location. Using a long line and heli-bags, a helicopter will place and retrieve recording equipment along the receiver lines at predetermined intervals. Recording personnel will access the equipment in the heli-bags and place a series of geophones approximately every 40 m along the receiver lines. The recording crew will be using a cable-less recording system. Cableless recording systems are ideal for gathering seismic data because they reduce the constraints on geophone placement, eliminate downtime for cable repair, and reduce the number of crew members required to deploy the equipment. Once in place, the geophones record the seismic waves created by the charges detonating on the source lines. Once the section of geophones is recorded, personnel and a helicopter return to retrieve the equipment and any debris used to mark the surveyed receiver locations. The geophones are returned to the staging site, downloaded, cleared and deployed back to the program to be laid out again to record the next section of line.



Photo 3-7. Example of a geophone.

Source Point Detonations — This stage begins after the first section of geophones has been laid out on the receiver lines. Specially trained personnel called "shooters" traverse the source lines on foot, via ATV or snowmobiles, to each source point. The shooter examines the area around the source point for any possible hazards, constraints, or wildlife and inspects the condition of the leads. They connect the detonation device to the leads and signal to the Observer (located at the staging site) that the charge is safe to detonate. The shooter stands clear of the source hole (approximately 30 m) but remains within

viewing distance to watch the area remains clear. A specific radio signal initiates the detonation, and the shooter returns to the hole to remove the detonation device, the leads, and any flagging or markers in the area. The shooter then proceeds to the next source point and repeats this procedure.

Once the program is complete, a crew may be deployed to clean up any remaining material used online for the seismic program. The garbage is returned to a staging point and discarded in an approved bin to be transported to a waste facility. The crew also reports issues that may require further reclamation to be immediately addressed.

During the recording stage, the equipment on the source and receiver lines is accessed by foot, ATV or snowmobile or by helicopter. The helicopter will be based out of the Chance Camp at km 325, and the use of the helicopter will be minimized as much as possible. Where possible, the helicopters will be sourced from local operators familiar with the environment and the Flying in Caribou Country guidance document (Government of Yukon 2010); however, specialized long-lining operators will be required outside Yukon for the recording operation. The addition of helipads will also be required for safety and medevac reasons but will be selected in naturally open and sparsely treed areas.

Staging sites will store some or all of the following equipment throughout the seismic program. All equipment is moved to the next staging site as the equipment is required in the next area of the program:

- Trucks (1/2, 3/4, and 1 ton);
- ATV and snowmobiles;
- Trailers (flat decks and covered);
- Double-walled fuel tanks (diesel 145,228 L, Gas 83,825 L and Jet-A 35,000 L) The fuel will be contained at the main camp in double-walled tanks and transported to the staging sites in a 2,000 L tank trailer for use during operational activities in each area.
- Helicopter & fuel tanker;
- Picker trucks (1-ton trucks with equipment);
- Recording bags;
- Garbage bins to temporarily store garbage before incineration;
- Magazine;
- Survey and drill supplies;
- Canvas tents;
- Medivac unit;
- LIS drill units;
- Seacan for storage and tools;
- Snow cats;
- Water truck;
- Battery truck; and
- Mulchers.

3.1.1.8 Program Access and Remote Camp

Access Trails & Road Crossings — Access routes will be created in strategic corridors to maximize HSE Occupational Health and Safety (OH&S) requirements and to minimize environmental effects. Proposed access trails will be developed using a combination of existing trails, historical seismic lines, or on new cut lines. All access trails will be developed and used to minimize disturbances to the soil, permafrost and vegetation. Where possible, trails will be positioned to follow the shortest and flattest routes, sharing existing linear features or open and burned areas. Construction will follow minimum disturbance techniques, such as mulcher high-blading, to keep the active layer intact. Most trails will be frozen-in or allowed to freeze up naturally.

The width of the access trails will be a maximum width of 6 m wide and will also have a minimum of 10 cm of packed snow. Proposed access is classified as “Winter Trails” and “Seismic Access”. The Winter trails are primary access routes and are expected to be used for seismic, drilling operations and potentially EFT activities with an upgrade to year-round access status. They must be 8 m wide to accommodate two-way traffic and large trailers. Seismic access is only required to be 6 m wide as these trails are only needed for the seismic programs and will be less used. There are potentially 120 km of new “Winter Trail” access and 158 km of new “Seismic Access” to be prepared.

Few new crossings will be required off the Dempster Highway as less seismic is proposed. The areas of the seismic program that encroach on the highway will be managed in two ways. The source and receiver lines will terminate 10 m from the Dempster Highway. Access to the source and receiver lines will be via access trails (connecting the source and receiver lines with the Dempster Highway). The width of access trails will be kept to a minimum while allowing safe access. Access trails will also be doglegged 30 m back from the highway (per the Department of Highways and Public Works guidelines for a 90-degree entry to the highway) (**Figure 3-7**). This will allow personnel an unobstructed view of the traffic on the highway so that safe entry from the access trail to the highway can be made. It also creates an obstructed view from the Dempster Highway users, which will assist in minimizing aesthetic concerns and use as access.

To the extent possible, the intention of the Dempster Highway Development Area (DHDA) will be a primary consideration during line placement of seismic lines near the highway. Travellers also use the Dempster Highway to gain access to the remote regions of the North Yukon and NWT. Chance understands that tourism is an important industry for the area. Since most seismic activity will be conducted during the winter and in remote areas, the effects on tourism are expected to be minimal.

Winter Seismic Transportation — During winter seismic operations, approximately 30 one-ton or ½-ton 4x4 trucks will transport personnel to and from the Chance Camp to their specific job site location daily. It will include mobilization/demobilization and crew transport to and from the main Chance Camp. Using a remote camp will reduce vehicular travel on all roads, including the Dempster Highway, as the proposed remote camp locations are 40 km closer to the seismic program area than the Chance Camp. This will reduce the environmental effects on the roads and surrounding areas and limit the likelihood of accidents or incidents due to travel.

The vehicles will primarily be travelling on the Chance and Blackie roads and other proposed winter access trails, as well as a small section of the Dempster Highway. Any use of the Dempster Highway will occur during specific times of the day as crews will be transported to and from their work site at daybreak, and sundown. Although the proposed project will increase traffic along the Dempster Highway, it is not anticipated to substantially affect users of adjacent Settlement Lands and traditional uses of the area. During the winter, a low number of vehicles (40 to 50 per day) travel the Dempster Highway; therefore, it is anticipated the added traffic for the seismic program will not interfere with regular highway users.

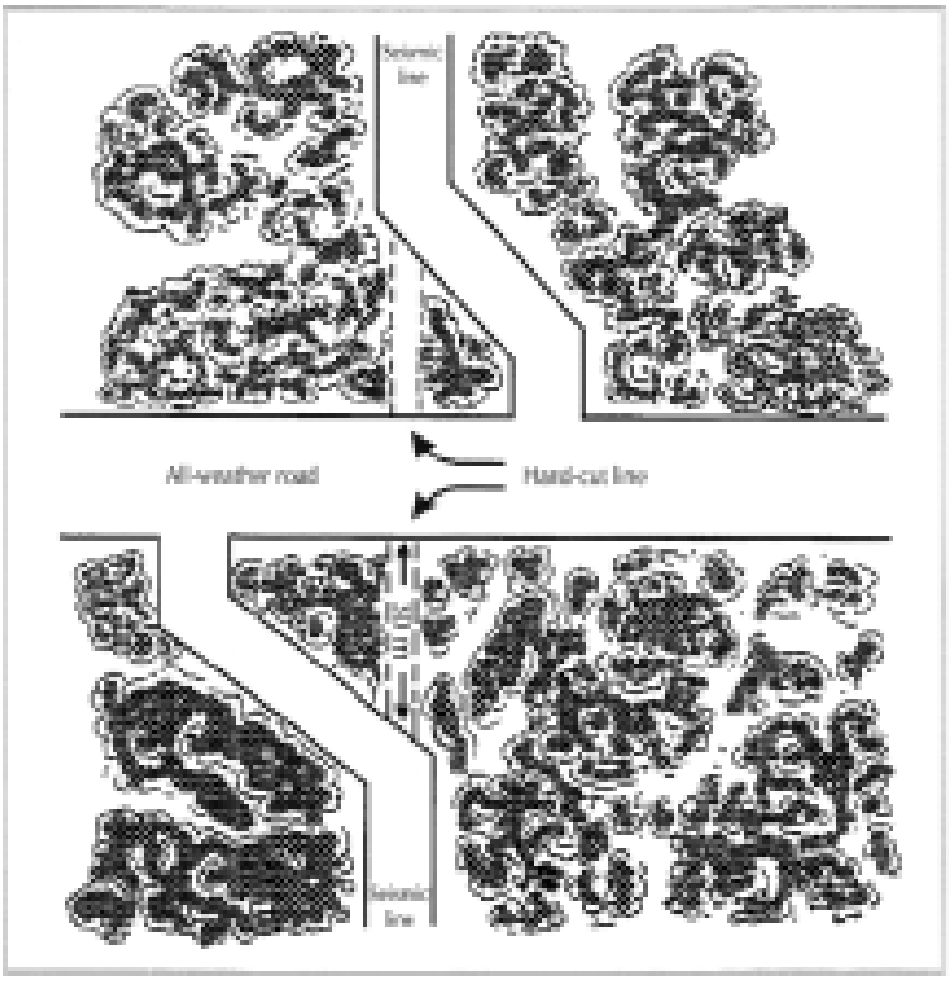


Figure 3-7. "Dogleg" seismic line at access points to limit visibility.

Source: (Yukon Energy Mines and Resources 2006)

Signs stating "Seismic Activity" will be erected in areas where the program is near the Dempster Highway. To avoid possible crew encounters, these signs promote awareness by regular users of the area where the workers are present. The potential for vehicular and hunting conflict will likely be minimal due to the remoteness of the seismic programs; however, crews working on the seismic program are mandated to wear brightly coloured safety vests and hard hats to improve visibility. Seismic crews must also give the right-of-way to all traffic and users of the area. Considering other Dempster Highway users, signage will be posted in communities (i.e., Dawson, Stewart Crossing, Carmacks and Inuvik) one month before the project starts to notify potential highway users that additional traffic may be encountered. Additionally, the Yukon Department of Highways and Public Works will be notified. With these measures, it is anticipated that potential effects on other highway users will be reduced or eliminated.

Summer Seismic Transportation — The summer operations will be limited to seismic recording. Two helicopters (Bell 412 type, capacity of 13 people) will transport workers to and from the program area. This will consist of approximately three trips in the morning and three trips returning to camp in the evening. The recording equipment will be deployed via A-Star type helicopter and long line. Aerial access protects the active layer and underlying permafrost, preserving saplings and small shrubs along the access routes as vehicular traffic will be limited. As caribou are not usually present in the Eagle Plains area during the summer, it is unlikely that they would be affected by the activity in the area. The proposition of year-round activities will also enable larger seismic program areas to be completed in one year, reducing the number of seismic programs needed to acquire the desired dataset.

3.2 DRILLING EXPLORATION PROGRAM

Chance may establish up to 30 well sites during the 10-year Project life, each approximately 1.44 ha. Total approximate disturbance due to well sites throughout the Project is anticipated to be a maximum of 43.2 ha if all 30 wells are drilled.

Initial drilling results will inform subsequent areas of investigation and well site locations. Chance will continue interpreting seismic and exploratory drilling data throughout the Project to understand better the geological setting, size, location, and geometry of potential prospects.

3.2.1 Well Site Locations

Well sites will be preferentially located on heights of land, and will consider the following:

- Avoidance of areas with challenging permafrost conditions.
- Avoidance of ecologically sensitive areas such as riparian corridors (i.e., within 45 m of a perennial watercourse), wetlands, steep slopes, old forest, sensitive wildlife habitat and permafrost features.
- Avoidance of areas with identified or potential heritage values (noted as “avoidance areas”) in Heritage Resource Overview Assessment and Heritage Resource Impact Assessment studies conducted for lands within the Project area (Matrix Research Ltd. 2008, 2013, 2014, Bennett 2022, 2023).
- Requirements from the Yukon *Oil and Gas Act*, RSY 2002, c.6 (*YOGA*) (Government of Yukon 2002) and the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004).

3.2.1.1 Pre-Drilling Preparation

The first exploratory wells will be drilled in the winter of Year 1. Pre-drilling preparation will require preparation of winter roads to the selected well sites, and preparation of the well sites. Winter road and well site preparation require a minimum of 10 centimetres (cm) of packed snow cover (including the highest hummocks) to prevent damaging the surface vegetation (Stanley Associates Engineering Ltd. and Sentar Consultants Ltd. 1993). At least 30 cm of snowfall is required to produce 10 cm of compacted snow (Stanley Associates Engineering Ltd. and Sentar Consultants Ltd. 1993). Snow packing via snowmobile or snowcat earlier in the season (potentially as early as November or December) is usually undertaken to facilitate freezing in the winter trail and well site locations and assist with full construction before drilling operations. Based on historical trends (i.e., when 10 cm of packed snow accumulation has been achieved in past

years), actual construction of the winter roads could occur as early as December or as late as mid-to-late January. Additional details are provided in **section 4.3.1**.

3.2.1.2 Preparing Winter Well Sites

Well site set-up typically requires approximately five days, during which 15 to 20 truckloads are required to mobilize the drill rig and other equipment/materials/infrastructure. Once established, well sites will be approximately 1.44 ha for single well pads and up to 2.5 ha for multiple well pads and will contain the drill rig, flare stack, rig trailers, and office trailers. There will also be trailers to provide sleeping capacity for key personnel required to stay at the rig full-time.

Vegetation clearing at each well site will be minimized as much as possible; well sites will be levelled by packing snow at the site and then icing to form a level pad, or, if not enough snow is available, using water to freeze well pads or making snow artificially. An impermeable liner will be laid on the pad, followed by interlocking wooden rig mats, where required. Rig mats are approximately 16 feet by 8 feet and may be used to cover the entire well site, the area around the drilling rig, or both.

Matting is used at well sites in northern locations to provide insulation and protection to the underlying snow and ground surface, distribute the weight of equipment, and minimize ground disturbance while using the site. Matting will be used when, a) the ground is uneven and leveling the well site with snow and ice is not possible or b) the ground may not be competent enough to support the heavy rig loads and the dynamic loading that is typical of a drilling operation. At winter well sites constructed without densified fill material as the base of the pad, equipment will always remain on matted surfaces in case of early thaw conditions.

3.2.1.3 Well Site Surface Infrastructure

Figure 3-15 illustrates the general layout of equipment, storage, and structures at a proposed well site. The planned 1.44 ha (120 m × 120 m) area is designed to accommodate the drilling operation and associated setback distances from surrounding vegetation, a separation between pieces of equipment, and personnel working and sleeping quarters. It should be sufficient to accommodate the well completion and EFT equipment. As presented in past assessments, Chance plans to use a drill rig with similar capabilities to Chance Rig #1. The drilling rig will be capable of drilling to depths of up to 2,500 m (vertically). The final area of each well site may not be square since the area will depend on topographical constraints.

The rig layout depicted is for a winter drilling operation (distinguished by the number of boilers onsite). Boilers are used extensively in very cold climates to prevent equipment and drilling fluids from freezing.

Table 3-2 describes the drill rig components identified in **Figure 3-8**. Well sites are defined as industrial areas and are therefore restricted entry areas; only appropriately trained, authorized personnel wearing all required personal protective equipment (coveralls, steel-toed boots, hard hat, gloves, and safety glasses) are allowed access. **Photo 3-8** shows a typical example of a Chance rig and is shown at night. **Photo 3-9** shows a typical Chance rig set up at the end of a constructed winter access road.

Table 3-2. Well site components shown in Figure 15 general layout of a well site.

Component	Description
Boilers	Used extensively in very cold climates to prevent equipment and drilling fluids from freezing.
Cement	Cement storage and mixing for use in wells to secure casing and seal off porous and permeable formations to prevent fluid inflow.
Medic, Offices, and Sleeping Trailer	Essential personnel trailers which serve as offices or sleeping quarters and include a multi-room sleeper for some of the personnel at the drilling location.
Flare Tank and Flare	Flare used to incinerate combustible fluids from the well. The flare tank is a reservoir to ensure the flare does not starve of combustible fluids.
Fuel Storage	Fuel used at the site for equipment including drill rig, pumps, light towers, accommodation trailers, boilers, generators, etc.
Garbage and Incinerator	Storage area for waste and incinerator to dispose of food waste.
General Storage	Storage and laydown area for equipment needed onsite.
Mud Tanks	Tanks where drilling mud is stored (drilling mud is a viscous fluid mixture, water based for this operation, used in oil and gas drilling operations to lubricate/cool the drill bit, to carry rock cuttings to the surface and to provide hydrostatic pressure within the drill hole to prevent fluid inflow from porous and permeable rock formations). The tanks are usually upright, fully enclosed, and pressurized, storing bulk materials for drilling mud. Section 31 of the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004) under *Yukon Oil and Gas Act*, SY 2019, c.6 (*YOGA*) (Government of Yukon 2002) stipulates that the "combined capacity of the drilling fluid tanks of every fluid system must not be less than the greater of 120 m^3 and 50% excess of the volume of the wellbore." Cement materials both prior to and after mixing are stored in similar tanks.
Main Mud Storage	Location where all the drilling mud materials are stored. Normally these materials are delivered on pallets stacked and shrink wrapped to protect them during transport and storage.
Drill Pipe Storage	Racks in which drill pipe is stored until required to be run in the hole.
Mud Mixing	Tank in which drilling mud products are first mixed with water to facilitate further mixing with drilling mud already mixed and in use. Products such as bentonite clay, for example, require a caustic soda solution to facilitate good mixing and preserve good flow characteristics
Mud Pumps	Pumps used to circulate the drilling mud down the drill pipe, around the drill bit, and up the annular space between the drill pipe and the open hole or casing to surface.
Return Mud Separator	The area where the return mud separator, known as a shale shaker, separates rock cuttings from the drilling mud. The rock cuttings are then centrifuged to separate residual liquid from the cuttings so the cuttings can be disposed in a Mix Bury Cover (MBC) sump. The centrifuge is also used at the end of the drilling operation to recover water for use in the next well and the spent mud is also disposed of in the MBC sump.
Drill Structure	Components required to drill the well, include: • Sub-structure, or base, on which the derrick is fixed. • Derrick that supports the draw works and top drive which hold drill pipe before it is run into or retrieved from the well and the equipment used to rotate the drill pipe during the drilling operation.

Component	Description
	• Top drive that is a mechanical, electrically powered linking device that attaches to the pipe in the hole and rotates it when drilling while simultaneously pumping drilling mud through the drill pipe and out of the drill bit at the bottom end. • Draw works that lifts and lowers the travelling block in the derrick/mast to run pipe in and out of the hole. • Blowout preventers are a series of closing valves that can hydraulically shut in a well in the event of unplanned influxes of formation fluids into the wellbore and prevent blowouts.
Water Storage and Water Treatment	Water storage tank and treatment containers to provide potable water for the rig crew and personnel.

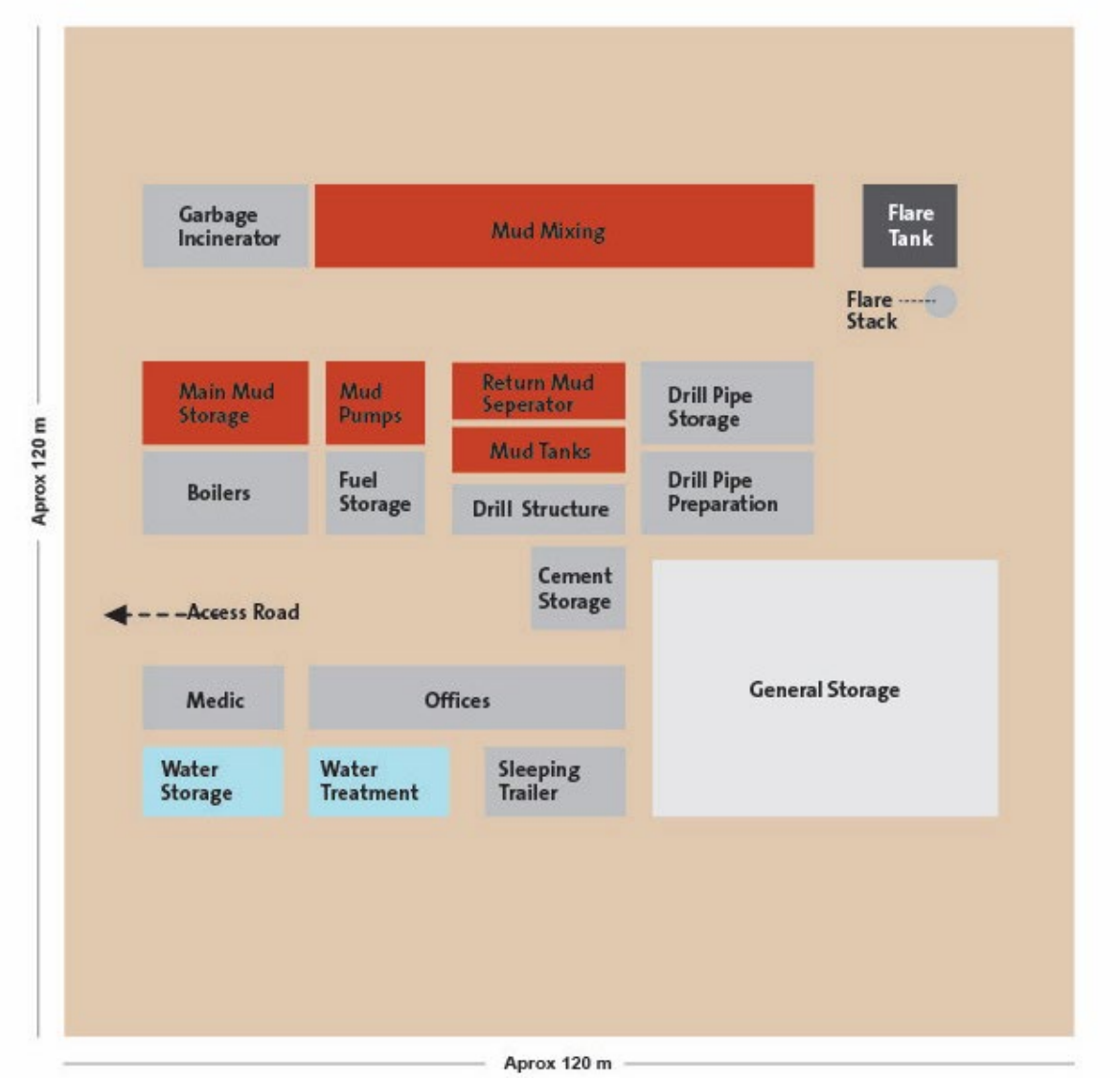


Figure 3-8. General layout of a well site.



Photo 3-8. Example of typical Chance rig at night.



Photo 3-9. Example of typical Chance rig at end of constructed winter access road.

3.2.1.4 Drilling Operations

Eagle Plains well sites and well design will incorporate the following key features to enhance efficiency, reduce waste, and minimize general effects on the surrounding environment.

- The rig will use sufficient casing pipe to reach the projected total depth of up to approximately 2,500 m (vertical depth). For reference, the well casing program will typically comprise the following elements:
  - Conductor of 13-3/8-inch diameter to approximately 25 m below ground level, cemented to surface.
  - Surface casing of 9-5/8-inch diameter to approximately 25% of the planned, measured depth of the well below ground level, cemented to surface.
  - Production or intermediate casing of 7-inch diameter either to total depth or within Yukon's Oil and Gas Drilling and Production Regulations requirement of not more than 25% of open hole remaining uncased at any time (Oil and Gas Drilling and Production Regulations Section 55-(1) (c) (i)) (Government of Yukon, 2004). This casing will also be cemented to surface.
  - 4-1/2-inch liner to a depth of 2,500 m, cemented with a minimum 100 m overlap into the previous casing.
- The nominal diameter of the various casing strings (all selected to meet industry standard dimensions) will reduce the size of the hole drilled and of drill cuttings generated as the well is deepened. For example, a 3,500 m exploratory well typically produces 400–500 metric tons of cuttings. Less than 150 metric tons will be produced for the typical exploratory well depth of 2,500 m proposed at Eagle Plains.
- A water-based mud system will be developed and managed by a specialized service contractor with comprehensive knowledge of the Alberta Energy Regulator (AER) *Directive 050 Drilling Waste Management* (AER 2023) requirements as they pertain to the Yukon jurisdiction regulations.
- All requirements in Sections 26 to 65 of the Yukon *Oil and Gas Drilling and Production Regulations* (Government of Yukon, 2004) (covering well design, casing design, groundwater protection, mud products, blowout prevention and choke/kill systems, fire detection and gas detection systems, safety of personnel, mitigation of operations effects, and more) will be either met or exceeded in the design, selection, and deployment of materials.
- Proposed drilling design planned operations procedures, relevant health, safety, and environment plans; oil spill contingency plans; and emergency response plans will be provided to the regulator for review at least six months before planned mobilization to site. Any perceived or identified deficiencies will be discussed and addressed with the Yukon regulator to confirm what is required before operations.
- Chance will enforce compliance on all third-party service suppliers to ensure that (1) their health, safety, and environment management systems address regulatory requirements in personnel training and skill development; (2) personal protective equipment provided to workers meets Canadian Standards Association (CSA) and international safety standards; and (3) supervisors are knowledgeable about operational standards related to health, safety, and environment. Chance company representatives will perform periodic inspections and audits during mobilization and operations.

- All wells will be drilled initially as “keepers” to facilitate EFT or to become early producers if the Project progresses to full development. The only wells likely to be abandoned would be unsuccessful (dry) wells with no potential to be used as water or natural gas disposal wells.
- Well sites will be designed and constructed with purpose-built collection berms to recover and contain for disposal any fluid not otherwise contained by the operation’s process control. During well site/well pad construction, an impermeable layer will be laid to prevent seepage into the ground below the fill material pad.
- Rig drilling, cementing, or DSTs fluids will be contained and recovered until disposal following regulations.

Drilling contractors must provide training and have operational procedures certified by a recognized professional or regulatory body in blowout prevention and well control. Crews undergo simulated safety drills at each shift on a 2-shift, 24-hour work rotation. During these safety drills, the response and efficiency of drill crews are evaluated. The equipment is also evaluated, and deficiencies are corrected immediately following the drills. Drill crew and well supervisor well control/blowout prevention/hydrogen sulphide certificates are normally inspected by a visiting inspector to confirm compliance when operating.

3.2.1.5 Drilling Mud

Drilling mud is a viscous, heavy liquid used in drilling oil and gas wells to lubricate and cool the drill bit, to carry the rock cuttings out of the drill hole and back to the surface where the cuttings are separated from the mud, and the mud is recycled for reuse in the drilling operation. The drilling mud system currently under consideration for the Project is a low-toxicity water-based drilling system; Chance is assessing systems and suppliers based on several factors, including ease of disposal at the end of its use.

The main function of drilling mud is to over-balance the well pressure to ensure that the pressure in the wellbore is higher than the pressures expected to be encountered from the various geological formations as the drill bit penetrates them. The drilling mud prevents formation fluids from entering the wellbore. It keeps the drill cuttings in fluid suspension when drilling is paused or the drilling assembly is cycled in and out of the hole for bit changes, well logging, DST work, or any other downhole activity. Drilling mud is selected to provide operational efficiency, minimize formation damage, reduce corrosion, and minimize the environmental effects of handling and disposal.

Project operations will minimize the volume of drill cuttings and drilling waste generated by drilling smaller-diameter holes. Drilling waste is composed of rock chips and cuttings. The drilling fluid returned to the surface is sent through a shale shaker to separate rock cuttings, and the drilling mud is returned to the well to continue drilling. The recovered cuttings are put through a centrifuge, where the drill cuttings are further separated from any residual water before being disposed of in an MBC sump. At the end of the drilling operation, the mud slurry is run through the centrifuge to separate the water for future use in the next well. Recovered mud is disposed of in the MBC sump.

3.2.1.6 Cement Plugs and Permafrost

When mixed with water and begin to set, typical oilfield cements produce heat, known as the heat of hydration. This heat can thaw the permafrost adjacent to the wellbore. Permafrost cements are a specific mixture of typical oilfield cement (Portland Cements) with additives such as gypsum (calcium sulphate) to

eliminate the heat of hydration. Calcium and sulphate are naturally occurring molecules at Eagle Plain and are environmentally benign. Use of permafrost cements will minimize the risk of permafrost degradation.

Permafrost cement usually is only used for the surface casing installed to isolate the wellbore from the rock formations and protect permafrost. Chance plans to install surface casing to a depth of 400 m at minimum.

3.2.1.7 Drill Stem Testing (DST)

Depending on the analysis of rock cuttings, measurements made of drilling fluids during the drilling operation, the well log results, and any core samples taken, it may be desirable to test prospective zones before drilling deeper or running casing. In these cases, a DST is commonly done. Drill stem tests are conducted through a special string of drill pipe that includes two packers, which are devices that, when inflated, serve to isolate the zone (the geological formation) of interest from the rest of the well and are set in place just above and below the zone undergoing DST. A special annular pressure-operated valve is placed inside the drill pipe near the zone to be tested. This valve is opened, and in a controlled manner, fluids in the formation are allowed to flow into the drill pipe and up to the surface for separation, measurement, and sampling.

At the surface, the drill pipe is connected through a series of valves allowing the operator to control the flow of fluids from the well and direct them through a pipe system, called flowlines, to the separator and the separator for measurement and sampling.

Figure 3-18 shows the DST process on the surface. Surface flow lines carry the fluids to a test separator. The separator splits the fluid mixture into component elements, which could combine crude oil, natural gas, and formation water. Each fluid stream is measured by flow meters to confirm the volume, pressure, temperature, and rate of flow. From the separator, the crude oil stream would be directed into a holding tank, the natural gas to the choke manifold on the derrick, and then sent to the flare stack or another pre-determined place (e.g., burned for heat, power generation or mechanical power). The separated formation water would be collected and hauled away for disposal; in an existing deep injection well located in the Eagle Plain area.

The exploration wells may encounter several hydrocarbon-bearing zones that could be evaluated by conducting a DST (or DSTs). Before DSTs are conducted, a well site-specific plan and DST procedures will be developed by Chance. Plans for all DSTs will be based on well results and will be discussed with the Oil and Gas Resources branch of the Yukon Department of Energy, Mines and Resources.

A well site-specific plan will be specific to the formation to be tested and the existing wellbore conditions. This plan will protect the safety of personnel, equipment, and the environment and provide for handling any fluids that may be recovered. Enform *IRP 4 Well Testing and Fluid Handling - An Industry Recommended Practice* guidelines (Enform Canada 2015) are one of the sources that will be referenced in preparing the plan. The formal project proposal will include a sample plan with information on how the plan will be assembled.

Flaring of gases during DST is a widely applied activity. The process, however, can only be undertaken in compliance with *YOGA Oil and Gas Drilling and Production Regulations* section 128 (Government of Yukon 2004), which is provided below for reference. Additionally, DST guidelines outlined in Enform *IRP 4 Well*

Testing and Fluid Handling – An Industry Recommended Practice (Enform Canada 2015) are intended to ensure that safe work procedures are in place and to "minimize the probability of either the mechanical or human systems failing during a test, as well as establishing minimum health, safety and operating standards". In addition, they are "designed to allow flexibility and must be used in conjunction with competent technical judgment".

As required, the flare line must be positioned downstream of the derrick's choke manifold, designed to prevent fluid accumulation within the line, and installed and anchored as specified by regulation. Gas encountered during DST is circulated through a degasser system to separate it from the drilling mud, rendering the mud safe to pump back into the wellbore. Larger volumes of gas may be control-burned through the flare stack according to the flare permit issued by the Oil and Gas branch of the Yukon Government.

An example of a typical well site flare process layout is illustrated in **Figure 3-9**, a typical flare stack and gas/vapour recovery flowsheet is illustrated in **Figure 3-10** and a typical portable flare stack is shown in **Figure 3-11**. Normally the flare line from the choke manifold is connected to the flare stack inlet to permit the direction of the gas to the flare for total control. The flare stack will be a minimum of 18 m high and a maximum 30 m high depending on surface conditions to assist in air dispersal of combustion end products and mitigate effects on permafrost.

Following the regulated spacing requirements, the flare stack will be positioned on the well site. If flaring is necessary, the flare will be higher than the surrounding vegetation or trees (as required by the *Oil and Gas Drilling and Production Regulations* [Government of Yukon, 2004]). Noise from flaring typically only occurs when very large volumes of high-pressure natural gas are being flared. During DST, flaring would only occur for a maximum of one day at the end of a drilling program for one well.

YOGA Oil and Gas Drilling & Production Regulations Part 9 (Government of Yukon 2004) specifies these parameters.: The flare stack will meet the requirements as follows:

> *128. Flare requirements*
>
> *Unless otherwise approved or directed by the Chief Operations Officer, any gas that is flared will be discharged from a flare stack that:*
>
> *(a) is at least*
>
> *(i) 50 metres from any well, treater, separator, compressor, crude oil storage tank or any other unprotected source of ignitable vapours*
>
> *(ii) 80 metres from any right-of-way, easement, road, public utility, building, installation, works, place of public concourse or any reservation for national defence, except only when there may exist special circumstances that, in the opinion of the Chief Operations Officer, justify the positioning of the stack at a greater or lesser distance*
>
> *(b) is adequately anchored and suitably protected against freezing*
>
> *(c) is designed to ensure flame stability and efficient combustion*
>
> *(d) is of sufficient height and diameter to ensure*
>
> *(i) that the average concentrations of hydrogen sulphide and sulphur dioxide in the ambient air do not exceed limits specified under the Occupational Health and Safety Act*

(ii) that vegetation combustion is prevented by maintaining an area free of vegetation and combustible debris around the base of the flare stack or the end of the flare line to the following minimum distances:

(A) 10 metres or 1.5 times the stack height, whichever is greater, in cultivated areas

(B) 30 metres or 2.5 times the stack height, whichever is greater, in forested areas

(C) 1.5 times the stack height, in any other area

(iii) that a minimum stack height of 2.5 times the height of the highest third-party building located within a distance equal to 5 times the height of the building is maintained

(iv) that any heat generated around the base of the stack does not exceed the manufacturer's specifications for any equipment situated there, to a maximum of 4.73 kW/m²

(e) has a sufficient exit velocity and is provided with guards or other features to prevent extinction of the flame.

(f) if the gas flow is intermittent, is provided with an ignition device to ensure continuous ignition of any gases.

To minimize potential deposition of residual chemicals produced via flaring on vegetation and soil, the site design will include an appropriate spacing between the flare stack and vegetation. Vegetation and soil adjacent to and downwind (prevalent) of each flare stack will be sampled before an activity that could result in gas production to provide a baseline of identified substances of concern at the site. Samples will then be taken during flaring for comparison with the baseline to monitor potential deposition. Visual monitoring will occur throughout flaring to observe nearby vegetation's safety and protection.

A typical operational sequence of DST is:

1. Wellbore is drilled to a depth of interest.
2. Well is logged using various diagnostic tools, and depth intervals for testing are selected.
3. Test equipment is connected to the end of a drill string and run into the well bore. The test equipment generally consists of two packers set above and below the geological formation being tested to isolate the formation to be tested from the rest of the wellbore. Inside the drill pipe between the packers, an annular pressure-controlled downhole valve to open and close at the beginning and end of the DST, respectively, and pressure gauges to measure the bottom flowing and shut-in pressures.
4. A cushion of fluid may be contained in the drill pipe to initially provide back pressure on the formation being tested, which may be required to control initial flow rates out of the formation, into the drill pipe, and up to the surface.
5. Once the test string is positioned at the zone to be tested, the packers are set, and the downhole valve is opened to allow formation fluids to flow into the drill string.
6. Fluids produced during the test are carried from the wellhead to a test separator as described above, where any natural gas, crude oil or formation water are separated for individual measurement, sample collection for further laboratory analyses, and either flared (natural gas), recovered for eventual disposal at a terminal in NEBC (crude oil) or disposed of (formation water) into one of the disposal wells designated by Chance.

7. Initially, the valve is opened and the well flows relatively quickly to clean up the wells (normally, this period may be a few hours). Following this period, flow is temporarily shut in the downhole, and a pressure buildup is recorded (with the initial shut-in period lasting 2 or 3 times the initial flow period).
8. The test zone is then flowed at constant or variable rates by opening the valve located in the packer and allowing formation fluids into the drill pipe and flow up to the surface. Each constant flow period is normally followed by a shut-in period to record how long it takes for the pressure to build back up inside the well.

- Before concluding the series of test rates, bottom hole and surface samples are collected. Samples are taken of all fluids for analysis (both Pressure Volume Temperature samples under the flowing reservoir pressure, temperature conditions and atmospheric samples to check for “base sediments and water characteristics of the produced fluid”).

After the DST, the tools are closed, packers unset (removed) and any samples within the drill pipe are reverse circulated to surface. A normal DST takes a few hours, not including the time required to prepare the tools, run pipe to depth and do the reversed process on completion.

Well log results, sample analysis and DST results are used to decide whether to abandon or insert casing into the well, pending further evaluation. To abandon the well, cement plugs are inserted using an open-ended drill pipe across all porous/permeable zones and the base of each casing string. At the surface, the well casing(s) are cut off 1 m below ground level and steel plates are welded across the top of the casing. A well sign is erected and the well site re-contoured and re-vegetated, all pursuant to the relevant *YOGA Oil and Gas Drilling and Production Regulations (Government of Yukon 2004).*

At least one DST per successful well will be conducted unless several zones require testing. If more than one prospective/productive formation is encountered in a well and is separate from other formations, DSTs will be conducted on those separate formations independently of each other. Sometimes, a DST may be re-done if there is a mis-run, or if the DSTs were not done in a steady sequence. The order in which DSTs are conducted will depend on where the zones of interest are found in relation to the various casing strings that could be set as the well is being drilled.

All well testing will be performed with the guidance of AER *Directive 034: Gas Well Testing, Theory and Practice* (Alberta Energy Regulator 1979) and in consultation with the Oil and Gas branch of the Yukon Government. Chance will follow related legislation, such as the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004). Part 5 of this regulation provides detail on well evaluation and testing requirements.

Specific details of past drilling experiences can be found on the Yukon Oil and Gas Online Information Site: (http://maps.gov.yk.ca/imf.jsp?site=OilandGas_wells). Chance’s comprehensive casing designs and rig and blow-out prevention system conform to *YOGA* and the *Oil and Gas Drilling and Production Regulations* (Sections 33-61 (Government of Yukon 2004). Additional details of Chance’s system configuration are confidential as per Section 176 (4) of the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004).

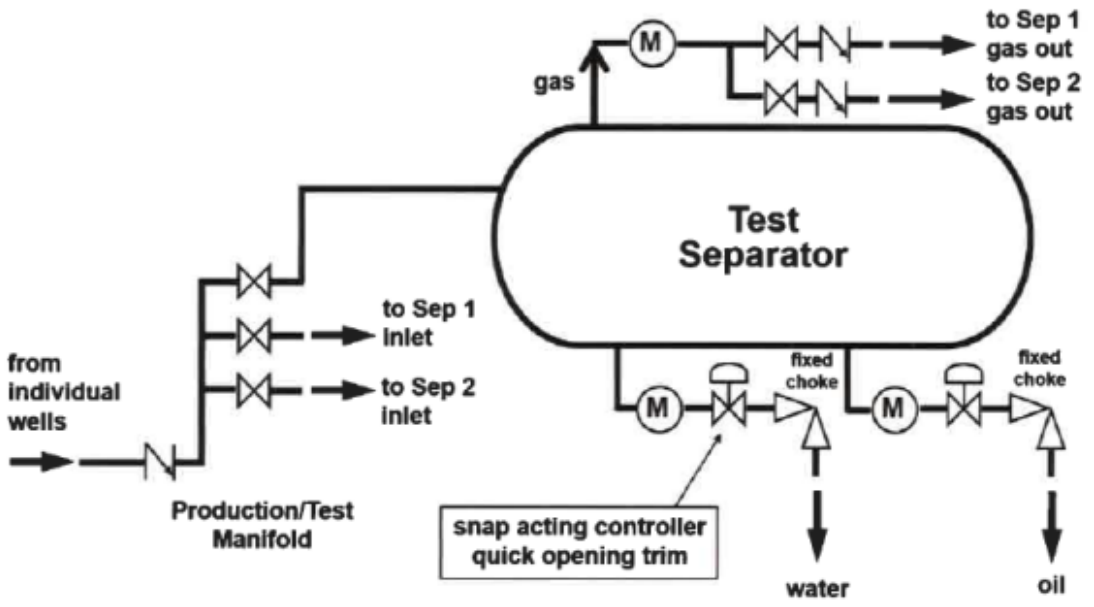


Figure 3-9. Drill Stem Test (DST) process diagram from well head through the test separator.

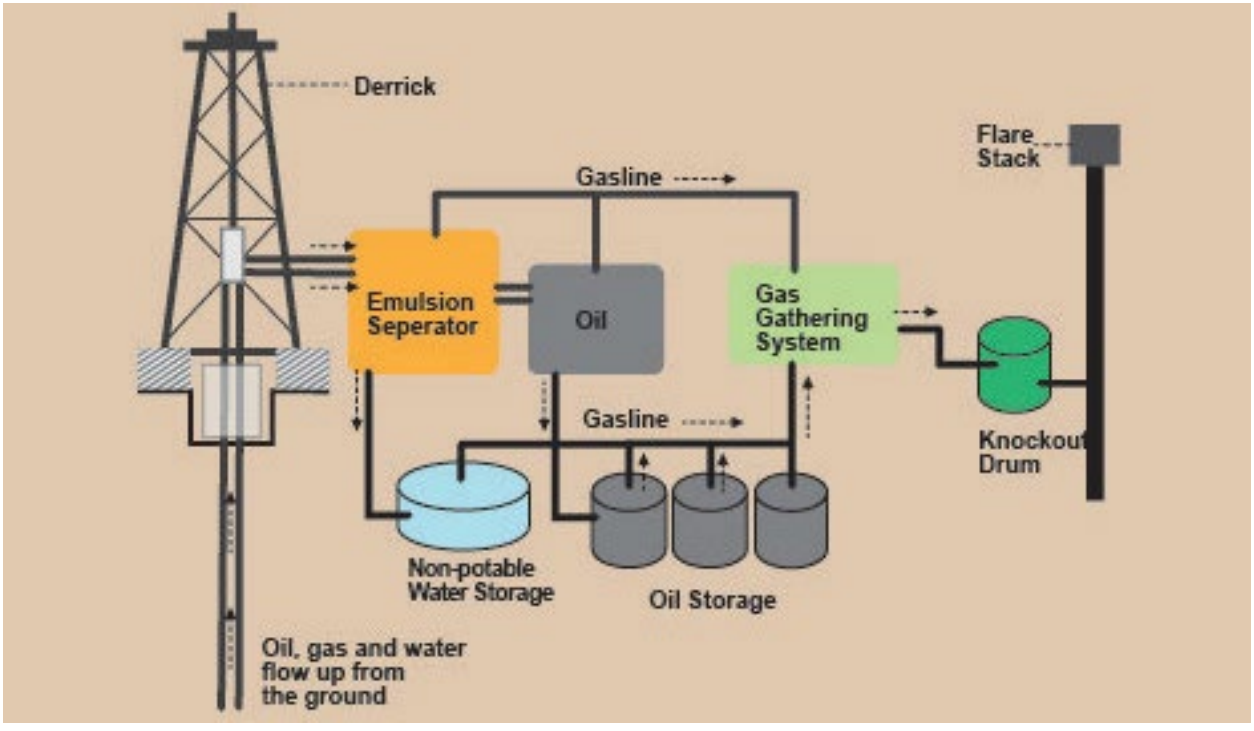


Figure 3-10. Typical flare stack and gas/vapour recovery flowsheet.

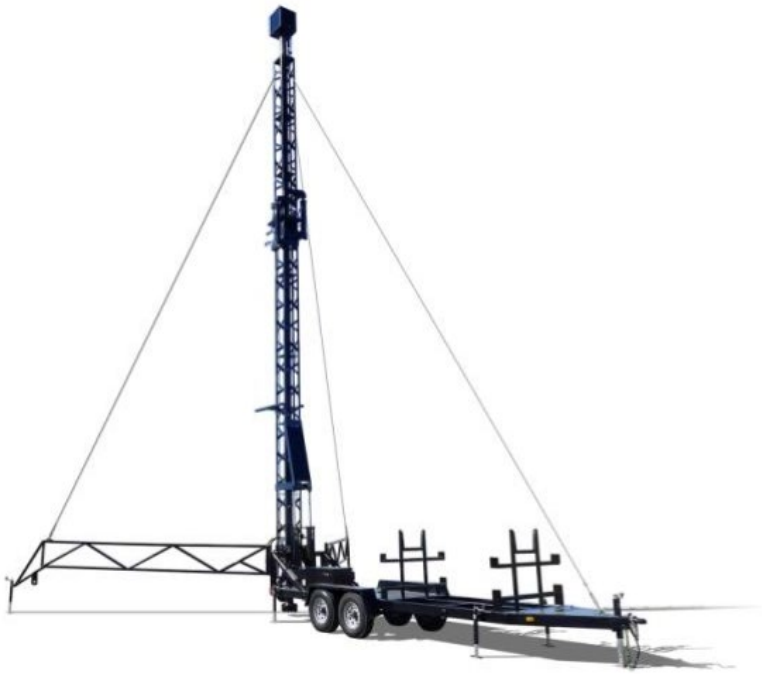


Figure 3-11. Typical flare stack unit on a portable rig.

3.2.1.8 Further Testing Details

Swabbing — Swabbing is usually conducted to help initiate fluid flow from the formation into the well and flow to the surface. Wells will only be swabbed if the well is drilled, cased, and a potential reservoir has been:

- identified;
- perforated;
- testing reveals that reservoir pressure is insufficient to flow liquids to the surface without swabbing; and/or,
- if well stimulation results in wellbore liquids that prevent flow to the surface.

Swabbing reduces in-well bore pressure that otherwise prevents a potentially productive formation from flowing to the surface naturally.

Acid Stimulation — Eagle Plains' previous oil and gas exploration activities indicate that small-volume acid stimulation treatments effectively remove scale and other impedances to allow or improve fluid flow into the wellbore. Acid stimulation entails pumping discrete amounts of hydrochloric acid at varying depths.

The acid is trucked to location in specially sealed tanks in compliance with regulations under the federal *Transportation of Dangerous Goods Act, S.C. 1992, c. 34* (Government of Canada 1992) and transferred to the cement pumping unit for pumping downhole. Treatment batches of 10 to 25 barrels (approximately 1.6 to 4.0 m^3) are pumped at controlled pressure until complete. The weak acid serves to dissolve scale

(calcium carbonate) or cement. The chemical reaction of the hydrochloric acid with carbonates forms non-toxic and pH-neutral calcium chloride salt and water as by-products.

The application of acid is for a new well and not used for an existing one that has been in operation for some time. Acid cleans up a newly drilled well to improve initial flow rates. It is also used as a remedial tool to improve production where there is evidence of flow impairment. For an exploration project, this improves production in a setting where little prior information or data exists and is therefore undertaken on a trial basis.

The product's Safety Data Sheets (SDS) describe the toxicity limits for oilfield hydrochloric acid. Oilfield concentrations are normally 10%, 15%, or 20% hydrochloric acid. In winter, if acid is spilled, like water, it would freeze and can be recovered from the surface snow or a thin soil layer.

3.2.1.9 Drilling By-Products Disposal

Eagle Plains is a sedimentary basin, and drill cuttings will consist of sandstone, shale, and carbonate rock none of which are significantly sulphide-bearing. Drill cuttings from wells drilled in 2012 were examined by Chance geologists; based on this examination and previous exploration / geological work in the area, the potential for acid rock drainage (ARD) from drill cuttings was determined to be remote to non-existent.

Naturally occurring radioactivity will be measured by gamma ray (GR) or spectral gamma ray wireline logs, a regulatory requirement in the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004). Gamma ray is a radioactivity detection device (similar to a Geiger Counter) that detects radioactive Uranium, Thorium or Potassium isotopes in the rock formations drilled. No abnormal detections have been made other than that attributed to natural rock formation radioactivity. Therefore, radioactivity appears absent or undetectable in the fluid of the Eagle Plains sedimentary formations.

The Oil and Gas branch of the Yukon Government has adopted the AER *Directive 050: Drilling Waste Management* (Alberta Energy Regulator 2023) procedures for the disposal of drilling wastes within the Yukon. Chance will manage the operation following the MBC requirements of the Directive for the remote sump locations.

Solid Drill Cuttings — Drill cuttings are a direct by-product of the drill bit grinding through rock. Cuttings are brought to surface with the drilling mud and separated via shale shakers and centrifuges, as described in **section 4.3.2**.

“Stripping” is running the drilling mud through centrifuges as it returns to the surface to separate the water from any solids suspended in the fluid stream. Cuttings are separated during stripping and stored separately on the well site until they can be disposed of. The fluid is then either recycled back into the mud system in the drilling operation or retained for use in future drilling locations.

Close attention to the dryness of the cuttings moving across the shale shakers and collected in the shale bins are required for the following reasons:

- Less total weight in the cuttings equals less cost associated with future handling of the drill cuttings.

- In the winter, handling and moving dry cuttings is easier as they do not freeze and create large blocks of material.
- Recycling more fluid separated from the cuttings reduced the need for additional make-up drilling fluid.

Drill cuttings will be removed from the well sites for disposal at the MBC, as described in **section 4.3.3**.

Drilling Mud — Chance is proposing to use water-based drilling fluid systems. After drilling a few wells using recycled drilling fluids, the mud system may need to be partially or fully reconstituted (disposal of the current fluid and mixing fresh water and new drilling fluid products). This ensures the drilling fluid is fresh and capable of drilling through the different rock types found in the proposed wells and is performing to meet operational needs. Chance has successfully re-used drilling fluid systems across multiple wells to reduce the overall need for make-up water and the total fluid volume for disposal at Eagle Plains.

The proposed drilling system and the site conditions present at the drilling locations and in the Eagle Plains general area have directly influenced the disposal options for waste drill fluid. Accordingly, the following conditions were established for the selection of the drilling mud system:

- Low-toxicity mud system confirmed through laboratory analysis;
- Meets operational requirements (maintain formation stability, hole cleaning and well control, etc.); and,
- Suitable for disposal via the MBC disposal process at a nearby location.

Any drill fluid selected must satisfy Section 32 "*Approved Drilling Fluid*" of *YOGA*'s *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004). The type and chemistry of the drilling fluid is described further in this section.

Injection Well — AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023) covers the disposal of drilling fluid. Drill cuttings will be mixed with the required amount of soil following AER *Directive 050 Drilling Waste Management* and disposed of in the MBC sump. Drilling fluid will be stripped back to the clear portion and disposed of in one of the injection wells.

Disposal requires further injectivity and suitability investigations. This cannot occur until the wells are re-entered and ready for the investigation trials. Chance candidate wells could be one or more of the following suspended well(s): Chance J-19, Chance M-08, Chance G-08, Blackie M-59, McParlane A-25 and Chance E-78 all of which are located within the Chance licence areas. Any well that is not a preferred EFT or future production candidate could be an injection well if strategically located near a usable well or wells and if it exhibits the required characteristics for injecting fluids. For this exploration project, the priority wells for disposal are A-25 and E-7, however others could be part of the disposal mix depending on the outcome of well maintenance assessment activities.

The *YOGA Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004) require that any produced water not be disposed of at the surface unless its quality and/or salinity is equal to or greater than the quality limits set out in producing field facility licence.

Any plans or intention to dispose of produced water from reservoir fluids separation must be submitted to the regulatory authority and must meet the environmental standards as well the oilfield waste disposal standards and limits (reference *YOGA Oil and Gas Drilling and Production Regulations* Sections 122. 123. 124, 130 and 165) (Government of Yukon 2004). Produced water disposal is only authorized when the operator demonstrates legislation requirements have been met and that good oilfield and reservoir management practices are satisfied.

Once their disposal suitability is established, the following liquid materials (treated with bactericide) and their volumes may be disposed of:

- Produced water per well (water cut 20% to 60% for 200 barrels of oil per day (BOPD)) = approximately 40 to 120 barrels water/day but dependant on field conditions;
- Workover fluids: Maximum 7" casing volume full = 276 barrels;
- Rig wash: hose flowing at five gallons per minute (gpm) water for one hour = ±seven barrels per day in summer;
- Saline fluids (completion brines) same as workover fluids = 276 barrels; and
- Liquid fraction of drilling fluids = approximately 200 m^3 at end of Project.

The zone must have an impermeable barrier above it to prevent migration of the injected fluid and be deeper than 750 m. The rock's Permeability and porosity must permit fluid pumping at low surface pressure and well below formation breakdown pressure. Testing must determine injection fluid compatibility between the rock and native reservoir before injection. The injection pressure and rate are measured, indicating the porosity and permeability of the formation and reservoir used for injection.

Disposal of highly saline-produced water at surface disposal sites may be greatly restricted in quality and quantity. To support best reservoir management practices, the re-injection of produced formation water back downhole may sometimes be required.

3.2.2 Extended Flow Testing

As noted above, well testing will be performed following the guidance of AER *Directive 034: Gas Well Testing, Theory and Practice* (Alberta Energy Regulator 1979) and in consultation with the Oil and Gas branch of the Yukon Government. Chance will also follow related legislation, such as the Yukon *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004). Part 5 of this regulation provides detail on well evaluation and testing requirements.

Petroleum or natural gas reserves identified through DST are expected to undergo EFT to gather important information about the nature of the resource accumulation and its productive capability. Duration of EFTs at each well where petroleum or natural gas is identified may occur during successive winters for up to two years. The information obtained from EFTs is critical to determining the future development plan for each discovery. The planned wells are exploratory; any flow testing will be contingent on identifying formations potentially containing hydrocarbons. Part 8, Section 103 (1) of the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004) requires:

> *"The Licensee of a well shall obtain sufficient well tests, formation flow tests, wireline logs, analyses, surveys, conventional cores, cuttings and samples during the drilling of the well to ensure that a comprehensive geological and reservoir evaluation can be made."*

EFTs will be undertaken if preliminary results from DST are encouraging, and the following criteria have been met:

- The well is drilled and cased;
- A potential reservoir is:
  - Identified;
  - DST has been conducted; and,
  - Test analysis of the DST concludes sufficient hydrocarbons present to proceed to further evaluation of the hydrocarbon bearing formation.

Table 3-3 outlines the sequence of activities in developing the well site areas.

The same regulatory constraints apply to fluids produced by EFT as to recovery by any other means.

EFT operates on a similar principal as DST. The main difference is that EFTs are undertaken after the well has been cased. In an EFT however, the drilling rig would be removed to drill another well while the drilled well is prepared for testing. As each well is drilled and drill stem tested to evaluate its candidacy for extended testing, it is left in a safe, secure state for further testing after removing the drilling rig. Mobilizing a service rig to complete the work may become necessary before turning the well to extended testing. A well service rig has very similar capabilities and equipment to a drilling rig except that it generally has fewer modules and is lighter equipment. If a service rig is required, it would be incremental equipment to the drilling rig.

Table 3-3. Sequence of well development activities.

<table>
<tr><th colspan="3">The sequence of Well Development Activities</th></tr>
<tr><td colspan="3">1. Develop winter access trail to well site</td></tr>
<tr><td colspan="3">2. Develop well site (approximately 1.44 ha in area)</td></tr>
<tr><td colspan="3">3. Install surface infrastructure for drilling and testing exploratory well on well site</td></tr>
<tr><td colspan="3">4. Drill well</td></tr>
<tr><td colspan="3">5. Transport and dispose of drill cuttings in MBC sump via winter access trail</td></tr>
<tr><td colspan="3">6. Well logging and core sampling prior to conducting Drill Stem Tests (DSTs)</td></tr>
<tr><td colspan="3">7. Conduct DSTs to determine whether Extended Flow Testing (EFT) should be conducted</td></tr>
<tr><td colspan="3">8. Move drill rig to next well site area</td></tr>
<tr><td rowspan="2">If DSTs not successful
(i.e., no petroleum products were encountered in the well)</td><td colspan="2">If DST is successful (i.e., Natural Gas or Crude Oil is encountered)

Successful wells will be suspended as an intermediate step to cover timing differences between finishing the DST and undertaking EFT.</td></tr>
<tr><td>Primarily Natural Gas Discovery</td><td>Primarily Crude Oil Discovery</td></tr>
<tr><td>Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).
Or</td><td>Complete well (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).</td><td>Complete well (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).</td></tr>
</table>

The sequence of Well Development Activities		
Suspend well to become an alternative location for deep zone injection (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).		
Remove all surface infrastructure.	Install required surface facilities (separator vessel, heaters, dehydrators, stock tanks, flow lines, metering equipment, portable generators, and flare stack).	Install required surface facilities (separator vessel, heaters, dehydrators, stock tanks, flow lines, metering equipment, portable generators, and flare stack).
Remediate well site area.	Conduct EFT over period of 1 – 2 months	Conduct EFT over period up to 2 years
Recontour well site area and revegetate disturbed areas to natural conditions.	Measure natural gas and water from wells.	• Measure, store, and process crude oil, natural gas, and water from wells. • Transport crude oil from EFT to central processing facility, then to acceptable market.
Recontour access roads and revegetate disturbed areas to natural conditions.	Conduct maintenance on well as required (work over).	Conduct maintenance on well as required (work over).
	Once EFT is, complete either: • Decommission and abandon well or • suspend well pending future use (e.g., develop further project proposal to bring into production)	Once EFT is complete, either: • Decommission and abandon well or • suspend well pending future use (e.g., develop further project proposal to bring into production)
	Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).	Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).
	Remove all surface infrastructure.	Remove all surface infrastructure.
	Remediate well site area and allow to regenerate naturally	Remediate well site area and allow to regenerate naturally

To allow the zone of interest to flow into the wellbore, the casing is perforated which is a routine procedure achieved by either using a wireline from surface or attached to the end of the production tubing from the surface to the zone of interest. In this case, the well is first completed with a packer attached to a tubing string and have downhole gauges to record flowing temperatures and pressures in real time. The surface would have the necessary “Christmas Tree” wellhead equipment and be flow line connected to the test separator through a choke manifold. Well fluids (gas, oil and water) would then be handled similarly.

Several wells at different locations could undergo EFT simultaneously, depending on drilling success/DST outcomes.

Extended flow testing is normally performed by specialists who provide the equipment, supervise the EFT operation, administer the safety protocols, and have the required certifications to perform the associated tasks. Extended flow testing however would be handled in the same fashion as production operations and still be conducted by trained professional operators under the direct supervision of a Production Superintendent.

EFTs will require installing surface and subsurface equipment and facilities at each well site to measure, process and store produced fluids. There is the potential to undertake more than one EFT per well if more than one zone is suitable for testing. The specific details of this equipment is subject to the nature of the discovery and could include:

- Casing of entire wellbore and perforate casing at zone of interest;
- Packer, tubing and downhole gauges;
- Wellhead valving assembly;
- Flare systems;
- Separator vessel;
- Treater to do additional separation of the produced fluids;
- Storage tanks;
- Appropriate artificial lift systems;
- Heaters;
- Dehydrators;
- Flow lines;
- Metering equipment; and,
- Portable generators.

Chance anticipates a delay (e.g., the following winter season) between completing DST, completing the well/removing the drill rig, and commencing EFT to allow time to design the flow test, secure the equipment and operating personnel, ship the equipment to site, install the equipment, and commence the operations. This program would include ancillary services to set up and perform the EFT (e.g., service rig). EFT will be undertaken on a maximum of 30 wells drilled during the exploration well drilling program. EFT may require up to a month to complete for a predominantly natural gas well or up to 2 years for a predominately crude oil well. Chance anticipates that up to 10 wells may undergo EFT simultaneously (based on the planned drilling schedule).

Fluids produced during EFT will be some combination of natural gas, crude oil and possibly formation water, which will be separated, measured, processed, used, sold, or disposed of as follows:

- Natural gas could be flared for short periods of time but would be preferentially used for process heating, fuel for mechanical power or possibly onsite power generation. Heaters are used to provide heat to vessels treating the produced fluids or keeping stored fluids warm; they can include heating an intermediate fluid such as glycol at the heater and circulating the glycol in a network of raised or insulated pipes (to prevent thawing ground surface) to the places where heat is required. The mechanical or power generators would likely be small engines fuelled with natural gas and sized according to the location's needs.
- Crude oil produced during the EFT would be preferentially stored temporarily for potential future shipment to market. This will require some processing at the well site or the CPF to

stabilize the crude oil for truck transport to a suitable, approved crude oil marketing point (i.e., terminal).
- Formation water produced with crude oil or natural gas will be separated from the hydrocarbon streams and disposed of via existing deep injection wells at Eagle Plains.

EFTs involve the flowing of a well or wells under human supervision, while wells flow unimpeded for the duration required for the test. In a multi-well producing field, for example, a maximum of three persons can manage the production operator tasks of a field with 50 or more producing wells (double that number when working a 24-hour day). Field production operators visit each well at least once daily unless there is a need for remedial work. They record flowing well pressures, ensure fluid pumps operate properly, have enough fuel to continue operating and visually inspect the facility for anything unusual.

Chance plans to use up to three operators to manage the EFT wells in any 12-hour cycle. A second set of up to three will form the cross-shift for a total number of six operators.

3.3 ACCESSORY PROJECT COMPONENTS

The following activities are required to support the principal exploration drilling and EFT:

- building and maintenance of winter access roads;
- other project facilities (i.e., remote camps and fuel storage);
- some surface facilities (e.g., flare stacks, flow lines, storage, processing, injections);
- airstrip construction and operations (estimated two fixed-wing aircraft flights per week); and,
- water use for drilling and camp needs, and for short periods to make snow and freeze in access trails.

Chance Camp at km 325 will be the main accommodation facility for the exploration program. During drilling operations, there will be some accommodation for essential staff in a mobile camp at the well location. This mobile camp will be occupied 24 hours per day, 7 days per week, to house essential personnel (rig supervisors, medic, geologist, etc.).

3.3.1 Well Maintenance

Any well completed for EFT, or not completed for EFT and suspended, may require maintenance during the 10-year term of the Project. Well maintenance is required on any suspended well before abandonment, conversion to an active well, or annually if it remains suspended. Well-maintenance equipment may include a service rig, wireline truck, cement trucks, and associated support equipment. Under the *Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004), a well is deemed suspended when it is safely secured, but not producing oil or natural gas.

Well maintenance activities, also known as workovers, generally include the following:

- pressure testing to confirm integrity of the casing and well head valves;
- removal of equipment in the well bores such as tubing and plugs;
- wireline investigations to measure temperatures and cement integrity and convey any perforating equipment;
- remedial work such as cement squeezes; and,

- wellbore integrity assessment.

3.3.1.1 Pressure Test and Surface Casing Vent Flow Test and Gas Migration Test

A pressure test will be conducted at each well to evaluate the integrity of the wellhead and the existing wellbore casing. The well (or Legacy well) will then be tested for surface casing vent flow (SCVF) and gas migration. Chance reports that no SCVF has ever been detected in existing suspended wells during annual inspections. If SCVF is identified, the well will be inspected and test results logged using various tools (e.g., noise tool, temperature tool, bond log tool) to determine the source of the SCVF and/or gas migration. The logs will be analyzed, and a plan will be formulated to complete a downhole shut-off at the source of the SCVF or gas migration if required. This is only done for significant vent flow events or when abandoning a well. Non-significant vent flows are normally left until end-of-life for newly producing or suspended wells. Depending on the status of the well (e.g., cased or completed with perforations) and the nature of the problem, the equipment needed to fix the problem will involve some combination of a service rig, wireline services and possibly cementing services.

3.3.1.2 Temperature Log and Cement Bond Log

Once SCVF and gas migration testing is complete, the service rig, support equipment, and wireline will be moved to the well site. A temperature log will be recorded from the surface to 300 m Kelly-Bushing below the surface (mKB) to identify anomalies or departures from the reference gradient. Most anomalies are related to fluids entering the formation through the borehole or fluid exit. If there is no anomaly, this work will be a good measure of the depth and thickness of permafrost.

A cement bond log will be run after the analysis of the temperature log. The cement log uses the variations in the amplitude of an acoustic signal travelling down the casing wall between a transmitter and receiver to determine the quality of a cement bond on the exterior casing wall. The acoustic signal will be more attenuated in the presence of cement than if the casings were uncemented. The cement log is used to identify sections of the well bore that will need intervention to isolate porous formations from adjacent formations.

3.3.2 Access Roads

Winter roads will be used for the exploration program. There will be no permanent roads within the exploration stage of the project. Temporary drilling pads created from snow on cleared but undisturbed ground will be used and will only exist during winter. **Figure 3-12** below shows the maximum potential winter road network to the exploration sites. Each winter road's number, location and length will be determined as the exploration program develops. As the program unfolds, the access road network's ultimate size will depend on drilling results (success). If drilling results are discouraging, the road network may be less than shown.

This project's proposed winter road construction method will be a compaction of the natural snow cover. Water may be needed in some areas to reinforce the packed snow. Some snow may be hauled to low areas or areas that are wind-blown. The natural vegetation cover will be preserved and remain undisturbed as much as possible. Compacted snow roads are appropriate to serve low ground pressure geotechnical field programs or winter roads with low traffic volumes. This method will suit this exploration program, as the expected traffic on this road will be the transport of a drilling rig with anticipated one to two moves (this

number could be up to 5 depending on the time needed to drill and evaluate a given well) per season, and a small number of support vehicles.

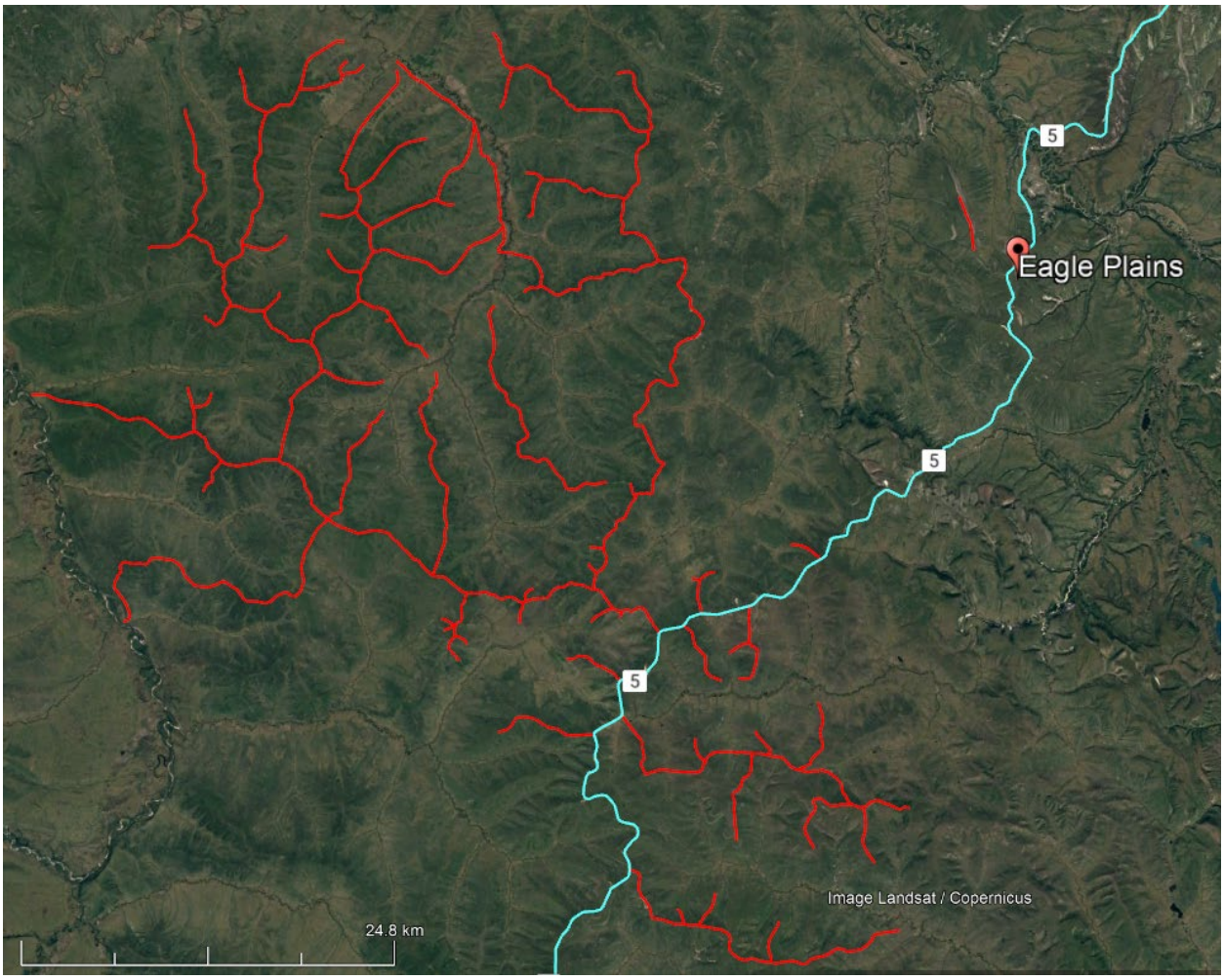


Figure 3-12. Conceptual winter road network.

3.3.2.1 Routing Rationale for the Winter Roads

The routing of a winter road needs to consider the following criteria (discussed in detail below):

- road geometry, such as grades and curves to suit the intended vehicles;
- number and width of water crossings;
- avoidance of unfavorable terrain;
- avoidance of selected areas determined by historical resources, vegetation, wildlife habitat, etc.; and,
- sensitivity of permafrost terrain to the construction of a winter road.

Road geometry — Ideally, for vehicle safety and operations, the maximum gradients on the road should be 6% or less, with only short sections up to 10%. The routing developed for this Project generally falls within this range, although route adjustments will likely be undertaken in the field if these desirable gradients are met.

Number and width of water crossings — Selecting routes that minimize the number and width of water crossings reduces the complexity of the winter road construction and the uncertainty or risk during operation. For this Project, there is only one wide crossing, and all crossings are expected to be completely frozen during the operating season.

Avoidance of unfavorable terrain — Chance has undertaken terrain mapping of the area. The route is located on bedrock, weathered bedrock and colluvial sediment where possible.

Sensitivity of permafrost terrain to constructing a winter road — Chance has undertaken permafrost mapping in combination with terrain mapping. The route, where possible, is generally located on ice-poor to ice-moderate permafrost. Ice-rich permafrost is sensitive to the activities associated with the construction and operation of winter roads and should be avoided to the extent possible. Specific mitigation to preserve permafrost will be undertaken in situations where it must be crossed.

The development of the routing for the potential winter road network has considered these criteria. The potential routes have been selected to minimize the effect of unfavorable terrain and thaw sensitive permafrost terrain while balancing the need to access sites.

3.3.2.2 Construction Considerations and Operating Season

The winter road will not be constructed until the ground is sufficiently frozen and has adequate snow cover to limit disturbance to the ground and vegetation.

Winter road construction will commence when the depth of snow cover is approximately 10 cm and sufficient to cover low-lying vegetation thereby minimizing effects to the ground. The winter road will be constructed with dozers supplemented with steel frame drags. Other equipment may be required to haul snow as necessary.

The winter road widths will be dependent on the size of vehicles to be used each season. Single-lane winter road for smaller lighter equipment and very low traffic volumes will be as narrow as 5 m. Wider two-lane winter roads, approximately 9 to 10 m in width, will be constructed for larger equipment and greater numbers of vehicles.

Closing a winter road is based on observed depletion of snow cover and current and forecasted weather. Once the insulating snow softens and disappears and the daily air temperatures rise above 0°C for a few days, the winter road will be operated only at night, and eventually closed before the ground thaws. Diligent and ongoing observations of the conditions and the forecasts will be undertaken to ensure that equipment is moved off site and the winter roads are closed appropriately.

The general operating season for a winter road in this area is estimated to be from the end of January to the end of March. Still, it could last longer depending on the timing of opening and the end of winter.

3.3.2.3 Mix Bury Cover (MBC) Sump Access Road

Chance also proposes constructing a 400 m long, 6 m wide winter road to the proposed MBC sump area. This road will be built as early in the operating season as possible (soon after mid-January as snow and weather permit) and will take approximately two weeks to complete. It will be reopened each winter season that drilling occurs. The proposed route follows an existing access trail; no major clearing will be required. The proposed route includes no watercourse crossings and is 800 m from the nearest surface water body.

3.3.2.4 Access Road Maintenance

Maintenance of winter access routes may include low-ground-pressure vehicles, a road grader equipped with a wing snow plough, some water application, and use of matting where required. Grading may be required over certain stretches of the route, and depressions along the roads will be filled with snow to smooth the surface. If required, water will be withdrawn from approved water sources using adequately sized intakes and screened to prevent debris blockage and fish mortality; refer to Interim *Code of Practice: End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater* (Government of Canada 2020).

3.3.3 Mix Bury Cover (MBC) Sump

As described and detailed in AER *Directive 050 Drilling Waste Management* Section 13 (Alberta Energy Regulator 2023), and accepted in the Yukon, MBC is a method of disposing of drilling waste (both drill cuttings and drilling mud) by which the by-products and spent mud are mixed with a local receiving soil at a specific mix ratio, deposited into a sump area, and then covered with clean subsoil.

A typical MBC sump design consists of three distinct layers:

- A clean subsoil layer 1 to 1.5 m deep on top of the drill cuttings and soil mix; this layer acts as an insulator between the subsoil/drill cutting mix and the vegetative layer to ensure that, after final reclamation, the site is returned to its original state.
- The subsoil/drill cutting mix layer is where the receiving subsoil is mixed at a specified mix ratio with the disposed of material (e.g., drill cuttings, spent drilling mud, etc.).
- Clay-rich material exceeding 1 m depth below the drill cuttings and soil mix, or alternative impermeable liner, acts as a hydraulic isolator.
- The identified MBC sump location will be investigated for suitability via drill cores to confirm the following conditions are present and at what depth:
- Sump soil has appropriate deposits of clay-rich soils.
- Appropriate clay-rich material of 1 m is beyond the horizontal and vertical dimensions of the sump to ensure hydraulic containment.
- There is an absence of hydraulic defects or ways for fluid to leak out of sump.
- A composite sample, made up of five subsamples, is required for every 3,000 m³ proposed to be used for MBC.

Before Chance begins exploratory drilling, a test sample of the drilling fluid will be analyzed and compared against the receiving soils at the proposed MBC site to estimate the soil/waste mix ratio to ensure the final soil composition complies with AER Directive 050 Drilling Waste Management Section 3 (Alberta Energy Regulator 2023). While an MBC sump is actively being used, Chance will monitor and inspect the site to evaluate sump integrity, volumes of material involved, and if further work is needed to the sump location.

For the proposed Project, drill cuttings will be transported to and disposed of at the identified MBC sump site, while drill fluids will be reused until the end of the Project or the end of the season. Chance plans to construct a new MBC sump (see **Figure 22**). The Devon sump location has not been used by Chance to dispose of drill cuttings or drilling fluid, and there are no plans to do so. The preferred MBC location for this Project is an adjacent, previously undisturbed area of approximately 63,910 m².

Figure 3-13 shows the proposed area with several 800 m² MBC pods representing an estimated area required to dispose of 300 m³ of drill cuttings, approximately one well's worth. The additional area is to accommodate spacing between MBCs for truck access and to stockpile excavated material. Typical operational practice is to have only one MBC pod open at a time to minimize potential permafrost exposure to ambient air temperature.

As per the AER directive, sampling drill waste will undergo the following sampling procedures:

- During drilling, the environmental monitor will be onsite to conduct sampling in compliance with AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023) to ensure that drilling waste is compliant and accurate records are being kept, and to respond to any spills.
- The environmental monitor will take soil samples at the MBC site before use for MBC and after closure and reclamation.

If drilling by-products do not meet AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023), the disposal materials will be transported to an appropriately permitted facility for disposal. Chance has previously used permitted facilities that can accept specified waste in Whitehorse and northeast BC.

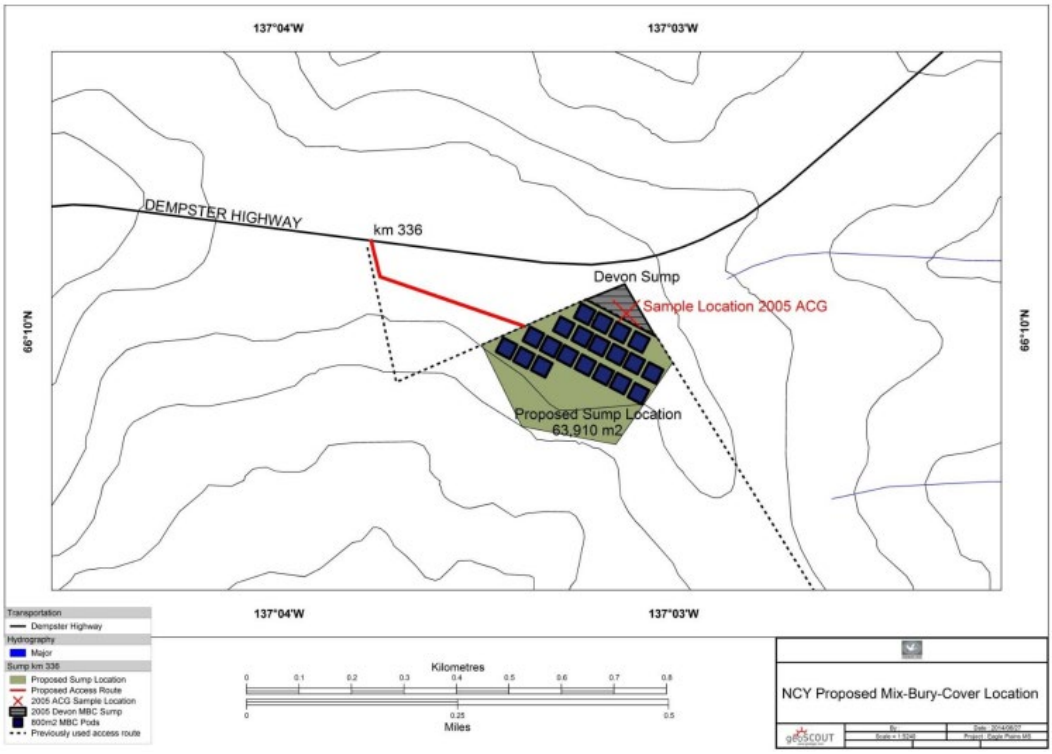


Figure 3-13. General location and plan of the proposed Mix Bury Cover (MBC) sump.

3.3.4 Central Processing Facility (CPF)

The Chance Camp's Central Processing Facility (CPF) will be located at the southernmost end of the camp area, furthest from other camp structures and personnel. The CPF will comprise multi-stage and multi-phase separators, heater treaters (to remove any remaining emulsified formation water and residual natural gas still in solution), a vapour and gas collection system, and a possible central power generation facility to charge all discrete well batteries. Trucks will transport fluid produced during EFT or (occasionally) DST from exploration wells for further processing at the CPF. Separated water will be further treated to remove any hydrocarbons, scale, anaerobic bacteria, and other colloidal or suspended solids ready for disposal in a nearby deep injection well.

Crude oil produced during the EFT would be preferentially stored temporarily for future shipment to market. This may require some processing at the well site or the CPF to stabilize the crude oil for truck transport to a suitable, approved crude oil marketing point (i.e., terminal). The volume (stored in up to five surface tanks in full compliance with Yukon and Canadian standards and regulations) also ensures safe crude stabilization before loading onto southbound trucks. In terms of maintenance, the only treatments appearing necessary at this stage of design are fluid separation (to separate oil from gas and water into three distinct streams), heat treating the crude to remove water remnants from the separated crude, and gas dehydration to make the gas useable as a fuel.

3.3.5 Airstrip

Chance will construct an airstrip along the existing Chance winter trail approximately 4 km off the Dempster Highway. The airstrip will be about 1,500 m long and part of the road network west of the Dempster Highway. This airstrip will be used only during the winter when the surface can be levelled using winter road construction techniques. If sufficient air traffic support is required, Chance may upgrade the airstrip to year-round usage. Until the Chance Road airstrip becomes serviceable each winter or at the end of the winter season operations when trail conditions deteriorate, Chance will continue to use the Dempster Highway adjacent to the camp as a periodic airstrip.

At the beginning of an operating season, the 800-m stretch of the Dempster Highway adjacent to the camp will be used as an airstrip similar to previous periods. Once the Chance winter road airstrip is built, flights will move to that location.

3.3.6 Transportation

For most of the exploration program, Chance will attempt to limit traffic on the winter access roads to authorized personnel. Traffic will include approximately eight to nine light-weight service trucks daily (for supplies and personnel), one to two water trucks, and one fuel truck as frequently as operations dictate. The fuel and water trucks will come to the Project site approximately three times per week or as demand dictates, and there will be occasional transport of drill cuttings from the well sites to the sump location. Air traffic is estimated at two flights in/out per week (normal arrival times between 10:30 a.m. and 12:00 p.m.).

Most traffic volume on winter access roads will be related to mobilizing the drill rig and constructing the site infrastructure. Well site set-up will take approximately five days, including 15 to 20 loads, to mobilize the drill rig. Winter roads will be restricted from public access for safety reasons. Chance's contractors will be transporting crews between the camp and the well site using company vehicles; all vehicles will be equipped

with radio communication and, particularly during busy times (i.e., setup and demobilization), traffic will be radio controlled. For safety reasons, any personnel accessing the areas (i.e., winter roads) must notify the appropriate staff (i.e., security personnel or managers/supervisors) when they leave the Dempster Highway and arrive at the well sites. Chance staff hired as wildlife monitors and security personnel will monitor access to the winter roads.

A typical description of road traffic during the prime operating periods (January 1 to April 15; May 1 to December 1) is presented in **Table 3-4**, and road users will follow the schedule as indicated previously in **Table 2-3** and **Table 3-3.**

Table 3-4. Typical road traffic during operating windows.

	Activity Description	Peak Traffic	Normal Traffic
1	Early Season Mobilization (Winter)	High	Light /High
2	Rig Mobilization (Winter)	High	Light /High
3	Drilling (Winter)	Light/High	Light
4	Access Road Construction (Winter)	Light/High	Light
5	Extended Flow Testing (Winter)	Light/High	Light

Notes:

1. High: 20–40 vehicles per 24-hour day
2. Light: less than 20 vehicles per 24-hour day

Chance expects vehicle volumes on the winter access roads during exploration drilling activities will range between medium and light traffic volumes. Minimal additional traffic is expected to and from the site, except for the trips by the water truck and fuel truck, which will be on-demand, transportation of other supplies as needed and possibly transport crude oil produced during EFT to an acceptable market off-site.

Trucking a stabilized crude oil cargo in specially constructed transporting tanks presents the same risk as transporting the diesel fuel required and used in Yukon. The process of loading and dispatching trucks at regular intervals will be planned and handled by professionals who will also maintain constant communication and GPS tracking of trucks as they travel down the Dempster Highway and on other connecting routes to their destination.

Chance has practised Journey Management on its previous exploration drilling work at Eagle Plains. In this instance, any unit transporting materials to Chance's Camp at km 325 will be called and tracked periodically by the dispatcher. The exact location when reaching certain pre-determined checkpoints will be relayed to the Chance Camp Management and Logistics Coordinator; this will ensure road safety for the truck driver and other road users and the safety of the vital cargo. It also provides critical planning information for receiving staff to plan for offloading its cargo and possibly loading backhauls.

The journey distance is 1,029 km from Eagle Plains to Skagway. The journey duration is approximately 17.5 hours driving at an average speed 59 km/hr. Other options exist, including truck delivery to terminals in Fort Nelson and Fort St. John, BC, or Grand Prairie, Alberta. The driving times will vary depending on which of these options is used, but the management procedures will remain the same.

Chance and its trucking contractor(s) will develop a *Transportation Alert and Emergency Response Plan* to manage potential risks and provide a clear chain of communication and action in the event of an accident while in transit on Yukon roads and highways. The plan will address any other Provincial routes. All reputable trucking contractors versed with transporting flammable liquids and petroleum products generally are mandated to follow the *Transportation of Dangerous Goods Act* (Government of Canada 1992). Ensuring the truck is safety-checked and the drivers are qualified and adhere to their company's safety policies are the key to preventing an incident or accident. Tracking the drivers to check on transit speed on a real-time basis means the truck's progress is never neglected and the driver is on notice to observe all road traffic rules at all times.

All incidents affecting Chance's trucking contractor are reported to Chance Operations Management and form part of Chance's safety statistics. Every incident is investigated, and the causes for each occurrence are closely analyzed and discussed with the truck owner. Should any trucking contractor exhibit an undue number of close calls/near misses or a series of incidents with the same causes, they would be removed from the contract without delay and replaced with a more competent and safety-minded contractor.

3.3.7 Workforce and Accommodations

Workforce requirements will vary over the life of the Project and will ultimately be limited by the existing camp capacity. During past drilling and seismic exploration programs undertaken between 2012 and 2014, Chance had no more than 75 to 80 people on-site at any time. During drilling, Chance operated on a 24-hour clock with a 20-day-on and 10-day-off crew rotation cycle, meaning that one-third of the crew was off duty at any point. Chance operated on a 12-hour clock for the seismic exploration program and cycled the various services as the program unfolded with limited crew changes, mostly connected with the camp catering operation.

Chance's existing camp (Chance Camp), office, and storage yard was established in October 2011 and is located at km 325 of the Dempster Highway. It is accessible year-round unless the highway is closed due to weather or construction. For this Project, Chance plans to use the camp for storing and transporting equipment and supplies needed for operations and personnel accommodations. The Chance Camp is the Project's main accommodation facility, and it can house up to 75 people in trailers and kitchen, sanitary and potable water treating facilities. Camp waste management consists of an incinerator for burning non-toxic and food waste and a secure storage area for other forms of waste. All non-incinerated waste will be transported to an appropriate municipal waste facility for disposal.

Due to the remoteness of some well sites, a remote camp (fly-in) would be established near the proposed East Greaves and West Greaves Winter Trails, roughly 40 km from the Chance Camp, to accommodate approximately 25 personnel. It would be used as an operations camp with full services, including food, fuel, sleeper trailers, bathrooms, water storage, and project management and HSE offices. The fly camp is necessary for operations planned in the winter months as the cold temperatures approaching -50°C, nearly 24-hour darkness and the potential of "white out" snow storms pose a real threat to crew member safety.

In addition, a mobile camp will be established at each active well. This will be a trailer that accommodates sleeping and a small medical/first aid trailer equipped with heat, power, water, and sewer service that may be installed at the well site during workover operations to provide essential first aid supplies and refuge for

workers. All wastewater and sewage will be collected in tanks approved by the CSA and transported off-site for disposal at an approved facility in Fort McPherson.

Chance aims to offer training, employment and contracts to its First Nation/Yukon partners as identified in sec. 68 of *YOGA* (Government of Yukon 2002). During its last drilling/seismic program, Chance successfully hired a workforce from the communities from Old Crow, Fort McPherson, Dawson, Whitehorse, and Inuvik.

3.3.8 Project Water Use

Water for the drill rig, winter road construction and the camp operation will be primarily sourced from existing withdrawal locations on the Eagle River, with locations on the Ogilvie River and Whitestone River as an alternative source. Licensed allowances will determine water usage. All water withdrawals will follow the DFO's *Interim Code of Practice: End-of-Pipe Fish Protection Screens for Small Water Intakes in Freshwater* (Government of Canada 2020).

If natural snowfall is below the minimum required depth to construct and maintain the winter roads, snowmaking equipment may be used to make up the shortfall. This is a contingent consideration and could require up to 300 m³ of water per day for a short period (a few days to a week) in the early winter. The sources of water include the Eagle River and the Ogilvie River. The water used to make snow and ice for the winter road(s) will be trucked from the source to the point of use, with each truck expected to complete between one and three deliveries per day.

Potable water for the Project will be sourced from the Eagle River, Ogilvie River and potentially the Whitestone River at a maximum rate of 20 m³/day, as described in Water Licence MN12-061 and treated at the Chance Camp using a combination of ultraviolet (UV) treatment, chlorination, and filtration. Wastewater disposal at the Camp consists of a wastewater treatment plant, holding lagoon, and exfiltration system.

3.3.9 Fuel Storage

Operation of the camp will require diesel and propane for power, heating and cooking. Diesel will be stored on-site in 15,000 L Enviro Tanks. There will be four to six tanks at the camp and one to two at the rig site. The tanks are bulk fuel, double-walled storage tanks with built-in secondary containment. The drilling rig, boilers, and any light towers at the rig site will have their own built-in fuel storage tanks.

Propane will be used to fuel the furnaces, hot water tanks, and the kitchen at the camp and at the rig sites and will be stored in 1,500 L propane bullet tanks. There will be six at the camp and one to two at the rig camp.

3.4 RECLAMATION AND CLOSURE

3.4.1 Seismic Lines

In addition to the low impact seismic methodology, with reduced line width and meandering paths, a remediation plan involving access deterrence will be used. Although nominal, standing timber will be gently pushed across lines to create a Leaning Tree Stand (LTS) using a "Stem Bending" method to decrease

these sight lines. Although not expected to be required to a great extent in the Eagle Plains area, this technique is highly effective in reducing access and enabling sufficient cover for vegetation regeneration.

3.4.2 Mix Bury Cover (MBC) Sump Site Reclamation

The standard AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023) of action prescribes the following closure and reclamation actions for MBC sumps:

- Upon completion of the Project, remote disposal locations will be covered with a minimum of 1.0 m of capping material and contoured to meet background topography.
- A Phase 1 Environmental Site Assessment (ESA) will be completed for each well and corresponding remote MBC location to identify any potential areas of environmental concern.
- If the Phase 1 ESA triggers a Phase 2 ESA, soil samples will be collected and analyzed at an accredited laboratory.
- If contamination is identified, a Remediation Action Plan will be prepared and upon approval, the remedial program will be completed. Once all contamination is addressed either in the Phase 1 ESA, Phase 2 ESA, or Remediation, a surface program including soil and vegetation will be conducted.
- Once vegetation is established, a Detailed Site Assessment; comparing soil lithology and vegetation onsite to offsite) will be completed.

The stockpiled vegetative layer and soil will be re-applied to the MBC sump area on top of the capping materials and after contouring has been completed.

Environmental monitors will follow the testing requirements in accordance with AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023):

1. Receiving soil
    a. Electrical conductivity and sodium adsorption ratio
2. Waste (solids or total waste)
    a. pH, electrical conductivity, sodium adsorption ratio, sodium (Na)
    b. nitrogen (N), if additives/products added to the drilling mud/waste system contain any amount of N or if N content was unknown
    c. metals, if concentrations exceeding limits were added to the drilling mud system or if the metal content of additives/products is not known
    d. hydrocarbons, if a hydrocarbon flag was encountered
    e. toxicity, if toxicity data are unknown for any of the mud additives/products used in the drilling mud system or if concentrations used exceeded pass threshold for luminescent bacteria toxicity test
3. Waste/soil mix (post-disposal)
    a. conductivity (EC), sodium adsorption ratio (SAR), and Na, if drilling waste EC >10 decisiemens per metre (dS/m) or Na >3000 milligrams per litre (mg/L) (saturated paste extract or filtrate from oversaturated waste)
    b. metals, if concentrations in drilling waste exceed concentrations listed
    c. hydrocarbons, if concentrations in the drilling waste exceed concentrations

d. N, if the nitrogen concentration in the drilling waste (wet weight) is ≥6 milligrams per kilogram (mg/kg) for disposals in coarse soil or ≥120 mg/kg for disposals in fine soil.

The first task on any well site is constructing the well pad or preparing the surface on which matting can be safely placed. The next step is to lay the mats on the 10 cm of packed snow, moving snow as needed to create a flat surface. The final process, before deploying the drilling equipment, is a professional geotechnical check on the stability of the surface and its resultant ability to support the maximum anticipated loads with a suitable safety factor. Finally, the geotechnical engineer will provide a signed/stamped report attesting to the stability and strength of the facility for the work contemplated.

3.4.3 Well Abandonment

As mentioned, the 30 proposed wells are part of an exploration program to help determine the region's oil and gas resource potential. Depending on the outcome of results, a given well may be tested and additional plans developed to bring it into production or decommissioning and abandonment if determined to be unproductive. As the Operator, Chance will always be responsible for all wells deemed its property. This responsibility can never be delegated to any other party unless and until such time Chance relinquishes ownership according to *YOGA* and its regulations (Government of Yukon 2002, 2004).

The standard AER *Directive 050 Drilling Waste Management* (Alberta Energy Regulator 2023) of action prescribes the following closure and reclamation actions for well sites:

- A Phase 1 ESA will be completed for each well location to identify any potential areas of environmental concern.
- If the Phase 1 ESA triggers a Phase 2 ESA, soil samples will be collected and analyzed at an accredited laboratory.
- If contamination is identified, a Remediation Action Plan will be prepared and upon approval, the remedial program will be completed. Once all contamination is addressed in the Phase 1 ESA, Phase 2 ESA, or Remediation, a surface program will be conducted, including soil and vegetation.
- Once vegetation is established, a Detailed Site Assessment; comparing soil lithology and vegetation onsite to offsite) will be completed.

Wells required for further operational uses such as producing wells, water or gas injector wells will be maintained in a suspended state and can be converted for use in the future. The *Oil and Gas Drilling and Production Regulations* under *YOGA* (Government of Yukon 2004) have specific actions required from an operator to maintain a well in a suspended state; key among these actions is to periodically conduct inspections to ensure that the integrity of the well is intact. While a well is in suspended status, the regulator requires a sum of money to be placed on deposit to cover the cost of abandonment and remediation of the site. Once abandoned, the status becomes permanent, and re-entering such a well would not be possible.

The normal stages before decommissioning/abandonment of a well are as follows:

- The well is first determined to be unusable.
- The perforations are first cemented by placing a cement plug below and above them and squeezing cement into the formations to isolate them within the wellbore permanently. A

mechanical shut-off device called a bridge plug may also be wireline set above the cement plug to add protection or isolation.

- A second cement plug would be set higher in the production casing and below the estimated permafrost maximum depth. This plug is normally set on top of a bridge plug to ensure it does not leak down in the casing. The plug is also "felt" with a drill bit to confirm its existence and hardness.
- The casing at the surface is cut 1 m below the original ground and buried under the soil to remediate the location entirely. The soil will be left to achieve a frozen state naturally, and permafrost is expected to establish within it at the same depth as the surrounding area.
- The lease is remediated by removing all equipment and infrastructure to restore the location to its original status. The surface location is left to be revegetated naturally.

When appropriate, a decommissioning/abandonment plan for the well sites will be developed to comply with Part 7 of the *Oil and Gas Drilling and Production Regulations* (Sections 95, 96, 97, 99) (Government of Yukon 2004). Wells would require final well abandonment according to the *YOGA Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004).

During winter work, sampling can be accomplished from the surface snow deposits around the well site. Chance has selected well site dimensions to ensure a sizable perimeter for containing liquid or solid waste from the Project. The well site will be lined to contain potentially released fluids. An outline procedure prepared by Chance in compliance with the *YOGA Oil and Gas Drilling and Production Regulations* (Government of Yukon 2004) is presented as follows:

- Seal off all perforations in the casings not already sealed with cement squeezes.
- Pressure test the casings to 7,000 kilopascals (kPa) to confirm isolated and sealed formations.
- Cut off the wellhead and casings to 1 m below ground level and weld/install plates to cover each casing string at the surface.
- Install well identification marker visible above ground level.
- Bury the cut casings to complete the abandonment.

If the entire Project had to be suspended but not completed, the infrastructure would be preserved and maintained until the Project resumes. If it is decided to terminate the Project, the infrastructure will be decommissioned. While operations are suspended, Chance would ensure access from the Dempster Highway would be barricaded and visually inspected periodically.

3.4.4 Winter Roads and Winter Well Sites

Reclamation activities will aim to enable sites to revegetate naturally as quickly as possible throughout the life of the Project. Well site and winter road reclamation activities will be designed to meet the following objectives:

- Leave the site uncontaminated following the completion of Project activities.
- Remove all garbage, petroleum products, and equipment.
- Prevent long-term erosion or slumping and promote successful natural revegetation of disturbed areas.

Given the winter road construction methods that will be employed (i.e., packing snow to a minimum thickness of 10 cm), no additional reclamation is anticipated to be required for the winter roads. Proposed Project activities will take place during winter, and the winter access roads and well site pads will be constructed using snow and ice to minimize damage to the vegetative layer or compaction/scarification of the organic soil layer. The proposed measures to promote successful natural revegetation are as follows:

- Complete removal of equipment, matting, materials and debris from well sites.
- Leaving the well sites and winter roads in such a condition that water ponding, slumping or soil erosion are unlikely outcomes – if (unplanned) soil disturbance takes place, the surface would be contoured to minimize erosion (depending on the area disturbed), roughened, and covered in a layer of mulch or cut vegetation.
- No stockpiles of snow or ice will be left at the well sites or along the winter roads, to minimize melt-related effects on vegetation.
- Existing shrub-stage vegetation will be pushed over, or cut as high as possible, during winter road construction.
- Trees and shrubs will be cleared but ground vegetation will be left intact and protected via minimum 6” packed snow or rig mats. Where trees and large shrubs exist, they will be hand cut and piled to form brush piles that will inhibit human travel and provide ongoing soil/non-woody vegetation protection post-melt.

Access to winter roads will be restricted during and after operations. Restricting access will ensure that the road can fully melt in spring, thus reducing the potential for additional disturbance from outside users and reducing risk to Chance employees and the public.

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APPENDIX 2-B-55. *Eagle Plains Oil and Gas Exploration Planning: Surficial Geology/Permafrost and Exploration Development Suitability Mapping*

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Memorandum

Date: January 22, 2021
Project #: 1903401
File #: 1

To: Richard Wyman, Chance Oil and Gas Limited

From: Robin McKillop, Cory McGregor

cc:

Re: Eagle Plains Oil and Gas Exploration Planning: Surficial Geology/Permafrost and Exploration Development Suitability Mapping

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1. Introduction

Palmer is pleased to submit this report to Chance Oil and Gas Limited (Chance) to accompany and explain the interpretive surficial geology/permafrost and exploration development suitability mapping in a priority area of its Eagle Plains property in northern Yukon. Our work provides a basis for Chance to effectively plan upcoming maintenance programs for its abandoned wells and the next phase of its exploration, by distinguishing areas well and poorly suited to road and well pad construction, and mix-bury-cover (MBC) drill cuttings disposal. It also aims to help streamline Chance's exploration permitting process by proactively characterizing the distribution and relative ice content of permafrost in anticipation of related information requests from the Yukon Environmental and Socio-economic Assessment Board (YESAB).

Following provision of important background information (Section 1), we provide an overview of the physical setting (Section 2) and describe the methods used to produce the interpretive mapping and derivative products (Section 3). Key results portrayed by the maps, including the areal distribution of distinct areas and implications for exploration development, are highlighted in Section 4. Recommended follow-up investigations are highlighted in Section 5.

1.1 Background

Chance is interested in expanding its exploration for oil and gas reserves within its property near Eagle Plains. Exploration is planned in phases across a 2,400 km^2 area within its property. To support exploration planning and associated permitting, Chance is seeking insight into the distribution, characteristics, and sensitivity of permafrost terrain within its exploration area as a basis for optimizing initial ground testing and ultimate site selection for its exploration wellpads, access roads and MBC disposal sites. A number of key characteristics are particularly important for assessing site-specific sensitivities to disturbance, including: permafrost extent (laterally) and depth (active layer thickness) with consideration of potential talik (unfrozen) zones; relative ice content (e.g., ice-rich or ice-poor); and past or present instabilities expressed by

thermokarst, gullying, shallow landslides and ice-wedge polygons. Indicators of concentrated and seasonally prolonged shallow groundwater flow, such as slopewash runnels and the margins of existing or recently abandoned water bodies, are also important considerations for site selection and land management as these may increase construction costs and maintenance requirements.

Palmer previously completed surficial geology/permafrost and derivative suitability mapping for a 440 km^2 subset of the Chance Eagle Plains property, located approximately 40 km southwest of Eagle Plains. This study builds on and refines the previous work to complete seamless mapping expanding from the 440 km^2 subset into the surrounding area. In addition, this study takes advantage of the previous reporting by Palmer (2015a), which has been adapted for the current objectives, updated based on limited field observations, and revised where necessary.

1.2 Study Area

The study area is located approximately 20 km southwest of Eagle Plains, and measures approximately 2,400 km^2, inclusive of the 440 km^2 subset mapped in 2015 (Figure 1). The Dempster Highway diagonally crosses the southern half of the study area between kilometres 300 and 347. The northern edge of the study area roughly coincides with the Arctic Circle at 66°30’00” N, while the southern edge is approximately 8 km north of the Peel River valley at 65°55’00” N.

1.3 Objectives

The overall objective of this study is to expand the existing understanding of terrain and permafrost distribution and will ultimately provide Chance with advance knowledge of permafrost sensitivity and development suitability across its 2,400 km^2 Eagle Plains study area. To accomplish this main objective, Palmer completed the following:

- A field reconnaissance program to calibrate the terrain and permafrost characteristics with limited helicopter- and ground-based observations;
- Surficial geology mapping for the study area, including delineation of terrain features through the newly added 1,960 km^2 expansion area and review and refinement of the original 440 km^2 subset;
- Classification of permafrost conditions across the study area, with a focus on describing relative active layer thickness and permafrost ice content; and
- Derivation of an Exploration Development Suitability map with a focus on highlighting regions where constraints related to terrain and permafrost conditions are most likely to affect road routing and design, wellpad siting and layout, and future construction and maintenance activities. The Exploration Development Suitability map also draws attention to areas potentially suitable for MBC disposal of drill cuttings.

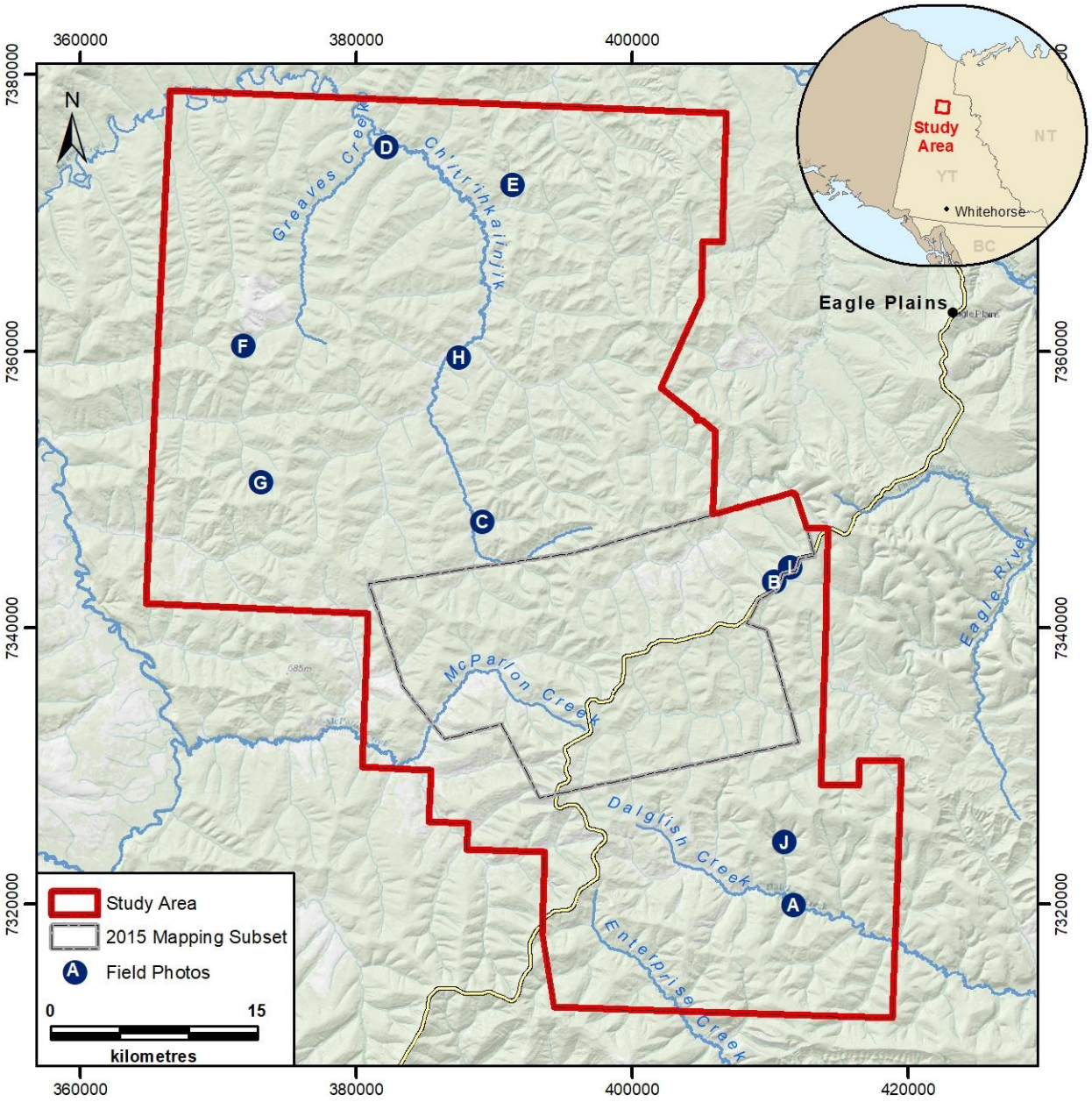

Figure 1. Eagle Plains study area and locations of representative field photos included below.

2. Physical Setting

The study area lies within the Eagle Plains Ecoregion, an area of modest relief in the lowlands between the North Ogilvie and Richardson mountain ranges (Yukon Ecoregions Working Group, 2004). Elevation ranges between 350 m asl at the base of the northernmost river valleys to 750 m asl at high points along the broad ridge system followed by the Dempster Highway. Climate is characterized by prolonged winter conditions which persist up to eight months of the year. Mean annual temperature is near -7.5ºC, with mean July temperatures around 13ºC and mean January temperatures slightly colder on the valley floors (-31ºC) than over higher terrain (-25ºC) due to strong temperature inversions associated with Arctic high pressure.

Annual precipitation is approximately 400 mm, falling mostly as rain during the summer months (Yukon Ecoregions Working Group, 2004). Most surface water drains into the northern-flowing Porcupine River, via major tributaries such as the Eagle River and Whitestone River; in the southeastern corner, Dalglish Creek and Enterprise Creek drain into the Peel River, which flows east to the Mackenzie River.

2.1 Bedrock Geology

The bedrock geology of the study area is dominated by the Upper Cretaceous rocks of the Cody Creek, Burnthill Creek, and Eagle Plain formations (Yukon Geological Survey, 2020). These rocks comprise fine- to medium-grained sedimentary sequences including sandstone, shale, siltstone, bituminous shale, mudstone, and coal. The easternmost edges of the study area intersect the mixed carbonate and clastic rocks of the Hart River and Ford Lake formations.

Differential weathering of these lithologies has contributed to the unique landscape in the study area. Broad ridges are formed by comparatively erosion-resistant sandstone beds. The Dempster Highway and Chance Road generally follow a network of these more resistant ridges. Isolated knolls along the ridge crests are likely remnants of the more competent bedrock in the area.

2.2 Landscape Evolution

Much of Yukon has been repeatedly glaciated during the Pleistocene, causing multiple episodes of erosion and deposition of thick and extensive glacial sediments. Beyond the maximum limit of glaciation, however, surficial deposits generally comprise deeply weathered bedrock and soils on plateaux and slopes, organic-rich soils and peat in depressions, and fluvial silts, sands, and gravels along river valleys (Hughes, 1972). During the last glaciation, the Laurentide Ice Sheet reached its all-time limit occupying the region surrounding the lower Mackenzie River Valley and reaching as far west as parts of the Richardson and Mackenzie Mountains. The study area lies within an unglaciated region to the west of this limit (Duk-Rodkin, 1999), and is generally unaltered by glacial processes. However, Laurentide ice obstructing the Peel River valley and impounding Glacial Lake Hughes diverted meltwater flow northward through the Eagle River valley (Duk-Rodkin and Hughes, 1995). Thus, glacial processes may have had an indirect effect on the study area by lowering the base level of the Eagle River and increasing the rate of incision of its upstream tributaries.

The lack of glacial erosion has resulted in broad, rolling uplands that are typically covered by veneers of relatively fine-grained colluvium or weathered bedrock and commonly bounded by well-drained scarps where more resistant bedrock transitions into fluvially incised, V-shaped valleys. The valley sides are covered by thick, fine-grained colluvium, locally overlain by organics. Thick, fine-grained to gravelly fluvial deposits occupy the valley bottoms. Remnant terraces perched above the floodplains within some of the larger valleys are composed of peat overlying fine sands and silts (Thomas and Rampton, 1982). The lower permeability and valley bottom position of these thicker sediments results in the preservation of ice-rich permafrost, which can introduce challenges for exploration and infrastructure development in these areas.

2.3 Permafrost and Periglacial Processes

Permafrost is ground, including both unconsolidated sediments and bedrock, that remains below 0°C for more than one year. Chance's Eagle Plains property is entirely within the zone of continuous permafrost,

based on property-specific geological and geophysical field data, ground surface expression visible in aerial photography, and regional-scale permafrost mapping compiled by Heginbottom et al. (1995) (Palmer, 2015b).

The depth to permafrost (or active layer thickness) varies spatially at regional and local scales, and temporally with changing seasons. The active layer is generally <1 m thick in the study area, even at its late summer maximum, although it may reach around 2 m in particularly well drained, elevated sites. Active layers may be even thicker, locally reaching bedrock at a depth of 3-4 m, following wildfire (Coates, 2008; Kryotek Arctic Innovation, 2015). At a local scale, active layer thickness primarily depends on elevation, aspect, slope position and shape, soil texture and drainage, snow pack and vegetation cover (Williams and Burn, 1996; Bonnaventure et al., 2012; McKillop et al., 2013). Well drained soils insulated by thick annual snow cover tend to have thicker active layers (deeper permafrost table) than wind-swept, poorly drained areas (shallower permafrost table). In areas of thick, mossy organic cover, permafrost may be encountered at depths as shallow as just a few tens of centimetres even at the end of summer. Active layer thickness increases following snowmelt in spring, and typically peaks in late summer.

Permafrost may or may not contain ice, depending primarily on the material within which it exists and its hydro-geomorphic setting. Most commonly, ice is restricted to the pores or fractures within surficial materials or bedrock, respectively. Such ‘ice-poor’ permafrost is widespread in the study area and most common in areas of exposed or shallow bedrock, along ridges of weathered bedrock, and on relatively well drained colluvial slopes. Where soil textures and drainage conditions permit, thin seams or small lenses of ice may form, representing a more moderate volumetric content of ice. Broad valley bottoms, which have been infilled with mixtures of fine-grained colluvium, fluvial deposits and organic matter, may contain ‘ice-rich’ permafrost. In addition to pore and lens ice, massive bodies of ice may exist within the unconsolidated material. Such bodies grow and shrink in response to changing climatic conditions and ground thermal regime (e.g., organic cover thickness, local drainage conditions). They may form ice wedges, which commonly form geometric networks well expressed at surface by interconnected, linear furrows. Ice-wedge polygons also occur on some gentle slopes, including broad ridge crests and shoulders within portions of the study area.

The sensitivity of permafrost to disturbance depends on a variety of factors, including its temperature, ice content, insulating ground cover (e.g., organics) and the material within which it is held. Relatively warm permafrost (i.e., warmer than -2°C) is more susceptible to thaw due to localized and even minor disturbances to the ground surface, whereas cooler permafrost is able to withstand minor disturbances without appreciable effect. Permafrost that is decoupled from current climatic conditions and only persists in areas of thick, mossy organic cover is more sensitive to disturbance through ground disturbance (e.g., stripping or compaction of organics). Permafrost within fine-grained materials is more likely to contain discrete bodies of ice and, thus, is more sensitive than that within weathered bedrock or coarse-grained colluvium.

Permafrost has a strong influence on soil and drainage conditions, the rates and mechanisms of colluvial (mass movement) processes, and overall hillslope and valley bottom morphology. An appreciation for periglacial processes is important to exploration planning. Permafrost acts as a barrier to water flow, in the absence of any taliks (unfrozen areas bounded by permafrost), so unconsolidated materials within the

active layer commonly become saturated during the summer. On level ground, differential frost heave may occur in the snow-free season, resulting in frost (mud) boils, irregular micro-topography and the formation of earth hummocks. Ice-wedge polygons may form under certain conditions. In areas of ice-rich permafrost, even minor ground disturbances may trigger thermokarst activity (e.g., natural windthrow ripping the surface organic mat and exposing underlying sediments), through which the ground subsides and slumps in response to the melting of buried ice bodies. Thermokarst commonly continues for extended periods of time (i.e., years to decades), once initiated, through a positive feedback cycle between increases in thaw and increases in water ponding. Retrogressive slumping is common along the shores of thaw ponds and along the banks of thermokarst gullies, which incrementally enlarges the area of subsidence.

On slopes, summertime saturation reduces the shear strength of the soil and promotes solifluction, the gradual, downslope creep of material on the permafrost table; or active-layer detachment, the rapid, downslope slide and/or flow of material on the permafrost table. Both processes increase in frequency and magnitude shortly after wildfire (Coates, 2008), mainly due to the loss of rooting strength and insulating organic cover (thaw rate and depth increase). Solifluction is best recognized at surface by conspicuous ‘lobes’ of organics and sediment, defined by a steep, rounded front and a gradual tail. Areas of active solifluction can destabilize roads through irregular settlement and mounding. Certain slopes are commonly prone to active-layer detachments; their histories of landslides are commonly indicated by conspicuous fall line-oriented ‘stripes’ of deciduous trees.

Slopewash is another widespread and important process on slopes underlain by permafrost, through which material is transported downslope through a combination of sheetwash (entrainment in surface runoff) and piping (entrainment in water percolating through the active layer). Shallow ‘runnels’ (also known as ‘water tracks’) are a surface manifestation of slopewash, formed by the repeated and preferential downslope transport of sediments along natural drainage paths. As slopewash runnels deepen, they concentrate and prolong the conveyance of surface runoff and shallow groundwater, resulting in a local depression in the permafrost table (thickening of the active layer). The interception of slopewash runnels by roads necessitates cross-ditching or drainage culvert installation; still, such sites may form ‘icings’ during the winter and spring months, which increase maintenance requirements on road surfaces and embankments.

3. Methods

3.1 Field Reconnaissance

A one-week field reconnaissance program was completed between July 1 to 7, 2019. Weather conditions were generally clear and sunny with brief periods of light rainfall. The program was undertaken with the support of a helicopter and included reconnaissance flights over much of the study area as well as ground-based assessments. The program was completed with a focus on characterizing a diversity of landforms, surficial materials, and permafrost conditions across the study area. Ground-based field observations were made through a series of foot traverses to document changes across the landscape. Field assessment involved examining sediments and visible ice in hand-dug soil pits and natural exposures (e.g., landslide scarps, gullies, stream cut-banks); measuring depth to frost (which may not have represented the true depth to permafrost at the start of the summer); determining material textures, origins, and expressions; and describing geomorphological processes. The program was completed in parallel with an ecological field program undertaken by Environmental Dynamics Inc. (EDI). Where possible, terrain interpretations were

supplemented by opportunistic field observations made and shared by EDI's ecologists as part of their field program.

3.2 Terrain Mapping

Palmer completed surficial geology/permafrost mapping for the 2,400 km^2 study area as a basis for communicating the distribution of distinct ground conditions. The mapping represents the seamless integration of the previously mapped 440 km^2 area (Palmer, 2015a) with the expanded interpretations within the surrounding 1,960 km^2. The 440 km^2 subset was reviewed and standardized for consistency with the surrounding area. Terrain interpretations were completed using a combination of multiple stereo-imagery sources in combination with high-resolution LiDAR-derived elevation data. Aerial photographs were acquired by Chance over the northern and southern regions of the study area, but smoke from wildfires precluded acquisition within the central portion of the study area. Satellite imagery acquired between 2014 and 2019 were overlain onto a digital elevation model to generate pseudo-stereo imagery and were used as a substitute for stereo aerial photographs in this region. Terrain interpretations were refined based on LiDAR-derived elevation data, available across the study area at a resolution of 2 m. Surficial mapping was digitized directly into a geographic information system (GIS) using DAT/EM's Summit 3D mapping software in conjunction with Esri's ArcMap.

Surficial geology/permafrost mapping was completed at a view scale of 1:20,000 using the standardized Yukon surficial geology mapping protocols (Lipovsky and Bond, 2014), which are an adaptation of the *Terrain Classification System for British Columbia* (Howes and Kenk, 1997), with modifications to accommodate project-specific objectives. Terrain polygons were delineated based on internally homogenous combinations of surficial materials, textures, surface expressions, drainage classes, and geomorphological processes. Under this system, up to two surficial materials were identified in each polygon as either a primary or secondary material, or in stratigraphic relation to each other. Relative depth to, and relative ice content of, permafrost were estimated for each map polygon using the terrain characteristics and calibrated based on ground observations made during the field reconnaissance program. Relative depth to permafrost refers to the approximate maximum (end of summer) depth of the permafrost table (active layer thickness) and is an inferred average value for the polygon (Table 1). Relative ice content is an inference of the amount of pore ice, segregated ice, massive ice, and/or excess ice (Table 2). Terrain and permafrost interpretations are limited by the mapped scale, and represent the average conditions within each map unit (polygon). It is possible that ground ice is more or less extensive than its mapped representation due to a necessary generalization of the terrain characteristics or geomorphological processes of the map unit. Polygons have been symbolized based on the primary surficial material. Discrete terrain features and geomorphic processes too small to be mapped as individual polygons, such as thermokarst subsidence and active-layer detachments, have been identified using on-site point and line features. All codes used in the mapping are defined in the legend.

3.3 Exploration Development Suitability

The Exploration Development Suitability maps represent the general suitability of distinct areas for the establishment and maintenance of access roads and wellpads, and for disposal of drill cuttings using MBC techniques. The general characteristics of terrain suitable for wellpads and access roads were assumed to be similar in the study area, so these suitabilities have been considered together.

Table 1. Inferred relative depth to permafrost.

Depth Classification	Definition	Description
Near-surface	Permafrost table located less than 0.4 m from the ground surface.	Permafrost is typically found within or at the base of surface organics. Includes map units overlain by organic blankets and veneers; very poorly to imperfectly drained fluvial fans, terraces, veneers; and inactive floodplains.
Shallow	Permafrost table located between 0.4 and 1.0 m from the ground surface.	Applies to relatively fine-grained and matrix-supported sediments and is considered the typical permafrost depth class through the study area. Includes most imperfectly to moderately well drained deposits, active floodplains and most deposits with mapped ice-wedge polygons or thermokarst subsidence.
Deep	Permafrost table located more than 1 m from the ground surface.	Typically applies to relatively coarse-grained and clast-supported deposits. Includes bedrock and most moderately to well drained colluvium and weathered bedrock along convex ridges and scarps.

Table 2. Inferred relative ice content of permafrost.

Ice Content Classification	Pore Ice	Segregated Ice	Massive Ice	Excess Ice[1]	Description
Ice-rich	Continuous	Extensive	Indicated (Xw), Inferred (Xt), or likely; widespread	Major	Typically includes sediments overlain by organic blankets and veneers; poorly to very poorly drained, mostly inactive fluvial deposits; and map units affected by ice-wedge polygons or thermokarst subsidence.
Ice-moderate	Continuous	Widespread, in seams and lenses	Possible, locally	Moderate	Includes fluvial deposits not previously classified as ice-rich; fine-grained colluvial aprons and blankets; imperfectly to poorly drained matrix-supported colluvial blankets; and map units affected by sheetwash or solifluction.
Ice-poor	Discontinuous to Continuous	Local, mostly in seams	Unlikely, except in isolated areas	None to minor	Applies to most moderately to well drained terrain throughout the rolling uplands and colluvial slopes and is considered the typical ice content class in the study area.

[1] Excess ice refers to the volume of ice that exceeds the total voids (e.g., pore space) that would be present under natural, unfrozen conditions.

The road and wellpad suitability and MBC disposal suitability classifications were derived from the 1:20,000-scale surficial geology interpretations and are specific to (and relative within) the project area. Map units (polygons) were categorized into five road and wellpad suitability classes (ranging from Very High to Very Low) and two MBC disposal suitability classes (Potentially Suitable and Probably Unsuitable) based on terrain characteristics, site drainage, and permafrost conditions, also considering field observations and professional experience in unglaciated Yukon (e.g., McKillop et al., 2013; McKillop et al., 2016). Definitions, explanations and implications of each class are outlined in Section 4.3 in association with the presentation of results. A lower suitability rating does not necessarily mean suitable terrain is not present in the map unit; localized portions of these polygons may be suitable for exploration development or MBC disposal based on site-specific terrain characteristics. Similarly, a higher rating does not necessarily mean the entire polygon is suitable for exploration development or MBC disposal. Field investigations remain warranted to evaluate suitability classifications at a site-specific level.

4. Results and Discussion

4.1 Key Field Observations

Ground observations were made at 103 field reconnaissance sites and supplemented by opportunistic observations and photographs taken along foot traverses and helicopter flights. An overview of representative photograph locations is shown in Figure 1, and examples of common terrain units and processes are presented in Figure 2. Most of the study area consists of gently sloping uplands dissected by stream valleys punctuated by bluffs at the crests of slopes (Photos A to C). Geomorphological processes related to ice-rich permafrost are visible by surface expressions including ice-wedge polygons (Photo D) and thermokarst subsidence (Photo E). Mass movements such as active-layer detachments were observed on gentle to moderate gradients along valley walls (Photo F).

Representative photographs of permafrost conditions and sediments in the study area are presented in Figure 3. Measurements of the active layer thickness at the time of site inspection (July 1 to 7, 2019) are estimated to be slightly thinner than the late summer maximum. In general, depth to frost was less than 1 m throughout the study area. Measurements were generally deeper near active streams and were assumed to be relatively deep on well drained, weathered bedrock ridges where high clast content typically restricted measurements using a frost probe. Permafrost was near-surface (<0.4 m) beneath areas of thick organic cover, such as fluvial terraces and inactive floodplains. Typically, ice content increases toward lower valley positions, and was noticeably higher within inactive floodplains. In one such environment, an eroding stream bank exposed massive ground ice in wedges >2 m high (Photo G). Excess ice was also observed within thick, fine-grained colluvial deposits (Photo H).

Competent bedrock rarely outcrops at surface through most of the study area, but several conspicuous outcrops of sandstone and conglomerate were observed near the Dempster Highway (e.g., Figure 3 Photo I). Most ridge crests appear as weathered bedrock and consist largely of well drained sands and angular clasts (Photo J).


A


B


C


D

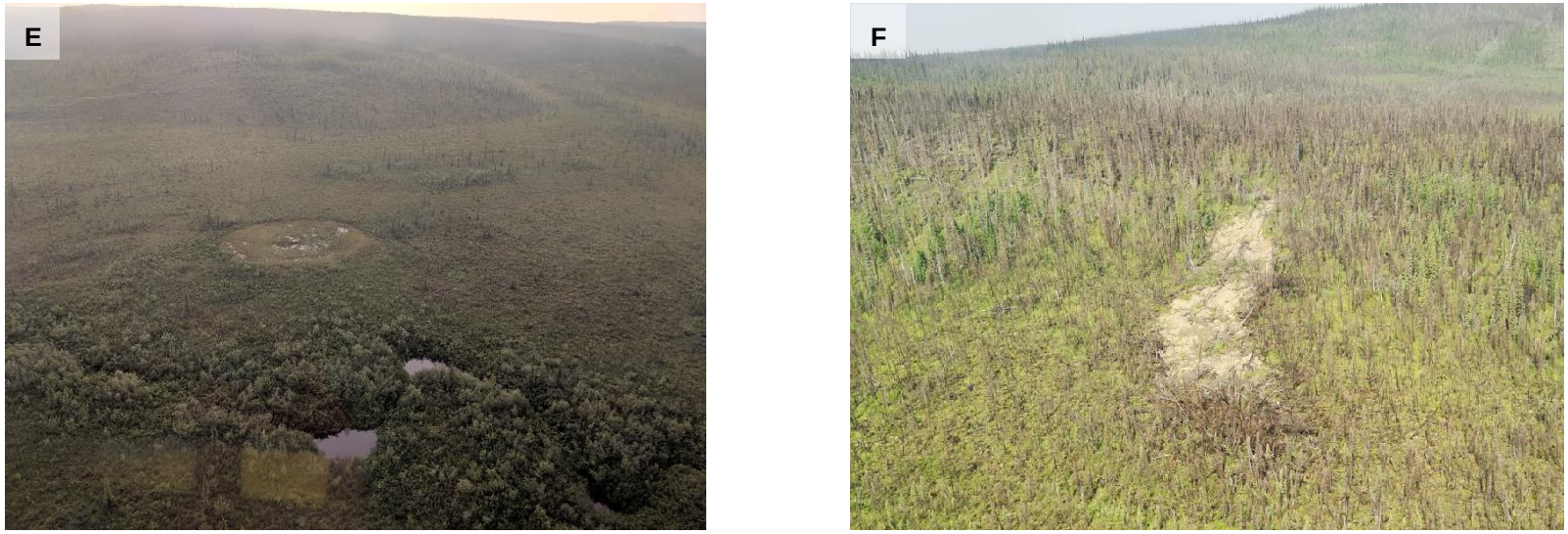

Figure 2. Field photographs representative of common landforms and geomorphological processes within the study area: A) View of the Dalglish creek valley, showing an irregularly meandering channel and several areas of lateral erosion where the creek has cut into the valley walls; B) Convex, mid-slope composed of more-resistant bedrock mantled by a veneer of weathered bedrock and colluvium; C) Gentle fluvial fan exhibiting a triangular- or wedge-shape, transitioning into a modern stream valley (lower right); D) Geometric surface expression of ice-wedge polygons over an inactive region of the floodplain; E) Thermokarst depression in an inactive region of the floodplain; and F) Recent active-layer detachment initiated at the crest of a gentle colluvial slope.



Figure 3. Field photographs representative of typical surficial material characteristics: G) Ice wedge exposed in freshly eroded stream bank (1.9 m-tall person for scale); H) Ice lens within fine-grained, colluvial sediment; I) Outcrop of more-resistant conglomerate exposed in a bluff near the Dempster Highway; J) Sandy, clast-supported veneer of weathered bedrock, typical of deposits found in weathered bedrock bluffs and knolls.

4.2 Surficial Geology and Permafrost

The results of the surficial geology/permafrost mapping are presented in the series of maps shown in **Appendix A**. Most landforms and materials in the study area are interpreted to have originated prior to the last glaciation. Apart from organics, recent fluvial deposits, and areas recently affected by active geomorphological processes, the landscape is dominated by deeply weathered sediments that have developed on slopes and ridges over many millennia.

Colluvial deposits (aprons, veneers, blankets, and mantles of variable thickness) are the most extensive surficial material, located ubiquitously on slopes and ridges and comprising 71.8% of the study area (Table 3). Fluvial deposits comprise 8.4% of the study area and are generally identified along the bottoms of broad valleys, although fans and veneers of fluvial sediments are mapped at confluences and within narrow ravines, respectively. Organic material accumulates on most imperfectly to very poorly drained deposits throughout the study area, but it is only identified in the terrain code when its thickness exceeds about 0.5 m. Organic veneers and blankets are generally mapped in low valley positions near active streams, and comprise 1.6% of the study area. Bedrock within the study area is commonly fissile and deeply weathered, located along ridge tops and convex slope-breaks along the crests of valley walls. Weathered veneers of bedrock cover 17.3% of the study area. Intact bedrock is rare at surface and is limited to exposures in steep scarps lining the broad ridge tops, covering 0.9% of the study area. Areas significantly disturbed by human activity (excluding road networks) have been mapped as anthropogenic landforms, and cover <0.1% of the study area

Table 3. Areal distribution of surficial materials and landforms by primary surface material.

Surficial Material and Landform	Terrain Code	Areal Extent	Areal Percentage
Anthropogenic	A	1.41 km^2	< 0.1%
Organic Veneer	Ov	10.24 km^2	0.4%
Organic Blanket	Ob	28.85 km^2	1.2%
Colluvial Apron	Ca	188.77 km^2	7.9%
Colluvial Veneer	Cv	816.12 km^2	34.0%
Colluvial Blanket	Cb	401.01 km^2	16.7%
Colluvial Mantle of Variable Thickness	Cw	315.50 km^2	13.2%
Weathered Bedrock Veneer	Dv	414.07 km^2	17.3%
Fluvial Plain (active and inactive)	FAp; Fp	111.80 km^2	4.7%
Fluvial Veneer (active)	FAv	49.53 km^2	2.1%
Fluvial Fan (active and inactive)	FAf; Ff	36.29 km^2	1.5%
Fluvial Terrace	Ft	2.87 km^2	0.1%
Bedrock	R	20.47 km^2	0.9%
Total		**2,396.93 km^2**	**100%**

Relative depth to permafrost is estimated to be shallow (0.4-1 m) across the majority of the study area (86.2%), and is found on most broad ridges, colluvial slopes, and around active floodplains (Table 4). Relative depth to permafrost is estimated to be near-surface within poorly drained valley bottoms and beneath organic deposits, comprising 3.6% of the study area. Relative depth to permafrost is estimated to be deep (> 1 m) across 10.2% of the study area and is commonly mapped in association with coarse colluvial or weathered bedrock deposits typically found along convex ridges and bluffs, and bedrock scarps.

Permafrost is estimated to be ice-rich across 12.9% of the study area, and is commonly found below poorly drained, inactive fluvial deposits and below organic cover (Table 4). Ice-rich permafrost may also be found along fine-grained colluvial slopes and even along some ridges where the surface expression of ice-wedge polygons is visible in LiDAR data or aerial imagery. Ice-moderate permafrost comprises 40.8% of the study area, and is commonly found below imperfectly drained fluvial deposits and thick, fine-grained colluvial deposits. Ice-moderate permafrost is also inferred in regions affected by sheetwash or solifluction. Nearly half the study area has been estimated to contain ice-poor permafrost (46.3%), which applies to most moderately to well drained terrain along ridges and upper valley slopes.

Table 4. Area distribution of permafrost conditions by relative depth and relative ice content.

Permafrost Condition Classification		**Estimated Relative Ice Content**			
		Ice-poor	**Ice-moderate**	**Ice-rich**	**Total**
Estimated Relative Depth	**Near-surface (<0.4 m)**	0% *(0 km²)*	0.1% *(2.2 km²)*	3.5% *(84.1 km²)*	**3.6% *(86.3 km²)***
	Shallow (0.4 – 1 m)	37.0% *(885.8 km²)*	39.9% *(955.6 km²)*	9.4% *(224.7 km²)*	**86.2% *(2,066.1 km²)***
	Deep (>1 m)	9.4% *(224.3 km²)*	0.8% *(20.2 km²)*	0% *(0 km²)*	**10.2% *(244.5 km²)***
	Total	**46.3% *(1,110.2 km²)***	**40.8% *(977.9 km²)***	**12.9% *(308.8 km²)***	**100% *(2396.9 km²)***

4.3 Exploration Development Suitability and Associated Implications

The series of Exploration Development Suitability maps is provided in **Appendix B**. The maps combine the results of the road and wellpad suitability classifications with the MBC disposal suitability classifications.

Road and wellpad suitability are presented as a five-class system (Table 5). A total of 17.4% of the study area has been classified as Very High or High suitability. These areas comprise ice-poor, isolated topographic highs and moderately to well drained ridge systems, which form sinuous networks through the landscape. Conversely, lower valley terrain such as floodplains and fine-grained colluvial aprons are generally prone to higher ice contents, and active permafrost and periglacial processes, including active-layer detachments, solifluction, thermokarst, and sheetwash. A total of 54.2% of the study area was classified as Low to Very Low suitability, due to one or more development constraints. The remaining 28.4% of terrain was considered moderately suitable for development and may be reasonable for road and wellpad establishment by employing proactive mitigation measures where necessary.

Table 5. Road and wellpad suitability classification and implications for construction and maintenance.

Road and Wellpad Suitability	Description	Implications for Construction and Maintenance	Percent of Study Area
Very High	Moderately well to well drained, isolated topographic highs with deep or shallow, ice-poor permafrost. Generally considered to be stable terrain, and typically located along wide, rounded ridge crests.	Favourable conditions for access road and wellpad establishment through standard best management practices. Minimal expectation for maintenance requirements.	8.1%
High	Generally, moderately well to well drained areas with deep or shallow, ice-poor permafrost. Typically associated with ridges of weathered bedrock or shallow colluvium over convex topography.	Generally favourable conditions for access road and wellpad establishment through standard best management practices. Low to moderate expectation for maintenance requirements.	9.3%
Moderate	Imperfectly to moderately well drained colluvial slopes with deep to shallow permafrost, commonly with poor to moderate ice content; Convex weathered bedrock bluffs, typically at moderate slope gradients; and fluvial terraces above the influence of modern stream processes.	Generally reasonable conditions for access road and wellpad establishment. Where necessary, employment of mitigations may be to proactively manage natural concentrations of surface runoff and to protect thaw-sensitive permafrost. Moderate expectation for maintenance requirements. Field reconnaissance would help inform route/site selection and mitigation requirements.	28.4%
Low	Poorly to imperfectly drained, thick colluvial slopes with shallow permafrost, commonly with moderate to rich ice content; imperfectly drained fluvial fans and veneers. Regions affected by sheetwash, gully erosion, and ice-wedge polygons are typically included in this category. Surface runoff becomes concentrated.	Generally unfavourable conditions for access road and wellpad establishment, except through mitigations to proactively manage natural concentrations of surface runoff and to protect thaw-sensitive permafrost. Moderate to high expectation for maintenance requirements. Field reconnaissance is necessary to inform route/site selection and mitigation requirements.	32.8%
Very Low	Very poorly to imperfectly drained areas with shallow or near-surface permafrost, commonly with rich to moderate ice content. Includes most floodplains and steep bedrock scarps. Thermokarst subsidence and ice-wedge polygons are common on level to gently sloping ground, and slopes may be subjected to mass movements including solifluction and active-layer detachments.	Unfavourable conditions for access road and wellpad establishment. Any necessary crossings will require comprehensive mitigations to protect thaw-sensitive permafrost and manage surface runoff and compressible, fine grained sediments. Road construction through steep bedrock scarps would require earthworks and potentially localized blasting. Maintenance expectations are high. Field reconnaissance is critical to inform route/site selection and mitigation requirements.	21.4%

Most moderate terrain can be found over mid- to upper-valley slopes and is mantled by imperfectly drained colluvial veneers and convex, moderately sloping weathered bedrock ridge crests. A summary of the implications for construction has been presented in association with typical constraints expected within each class (Table 5). Design, construction and maintenance of exploration infrastructure generally require greater effort and more complex mitigative solutions as road and wellpad suitability decreases.

The MBC disposal suitability serves to highlight ice-poor, gently-sloping, and relatively stable regions of the landscape set back from significant watercourses as potentially suitable for MBC disposal (Table 6). These criteria were generally met along broad ridge systems and isolated knolls. A total of 13.2% of the study area has been classified as potentially suitable for MBC drill cuttings disposal, most commonly in association with areas classified as High or Very High suitability for road and wellpad suitability. Runoff may be variable at the mapped scale such that different areas within a polygon may have less or more interaction with surface water. For example, polygons affected by slopewash may show discrete runnels where runoff is concentrated. As a result, field investigations are suggested to refine the MBC disposal suitability classifications at a site-specific scale which would better determine target areas for cuttings disposal within each map unit (polygon).

Table 6. Mix-bury-cover (MBC) disposal suitability classification.

MBC Disposal Suitability	Description	Percent of Study Area
Potentially Suitable	Generally geomorphologically isolated regions on level or near-level, elevated areas with minimal or no receipt of surface runoff (i.e., 'shedding sites'). Areas are typically located along broad to rounded ridge crests and knolls that are set back from significant watercourses.	13.2%
Probably Unsuitable	Includes moderate to steeply sloping regions; areas with ice-rich permafrost; and areas exhibiting evidence of geomorphological instability such as fluvial erosion, thermokarst subsidence, solifluction, and active-layer detachments.	86.8%

5. Recommendations

Palmer recommends Chance consider a number of logical follow-up initiatives based on the results of this mapping project to help optimize its upcoming multi-year, multi-well drilling program:

- **GIS-based road routing optimization analysis** – To minimize design, construction, maintenance, and rehabilitation costs, project elements and infrastructure should be site to minimize exposure to low Exploration Development Suitability terrain to the extent possible. This may be accomplished through a collaborative GIS-based road routing analysis between Palmer and the Chance project team, whereby effort and cost are attributed to distinct terrain units, and optimized for development.

- **Incorporation of environmental discipline perspectives into suitability** – The Exploration Development Suitability classification was prepared with a focus on terrain and permafrost constraints. Combining this with the perspectives of other environmental disciplines would yield a more robust suitability classification by accounting for additional environmental values (e.g., vegetation, wildlife habitat, First Nations land uses, archaeological resource potential, etc.).
- **Road alignment delineation** – Following determination of an approximate road route at the polygon-scale (two bullets above), more precise delineation of an actual road alignment would help enable avoidance of local terrain and permafrost constraints (e.g., drainage runnels, thermokarst).
- **Targeted field investigations of complex terrain and areas for MBC disposal** – Complete avoidance of terrain with low or very low Exploration Development Suitability may not be feasible given its abundance in lower valley and floodplain positions. Targeted field investigations in these locations would serve to fine-tune the alignment and confirm the interpretations, site conditions, and cost implications. As local permafrost and runoff conditions may show slight variability at the mapped scale, targeted field investigations would also benefit the selection of specific sites for MBC disposal within polygons identified as Potentially Suitable for MBC disposal.
- **Proactive identification of rehabilitation plans** – It may be productive for Chance to proactively identify its planned approaches for site, road, and wellpad rehabilitation following the completion of work, in anticipation of comments by YESAB, First Nations, and other stakeholders. Rehabilitation plans are best tailored to existing ground and runoff conditions.

6. Statement of Limitations

This report has been prepared by Palmer for Chance in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the “Master Service and Supply Agreement”). The report and the information it contains may be used and relied upon only by Client, except (1) as agreed to in writing by Consultant and Client, (2) as required by-law.

The extent of this study was limited to the specific scope of work for which Palmer was retained and is described in this report. Palmer has assumed that the information and data provided by the client or any secondary sources of information are factual and accurate. Palmer accepts no responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or negligent acts from relied-upon data. Judgement has been used by Palmer in interpreting surficial geology, geomorphological processes, and exploration development susceptibility based on desktop analysis and limited field reconnaissance. Interpretations of subsurface conditions have been made based on surface observations and limited subsurface exposures and may not fully capture the variability in the study area or within a given map unit (polygon).

Palmer is not a guarantor of site conditions or potential hazards or risks but warrants only that our work was undertaken and our report prepared in a manner consistent with the level of skill and diligence normally exercised by competent geoscience professionals practicing in Yukon. Our findings, conclusions and recommendations should be evaluated in light of the limited scope of our work.

7. Certification

This memorandum was prepared and reviewed by the undersigned.

Prepared By: DRAFT

Cory McGregor, GIT
Geoscientist

Reviewed By: DRAFT

Robin McKillop, M.Sc., P.Geo.
Principal, Geomorphologist

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Appendix A.

Surficial Geology and Permafrost Classification.
Eagle Plains, Yukon

Appendix B.

Exploration Development Suitability.
Eagle Plains, Yukon

APPENDIX 2-B-56. *Devon Sump Photos*





APPENDIX 2-B-57. Land Tenure Extension Request for Exploration Permits 0008-0017, 0019 and 0020 (“Permits”) Letter

Chance
OIL AND GAS LIMITED

December 15, 2021

Government of Yukon
Department of Energy, Mines and Resources
P.O. Box 2703
Whitehorse, YT
Y1A 1B2

sent via email: john.streicker@yukon.ca

Attention: Hon. John Streicker, Minister of Energy, Mines and Resources
Dear Sir:

Re: Land Tenure Extension Request for Exploration Permits 0008-0017, 0019 and 0020 ("Permits")

Chance Oil and Gas Limited ("Chance", the "Company") hereby requests that the referenced Permits be extended for an additional five years pursuant to Sections 27(b), 28(1)(c) and (d) and 31.01 of the Yukon *Oil and Gas Act* (the "Act"). The basis for this extension request is described in the following paragraphs and has not materially changed since the last request for tenure extension was made on March 11, 2020 for one of the Exploration Permits. Timelines to be able to exercise exploration rights in Yukon are long and growing.

The actions of Chance and its predecessor, Northern Cross (Yukon) Limited, in respect of the rights under the Permits have been consistent with the Act by diligently trying to conduct an exploration program at Eagle Plains to evaluate the crude oil and natural gas resource potential. These efforts are substantially documented in the records of a variety of government departments, including Energy Mines and Resources. The Company has only been partially successful accomplishing its exploration objectives.

Unfortunately, Chance has been subjected to external influences beyond the control of the Company. These include the indefinite, perhaps permanent, moratorium on hydraulic fracture

stimulation ("Moratorium") in the Eagle Plain Sedimentary Basin, the impact of the Peel Watershed Land Use Planning exercise which challenged access, and the inconsistent, unpredictable and expanded time and information requirements of environmental impact assessment processes with the Yukon Environmental and Socio-economic Assessment Board ("YESAB"). Timelines and conditions related to the conduct of exploration activities are further increased by the requirement under Ministerial Orders whereby Chance has established Engagement and Communication Plans ("Plans") with four First Nations, including designated organizations. The Company is using its best efforts to actively implement these Plans in respect of a significant exploration project, but the pace of this implementation is slow and uneven and has been dramatically affected by Covid 19. The collective impact of these influences was not reasonably foreseen at the time Chance was awarded the Permits nor after exploration activities commenced, but they have adversely affected the ability of the Company to exercise its exploration rights either in a timely way or at all.

Since the Permits were originally awarded during the period between 2007 and 2010, Chance has demonstrated its commitment to oil and gas exploration in Yukon by diligently undergoing several YESAB assessments, obtaining regulatory approvals, and executing drilling and seismic data acquisition programs within the area of the Permits. This work was conducted in an environmentally and corporately responsible manner and in full compliance with various permits and licenses issued to undertake this exploration work. The efforts of the Company have advanced the geological understanding of the Eagle Plain Sedimentary Basin while providing very significant benefits to Yukon in the form of employment, training, and business opportunities. Well over $100 million has been spent, which is about five times the amount that was committed at the time these Permits were originally awarded. Most of this investment is now stranded in view of the Moratorium.

Chance has undertaken or consultants acting on behalf of Chance have undertaken the following activities related to the proposed multi-well exploration and seismic data acquisition program:

1. Geological field program to sample rocks at various outcrops at Eagle Plain to help mature new prospects,
2. Purchased under license vintage 2D seismic data in the Eagle Plain area,
3. Bird survey,
4. Fish and other aquatic surveys,
5. Site investigations of vintage and modern seismic lines to understand use by wildlife and humans and regeneration patterns,
6. Field studies covering a range of permafrost processes;
7. Water sampling at various locations in the proposed area of exploration interest;
8. Porcupine Caribou studies in collaboration with the Porcupine Caribou Management Board,
9. LiDAR and aerial photography surveys; and

10. Meetings with affected First Nations in Old Crow, Inuvik, Tsiigehtchic, Ft. McPherson, Aklavik, Dawson City, Mayo and Whitehorse in respect of a proposed multi-well exploration and seismic data acquisition plan.

More field work is planned for the winter of 2022-2023 to evaluate the condition of 8 suspended wells operated by Chance with the objective of remediating any problems so the wells can remain suspended until used in future operations, converting two wells to become deep zone injectors or disposal wells, extended flow testing of three natural gas formations in three vintage wells and abandoning at least 3 of the suspended wells. Where possible, Chance hires First Nation citizens to participate in these field programs. In the past three years, the approximate expenses incurred to undertake these activities was $6.7 million. Spending at this level or higher is anticipated to continue for additional exploration work and related activities as described above for well maintenance and continuance. Preserving suspended status of wells that are sound and secure supports the request for tenure extension as well.

Chance is hopeful that it will be in a position to submit to the Executive Committee of YESAB under new processes expected to commence in the first quarter of 2022 to begin the assessment of the multi-well exploration drilling and seismic data acquisition project, but First Nation engagement under the Plans may be a rate determining step.

The maintenance program planned for the winter of 2022-2023 offers a great opportunity to measure the depth of permafrost and Chance plans to run a temperature survey in a number of the suspended wells to determine the geographic extent of permafrost and any variability of its depth.

Notwithstanding very limited oil field service and supply capacity resident in Yukon, the historical exploration drilling and seismic data gathering programs operated by the Company were organized and executed in a way that responded to concerns expressed by many Yukon stakeholders to maximize Yukon participation and mitigate the historical experience of intensive, short term projects punctuated by lengthy periods of inactivity that collectively had the effect of restricting local participation in employment, training and business opportunities. For almost two years, Chance's drilling and seismic programs provided reasonably steady employment for many Yukon citizens working directly or indirectly on the projects. Going forward, to overcome the frustration of starting and stopping, future activities are expected to be small scale and be undertaken over longer time periods. This style of operation has the objective of providing opportunities for Yukon citizens and businesses to invest in training and equipment to be able to assume growing roles in any activities that Chance might propose while benefitting from learning curve efficiency and economy of scale arising from steady, predictable operations. Environmental impacts are expected to be significantly reduced by operating on a small scale over longer periods of time, too.

Future exploration activities will require maximum allowable tenure extensions in order to satisfy commitments anticipated to be made under the Plans as they are implemented, undergo higher level YESAB impact assessments, obtain required regulatory approvals and ultimately undertake any planned activities. For example, in several meetings with your officials, Chance has outlined an exploration plan to drill up to thirty (30) exploration and appraisal wells, acquire up to fifteen hundred (1,500) square kilometres of new 3-D seismic data and acquire up to two thousand (2,000) kilometres of new 2-D seismic data. This plan will take years to complete especially if the scale of operations is small in order to minimize environmental impacts and maximize participation of Yukon citizens and businesses. Prior to undertaking this program, environmental impact assessments are required which are expected to take at least a couple of years to complete with more time needed to execute on approved activities.

Developing Yukon energy resources will also have a beneficial impact on greenhouse gas emissions by displacing imported fuels extracted and processed thousands of kilometres away from Yukon. In addition, as the energy market transitions to a lower or no carbon condition, the hydrocarbons in Yukon offer a great source of hydrogen and the geological formations at Eagle Plains provide opportunities to sequester CO2.

This letter has been prepared on a "Without Prejudice" basis given the unresolved legal claim that the Company has made against Yukon in respect of the damages caused by the Moratorium. Tenure extension is needed to continue implementing the Plans and advance the proposed exploration project through the YESAB process to execution.

In conclusion, Chance believes that it has diligently acted and continues to act in a manner that is consistent with the Act, that the exercise of its exploration rights has been significantly impaired by circumstances that were neither foreseen nor within the Company's control. Throughout the evolving landscape of procedural changes, political sensitivity and growing obligations to engage with aboriginal communities, Chance has taken numerous and costly measures to mitigate the impediments where it can.

Chance trusts that you will consider this tenure request in the face of expanding timelines and complexities associated with the undertaking of exploration projects.

Yours truly,
Chance Oil and Gas Limited

FOR Richard Wyman, President

Cc: John Bailey

Ed van Randen
Derek Fraser
Michael Chernoff
Greg Charlie
Cindy Dickson
Chief Dana Tizya-Tramm
Chief Simon Mervyn
Chief Roberta Joseph
Grand Chief Ken Kyikavichik

APPENDIX 2-B-58. Terms of Reference for Engagement and a proposed Cooperation Agreement between Chance Oil and Gas Limited and the Gwich'in Tribal Council Letter

June 7th, 2022

Grand Chief [redacted]
Gwich'in Tribal Council
1 - 3 Council Crescent
P.O. Box 1509
Inuvik, NT X0E 0T0

Dear Grand Chief [redacted]

Terms of Reference for Engagement and a proposed Cooperation Agreement between Chance Oil and Gas Limited and the Gwich'in Tribal Council

Further to our recent discussions, we refer to the Gwich'in Tribal Council (the **GTC**) and Chance Oil and Gas Limited (**Chance**) Communication and Consultation Plan dated August 1, 2018 (the **Plan**). As mentioned in the Plan, Chance would like to propose some initial terms of reference for our ongoing engagement and for the collaborative process that will be necessary to conclude a Cooperation Agreement between the GTC and Chance.

Our objective is to commence an open discussion with the GTC, in accordance with the Plan, on the potential terms for inclusion in a Cooperation Agreement. Our intention throughout this process is to work respectfully, collaboratively, transparently and in a timely fashion with the GTC with a view to finalizing a mutually agreed Cooperation Agreement in the coming weeks.

As we work together to establish the basis for cooperation, we foresee the ongoing relationship between Chance and the GTC evolving in the following stages:

1. Reaching initial agreement with the GTC on the terms of reference proposed in this letter.

2. Negotiating and concluding a memorandum of understanding (**MOU**) that will formalize the key principles for inclusion in a Cooperation Agreement.

3. Negotiating and concluding a Cooperation Agreement, incorporating the terms of the MOU, that will govern the collaborative relationship between Chance and the GTC during the pre-development phase of Chance's planned oil and gas exploration activities in the Eagle Plains basin of the Yukon Territory (the **Project**) (which pre-development phase is expected to include undertaking and concluding the regulatory processes required prior to implementation of the Project).

4. The Cooperation Agreement will then facilitate and frame the discussion around identifying economic benefits and opportunities related to the Project.

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The terms of reference that we propose herein are not intended to be prescriptive and we welcome any feedback, input and ideas from the GTC that will enhance collaboration or improve transparency. We have tried to categorise the terms of reference for our engagement into the following key areas:

- Objectives of the Cooperation Agreement; and
- Key principles that will form the foundation of all engagement between Chance and the GTC.

1. **Objectives of the Cooperation Agreement**:

   Although not exhaustive, from Chance's perspective, the main objectives of the Cooperation Agreement will be to:

   - cooperatively define, in greater detail, the Project and the work proposed to be undertaken by Chance in connection therewith;
   - establish a protocol for the conduct of Chance and the GTC for regular and ongoing cooperation and communication during the pre-development phase of the Project;
   - provide studies and other information related to how the Eagle Plains basin, the area in which the Project will be carried out, is used by the Porcupine Caribou Herd and seek the GTC's input into the design of management plans and mitigation measures to protect the Porcupine Caribou Herd in this area;
   - facilitate the identification of the other potential impacts of the Project on the Gwich'in (including through, among other things, ecological value assessments);
   - identify opportunities for, and impediments to, the GTC's continued engagement with Chance and its participation in the regulatory approval processes associated with the Project;
   - provide for certain reasonable and agreed financial support by Chance to the GTC to allow the GTC to participate in ongoing engagement with Chance and to participate in the regulatory processes associated with the Project; and
   - identify and discuss the potential benefits that Chance may make available to the GTC during the implementation phase of the Project.

2. **Key Principles for Engagement:**

   Without limiting the objectives and procedures outlined in the Plan, Chance has specifically identified the following key principles that should guide all interactions between Chance and the GTC:

   - Collaboration
   - Cooperation
   - Transparency
   - Timeliness

Chance is of the view that if these principles guide and inform how we interact, negotiate and work together with the GTC, a mutually beneficial and acceptable MOU and Cooperation Agreement can be finalized over the coming weeks. A mutually beneficial Cooperation Agreement that has been negotiated in accordance with these central principles will also help to ensure that an eventual, and more substantive, benefits arrangement is a realistic longer-term objective. We welcome any ideas from the GTC as to how we may effectively engage with the GTC and how we may enhance our collaborative relationship.

We look forward to working together with the GTC and adopting a unified approach towards our ongoing engagement and the conclusion of a Cooperation Agreement. We welcome your input and, upon settling our agreed terms of reference, we would be pleased to prepare a first draft of an MOU for the GTC's consideration.

[redacted]
Vice President of Government and Community Relations

Copy to: [redacted] President Chance Oil and Gas Limited
[redacted] Chief Executive Officer of the Gwich'in Tribal Council
[redacted] Manager, Land & Resources, Gwich'in Tribal Council

APPENDIX 2-B-59. Land Tenure Extension Request for Exploration Permits 0012-0017, 0019 and 0020 (“EP’s”) Letter

Chance
OIL AND GAS LIMITED

March 7, 2023.

Government of Yukon
Department of Energy, Mines and Resources
P.O. Box 2703
Whitehorse, YT
Y1A 1B2

sent via email: john.streicker@yukon.ca

Attention: Hon. John Streicker, Minister of Energy, Mines and Resources
Dear Sir:

Re: Land Tenure Extension Request for Exploration Permits 0012-0017, 0019 and 0020 ("EP's")

Chance Oil and Gas Limited ("Chance", the "Company") hereby requests that the referenced Permits be extended for an additional five years pursuant to Sections 27(b), 28(1)(c) and (d) and 31.01 of the Yukon *Oil and Gas Act* (the "Act"). The basis for this extension request is described in the following paragraphs and has not materially changed since the last request for tenure extension was made on December 15, 2021. Timelines for the exercise of exploration rights in Yukon are long and growing.

The actions of Chance and its predecessor, Northern Cross (Yukon) Limited, in respect of the rights under the EP's have been consistent with the Act by diligently trying to conduct an exploration program at Eagle Plains to evaluate the crude oil and natural gas resource potential. These efforts are substantially documented in the records of a variety of government departments, including Energy Mines and Resources. The Company has only been partially successful accomplishing its exploration objectives and is planning further exploration drilling and seismic data acquisition programs.

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Unfortunately, Chance has been subjected to external influences beyond the control of the Company. These include the indefinite, perhaps permanent, moratorium on hydraulic fracture stimulation ("Moratorium") in the Eagle Plain Sedimentary Basin; the impact of the Peel Watershed Land Use Planning exercise which impaired access to and cancelled exploration opportunities on affected EP's located in protected areas of the Peel Watershed; and the inconsistent, unpredictable, and expanded time needed to complete environmental impact assessment processes with the Yukon Environmental and Socio-economic Assessment Board ("YESAB"). The most recent example of unexpected YESAB process uncertainty is the advice the Company received in July 2022 that the Company's proposed multi-year exploration project would be treated as a referral to Executive Committee, based on the YESAB decision made in 2016 in respect of a different multi-well exploration drilling project despite the fact that the currently proposed program is different in terms of breadth of activity, scale of operations, location, and duration. This advice was not expected since the Company was preparing to enter the Executive Committee of YESAB under the new pre-submission process that took effect last year. The timing for the Company to submit a much larger and comprehensive document is now expected to be this year though timing is always subject to satisfactory engagement with affected First Nations.

On that point, as further frustration of the Company's ability to advance exploration work, stonewalling behavior of the Vuntut Gwitchin First Nation ("VGFN") is evident by the unilateral decision made by the Vuntut Gwitchin Government ("VGG") to suspend indefinitely the Communication and Engagement Plan ("Plan", or "Plans" as they collectively refer to all Engagement and Communication Plans that Chance has with affected VGG and the First Nation of Na-Cho Nyak Dun, the Trondek Hwech'in First Nation and the Gwich'in Tribal Council) and all engagement activities thereunder as was approved in 2018. This has adversely affected the ability of the Company to cooperatively share information and engage in a constructive manner with the VGG, as the representative of the VGFN. However, over the past year, Chance was able to host several community meetings in Old Crow where information was shared with VGFN citizens and VGG government officials who attended in an "unofficial" manner. Chance has used its best efforts under Plans with the four affected First Nations with interests in northern Yukon in accordance with the terms of various Orders in Council granting tenure extension in the past. The engagement log has been shared with officials of the Yukon Government. The Company is clearly struggling to make headway when a key party is unwilling to engage. Finally, Covid-19 had a notably negative impact on the Company's ability to meet and furnish information to affected First Nation communities due to travel restrictions. The collective impact of these influences was not reasonably foreseen at the time Chance was awarded the EPs nor after exploration activities commenced, but they have negatively impacted the ability of the Company to exercise its exploration rights in a meaningful way.

Since the Permits were originally awarded between 2007 and 2010, Chance has demonstrated its commitment to oil and gas exploration in Yukon by diligently conducting geological and geophysical studies, designing various exploration programs, undergoing several YESAB assessments, obtaining regulatory approvals, and executing drilling and seismic data acquisition programs within the area of the Permits. This work was conducted in an environmentally, socially and corporately responsible manner and in full compliance with various regulations and conditions of permits and licenses issued to undertake this exploration work. The efforts of the Company have advanced the geological understanding of the Eagle Plain Sedimentary Basin while providing very significant benefits to Yukon in the form of employment, training, and business opportunities. Well over $100 million has been spent, which is about five times the amount that was committed at the time these Permits were originally awarded. Most of this investment is now stranded as a result of the Moratorium.

Chance has undertaken, or consultants acting on behalf of Chance have undertaken, the following activities related to the proposed multi-well exploration and seismic data acquisition program:

1. Geological field program to sample rocks at various outcrops at Eagle Plain to help identify and mature new prospects;
2. Purchased under license vintage 2D seismic data in the Eagle Plain area;
3. Bird survey;
4. Fish and aquatic surveys;
5. Heritage resource surveys within the broader Exploration Permit area;
6. Site investigations of vintage and modern seismic lines to understand use by wildlife and humans and regeneration patterns;
7. Field studies to identify and assess a range of permafrost processes;
8. Temperature monitoring in a variety of settings within the EPs to understand the near surface seasonal variation of freeze and thaw rates as they may be affected by natural or manmade disturbances, aspect to the sun, and topographical position;
9. Water sampling at various locations in the proposed area of exploration interest;
10. Porcupine Caribou studies in collaboration with the Porcupine Caribou Management Board;
11. LiDAR and aerial photographic surveys;
12. Effects assessments of planned exploration activities on various value components; and
13. Meetings over the years with affected First Nations in Old Crow, Inuvik, Tsiigehtchic, Ft. McPherson, Aklavik, Dawson City, Mayo, and Whitehorse in respect of a proposed multi-well exploration and seismic data acquisition plan.

More field work is planned for the summer of 2023 to retrieve temperature data, undertake annual inspections of suspended wells, survey well sites for design of equipment layout and access routes to undertake the required well maintenance work, mandated by the Yukon Government, and more heritage resource investigation. The required well maintenance program is planned for the winter of 2023-2024 to: (i) evaluate the condition of 8 suspended wells operated by Chance with the objective of remediating any problems so the wells can remain suspended until used in future operations, (ii) converting two wells to become deep zone injectors or disposal wells, (iii) extended flow testing of three natural gas formations in three vintage wells, and (iv) abandoning at least 3 of the suspended wells. This program has already successfully completed a YESAB screening. It has been delayed by a year due to a lack of oil field services available to do this work and challenges concluding a Benefits Agreement with affected First Nations, including VGFN, in accordance with Section 68 of the Act. Where possible, Chance hires First Nation citizens to participate in these field programs.

Since 2018, the approximate expenses incurred to undertake these activities total over $12 million. Spending is anticipated to increase in connection with the exploration project and activities described above for well maintenance and continuance of suspended wells for future use. Preserving suspended status of wells that are sound and secure supports the request for tenure extension as well.

The maintenance program now planned for the winter of 2023-2024 offers a great opportunity to measure the depth of permafrost and Chance plans to run a temperature survey in a number of the suspended wells to determine the geographic extent of permafrost and any variability of its depth.

Notwithstanding very limited oil field service and supply capacity resident in Yukon, the historical exploration drilling and seismic data gathering programs operated by the Company were organized and executed in a way that responded to concerns expressed by many Yukon stakeholders to maximize Yukon participation and mitigate the historical experience of intensive, short term projects punctuated by lengthy periods of inactivity that collectively had the effect of restricting local participation in employment, training and business opportunities. For almost two years, Chance's drilling and seismic programs provided reasonably steady employment for many Yukon citizens working directly or indirectly in and on these projects. Going forward, to overcome the frustration of starting and stopping, future activities are expected to be small scale and be undertaken over longer time periods. This style of operation has the objective of

providing opportunities for Yukon citizens and businesses to invest in training and equipment to be able to assume growing roles in any activities that Chance might propose while benefitting from learning curve efficiency and economy of scale arising from steady, predictable operations. Environmental impacts are expected to be significantly reduced by operating on a small scale over longer periods of time, too.

Future exploration activities will require maximum allowable tenure extensions in order to satisfy commitments anticipated to be made under the Plans as they are implemented, undergo higher level YESAB impact assessments, obtain required regulatory approvals and ultimately undertake any planned activities. For example, in several meetings with Yukon Government officials, Chance has outlined an exploration plan to drill up to thirty (30) exploration and appraisal wells, undertake extended flow testing of discoveries, acquire up to fifteen hundred (1,500) square kilometres of new 3-D seismic data and acquire up to two thousand (2,000) kilometres of new 2-D seismic data. This plan will take years to complete especially if the scale of operations is small in order to minimize environmental impacts and maximize participation of Yukon citizens and businesses. Prior to undertaking this program, an environmental impact assessment by the Executive Committee of YESAB is required which is expected to take at least a couple of years to complete with more time needed afterwards to execute on approved activities.

Developing Yukon energy resources will also have a beneficial impact on greenhouse gas emissions by displacing imported fuels extracted and processed thousands of kilometres away from Yukon. In addition, as the energy market transitions to a lower or no carbon condition, the hydrocarbons in Yukon offer a great source of hydrogen and the geological formations at Eagle Plains provide opportunities to sequester CO2. Lastly, developing local energy resources will provide security of supply and reliable high value added economic activity.

From a social perspective, the employees of Chance come from diverse backgrounds. Half the staff are First Nation citizens from Yukon and half are women with all working in responsible positions. The Board is composed of businesspeople from Yukon, British Columbia and Alberta and includes female representation.

Chance reserves all its rights with regard to the Company's litigation against the Yukon Government in relation to damages caused by the Moratorium. Tenure extension is needed to continue implementing the Plans and advance the proposed exploration project through the YESAB process and onward to project execution.

In conclusion, Chance believes that it has diligently acted and continues to act in a manner that is consistent with the Act and in accordance with the Plans, that the timely exercise of its exploration rights has been significantly impaired by circumstances that were neither foreseen nor within the Company's control. Throughout the evolving landscape of procedural changes, political sensitivity, and growing obligations to engage with aboriginal communities, Chance has taken numerous and costly measures to mitigate the impediments where it can.

Chance trusts that you will consider this tenure request in the face of expanding timelines and complexities associated with the undertaking of exploration projects.

Yours truly,
Chance Oil and Gas Limited



Greg Charlie, Vice President

Cc: Patricia Randell
Derek Fraser
Aparna Verma
Michael Chernoff
Cindy Dickson
Richard Wyman
Chief Pauline Frost
Chief Roberta Joseph
Grand Chief Ken Kyikavichik
Chief Simon Mervyn

APPENDIX 2-B-60. Communication and Engagement Plans Letter - document not available at time of submission.

APPENDIX 2-B-61. Draft *Project Description* (Version 1)

DRAFT PROJECT DESCRIPTION

Eagle Plains Exploration Project

Prepared for:

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Volume I

June 5, 2019

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
2D	two-dimensional
3D	three-dimensional
AER	Alberta Energy Regulator
CPF	Central Process Facility
D50	AEP Directive 50: Drilling Water Management Plan
DFO	Fisheries and Oceans Canada
DST	drill stem test
EBA	EBA Engineering Consultants Ltd.
EFT	extended flow test
ESA	Environmental Site Assessment
GPS	Global Positioning System
MBC	Mix Bury Cover
Plan	North Yukon Land Use Plan
Project	Eagle Plains Exploration Project
Proponent	Chance Oil and Gas Ltd.
YOGA	Yukon *Oil and Gas Act*, SY 2019, c.6
YESAB	Yukon Environmental and Socio-economic Assessment Board

SYMBOLS AND UNITS OF MEASURE

Symbol / Unit of Measure	Definition
º	degrees
%	percent
cm	centimetre
dS/m	
ha	hectare
km	kilometre
km^2	square kilometre
kPa	kilopascals
L	litre
m	metre
mg/L	milligrams per litre
mm	millimetre
m^2	square metre
m^3	cubic metre

PROJECT DESCRIPTION

This document presents the location of the proposed Eagle Plains Exploration Project (Project), the preliminary scope of the Project, the principal and accessory Project components, and Project phases and scheduling. The descriptions provided below are conceptual and intended to provide the level of detail necessary to initiate discussions with stakeholders on the Project Description.

Detailed design and implementation procedures will be developed following Project approvals. All design, methodology, or procedural changes will conform to the commitments made by Chance Oil and Gas Ltd. (Proponent), as well as the terms and conditions stated in any Decision Document resulting from the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Screening process and permits, approvals, and authorizations once issued.

The development of this section is based on the *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (YESAB 2005), specifically Part 1, Section 5.0 Project Description.

The Proponent will develop a series of management plans to provide additional information on infrastructure design and phase-specific activities including monitoring. These management plans are referenced throughout this section where relevant.

1.1 Project Description Overview

The Proponent intends to conduct exploration drilling and flow testing of any discoveries over an area of approximately 2,400 square kilometres (km²) in the Eagle Plains area, located between the Ogilvie and Richardson mountain ranges along the Dempster highway in Yukon. The purpose of this exploration drilling and flow testing program is to confirm the quality, quantity, and areal extent of any accumulations of hydrocarbons. The Proponent will drill up to 30 wells sequentially over a period of up to 10 years. If a well is successful (i.e., if there is a discovery of crude oil or natural gas in sufficient quantities), the Proponent will conduct an extended flow test (EFT) for a period up to 2 years on that particular well. There is considerable uncertainty in terms of outcome from exploration drilling, so it is only possible at this stage to speculate on the number of discoveries that will be made. For the purposes of this assessment, the Proponent estimates that crews may conduct EFTs on up to 20 wells, depending on the drilling success. Due to the exploratory nature of the work, it is impossible to predict the timing of any discovery and therefore the timing of any EFTs.

The Proponent will drill one well at a time and up to five wells per year. Assuming all wells are successful and EFTs are conducted for 2 years at each well, there may be up to 10 EFTs being conducted at one time. The information obtained from the EFTs is critical to establishing the future development plan for each discovery.

If several wells reach successful outcomes and are identified for extended flow testing, the wells will have completion equipment installed within their wellbores, the casing will be perforated, and the wells will be flowed. This would require a completion or service rig to install the completion equipment and the tubing used to conduct produced well fluid to ground surface, at which point surface equipment would then be installed, which may include artificial lift equipment to help the fluid continue to flow.

Fluids produced during EFT will need to be measured, processed, and dealt with in an environmentally responsible manner. Depending on the nature of a discovery, the Proponent anticipates that some combination of natural gas, crude oil, and possibly formation water will be extracted during the EFTs. These fluids are separated and measured in facilities on the surface. Natural gas could be flared for short periods of time, but the Proponent prefers to conserve it to provide fuel for process heating, fuel for engines providing mechanical power, and possibly onsite power generation. If natural gas quantities are significant, the Proponent would consider re-injecting surplus natural gas into a compatible reservoir in the Eagle Plains basin using an existing suspended well. The Proponent currently has 8 suspended wells that were drilled in the past, which could be used for re-injection. Alternatively, some of the new wells, drilled as part of this 30-well Project, may be used.

Fluid transportation vehicles will be required to travel from site to site and transport the produced fluid back to the Central Process Facility for storage, further treatment, and transfer to trucks for transport to market or disposal. To the greatest extent possible, crude oil produced during the EFTs will be conserved instead of flared. This will require some processing to stabilize the crude oil for truck transport to a suitable, approved crude oil marketing point, such as terminals in the vicinity of Fort Nelson or Fort. St. John, British Columbia or Grand Prairie, Alberta. All these locations are ready to receive and utilize crude oil produced from Yukon sources in the absence of such destinations existing within Yukon. The Proponent may also consider trucking crude oil produced during the EFT to ports in Alaska such as Skagway, Haines, or Valdez for onward shipping to suitable markets elsewhere in North America.

Formation water produced in conjunction with crude oil or natural gas will be separated from the hydrocarbon streams and disposed of underground into a compatible and approved geological formation at Eagle Plain using one of the suspended wells or one of the wells drilled as part of this Project. These procedures to process, transport, and dispose of various fluids produced are common practice using proven technologies and equipment in every oil and gas province in Canada.

The Proponent also intends to conduct a seismic exploration program consisting of up to 1,500 km² of three-dimensional (3D) seismic and up to 2,000 km² of two-dimensional (2D) seismic to identify and map oil and gas geological structures in the area.

Additional activities are required to support the drilling and seismic exploration, including:

- Mix Bury Cover (MBC) sump area to dispose of drill cuttings
- Construct winter and all-season access roads
- Construct airstrip
- Advance borrow source developments
- Transport equipment and supplies to the site and within the Project area
- Use existing camp at kilometre (km) 325 of the Dempster Highway and periodic use of the Eagle Plains Hotel.

The Proponent is planning to begin exploration activities as early as the end of 2021 and continue for a period of 10 years to cover the various stages of drilling and extended flow testing of the proposed wells. The execution of the EFTs will likely be phased, depending on the nature of the discovery (e.g., natural gas versus crude oil) and the capacity of the 75-person base camp and the Eagle Plains Hotel to accommodate

the necessary crews. Until there is more information about the resources discovered, it is difficult to accurately predict the full duration the complete flow testing program.

1.2 Project Location

The Project is located within the southern part of Eagle Plain Sedimentary Basin in northern Yukon (**Figure 1.1)**. The main camp is located at km 325 of the Dempster Highway, with one MBC sump area located at km 336. **Figure 1.1** illustrates the overall Project area.

The proposed Project area overlaps with the following three First Nation Traditional Territories:

- Vuntut Gwitchin First Nation
- First Nation of Na-Cho Nyäk Dun
- Tetlit Gwich'in Council Secondary Use Area.

The proposed Project area is north of the Tr'ondëk Hwëch'in First Nation Traditional Territory and Settlement Land. The Traditional Territories and Settlement Land blocks in the vicinity of the Project are detailed on **Figure 1.1**.

The proposed Project is located within the boundaries of the North Yukon Planning Region and is therefore subject to the North Yukon Land Use Plan (Plan). A main purpose of the Plan is to address oil and gas development in North Yukon. The locations of proposed well sites are within the region of the Plan designated for the highest level of development. In the Plan, this designation is described as Lower ecological and heritage/cultural values within a moderately sensitive biophysical setting.

1.3 Project Components and Activities

This section describes the principal Project components, along with accessory components that are necessary to support Project activities. Information provided below for each Project component includes its location, key design features, and, where applicable, the results of any relevant investigations to establish site conditions (e.g., seismicity, geotechnical parameters). The three main components of the Project are described as follows:

1. Exploration well program – comprising 30 wells within an area of approximately 2,400 km². Wells will be located within areas identified in **Figure 1.1**. The program includes drilling, drill stem testing, and extended flow testing of the wells. Hydraulic fracturing is not being proposed as part of the Project. See **Section 1.3.2** for details.
2. Construction of access roads to each proposed well location – roads required for the Project will be a combination of winter and all-season access roads. Details regarding road construction and location are provided in **Section 1.3.3.1**.
3. Construction of a new MBC sump area and all-season access road – (approximately 400 metres (m) long) at km 336 of the Dempster Highway, and construction of additional MBC sumps in other suitable areas. Details are provided in **Section 1.3.2.7**.
4. Seismic exploration program (**Section 1.3.2.9**) consisting of up to 2,000 km² of 2D seismic exploration and up to 1,500 km² of 3D seismic exploration.

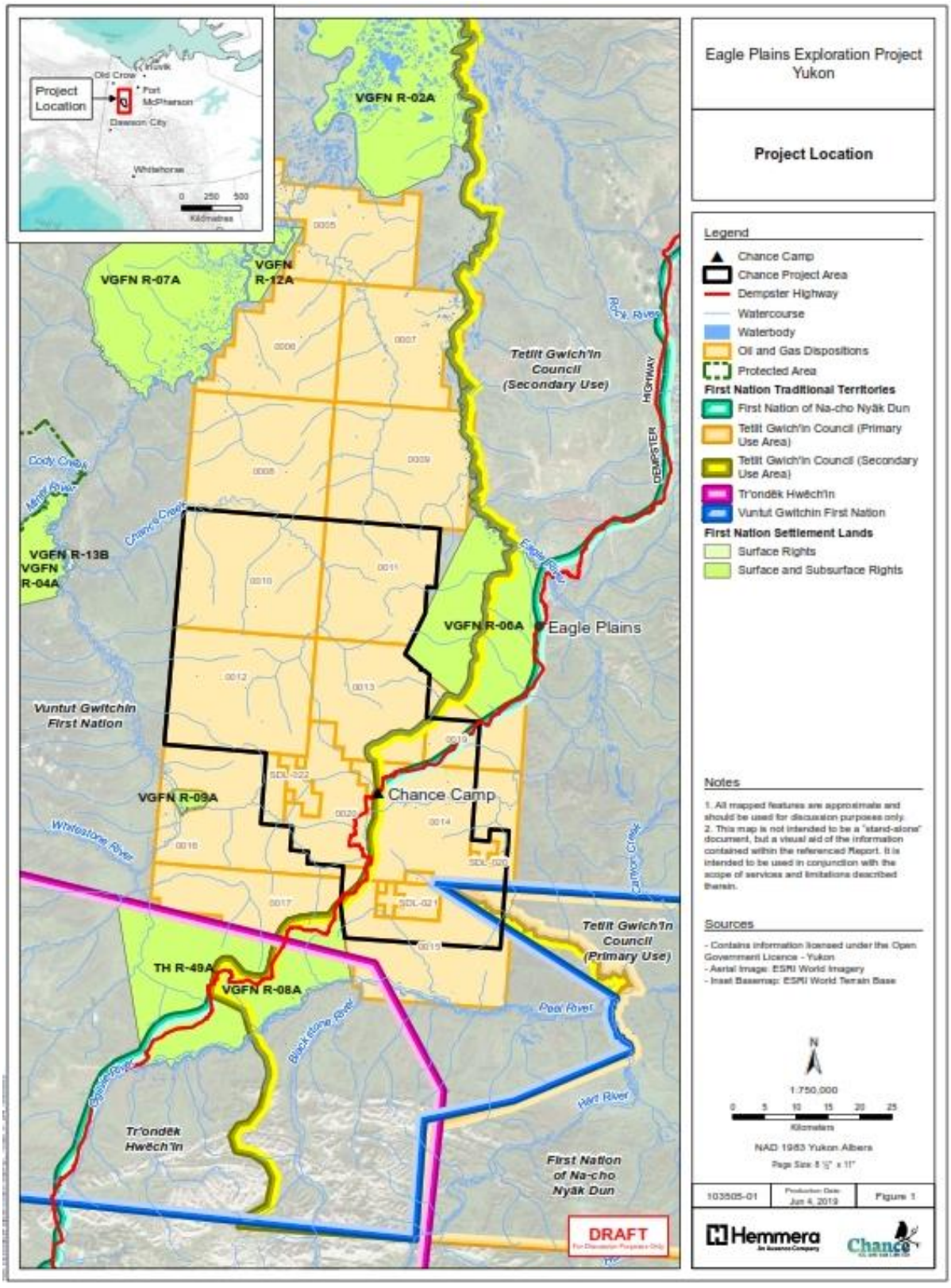

Figure 1.1 Project Location

Details related to the project components and activities are provided in **Section 1.3 Project Components and Activities** noting that the development of some Project components occurs in both phases. That is, once a well site has been prepared, drilling and well development will occur at that site, and additional well sites may be prepared simultaneously. Reclamation activities are described in **Section 1.4.4 Reclamation, Abandonment, and Closure Phase**.

1.3.1 Preliminary Scope of the Project

The preliminary scope of each Project component is described in **Table 1.1**.

Table 1.1 Preliminary Scope of Project

Project Component	Activities
General Project	• Exploration activities for oil and gas in the Eagle Plains area ▫ Exploration well drilling, testing, suspension, decommissioning, and abandonment ▫ Successful wells will be suspended and may be brought forward in future development project proposals ▫ 2D and 3D seismic exploration • Project phases will occur sequentially over a 10-year period and include ▫ Initial mobilization of equipment to the Project site ▫ Construction of required infrastructure ▫ Well development, testing, decommissioning, and abandonment ▫ Progressive reclamation ▫ Final closure and reclamation • The Project will occur over an area covering approximately 2,400 km² located at approximately km 325 of the Dempster Highway
Exploration Well Drilling	• Establishment of up to 30 well sites each, approximately 1.44 hectares (ha) in size within the overall Project area (approximately 2,400 km²) ▫ Site levelling using gravel, packed snow or ice and rig matting as required • Installation of surface infrastructure on drill sites including: ▫ Drill rig ▫ Mud tanks, pumps, and mud processing systems ▫ Power generators ▫ Boilers ▫ Blowout preventer accumulator system ▫ Fuel storage ▫ Flare tank and flare stack ▫ Cement mixing and storage ▫ Storage bins for rock cuttings ▫ Trailers for offices, first aid, rig crew sleeping quarters, water storage and treatment, sewage storage, and food waste incinerator • Drilling of up to 30 wells to a depth up to approximately 2,500 m ▫ Wells will be drilled sequentially, one well at a time, up to four wells per year • Use of low-toxicity, water-based mud system • Use of up to 15 cubic metres (m³) of water per operating day for drilling

Project Component	Activities
Drill Stem Testing	• One or more drill stem tests (DSTs) on each well to analyze prospective/productive formation areas • Potential acid stimulation using a weak concentration (10% to 20%) of hydrochloric acid approximately 5 to 10 m3 per well • Flaring natural gas • Production of crude oil and transport from the site to markets outside of Yukon
Extended Flow Testing	• Conduct EFTs on up to 20 successful wells ▫ May be conducted within a month for a predominantly natural gas well or up to 2 years for a predominately crude oil well ▫ Up to 10 EFTs conducted at the same time • Installation of surface and subsurface equipment and facilities to enable EFT including: ▫ Casing of entire wellbore and perforation of casing at zone or zones of interest ▫ Packer, tubing, and downhole gauges ▫ Wellhead valving assembly ▫ Flare systems ▫ Separator vessel, treating vessel, and storage tanks ▫ Appropriate artificial lift systems ▫ Heaters ▫ Dehydrators ▫ Flow lines ▫ Metering equipment ▫ Portable generators • Separation of natural gas, crude oil, and formation water • Flaring natural gas for a period of several days to several weeks • Production of crude oil and transportation of produced crude oil from the site to markets outside of Yukon • Use of natural gas on site for power generation, tank heating, fuelling artificial lifting to assist crude oil production, or compression for re-injection of natural gas • Disposal of formation water underground in existing suspended wells, or wells suspended as part of this exploration Project
Drilling Waste Disposal	• Construction of MBC sump approximately 6.4 ha in area to dispose of drill cuttings • Disposal of drill cuttings in MBC pods approximately 300 m^3 over an area of 800 square metres (m^2) (estimated volume of drill cuttings for one well) • Disposal of approximately 200 m^3 of drilling mud in MBC and drilling fluid underground in existing suspended wells, or wells suspended as part of this exploration Project • Disposal of the following liquid waste in existing suspended wells, or wells suspended as part of this exploration Project: ▫ Formation water ▫ Saline fluids ▫ Liquid fraction of drilling fluids ▫ Rig wash
Seismic Exploration	• Up to 1,500 km^2 of 3D seismic

Project Component	Activities
	• Up to 2,000 km² of 2D seismic • Establishment of seismic survey lines • Air hammer drilling • Receiver stations and source stations • Storage (in magazines), transportation, and use (1 kg per source station) of dynamite
Well Maintenance (Workovers)	• Mobilization and installation of a service rig to the well site • Conduct maintenance to: ▫ Install, change, or modify the production flow control equipment ▫ Perforate zones of interest for EFTs ▫ Seal some or all perforations made across productive zones ▫ Re-perforate a zone or zones elsewhere in the wellbore ▫ Other routine maintenance practices to ensure optimal production performance of the producing formation
Access Roads	• Use of permitted Chance Road all-season road for Project activities • Construction of all-season access roads to well sites requiring EFT and borrow source locations ▫ Approximately 7 m in width with pullouts on average every 750 m ▫ Up to approximately 87 km total in length ▫ Clearing and mulching of vegetation ▫ Removal and stockpile of organic cover material for use in reclamation • Construction of winter access to well sites for initial well drilling and DST
Borrow Source Development	• Quarrying of approximately 1,800,000 m³ of aggregate for use in Project activities, including: ▫ Winter development of up to 23 quarries ▫ Use of approximately 450,000 m³ of aggregate for well pads ▫ Use of approximately 1,350,000 m³ of aggregate for access road construction ▫ Use of aggregate for airstrip construction ▫ Use of aggregate for Central Processing Facility construction ▫ Use of explosives • Removal and stockpile of organic cover material and silts for use in reclamation
Central Processing Facility	• Construction of central processing facility adjacent to camp • Processing facility ▫ Multi-stage and multi-phase separators ▫ Heater treaters ▫ Vapour and gas collection system to flares or to provide fuel for camp use ▫ Processing of crude oil to stabilize and meet market specs for truck transport ▫ Storage of approximately 3,180 m³ of produced crude oil ▫ Storage of approximately 119 m³ of produced (formation) water • Fuel storage facility ▫ 151 000 litres (L) diesel fuel ▫ 24 000 L propane

Project Component	Activities
	• Storage and use of chemicals and reagents: ▫ Hydrochloric acid (10% to 20% concentration) ▫ Methanol ▫ Additives to prevent corrosion ▫ Demulsifiers • Bulk explosive compound to store dynamite for use in construction of borrow sources and for seismic exploration
Airstrip	• Construction of airstrip approximately 1,500 m long at km 4 of the Chance winter road • Use of airstrip during all phases of the Project approximately 2 flights in/out per week • Storage of aviation fuel
Water Use	• Use of up to 300 m³ of water per day for making snow to build winter trails, ice roads and temporary well sites, not exceeding 10% of instantaneous flow from the following extraction points: ▫ Year-round extraction from the Eagle River and Ogilvie ▫ Seasonal extraction from Glacier Creek and Fly Camp • Use of up to 300 m³ of water per day for camp from existing onsite groundwater water well. • Construction of portable water reservoir at the camp for water storage and use during low water periods
Transportation	• Use of Dempster Highway, North and South Klondike Highway, and Alaska Highway to access Project site and to transport crude oil to potential markets • Approximate offsite traffic on public roads between the site and supply points • Onsite traffic on Proponent-controlled roads ▫ 15 to 20 truckloads over approximately 5-day period to mobilize the drill rig to each well site
Camp and Workforce	• Workforce up to 75 people during all phases of the Project • Continued use of existing permitted 75-person camp located at km 325 of the Dempster Highway ▫ Municipal waste management and disposal ▫ Sewage treatment facilities
Reclamation and Closure	• Progressive abandonment of unsuccessful wells ▫ Installation of cement plugs across all porous/permeable zones, across the base of each casing string and at surface ▫ Cutting of well casing(s) off 1 m below ground level and weld steel plates across each string ▫ recontouring and revegetation of area • Progressive decommissioning and reclamation of borrow source and quarry areas when they are no longer useful or necessary ▫ Recontouring of area and replacement of stockpiled silts and organic cover material • Well suspension and abandonment at end of Project

1.3.2 Principal Project Components

1.3.2.1 Overview

The principal Project activities are the drilling program, well testing, and seismic exploration program. The goal of the proposed drilling program is to obtain the maximum amount of information to determine the geological settings and evaluate oil and gas reserves in the Eagle Plains area. During operation, drilling will occur 24 hours per day, and 7 days per week. Chance will drill 1, possibly 2, wells at a time and up to 5 wells per year.

Initial drill stem tests (DSTs) will occur on any or all of the 30 proposed wells. Up to 5 wells could be tested each year. Chance will conduct EFT on successful wells, where hydrocarbon resources are discovered, to gather important information about the nature of the resource accumulation and its productive capability. EFT for wells with a primarily natural gas discovery may take place over a maximum period of 1 to 2 months maximum. EFT for wells with a primarily crude oil discovery may take place over a period up to 2 years. Chance may conduct up to 10 EFTs concurrently and EFTs on up to 20 wells over the life of the Project. The information obtained from the EFTs is critical to determining the future development plan for each discovery. **Table 1.2** outlines the sequence of activities in developing the well site areas.

The Proponent also intends to conduct a seismic exploration program consisting of up to 1,500 km² of 3D seismic and up to 2,000 km² of 2D seismic to identify and map oil and gas geological structures in the area. The 3D seismic program is likely going to be undertaken in a series of smaller projects, each of approximately 400 km². The 2D seismic program could be done either as one project or as a series of smaller projects. Details on the Project components and activities are provided in the following sections.

Table 1.2 Sequence of Well Development Activities

Initial Exploration Drilling		
Develop winter access trail to well site		
Develop well site approximately 1.44 ha in area		
Install surface infrastructure on well site necessary for drilling and testing exploratory well		
Drill well		
Transport and dispose of drill cuttings in MBC sump		
Conduct DSTs to determine whether successful or not in order to move on to EFT		
Move drill rig to next well site area		
If not successful	**If successful**	
	Primarily Natural Gas Discovery	**Primarily Crude Oil Discovery**
Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).	Complete well (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).	Complete well (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).
Remove all surface infrastructure.	Install required surface facilities (separator vessel, heaters, dehydrators, stock tanks, flow lines,	Construct all-season access to well site.

Initial Exploration Drilling		
	metering equipment, portable generators, and flare stack).	
Remediate well site area (remove mats and gravel fill material).	Conduct EFT over period of 1 – 2 months	Install required surface facilities (separator vessel, heaters, dehydrators, stock tanks, flow lines, metering equipment, portable generators, and flare stack).
Recontour well site area and revegetate disturbed areas to natural conditions.	Measure natural gas and water from wells.	Conduct EFT over period up to 2 years
Recontour access roads and revegetate disturbed areas to natural conditions.	Conduct maintenance on well as required (work over).	Measure, store, and process crude oil, natural gas, and water from wells.
	Once EFT is, complete either 1. develop a new proposal to bring into production, or 2. decommission and abandon well.	Conduct maintenance on well as required (work over).
	Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).	Transport crude oil from EFT to central processing facility then to acceptable market.
	Remove all surface infrastructure.	Once EFT is complete, either 1. prepare development plans for future assessment and regulatory review to bring into production, or 2. decommission and abandon well.
	Remediate well site area (remove mats and gravel fill material).	Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).
	Recontour well site area and revegetate disturbed areas to natural conditions.	Remove all surface infrastructure.
	Recontour access roads and revegetate disturbed areas to natural conditions.	Remediate well site area (remove mats and gravel fill material).
		Recontour well site area and revegetate disturbed areas to natural conditions.
		Recontour access roads and revegetate disturbed areas to natural conditions.

1.3.2.2 Exploration Well Drilling Program

Establishment of Well Sites and Drilling

Chance will establish up to 30 well sites, each approximately 1.44 ha in size within the overall Project area (approximately 2,400 km²). Total approximate disturbance for well site locations will be up to 43.2 ha if all 30 wells are drilled. Exact well locations and sequencing cannot be determined at this time as they are dependent on seismic data interpretation, drilling results, EFT results, weather, and local surface conditions and other environmental factors. The Proponent is continuing the ongoing process of interpreting seismic data to better understand the geological setting, size, and geometry of potential prospects. Each well drilled will add to that understanding.

Generally, well sites will be located on the heights of land. Criteria for well site locations include the following:

- Avoidance of areas with challenging permafrost conditions and ecologically sensitive areas such as riparian corridors, wetlands, steep slopes, old growth forest, and critical wildlife habitat and permafrost features.
- No drilling within 45 m of a perennial watercourse
- Avoidance of areas identified with heritage values (noted as “avoidance areas”) in the Heritage Resource Overview Assessment and Heritage Resource Impact Assessment (Matrix 2013).
- Requirements from the Yukon *Oil and Gas Act*, SY 2019, c.6 (YOGA) and the Oil and Gas Drilling and Production Regulations.

Drill Program

The first of the exploratory wells will be drilled in winter commencing around mid-January 2021. Pre-drilling preparation will entail building winter trails to gain access to the first selected well sites and to build access roads and the leases to accommodate the mobilization and setup of the drilling rig. Winter road and lease building can only commence once there is the 10 cm of snow cover required to facilitate construction. Based on historical trends, this could occur as early as December or as late as mid- to late January in any year.

Summer well sites may be established if there is already a year-round access road built nearby to service a well or wells undergoing EFT. Summer well sites will allow the Proponent to extend the drilling season into the summer if new wells can be drilled within a few kilometres of an existing road. A summer well site will require all-season access to the site.

Once established, the well site will contain the drill rig, flare stack, rig trailers, and office trailers and will provide sleeping capacity for the required number of key people to stay at the rig full time. Each well site will be approximately 1.44 ha in size to facilitate drilling and any subsequent EFTs. The amount of clearing will be kept to a minimum.

The well site dimensions should be adequate for advancing to a possible production operation in the future and therefore should accommodate all field production equipment.

Winter Matting Use

Matting for winter operations will be used when a) the ground is too uneven, b) it may not be possible to level the lease using earth-moving equipment and when the ground may not be competent enough to support the heavy rig loads, or c) when it is not possible to level the ground by laying down a base of gravel or soils. Matting may be used in drilling operations to reduce ground surface disturbance and distribute the ground pressure of equipment. Matting may also be used to stabilize the drill rig to provide insulation and protection to the snow and ground surface. Matting will not be used on the proposed roads.

The Proponent intends that well sites would be built with fill material from other well sites or from borrow sources. Should matting be used, it may cover the entire well site area (several locations of 1.44 ha) or the area immediately adjacent to where a drilling rig may be placed.

Well sites will be levelled by bringing in material such as gravel, or possibly snow for packing and then icing. An impermeable liner will then be laid on top of the pad, followed by wooden rig mats that interlock. Rig mats are approximately 16 feet by 8 feet in area, though there is some variance from one manufacturer to another.

Any matting used for this Project will be designed to support heavy loads and distribute the weight over large surface areas. The use of matting is a common practice for oil and gas drilling operations in northern locations. Any matting used for this Project will be placed on the frozen ground with snowpack and removed before spring melt.

The well site area adjacent to where the rig is situated and the road access will be matted if an unprecedented early melt occurs. In the event of an unprecedented early melt, rig equipment will be “leapfrogged” along the access road to support equipment and protect the vegetative mat as the rig is being demobilized and on its way out from the well site location. If leases are not constructed from densified fill material, equipment will remain on matted surfaces at all times in the event of early melt conditions.

Mats currently placed on previous well locations are periodically inspected for any movement or deterioration that could affect their ability to support intended loads. All matted well sites are maintained as much as possible because suspended wells must be usable by Chance in future exploratory and appraisal programs.

Summer Matting Use

The laying of matting in summer first requires the frozen level ground to be insulated with an impermeable textile layer. Laying matting early, before the thaw, ensures vegetation is not yet active and may be covered by a layer of snow or frozen soil. The Proponent plans to drill summer wells (following early exploratory successes from the winter wells) by constructing gravel pads of sufficient thickness to facilitate levelling and a firm base to support drilling loads.

The Proponent will likely use double-matting procedures where required to provide a stable, level surface on a summer location if the terrain is uneven. If double matting is used, the upper layer of mats can be lifted independently while the lower mats are left in place if frost adhesion is evident.

The Proponent expects future leases for well sites will be constructed from a more durable borrow site fill material of a suitable thickness to protect and insulate the permafrost and provide a safe and stable working surface for the drilling and subsequent extended flow testing. Should any well also become a long-term producer, the lease condition will be expected to endure for a longer term of several more years.

Geotextile membrane would only be applied over the vegetation surface as an option for locally levelling terrain. This would be necessary if double matting techniques were not possible as a solution for stabilizing mats on the vegetation surface. Geotextile will be used when:

- Levelling using fill material on top of natural vegetation could compromise the stability of the surface under loads.
- Levelling by double matting is not the best solution in the circumstances.
- Geotextile use would help protect vegetation or be a valuable aid in site clean-up.

Geotextile may be used prior to application of fill to level part of the drill site or access route, which could involve applying a minimal thickness of granular material (local rock or soil fill).

The Proponent retained EBA Engineering Consultants Ltd. (EBA) in 2008 to provide permafrost, soil, and vegetation expertise to evaluate the proposed use of industrial wooden mats for summer access. Tetra Tech/EBA (the successor company to EBA) or a similarly qualified individual or firm will be required to perform site-specific geotechnical pre-drilling investigations to confirm amounts of fill required and the proper placement of fill material to support the anticipated rig loads in accordance with good engineering practices.

Well Site Surface Infrastructure

The Proponent plans to use a drill rig with similar characteristics to Chance Rig #1 as presented in past assessments. The rig is capable of drilling to depths of up to 2,500 m. A normal rate of drilling would be to drill 1 well at a time during this exploratory phase.

Figure 1.2 illustrates the general layout of the proposed well site. The rig is designed to fit on a much smaller layout, but the planned 1.44 ha (120 m × 120 m) square layout is designed to accommodate not only the drilling operation but also the well completion and EFT equipment, and to preserve setback distances from surrounding vegetation and from personnel working and sleeping quarters. Note that the final area may not be square since the area will depend on topographical constraints. However, the total area for a well site will be approximately 1.44 ha. The rig layout depicted would likely be for a winter drilling operation distinguished by the number of boilers onsite. Boilers are used extensively in very cold or Arctic climates for preventing equipment and drilling fluids from freezing Arctic temperatures. **Table 1.3** provides a description of the drill rig components identified in **Figure 1.2**.

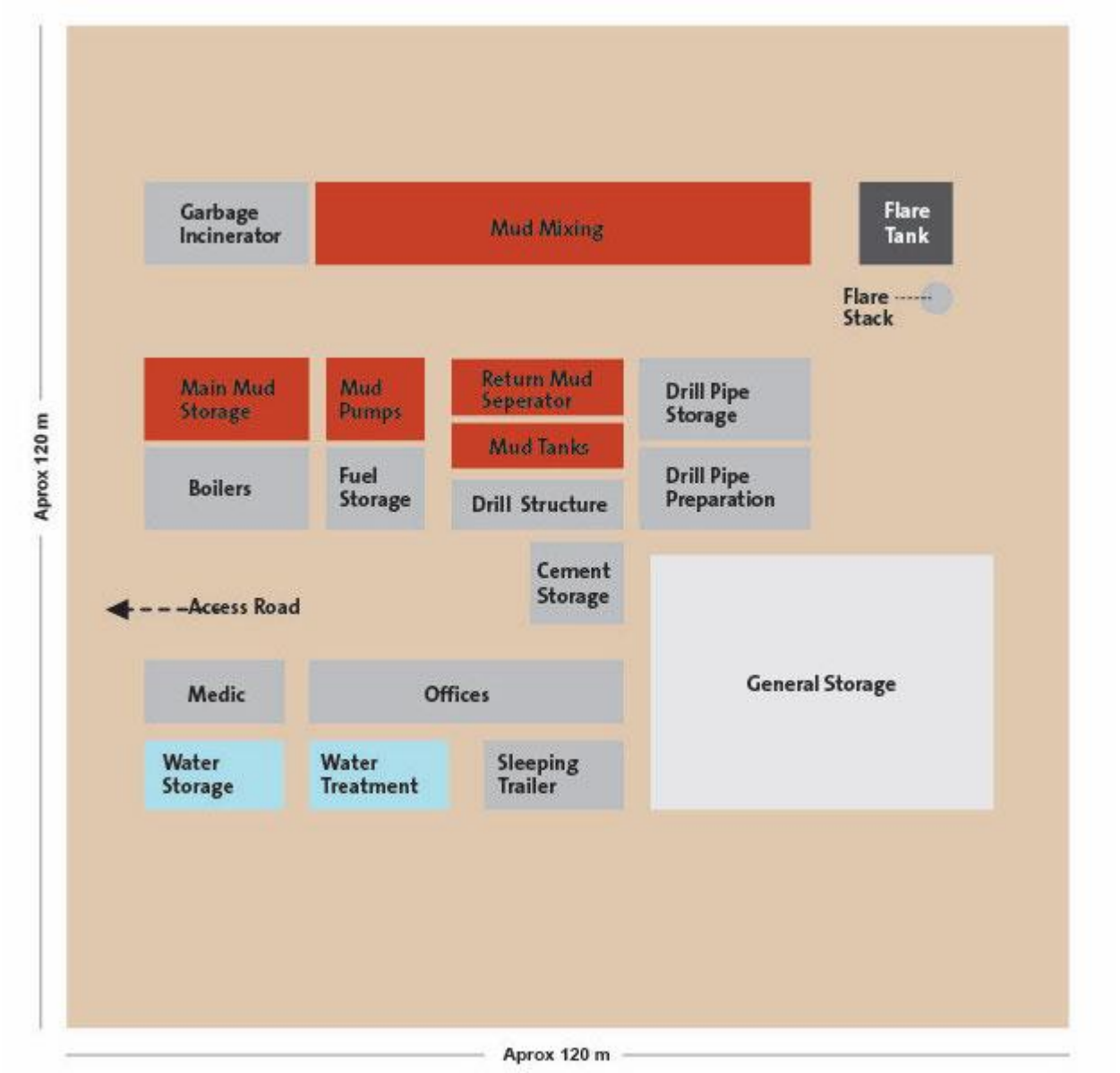

Figure 1.2 General Layout of a Well Site

Table 1.3 Well Site Components Shown on Figure 1-3

Component	Description
Boilers	Used extensively in very cold and Arctic climates for preventing equipment and drilling fluids from freezing Arctic temperatures.
Cement	Cement storage and mixing for use in wells.
Medic, Offices, and Sleeping Trailer	Essential personnel trailers which serve as offices as well as sleeping quarters and include a multi-room sleeper for some of the rig crew.

Component	Description
Flare Tank and Flare	Flare used to incinerate combustible fluids from the well. The flare tank is a reservoir to ensure the flare does not starve of combustible fluids.
Fuel Storage	Fuel for use on well site for equipment including drill rig, pumps, generators, etc.
Garbage and Incinerator	Storage area for waste and incinerator to dispose of food waste.
General Storage	Storage and laydown area for equipment needed onsite.
Mud Tanks	Tanks where all the surface mud volume is stored. Section 31 of the Drilling and Production Regulations under YOGA (Government of Yukon 2004) stipulates that the "combined capacity of the drilling fluid tanks of every fluid system must not be less than the greater of 120 m^3 and 50% excess of the volume of the wellbore."
Main Mud Storage	Location where all the mud materials are stored. Normally these materials are delivered on pallets neatly stacked and shrink wrapped to protect them during the truck journey north.
Drill Pipe Storage	Receptacle in which drill pipe is stored until required to be run in the hole.
Mud Mixing	Tank in which certain mud products are first hydrated to render them miscible with the fluid phase of the mud. Products such as bentonite clay, for example, require a caustic soda solution to neutralize the ionic attraction forces between clay flakes, allowing the water to lose its surface tension and to completely wet the flakes.
Mud Tanks	Large tanks, normally upright, fully enclosed and pressurized, where cement or bulk mud products are stored. Cement or barite (drilling mud weighting material) are pneumatically pumped from the P Tank into a smaller surge tank and then to the cementing unit or, alternatively, to the mixing or premix tank to enter the mud system.
Mud Pumps	Pumps used to circulate the drilling mud down the drill pipe, around the drill bit, and up the annular space between the drill pipe and the open hole or casing to surface.
Return Mud Separator	Area where the return mud separator known as a shale shaker is housed. The CF is the centrifuge that uses centrifugal force through high-speed rotation to separate the fluid part of the mud from the solids.
Drill Structure	Components required to drill the well, including: • Sub-structure, or base, to which the derrick is fixed • Derrick that supports the draw works and top drive • Top drive that is a mechanical, electrically powered linking device that attaches to the pipe in the hole and rotates it when drilling while simultaneously pumping drilling mud through the drill pipe and out of the drill bit at the bottom end • Draw works that lifts and lowers the travelling block in the derrick/mast to run pipe in and out of the hole • Blowout preventers, which are a series of closing valves that can hydraulically shut in a well in the event of unplanned influxes of formation fluids into the wellbore
Water Storage and Water Treatment	Water storage tank and treatment containers to provide potable water for the rig crew and personnel.

Any well site is an industrial area and therefore has restricted entry requirements, allowing entry to only authorized personnel wearing personal protective equipment (coveralls, steel-toed boots, hard hat, gloves, and safety glasses).

Figure 1.3 and **Figure 1.4** show the rig set up at the Chance camp located at km 325 of the Dempster Highway.



Figure 1.3 Chance Rig #1



Figure 1.4 Chance Rig #1 and Chance Camp at km 325 of the Dempster Highway

Drilling Operations

Well sites will be designed and constructed to support the rig and ancillary equipment positioned on them. The well site locations will be determined based on geotechnical assessments. Because construction will use borrow source fill, the well sites will be able to accommodate the drilling, EFT, and eventual production phases of well operating life. The lease area will be sized to fully accommodate a purpose-designed well pad, process facilities, and possible service rig equipment spreads that may follow in the future. Eagle Plains well sites and well design will incorporate the following key features to enhance efficiencies and reduce waste and general impact to the surroundings:

- The rig will use the minimal number of casings necessary to reach the projected total depth of approximately 2,500 m. The schematic well profile shown in Figure 1.5 illustrates a cross-section of the casing run, including annular cementation and other well features together with drilling equipment. For reference, the well casing program will typically comprise the following elements:
  - Conductor of 13-3/8-inch diameter to approximately 25 m below ground level, cemented to surface.
  - Surface casing of 9-5/8-inch diameter to approximately 400 m below ground level, cemented to surface.
  - Production casing of 7-inch diameter either to total depth or to just above the top of the Hart River formation at circa 1600 m, to comply with Yukon's Drilling and Production Regulations requirement of not more than 25% of open hole remaining uncased at any time (Drilling and Production Regulations Section 55-(1) (c) (i)). This casing will also be cemented to surface.
  - 4-1/2-inch liner to total depth at 2,200 m, cemented with a minimum 100 m overlap into the previous casing.
- The nominal diameter of the casings (all selected to remain industry standard dimensions) will reduce the size of holes drilled and of drill cuttings generated. For example, a 3,500 m exploratory well would typically produce 400 to 500 metric tons of cuttings. Less than 150 metric tons will be produced for the typical exploratory well depth of 2,200 m proposed at Eagle Plains.
- A water-based mud system will be developed and managed by a specialized service contractor with comprehensive knowledge of the Alberta Energy Regulator (AER) Directive 50 requirements as they pertain to the Yukon jurisdiction being operated in.
- All requirements in Sections 26 to 65 of the Drilling and Production Regulations (covering well design, casing design, groundwater protection, mud products, blowout prevention and choke/kill systems, fire detection and gas detection systems, safety of personnel, mitigation of operations impact, and more) will be either met or exceeded in the design, selection, and deployment of materials.
- The Yukon Oil & Gas drilling and production regulator will review proposed drilling design and planned operations procedures, as well as the health, safety, and environment policies and manual; oil spill contingency plans; and emergency response plans. Any perceived or identified deficiencies will be discussed, addressed and reported back to the regulator to confirm what action had been or needs to be taken before operations can proceed.
- The Proponent will enforce compliance on all third-party service suppliers to ensure that (1) their health, safety, and environment management systems address all regulatory requirements in personnel training and skill development; (2) personal protection equipment provided to workers

meets all Canadian Standards Association and international safety standards; and (3) supervisors are knowledgeable about operational standards related to health, safety, and environment. Periodic inspections and audits will be performed by Chance company representatives while operations are mobilized and ongoing at well sites.

- All wells will be drilled as "keepers" to facilitate EFTs and/or to become early producers in the event the Project advances to a full development. The only wells likely to be abandoned would be unsuccessful (dry) wells with no potential to be used as water or gas disposal wells.
- Leases will be designed and constructed to contain any fluid runoff into purpose-built collection ditches for recovery and disposal. A non-permeable layer will be laid during lease / well pad construction to prevent any seepage into the natural ground layer below the fill material pad.
- Rig deployment will ensure any rig wash; drilling, cementing, or DSTs fluids will be contained and recovered at all times.
- The standard and proven drilling method proposed has many advantages, including the following:
  - Large volumes of water will not be required for the drilling process because of the use of solids control equipment allows recycling of the majority of drilling fluid. Chance Rig #1 normally consumes approximately 15 m³ water per operating day averaged over the duration of the well being drilled.
  - Minimal volumes of water are expected to be lost into the formation. The Proponent's experience drilling to these depths confirms this. Studies of other offset/nearby wells also confirm this expectation.
  - In the event that hydrocarbons are encountered, they will be controlled by the drilling mud contained in the hole; as a secondary barrier, the blowout preventer system will comprise two or more rams to fully close in the well within seconds of detecting an influx into the wellbore.
  - In the unlikely event that abnormally pressured zones are encountered (all formations to be encountered in the proposed program have been previously drilled in past wells A-25, H-28 and B-73 and no overpressures have been experienced or detected), the Proponent has designed a comprehensive drilling fluids management, casing, and blow-out prevention system to control such occurrences. Well conditions and all pressure parameters are constantly monitored and detected first by the frontline drill crew members (driller constantly on the drilling control brake, mudman aided by the well monitoring personnel constantly viewing and responding to sensor responses). As an added backup, electronic detection alarms are set to trip when very small influxes occur.

Chance Rig #1 is approved to have a Class IV BOP system, which in Yukon Drilling and Production Regulations Section 33 (1) (d) permits the rig to drill wells between 1,800 m and less than 3,600 m and is rated for 21,000 kilopascals (kPa) (3,000 psi) working pressure (Drilling and Production Regulations Section 33 (2) (c)).

Drill crews, by professional training and enforced by regulatory requirement, must be fully trained and certified in blowout prevention and well control. Crews undergo simulated drills at each shift on a 2-shift, 24-hour work rotation. During these drills, the response and efficiency of drill crews are evaluated. The equipment is also evaluated, and any deficiencies are corrected immediately following the drills. Drill crew

and well supervisor well control / blowout prevention / hydrogen sulphide certificates are normally inspected by a visiting inspector to confirm compliance at all times when operating.

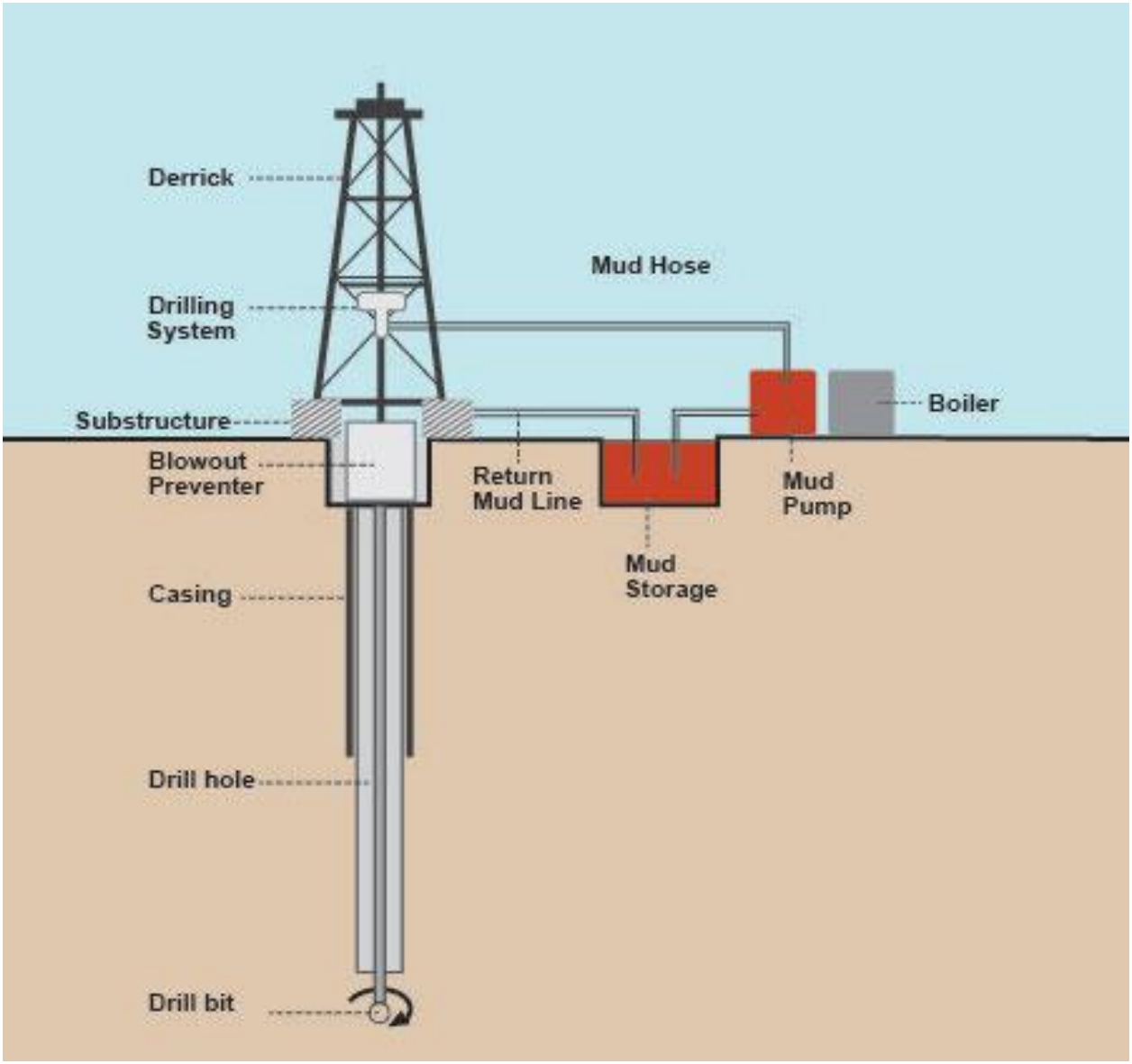

Figure 1.5 Well Profile

Drilling Fluids

Drilling fluid (or mud) is a vital component used in drilling oil, gas, and water wells. The drilling fluid system being currently researched for evaluation will be low-toxicity water-based drilling system similar to those in extensive use in other parts of western Canada. The supplier of any system will be assessed on previous comparative experience and required to pay great attention to mud system drilling performance and enhance ease of disposal to the highest standards demanded by AER Directive 50 for chemical constituents, dissolved salts, minimal oils, miscibility with native soils, and other characteristics.

A typical water-based mud system may be one of the following:

- Weighted (low-solids, non-dispersed) mud
- Glycol/glycerol mud system
- Saturated salt water mud (using sodium chloride, i.e., common salt)
- Calcium-based mud.

The list of typical mud formulations above covers a wide range of basic muds suitable for drilling in relatively benign (non-active clay), low-temperature environments. Simple muds comprise bentonite clay, caustic soda, shale inhibitors (common salt, hydrated gypsum, or lime) all well mixed together to help lift drill cuttings as well as minor additives to prevent drilling equipment corrosion, balance acidity or pH, permit the removal of drilled solids, and keep the ingredients in a slurry rather than separating or flocculating.

The Proponent has used a gel/chemical system on E-78, a relatively shallow well (approximately 1,000 m total depth). This system is used extensively in western Canada and exhibits the low-toxicity features desired for the proposed exploratory program. However, there remains the need to perform compatibility tests or analyses to confirm its suitability for drilling to 2,200 metres at Eagle Plains.

The Proponent is undertaking interviews and expanded discussions with a select number of well-established medium-sized mud services suppliers in conjunction with cuttings disposal specialists, all very active in other drilling jurisdictions. A mud services scope of work will emerge from these discussions to request proposals for providing the service for all exploratory wells. Once the system is designed and validated, all drilling mud characteristics, , such as mineralogy, lithology, pH levels, and others, will be known and can be disseminated to Yukon regulators.

The main function of drilling fluid is to over-balance the well pressure to ensure that the pressure in the wellbore is higher than the pressures expected to be encountered from the various geological formations as the drill bit penetrates them. The drilling fluid prevents formation fluids from entering the wellbore, keeps the drill bit cool and lubricated, circulates out drill cuttings, and keep in fluid suspension the drill cuttings during periods when drilling is paused or when the drilling assembly is cycled in and out of the hole. Drilling fluid is selected to provide operational efficiency, minimize formation damage, reduce corrosion, and minimize environmental impact for handling and disposal.

Project operations will utilize drilling practices that minimize the volume of drill cuttings and drilling waste generated. This minimization will in large part be due to drilling smaller-diameter holes to what will be a relatively shallow total depth. Drilling waste is composed of rock chips and cuttings and the drilling fluid that is recirculated. The drill fluid returned to the surface is sent through a shale shaker and centrifuge where the drill cuttings are separated and have most of the mud removed. The liquid fraction from the separation will be returned to the active tankage system for reuse.

Flaring

Flaring of gases during the drill stem testing part of well evaluation is a widely applied activity. The process, however, can only be undertaken in compliance with rigid regulatory controls. The requirements establish that the flare line must originate downstream of the choke manifold, must be designed to prevent the accumulation of any fluid within the line, and must be properly installed and anchored. Any amount of gas

encountered would be circulated through the rig degasser system to remove it from the drilling mud, thereby rendering the mud safe to pump back into the wellbore. Larger volumes of gas may be control-burned through the flare stack according the flare permit issued by Yukon Oil & Gas.

An example of a typical well site flare layout is illustrated below (**Figure 1.6**). Normally the flare line from the Choke Manifold is connected to the Flare Stack inlet to permit the directing of the gas to the flare until total control in terms of flow rate and flow pressures.

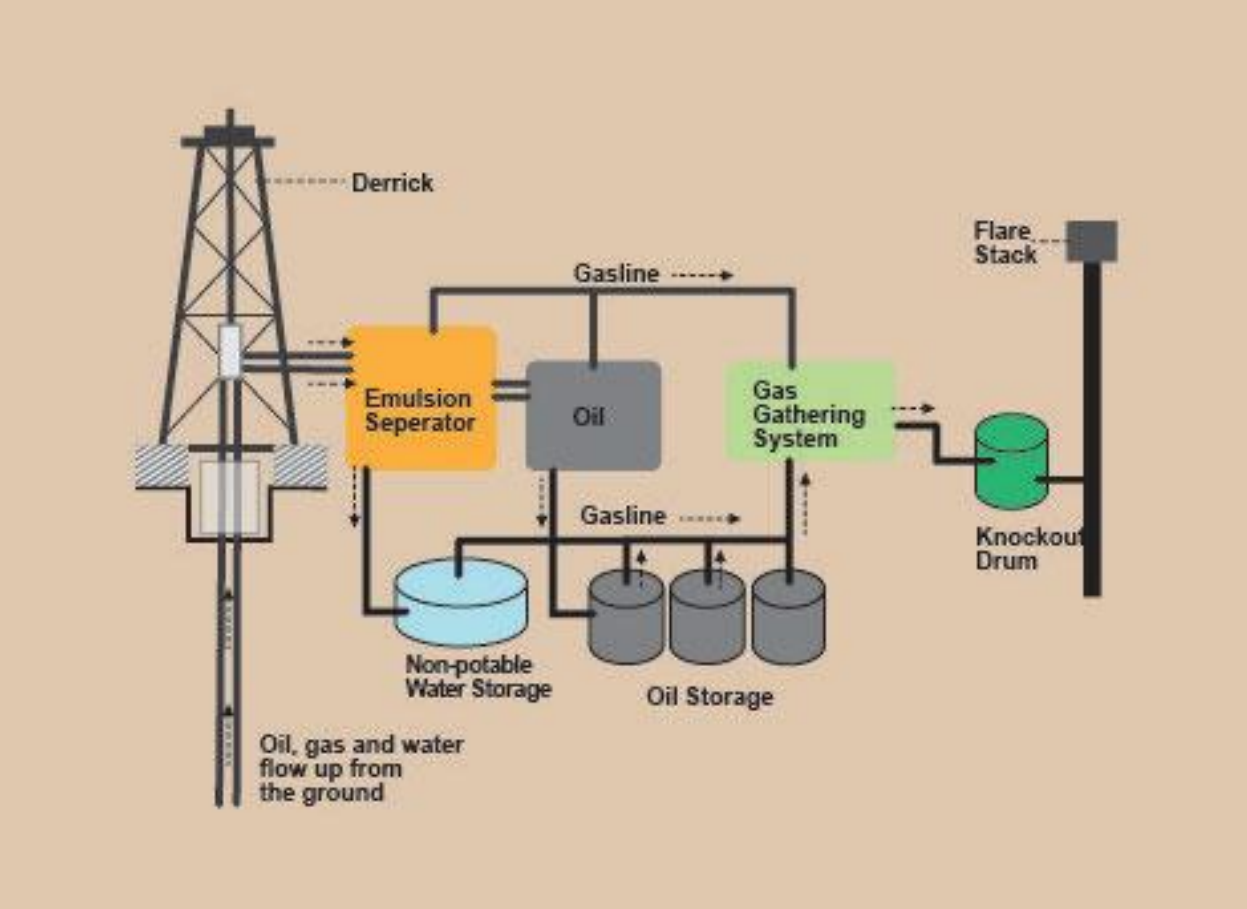

Figure 1.6 Typical Flare Stack and Gas/Vapour Recovery Flowsheet

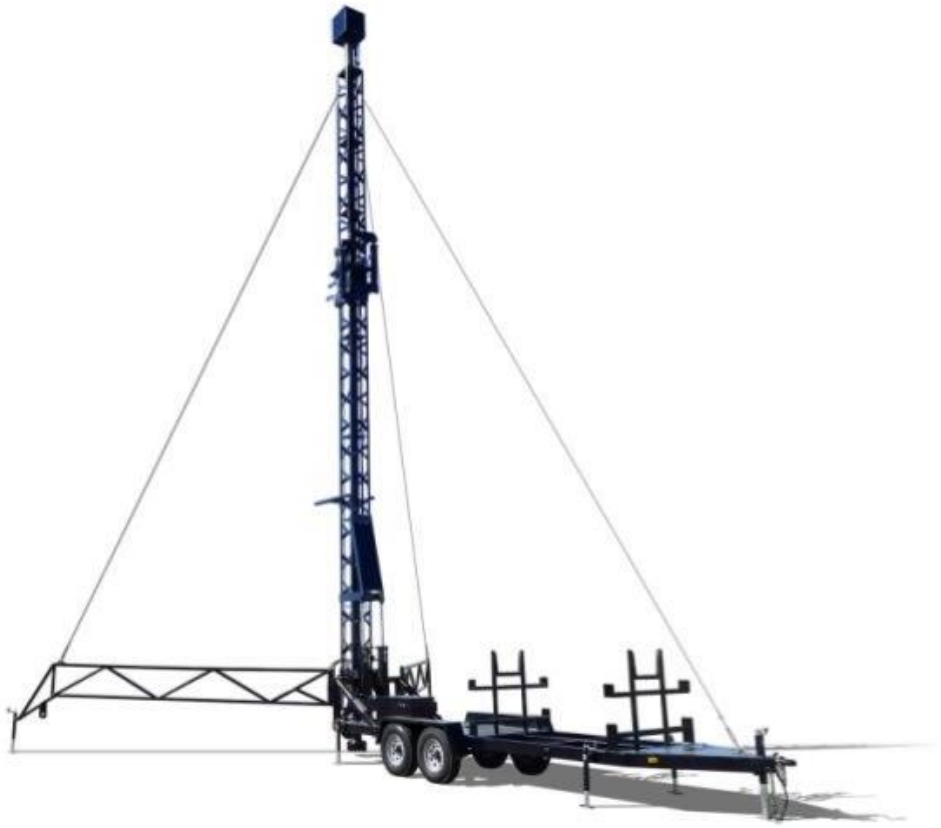

Figure 3-11 Typical Portable Rig Flare Stack Unit

Figure 1.7 Typical Flare Stack Unit on a Portable Rig.

It is expected that the targeted formations will produce less gas than in the past. Newly drilled wells will not contain the anaerobic bacterial contamination present in some of the older wells which may have caused small amounts of H_2S to be present.

The Proponent has not flared gases during the previous exploration programs; however it is likely to occur during some of the flow test operations until a use is found for the gas (heating, power generation, re-injection in a formation etc.).

In the event flaring is necessary, the flare will be higher than the surrounding area and designed to be well above vegetation or trees for example (both specific references made in the YOGA Drilling and Production Regulations quoted earlier). Noise from flaring normally only occurs when very large volumes of high pressure natural gas are being flared.

Flaring would only occur over a period of a maximum 1 day while conducting a DSTs at the end of a drilling program of one well. During extended flow testing, flaring may be necessary for between a few days to a few weeks. After that time actions would be taken to utilize the gas for power generation, tank heating or

possibly, gas lifting to assist crude oil production or re-injection. It would be the intent to eliminate gas flaring and reduce gas emissions to very small amounts when unavoidable.

The Oil and Gas group of Yukon Government's Department of Energy, Mines and Resources has adopted the AER Directive 50 – Drilling Waste Management (as recently amended and updated) procedures for the disposal of drilling wastes within the Yukon. The Proponent will manage the operation in accordance with the MBC requirements of AER Directive 50 – Drilling Waste Management for the remote sump locations and/or Alberta Forestry's "Drilling Waste Management, Disposal on Licence of Occupation" for the LWD disposal method (AER 2016).

It is not anticipated that significant levels of residue chemicals will be deposited on terrestrial and aquatic environmental components. The flare stack will be at 10 m high to assist in air dispersal of combustible end products and will be positioned on the well site in accordance with the regulated spacing requirements. All flaring processes will be in accordance with the air emission permit regulations and best practices.

To ensure that vegetation and soil are not be impacted by residual chemicals, the site design will include an appropriate spacing between the flare stack and any vegetation. Vegetation and soil samples will be taken adjacent and downwind (prevalent) and analyzed for identified chemicals of concern. These lab results will be compared to results obtained from control vegetation and soil samples taken at a similar ecosite, but not near the influence of flaring. Visual monitoring will occur throughout flaring period to ensure safety and protection of nearby vegetation.

YOG Drilling & Production Regulations specify these parameter in Part 9 of the Regulations: In summary the flarestack has to meet the following requirements (Note: operations when flaring will be conducted in full compliance with these requirements):

Flare requirements

128. Unless otherwise approved or directed by the Chief Operations Officer, any gas that is flared will be discharged from a flare stack that:

(a) is at least
    (i) 50 metres from any well, treater, separator, compressor, crude oil storage tank or any other unprotected source of ignitable vapours
    (ii) 80 metres from any right-of-way, easement, road, public utility, building, installation, works, place of public concourse or any reservation for national defence, except only when there may exist special circumstances that, in the opinion of the Chief Operations Officer, justify the positioning of the stack at a greater or lesser distance
(b) is adequately anchored and suitably protected against freezing
(c) is designed to ensure flame stability and efficient combustion
(d) is of sufficient height and diameter to ensure
    (i) that the average concentrations of hydrogen sulphide and sulphur dioxide in the ambient air do not exceed limits specified under the Occupational Health and Safety Act
    (ii) that vegetation combustion is prevented by maintaining an area free of vegetation and combustible debris around the base of the flare stack or the end of the flare line to the following minimum distances:

(A) 10 metres or 1.5 times the stack height, whichever is greater, in cultivated areas

(B) 30 metres or 2.5 times the stack height, whichever is greater, in forested areas

(C) 1.5 times the stack height, in any other area

(ii) that a minimum stack height of 2.5 times the height of the highest third party building located within a distance equal to 5 times the height of the building is maintained

(iii) that any heat generated around the base of the stack does not exceed the manufacturer's specifications for any equipment situated there, to a maximum of 4.73 kW/m²

(e) (e) has a sufficient exit velocity and is provided with guards or other features to prevent extinction of the flame

(f) (f) if the gas flow is intermittent, is provided with an ignition device to ensure continuous ignition of any gases.

Cement Plugs and Permafrost

Cement is a chemical mixture which reacts with and changes form when mixed with water. The reaction gives off heat when mixed with water. As the reaction progresses, the cement hardens. Cementing casing to attain the desired minimum hardness to withstand 500 psi (approximately 3,500 kPa) takes 6-8 hours depending on the amount of accelerator or retarder compound is mixed with the cement. This setting pressure permits the pressure testing of the casing within 12 hours of the cement job concluding to reach 80% of the casing internal yield pressure to confirm pressure integrity. Production casing for example, has an internal yield strength of 56,260 kPa (8160 psi); so 80 % test pressure would be 6525 psi or 45,000 kPa.

Permafrost cement (also named Arcticset or Polarset Cement by different suppliers) is manufactured reduce the amount of heat released during the reaction caused by mixing cement with water by adding Silica Flour mainly. When the cement is mixed with water the reaction proceeds with minimal heat generation and therefore does not contribute to permafrost degradation.

Typical oilfield cements, when mixed with water and begin to set, produce substantial levels of heat, known as the heat of hydration. This heat can melt the permafrost in the near wellbore region. Permafrost cements are a specific mixture of typical oilfield cement (Portland Cements) with additives such as gypsum and/or Calcium sulphate. This blend is specifically designed to create cement that, when mixed with water and begins to set, produces no increase in temperature of the slurry (no additional heat of hydration). This eliminates any permafrost degradation.

Permafrost cement is normally only used for the Surface Casing which is installed to protect any shallow aquifers and permafrost. The Proponent plans to install Surface Casing to a depth of 400 metres at minimum.

1.3.2.3 Drill Stem Testing

All well testing will be performed with the Guidance of AER, Directive 034: Well Testing, Theory and Practice and in consultation with Yukon Government's Energy, Mines and Resources- Oil and Gas Branch. As well, the Proponent will follow related non-discretionary legislations, such as the Drilling and Production Regulations. Part 5 of this Regulation provides detail on well evaluation and testing requirements.

Depending on analysis of rock cuttings, fluid measurements made during the drilling operation, and the well log results, it may be desirable to test prospective zones prior to drilling deeper or running casing. In these cases, a DST is commonly done. Drill stem testing or well flow tests are conducted through a special string of drill pipe anchored at the bottom of the well just above the target zone. The drill pipe would be made up to a packer that isolates the zone from the rest of the well and which would be mechanically fixed to the side wall of the wellbore A special annular pressure operated valve is placed above the packer and with either a small amount of fluid (e.g. water, diesel or other light density fluid) or with the pipe mostly empty of liquid to promote immediate flow from the formation in a controlled manner.

The surface end of the pipe would be connected to a well head made up of a series of valves to control flow and direct it where the operator requires but always with complete control. From the well head, the fluids from the well are carried by surface flow lines to a test separator. The separator splits the fluid mixture into its component elements which could be some combination of crude oil, natural gas and formation water, each stream of which is accurately measured by flow meters, to confirm the volume, pressure, temperature and rate of flow. From the separator, the crude oil stream is sent to a holding tank, the natural gas flows to the choke manifold to the approved flare or other pre-determined place (e.g. burned for heat, power or injected into an appropriate formation below ground) and the water would be filtered or treated in some manner to make is usable elsewhere or pumped back into an approved disposal well (most likely an existing suspended well in the area) in a similar manner as natural gas being injected in a suitable formation.

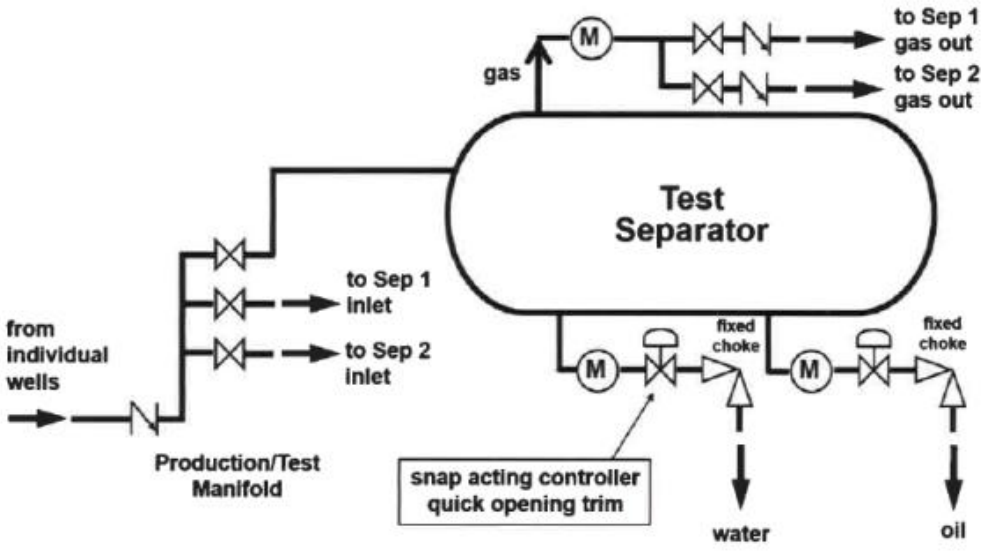

Figure 1.8 Typical Test Separator Schematic

The test separator (**Figure 1.8**) is kept operational permanently in every processing facility. This enables plant operators to assess the performance of the operation periodically. Outflow from the test separator normally is directed to a Central Processing Facility to join production from other wells. Separated natural gas may be piped to a dehydration vessel for future use as fuel or for injection downhole in a suitable well formation.

A typical operational sequence of DST is:

- Well is logged using various diagnostic tools and intervals for testing are selected.
- Test equipment is connected to the end of drill string and run into the well bor. The test equipment, generally consists of one or two packers for isolating the perforated intervals (to be tested), an annular pressure controlled downhole valve to open and shut in the well test and pressure gauges to measure the bottom flowing and shut-in pressures.
- Surface flow lines carry the fluids produced during the test from the wellhead (or surface test tree) to a test separator, where any natural gas is separated and either flared or utilized as fuel and any crude oil is separated and stored in tanks located onsite.
- A cushion of fluid contained in the drill pipe to initially ensure back pressure on the formation, which may be required to control initial flow rates.
- Once the test string is positioned at the zone to be tested, the packer is set and the down hole valve is opened to allow formation fluids to flow into the drill string.
- Initially, the well flows for relatively short period of time to clean up the wells (normally, this period may be a few hours). Following this period, flow is temporarily shut in downhole and a pressure buildup is recorded (with the initial shut-in period lasting for a period lasting 2 or 3 times the initial flow period).
- The test zone is now ready to be flowed at constant or variable rates, with each constant flow period normally followed by a shut-in period.
- Before concluding the series of test rates, bottom hole and surface samples are collected.

At the conclusion of the test, the tools are closed, packers unset and any samples within the drill pipe reverse circulated to surface. Formation fluids that may be produced during a successful test are piped into a test separator with produced gas being metered then flared and oil and/or water stored in sealed tanks.

Samples are taken of all fluids for analysis (both Pressure Volume Temperature samples under the flowing reservoir pressure, temperature conditions and atmospheric samples to check for “base sediments and water characteristics of the produced fluid”). A normal DST duration is approximately a few hours, not including the time required to make up the tools and run pipe to depth and do the reverse on completion. In addition to the time required to flow the well is an even longer period with the well shut in to determine the time it takes for the formation pressure to fully recover to pre-tests levels.

Depending on well log results, sample analysis and potential DST results, the decision is made either to abandon or case the well for further evaluation. In the former event, cement plugs are run using open-ended drill pipe across all porous/permeable zones, across the base of each casing string and at surface, the well casing(s) are cut off 1 m below ground level and steel plates welded across each string, a well sign is erected and the well site returned to original contours and re-vegetated, all pursuant to various oil and gas and land use regulations (all actions in compliance with Sections 90 to 96 of the YOGA Drilling and Production Regulations).

For each DST (minimum one per successful well unless several discrete zones require testing) one well flow should be sufficient and 30 in total days for 30 well DSTs would be typical. Should there be more than one prospective/productive formation which is separate from the other, a second (or more) DST will be

conducted on that formation. In some cases, a DST may need to re-done if there is a misrun. In addition, the DSTs may or may not be done in a steady sequence. Sequencing will depend on where the zones of interest are found in relation to the various casing strings that could be set as the well is being drilled.

Further Testing Details

The DST guidelines outlined in Enform IRP 4 are intended to ensure that safe work procedures are in place and to "minimize the probability of either the mechanical or human systems failing during a test, as well as establishing minimum health, safety and operating standards". In addition, they are "designed to allow flexibility and must be used in conjunction with competent technical judgment".

The exploration wells to be drilled may encounter hydrocarbon bearing zones that could be evaluated by conducting a DST (or DSTs). If DSTs are conducted a plan and testing procedures program will be in place, prior to conducting the test. The plan will be specific to the formation to be tested and the wellbore conditions existing at that time. The plan will be designed to ensure the safety of personnel and equipment and will provide for handling of any fluids that may be recovered. Enform IRP 4 guidelines are one of the sources that will be referenced in preparation of the plan.

Although the Proponent is the only operator currently active in the Eagle Plains basin, there have been several other operators in the past. The records of the historic wells in the basin are available on the website of Yukon Oil and Gas Resources. Nearly 200 DSTs were conducted on approximately 28 wells in the Eagle Plains during the period from 1960 to 2005. To our knowledge, there were no incidents where these tests had any adverse impact on the environment or presented any operational problems. Drill stem tests are a common method of evaluating potential hydrocarbon intervals in exploration wells and have been performed for over 60 years. They are usually of short duration. Flow periods are usually only 1 to 4 hours in duration, and seldom more than one day. The procedures for handling any produced hydrocarbons, and other fluids are the same as for any other operations conducted on the wells.

Three of the wells drilled in the Eagle Plains basin have had one, or more, acid stimulation treatments performed. One of these treatments was conducted by the Proponent. Records of these treatments are available on the Yukon Oil and Gas Resources website. These treatments are usually of small volume where the acid required for the stimulation treatment is transported in a single truck, and the treatment is performed in a single day. The fluid management practices utilized, as for other operations conducted on the well, prevent the release of any fluids to the environment.

Specific details of past drilling experiences can be found on the Yukon Oil and Gas Online Information Site: (http://maps.gov.yk.ca/imf.jsp?site=OilandGas_wells). For reference: the Proponent's comprehensive casing designs and rig and blow-out prevention system conforms fully to the YOGA (http://www.emr.gov.yk.ca/oilandgas/pdf/unofficial_office_consolidation_oil_and_gas.pdf), and the Drilling and Production Regulations (Sections 33- 61) (http://www.gov.yk.ca/legislation/regs/oic2004_158.pdf).

Further details of the Proponent's system configuration are confidential as per Section 176 (4) of the Yukon Oil and Gas Regulations. This section outlines what information is required to be non-confidential.

In consideration of the above text, it is not possible to accurately determine the number of DSTs that may be conducted at a well site. A more accurate estimation can only be determined after initial work occurs

which will inform Chance personnel of the geology, potential of oil and gas reserves. Plans for all DSTs will be based on well results and will be discussed with the Oil and Gas Resources branch of the Yukon Department of Energy, Mines and Resources.

Swabbing

There is the possibility that any well may be swabbed (normally a service/work over operation). Swabbing is a procedure to unload wellbores of heavier fluids thereby permitting the formation fluids to enter the wellbore and be circulated to surface. Wells will only be swabbed if the well is drilled, cased and a potential reservoir is:

- Identified,
- Perforated; and,
- Testing reveals that reservoir pressure is insufficient to flow liquids to surface; or,
- If well stimulation results in wellbore liquids that prevent flow to surface.

If the above criteria are met, swabbing is an accepted practice to reduce the pressure preventing a potentially productive formation from flowing to surface naturally. The same regulations affecting the handling and disposal of these fluids apply to fluids produced by swabbing as to recovery by any other means.

Acid Stimulation

Previous formation analyses have indicated small volume acid stimulation treatments would work well to clean up wells, remove scale and other impedances from formation pore throats to allow or improve flow into the wellbore. Acid stimulation entails the pumping of discrete amounts of normally hydrochloric acid at varying concentrations of 10%, 15% or 20%. The acid is trucked to location in specially sealed tanks in compliance with Transport of Dangerous Goods regulations and transferred to the cement pumping unit for pumping downhole. Treatment batches of 10 to 25 barrels (approximately 1.60 to 4 cubic metres) are pumped slowly controlled pressure until the entire batch is pumped. The relatively weak acid serves to dissolve scale (calcium Carbonate) deposited in flow paths over time. Successful stimulation is when the well flows at increased daily rates which could be +30 to 150 % of pre-stimulation rates.

The toxicity limits for oilfield hydrochloric acid are described in the Environment Canada documents and the Material Safety Data Sheets for the products. Hydrochloric acid is a gas dissolved in water to form hydrochloric acid. If heated the gas evaporates from the aqueous phase and water will be left. The chemical reaction of acid with carbonates renders the carbonates to form a harmless Calcium Chloride salt and water as by-products.

Oilfield concentrations are normally 10%, 15%, or 20% concentration hydrochloric acid. 5ppm (5mg/cubic metre) is considered safe concentration from an environmental perspective. Acid stimulation is normally only used once per well operation. The acid is transported in a special truck mounted tank that are designed and constructed for safe acid transport according to Transport Canada and Department of Transport regulations. A small quantity of relatively weak acid (10%, 15% or 20% concentration) is used on any occasion normally 5 to 10 cubic metres maximum. The acid is pumped from the truck into the pumper unit and from there downhole and never actually “sees daylight”. In winter, if acid is spilled as with water, it

would freeze and can be recovered from the surface snow or a thin surface soil layer. In summer, immediately flushing the spill with water would neutralize the acid and render it harmless (less damaging than vinegar). Flowing the well to “clean it up” would return the “spent acid solution” as Calcium Chloride, Carbon Dioxide and water.

In summary, acid stimulation is a common practice and an economic means to enhance well flow and reduce if not remove the materials impairing the ability of the formation to allow fluids to flow into the wellbore.

1.3.2.4 Extended Flow Testing

As noted above, all well testing will be performed with the Guidance of AER, Directive 034: Well Testing, Theory and Practice and in consultation with Yukon Government’s Energy, Mines and Resources- Oil and Gas Branch. As well, the Proponent will follow related non-discretionary legislations, such as the Drilling and Production Regulations. Part 5 of this Regulation provides detail on well evaluation and testing requirements.

In addition to drilling, any discoveries identified through DST are expected to undergo extended flow testing in order to gather important information about the nature of the resource accumulation and its productive capability. Given the remoteness of the region, the limited infrastructure to support oil and gas industry activities and the very early stage of oil industry evolution at Eagle Plains, the duration of these EFTs at each discovery could be up to 2 years. The information obtained from EFTs is critical to determining the future development plan for each discovery. The planned wells are exploratory; any flow testing will be contingent on discovery of formations potentially containing hydrocarbons. Part 8, Section 103 (1) of the Yukon Drilling and Production Regulations requires:

> *“The Licensee of a well shall obtain sufficient well tests, formation flow tests, wireline logs, analyses, surveys, conventional cores, cuttings and samples during the drilling of the well to ensure that a comprehensive geological and reservoir evaluation can be made.”*

EFTs will be undertaken if preliminary results from DST are encouraging and the following criteria have been met:

1. The well is drilled and cased; and,
2. A potential reservoir is:
    a. Identified
    b. DST has been conducted and
    c. Test analysis of the DST concludes sufficient hydrocarbons present to proceed to further evaluation of the hydrocarbon bearing formation.

In such a case, an EFT will be conducted to obtain more extensive information on reservoir characteristics and potential reserves. The same regulatory constraints apply to fluids produced by extended flow testing as to recovery by any other means.

EFT operates in a similar principal to DST. The main difference is that EFTs are undertaken after the well has been cased. To allow the zone of interest to flow into the wellbore, the casing has to be perforated

which is a routine procedure carried by either using a wireline from surface or attached the end of the production tubing from the surface to the zone of interest. The well, in this case, is first completed with a packer attached to a tubing string and have special downhole gauges to record flowing temperatures and pressures in real time. The surface would have the proper “Christmas Tree” wellhead equipment and be flow line connected to the test separator through a choke manifold. Well fluids (gas, oil and water) would then be handled in a similar manner as described previously. In an EFT however, the drilling rig would be removed to drill another well while the drilled well is prepared for testing.

Depending on drilling success several wells in different prospects would be flow tested simultaneously. As each well is drilled and drill stem tested to evaluate its candidacy for extended testing, it is left in a safe, secure state for further testing to take place after the drilling rig has been removed. It may become necessary to mobilize a small service rig to perform the completion work before turning the well to extended testing, but Chance Rig #1 could also perform this task and the solitary drilling/service unit at Eagle Plains. A well service rig has very similar capabilities and equipment as a drilling rig except that it generally has fewer modules and is also lighter equipment. If a service is required, it would be incremental equipment to the drilling rig.

Well testing is normally performed by specialized experts who would provide the specialized equipment, operating and safety procedures and the certification to be able to perform the associated tasks. Extended flow testing however would be handled in the same fashion as production operations and still be conducted by trained professional operators under the direct supervision of a Production Superintendent.

EFTs will require the installation of surface and subsurface equipment and facilities at each well site to measure, store and process produced fluids before it can be safely consumed, transported out of the operating area, or disposed at an approved location. The specific details of this equipment is subject to the nature of the discovery and could include:

- Casing of entire wellbore and perforate casing at zone of interest
- Packer, tubing and downhole gauges
- Wellhead valving assembly
- Flare systems
- Separator vessel
- Treater to do additional phase separation of the fluids
- Storage tanks
- Appropriate artificial lift systems
- Heaters
- Dehydrators
- Flow lines
- Metering equipment
- Portable generators

The Proponent anticipates a period of time to elapse between confirming a discovery worthy of further evaluation and commencing the EFT to allow time to properly design, fabricate, install, and commission the extended flow testing facilities.

The Proponent will conduct EFT on up to 20 successful wells. EFT may be completed within a month for a predominantly natural gas well or up to 2 years for a predominately crude oil well. There may be up to eight EFTs conducted at the same time.

Fluids produced during extended well flow testing will need to be measured, processed and dealt with in an environmentally responsible manner. Depending on the nature of a discovery, the Proponent anticipates that some combination of natural gas, crude oil and possibly formation water will be extracted during the EFTs. These fluids are separated and measured in facilities on the surface.

Natural gas could be flared for short periods of time. However, the Proponent may conserve natural gas and use it to provide fuel for process heating and possibly onsite power generation. Heaters are burners in a contained system of firetubes and the heat given off from combustion is used to provide heat to vessels treating the produced fluids or keeping stored fluids warm. The design of heaters can include heating an intermediate fluid such as glycol at the heater and circulating the glycol in a network of pipes to the places where heat is required. The generators are likely going to be small engines fuelled with natural gas and sized according to the power needs of the location.

Crude oil produced during the EFTs will also be conserved instead of flared to the greatest extent possible. This will require some processing at the well site or the central processing facility to stabilize the crude oil for truck transport to a suitable, approved crude oil marketing point, such as terminals near Ft. Nelson or Ft. St. John in British Columbia or Grand Prairie in Alberta. All of these locations are ready to receive and utilize crude oil produced from Yukon sources in the absence of such destinations within the Yukon. The Proponent may also consider trucking crude oil produced during the EFTs to ports in Alaska such as Skagway, Haines or Valdez for onward shipping to suitable markets elsewhere in North America.

Formation water produced in conjunction with crude oil and/or natural gas will be separated from the hydrocarbon streams and disposed of underground into a compatible and approved formation at Eagle Plains using one of the suspended wells. These procedures to process, transport and dispose of various fluids produced are common practice in every oil and gas province in Canada.

While water injection as a means to replace produced crude oil in the underground reservoir to maintain pressure in the reservoir is universally used in the oil and gas industry. The Proponent does not feel there is enough reservoir information data to predict the need for water injection in the future life of an Eagle Plains producing oilfield. The normal ratio of produced oil to injected water is 1:1. That is for every barrel of oil produced, there will be a requirement for a barrel of water to be injected following an initial period without water injection. The need for and the design of a water injection operational procedure will accompany and be part of a full field development plan should one transpire. One of the objectives of EFT is to gauge whether reservoir pressure maintenance occurs naturally or whether it needs to be done artificially using water or natural gas injection. This information will in turn support any longer term, development plan.

An EFT of any well can only be accomplished when year-round access to the each well is established. Producing wells require periodic inspection by field personnel to ensure the operation is proceeding within design parameters and safely. The well fluids have to be trucked out periodically as well.

During an EFT, all produced fluids will be separated into fluids that can safely be disposed of in the area (clean water) and fluids that must be transported to distant markets or safe disposal sites (crude oil, condensates). The natural gas element will, as previously stated, metered to accurately determine its volume/production rate and likely flared onsite, unless a local use can be identified (or burned for heating, gas lifting and/or power generation).

The average production rate experienced from previous well testing on the Proponent's old wells, 200 barrels of oil per day is expected to be the average per well production and less than 5% water cut is planned for. Therefore 4,000 barrels per day is likely the upper limit and a design limit of 2,000 barrels per day is more realistic for the daily maximums.

1.3.2.5 Well Maintenance (Workovers)

Any well completed for EFT or longer-term production may require workovers during its lifetime. A work over entails the manipulation of the wellbore production equipment (pumps, tubing, packers, etc.) using a suitably sized service rig or occasionally a drilling rig. In this activity the objective would be to change the condition of a well to improve productivity, replace faulty components or extend the well's productive life in some manner.

Over time, a reservoir depletes in such a way at to permit the water interface with crude oil or natural gas in the formation to rise to a point where only water flows from the wellbore. Producing too much water over a period of time could impair the ultimate recovery of crude oil or natural gas and possibly shorten the life of a producing well. Measures are needed to reduce or shut off the water flow to allow continued recovery of crude oil or natural gas. These include plugging some or all of the perforations and perforating at different section of the wellbore casing. Other factors that impair production of crude oil and natural gas include scale buildup, asphaltene (a constituent of some crude oils) plugging, etc. need remediation and this work is done using service rigs, wireline services and so on. These practices are commonly used by the oil and gas industry and conforms to the regulatory requirements to optimize the recovery of the resources from the reservoir.

The well completion design and installation phase is critical in ensuring the well maintains a longer period of uninterrupted production. To this end completions are designed to require minimal intervention for many years by installing simple less mechanically operated systems, superior corrosion protection, erosion protection, possible use of internally coated production tubing etc. All such actions are focused on making product flow as smoothly as possible. Furthermore, the actual tubular components are selected to minimize changes in internal diameter, prevent areas where turbulence is generated and reduce if not eliminate leakage paths.

The completion is also designed to make its installation as trouble free and time saving as possible (have components which could assist in pressure testing the tubing internally while being run to eliminate leaks. The simplest completion should comprise of tubing and perhaps a tubing anchor or packer. Seating or landing nipples are installed to enable internal pressure testing of a completion string as well as land

downhole pressure gauges while flowing, permit circulation of kill fluids from the annulus into the tubing bore or reverse and possibly plug a well at a certain depth. The term “kill fluid” describes a fluid of sufficient density that creates a hydrostatic pressure at the bottom of the fluid column that is equal to or great than the formation pressure and prevents formation fluid from flowing into the wellbore.

Work overs nearly always start with “killing the well” to prevent further flow and circulating the wellbore contents to be replaced with a stable, non-flammable fluid. The kill fluid is normally weighted brine with corrosion inhibitive features. Salt dissolved in water (Brine) makes the water “heavier” (denser) and therefore an over balance medium fluid to keep formation fluids in the formation and not allow then to enter the casing/well. Normal completion brines are Sodium Chloride, Potassium Chloride and Calcium Chloride depending on the bottom hole pressures encountered. Eagle Plains conventional wells can be completed with Sodium Chloride (common salt) brine mediums. Only additives that may be added to the workover brine is corrosion inhibitors and/or biocide.

Following that activity, the wellhead is removed and a blowout preventer is installed to provide additional control of the well during the work over. The production tubing is recovered to surface for reuse or disposal if it is too eroded or corroded for future use. The wellbore would be cleaned of debris accumulating over a production period (normally a bit and casing scraper run accomplishes this). The remedial work is done to the well to fix whatever problems were encountered and the well is returned to a condition that allows production to resume.

1.3.2.6 Drilling By-Products

Within the described drilling program, two forms of drilling by-products will be produced. The following sections will describe and detail their creation and industry wide solutions for dealing with these by-products.

Please note, the Proponent is drilling within a sedimentary basin. Drill cuttings consist of sandstone, shale, and carbonate rock and are therefore, not significantly sulphide bearing. These rocks have been examined by Chance geologists and do not contain the materials that cause acid creation and as such the potential for acid rock drainage caused by the disposal of drill cuttings is remote to non-existent.

Naturally occurring radioactivity will be measured by gamma ray or spectral gamma ray wireline logs, which is a regulatory requirement in the Yukon Government Drilling and Production Regulations. GR is a radioactivity detection device (similar to a Geiger Counter) and therefore detects any existence of radioactive Uranium, Thorium and/or Potassium isotopes in the rock formations drilled. To date no abnormal detections have been made other than that attributed to natural rock formation radioactivity and therefore, radioactivity appears absent or undetectable in the fluid of the Eagle Plains sedimentary formations.

Solid Drill Cuttings

When drilling a well, cuttings are produced. These cuttings are a direct by-product of the drilling action caused by the bit grinding rock. After being drilled, these cuttings are brought to surface with the drilling fluid and separated from the drilling fluid using sophisticated equipment (e.g., shale shakers and centrifuges). These cuttings are stored onsite in metal bins referred to as shale bins. Close attention is

given to the dryness of the cuttings coming across the shale shakers and collected in the shale bins. It is important that as much fluid as possible be recovered from the cuttings for a few reasons:

- Less total weight in the cuttings, hence less cost associated with future handling of the drill cuttings.
- In the winter, it is easier to handle and move dry cuttings as they do not freeze and create large blocks of material.
- Reduces the need for additional make-up drilling fluid by recycling more fluid that is separated from the cuttings.

Drilling Fluid

The Proponent is proposing to use water-based drilling fluid systems. It is not uncommon that after drilling a few wells using the recycled drilling fluids, a mud system may need to be partially or fully reconstituted (disposal of the current system and mixing of fresh water and new drilling fluid products). This ensures the drilling fluid is fresh and capable of drilling through the different rock types found in the proposed wells. It is unclear how often a reconstitution process will be needed. The Proponent has had success with re-using drilling fluid systems across multiple wells to reduce the overall need for make-up water and reduce ultimate disposal of material at the conclusion of its use. As drilling is likely confined to a winter drilling season, the Proponent will likely re-use drilling fluid throughout one drilling season.

The first stage of fluid and material management is called ‘Stripping’; this is the process of running the drilling fluid as it returns to surface through centrifuges multiple times to separate the water from any solids suspended in the fluid stream. The fluid is then either recycled back into the mud system or used elsewhere on the rig

The disposal options outlined for the drilling program have been directly influenced by both the proposed drilling system and the site conditions present at the drilling locations and in the Eagle Plains area generally.

- Accordingly, the following conditions were established for selection of the drilling mud system: a low-toxicity mud system confirmed through laboratory analysis; and
- Meet operational requirements (maintain formation stability, hole cleaning and well control, etc.)
- The following conditions were established for selection of a cutting disposal method:
  - minimize the extent of surface disturbance; and
  - minimize transporting the material off-site for disposal.

In response to both these sets of conditions, the Proponent plans to select a water-based mud system as generally described which has been previously proven suitable for the MBC disposal process in an approved nearby site.

Any drill fluid selected will first have to satisfy Section 32 “Approved Drilling Fluid” of YOGA Drilling and Production Regulations. The type and chemistry of the drilling fluid will be a key part of the drilling Program issued in application for a Well Licence. This is explained and described further in this section.

1.3.2.7 Mix Bury Cover Sump

The Yukon has accepted AER Directive 50 as the governing regulation to determine the eligibility and applicability of various disposal alternatives for various drilling by-products and mud systems. Mix-bury-cover, as described and detailed in AER Directive 50 Section 13, is a method of disposing of drilling waste (both drill cuttings and drilling fluid or just drill cuttings) by which the by-products and spent mud is mixed with a local receiving soil at a specific mix ratio, then deposited into a sump, and then covered with clean subsoil.

A typical MBC sump design consists of three distinct layers:

- A clean subsoil layer 1 to 1.5 m in depth. This layer acts as an insulator between the subsoil/drill cutting mix and the vegetative layer to ensure that, after final reclamation, the site is returned to its original state.
- The subsoil/drill cutting mix layer is where the receiving subsoil is mixed at a specified mix ration with the disposed material (e.g., drill cuttings, spent drilling mud, etc.).
- Clayey material exceeding 1 m in depth, or alternative impermeable liner, acting as a hydraulic isolator.

Sump Suitability

Initial investigation into sump locations is required. AER Directive 50 Section 6.3 specifies the procedures and parameters for sump site investigation. Any proposed location will have cores drilled and the subsoil will be analyzed to confirm the following for a proposed sump:

- Sump soil has appropriate deposits of clayey soils.
- Must have appropriate clayey material of 1 m beyond the horizontal and vertical dimensions of the sump to ensure hydraulic containment.
- Absence of hydraulic defects or ways for fluid to leak out of sump.
- A composite sample, made up of five subsamples, is required for every 3 000 m² proposed to be used for MBC.

In the instance where the subsoil is found to be saline, special care will be taken when these sumps are excavated to ensure the non-saline active layer and subsurface materials are returned to the surface allowing the site to return to its equivalent land capability.

The Proponent has begun a sump suitability study of chosen locations throughout the area proposed in this application. Core samples, from existing and potential future locations for MBC style disposal, are being examined and analyzed by qualified experts. The results of this work will determine the course the Proponent will pursue for MBC at Eagle Plains.

The actual drilling fluid system that the Proponent plans to use has not yet been determined due to the exploratory nature of the drilling program (uncertainty of lithology), more information about this can be found in the Environmental Conditions report (Appendix D) describing the geology in the area. Before the Proponent begins the drilling of a well, a test sample of the drilling fluid will be prepared. The properties of

this fluid will be analyzed and compared against the receiving soils at the MBC site(s) to estimate the soil/waste mix ratio to ensure the final soil composition complies with AER Directive 50 section 3.

The Proponent intends to assign cuttings disposal management and direction to a competent individual representing an organization with the most experience operating under the terms and conditions of AER Directive 50.

MBC is not a viable disposal option if:

- Suitable sump site that meets all of the requirements established under AER directive 50 cannot be found.
- Drilling fluid that is incompatible with receiving soils or prohibited for MBC under AER Directive 50 is used.
- Drilling by-products/receiving-soil properties require a mix ratio greater than 7.

In order to minimize the potential for deep permafrost exposure during summer exploratory drilling program, the following mitigating procedures will be adopted:

- The sump will be excavated as disposal volume is required, in order to minimize the area of basal and wall permafrost exposure at any time. This may be in the form of narrow compartments oriented E-W to maximize shading of the basal permafrost surfaces or any other field procedure determined superior at the time.
- The top of the open area of the sump may be covered if environmental/geotechnical monitoring indicates degradation of wall structures in the sump trench due to thaw.

While an MBC sump is actively being used, the Proponent will monitor and inspect the site to evaluate sump integrity, volumes of material involved and to assess if further work is needed to the sump location. The drilling operations will utilize practices that minimize the volume of drill cuttings and drilling by-products generated.

The Proponent will arrange for full-time disposal expertise, provided from the selected mud services contractor, who will be available for Project management and consultation regarding disposal operations.

As noted above, all materials to be disposed of in the sump will meet AER Directive 50. If materials to be disposed of do not meet AER Directive 50, the disposal material will be transported to an appropriate permitted facility for disposal consistent with the practice employed in previous exploratory wells drilled at Eagle Plains. The Proponent has used permitted facilities that can accept specified waste in Whitehorse and northeast British Columbia.

Drill cuttings and fluids will be held in containers for minimal periods before disposal. After drill cuttings are circulated out of the hole, they are separated from the drilling fluid and stored in 3-sided metal bins. For final disposal, the cuttings are transported to the proposed MBC site for mixing with the subsoil. After the three-sided bins have been emptied, they will be moved, along with the rig, to the next drilling location. Disposal will take place as and when required during drilling or when the shale bins contain a full truck load of material.

For the proposed Project, drill cuttings will be transported to and disposed of at the MBC sump site, while fluids will be reused until the end of the Project. The Proponent plans to construct a new MBC sump adjacent to the Devon sump area to the same specifications to dispose of drill cuttings from the proposed 30 wells (see **Figure 1.9**). The Proponent has not used the Devon site for any drill cuttings or drilling fluid disposal to date and does not intend to use the site for disposal in the future. The Proponent's preferred disposal site is separate from where Devon drill cuttings and drilling fluid were buried but in an adjacent, previously undisturbed area,The Proponent has not monitored or inspected any of the Devon sumps. The proposed exploration drilling program will be performed under a comprehensive drilling fluids management process managed by a services supplier competent in AER Directive 50 and fully versed in safe MBC techniques in use in western Canada.

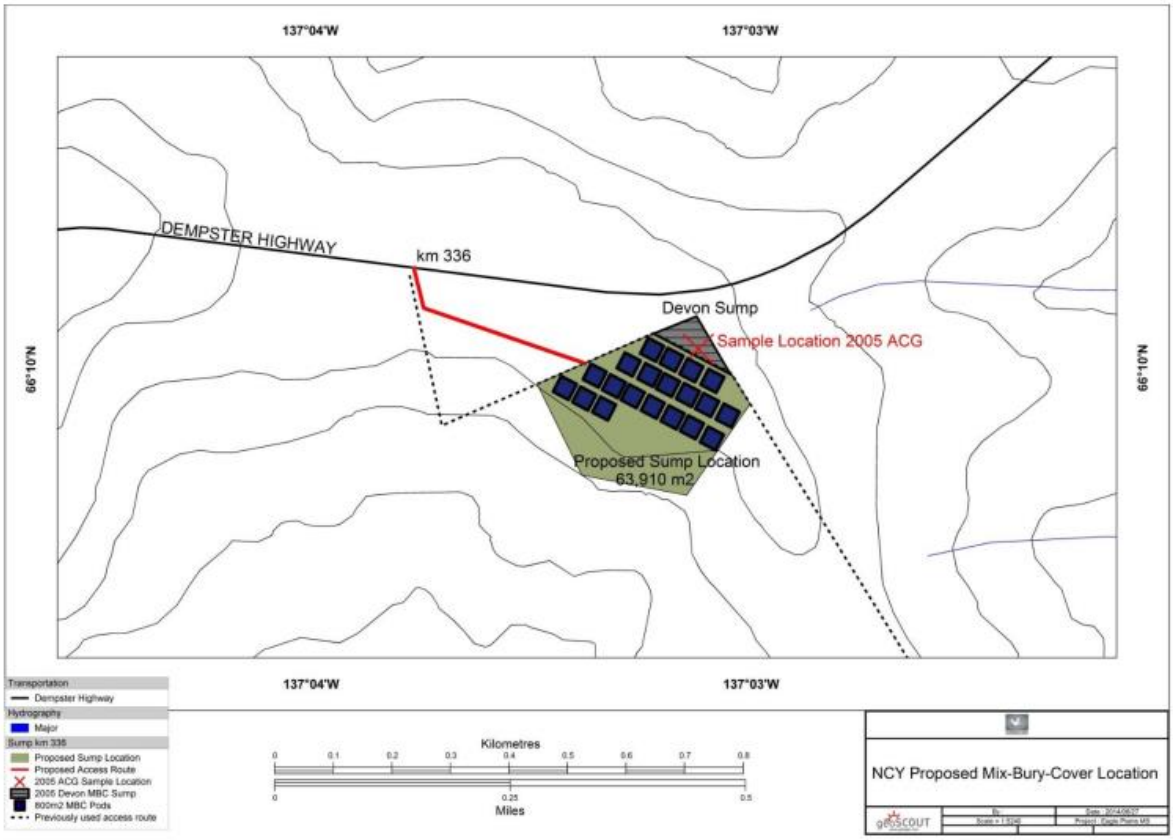

Figure 1.9 General Location and Typical Plan of MBC Sump Site

Figure 1.9 shows the 63,910 m² area proposed for MBC disposal. This area was determined based on the estimated area required for disposal. Each 800 m² MBC pod signifies an estimate of how much area would be required to dispose of one well's drill cuttings. The additional area, a rough estimate, would allow for spacing between MBCs for truck access and to pile excavated material before MBC commences. All estimated calculations, as required by Yukon Government Drilling and Production Regulations (Government of Yukon 2004), were made in accordance with the requirements of AER Directive 50. Typical operational practice is to have only one MBC open at a time.

MBC pods will be sized based on the anticipated volume of drill cuttings disposal required per well. This will ensure that the MBC opening time is minimal. As mentioned previously, a typical well would produce up to 300 m³ of drill cuttings and require an area of approximately 800 m² to dispose the drill cuttings. The Proponent proposes to only use the site described in **Figure 1.9** for the MBC sump. The section of area where the Devon 2005 MBC was located and whose exact location is known, will not be disturbed by any of the proposed operations. The Proponent aims to minimize surface disturbance by using a single previously disturbed area for multiple MBC pods. The site is adjacent to an already disturbed site used by previous oil and gas activity (Devon access road 2004) and it has already proven to have the soil characteristics required as stated in AER Directive 50 Section 6.3. There is no operational need to establish other discrete MBC locations.

1.3.2.8 Injection Well

DIR 50 covers the disposal of drilling fluid. In this case the fluid would be added to the drill cutting and then mixed with the required amount of soil in accordance with AER Dir 50. Drilling fluid may also be stripped back to just the clear portion and disposed of using an approved water injection well.

Well choice requires further injectivity and suitability investigations. This cannot occur until the wells are re-entered and made ready for the investigation trials. Chance Candidate wells could be one or more of the following suspended well(s): Chance J-19, Chance M-08, Chance G-08, Blackie M-59 and Chance E-78 all located within the Chance licence areas. Any well that is not a preferred EFT or future production candidate could be an injection well if strategically located in close proximity to a usable well or wells and if it exhibits the required characteristics for injecting fluids.

The YOGA Drilling and Production Regulations require reservoir produced water not be disposed of at the surface unless its quality and/or salinity is equal to or better than the quality limits set out in producing filed facility licence.

Any plans or intention to dispose of produced water from reservoir fluids separation have to be submitted to the regulatory authority and must meet the pertinent environmental standards as well the oilfield waste disposal standards and limits (reference YOGA Drilling and Production Regulations Sections 122. 123. 124, 130 and 165). The YOG regulator will only authorize produced water disposal when the operator demonstrates all legislation in force requirements have been met and that good oilfield exploitation and reservoir management practices are satisfied.

Once their disposal suitability is established, the following liquid materials (all treated with bactericide) and their volumes may be disposed of:

- Produced water per well (water cut 20% to 60% for 200 BOPD) = 40 to 120 barrels water/day
- Workover fluids: Maximum 7” casing volume full= 276 barrels
- Rig wash: hose flowing at 5gpm water for one hour = ±7 barrels per day in summer
- Saline fluids (completion brines) same as workover fluids = 276 barrels
- Liquid fraction of drilling fluids = approximately 200 cubic metres at end of Project

The zone must have an impermeable barrier above it to prevent migration of the injected fluid and be deeper than 750 metres. Permeability and porosity of the rock must permit pumping of the fluid at low surface pressure and especially well below formation breakdown pressure. Testing will also have to determine injection fluid compatibility between the rock and native reservoir before injection.

The injection pressure and rate, and the pressure in the casing tubing annulus will be monitored at all times. Accurate/calibrated surface pressure gauges will continually monitor pressure readings and any fluctuations. The conditions are injectivity rate, porosity and permeability of the formation being injected into.

Disposal of highly saline produced water at surface disposal sites may be greatly restricted in quality and quantity. To this end and to support best reservoir management practices, it may at times be mandatory to re-inject reservoir produced water back downhole as the only viable and environmentally safe option.

1.3.2.9 Seismic Exploration

The seismic program will consist of approximately 1,500 km² of 3D and 2,000 km² of 2D reflection seismic exploration. Actual final seismic survey location, design and layout will be dependent on drilling outcomes as they progress. Utilization of the low-impact seismic methodology will result in very low impact on the environment. Source lines are limited to 3 metres in width and receiver lines limited to 2 metres in width. The Proponent intends to leave a small amount of snow on the lines so that the tundra and permafrost are not disturbed. The low-impact seismic drills are outfitted with air hammers and as a result will not require water for drilling.

The Proponent plans to deploy a wireless recording system. This wireless system is preferred since a cabled system could present a hazard for migrating animals and requires a larger hand cut line than is necessary for a cable-less system where the layout crew only requires a path 2 metre or less through the land. A cable-less system is also less impactful on the environment as it is easier to carry down the receiver lines and requires fewer personnel on the recording crew.

Preflagging (Cruising)

Prior to line preparation, a detailed line by line spatial analysis (area examination) is performed utilizing a combination of air photos (2011 vintage with 2 m resolution), LIDAR (Light Detecting and Ranging), field scout information, GIS information, First Nation cultural inputs, and any information identified by the preflagging/cruising phase. This greatly helps reduce time spent in the field dealing with localized line preparation issues.

Preflagging (cruising) will be conducted to identify and mark line locations, areas containing riparian areas, difficult terrain, historical/archaeological areas, animal sites and facilities. This is done by having personnel on the ground marking the line locations and areas of concern for the mulchers and chainsaw operators to follow or avoid. These areas will be added to the Project map. Handheld Global Positioning Systems (GPS) units ensures accurate line placement and automatic notifications are sent to management when the mechanical equipment is approaching a “Hot Spot”, or stations that are encroaching any buffered zones or areas.

Line Preparation

A combination of low-impact seismic mulchers and chainsaw operators will be utilized to prepare source and receiver lines. Both source and receiver lines will be slashed to ensure there are no pokers or leaning trees for safety reasons. On board GPS on all mulching equipment ensures accurate line placement and automatic notifications are sent to management when the mechanical equipment is approaching an area of concern, or stations that are encroaching any buffered zones or areas. Lines will be doglegged or bent from any access point to avoid creation of a line of site and will meander to avoid disturbance of any timber larger than 20 to 30 centimetres in diameter. Source lines will be 3.0 metres wide to accommodate vehicles. A minimum of 20 centimetres of packed snow will be left on line to avoid possible damage to vegetation or permafrost. Receiver lines will be 1.75 metres wide to accommodate personnel.

Survey

After source and receiver lines are prepared, surveyors travel the source lines to mark the location of where the low-impact seismic drills will create the source points, and the receiver lines to mark where the recording crew will place the wireless recording equipment. They do this using GPS which allows for meandering and narrow lines.

Source Point Preparation

Source point holes 9 m in depth and 10 cm in diameter will be drilled every 60 m along the source lines using a small, low-impact seismic air hammer drill. A charge of one kilogram of dynamite is then loaded into the hole to be detonated by the recording crew. Dynamite is transported and stored at one of the staging sites in a federally regulated Explosives Magazine.

Recording

With the use of a long line and helibags, a helicopter will place and retrieve recording equipment at pre-determined intervals along the receiver lines. Recording personnel will access the equipment in the helibags and will place a series of geophones every 60 m along the receiver lines. The recording crew will be using a cable-less recording system. Cable-less recording systems are ideal for gathering seismic data because they reduce the constraints on geophone placement, eliminate downtime for cable repair, and reduces the impact on the environment. The geophones record the vibration created by the charges being detonated on the source lines. The data that is recorded is relayed to the observer truck. Once the data is relayed, personnel and helicopter return to retrieve the equipment and any debris used to mark the surveyed receiver and source locations.

The helicopter will be based out of the camp and the use of the helicopter will be minimal. The Proponent will follow the Flying in Caribou Country guide. Helipads will be built for safety and medevac reasons.

Access Trails/Creek Crossings

For safety reasons, vehicular and personnel movement a minimal amount of access trails will be required within the program area. This will be done on existing trails, historical seismic lines or lines that will also be used for source lines and receiver lines. The width of the access trails will be a maximum width of 5.5 metres wide and will also have a minimum of 20 centimetres of packed snow.

1.3.3 Accessory Project Components

The following activities are expected to be completed, as required, to support the principal activity of drilling completing, and testing exploration wells:

- Well site(s) preparation
- Other Project Facilities (i.e., camps and fuel storage)
- Some surface facilities (e.g., storage, processing, injections)
- Airstrip construction and operations, and 2 fixed-wing aircraft flights per week
- Building and maintenance of access roads (all-season and winter roads)
- Development of borrow sources for airstrip and roads
- Water use for drilling and camp

For drilling: Camp 325 will be the main accommodation facility for the exploration program. The Chance Rig #1 will also have a smaller mobile camp, occupied 24 hours per day, 7 days per week, to house essential personnel (rig supervisors, medic, geologist, etc.).

1.3.3.1 Access Roads

Assuming all wells are successful, all-season roads will then be required to access all 30 wells. Access to wells that are proximate to the Dempster Highway , drilled in proximity, or enroute to a successful well will have all-season access built to them. Wells undergoing EFTs, including the legacy suspended wells located on the Chance Significant Discovery Licence, will require all-season access. The Chance Road will be established as an all-season road regardless of the results of the drilling program.

After drilling several wells and depending on success in discovering hydrocarbon-bearing formations, access roads will be upgraded to all-season roads constructed from rock material from borrow fill sites. The diagram below, prepared by Boreal Engineering Ltd., illustrates a typical road construction design. The pad will be constructed to be approximately 7 m in width, sufficient for safely accommodating a transport truck, but also having roadside passing areas to allow 2 trucks to pass beside one another. Passing bays will likely have frequency of 1 approximately every 750 m allowing vehicles coming from opposite directions to have a clear view and prepare to enter the nearest passing area on their side of the road.

The estimated distance between pull outs to be 1 km; however, they should occur as/when required when the roads winds and visibility for oncoming traffic is impaired. Pullouts will be 150 m long, at inter-visible locations and identified with signs indicating the km / station. It is intended that the maximum distance between pullouts will be 1 000 m; however, they may be as close as 300 m to provide a passing lane to ensure that pullouts are inter-visible. The purpose is that if a vehicle were on the road without radio control, a widened road would be available for passing transport trucks. For the purpose of volume calculations, it is estimated that average distance between pullouts will be 750 m. Well site access roads would, in turn, also be constructed using a similar design.

The base road pad will be ultimately covered with a sandy material for protection of the road surface and endurance. All-season roads will require periodic maintenance as surface material is removed or eroded by the elements or vehicular traffic.

Winter road construction will utilize similar techniques as previously applied. Once snow cover equals or exceeds 10 cm there should be adequate snow to build winter roads. Well site access roads will also be constructed in a similar fashion using accumulated snow to construct berms on the road margins and filling the space between with amounts of snow and water trucked from approved sources. All roads will be supervised by a competent and qualified geotechnical engineer to ensure their ability to safely support the drilling rig and other similar heavy loads that will be transported across them.

Water Crossings

The access routes are designed to have as few water crossings as possible by following previously travelled trails and roads located on ridges or higher areas well above the water drainage valleys in between. The normal techniques applied when constructing water crossings is to lay a culvert of a sufficient outside diameter as to not reduce or obstruct the water flow, nor impeded fish movement along the water course. To this end, the Proponent has directed that water crossings must meet all the Yukon Government land use and transportation requirements.

Culverts will be installed per the Yukon Government Highways and Public Works standard drawing for culverts in permafrost conditions. Culverts will be installed using standard engineering practice in permafrost areas and per the attached Yukon Government standard drawing 06010-5. Culverts will be sized following a hydrological assessment by a Professional Engineer registered in Yukon to determine flow volumes. Culverts will be sized accordingly to the 100-year return event. Minimum culvert size will be 600 millimetres (mm). Culvert installation methods will follow those methods provided by *Best Management Practices for Contractors and Inspectors* handbook. The hydrological assessment is necessary to determine the stream flow for culvert sizes of each water crossing. The Alaska document urges the understanding and appreciation for the thermal effects of standing and running water because water can initiate thaw settlement and erosion that can destroy the road.

It is recommended that “the velocity and volume of water running beside the toe of a road should be carefully evaluated, providing for a series of culverts, rather than large culverts at discrete intervals rather than large culverts at great distances” (Author year) The Guidelines further recommend “Culverts should be considered in three distinct phases: 1) during the original deployment, 2) during the first summer after snow is gone and actual drainage cane be seen and reassessed and 3) in subsequent summers when perhaps the roadway and culverts have settled or other factors have influenced their effectiveness” (Author year).

The Proponent will commission a fully qualified road Arctic construction organization currently operating in Yukon who are versed in the construction techniques applied to remote areas as Eagle Plains.

Water courses will not be diverted. A culvert will be installed within the flow path of the stream. Following completion of the culvert installation, water will be directed through the culvert prior to placement of fill for road construction. Following closure of the road, the culvert will be removed and the water course will be returned to its natural state.

MBC Sump Access Road

The Proponent also proposes to construct a 400 m all-season access road to MBC sump area (Error! Reference source not found.). This road will be constructed as early in Project as possible (soon after mid-

January as snow and weather permit) and will take approximately 2 weeks to complete. The minority of the road follows an existing access trail, and no major clearing will be required. Please see photos of access and terrain. The road does not span any waterways and is 800 m away from the nearest water drainage. The road dimensions will be approximately 400 m long by 6 m wide. The material used for road construction will be approximately 3,000 m³ of locally sourced granular material.

Well Site Access – Summer

All material used for road construction will be locally sourced granular material. Materials utilized will be those approved for use as a road construction material. Several identified borrow sites have been cored and evaluated for quality and quantity of fill material by geotechnical engineers from Tetra Tech/EBA and Yukon Engineering Services. Kryotek Engineering and Boreal Engineering have also been consulted for expert advice regarding Arctic road construction techniques in Yukon. A combination of the previously mentioned engineering organizations will be contracted to undertake road design, construction, and general project management. The construction of a summer access road will be completed as described above.

Well Site Access – Winter

Winter access will only be constructed if the ground and water bodies are frozen and if there is adequate snow coverage. The Proponent will ensure there is a minimum packed snow cover of 10 cm to the vegetation layer. Where required, an increased snow depth will be maintained to avoid disturbing surface vegetation and duff (i.e., tussock terrain).

The factors that will be considered while making the determination will be terrain features, vegetation present, and local topography. If this snow depth (minimum of 10 cm) is not sufficient in certain areas, additional snow depth will be ensured to provide adequate protection to surface vegetation and duff (i.e., tussock terrain). If this is required, snow will be removed from appropriate locations in the direct vicinity of the winter road (i.e., surrounding areas that have ample snow coverage) and added to the snow pack on the winter road. Vegetation will be cut, with no disturbances to the vegetation mat. Access routes will be constructed using equipment appropriate for packing snow.

Several water bodies may require ice bridges/snow construction. All water bodies will be treated as fish-bearing and will be constructed as per Fisheries and Oceans Canada's (DFO's) Operational Statement on Ice Bridges and Snowfill (http://www.pac.dfo-mpo.gc.ca/habitat/oseo /icebridge-pontsduglace-eng.htm) as well as the Safety Guide for Operations over Ice. As well, if water is required to be withdrawn from nearby water sources, adequately sized intakes will be used and screened to prevent debris blockage and fish mortality (refer to DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 1995).

A minimum snowpack of 10 cm is required for the winter road. However, if the amount of snowfall in the area allows for a thicker snowpack (i.e. 15 cm to 20 cm) during initial road construction, a thicker snowpack will be used. As the winter progresses, the Proponent will continue to add to the snowpack.

If natural snowfall is below the minimum required to commence access and well site construction, the Proponent will consider artificially making snow to make up the shortfall. This is a contingent consideration and could require up to 300 m³ of water per day for a short period of time (several days to a week) if more than 1 access route is under construction at any given time. The sources of water are likely to include the

Eagle River, the Ogilvie River, and the water well at Chance's camp once proper treatment facilities are in place. The water to be used to make snow and ice the winter road(s) will be trucked from the source to the point of use. At maximum, between 20 and 30 truckloads per day would be needed. The actual number of trucks being used would be less since a truck can probably complete 4 to 6 deliveries per day. Generally low snowpack is only an issue during the early part of winter, so this provision would only apply on a contingent basis during the months of November, December, and January. The timing for making artificial snow will depend on how late in the winter season winter road construction begins. If, for example, in late December there is little or no snow fall or snow accumulation on the ground, snow making could ensure a sufficient snow base to commence winter road construction. Snow can only be made when the ambient temperature drops to 0 degrees (°) Centigrade.

Access Road Maintenance

Maintenance will involve grading and filling to ensure a smooth travelling surface, cleaning/maintenance of drainage structures, snow removal in winter, and to ensure signage remains suitable for service. Maintenance equipment will include a road grader, a mid-size (D6) dozer, trucks to haul aggregate, and an excavator for maintenance of drainage structures. Maintenance of winter access routes may include low-ground-pressure vehicles, a road grader equipped with a wing snow plow, some water application, and use of matting where required. Grading may be required over certain stretches of the routes, and depressions along the roads will be filled with snow to smooth the surface. If required, water will be withdrawn from approved water sources using adequately sized intakes and screened to prevent debris blockage and fish mortality; refer to DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 1995). The Proponent will avoid using small streams as a water source. Should winter access roads convert to all-season roads, maintenance will be ongoing to ensure road safety and reliability. This will be especially valid when wells are transformed into extended flow sites and require constant year-round access for operational reasons. Road repair and maintenance for all-season roads will require additional machinery, specified and supplied by the selected qualified contractor.

Dust will be kept to a minimum by enforcing reduced speeds on access roads. Dust will also be kept to a minimum by spraying the road surfaces with water whenever they become too dry; some fine airborne dust may become deposited on the surrounding vegetation. The small quantities of fine dust should not cause vegetation to be affected but periodic visual inspections will be made to check for any visible changes to the surrounding areas.

1.3.3.2 Borrow Source Development

Borrow material will be required for the Project for activities such as road and well pad construction. Approximately 21,600 m^3 of borrow material will be needed per well site. The borrow material will come from the closest approved borrow site. In total, the Proponent anticipates requiring up to approximately 1.7 million m^3 of borrow material for the Project.

Borrow Pit locations will be confirmed throughout drilling proposed locations and are identified in **Figure 1.10** and **Table 1.4**. To eliminate any water pooling, borrow pit design and development will be done in the winter while ground is frozen. Borrow pit access roads will be built to the same standards as the main access roads. Timing of construction is for 2016 winter season.

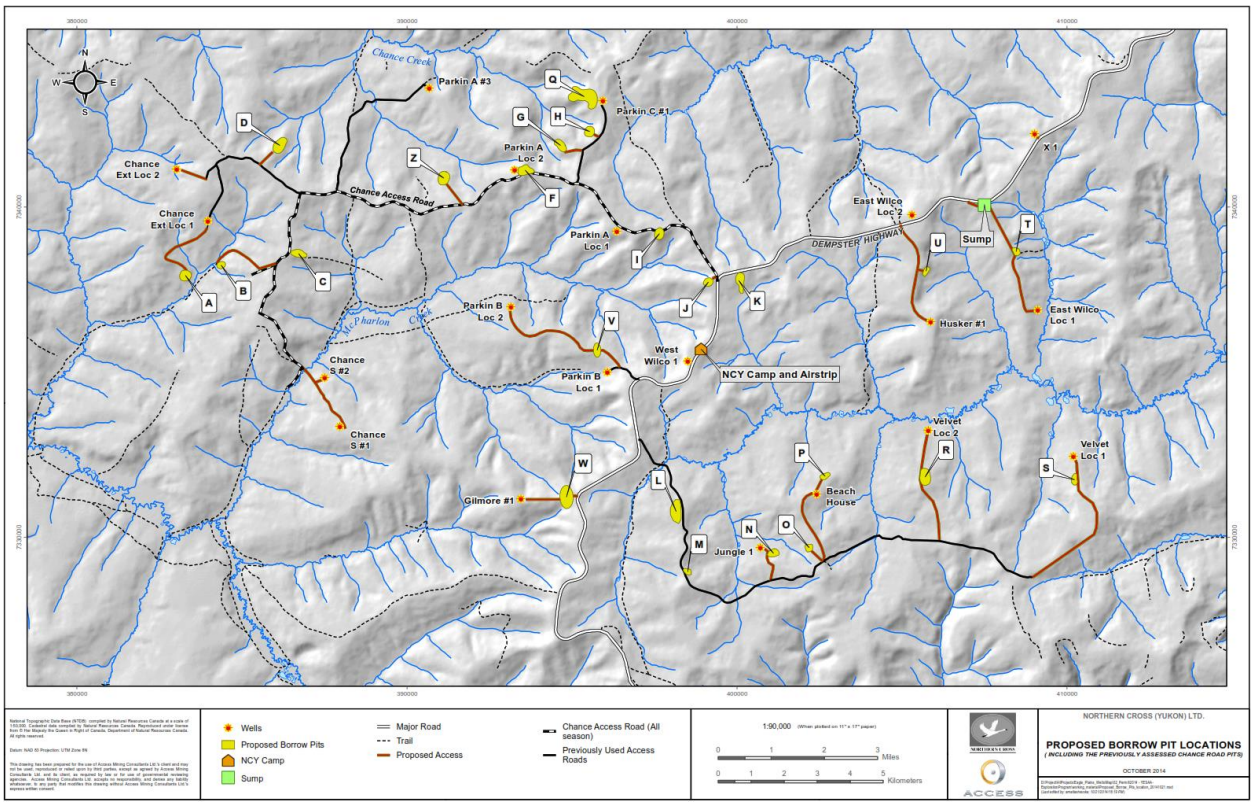

Figure 1.10 Borrow Pit Locations

The Proponent intends that initial access to each well site will be acquired through winter construction of an ice road and placement of rig matting for drilling the well. If the well is successful in finding testable hydrocarbons and it is determined that flow testing will take place, an all-weather road will be constructed. Design and construction of each all-weather access road will only occur once the well has been drilled and a determination has been made whether flow testing will take place. Details of the design of each specific access road including sources, volumes, lifespan, environmental conditions, and closure planning will be provided to regulators prior to construction.

Materials for construction of the access roads will be sourced by drilling the alignment of the proposed access road to each well site to determine the depth of overburden and the geotechnical properties of the bedrock (sand/silt stone, shale, etc.). The general trend has been that those areas higher in elevation along ridges and the crests of hills have less depth of overburden, so materials will be sourced in those locations. There may be a requirement (if the overburden is too deep along the alignment) to source materials from a borrow source off alignment. Access roads will require 15 m^3 per m of road constructed plus pullout and drill pad requirements.

The borrow site locations were determined using lithological data gathered from the shot holes drilled as part of the 2014 3D seismic program. Borrow sites will be accessed in March to April of 2021 when sufficient well results are known to merit access. Summer access could be anytime from May to October any year. Fill sources will be located along the road alignment at those locations identified through drilling at which

lesser amounts of overburden will be required to be excavated. The potential life span of the access will be determined by the drilling and any EFT results. The access life span has the potential to be as long as the life of the well. The closure plan will follow the previously submitted plan. Subject to road design, drill samples will be identified to determine the depth of bedrock of the borrow sources adjacent to the proposed road alignment, and information will be taken from the 3D seismic program.

Organic cover will be removed, and stockpiled for reclamation purposes, using a large crawler tractor. Underlying silts will be excavated by ripping and dozing with a large tractor and stock piled separately for reclamation purposes. Bedrock that consists of siltstone and sandstone or shale (depending on the difficulty of using large equipment, it may be necessary to drill and blast) will be excavated with large excavator and or dozer. The excavated material will be loaded directly from the borrow pit for use in the construction of roads. There will be no water pooling; borrow sources will be constructed to prevent water pooling. Any blasting will be performed by a certified experienced blaster according to all applicable Yukon regulations. The necessary metal sulphides required for acid rock drainage are not present because the borrow sites contain sedimentary rock. To date, acid rock is not known to exist in the Eagle Plains area.

For the purpose of the current assessment the following volumes are expected to be sourced, with the preference to source materials along the alignment. (See **Figure 1.10** and **Table 1.4**).

Borrow sources will be decommissioned when the Proponent deems them no longer useful or necessary for the Project. Decommissioning is described in **Section 1.3.4.2** and will be carried out in accordance with the Decommissioning Plan.

Table 1.4 Borrow Source Material Required and Areas of Disturbance

Length and Volume of Pads and Roads

	Length	Volume	Pullouts	Well Sites	Totals	Borrow Source
Chance rd to Parkin A Loc 1	370	5550	0	21,600	27150	
Chance rd to Parkin C	2950	44250	1770	21,600	67620	
Chance rd to Parkin A Loc 2	450	6750	0	21,600	28350	
Chance rd to Parkin A	4950	74250	2970	21,600	98820	
Chance rd to Chance Ext Loc 2	4500	67500	2700	21,600	91800	
Chance Ext Loc 2 rd to Chance Ext Loc 1	1950	29250	1170	21,600	52020	
Chance rd to Chance S	3200	48000	1920	21,600	71520	
Dempster hwy to Parkin B Loc 2	5350	80250	3210	21,600	105060	V
Parkin B Loc 2 rd to Parkin B Loc 1	550	8250	0	21,600	29850	V
Dempster hwy to Gilmore	1700	25500	1020	21,600	48120	W
Dempster hwy to Velvet Loc 1	19250	288750	11550	21,600	321900	S,R,N,M,L
Velvet Loc 1 rd to Velvet Loc 2	3700	55500	2220	21,600	79320	R
Velvet Loc 1 rd to Beach House	2600	39000	1560	21,600	62160	O
Velvet Loc 1 rd to Jungle 1	1100	16500	660	21,600	38760	N
Dempster hwy to Husker	3500	52500	2100	21,600	76200	U
Dempster hwy to East Wilco Loc 1	4000	60000	2400	21,600	84000	T
Dempster hwy to West Wilco 1	0	0	0	0	0	
Dempster hwy to East Wilco Loc 2	100	1500	0	21,600	23100	U,K
Dempster hwy to X-1	250	3750	0	21,600	25350	T
Chance Road	21400	321000	12840	21,600	355440	
Totals	**81870**	**1228050**	**48090**	**410,400**	**1686540**	

Area of disturbance

	Length	Road	Pullouts	Well Sites	Borrow	Totals
Chance rd to Parkin A Loc 1	350	4550	0	14,400.00	925	19875
Chance rd to Parkin C	2950	38350	1180	14,400.00	7375	61305
Chance rd to Parkin A Loc 2	450	5850	0	14,400.00	1125	21375
Chance rd to Parkin A	4950	64350	1980	14,400.00	12375	93105
Chance rd to Chance Ext Loc 2	4500	58500	1800	14,400.00	11250	85950
Chance Ext Loc 2 rd to Chance Ext Loc 1	1950	25350	780	14,400.00	4875	45405
Chance rd to Chance S	3200	41600	1280	14,400.00	8000	65280
Dempster hwy to Parkin B Loc 2	5350	69550	2140	14,400.00	13375	99465
Parkin B Loc 2 rd to Parkin B Loc 1	550	7150	0	14,400.00	1375	22925
Dempster hwy to Gilmore	1700	22100	680	14,400.00	4250	41430
Dempster hwy to Velvet Loc 1	19250	250250	7700	14,400.00	48125	320475
Velvet Loc 1 rd to Velvet Loc 2	3700	48100	1480	14,400.00	9250	73230
Velvet Loc 1 rd to Beach House	2600	33800	1040	14,400.00	6500	55740
Velvet Loc 1 rd to Jungle 1	1100	14300	440	14,400.00	2750	31890
Dempster hwy to Husker	3500	45500	1400	14,400.00	8750	70050
Dempster hwy to East Wilco Loc 1	4000	52000	1600	14,400.00	10000	15950
Dempster hwy to West Wilco 1	0	0	0	0.00	0	0
East Wilco Loc 2	100	1300	0	14,400.00	250	15950
Dempster hwy to X-1	250	3250	0	14,400.00	625	18275
Chance Road	21400	278200	8560	14,400.00	53500	354660
Totals	**81850**	**1064050**	**32060**	**273600**	**204675**	**1512335**

Borrow Source Volumes from East side of Dempster

Borrow Pit	Volume	Areas	Roads
L	45,000	6,000	Dempster to Velvet 1 - 3 km
M	30,000	4,000	Dempster to Velvet 1 - 2 km
N	111,600	14,000	Velvet 1 road to Jungle 1 - 1.1 km plus Dempster to Velvet 1 road - 4 km
O	54,600	7,000	Velvet 1 road to Beach House - 2.6 km plus pit access 200m
P	4,500	5,000	Used if necessary, 300 m of acces to pit
R	142,000	18,000	Velvet 1 road to Velvet 2 - 3.7 km plus Dempster to Velvet road - 4.2 km
S	111,600	14,000	Dempster to Velvet 1 Road - 6 km
T	116,950	15,000	Dempster to East Wilco plus Dempster to X-1
U	60,000	8,000	Dempster to Husker plus 500 m pit access
V	135,000	17,000	Dempster to Parkin B Loc 2 plus Parkin B road to Parkin A
W	48,000	6,000	Dempster to Gilmore 1

*All volumes, areas and distances are in metres

1.3.3.3 Central Processing Facility

The camp's Central Processing Facility (CPF) will comprise additional multi-stage and multi-phase separators, heater treaters (to help remove remaining amounts of emulsified formation water), vapour and gas collection system, and possibly central power generation facility to power all discrete well batteries. Separated water will be further treated to remove any hydrocarbons, scale, anaerobic bacteria, and other colloidal or suspended solids ready for disposal in a suspended well nearby following in a pre-approved process. The CPF will be located at the furthest (southernmost) point away from the camp for safety of the camp and its occupants. Having the CPF at the far end of the camp area will ensure trucks can turn around and exit safely without encroaching on any other activity or building. This should also ensure the camp remains upwind from the CPF.

The CPF will have enough storage to contain produced crude oil for loading onto longer distance trucks ("B" trains) and hauling to a pre-approved market site in British Columbia, Alberta, or possibly Alaska. It is estimated that the CFP will accommodate approximately 10 days of storage capacity for crude oil at an approximate daily rate of 2,000 barrels of oil per day or total 20,000 barrels. The volume (stored in up to 5 surface tanks in full compliance with Yukon and Canadian standards and regulations) also ensures the safe crude stabilization before loading onto southbound trucks. In terms of maintenance, the only treatments appearing necessary at this stage of design are fluid separation (to separate oil from gas and water into 3 distinct streams), heat treating the crude to remove water remnants from the separated crude, and gas dehydration to make the gas useable as a fuel.

1.3.3.4 Airstrip

The Proponent will construct an airstrip located along the existing Chance winter trail at a location approximately 4 km off the Dempster Highway. The airstrip will be approximately 1,500 m long and will be part of the road network west of the Dempster Highway. In the early years of the Project, this airstrip will likely be used only during the winter, but could graduate to year-round usage if discoveries support the investment. Until the Chance road airstrip becomes serviceable each winter, or at the end of the winter season operations when trail conditions deteriorate, the Proponent will continue to use the Dempster Highway adjacent to the camp as a periodic airstrip.

1.3.3.5 Transportation

For the majority of the exploration program, the Proponent will attempt to limit traffic on the winter access roads to authorized personnel. Traffic will include approximately 8 to 9 light-weight service trucks (for supplies and personnel), 1 water truck, and one fuel truck. The fuel and water trucks will come to the Project site approximately once per week or as demand dictates, and there will be occasional transport of drill cuttings from the well sites to the sump location. Air traffic estimated at 2 flights in/out per week (normal arrival times from approximately 10:30 a.m. to 12:00 p.m.).

A majority of the traffic volume will be related to mobilizing the drill rig and constructing the site infrastructure. As mentioned above, the setup of the well sites will take approximately 5 days to complete. Included in this amount, the drill rig will require 15 to 20 loads to mobilize. Unauthorized vehicles will not be permitted on the winter roads and the roads will be restricted from public access. The Proponent will be transporting crews using company vehicles; all vehicles will be equipped with radio communication and,

particularly during busy times (i.e., setup and demobilization), traffic will be radio controlled. For safety reasons, any personnel accessing the areas (i.e., winter roads) will be required to notify appropriate staff (i.e., security personnel and/or managers/supervisors) when they leave the Dempster Highway and when they arrive at the well sites. Access to the winter roads will be monitored by Chance staff hired as wildlife monitors/ security personnel.

A typical description of road traffic during the prime operating periods (January 1 to April 15; May 1 to December 1) is presented in **Table 1.5** below and road users will follow the Operations Activity Schedule introduced in **Section 1.4**.

Table 1.5 Typical Road Traffic during Prime Operating Hours

Table 3-4 Typical Road Traffic During Prime Operating

	Activity Description	Peak Traffic	Normal Traffic
1	Early Season Mobilization (Winter)	High	Medium
2	Rig Mobilization (Winter)	Very High	Medium
3	Winter Operating (Drilling)	Very High/High	Medium
4	Access Road Construction (Winter)	Very High	Medium
5	Summer Mobilization	Very High	Medium
6	Summer Rig Mobilization	Very High	Medium
7	Summer Normal Operating (Drilling)	Medium/High	Medium
8	Extended Testing Winter	High/Medium	Light
9	Extended Flow Testing Summer	Medium	Light

LEGEND:

Very High	More than 50 vehicles per 24 hour day
High Traffic	50 or more vehicles per 24 hour day
Medium Traffic	20-50 vehicles per 24 hour day
Light Traffic	Less than 20 vehicles per 24 hour day

The Proponent expects exploration drilling operations activities will range between medium and light traffic volumes. Crude oil produced during the flow-testing phases of exploration work, as described in this document, will be transported to an acceptable market.

Trucking of a stabilized crude cargo in specially constructed transporting tanks presents the same risk as transporting the diesel fuel required and used in Yukon. The process of loading and dispatching trucks at regular intervals will be planned and handled by professionals who will also maintain constant communication and GPS tracking of trucks as they travel down the Dempster and on other connecting routes to their destination. Trucking is by nature a very controlled process. Truck drivers are only permitted a fixed number of driving hours per 24-hour period and are expected to stop for refresher breaks at regular intervals. All their movements are accurately tracked through their onboard GPS, which can provide any truck's location to within a few metres anywhere in Canada or the USA.

The Proponent has practised Journey Management on its previous exploration drilling work at Eagle Plains. In this instance, any unit transporting materials to Chance's camp 325 will be called and tracked periodically by its company dispatcher. The exact location when reaching certain pre-determined check points will be relayed to Chance camp management and Logistics coordinator; this will ensure road safety for the truck driver and other road users and safety of the vital cargo and provides critical planning information for receiving staff to plan for offloading its cargo and possibly loading backhauls.

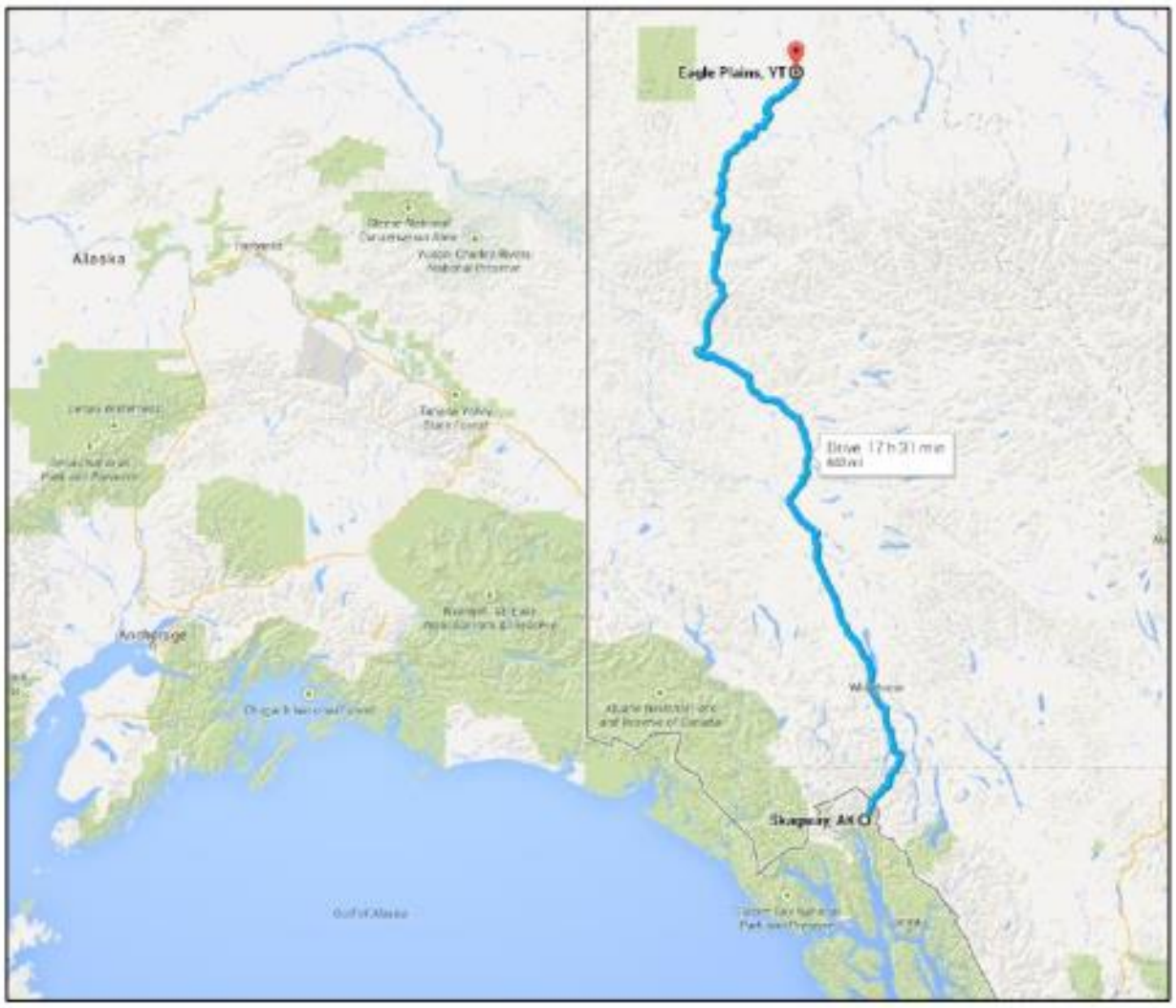

Figure 1.11 Typical Export Truck Route to Skagway, Alaska

Figure 1.11 illustrates one of the possible export truck routes to Skagway Alaska. The journey distance is 1,029 km from Eagle Plains to Skagway. The journey duration is approximately 17.5 hours driving at an average speed 59 km/hr. Other options exist, which include delivery by truck to terminals in Fort Nelson and Fort St. John, British Columbia, or Grand Prairie, Alberta. Depending on which of these options is used, the driving times will vary but the management procedures will remain the same.

The Proponent and its trucking contractor(s) will develop and Alert and Emergency Response Plan to address any incident or accident while in transit on Yukon roads and highways. The same plan will also address any other Provincial routes and routes within the United States border. All reputable trucking contractors versed with transporting flammable liquids and petroleum products in general are mandated to follow the Transportation of Dangerous Goods Federal Legislation. The legislation dictates such activities as how truck contents are identified on the outside of the tank; how the tank is installed on the truck body and strengthened; the level of knowledge and training the driver and any assistant travelling with them must

have to be eligible to operate the particular truck; and the spill response equipment needed to be readily available. Ensuring the truck is safety-checked and the drivers are qualified and adheres to their company's safety policies are the key means of preventing an incident or accident. Tracking the drivers to check on transit speed on a real-time basis means the truck's progress is never neglected and the driver is on notice to observe all road traffic rules at all times.

All incidents affecting the Proponent's trucking contractor are reported back to Chance Operations Management and form part of the Proponent's safety statistics. Every incident is investigated and the causes for each occurrence are closely analyzed and discussed with the truck owner. Should any trucking contractor exhibit an undue number of close calls/near misses or a series of incidents with the same causes, they would be removed from the contract without delay and replaced with a more competent and safety-minded contractor.

1.3.3.6 Workforce

Work force requirements will vary over the life of the Project and will ultimately be limited by the existing camp capacity. During past drilling and seismic exploration programs undertaken between 2012 and 2014, the Proponent had no more than 75 to 80 people onsite at any one time. During drilling, the Proponent operated on a 24-hour clock with a 20-day-on and 10-day-off crew rotation cycle, which means that one-third of the crew was off duty at any point in time. For the seismic exploration program, the Proponent operated on a 12-hour clock and cycled the various services through as the program unfolded with only limited crew changes, mostly connected with the camp catering operation.

The Proponent has an arrangement with Northern First Nation groups and will have time to define their involvement to participate during this exploration program. It is Chance's objective to provide all available work and contracts to its FN/Yukon partners as identified in sec. 68 of YOGA. Chance was successful during its last drilling/seismic program hiring a workforce from the communities from Old Crow, Fort McPherson, Dawson, Whitehorse, and Inuvik.

1.3.4 Reclamation and Closure

1.3.4.1 MBC Sump Site Reclamation

Before the MBC Sump disposal site is opened, the top soil and the vegetative layer will be removed and stored separately from the lower subsoils. This material will then be re-applied after the MBC Sump has been covered by the 1 m of unmixed subsoil. This will bring the disturbed area back to its equivalent land capability. No further reclamation plan is warranted. The standard Directive 050 Drilling Waste Management (D50) plan (AER 2016) of action entails the following:

- The environmental monitor must be onsite during drilling to conduct D50 sampling to ensure that drilling waste is compliant and accurate records are being kept and respond to any spills that may occur.
- The environmental monitor will sample pre- and post-MBC.
- Upon completion of the Project, remote disposal locations will be covered with a minimum of 1.0 m of capping material and contoured to meet background topography.

- A Phase 1 Environmental Site Assessment (ESA) will be completed for each well and corresponding remote MBC location to identify any potential areas of environmental concern.
- If the Phase 1 ESA triggers a Phase 2 ESA, soil samples will be collected and analyzed at an accredited laboratory.
- If contamination is identified, a Remediation Action Plan will be prepared and upon approval, the remedial program will be completed. Once all contamination is addressed either in the Phase 1 ESA, Phase 2 ESA, or Remediation, a surface program including soil and vegetation will be conducted.
- Once vegetation is established, a Detailed Site Assessment; comparing soil lithology and vegetation onsite to offsite) will be completed.

For clarification, environmental monitors will be sampling the following, as per ref AER DIR 50; table 13.1 of this directive lists the Testing Requirements (AER 2016):

1. Receiving soil
    a. Electrical conductivity and sodium adsorption ratio
2. Waste (solids or total waste)
    a. pH, electrical conductivity, sodium adsorption ratio, Sodium (Na)
    b. Nitrogen (N), if additives/products added to the drilling mud/waste system contain any amount of N or if N content was unknown
    c. metals, if concentrations exceeding limits were added to the drilling mud system or if the metal content of additives/products is not known
    d. hydrocarbons, if a hydrocarbon flag was encountered
    e. toxicity, if toxicity data are unknown for any of the mud additives/ products used in the drilling mud system or if concentrations used exceeded pass threshold for luminescent bacteria toxicity test
3. Waste/soil mix (post-disposal)
    a. EC, SAR, and Na, if drilling waste EC > 10 dS/m or Na > 3000 mg/L (saturated paste extract or filtrate from oversaturated waste)
    b. metals, if concentrations in drilling waste exceed concentrations listed
    c. hydrocarbons, if concentrations in the drilling waste exceed concentrations
    d. N, if the nitrogen concentration in the drilling waste (wet weight) is ≥6 mg/kg for disposals in coarse soil or ≥120 mg/kg for disposals in fine soil.

Furthermore, in terms of soil sampling, commencing operations in winter does not necessarily mean sampling would not be possible or even preferable. Sampling can also be accomplished from the surface snow deposits around the well site. The Proponent selected lease dimensions to ensure there is a sizable perimeter for full containment of generated or airborne wastes from the Project.

The first task on any well site would be to construct the well pad or prepare the surface on which matting could be safely placed. The next step is to lay the mats on previously densified/well-trodden surface to render the suface as flat as possible. The final process, before deploying the drilling equipment, would be to undertake a professional geotechnical check on the stability of the surface and its resultant ability to

support the maximum anticipated loads with a suitable safety factor. Finally, the geotechnical engineer will provide a signed/stamped report attesting to the stability and strength of the facility for the work contemplated.

1.3.4.2 Well Decommissioning and Abandonment

As previously mentioned, the 30 proposed wells are part of an exploration program to help determine the oil and gas potential of the region. Depending on the outcome of results, a given well may be tested and additional plans developed to bring into production or be determined to be unproductive and require decommissioning and abandonment. As the Operator, Chance will always carry the full responsibility for all wells deemed to be its property. This responsibility can never be delegated to any other party unless and until such time the Proponent relinquishes ownership according to YOGA and its regulations.

Wells required for further operational uses such as producing wells, water or gas injectors will be maintained in a suspended state with an ability to be converted for use in the future. The Drilling and Production Regulations under YOGA have specific actions required from an operator to maintain a well in a suspended state; key among these actions is to periodically conduct inspections to ensure that the integrity of the well is intact. While in a suspended status, the regulator requires a sum of money be placed on deposit to cover the cost of abandonment and remediation of the site. Once abandoned, the status becomes permanent and there would not be an option to re-enter such a well.

The normal stages before decommissioning/abandonment of a well are as follows:

- The well is first determined as unusable.
- The perforations are first cemented by placing a cement plug below and above them and squeezing some amount of cement into the formations to permanently isolate them within the wellbore. A mechanical shut-off device called a bridge plug may also be wireline set above the cement plug to add protection or isolation.
- Higher in the production casing and below the estimated permafrost maximum depth, a second cement plug would be set. This plug is normally set on top of a bridge plug to ensure it does not leak down in the casing. The plug is also “felt” with a drill bit to confirm its existence and hardness.
- The casing at surface is cut 1 m below the original ground and buried under the soil to finally remediate the location entirely.
- The lease is remediated by removing fill material to restore the location to original status. The surface location would be revegetated with what is normally growing there in the first place.

When appropriate, a decommissioning/abandonment plan for the well sites will be developed that will comply with Part 7 of the Yukon Government Oil and Gas Drilling Regulations (Sections 95, 96, 97, 99). Wells would require final well abandonment according to the YOGA Drilling and Production Regulations. Wells would be sealed with cement, and casings would be cut off below ground level. The casing stubs would be buried below ground surface as required by the Regulations and a surface-visible sign would be installed for identification. The entire site will then be cleared of all debris and refuse. Finally, the site will be contoured, seeded, and left to naturally reclaim.

An outline procedure prepared by the Proponent in compliance with the YOGA Regulations is presented as follows:

- Seal off all perforations in the casings that are not already sealed with cement squeezes.
- Pressure test the casings to 7000 kilopascals (kPa) to confirm formations are isolated and sealed.
- Cut off the wellhead and casings to 1 m below ground level and weld/install plates to cover each casing string at surface.
- Install well identification marker visible above ground level.
- Bury the cut casings to complete the abandonment.

If the entire Project had to be suspended but not completed, the infrastructure would be preserved and maintained until the Project resumes. If it is decided for whatever reason to terminate the Project, then the infrastructure would be decommissioned. While operations are temporarily suspended, the Proponent will ensure access from the Dempster Highway will be barricaded and visually inspected periodically.

1.4 Project Phases and Scheduling

1.4.1 Project Schedule

The Project plan is to have all necessary permitting and approvals in place by the end of 2021 and begin drilling in December 2021. The construction of winter roads, drilling and testing of the first few wells is anticipated to occur during the winter (December to April) and summer months (May 1 to October 31), commencing in December 2021 with the first winter locations.

In the early years it is assumed that all wells will be drilled in the winter. Summer drilling might happen in future locations that are in reasonably close proximity to yet to be developed all-season access. Well priorities and their drilling order can only be best determined after the program commences and in response to drilling results and Chance corporate exploratory information gathering requirements.

The construction of the 400 m all-season access road to the MBC sump location is anticipated to occur in March 2022 and take not more than 2 weeks to complete.

The Proponent anticipates a period to elapse between confirming a discovery worthy of further evaluation and commencing the EFTs to allow time to properly design, fabricate, install, and commission the extended flow testing facilities. This period could be up to 6 months. If drilling is successful and significant hydrocarbons are discovered, the access roads would be upgraded to year-round access to undertake the EFTs. Year-round access to flowing wells is critical to daily well inspections and safety assurance of all operations.

The previously summarized scope of the Proponent's exploration activity can be expected to start as early as December 2021 and continue over a period up to 10 years to cover the various stages of drilling and extended flow testing of the wells. The actual execution of the EFTs could be phased depending on the nature of the discovery (e.g. natural gas versus crude oil) and the capacity of the base camp and the Eagle Plains Hotel to accommodate the necessary crews. Until there is more information about discovered resources, it is impossible to predict with any precision the full duration of the flow testing program. At least 8 wells could be tested in each year.

In summary, the chronological activities can be best described as follows:

1. Complete 3D seismic processing & interpretation (Chance Exploration rank prospects and establish company exploration objectives to meet Yukon Government lease commitments and CHANCE corporate objectives for exploration)
2. All preparations completed by December 31, 2021 (Seismic, YESAB, Well Licences, Camp, rig upgrade & certify, consumables and services, geotechnical prep work)
3. Prepare first location to mobilize Chance Rig #1 (start January 1, 2022 or soon thereafter)
4. Drill & test winter wells (possibly as many as 4; suspend operations April 15th ±)
5. Prepare for summer drilling (contingent on positive drilling results); ready to construct all-season access to next drill and test targets on schedule. Subsequent wells may be predicated on encouraging well results influencing more follow-up appraisal drilling
6. Continue drilling exploration wells in the remaining prospects to build on positive previous drilling results.
7. Identify wells with positive results meriting extended flow testing to acquire in depth reservoir information.
8. Design order/fabricate well site battery processing equipment in preparation for extended flow testing of selected wells.
9. Re-enter selected wells; install completion tubulars and other accessories, Christmas trees and ready for extended flow testing.
10. Install surface pumping equipment (standard pump jack device to lift the well fluids to surface); hook up well Flowline to well site battery (separator, flare system, crude oil storage tank and water disposal tank).
11. Supervise and operate well pumping, transfer stabilized (crude that has been allowed to “age” in atmospheric storage tanks; made safer for trucking) crude from tanks to truck for transport to the camp’s Central Process Facility.
12. Construct the camp’s Central Process Facility.
13. All vapour and gas removed from the well fluids will either be used for fuel to prevent storage tanks contents from freezing, generating electricity, pumped downhole in an approved manner or flared at site.
14. Progressively more wells would be drilled and brought on stream while extended flow testing and contribute to the accumulated fluid to be removed by trucks to a suitable market.
15. During EFTs flowing information would be gathered including bottom hole pressure profiles to learn about the reservoir flow characteristics and understand more about the prospect’s full development potential.
16. Development would become the subsequent phase of continuing operations. The nature and details of that operation will be described in later submissions as per the YOGA and regulations derived from it.
17. To complete the life cycle of a well, wells drilled, evaluated, tested and completed as part of a field development plan, would be either worked over and recompleted in the event of, for example, water ingress; or, if deemed not having future production potential, would be abandoned according to the YOGA Drilling and Production Regulations. In this instance, all previously perforated producing zones would be cemented shallower cement plugs would be placed and the casing at surface cut

to 1 metre below the normal ground surface. The surface lease would be fully remediated and restored to its original state.

18. The Proponent's future operating schedule for exploratory drilling assumes a continual, year-round program in order to benefit from the economies of scale of uninterrupted operations involving several wells rather than discrete ones with breaks in between. This will also contribute to a stable employment and goods and services market for Yukon residents servicing and supplying operations at Eagle Plains.
19. EFTs involve the flowing of a well or wells. There is no human intervention while wells flow unimpeded for the duration required for the test. In a multi-well producing field, for example, a maximum of three persons can handle all the production operator tasks of a field with 50 or more producing wells (double that number if working a 24-hour day). Field production operators visit each well at least once daily unless there is a need for other demanding work. They record flowing well pressures, ensure fluid pumps operate properly, have enough fuel to continue operating and visually inspect the facility for anything out of the ordinary.
20. The Proponent plans to have three operators managing the EFT wells in any 12-hour cycle. A second set of three will form the cross-shift making a total number of operators 6.

The sequence of wells is dependent on drilling success, discovery, weather and road conditions. The Proponent is continuing the ongoing process of interpreting seismic data in order to better understand the geological setting and size/geometry of potential prospects. Each well drilled will add to that understanding.

In summary: the Proponent will drill up to 30 wells sequentially over a period of 10 years starting in 2022. If a well is successful (i.e., if there is a discovery of crude oil or natural gas in sufficient quantities) the Proponent will conduct an EFT for a period up to 2 years on that particular well. There may be EFTs on up to 20 wells depending on the success of each well. The Proponent will drill one well at a time and up to 5 wells per year. Assuming all wells are successful and EFTs are conducted for 2 years at each well, there may be up to 10 EFTs being conducted at one time.

The schedule illustrates the breakdown as it is known at this time. The maximum time is estimated to be 10 years. The schedule does not account for operations interruptions owing to weather, geological re-interpretation, equipment breakdown or other delays beyond the control of the operator. A normal rate of drilling would be to drill one well at a time during this exploratory phase.

1.4.2 Construction Phase

The mobilization and Construction Phase of the Project is expected to commence in Q4 of 2022. Key activities during the Construction Phase are summarized by Project component in **Table 1.6**.

Table 1.6 Summary of Key Construction Phase Activities

Project Activity	Key Construction Phase Activity
Tree Clearing and Grubbing	Salvage to be completed prior to construction of the well pads and portions of the access roads (winter and all-season)
Road Construction	Completed as roads are required to access facilities and well pads

Project Activity	Key Construction Phase Activity
Quarry Development	Quarries will be developed based on volume of material required to build leases and roads.
Lease Construction	Topsoil and subsoil salvage and local stockpiling
	Lease pads will be constructed on an as-needed basis using material from nearby quarries
Main Camp	Camp will be used to house drilling crew
	Construction of the Central Processing Facility
Accessory Activities	Road construction and upgrades to roads as required
	Construction of an airstrip
	Vehicle traffic related to drilling and construction activities
	Transportation of production fluids to Central Processing Facility and to market
	Follow Blasting Mitigation Plan
	Water use permit for lease and road construction
	Baseline data collection and environmental monitoring
	Monitoring and establishing erosion control features for roads, leases, and the Central Processing Facility
	Updating and following the Emergency Response and Risk Management Plans, as required
	Following a Weed Management Plan for soil stockpiles and leases
	Maintaining and snow-clearing roads and leases for all-season access

1.4.3 Operation Phase

The Operation Phase will begin in Q1 of 2022 and will continue through to the end of 2031. The key activities occurring during this phase are summarized in **Table 1.7**. This section describes the main operational activities that will occur during the Operation Phase.

Table 1.7 Summary of Key Operation Phase Activities

Project Activity	Key Operation Phase Activity
Road Construction	Upgrade roads to all-season roads, with water crossings, as required. Road maintenance will be conducted, as required
Drilling	Up to 30 pads will be constructed and drilled for oil and gas products
	Remote sump access for drilling fluid waste disposal
	Excess drilling mud to be disposed of offsite at the remote sump
	Completing drill stem tests
	Acid stimulation and completion of wells for testing
Well Testing	Facilities to be installed, as needed, for testing and extended well tests
	Routine maintenance of facilities, as needed

Project Activity	Key Operation Phase Activity
	Gas is to be flared off, and oil placed in storage tanks
	Production fluid transport to Central Processing Facility and market
Accessory Activities	Road Maintenance
	Energy may include switching power generation from diesel generators to natural gas produced from the wells
	Updating and following the Emergency Response and Risk Management Plans, as required
	Water permit use for boilers during winter drilling
	Following Weed Management Plan
	Central Processing Facility to handle production fluids, disposal fluids and fuels
	Maintaining and snow-clearing roads and leases for all-season access
	Environmental Monitoring

1.4.4 Reclamation, Abandonment and Closure Phase

Reclamation, abandonment and closure activities will be detailed in a Conceptual Reclamation and Closure Plan. A summary description of key activities is provided below for the Reclamation, Abandonment and Closure phase are described in **Table 1.8**.

Table 1.8 Summary of Key Reclamation Phase Activities

Project Activity	Key Reclamation Phase Activity
Well Abandonment	Wellheads will be abandoned when testing or production phases are complete
	Testing or production facilities are to be removed from each site
MBC Sump Site Reclamation	Site will be reclaimed as per Directive 50
Central Processing Facility	Upon complete field decommissioning activities, the removal of the Central Processing Facility will occur
Well Site Reclamation	Imported material will be removed, and area reclaimed to natural conditions, as much as possible
	Revegetation of disturbed areas to natural conditions and follow-up monitoring
Infrastructure Decommissioning	Water crossings will be removed
	Appropriate sloping and seeding to prevent erosion and scarification to encourage revegetation
Borrow Source Reclamation	To be reclaimed as soon as materials are exhausted or no longer required
	Revegetation to natural conditions and follow-up monitoring
List Accessory Activities	Discussions with YESAB (and other Regulators, as necessary) prior to reclamation work to determine whether there should be changes to the Plan
	Updating the Reclamation Plan to meet new criteria, if required
	Following Weed Management Plan until sufficient revegetation has occurred on reclaimed sites

Project Activity	Key Reclamation Phase Activity
	Annual monitoring until vegetation regrowth deemed satisfactory
	Soil Detailed Site Assessment prior to seeding
	Conduct a Phase 1 Environmental Site Assessment for each location
	Potential Phase 2 environmental assessments of soil and groundwater
	Obtain Regulatory Closure

1.5 References

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Fisheries and Oceans Canada (DFO). 1995. Freshwater Intake End-of-pipe Fish Screen Guidelines. ISBN 0-662-23168-6. Catalogue No. Fs23-270 / 1995E. Available at www.dfo-mpo.gc.ca/Library/223669.pdf. Accessed June 2019.

Matrix Resarch Ltd. Heritage Resource Overview Assessment for the 2013 Seismic Program, Eagle Plains, on Behalf of Northern Cross (Yukon) Limited. 2013

Yukon Environmental and Socio-economic Assessment Board (YESAB). 2005. Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions. Available at http://www.yesab.ca/wp/wp-content/uploads/2013/04/Proponents-Guide-to-Info-Requirements-for-EC-Project-Submission.pdf. Accessed June 2019.

Yukon Environmental and Socio-economic Assessment Board (YESAB). 2016. Dawson City Designated Office Evaluation Report – Eagle Plains Multi-Well Exploration Program. Project Number: 2014-0112.

APPENDIX 2-B-62. Residents of Communities Record of Contact

Residents of Communities Record of Contact (January 1, 2014 - January 1, 2024)

Reference	Date	Communication Method	Location	Community Open House Attendees	Subject	Summary	Additional Comments	Attachments
VG0207	15-Jun-14	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 4:00 pm - 7:00 pm. Chance shared Project information by presentation. Chance provided dinner and door prizes.	N/A	210607_Chance_OldCrow_June15OpenHouseFlyer
VG0237	16-Jun-14	Community Event	Whitehorse	Residents of Whitehorse	Community Event	Chance held a community open house event in Whitehorse at the Yukon Inn from 4:30 pm - 6:00 pm. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided an open house survey to get feedback to improve future engagement with the community.	N/A	Open House Advertisement June 2014.pdf
VG0209	16-Jun-14	Community Event	Whitehorse	Residents of Whitehorse	Community Event	Chance held a community open house event from 1:00 PM to 2:00PM MST at the Vuntut Gwitchin First Nation Whitehorse Office at 3A-508 Hansen Street.	N/A	20140616-VG0209
NND0128	17-Jun-14	Community Event	Mayo	Residents of Mayo	Community Event	Chance held a community open house event in Mayo at the First Nation of Na cho Nyäk Dun Multi-Purpose Room from 10:00 am - 12:00 pm. Chance shared Project information by presentation and held a question-and-answer period after. Chance provided lunch to the residents of Mayo.	N/A	Mayo Open House Notice for June 17 2014.pdf Open House Advertisement June 2014.pdf
VG0210	17-Jun-14	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Old Crow Community Hall from 4:00 pm - 6:00 pm. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided dinner to the residents of Old Crow.	N/A	Old Crow Notice for June 17 2014.pdf Open House Advertisement June 2014.pdf
TH0099	18-Jun-14	Community Event	Dawson City	Residents of Dawson City	Community Event	Chance held a community open house event in Dawson City at the YOOP Hall from 4:00 pm - 6:00 pm. Chance shared Project information by presentation and had a question-and-answer period after.	N/A	Dawson City Open House Notice for June 18 2014
VG0238	03-Sep-14	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 3:30 pm - 7:30 pm. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided juice boxes and packaged sandwiches to the residents of Old Crow.	N/A	200826_Chance_OldCrowOpenHouseFlyerRevised.pdf
E01252	06-Jun-19	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community dinner in Old Crow at the Community Hall. Chance presented the draft Project Description, as well as the transition from Northern Cross to Chance Oil and Gas Limited, seismic techniques, YESAB process, YESAB's Executive Committee, consultation and engagement, and the Porcupine Caribou Herd.	N/A	E01252_190606_Chance_OldCrowCommunity_June6_SignInSheet.pdf E01252_190620_Draft_June6_VGCommunity-ChanceMeetingsummary_v.0.3.docx
E01254	19-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01255	20-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01253	21-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01256	22-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01257	20-Apr-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Meeting summary not available at time of submission.	N/A	E01257_210430_Chance_OldCrowOpenHouse_April20_SignInSheet.pdf
E01258	21-Apr-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Meeting summary not available at time of submission.	N/A	E01258_210430_Chance_OldCrowOpenHouse_April21_SignInSheet.pdf
E01259	18-May-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Meeting summary not available at time of submission.	N/A	E01259_210521_Chance_OldCrowOpenHouse_May18_SignInSheet.pdf
E01260	13-Oct-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 4:30 pm - 7:30 pm. Chance shared Project information by presentation. Chance provided a dinner and door prizes.	N/A	E01260_211101_Chance_OldCrowOpenHouse_Oct13_SignInSheet.pdf E01260_211123_VGCommunity-Chance_Oct13OpenHouse_Metingsummary_v.0.4.docx

E01398	05-May-22	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Darius Elias Community Centre from 11:00 am – 7:00 pm MST. Chance shared information regarding the Project, heritage resources, permafrost, seismic testing, and wildlife studies.	N/A	E01397_220526_VGCommunity-Chance_May5OpenHouse_Meetingsummary_v.0.3.docx E01397_220505_VGCommunity-Chance_May5OpenHouse_Sign-inSheet.pd
E01384	26-May-22	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Darius Elias Community Centre from 10:00 am – 8:00 pm MST. Chance shared information regarding the Project, drilling techniques and equipment, YESAA and YESAB's Pre-Submission Engagement Process, linear features and disturbance, and water bodies in the Project area.	N/A	E01384_220606_VGCommunity-Chance_May26OpenHouse_Meetingsummary_v.0.5.docx E01384_220525_VGCommunity-Chance_May25OpenHouse_sign-inSheet.pdf
VG0098	10-Jan-23	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance went to Old Crow to witness the Swearing In Ceremony of the newly elected Vuntut Gwitchin First Nation leadership.	N/A	E01485 - Air North Yukon's Airline-Confirmation 23163751
VG0142	15-May-23	Community Event	Old Crow	N/A	Community Event	The Project Team travelled to Old Crow and planned to conduct an in-person community open house event. This event was cancelled due to a potential flash flood. Chance, with approval from Chief Frost, provided a catered dinner for leadership and community members at the Old Crow Community Centre.	N/A	N/A
VG0143	15-May-23	Community Event	Old Crow	N/A	Community Event	The Chance team travelled to Old Crow and the meeting ended up being postponed due to potential flooding of the community.	N/A	N/A
E0141852	16-May-23	Community Event	Inuvik	Residents of Inuvik	Community Event	Chance held a community open house event in Inuvik at the Nihtat Gwich'in Council Board Room from 4:00 pm – 8:00 pm MST. Six community members attended this event. Open house attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to open house attendees. This presentation included a question-and-answer period as well as a draw for two Air North tickets.	N/A	Summary Report
E0141852	17-May-23	Community Event	Fort McPherson	N/A	Community Event	Chance planned to conduct an in-person community open house event in Teetł'it Zheh (Fort McPherson). This event was cancelled due to flash flooding in the Teetł'it Zheh (Fort McPherson) area.	N/A	N/A
E0141852	17-May-23	Community Event	Fort McPherson	N/A	Community Event	Chance planned to conduct an in-person community open house event in Teetł'it Zheh (Fort McPherson). This event was cancelled due to flash flooding in the Teetł'it Zheh (Fort McPherson) area.	N/A	N/A
VG0236	06-Dec-23	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a World Cafe event in Old Crow at the Darius Elias Community Centre from 4:00 pm – 8:00 pm MST. World Cafe attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to World Cafe attendees. After dinner, technical experts from EDI, Ecofor, and Palmer were divided amongst the groups. Focus group #1 had a presentation from EDI on Wildlife and Fish and Fish Habitat. Focus group #2 had presentations from Ecofor and Palmer on Archaeology / Heritage Resources and Permafrost. Once presentations and comments/concerns were addressed, the technical experts switched tables and presented to the rest of the attendees. The World Cafe event had door prizes that were drawn throughout the event which included 2 Air North gift cards, 3 Co-op grocery gift cards, Ecofor packages, and a mug from Indigo.	N/A	Summary Report

GTC0220	07-Dec-23	Community Event	Fort McPherson	Residents of Fort McPherson	Community Event	Chance held a community open house event in Fort McPherson at the Tetlit' Zheh Fort McPherson Hamlet Chamber from 4:00 to 8:00 pm MST. Open house attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to the Open House attendees. The Open House event had door prizes that were drawn throughout the event which included 2 Air North gift cards, 2 Co-op grocery gift cards, and Ecofor packages.	N/A	Summary Report

APPENDIX 2-B-63. April 24, 2018 Letter

Meeting Title: Gwich'in Tribal Council, Tetlit Gwich'in Council, and Chance Oil and Gas Limited Meeting

Date: April 24, 2018

Location: Gwich'in Tribal Council Office, Inuvik, Northwest Territories

Attendees:

Gwich'in Tribal Council (GTC) and Tetlit Gwich'in Council (TGC)

Grand Chief [redacted]

[redacted], President of Tetlit Gwich'in Council

[redacted] Director of Lands and Resources (GTC)

[redacted], Transboundary Specialist (GTC)

[redacted], Director of Intergovernmental Relations (GTC)

[redacted] Chief Operating Officer (GTC)

Chance Oil and Gas

[redacted]

Hemmera

[redacted]

Introduction: Purpose and Objectives

Meeting Objectives:

- Introduce team members and discuss roles and responsibilities;
- Share information on Chance's exploration interests; and
- Allow opportunities for participants to share their views on what they would like this relationship and engagement and communication plan to look like.

Key Outcomes for Chance:

- Agreement to work together on an engagement and communication plan (plan);

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- Identification of team members to lead on developing the plan;
- Identify next steps for completing the plan; and
- Understand the Gwich'in Tribal Council relationship with the Tetlit Gwich'in Council and the Teetl'it Gwich'in Council.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
GTC to update Chance when the GTC and Yukon Government Communications Protocol has been finalized	GTC	TBD
Send [redacted] the study on caribou done by [redacted]	C. Dickson	ASAP
Hemmera to send a draft Engagement and Communication Plan to the GTC and the TGC	K. Constable	ASAP

Meeting Outcomes:

Meeting Outcome	Responsible Party	Date Required
Chance to consider linear disturbance related to effects on wildlife and predator/prey interactions in a future project proposal	Chance	In the future should Chance pursue defining and assessing a project.
Chance, the GTC, and the TGC to work collaboratively on one Engagement and Communication Plan	All	Near future
Tetlit Gwich'in Council, the Designated Gwich'in Organization, is the appropriate party for Chance to engage and the Teetl'it Gwich'in Council is not; however, Chance should	Chance	Ongoing

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inform them of updates as a courtesy.		

Discussion of Key Topics:

Chief [redacted] and [redacted] explain the Gwich'in Tribal Council (GTC) organizational structure and notes that [redacted] is the contact and president of Tetlit Gwich'in Council (TGC), not Chief [redacted] of Teetl'it Gwich'in Council. Teetl'it Gwich'in Council is the band under the Indian Act in Fort McPherson; the TGC is the Gwich'in Designated Organization (DGO) in Fort McPherson and is the body responsible for the Gwich'in land claim. [redacted] explains that this is the same for each Gwich'in community; there is one DGO and one Indian Act Band, and the GTC is working on a communications protocol with Yukon Government to help clarify this and other matters. [redacted] will update Chance when this protocol is finalized. [redacted] expresses Chance's appreciation for the explanations regarding the GTC and TGC, noting that Chance wants to make sure that engagement is respectful of the GTC and TGC's protocols.

[redacted] thanks the GTC and TGC for inviting Chance to meet with them and references the previous meeting that took place between Chance and the GTC, which was when Chance was in the Yukon Environmental and Socio-economic Assessment Board (YESAB) process. Chance is not in the YESAB process at this time and is looking to establish an engagement and communication protocol as a framework to support discussions about Chance's activities now and into the future. [redacted] describes the history of Chance and describes the historic wells that have been drilled for oil and gas exploration in the Eagle Plain basin by other companies, mainly in the 1960s. Chance has tested these historic wells as part of their previous oil and gas exploration work and the crude oil from these wells was used to power the Whitehorse Generator for about 18 hours. During the economic downturn, Chance was invested in by the Chinese National Offshore Oil Company and Chance performed a seismic program that covered 325 km^2. Information from this program contributed to Chance defining a 20 well exploration program, which was submitted to YESAB and did not complete the YESAB process. Chance will not be pursing this plan any longer.

[redacted] provides an overview of the Chance oil and gas dispositions map, explaining the difference between the significant discovery licenses in red and the and exploration permits in yellow; exploration permits have an expiry to the tenure, where permits 12 – 17 will expire in August 2018 unless they are extended, and permits 19 and 20 will expire in 2019 and 2020. Significant discovery licenses have indefinite tenure. R. Wyman explains that the work done to date by Chance has been within permits 20, 13, and 19, and it is likely that future work would be focused in those areas and perhaps in permits 14 and 12 as well. The Tetlit Gwich'in Primary and Secondary use areas are noted in respect to Chance's permits, as well as where the Peel Watershed is.

[redacted] describes how Chance is currently in the exploration phases of work and would need to understand the oil and/or natural gas resource in the region before progressing to the project phase.

The goal would be to support a local market and provide value-added services to what is extracted in the region. Yukon currently imports 200 – 300 million litres of diesel per year, so Chance has the goal to offset that. Currently, there is about 2/3rds of the diesel coming from America and 1/3rd of the diesel is coming from Alberta. Chance would not propose hydraulic fracking, as Chance would not pursue resources in the kinds of rock that would require fracking to extract it.

Chance is once again a 100% Canadian owned company, [redacted] notes, with [redacted] as the majority shareholder, who has also been involved with Chance for the past 12 years. [redacted] is an exploration geologist who has worked in the Mackenzie Delta and Eagle Plain region for many years, starting his career in these regions. [redacted] notes that Chance has established the Community Relations Committee of the Board, which is meant to provide a direct line of communication between the board and communities.

[redacted] notes that regarding tenue, the devolution process in the Northwest Territories that has occurred has resulted in changes to the tenure of old significant discovery licenses, which are usually indefinite tenure, where the cost of retaining the old significant discovery licenses is higher so that proponents must act on them and adds that Yukon might also be considering this.

[redacted] notes how Chance had submitted an application for 20 exploratory wells to YESAB and heard through the YESAB process that access was an issue, as YESAB was assessing the proposed work as all 20 sites being opened for access at once, but YESAB wanted Chance to only open up access to a few wells at a time; [redacted] asks if this is why the YESAB assessment of the 20 exploratory wells went awry? R. Wyman explains that YESAB's main reason for promoting Chance's proposed 20-well exploration project from a District Office level review to an Executive Committee Screening is due to the need to assess the effects of increased access on caribou, which was a key concern raised by Yukon First Nations. YESAB did not direct this concern in a straightforward manner to Chance, so the reason for decision came as a surprise to Chance. [redacted] notes that there is the North Yukon Land Use Plan (NYLUP) implemented in the area that Chance's dispositions are, which has zones of influence and best management practices associated with it.

[redacted] notes that Chance is in the Eagle Plain Basin region because of the NYLUP, and Chance's proposed works when they submitted to YESAB was in an area called Zone 4, which is designated for the highest level of development. Tr'ondëk Hwëch'in, the First Nation of Na-cho Nyak Dun, and Vuntut Gwitchin First Nation were very involved in the NYLUP development. [redacted] adds that Chance and Vuntut Gwitchin are on their second draft of an engagement and communication plan (plan) currently.

[redacted] explains the framework that Vuntut Gwitchin and Chance have developed for the engagement and communication plan, describing how the plan accounts for discussions that might need to happen in the future, but are too early to have now, such as capacity funding discussions or a Traditional Knowledge and Traditional Land Use Study. [redacted] notes that a Terms of Reference for the Community Relations Committee of the Board is being developed with Vuntut Gwitchin's input as well.

[redacted] notes that he thinks one committee is a good idea, as it is good for the community to have access to the Senior Board, and asks if Chance would have a Memorandum of Understanding with each affected Nation? [redacted] reply that it would be an engagement plan with each Nation that Chance is seeking to develop. [redacted] comments that Yukon Government is also pursing an engagement protocol with the Gwich'in Tribal Council and that there might be bilateral working groups.

[redacted] comments that Chance is sensitive to what is happening in Alaska as well and wants to make sure that everyone is heard. The YESAB District Office experience was not good for Chance in the past, and Yukon is very accustomed to mining projects but not to oil and gas projects, and YESAB's review and commenting process contributed to the public perception that Chance was proposing something that isn't allowed in the Yukon, when realistically, this is a planned activity in the Eagle Plain Basin per the NYLUP and in the Vuntut Gwitchin Final Agreement. [redacted] describes his experience as a Vuntut Gwitchin representative during the NYLUP development process, and this process resulted in over 60% of Vuntut Gwitchin Territory being protected. [redacted] notes that he is personally invested in making sure that anything Chance does is done right, including laying the information out properly for an effective YESAB review process and ensuring that the community is informed by Chance about what is being proposed, as in Chance's most recent YESAB experience, there were other organizations providing false information to community members and further perpetuating a negative perception of Chance's proposal.

[redacted] adds that it is important to Chance that they also work as a company to get communities to a place where they have the capacity to provide services to Chance. YESAB portrayed Chance's previously proposed exploration drilling program as large, but it is not large as the wells are proposed to be drilled in succession, not all at once. This way, if Chance were to drill a well that resulted in failure to produce a resource at that site, then Chance would not pursue nearby drilling targets and cross those off the plan. Chance's ultimate goals are to keep a future exploration drilling program small-scale and ongoing over a longer period of time; the general plan would be to drill a few exploration wells, analyze the results, then plan the next drill sites accordingly. This type of process means that there's more opportunity for building capacity over time and it means that the footprint is kept smaller as well.

[redacted] notes that the landscape itself is important to First Nations people, so any impacts to the landscape are felt. For example, the 325 km of seismic line that Chance did affects people, as they drive by the site on the Dempster Highway they see it and are shocked. [redacted] highlights the effects of linear disturbance on predator and prey interactions is a key concern for the community, which has been studied in Alberta, and asks that Chance consider how predators use linear disturbance in any future assessment and project. [redacted] replies that Chance's field crews did meandering seismic lines to minimize disturbance and the field crew noticed animals using the lines to move around. G. Charlie explains that Chance's wildlife experts are EDI Dynamics, based in Whitehorse, and that Chance recognizes that there will be a footprint that results from anything that Chance does on the land. [redacted] offers to send a study done by [redacted] on caribou. [redacted] notes that all of the GTC's points are well-taken, and that this is why having an Engagement and Communication Plan to provide a

framework for these discussions in the future will ensure that the information is flowing as easily as possible.

[redacted] discusses Chance's future employment and contracting sourcing, asking if there are skills and services more easily sourced from the south, and if the remaining skills and services can be capacity to be built within the communities? [redacted] replies that there are short-term services that will be needed, but it is not recommended that First Nations pursue building capacity there. The best opportunities for First Nations are to do camp maintenance, catering, and operations, as these last for a long period of time. Drilling would be an opportunity, but the rigs would need to be moved around after Chance's program concluded to BC or Alberta to pursue opportunities, so it would take those people away from their homes for work. Construction, building the winter trail and maintaining it, are also good opportunities for locals. R. Wyman goes on to explain more opportunities for steady, longer-term work. [redacted] notes that the GTC is interested in training and capacity building, and asks what time-frame the resource would have? [redacted] explains that there are a lot of factors that would feed into that, and there are many conditions that need to be satisfied before Chance can get to a point where they would know this. The dream is to have decades of resource pulled from multiple sites, and technology has changed so much that the environmental footprint of Chance's activities are greatly reduced compared to a few decades ago. [redacted] notes that he lived in Alberta and people cycled in and out of core activities, so this can be an opportunity for community members to do seasonal work as well. [redacted] notes that Canadian oil and gas work is seasonal, this is the nature of the landscape.

[redacted] asks about the 3000 km supply chain for drilling services, looking for more information. R. Wyman explains that many drills are in Leduc, some are in northern BC. The closer you get to the Yukon, the more broadly you will have to source the drilling services you need as a proponent. G. Charlie adds that most Yukon services are geared towards mining.

[redacted] goes on to describe how oil and gas development is not on the forefront of Yukon Governments mind, and that Chance has heard from other First Nations that they have met with that an all-party meeting is a good idea to discuss matters of oil and gas development in the Eagle Plain Basin. [redacted] notes that this potential meeting could be a good opportunity for all parties to learn together and better understand Chance's objectives of oil and gas development in the region. It would also be a good time to discuss the topic from a political perspective, and from a sustainability perspective regarding the Porcupine Caribou Herd. [redacted] reiterates that Chance wants to make sure that the right information is getting to communities and that the communities are receiving opportunities. [redacted] notes that especially as a Vuntut Gwitchin Citizen she sees the need for jobs in Old Crow, as young people do not have any opportunities unless they work for government. [redacted] adds that in Old Crow he hears Elders speak about how settlement land parcels R7 and R8 are "money in the bank" for the next generation, and that Vuntut Gwitchin need to be stewards of the land and they have done that through the NYLUP; [redacted] notes that he respects the GTC's responsibility to the land and their people as well.

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[redacted] asks if the GTC has a mechanism for working with other First Nations? [redacted] explains that if there is an overall committee for a matter or with a proponent, then the GTC can be part of that for engagement on common issues; the GTC sees value in bilateral relationships and then working on specific issues in a different forum. [redacted] asks if there's a reporting requirement for Chance's dispositions? [redacted] explains that there's a reporting minimum in the Yukon Oil and Gas Act but Chance is looking to go above and beyond this requirement with the Community Relations Committee of the Board; [redacted] goes on to speak as a Gwich'in person that he would like to see a larger group with the GTC and other Gwich'in collaborating on opportunities. The Plan that Chance wishes to develop with the GTC and TGC will be a framework to support those conversations about economic opportunities as well. [redacted] notes that northern communities are well-positioned to provide services to Chance. [redacted] adds that the Plan will provide the framework for Chance and GTC, TGC to engage and build the relationship, as well as meet with communities.

[redacted] explains to Chance that [redacted] the contact for Tetlit Gwich'in Council, which is the appropriate body for Chance to engage with. [redacted] explains that Yukon Government directed Chance to speak with Chief [redacted], which was not correct, and Chance did try to discuss the difference between Teetl'it Gwich'in Council and Tetlit Gwich'in Council at the time. Grand Chief [redacted] notes for Chance to still pursue the meeting that Chance has in Fort MacPherson with Chief [redacted] and Teetl'it Gwich'in Council that evening and update them on this current meeting. [redacted] reiterates for Chance that when in doubt, go by the land claim – Gwich'in Tribal Council and the Designate Gwich'in Organizations are the bodies to work with as they represent the registered Gwich'in people, and confirms that the Ministerial Order is referring to the Designated Gwich'in Organization of Tetlit Gwich'in. [redacted] adds that Yukon Government's lawyers also have a different definition of Tetlit Gwich'in in their transboundary agreement, which may have contributed to confusion. [redacted] highlights that this further solidifies the need for an all-party meeting. Chief [redacted] agrees and notes that early engagement is also important because it allows time to work out these issues, and encourages Chance to engage early and consistently. Chief [redacted] notes that the GTC will participate in the North Yukon Chiefs meetings, but such a meeting hasn't been called in a while.

President [redacted] describes the changes to the board structure for Tetlit Gwich'in Council, noting that they have a new Executive Director and Community Coordinator, as well as a business development arm called the Rat River Development Corp. President [redacted] asks where in the development process Chance is, noting that he understands it as if there were a scale from 1 to 10, Chance sounds like it is at a 2. [redacted] notes that Chance isn't even at a 2 yet on [redacted] example scale and explains the history of the significant discovery licenses and what has been discovered in these locations. Based on those historic results, there could be resource elsewhere, and Chance needs at least one more phase of drilling to know if there's enough there to justify proposing production. G. Charlie adds that the vision is to provide local oil to the local market.

[redacted] asks where the potential consumer product would be produced in Chance's vision? [redacted] Replies that hopefully this is produced in the Yukon. Over 60% of the fuel used in Yukon is diesel

and the other portion is gasoline; gasoline is complex to make whereas diesel is simple to make. The diesel refining operation is essentially a still and the leftover products would be put back in the ground or used for industrial heating. There may also be natural gas in the Eagle Plain Basin. At this time, there is not enough to commercialize anything; part of exploration is to understand how the wells will form and how to maximize recovery though flow tests. [redacted] asks how many barrels of oil would need to be produced to make it economically feasible? [redacted] replies that it would be a few thousand barrels per day, adding the example of if 20 truckloads of diesel come into the Yukon per day, Chance would like to offset 10 truckloads.

[redacted] confirms that he and [redacted] are the main contacts for developing an Engagement and Communication Plan with Chance. [redacted] notes that Chance would like to have one collaborative plan with both the GTC and TGC; Grand Chief [redacted] and President [redacted] agree. [redacted] adds that it is the GTC's responsibility to keep other communities informed. [redacted] adds that there is an August 1 deadline for Chance on the Engagement and Communication Plan and that Chance is looking to work with GTC and TGC on this; [redacted] replies that Chance should send a draft for their review.

Attachments:

None.

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APPENDIX 2-B-64. January 22, 2015 Letter

Gwich'in Social & Cultural Institute

www.gwichin.ca

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Tel: (867)953-3613
Fax: (867)953-3820
[redacted] Heritage Researcher

Executive Director Office
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(867) 952-2238
[redacted] Executive Director

Language Office
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Fort McPherson, NT X0E 0J0
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(867)952-2433
[redacted], Language Manager

Research Office
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Yellowknife, NT X1A 1P3
(867)669-9743
(867)669-7733
[redacted], Research Director

Dawson Designated Office, YESAB
Yukon Y0B 1G0
Via email: dawson.do@yesab.ca

January 22, 2015

To Whom It May Concern,

Re: Eagle Plains Multi-Well Exploration Program - Northern Cross (Yukon) Ltd.

We have reviewed the above application against our heritage databases, and we have the following concerns.

1. There has been no Traditional Use/Traditional Knowledge study conducted, to the knowledge of the GSCI, with the Gwich'in participants who use this area or have knowledge of it. Without a traditional use study, the effects on traditional use cannot be assessed. In addition, integrating traditional and scientific knowledge into impact assessments is considered best practice, but traditional knowledge is held by land users and must be gathered in targeted studies. Traditional Use and Traditional Knowledge studies with Gwich'in participants are covered by a TK Policy (http://www.gwichin.ca/TheGwichin/traditional.html).
2. The GSCI has not been afforded the opportunity to fully review the development proposal against existing cultural and heritage data. This review would provide the proponent with more detailed information for use in planning and mitigation, and would be done at the cost of the proponent.
3. This project will contribute to climate change. Climate change is causing changes to the land (for example, retrogressive thaw slumps), the weather, and the animals upon which the Gwich'in depend for food. Climate change is affecting the ability of the Gwich'in to travel on and use the land for traditional pursuits.
4. The size of the project is of great concern to the GSCI. The high number of wells proposed, the establishment of new roads, in particular new all-season roads, are of particular concern.



As with any application, if archaeological or heritage materials are encountered during development within the Gwich'in Settlement Area, all work must cease immediately as required by law, and the appropriate authorities (including the GSCI) must then be contacted.

Sincerely,

[redacted]
Executive Director, GSCI

c.c.

APPENDIX 2-B-65. July 8, 2020 Memo

Hemmera
An Ausenco Company

MEMORANDUM

Date:	July 8, 2020
To:	[redacted], Gwich'in Tribal Council
From:	[redacted], Chance Oil and Gas [redacted], Hemmera
File:	104709-01
Re:	Response to Gwich'in Tribal Council Comments

Please see the Chance Oil and Gas response, outlined in the table below, to the Gwich'in Tribal Council comments and concerns on the Eagle Plain Well Maintenance Project sent on June 18, 2020. We would be happy to discuss if you have any further comments or concerns.

GTC Comments and Concerns	Chance Oil and Gas Comments and Approach
I – High environmental standards in the Peel River watershed and protection of scattered wetlands within the Land Management Unit (LMU) 7	
Part of the maintenance site is located in the northwest of the LMU 7 (Dalglish river) of the Peel watershed. And According to the Peel plan, Porcupine caribou use the entire unit, mostly as a migration route. It is also true for Moose as there are ribbons of high-value habitat along major creeks in the area. As such, GTC is concerned that the proposed maintenance activities will negatively affect the Porcupine Caribou migration and moose habitat. For this reason, GTC recommends hiring a wildlife monitor throughout the maintenance activities to ensure that Caribou migration is neither interrupted nor slowed by the structures which will be put in place.	Wildlife has been selected as a valued component for assessment in the project proposal. Chance will consider the effects of the well maintenance program on Porcupine caribou migration and moose habitat. In addition, Chance will have a wildlife monitor on-site during construction of winter roads and during maintenance activities.
Related, the existence of high-value waterbird habitat along riparian areas, coupled with significant pockets of species of conservation concern, makes it compulsory for the proponent to adopt best practices that will help minimize surface and vegetation disturbance adjacent to water bodies.	The well maintenance program will not have negative effects on riparian areas. The program is designed to happen in the winter during frozen conditions. The construction and use of winter roads will minimize any effects to surface vegetation. In addition, winter roads follow the height of land avoiding riparian areas and water bodies. All activity is happening well away from riparian settings and there are no stream crossings associated with the winter roads.
As there are many water bodies and wetlands in the proposed project location, GTC is concerned by the impact of these activities, especially the effect of the construction of the 11 km new winter road on the permafrost/terrain stability	As noted above, the program is designed to happen in the winter during frozen conditions. The construction and use of winter roads will minimize any effects

and the local ecology. As mitigation measures for this ecological concern, GTC strongly suggests that proponent explores the use of other access methods according to the research recommendation #7 of the Peel Plan which states that: *"In order to avoid unnecessary road (or rail) building, the following research recommendation is provided: Research Recommendation #7. The suitability of large airlift technology now being developed and tested in the marketplace to enable remote access for industrial activities (e.g., Boeing's SkyHook™ Technology) should be examined in advance of any new road construction."* Peel Watershed Regional Land Use Plan, 2019, PP63.	to surface vegetation and permafrost. There should be no negative effects to vegetation or permafrost Additionally, the winter road construction is not anticipated to affect terrain stability. The winter roads will follow the height of land and will not require any grading or clearing of surface soils. Rather, a minimum of 10 cm will be built up and compacted to support equipment.
The proponent did not list Off-Road Vehicles (ORV) as part of the vehicle fleet to be used on the project site. However, as an area of the project location is in the Peel watershed, GTC would like to underline that the choice of not using ORVs on-site, especially M-59 in the Northwest of the LMU7, is consistent with the Peel Plan. And this, in its policy recommendation #13 states that: *"To prevent impacts on wildlife, soil damage and land user conflicts, the use of wheeled ORVs (e.g. quads, motorbikes and Argo-like vehicles) for any purpose, should be restricted to the Hart River Trail, existing trails in areas immediately adjacent to the Dempster Highway, licensed camps, and existing facilities"* Peel Watershed Regional Land Use Plan, 2019, PP62	Chance is not planning to use wheeled Off-Road Vehicles for this project. Chance may use snowmobiles for initial reconnaissance for trail construction and for wildlife monitoring.
II – Protection of Wildlife and Wildlife Habitats	
GTC is concerned about clearings and vegetation disturbance that will occur during the execution of the project as it can negatively impact wildlife (change of dynamics in the food chain) and wildlife habitat (disintegration, and perturbation). GTC advises the proponent to i) help support collection of information on amount and state of surface disturbance before and after the project and ii) reduce the number of clearings to the minimum and iii) do the reclamation of disturbed areas after maintenance on well site.	This project will require minimal vegetation clearing. Some vegetation clearing (primarily willows and shrubs) will be required to re-establish the winter roads and at the well sites. Chance will consider the impacts of vegetation clearing on wildlife and wildlife habitat in the project proposal. The clearing of vegetation is restricted to the winter roads and the individual well sites.
Furthermore, GTC is concerned about the human land use-related disturbances such as noise, smell and light and would like to know what mitigation measures the proponent will put in place to reduce/avoid them. For example, bears and other wildlife can be attracted to the project camp due to food smell or other attractants. This situation might lead to wildlife encounters and the killing of wildlife. The training of project personnel about eco-responsible practices to adopt to respect and protect wildlife and wildlife habitats is strongly recommended.	The overall project will use the minimal amount of work to re-establish the winter roads and do the required maintenance work. This will reduce disturbances such as noise, smell and light. While the project should not attract bears due to all activities occurring during the winter, the Chance camp is constructed in order to minimize attractants. For example, food waste is stored in secure areas so as not to be accessible to wildlife. Incinerators are present at the camp to burn organic material and reduce wildlife attractants.
In terms of transportation of personnel and equipment, using primary vehicles, Pickup trucks, Water trucks and the eleven flatbed truckloads, GTC expects the project team to make commendable efforts to minimize traffic and avoid unnecessary degradation of the soil and destruction of wildlife habitat.	Chance will minimize traffic to the Project and on the Project site so as to avoid effects to wildlife (e.g., restricted access and speed limits). Additionally, the design of the Project (e.g., re-establishing winter roads and work during winter) is intended to minimize and/or eliminate potential effects to value such as soil, permafrost, vegetation, riparian areas, and wildlife habitat

On a broader level, with respect to the proposed activities, GTC requires that the evaluation of the potential impact of the mobilization and demobilization of equipment on riparian zone should be incorporated in the environmental assessment of this project.	The well maintenance program will not have negative effects on riparian areas. The program is designed to happen in the winter during frozen conditions. The construction and use of winter roads will minimize any effects to surface vegetation. In addition, winter roads follow the height of land avoiding riparian areas and water bodies.
As for access management (new winter roads and previously existing roads), GTC is concerned that gating alone might not be enough and recommends the combination of gating and signage.	Winter roads are designed as single lane roads with periodic pullouts to let opposing traffic pass. Access will be controlled using strategies such as gating and signage as necessary while traffic will be controlled by radio communication.
III – Protection of the Environment, water quality, quantity and Potential Spills	
Concerning the current additional project information, there is a lack of details about the type of fluids that will be used for the Pressure Test and Wellbore fluid test. This information is needed to help determine the potential impact of this use on the environment. At the outset, GTC is worried about spills and the effect of fluid injection in geological formations on groundwater. GTC is requesting that the project detail outlines the risk level of each well, based on the type of fluid to be used, and a response plan when a spill occurs.	Chance will list the fluids and materials necessary for the well maintenance program. In addition, Chance will develop a spill response plan in order to minimize potential effects related to spills. Drip trays and other catchment equipment will be readily available and used during the operation to prevent even small spills.
To protect wetlands, GTC recommends that all clearings and storage (food, water, wastewater, fluid and fuel) should be located, at least 100m away from water bodies. The presence of scattered wetlands in the project location is an overriding reason to consider this recommendation. All personnel should be trained on spill reporting, and any spill must be reported to YG and the Affected First Nations governments right away.	All of the well sites are located at least 100 m from any water bodies. Chance will not store any materials outside of the well sites or the existing Chance camp. All personnel will be required to be familiar with Chance's spill response plan. Personnel trained in spill response will be onsite for the duration of the Project. In addition to spill response and cleanup, the spill response plan will include details on reporting requirements.
Besides, the use of water from Ogilvie and Eagle rivers is great concern as these watercourses might get contaminated through the pollutants that the water trucks can bring into these fragile ecosystems. Added to that, is the risk of the introduction of invasive species and hydrocarbons into these water bodies. Furthermore, GTC is also concerned that the frequency of trips to these two rivers may disrupt the original balance and stability of the soil and ecosystem of their banks. For these reasons, GTC is cautions against such use, especially the Ogilvie river that is part of the Wilderness Area in the Peel Watershed.	Chance will use best practices when withdrawing water from the Ogilvie or Eagle rivers in order to minimize effects related to values such as water quality, fish and fish habitat, and soil stability. This includes ensuring that water withdrawals do not result in release of contaminants (e.g., hydrocarbons) into water bodies. In addition, Chance will only use existing access and withdrawal sites in order to minimize the risk of erosion and sedimentation. In addition, daily water use is generally very low (~ 10 to 20 m^3) and recycling of fluid from one well to the next is possible. The peak water demand will be contingent on natural snowpack. Low snowpack will require more water use to be able to make snow for building winter roads and well sites. In the latter case, perhaps between 100 and 300 m^3 per day for short periods of time may be needed.
IV – Protection of Cultural Heritage Resources/Values	
[redacted]	Chance will follow all applicable legislation and rules with regards to protection of cultural and heritage resources. Chance also has a "Chance Find Procedure" in the event that archaeological or paleontological materials are discovered.

[redacted]	However, Chance does not anticipate any effects to cultural or heritage resources. The Project is occurring in areas that have already been used for the intended purpose (i.e., re-establishment of winter roads and use of existing well sites and camp). In addition, by completing the project during the winter months, Chance does not intend to disturb the ground surface or move any soils and surface materials.
[redacted]	Wildlife has been selected as a valued component for assessment in the project proposal. Chance will consider the effects of the well maintenance program on wildlife and wildlife habitat and will ensure mitigation measures are included in the project proposal. In addition, Chance will have a wildlife monitor on-site during construction of winter roads and during maintenance activities.
The area in general is also known for bald eagles.	Chance does not anticipate any impacts to bald eagles as the Project is occurring during the winter when daylight is limited and eagles are not present.
V – Economic Development Opportunities	
Employment opportunities • GTC could offer to provide leads for the positions of wildlife monitor relating to LMU 7 (Dalglish river) of the Peel watershed. • GTC could also provide leads for those who can provide Traditional Knowledge in relation to ▫ high-value water bird habitat along riparian areas, coupled with significant pockets of species of conservation concern ▫ training of project personnel about eco-responsible practices to adopt to respect and protect wildlife and wildlife habitat [redacted]	Chance welcomes the opportunity to have further discussions with GTC to understand and potential economic development opportunities.

• GTC could offer to provide leads to the proponent to contact Gwich'in who have appropriate training to collect information on amount and state of surface disturbance before and after project, as GTC advises.	
Business opportunities • Construction & maintenance of roads and sites, and reclamation of disturbed areas could be carried out by several Gwich'in registered businesses qualified for such work. They include:  • Many of the above businesses provide equipment rental services. GTC could obtain from the proponent a list of required machinery/equipment. GTC could request that local businesses have the opportunity to provide such rental equipment. There may not be an overlap of equipment required/equipment available locally, but it could represent an opportunity.	Chance welcomes the opportunity to have further discussions with GTC to understand and potential economic development opportunities.

APPENDIX 2-C. Vuntut Gwitchin First Nation and Residents of Old Crow Consultation and Engagement Records

APPENDIX 2-C-01. Open House Flyer

NORTHERN CROSS (YUKON) OPEN HOUSES

DATES AND LOCATION

Northern Cross (Yukon) Limited is hosting a series of information sessions across Yukon to present its plans for the next phase of exploration activities at Eagle Plains. These information sessions are open to the public to attend.

Using information obtained from the recently concluded 3D seismic program, the next phase of exploration activity is planned to be a targeted exploration drilling program. The format of the Open Houses will be a formal presentation by representatives of Northern Cross followed by a period of questions and answers. The entire management team at Northern Cross will be participating at the Open Houses.

June 16th	1PM - 2PM	Vuntut Gwitchin Beneficiaries Open House Venue: VGFN Whitehorse Office, 3A – 508 Hanson Street
June 16th	4:30 PM - 6PM	Whitehorse Open House Venue: Yukon Inn, Fireside South Room
June 17th	10AM - 12PM	Mayo Open House Venue: First Nation of Nacho Nyak Dun Multi-Purpose Room
June 17th	4 PM – 6PM	Old Crow Open House Venue: Old Crow Community Hall
June 18th	4 PM – 6PM	Dawson City Open House Venue: YOOP Hall

Northern Cross (Yukon) Limited

Whitehorse Office:
201 B, 1191 First Avenue
Whitehorse, YT Y1A 0K5
Telephone (867)456-7805
Cell (867) 333-0010

Calgary Office:
Suite 850, 700-4th Avenue SW
Calgary, AB T2P 3J4
Telephone (403) 699-0055
Fax (403) 699-0044

APPENDIX 2-C-02. June 2014 Open House Flyer

Chance
OIL AND GAS LIMITED

COMMUNITY OPEN HOUSE

Everyone is invited to learn about:

- **Chance Oil and Gas**
- **Eagle Plains Exploration Project**

A sit-down dinner and presentation will be provided at 5:30 PM.
Door prizes will be awarded throughout the evening.

Location	Date	Time
Chief Zzeh Gitlitt School Gym	June 15th	4:00 to 7:00 PM





APPENDIX 2-C-03. *Yukon First Nation Engagement and Communication Strategy*

[Northern Cross and First Nation Logos]

Yukon First Nation Engagement and Communication Strategy

1. **Key First Nation and Proponent connections**
    - **Chief and Council**
    - **First Nation Government department officials and advisors**
    - **First Nation Business Development agencies**
    - **First Nation Communities at large**
    - **Proponent Management and designated staff and advisors**

2. **Communication methods**
    - **In person meetings**
    - **Email and telephone**
    - **Website**
    - **Newsletters and reports**
    - **Frequency and intensity is flexible based on need**

3. **Communication content**
    - **Project information from proponent**
    - **Effective First Nation consultation to inform the proponent of issues and concerns**
    - **Community readiness and planning discussions to facilitate participation**

4. **Engagement elements**
    - **Terms of reference under which the parties operate**
    - **Cooperation, Communication and Engagement Agreements or MOU's**
    - **Business opportunities and partnerships**
    - **Equity ownership opportunities**
    - **Environmental stewardship partnerships**
    - **Training and employment opportunities**

5. **Record keeping**
    - **Meeting Agenda**
    - **Meeting Minutes**
    - **Invitee/Attendee lists**
    - **Contact log**

6. **Review and assessment processes to measure success of the strategy**

APPENDIX 2-C-04. Vuntut Gwitchin Government Engagement with Chance Oil and Gas Limited Letter

VUNTUT GWITCHIN GOVERNMENT
Government of Vuntut Gwitchin First Nation
CHIEF AND COUNCIL
P.O. Box 94,
Old Crow, Yukon
Y0B 1N0
Phone: (867)966-3261
Fax: (867)966-3116
Web: www.vgfn.ca

September 12, 2017

VIA EMAIL – rwyman@chanceyukon.ca

Chance Oil and Gas Limited
850, 700 – 4th Avenue S.W.
Calgary, AB T2P 3J4

Attention: Richard Wyman, President

Dear Mr. Wyman:

Re: Vuntut Gwitchin Government ("VGG") Engagement with Chance Oil and Gas Limited ("Chance")

Mahsi cho for your letter dated September 8, 2017 regarding an Engagement and Communication Plan.

We acknowledge and understand Order-in-Council 2017/37 which granted a 1-year extension to Chance's southern exploration permits subject to certain conditions, including the requirement for Chance to complete a First Nation engagement and communication plan before August 1, 2018. We note that the condition for a First Nation engagement and communication plan originated from Order-in-Council 2016/169 as a result of concerns, issues and shortcomings arising from Chance's past engagement with VGG.

We acknowledge the draft summary of such a First Nation engagement and communication plan was prepared and tabled by Chance in winter 2016 and the subsequent establishment of a Chance Community Relations Committee. While we appreciate your efforts and willingness in this regard, as a self-governing First Nation VGG is responsible for establishing and implementing our own governmental policies and processes for engaging with proponents wishing to carry out industrial activities that have the potential to adversely affect our rights, responsibilities and interests. To this end and as previously communicated to Chance, VGG has been developing and drafting an Oil and Gas Engagement Policy for the past several months. The Policy is now in its final stages of VGG review and approval. We fully expect that the Policy will be approved by December 31, 2017, and in any event, well before August 1, 2018.

We are confident that the Policy will provide a solid foundation for respectful, transparent and meaningful engagement while ensuring that any benefits and stewardship arrangements adhere to the objective of Sustainable Development as enshrined in the *Vuntut Gwitchin First Nation Final Agreement*. Moving forward, the Policy will be the framework for all engagement between VGG and Chance. As such, from VGG's perspective, the Policy *is* the engagement and communication plan that VGG will consider satisfactory for the purposes of Order-in-Council 2017/37. As we have previously

communicated, we would be pleased to meet and review the Policy with Chance upon its approval.

Yours truly,



Chief Bruce Charlie
Vuntut Gwitchin First Nation

APPENDIX 2-C-05. Letter – document not available at time of submission.

APPENDIX 2-C-06. Letter – document not available at time of submission.

APPENDIX 2-C-07. Letter – document not available at time of submission.

APPENDIX 2-C-08. *Community Relations Terms of Reference* – document not available at time of submission.

APPENDIX 2-C-09. Draft *Schedule of Engagement* - document not available at time of submission.

APPENDIX 2-C-10. *Vuntut Gwitchin and Chance Communication and Engagement Plan* - document not available at time of submission.

APPENDIX 2-C-11. *Vuntut Gwitchin and Chance Communication and Engagement Plan* - document not available at time of submission.

APPENDIX 2-C-12. Draft *Community Event* – document not available at time of submission.

APPENDIX 2-C-13. *Exploration Scenarios* - document not available at time of submission.

APPENDIX 2-C-14. Intent to Relinquish Exploration Rights to the Exploration Permit 0005 Letter – document not available at time of submission.

APPENDIX 2-C-15. Relinquishment of Exploration Permit #5 Letter

VUNTUT GWITCHIN GOVERNMENT
Government of Vuntut Gwitchin First Nation
CHIEF AND COUNCIL
P.O. Box 94,
Old Crow, Yukon
Y0B 1N0
Phone: (867)966-3261
Fax: (867)966-3116
Web: www.vgfn.ca

[redacted] President
Chance Oil & Gas Limited
1000, 340-12th Avenue S.W.
Calgary, Alberta, T2R 1L5

RE: Relinquishment of Exploration Permit #5

Dear Mr. [redacted],

In the 2009 approved North Yukon Land Use Plan (NYLUP) referencing Land Management Unit #8 Whitefish Wetlands on page 6-20 it was recommended by the Commission that a protected area be created by the parties.

Thus as we began to implement NYLUP the parties began a management planning process in March of 2013 for what is now called the Ch'ihilii Chik Protection Area encompassing 468 square kilometers and made up of 75% Category A Settlement Land (R-2A), and the rest is Yukon public land.

The Ch'ihilii Chik working group is now prepared to submit a completed management plan to the parties that has had a rigorous public consultation.

In response to our request in September of 2018 we recognize your letter dated October 16th, 2018 surrendering your oil and gas Exploration Rights to your permit #0005 ("EP5") so that the working group may submit a "clean" Ch'ihilii Chik Habitat Protection Area Management Plan without any third party land interests to ourselves and the Minister of Environment which is viewed as a "good will gesture" of cooperation and respect.

On behalf of our people, we would like to express our appreciation and gratitude to yourself and Chance Oil & Gas for your prompt response in rectifying the 3.8 square kilometer overlap issue with our new protected area. We also recognize the fact that this is the first time Yukon Oil & Gas branch has dealt with such a request.

Mahsi' cho (Thank you very much),

[redacted]
Councilor
Vuntut Gwitchin Government

APPENDIX 2-C-16. VGG Oil and Gas Engagement Policy Stage 1 Letter

Chance Oil and Gas Limited
Suite 1000, 340 – 12th Avenue SW
Calgary, AB T2R 1L5
T: 587.390.4136

March 15, 2019

Vuntut Gwitchin First Nation
PO Box 94
Old Crow, Yukon Y0B 1N0

Attention: [redacted], Director of Natural Resources

Dear [redacted],

Re: VGG Oil and Gas Engagement Policy Stage 1

This purpose of this letter is to provide notice to the Director of Natural Resources, Vuntut Gwitchin Government (VGG), of the intention of Chance Oil and Gas Limited (Chance) to apply to the Yukon Government to extend the tenure of select oil and gas dispositions held by Chance in the Eagle Plain Basin. The following information is being provided to fulfill the requirements of Stage I, Article 23 of the Vuntut Gwitchin Government Oil and Gas Engagement Policy (the Policy).

1.0 INTRODUCTION TO CHANCE

Chance is an oil and gas exploration company that holds valid permits to perform oil and gas exploration activities in the Eagle Plain Basin of Yukon Territory within the Traditional Territory of the Vuntut Gwitchin First Nation (VGFN).

Chance was incorporated in Yukon on September 19, 1994. The company has its head office in Calgary, but also maintains an office in Whitehorse. The business plan of the company is to explore for and potentially develop oil and natural gas resources in the Eagle Plain Basin of northern Yukon to help meet the energy needs of Yukon and other markets depending on the scale and quality of commercially viable resources.

Chance and VGG Relationship
Chance and VGG have an ongoing relationship that has been recently formalized by the completion of a Communication and Engagement Plan (Plan) in May 2018. The Plan outlines a mutually agreed upon framework to guide communication and engagement in relation to all aspects of Chance's activities. The

VGG Oil and Gas Engagement Policy is appended to the Plan and Chance is committed to complying with the Policy.

The Plan was completed to fulfill Ministerial Order 2017/37. The subsequent Ministerial Order, 2018/042, requests that Chance report to Yukon Government annually on the implementation of Plan.

Additional details of Chance and VGG's recent relationship include a formal introduction of Chance to the new Chief and Council and the Natural Resources Committee in Old Crow on January 29, 2019. In addition, four VGG representatives attended the Chance All-Party Meeting held in Vancouver on February 1, 2019.

2.0 COMPANY PROFILE

2.1 Organizational Structure

Chance Oil and Gas Limited is a privately-owned company incorporated in Yukon with headquarters in Calgary, Alberta. Chance's team is based partly in Calgary, Alberta, partly in Whitehorse, Yukon, and partly in Vancouver, British Columbia.

2.2 Team Profile

[redacted] – Chairman and Chief Executive Officer

[redacted] – President and Director

[redacted] – Vice President Government and Community Relations

[redacted] – Regulatory, Environmental and Community Relations Coordinator

[redacted] – Corporate Secretary

2.3 Financial Statements

It is important that Chance have a signed Confidentiality Agreement with VGG before Chance discloses confidential information such as financial records. A draft Confidentiality Agreement, meant to cover the disclosure of all information either party considers to be confidential, has been previously provided to VGG representatives and can also be found in **Appendix I**. Chance requests that VGG review this draft confidentiality agreement, discuss its content with Chance if necessary, and return it for signing by both parties before Chance discloses their financial statements.

2.4 Compliance Record

Chance has always operated in compliance with applicable Yukon regulations. In **Appendix II** please find the Compliance Records, a list of the licenses and permits with which Chance has complied in the past.

3.0 DESCRIPTION OF OIL AND GAS DISPOSITIONS AND APPLICATION

Chance holds 14 oil and gas dispositions in the Eagle Plain basin all of which are on Vuntut Gwitchin Traditional Territory (See map Chance Oil and Gas Limited Dispositions and Wells in **Appendix III**). Of these dispositions, Chance is applying to extend the tenure of Permits, 0006, 0007, 0008, 0009 ,0010,

0011, and 0019 for the maximum allowed time of five years. With the extended tenure, Chance intends to pursue oil and gas exploration.

As previously discussed with Vuntut Gwitchin representatives at the All-Party Meeting on February 1, 2019 and with the Natural Resources Committee in Old Crow on January 29, 2019, Chance is in the early stages of planning an exploration project. Chance will further discuss the scope and details of their exploration project with VGG when more progress has been made on the exploration project description. Chance will submit notice of their proposed oil and gas activity to the Director of Natural Resources to comply with Article 24 of the Policy when this information ready.

4.0 PROPONENT SPOKESPERSON

[redacted]

VP Government and Community Relations

Suite 202, 208 Main Street

Whitehorse, YT Y1A 2A9

Office: 867.456.7805

Cell: 867.333.0010

Email: gcharlie@chanceyukon.ca

Sincerely,

[redacted]

Vice President Government and Community Relations
867.456.7805
gcharlie@chanceyukon.com

APPENDIX 2-C-17. *Draft Project Description*

DRAFT PROJECT DESCRIPTION

Eagle Plains Exploration Project

Prepared for:

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Volume I

June 5, 2019

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
2D	two-dimensional
3D	three-dimensional
AER	Alberta Energy Regulator
CPF	Central Process Facility
D50	AEP Directive 50: Drilling Water Management Plan
DFO	Fisheries and Oceans Canada
DST	drill stem test
EBA	EBA Engineering Consultants Ltd.
EFT	extended flow test
ESA	Environmental Site Assessment
GPS	Global Positioning System
MBC	Mix Bury Cover
Plan	North Yukon Land Use Plan
Project	Eagle Plains Exploration Project
Proponent	Chance Oil and Gas Ltd.
YOGA	Yukon *Oil and Gas Act*, SY 2019, c.6
YESAB	Yukon Environmental and Socio-economic Assessment Board

SYMBOLS AND UNITS OF MEASURE

Symbol / Unit of Measure	Definition
º	degrees
%	percent
cm	centimetre
dS/m	
ha	hectare
km	kilometre
km^2	square kilometre
kPa	kilopascals
L	litre
m	metre
mg/L	milligrams per litre
mm	millimetre
m^2	square metre
m^3	cubic metre

PROJECT DESCRIPTION

This document presents the location of the proposed Eagle Plains Exploration Project (Project), the preliminary scope of the Project, the principal and accessory Project components, and Project phases and scheduling. The descriptions provided below are conceptual and intended to provide the level of detail necessary to initiate discussions with stakeholders on the Project Description.

Detailed design and implementation procedures will be developed following Project approvals. All design, methodology, or procedural changes will conform to the commitments made by Chance Oil and Gas Ltd. (Proponent), as well as the terms and conditions stated in any Decision Document resulting from the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Screening process and permits, approvals, and authorizations once issued.

The development of this section is based on the *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (YESAB 2005), specifically Part 1, Section 5.0 Project Description.

The Proponent will develop a series of management plans to provide additional information on infrastructure design and phase-specific activities including monitoring. These management plans are referenced throughout this section where relevant.

1.1 Project Description Overview

The Proponent intends to conduct exploration drilling and flow testing of any discoveries over an area of approximately 2,400 square kilometres (km²) in the Eagle Plains area, located between the Ogilvie and Richardson mountain ranges along the Dempster highway in Yukon. The purpose of this exploration drilling and flow testing program is to confirm the quality, quantity, and areal extent of any accumulations of hydrocarbons. The Proponent will drill up to 30 wells sequentially over a period of up to 10 years. If a well is successful (i.e., if there is a discovery of crude oil or natural gas in sufficient quantities), the Proponent will conduct an extended flow test (EFT) for a period up to 2 years on that particular well. There is considerable uncertainty in terms of outcome from exploration drilling, so it is only possible at this stage to speculate on the number of discoveries that will be made. For the purposes of this assessment, the Proponent estimates that crews may conduct EFTs on up to 20 wells, depending on the drilling success. Due to the exploratory nature of the work, it is impossible to predict the timing of any discovery and therefore the timing of any EFTs.

The Proponent will drill one well at a time and up to five wells per year. Assuming all wells are successful and EFTs are conducted for 2 years at each well, there may be up to 10 EFTs being conducted at one time. The information obtained from the EFTs is critical to establishing the future development plan for each discovery.

If several wells reach successful outcomes and are identified for extended flow testing, the wells will have completion equipment installed within their wellbores, the casing will be perforated, and the wells will be flowed. This would require a completion or service rig to install the completion equipment and the tubing used to conduct produced well fluid to ground surface, at which point surface equipment would then be installed, which may include artificial lift equipment to help the fluid continue to flow.

Fluids produced during EFT will need to be measured, processed, and dealt with in an environmentally responsible manner. Depending on the nature of a discovery, the Proponent anticipates that some combination of natural gas, crude oil, and possibly formation water will be extracted during the EFTs. These fluids are separated and measured in facilities on the surface. Natural gas could be flared for short periods of time, but the Proponent prefers to conserve it to provide fuel for process heating, fuel for engines providing mechanical power, and possibly onsite power generation. If natural gas quantities are significant, the Proponent would consider re-injecting surplus natural gas into a compatible reservoir in the Eagle Plains basin using an existing suspended well. The Proponent currently has 8 suspended wells that were drilled in the past, which could be used for re-injection. Alternatively, some of the new wells, drilled as part of this 30-well Project, may be used.

Fluid transportation vehicles will be required to travel from site to site and transport the produced fluid back to the Central Process Facility for storage, further treatment, and transfer to trucks for transport to market or disposal. To the greatest extent possible, crude oil produced during the EFTs will be conserved instead of flared. This will require some processing to stabilize the crude oil for truck transport to a suitable, approved crude oil marketing point, such as terminals in the vicinity of Fort Nelson or Fort. St. John, British Columbia or Grand Prairie, Alberta. All these locations are ready to receive and utilize crude oil produced from Yukon sources in the absence of such destinations existing within Yukon. The Proponent may also consider trucking crude oil produced during the EFT to ports in Alaska such as Skagway, Haines, or Valdez for onward shipping to suitable markets elsewhere in North America.

Formation water produced in conjunction with crude oil or natural gas will be separated from the hydrocarbon streams and disposed of underground into a compatible and approved geological formation at Eagle Plain using one of the suspended wells or one of the wells drilled as part of this Project. These procedures to process, transport, and dispose of various fluids produced are common practice using proven technologies and equipment in every oil and gas province in Canada.

The Proponent also intends to conduct a seismic exploration program consisting of up to 1,500 km² of three-dimensional (3D) seismic and up to 2,000 km² of two-dimensional (2D) seismic to identify and map oil and gas geological structures in the area.

Additional activities are required to support the drilling and seismic exploration, including:

- Mix Bury Cover (MBC) sump area to dispose of drill cuttings
- Construct winter and all-season access roads
- Construct airstrip
- Advance borrow source developments
- Transport equipment and supplies to the site and within the Project area
- Use existing camp at kilometre (km) 325 of the Dempster Highway and periodic use of the Eagle Plains Hotel.

The Proponent is planning to begin exploration activities as early as the end of 2021 and continue for a period of 10 years to cover the various stages of drilling and extended flow testing of the proposed wells. The execution of the EFTs will likely be phased, depending on the nature of the discovery (e.g., natural gas versus crude oil) and the capacity of the 75-person base camp and the Eagle Plains Hotel to accommodate

the necessary crews. Until there is more information about the resources discovered, it is difficult to accurately predict the full duration the complete flow testing program.

1.2 Project Location

The Project is located within the southern part of Eagle Plain Sedimentary Basin in northern Yukon (**Figure 1.1)**. The main camp is located at km 325 of the Dempster Highway, with one MBC sump area located at km 336. **Figure 1.1** illustrates the overall Project area.

The proposed Project area overlaps with the following three First Nation Traditional Territories:

- Vuntut Gwitchin First Nation
- First Nation of Na-Cho Nyäk Dun
- Tetlit Gwich'in Council Secondary Use Area.

The proposed Project area is north of the Tr'ondëk Hwëch'in First Nation Traditional Territory and Settlement Land. The Traditional Territories and Settlement Land blocks in the vicinity of the Project are detailed on **Figure 1.1**.

The proposed Project is located within the boundaries of the North Yukon Planning Region and is therefore subject to the North Yukon Land Use Plan (Plan). A main purpose of the Plan is to address oil and gas development in North Yukon. The locations of proposed well sites are within the region of the Plan designated for the highest level of development. In the Plan, this designation is described as Lower ecological and heritage/cultural values within a moderately sensitive biophysical setting.

1.3 Project Components and Activities

This section describes the principal Project components, along with accessory components that are necessary to support Project activities. Information provided below for each Project component includes its location, key design features, and, where applicable, the results of any relevant investigations to establish site conditions (e.g., seismicity, geotechnical parameters). The three main components of the Project are described as follows:

1. Exploration well program – comprising 30 wells within an area of approximately 2,400 km². Wells will be located within areas identified in **Figure 1.1**. The program includes drilling, drill stem testing, and extended flow testing of the wells. Hydraulic fracturing is not being proposed as part of the Project. See **Section 1.3.2** for details.
2. Construction of access roads to each proposed well location – roads required for the Project will be a combination of winter and all-season access roads. Details regarding road construction and location are provided in **Section 1.3.3.1**.
3. Construction of a new MBC sump area and all-season access road – (approximately 400 metres (m) long) at km 336 of the Dempster Highway, and construction of additional MBC sumps in other suitable areas. Details are provided in **Section 1.3.2.7**.
4. Seismic exploration program (**Section 1.3.2.9**) consisting of up to 2,000 km² of 2D seismic exploration and up to 1,500 km² of 3D seismic exploration.

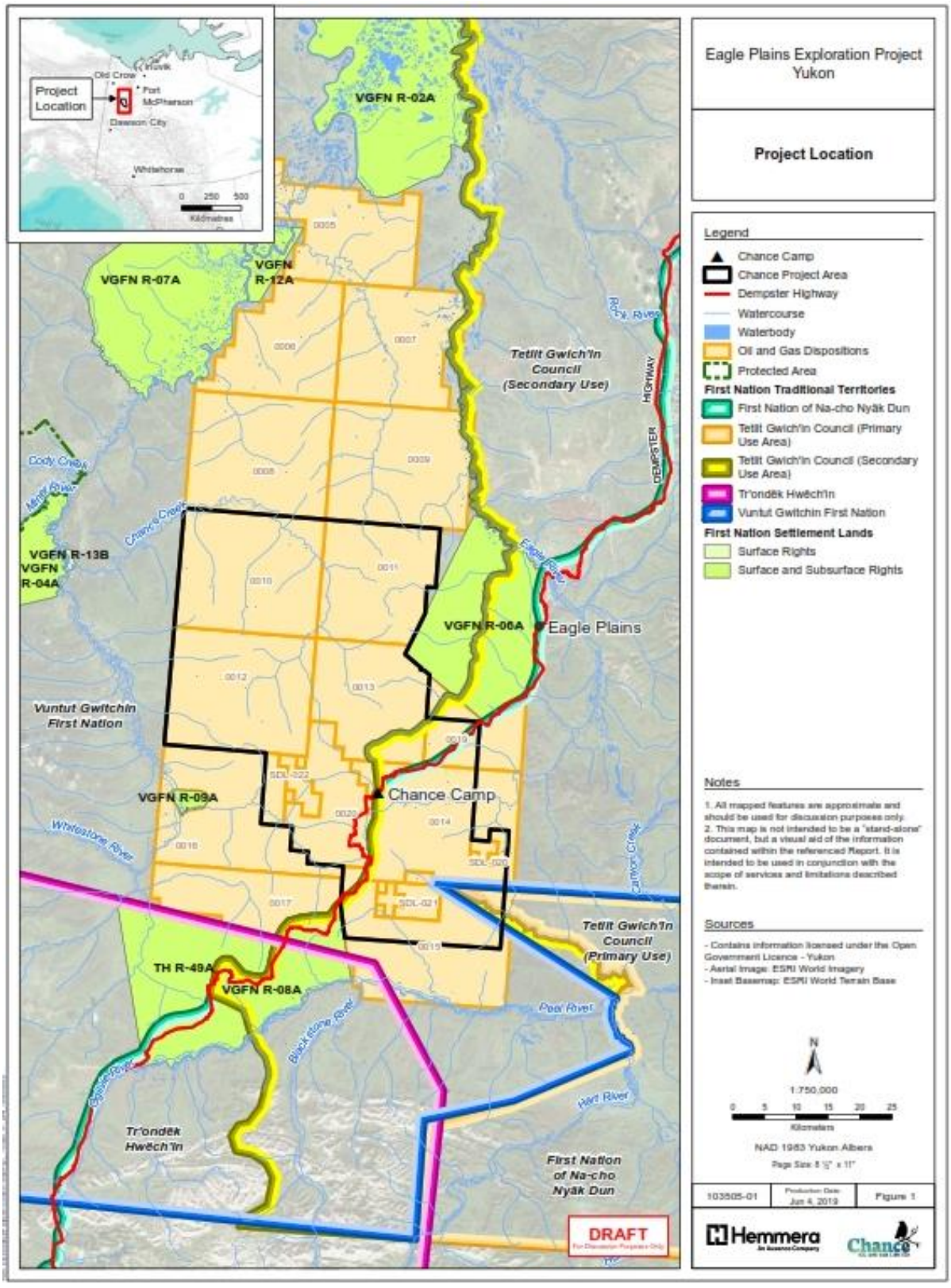

Figure 1.1 Project Location

Details related to the project components and activities are provided in **Section 1.3 Project Components and Activities** noting that the development of some Project components occurs in both phases. That is, once a well site has been prepared, drilling and well development will occur at that site, and additional well sites may be prepared simultaneously. Reclamation activities are described in **Section 1.4.4 Reclamation, Abandonment, and Closure Phase**.

1.3.1 Preliminary Scope of the Project

The preliminary scope of each Project component is described in **Table 1.1**.

Table 1.1 Preliminary Scope of Project

Project Component	Activities
General Project	• Exploration activities for oil and gas in the Eagle Plains area ▫ Exploration well drilling, testing, suspension, decommissioning, and abandonment ▫ Successful wells will be suspended and may be brought forward in future development project proposals ▫ 2D and 3D seismic exploration • Project phases will occur sequentially over a 10-year period and include ▫ Initial mobilization of equipment to the Project site ▫ Construction of required infrastructure ▫ Well development, testing, decommissioning, and abandonment ▫ Progressive reclamation ▫ Final closure and reclamation • The Project will occur over an area covering approximately 2,400 km² located at approximately km 325 of the Dempster Highway
Exploration Well Drilling	• Establishment of up to 30 well sites each, approximately 1.44 hectares (ha) in size within the overall Project area (approximately 2,400 km²) ▫ Site levelling using gravel, packed snow or ice and rig matting as required • Installation of surface infrastructure on drill sites including: ▫ Drill rig ▫ Mud tanks, pumps, and mud processing systems ▫ Power generators ▫ Boilers ▫ Blowout preventer accumulator system ▫ Fuel storage ▫ Flare tank and flare stack ▫ Cement mixing and storage ▫ Storage bins for rock cuttings ▫ Trailers for offices, first aid, rig crew sleeping quarters, water storage and treatment, sewage storage, and food waste incinerator • Drilling of up to 30 wells to a depth up to approximately 2,500 m ▫ Wells will be drilled sequentially, one well at a time, up to four wells per year • Use of low-toxicity, water-based mud system • Use of up to 15 cubic metres (m³) of water per operating day for drilling

Project Component	Activities
Drill Stem Testing	• One or more drill stem tests (DSTs) on each well to analyze prospective/productive formation areas • Potential acid stimulation using a weak concentration (10% to 20%) of hydrochloric acid approximately 5 to 10 m3 per well • Flaring natural gas • Production of crude oil and transport from the site to markets outside of Yukon
Extended Flow Testing	• Conduct EFTs on up to 20 successful wells ▫ May be conducted within a month for a predominantly natural gas well or up to 2 years for a predominately crude oil well ▫ Up to 10 EFTs conducted at the same time • Installation of surface and subsurface equipment and facilities to enable EFT including: ▫ Casing of entire wellbore and perforation of casing at zone or zones of interest ▫ Packer, tubing, and downhole gauges ▫ Wellhead valving assembly ▫ Flare systems ▫ Separator vessel, treating vessel, and storage tanks ▫ Appropriate artificial lift systems ▫ Heaters ▫ Dehydrators ▫ Flow lines ▫ Metering equipment ▫ Portable generators • Separation of natural gas, crude oil, and formation water • Flaring natural gas for a period of several days to several weeks • Production of crude oil and transportation of produced crude oil from the site to markets outside of Yukon • Use of natural gas on site for power generation, tank heating, fuelling artificial lifting to assist crude oil production, or compression for re-injection of natural gas • Disposal of formation water underground in existing suspended wells, or wells suspended as part of this exploration Project
Drilling Waste Disposal	• Construction of MBC sump approximately 6.4 ha in area to dispose of drill cuttings • Disposal of drill cuttings in MBC pods approximately 300 m^3 over an area of 800 square metres (m^2) (estimated volume of drill cuttings for one well) • Disposal of approximately 200 m^3 of drilling mud in MBC and drilling fluid underground in existing suspended wells, or wells suspended as part of this exploration Project • Disposal of the following liquid waste in existing suspended wells, or wells suspended as part of this exploration Project: ▫ Formation water ▫ Saline fluids ▫ Liquid fraction of drilling fluids ▫ Rig wash
Seismic Exploration	• Up to 1,500 km^2 of 3D seismic

Project Component	Activities
	• Up to 2,000 km² of 2D seismic • Establishment of seismic survey lines • Air hammer drilling • Receiver stations and source stations • Storage (in magazines), transportation, and use (1 kg per source station) of dynamite
Well Maintenance (Workovers)	• Mobilization and installation of a service rig to the well site • Conduct maintenance to: ▫ Install, change, or modify the production flow control equipment ▫ Perforate zones of interest for EFTs ▫ Seal some or all perforations made across productive zones ▫ Re-perforate a zone or zones elsewhere in the wellbore ▫ Other routine maintenance practices to ensure optimal production performance of the producing formation
Access Roads	• Use of permitted Chance Road all-season road for Project activities • Construction of all-season access roads to well sites requiring EFT and borrow source locations ▫ Approximately 7 m in width with pullouts on average every 750 m ▫ Up to approximately 87 km total in length ▫ Clearing and mulching of vegetation ▫ Removal and stockpile of organic cover material for use in reclamation • Construction of winter access to well sites for initial well drilling and DST
Borrow Source Development	• Quarrying of approximately 1,800,000 m³ of aggregate for use in Project activities, including: ▫ Winter development of up to 23 quarries ▫ Use of approximately 450,000 m³ of aggregate for well pads ▫ Use of approximately 1,350,000 m³ of aggregate for access road construction ▫ Use of aggregate for airstrip construction ▫ Use of aggregate for Central Processing Facility construction ▫ Use of explosives • Removal and stockpile of organic cover material and silts for use in reclamation
Central Processing Facility	• Construction of central processing facility adjacent to camp • Processing facility ▫ Multi-stage and multi-phase separators ▫ Heater treaters ▫ Vapour and gas collection system to flares or to provide fuel for camp use ▫ Processing of crude oil to stabilize and meet market specs for truck transport ▫ Storage of approximately 3,180 m³ of produced crude oil ▫ Storage of approximately 119 m³ of produced (formation) water • Fuel storage facility ▫ 151 000 litres (L) diesel fuel ▫ 24 000 L propane

Project Component	Activities
	• Storage and use of chemicals and reagents: ▫ Hydrochloric acid (10% to 20% concentration) ▫ Methanol ▫ Additives to prevent corrosion ▫ Demulsifiers • Bulk explosive compound to store dynamite for use in construction of borrow sources and for seismic exploration
Airstrip	• Construction of airstrip approximately 1,500 m long at km 4 of the Chance winter road • Use of airstrip during all phases of the Project approximately 2 flights in/out per week • Storage of aviation fuel
Water Use	• Use of up to 300 m³ of water per day for making snow to build winter trails, ice roads and temporary well sites, not exceeding 10% of instantaneous flow from the following extraction points: ▫ Year-round extraction from the Eagle River and Ogilvie ▫ Seasonal extraction from Glacier Creek and Fly Camp • Use of up to 300 m³ of water per day for camp from existing onsite groundwater water well. • Construction of portable water reservoir at the camp for water storage and use during low water periods
Transportation	• Use of Dempster Highway, North and South Klondike Highway, and Alaska Highway to access Project site and to transport crude oil to potential markets • Approximate offsite traffic on public roads between the site and supply points • Onsite traffic on Proponent-controlled roads ▫ 15 to 20 truckloads over approximately 5-day period to mobilize the drill rig to each well site
Camp and Workforce	• Workforce up to 75 people during all phases of the Project • Continued use of existing permitted 75-person camp located at km 325 of the Dempster Highway ▫ Municipal waste management and disposal ▫ Sewage treatment facilities
Reclamation and Closure	• Progressive abandonment of unsuccessful wells ▫ Installation of cement plugs across all porous/permeable zones, across the base of each casing string and at surface ▫ Cutting of well casing(s) off 1 m below ground level and weld steel plates across each string ▫ recontouring and revegetation of area • Progressive decommissioning and reclamation of borrow source and quarry areas when they are no longer useful or necessary ▫ Recontouring of area and replacement of stockpiled silts and organic cover material • Well suspension and abandonment at end of Project

1.3.2 Principal Project Components

1.3.2.1 Overview

The principal Project activities are the drilling program, well testing, and seismic exploration program. The goal of the proposed drilling program is to obtain the maximum amount of information to determine the geological settings and evaluate oil and gas reserves in the Eagle Plains area. During operation, drilling will occur 24 hours per day, and 7 days per week. Chance will drill 1, possibly 2, wells at a time and up to 5 wells per year.

Initial drill stem tests (DSTs) will occur on any or all of the 30 proposed wells. Up to 5 wells could be tested each year. Chance will conduct EFT on successful wells, where hydrocarbon resources are discovered, to gather important information about the nature of the resource accumulation and its productive capability. EFT for wells with a primarily natural gas discovery may take place over a maximum period of 1 to 2 months maximum. EFT for wells with a primarily crude oil discovery may take place over a period up to 2 years. Chance may conduct up to 10 EFTs concurrently and EFTs on up to 20 wells over the life of the Project. The information obtained from the EFTs is critical to determining the future development plan for each discovery. **Table 1.2** outlines the sequence of activities in developing the well site areas.

The Proponent also intends to conduct a seismic exploration program consisting of up to 1,500 km² of 3D seismic and up to 2,000 km² of 2D seismic to identify and map oil and gas geological structures in the area. The 3D seismic program is likely going to be undertaken in a series of smaller projects, each of approximately 400 km². The 2D seismic program could be done either as one project or as a series of smaller projects. Details on the Project components and activities are provided in the following sections.

Table 1.2 Sequence of Well Development Activities

Initial Exploration Drilling		
Develop winter access trail to well site		
Develop well site approximately 1.44 ha in area		
Install surface infrastructure on well site necessary for drilling and testing exploratory well		
Drill well		
Transport and dispose of drill cuttings in MBC sump		
Conduct DSTs to determine whether successful or not in order to move on to EFT		
Move drill rig to next well site area		
If not successful	**If successful**	
	Primarily Natural Gas Discovery	**Primarily Crude Oil Discovery**
Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).	Complete well (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).	Complete well (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).
Remove all surface infrastructure.	Install required surface facilities (separator vessel, heaters, dehydrators, stock tanks, flow lines,	Construct all-season access to well site.

Initial Exploration Drilling		
	metering equipment, portable generators, and flare stack).	
Remediate well site area (remove mats and gravel fill material).	Conduct EFT over period of 1 – 2 months	Install required surface facilities (separator vessel, heaters, dehydrators, stock tanks, flow lines, metering equipment, portable generators, and flare stack).
Recontour well site area and revegetate disturbed areas to natural conditions.	Measure natural gas and water from wells.	Conduct EFT over period up to 2 years
Recontour access roads and revegetate disturbed areas to natural conditions.	Conduct maintenance on well as required (work over).	Measure, store, and process crude oil, natural gas, and water from wells.
	Once EFT is, complete either 1. develop a new proposal to bring into production, or 2. decommission and abandon well.	Conduct maintenance on well as required (work over).
	Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).	Transport crude oil from EFT to central processing facility then to acceptable market.
	Remove all surface infrastructure.	Once EFT is complete, either 1. prepare development plans for future assessment and regulatory review to bring into production, or 2. decommission and abandon well.
	Remediate well site area (remove mats and gravel fill material).	Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).
	Recontour well site area and revegetate disturbed areas to natural conditions.	Remove all surface infrastructure.
	Recontour access roads and revegetate disturbed areas to natural conditions.	Remediate well site area (remove mats and gravel fill material).
		Recontour well site area and revegetate disturbed areas to natural conditions.
		Recontour access roads and revegetate disturbed areas to natural conditions.

1.3.2.2 Exploration Well Drilling Program

Establishment of Well Sites and Drilling

Chance will establish up to 30 well sites, each approximately 1.44 ha in size within the overall Project area (approximately 2,400 km²). Total approximate disturbance for well site locations will be up to 43.2 ha if all 30 wells are drilled. Exact well locations and sequencing cannot be determined at this time as they are dependent on seismic data interpretation, drilling results, EFT results, weather, and local surface conditions and other environmental factors. The Proponent is continuing the ongoing process of interpreting seismic data to better understand the geological setting, size, and geometry of potential prospects. Each well drilled will add to that understanding.

Generally, well sites will be located on the heights of land. Criteria for well site locations include the following:

- Avoidance of areas with challenging permafrost conditions and ecologically sensitive areas such as riparian corridors, wetlands, steep slopes, old growth forest, and critical wildlife habitat and permafrost features.
- No drilling within 45 m of a perennial watercourse
- Avoidance of areas identified with heritage values (noted as “avoidance areas”) in the Heritage Resource Overview Assessment and Heritage Resource Impact Assessment (Matrix 2013).
- Requirements from the Yukon *Oil and Gas Act*, SY 2019, c.6 (YOGA) and the Oil and Gas Drilling and Production Regulations.

Drill Program

The first of the exploratory wells will be drilled in winter commencing around mid-January 2021. Pre-drilling preparation will entail building winter trails to gain access to the first selected well sites and to build access roads and the leases to accommodate the mobilization and setup of the drilling rig. Winter road and lease building can only commence once there is the 10 cm of snow cover required to facilitate construction. Based on historical trends, this could occur as early as December or as late as mid- to late January in any year.

Summer well sites may be established if there is already a year-round access road built nearby to service a well or wells undergoing EFT. Summer well sites will allow the Proponent to extend the drilling season into the summer if new wells can be drilled within a few kilometres of an existing road. A summer well site will require all-season access to the site.

Once established, the well site will contain the drill rig, flare stack, rig trailers, and office trailers and will provide sleeping capacity for the required number of key people to stay at the rig full time. Each well site will be approximately 1.44 ha in size to facilitate drilling and any subsequent EFTs. The amount of clearing will be kept to a minimum.

The well site dimensions should be adequate for advancing to a possible production operation in the future and therefore should accommodate all field production equipment.

Winter Matting Use

Matting for winter operations will be used when a) the ground is too uneven, b) it may not be possible to level the lease using earth-moving equipment and when the ground may not be competent enough to support the heavy rig loads, or c) when it is not possible to level the ground by laying down a base of gravel or soils. Matting may be used in drilling operations to reduce ground surface disturbance and distribute the ground pressure of equipment. Matting may also be used to stabilize the drill rig to provide insulation and protection to the snow and ground surface. Matting will not be used on the proposed roads.

The Proponent intends that well sites would be built with fill material from other well sites or from borrow sources. Should matting be used, it may cover the entire well site area (several locations of 1.44 ha) or the area immediately adjacent to where a drilling rig may be placed.

Well sites will be levelled by bringing in material such as gravel, or possibly snow for packing and then icing. An impermeable liner will then be laid on top of the pad, followed by wooden rig mats that interlock. Rig mats are approximately 16 feet by 8 feet in area, though there is some variance from one manufacturer to another.

Any matting used for this Project will be designed to support heavy loads and distribute the weight over large surface areas. The use of matting is a common practice for oil and gas drilling operations in northern locations. Any matting used for this Project will be placed on the frozen ground with snowpack and removed before spring melt.

The well site area adjacent to where the rig is situated and the road access will be matted if an unprecedented early melt occurs. In the event of an unprecedented early melt, rig equipment will be “leapfrogged” along the access road to support equipment and protect the vegetative mat as the rig is being demobilized and on its way out from the well site location. If leases are not constructed from densified fill material, equipment will remain on matted surfaces at all times in the event of early melt conditions.

Mats currently placed on previous well locations are periodically inspected for any movement or deterioration that could affect their ability to support intended loads. All matted well sites are maintained as much as possible because suspended wells must be usable by Chance in future exploratory and appraisal programs.

Summer Matting Use

The laying of matting in summer first requires the frozen level ground to be insulated with an impermeable textile layer. Laying matting early, before the thaw, ensures vegetation is not yet active and may be covered by a layer of snow or frozen soil. The Proponent plans to drill summer wells (following early exploratory successes from the winter wells) by constructing gravel pads of sufficient thickness to facilitate levelling and a firm base to support drilling loads.

The Proponent will likely use double-matting procedures where required to provide a stable, level surface on a summer location if the terrain is uneven. If double matting is used, the upper layer of mats can be lifted independently while the lower mats are left in place if frost adhesion is evident.

The Proponent expects future leases for well sites will be constructed from a more durable borrow site fill material of a suitable thickness to protect and insulate the permafrost and provide a safe and stable working surface for the drilling and subsequent extended flow testing. Should any well also become a long-term producer, the lease condition will be expected to endure for a longer term of several more years.

Geotextile membrane would only be applied over the vegetation surface as an option for locally levelling terrain. This would be necessary if double matting techniques were not possible as a solution for stabilizing mats on the vegetation surface. Geotextile will be used when:

- Levelling using fill material on top of natural vegetation could compromise the stability of the surface under loads.
- Levelling by double matting is not the best solution in the circumstances.
- Geotextile use would help protect vegetation or be a valuable aid in site clean-up.

Geotextile may be used prior to application of fill to level part of the drill site or access route, which could involve applying a minimal thickness of granular material (local rock or soil fill).

The Proponent retained EBA Engineering Consultants Ltd. (EBA) in 2008 to provide permafrost, soil, and vegetation expertise to evaluate the proposed use of industrial wooden mats for summer access. Tetra Tech/EBA (the successor company to EBA) or a similarly qualified individual or firm will be required to perform site-specific geotechnical pre-drilling investigations to confirm amounts of fill required and the proper placement of fill material to support the anticipated rig loads in accordance with good engineering practices.

Well Site Surface Infrastructure

The Proponent plans to use a drill rig with similar characteristics to Chance Rig #1 as presented in past assessments. The rig is capable of drilling to depths of up to 2,500 m. A normal rate of drilling would be to drill 1 well at a time during this exploratory phase.

Figure 1.2 illustrates the general layout of the proposed well site. The rig is designed to fit on a much smaller layout, but the planned 1.44 ha (120 m × 120 m) square layout is designed to accommodate not only the drilling operation but also the well completion and EFT equipment, and to preserve setback distances from surrounding vegetation and from personnel working and sleeping quarters. Note that the final area may not be square since the area will depend on topographical constraints. However, the total area for a well site will be approximately 1.44 ha. The rig layout depicted would likely be for a winter drilling operation distinguished by the number of boilers onsite. Boilers are used extensively in very cold or Arctic climates for preventing equipment and drilling fluids from freezing Arctic temperatures. **Table 1.3** provides a description of the drill rig components identified in **Figure 1.2**.

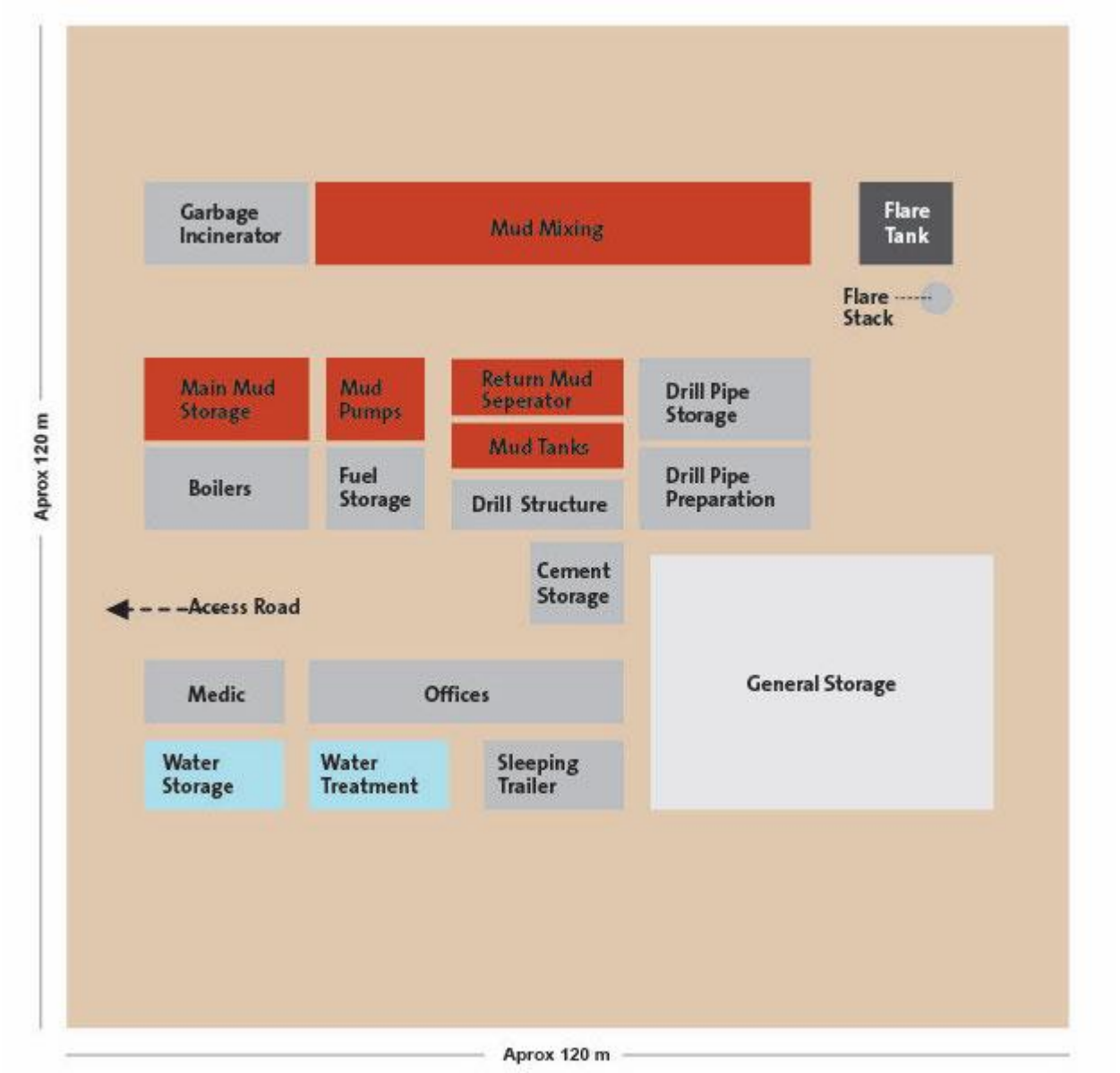

Figure 1.2 General Layout of a Well Site

Table 1.3 Well Site Components Shown on Figure 1-3

Component	Description
Boilers	Used extensively in very cold and Arctic climates for preventing equipment and drilling fluids from freezing Arctic temperatures.
Cement	Cement storage and mixing for use in wells.
Medic, Offices, and Sleeping Trailer	Essential personnel trailers which serve as offices as well as sleeping quarters and include a multi-room sleeper for some of the rig crew.

Component	Description
Flare Tank and Flare	Flare used to incinerate combustible fluids from the well. The flare tank is a reservoir to ensure the flare does not starve of combustible fluids.
Fuel Storage	Fuel for use on well site for equipment including drill rig, pumps, generators, etc.
Garbage and Incinerator	Storage area for waste and incinerator to dispose of food waste.
General Storage	Storage and laydown area for equipment needed onsite.
Mud Tanks	Tanks where all the surface mud volume is stored. Section 31 of the Drilling and Production Regulations under YOGA (Government of Yukon 2004) stipulates that the "combined capacity of the drilling fluid tanks of every fluid system must not be less than the greater of 120 m^3 and 50% excess of the volume of the wellbore."
Main Mud Storage	Location where all the mud materials are stored. Normally these materials are delivered on pallets neatly stacked and shrink wrapped to protect them during the truck journey north.
Drill Pipe Storage	Receptacle in which drill pipe is stored until required to be run in the hole.
Mud Mixing	Tank in which certain mud products are first hydrated to render them miscible with the fluid phase of the mud. Products such as bentonite clay, for example, require a caustic soda solution to neutralize the ionic attraction forces between clay flakes, allowing the water to lose its surface tension and to completely wet the flakes.
Mud Tanks	Large tanks, normally upright, fully enclosed and pressurized, where cement or bulk mud products are stored. Cement or barite (drilling mud weighting material) are pneumatically pumped from the P Tank into a smaller surge tank and then to the cementing unit or, alternatively, to the mixing or premix tank to enter the mud system.
Mud Pumps	Pumps used to circulate the drilling mud down the drill pipe, around the drill bit, and up the annular space between the drill pipe and the open hole or casing to surface.
Return Mud Separator	Area where the return mud separator known as a shale shaker is housed. The CF is the centrifuge that uses centrifugal force through high-speed rotation to separate the fluid part of the mud from the solids.
Drill Structure	Components required to drill the well, including: • Sub-structure, or base, to which the derrick is fixed • Derrick that supports the draw works and top drive • Top drive that is a mechanical, electrically powered linking device that attaches to the pipe in the hole and rotates it when drilling while simultaneously pumping drilling mud through the drill pipe and out of the drill bit at the bottom end • Draw works that lifts and lowers the travelling block in the derrick/mast to run pipe in and out of the hole • Blowout preventers, which are a series of closing valves that can hydraulically shut in a well in the event of unplanned influxes of formation fluids into the wellbore
Water Storage and Water Treatment	Water storage tank and treatment containers to provide potable water for the rig crew and personnel.

Any well site is an industrial area and therefore has restricted entry requirements, allowing entry to only authorized personnel wearing personal protective equipment (coveralls, steel-toed boots, hard hat, gloves, and safety glasses).

Figure 1.3 and **Figure 1.4** show the rig set up at the Chance camp located at km 325 of the Dempster Highway.



Figure 1.3 Chance Rig #1



Figure 1.4 Chance Rig #1 and Chance Camp at km 325 of the Dempster Highway

Drilling Operations

Well sites will be designed and constructed to support the rig and ancillary equipment positioned on them. The well site locations will be determined based on geotechnical assessments. Because construction will use borrow source fill, the well sites will be able to accommodate the drilling, EFT, and eventual production phases of well operating life. The lease area will be sized to fully accommodate a purpose-designed well pad, process facilities, and possible service rig equipment spreads that may follow in the future. Eagle Plains well sites and well design will incorporate the following key features to enhance efficiencies and reduce waste and general impact to the surroundings:

- The rig will use the minimal number of casings necessary to reach the projected total depth of approximately 2,500 m. The schematic well profile shown in Figure 1.5 illustrates a cross-section of the casing run, including annular cementation and other well features together with drilling equipment. For reference, the well casing program will typically comprise the following elements:
  - Conductor of 13-3/8-inch diameter to approximately 25 m below ground level, cemented to surface.
  - Surface casing of 9-5/8-inch diameter to approximately 400 m below ground level, cemented to surface.
  - Production casing of 7-inch diameter either to total depth or to just above the top of the Hart River formation at circa 1600 m, to comply with Yukon's Drilling and Production Regulations requirement of not more than 25% of open hole remaining uncased at any time (Drilling and Production Regulations Section 55-(1) (c) (i)). This casing will also be cemented to surface.
  - 4-1/2-inch liner to total depth at 2,200 m, cemented with a minimum 100 m overlap into the previous casing.
- The nominal diameter of the casings (all selected to remain industry standard dimensions) will reduce the size of holes drilled and of drill cuttings generated. For example, a 3,500 m exploratory well would typically produce 400 to 500 metric tons of cuttings. Less than 150 metric tons will be produced for the typical exploratory well depth of 2,200 m proposed at Eagle Plains.
- A water-based mud system will be developed and managed by a specialized service contractor with comprehensive knowledge of the Alberta Energy Regulator (AER) Directive 50 requirements as they pertain to the Yukon jurisdiction being operated in.
- All requirements in Sections 26 to 65 of the Drilling and Production Regulations (covering well design, casing design, groundwater protection, mud products, blowout prevention and choke/kill systems, fire detection and gas detection systems, safety of personnel, mitigation of operations impact, and more) will be either met or exceeded in the design, selection, and deployment of materials.
- The Yukon Oil & Gas drilling and production regulator will review proposed drilling design and planned operations procedures, as well as the health, safety, and environment policies and manual; oil spill contingency plans; and emergency response plans. Any perceived or identified deficiencies will be discussed, addressed and reported back to the regulator to confirm what action had been or needs to be taken before operations can proceed.
- The Proponent will enforce compliance on all third-party service suppliers to ensure that (1) their health, safety, and environment management systems address all regulatory requirements in personnel training and skill development; (2) personal protection equipment provided to workers

meets all Canadian Standards Association and international safety standards; and (3) supervisors are knowledgeable about operational standards related to health, safety, and environment. Periodic inspections and audits will be performed by Chance company representatives while operations are mobilized and ongoing at well sites.

- All wells will be drilled as "keepers" to facilitate EFTs and/or to become early producers in the event the Project advances to a full development. The only wells likely to be abandoned would be unsuccessful (dry) wells with no potential to be used as water or gas disposal wells.
- Leases will be designed and constructed to contain any fluid runoff into purpose-built collection ditches for recovery and disposal. A non-permeable layer will be laid during lease / well pad construction to prevent any seepage into the natural ground layer below the fill material pad.
- Rig deployment will ensure any rig wash; drilling, cementing, or DSTs fluids will be contained and recovered at all times.
- The standard and proven drilling method proposed has many advantages, including the following:
  - Large volumes of water will not be required for the drilling process because of the use of solids control equipment allows recycling of the majority of drilling fluid. Chance Rig #1 normally consumes approximately 15 m³ water per operating day averaged over the duration of the well being drilled.
  - Minimal volumes of water are expected to be lost into the formation. The Proponent's experience drilling to these depths confirms this. Studies of other offset/nearby wells also confirm this expectation.
  - In the event that hydrocarbons are encountered, they will be controlled by the drilling mud contained in the hole; as a secondary barrier, the blowout preventer system will comprise two or more rams to fully close in the well within seconds of detecting an influx into the wellbore.
  - In the unlikely event that abnormally pressured zones are encountered (all formations to be encountered in the proposed program have been previously drilled in past wells A-25, H-28 and B-73 and no overpressures have been experienced or detected), the Proponent has designed a comprehensive drilling fluids management, casing, and blow-out prevention system to control such occurrences. Well conditions and all pressure parameters are constantly monitored and detected first by the frontline drill crew members (driller constantly on the drilling control brake, mudman aided by the well monitoring personnel constantly viewing and responding to sensor responses). As an added backup, electronic detection alarms are set to trip when very small influxes occur.

Chance Rig #1 is approved to have a Class IV BOP system, which in Yukon Drilling and Production Regulations Section 33 (1) (d) permits the rig to drill wells between 1,800 m and less than 3,600 m and is rated for 21,000 kilopascals (kPa) (3,000 psi) working pressure (Drilling and Production Regulations Section 33 (2) (c)).

Drill crews, by professional training and enforced by regulatory requirement, must be fully trained and certified in blowout prevention and well control. Crews undergo simulated drills at each shift on a 2-shift, 24-hour work rotation. During these drills, the response and efficiency of drill crews are evaluated. The equipment is also evaluated, and any deficiencies are corrected immediately following the drills. Drill crew

and well supervisor well control / blowout prevention / hydrogen sulphide certificates are normally inspected by a visiting inspector to confirm compliance at all times when operating.

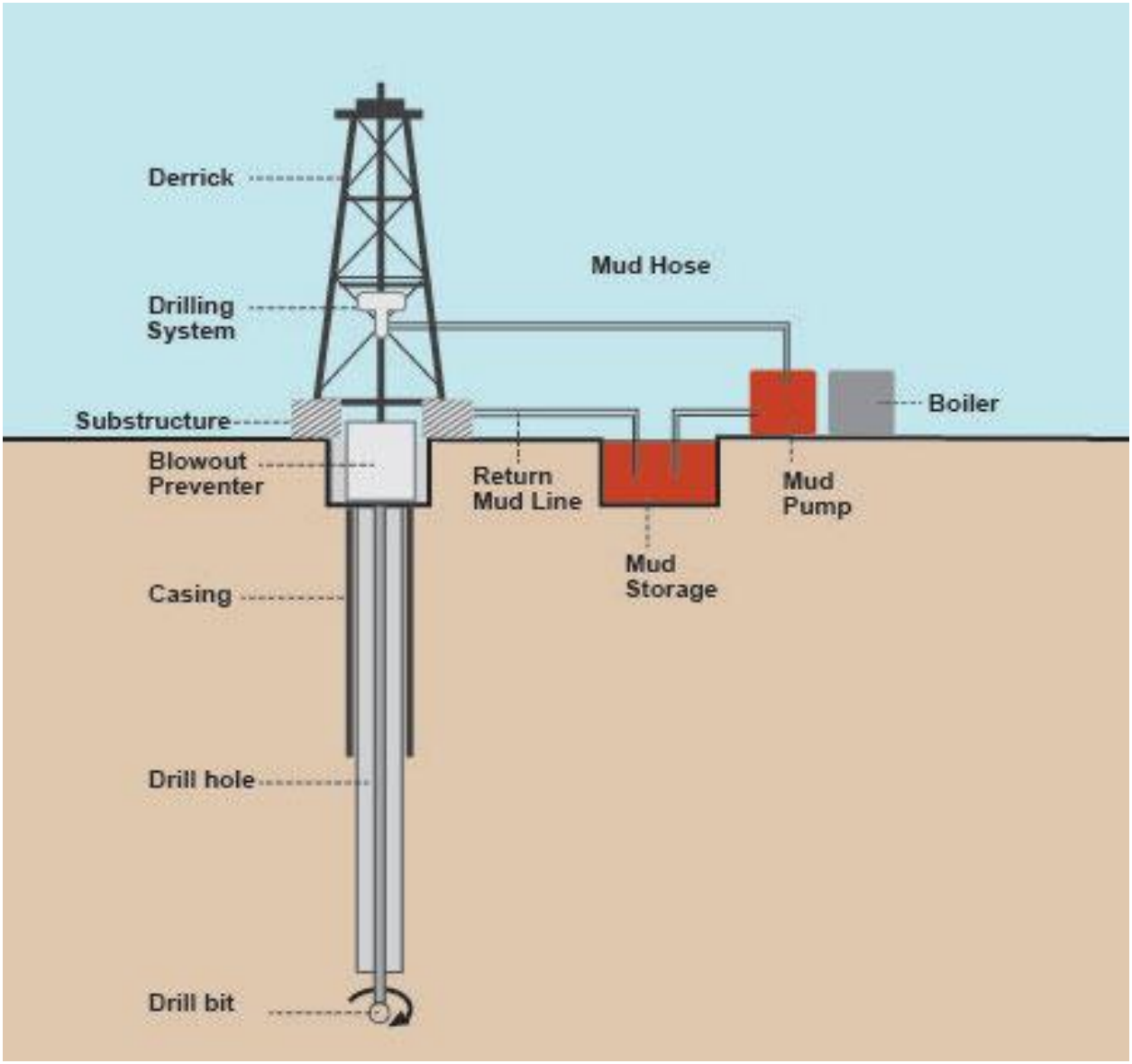

Figure 1.5 Well Profile

Drilling Fluids

Drilling fluid (or mud) is a vital component used in drilling oil, gas, and water wells. The drilling fluid system being currently researched for evaluation will be low-toxicity water-based drilling system similar to those in extensive use in other parts of western Canada. The supplier of any system will be assessed on previous comparative experience and required to pay great attention to mud system drilling performance and enhance ease of disposal to the highest standards demanded by AER Directive 50 for chemical constituents, dissolved salts, minimal oils, miscibility with native soils, and other characteristics.

A typical water-based mud system may be one of the following:

- Weighted (low-solids, non-dispersed) mud
- Glycol/glycerol mud system
- Saturated salt water mud (using sodium chloride, i.e., common salt)
- Calcium-based mud.

The list of typical mud formulations above covers a wide range of basic muds suitable for drilling in relatively benign (non-active clay), low-temperature environments. Simple muds comprise bentonite clay, caustic soda, shale inhibitors (common salt, hydrated gypsum, or lime) all well mixed together to help lift drill cuttings as well as minor additives to prevent drilling equipment corrosion, balance acidity or pH, permit the removal of drilled solids, and keep the ingredients in a slurry rather than separating or flocculating.

The Proponent has used a gel/chemical system on E-78, a relatively shallow well (approximately 1,000 m total depth). This system is used extensively in western Canada and exhibits the low-toxicity features desired for the proposed exploratory program. However, there remains the need to perform compatibility tests or analyses to confirm its suitability for drilling to 2,200 metres at Eagle Plains.

The Proponent is undertaking interviews and expanded discussions with a select number of well-established medium-sized mud services suppliers in conjunction with cuttings disposal specialists, all very active in other drilling jurisdictions. A mud services scope of work will emerge from these discussions to request proposals for providing the service for all exploratory wells. Once the system is designed and validated, all drilling mud characteristics, , such as mineralogy, lithology, pH levels, and others, will be known and can be disseminated to Yukon regulators.

The main function of drilling fluid is to over-balance the well pressure to ensure that the pressure in the wellbore is higher than the pressures expected to be encountered from the various geological formations as the drill bit penetrates them. The drilling fluid prevents formation fluids from entering the wellbore, keeps the drill bit cool and lubricated, circulates out drill cuttings, and keep in fluid suspension the drill cuttings during periods when drilling is paused or when the drilling assembly is cycled in and out of the hole. Drilling fluid is selected to provide operational efficiency, minimize formation damage, reduce corrosion, and minimize environmental impact for handling and disposal.

Project operations will utilize drilling practices that minimize the volume of drill cuttings and drilling waste generated. This minimization will in large part be due to drilling smaller-diameter holes to what will be a relatively shallow total depth. Drilling waste is composed of rock chips and cuttings and the drilling fluid that is recirculated. The drill fluid returned to the surface is sent through a shale shaker and centrifuge where the drill cuttings are separated and have most of the mud removed. The liquid fraction from the separation will be returned to the active tankage system for reuse.

Flaring

Flaring of gases during the drill stem testing part of well evaluation is a widely applied activity. The process, however, can only be undertaken in compliance with rigid regulatory controls. The requirements establish that the flare line must originate downstream of the choke manifold, must be designed to prevent the accumulation of any fluid within the line, and must be properly installed and anchored. Any amount of gas

encountered would be circulated through the rig degasser system to remove it from the drilling mud, thereby rendering the mud safe to pump back into the wellbore. Larger volumes of gas may be control-burned through the flare stack according the flare permit issued by Yukon Oil & Gas.

An example of a typical well site flare layout is illustrated below (**Figure 1.6**). Normally the flare line from the Choke Manifold is connected to the Flare Stack inlet to permit the directing of the gas to the flare until total control in terms of flow rate and flow pressures.

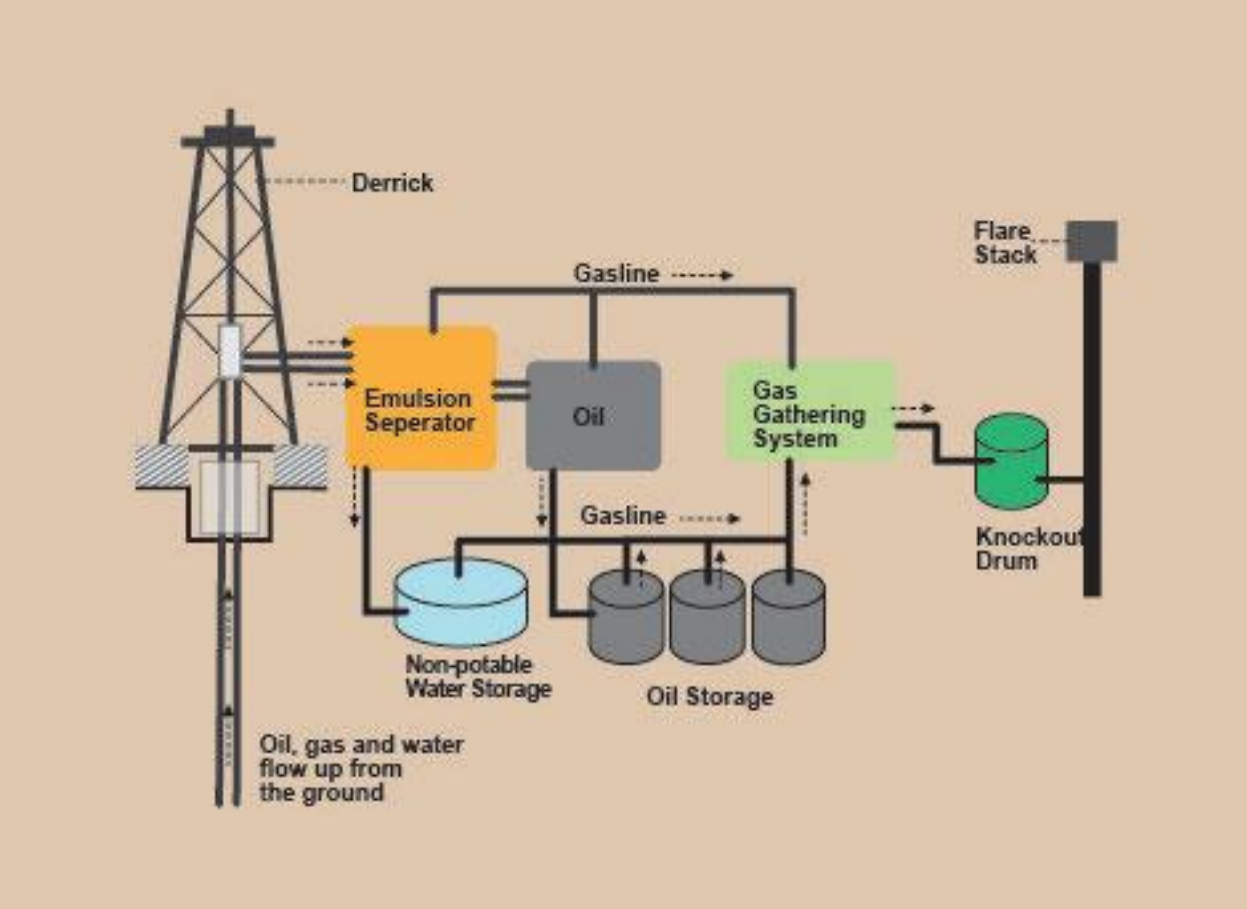

Figure 1.6 Typical Flare Stack and Gas/Vapour Recovery Flowsheet

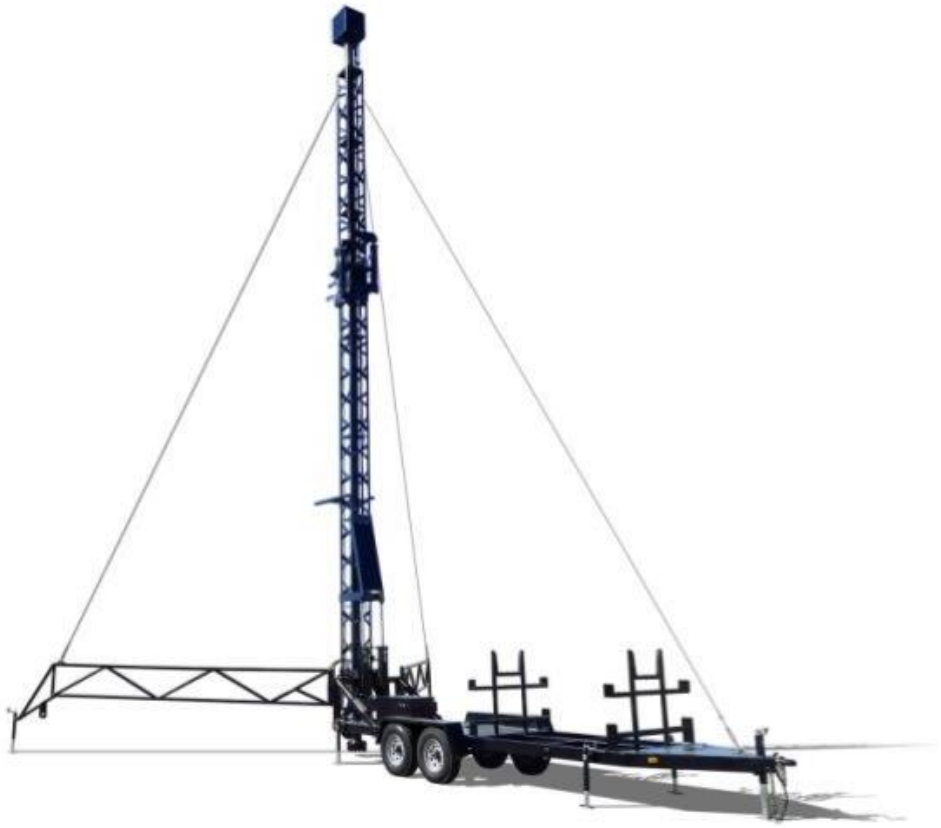

Figure 3-11 Typical Portable Rig Flare Stack Unit

Figure 1.7 Typical Flare Stack Unit on a Portable Rig.

It is expected that the targeted formations will produce less gas than in the past. Newly drilled wells will not contain the anaerobic bacterial contamination present in some of the older wells which may have caused small amounts of H_2S to be present.

The Proponent has not flared gases during the previous exploration programs; however it is likely to occur during some of the flow test operations until a use is found for the gas (heating, power generation, re-injection in a formation etc.).

In the event flaring is necessary, the flare will be higher than the surrounding area and designed to be well above vegetation or trees for example (both specific references made in the YOGA Drilling and Production Regulations quoted earlier). Noise from flaring normally only occurs when very large volumes of high pressure natural gas are being flared.

Flaring would only occur over a period of a maximum 1 day while conducting a DSTs at the end of a drilling program of one well. During extended flow testing, flaring may be necessary for between a few days to a few weeks. After that time actions would be taken to utilize the gas for power generation, tank heating or

possibly, gas lifting to assist crude oil production or re-injection. It would be the intent to eliminate gas flaring and reduce gas emissions to very small amounts when unavoidable.

The Oil and Gas group of Yukon Government's Department of Energy, Mines and Resources has adopted the AER Directive 50 – Drilling Waste Management (as recently amended and updated) procedures for the disposal of drilling wastes within the Yukon. The Proponent will manage the operation in accordance with the MBC requirements of AER Directive 50 – Drilling Waste Management for the remote sump locations and/or Alberta Forestry's "Drilling Waste Management, Disposal on Licence of Occupation" for the LWD disposal method (AER 2016).

It is not anticipated that significant levels of residue chemicals will be deposited on terrestrial and aquatic environmental components. The flare stack will be at 10 m high to assist in air dispersal of combustible end products and will be positioned on the well site in accordance with the regulated spacing requirements. All flaring processes will be in accordance with the air emission permit regulations and best practices.

To ensure that vegetation and soil are not be impacted by residual chemicals, the site design will include an appropriate spacing between the flare stack and any vegetation. Vegetation and soil samples will be taken adjacent and downwind (prevalent) and analyzed for identified chemicals of concern. These lab results will be compared to results obtained from control vegetation and soil samples taken at a similar ecosite, but not near the influence of flaring. Visual monitoring will occur throughout flaring period to ensure safety and protection of nearby vegetation.

YOG Drilling & Production Regulations specify these parameter in Part 9 of the Regulations: In summary the flarestack has to meet the following requirements (Note: operations when flaring will be conducted in full compliance with these requirements):

Flare requirements

128. Unless otherwise approved or directed by the Chief Operations Officer, any gas that is flared will be discharged from a flare stack that:

(a) is at least
    (i) 50 metres from any well, treater, separator, compressor, crude oil storage tank or any other unprotected source of ignitable vapours
    (ii) 80 metres from any right-of-way, easement, road, public utility, building, installation, works, place of public concourse or any reservation for national defence, except only when there may exist special circumstances that, in the opinion of the Chief Operations Officer, justify the positioning of the stack at a greater or lesser distance
(b) is adequately anchored and suitably protected against freezing
(c) is designed to ensure flame stability and efficient combustion
(d) is of sufficient height and diameter to ensure
    (i) that the average concentrations of hydrogen sulphide and sulphur dioxide in the ambient air do not exceed limits specified under the Occupational Health and Safety Act
    (ii) that vegetation combustion is prevented by maintaining an area free of vegetation and combustible debris around the base of the flare stack or the end of the flare line to the following minimum distances:

(A) 10 metres or 1.5 times the stack height, whichever is greater, in cultivated areas

(B) 30 metres or 2.5 times the stack height, whichever is greater, in forested areas

(C) 1.5 times the stack height, in any other area

(ii) that a minimum stack height of 2.5 times the height of the highest third party building located within a distance equal to 5 times the height of the building is maintained

(iii) that any heat generated around the base of the stack does not exceed the manufacturer's specifications for any equipment situated there, to a maximum of 4.73 kW/m²

(e) (e) has a sufficient exit velocity and is provided with guards or other features to prevent extinction of the flame

(f) (f) if the gas flow is intermittent, is provided with an ignition device to ensure continuous ignition of any gases.

Cement Plugs and Permafrost

Cement is a chemical mixture which reacts with and changes form when mixed with water. The reaction gives off heat when mixed with water. As the reaction progresses, the cement hardens. Cementing casing to attain the desired minimum hardness to withstand 500 psi (approximately 3,500 kPa) takes 6-8 hours depending on the amount of accelerator or retarder compound is mixed with the cement. This setting pressure permits the pressure testing of the casing within 12 hours of the cement job concluding to reach 80% of the casing internal yield pressure to confirm pressure integrity. Production casing for example, has an internal yield strength of 56,260 kPa (8160 psi); so 80 % test pressure would be 6525 psi or 45,000 kPa.

Permafrost cement (also named Arcticset or Polarset Cement by different suppliers) is manufactured reduce the amount of heat released during the reaction caused by mixing cement with water by adding Silica Flour mainly. When the cement is mixed with water the reaction proceeds with minimal heat generation and therefore does not contribute to permafrost degradation.

Typical oilfield cements, when mixed with water and begin to set, produce substantial levels of heat, known as the heat of hydration. This heat can melt the permafrost in the near wellbore region. Permafrost cements are a specific mixture of typical oilfield cement (Portland Cements) with additives such as gypsum and/or Calcium sulphate. This blend is specifically designed to create cement that, when mixed with water and begins to set, produces no increase in temperature of the slurry (no additional heat of hydration). This eliminates any permafrost degradation.

Permafrost cement is normally only used for the Surface Casing which is installed to protect any shallow aquifers and permafrost. The Proponent plans to install Surface Casing to a depth of 400 metres at minimum.

1.3.2.3 Drill Stem Testing

All well testing will be performed with the Guidance of AER, Directive 034: Well Testing, Theory and Practice and in consultation with Yukon Government's Energy, Mines and Resources- Oil and Gas Branch. As well, the Proponent will follow related non-discretionary legislations, such as the Drilling and Production Regulations. Part 5 of this Regulation provides detail on well evaluation and testing requirements.

Depending on analysis of rock cuttings, fluid measurements made during the drilling operation, and the well log results, it may be desirable to test prospective zones prior to drilling deeper or running casing. In these cases, a DST is commonly done. Drill stem testing or well flow tests are conducted through a special string of drill pipe anchored at the bottom of the well just above the target zone. The drill pipe would be made up to a packer that isolates the zone from the rest of the well and which would be mechanically fixed to the side wall of the wellbore A special annular pressure operated valve is placed above the packer and with either a small amount of fluid (e.g. water, diesel or other light density fluid) or with the pipe mostly empty of liquid to promote immediate flow from the formation in a controlled manner.

The surface end of the pipe would be connected to a well head made up of a series of valves to control flow and direct it where the operator requires but always with complete control. From the well head, the fluids from the well are carried by surface flow lines to a test separator. The separator splits the fluid mixture into its component elements which could be some combination of crude oil, natural gas and formation water, each stream of which is accurately measured by flow meters, to confirm the volume, pressure, temperature and rate of flow. From the separator, the crude oil stream is sent to a holding tank, the natural gas flows to the choke manifold to the approved flare or other pre-determined place (e.g. burned for heat, power or injected into an appropriate formation below ground) and the water would be filtered or treated in some manner to make is usable elsewhere or pumped back into an approved disposal well (most likely an existing suspended well in the area) in a similar manner as natural gas being injected in a suitable formation.

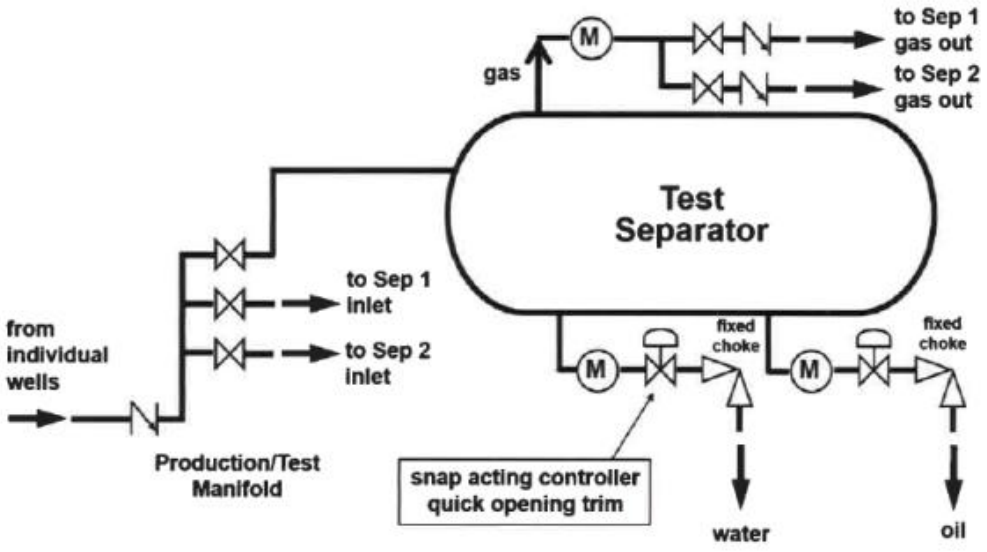

Figure 1.8 Typical Test Separator Schematic

The test separator (**Figure 1.8**) is kept operational permanently in every processing facility. This enables plant operators to assess the performance of the operation periodically. Outflow from the test separator normally is directed to a Central Processing Facility to join production from other wells. Separated natural gas may be piped to a dehydration vessel for future use as fuel or for injection downhole in a suitable well formation.

A typical operational sequence of DST is:

- Well is logged using various diagnostic tools and intervals for testing are selected.
- Test equipment is connected to the end of drill string and run into the well bor. The test equipment, generally consists of one or two packers for isolating the perforated intervals (to be tested), an annular pressure controlled downhole valve to open and shut in the well test and pressure gauges to measure the bottom flowing and shut-in pressures.
- Surface flow lines carry the fluids produced during the test from the wellhead (or surface test tree) to a test separator, where any natural gas is separated and either flared or utilized as fuel and any crude oil is separated and stored in tanks located onsite.
- A cushion of fluid contained in the drill pipe to initially ensure back pressure on the formation, which may be required to control initial flow rates.
- Once the test string is positioned at the zone to be tested, the packer is set and the down hole valve is opened to allow formation fluids to flow into the drill string.
- Initially, the well flows for relatively short period of time to clean up the wells (normally, this period may be a few hours). Following this period, flow is temporarily shut in downhole and a pressure buildup is recorded (with the initial shut-in period lasting for a period lasting 2 or 3 times the initial flow period).
- The test zone is now ready to be flowed at constant or variable rates, with each constant flow period normally followed by a shut-in period.
- Before concluding the series of test rates, bottom hole and surface samples are collected.

At the conclusion of the test, the tools are closed, packers unset and any samples within the drill pipe reverse circulated to surface. Formation fluids that may be produced during a successful test are piped into a test separator with produced gas being metered then flared and oil and/or water stored in sealed tanks.

Samples are taken of all fluids for analysis (both Pressure Volume Temperature samples under the flowing reservoir pressure, temperature conditions and atmospheric samples to check for “base sediments and water characteristics of the produced fluid”). A normal DST duration is approximately a few hours, not including the time required to make up the tools and run pipe to depth and do the reverse on completion. In addition to the time required to flow the well is an even longer period with the well shut in to determine the time it takes for the formation pressure to fully recover to pre-tests levels.

Depending on well log results, sample analysis and potential DST results, the decision is made either to abandon or case the well for further evaluation. In the former event, cement plugs are run using open-ended drill pipe across all porous/permeable zones, across the base of each casing string and at surface, the well casing(s) are cut off 1 m below ground level and steel plates welded across each string, a well sign is erected and the well site returned to original contours and re-vegetated, all pursuant to various oil and gas and land use regulations (all actions in compliance with Sections 90 to 96 of the YOGA Drilling and Production Regulations).

For each DST (minimum one per successful well unless several discrete zones require testing) one well flow should be sufficient and 30 in total days for 30 well DSTs would be typical. Should there be more than one prospective/productive formation which is separate from the other, a second (or more) DST will be

conducted on that formation. In some cases, a DST may need to re-done if there is a misrun. In addition, the DSTs may or may not be done in a steady sequence. Sequencing will depend on where the zones of interest are found in relation to the various casing strings that could be set as the well is being drilled.

Further Testing Details

The DST guidelines outlined in Enform IRP 4 are intended to ensure that safe work procedures are in place and to "minimize the probability of either the mechanical or human systems failing during a test, as well as establishing minimum health, safety and operating standards". In addition, they are "designed to allow flexibility and must be used in conjunction with competent technical judgment".

The exploration wells to be drilled may encounter hydrocarbon bearing zones that could be evaluated by conducting a DST (or DSTs). If DSTs are conducted a plan and testing procedures program will be in place, prior to conducting the test. The plan will be specific to the formation to be tested and the wellbore conditions existing at that time. The plan will be designed to ensure the safety of personnel and equipment and will provide for handling of any fluids that may be recovered. Enform IRP 4 guidelines are one of the sources that will be referenced in preparation of the plan.

Although the Proponent is the only operator currently active in the Eagle Plains basin, there have been several other operators in the past. The records of the historic wells in the basin are available on the website of Yukon Oil and Gas Resources. Nearly 200 DSTs were conducted on approximately 28 wells in the Eagle Plains during the period from 1960 to 2005. To our knowledge, there were no incidents where these tests had any adverse impact on the environment or presented any operational problems. Drill stem tests are a common method of evaluating potential hydrocarbon intervals in exploration wells and have been performed for over 60 years. They are usually of short duration. Flow periods are usually only 1 to 4 hours in duration, and seldom more than one day. The procedures for handling any produced hydrocarbons, and other fluids are the same as for any other operations conducted on the wells.

Three of the wells drilled in the Eagle Plains basin have had one, or more, acid stimulation treatments performed. One of these treatments was conducted by the Proponent. Records of these treatments are available on the Yukon Oil and Gas Resources website. These treatments are usually of small volume where the acid required for the stimulation treatment is transported in a single truck, and the treatment is performed in a single day. The fluid management practices utilized, as for other operations conducted on the well, prevent the release of any fluids to the environment.

Specific details of past drilling experiences can be found on the Yukon Oil and Gas Online Information Site: (http://maps.gov.yk.ca/imf.jsp?site=OilandGas_wells). For reference: the Proponent's comprehensive casing designs and rig and blow-out prevention system conforms fully to the YOGA (http://www.emr.gov.yk.ca/oilandgas/pdf/unofficial_office_consolidation_oil_and_gas.pdf), and the Drilling and Production Regulations (Sections 33- 61) (http://www.gov.yk.ca/legislation/regs/oic2004_158.pdf).

Further details of the Proponent's system configuration are confidential as per Section 176 (4) of the Yukon Oil and Gas Regulations. This section outlines what information is required to be non-confidential.

In consideration of the above text, it is not possible to accurately determine the number of DSTs that may be conducted at a well site. A more accurate estimation can only be determined after initial work occurs

which will inform Chance personnel of the geology, potential of oil and gas reserves. Plans for all DSTs will be based on well results and will be discussed with the Oil and Gas Resources branch of the Yukon Department of Energy, Mines and Resources.

Swabbing

There is the possibility that any well may be swabbed (normally a service/work over operation). Swabbing is a procedure to unload wellbores of heavier fluids thereby permitting the formation fluids to enter the wellbore and be circulated to surface. Wells will only be swabbed if the well is drilled, cased and a potential reservoir is:

- Identified,
- Perforated; and,
- Testing reveals that reservoir pressure is insufficient to flow liquids to surface; or,
- If well stimulation results in wellbore liquids that prevent flow to surface.

If the above criteria are met, swabbing is an accepted practice to reduce the pressure preventing a potentially productive formation from flowing to surface naturally. The same regulations affecting the handling and disposal of these fluids apply to fluids produced by swabbing as to recovery by any other means.

Acid Stimulation

Previous formation analyses have indicated small volume acid stimulation treatments would work well to clean up wells, remove scale and other impedances from formation pore throats to allow or improve flow into the wellbore. Acid stimulation entails the pumping of discrete amounts of normally hydrochloric acid at varying concentrations of 10%, 15% or 20%. The acid is trucked to location in specially sealed tanks in compliance with Transport of Dangerous Goods regulations and transferred to the cement pumping unit for pumping downhole. Treatment batches of 10 to 25 barrels (approximately 1.60 to 4 cubic metres) are pumped slowly controlled pressure until the entire batch is pumped. The relatively weak acid serves to dissolve scale (calcium Carbonate) deposited in flow paths over time. Successful stimulation is when the well flows at increased daily rates which could be +30 to 150 % of pre-stimulation rates.

The toxicity limits for oilfield hydrochloric acid are described in the Environment Canada documents and the Material Safety Data Sheets for the products. Hydrochloric acid is a gas dissolved in water to form hydrochloric acid. If heated the gas evaporates from the aqueous phase and water will be left. The chemical reaction of acid with carbonates renders the carbonates to form a harmless Calcium Chloride salt and water as by-products.

Oilfield concentrations are normally 10%, 15%, or 20% concentration hydrochloric acid. 5ppm (5mg/cubic metre) is considered safe concentration from an environmental perspective. Acid stimulation is normally only used once per well operation. The acid is transported in a special truck mounted tank that are designed and constructed for safe acid transport according to Transport Canada and Department of Transport regulations. A small quantity of relatively weak acid (10%, 15% or 20% concentration) is used on any occasion normally 5 to 10 cubic metres maximum. The acid is pumped from the truck into the pumper unit and from there downhole and never actually “sees daylight”. In winter, if acid is spilled as with water, it

would freeze and can be recovered from the surface snow or a thin surface soil layer. In summer, immediately flushing the spill with water would neutralize the acid and render it harmless (less damaging than vinegar). Flowing the well to “clean it up” would return the “spent acid solution” as Calcium Chloride, Carbon Dioxide and water.

In summary, acid stimulation is a common practice and an economic means to enhance well flow and reduce if not remove the materials impairing the ability of the formation to allow fluids to flow into the wellbore.

1.3.2.4 Extended Flow Testing

As noted above, all well testing will be performed with the Guidance of AER, Directive 034: Well Testing, Theory and Practice and in consultation with Yukon Government’s Energy, Mines and Resources- Oil and Gas Branch. As well, the Proponent will follow related non-discretionary legislations, such as the Drilling and Production Regulations. Part 5 of this Regulation provides detail on well evaluation and testing requirements.

In addition to drilling, any discoveries identified through DST are expected to undergo extended flow testing in order to gather important information about the nature of the resource accumulation and its productive capability. Given the remoteness of the region, the limited infrastructure to support oil and gas industry activities and the very early stage of oil industry evolution at Eagle Plains, the duration of these EFTs at each discovery could be up to 2 years. The information obtained from EFTs is critical to determining the future development plan for each discovery. The planned wells are exploratory; any flow testing will be contingent on discovery of formations potentially containing hydrocarbons. Part 8, Section 103 (1) of the Yukon Drilling and Production Regulations requires:

> *“The Licensee of a well shall obtain sufficient well tests, formation flow tests, wireline logs, analyses, surveys, conventional cores, cuttings and samples during the drilling of the well to ensure that a comprehensive geological and reservoir evaluation can be made.”*

EFTs will be undertaken if preliminary results from DST are encouraging and the following criteria have been met:

1. The well is drilled and cased; and,
2. A potential reservoir is:
    a. Identified
    b. DST has been conducted and
    c. Test analysis of the DST concludes sufficient hydrocarbons present to proceed to further evaluation of the hydrocarbon bearing formation.

In such a case, an EFT will be conducted to obtain more extensive information on reservoir characteristics and potential reserves. The same regulatory constraints apply to fluids produced by extended flow testing as to recovery by any other means.

EFT operates in a similar principal to DST. The main difference is that EFTs are undertaken after the well has been cased. To allow the zone of interest to flow into the wellbore, the casing has to be perforated

which is a routine procedure carried by either using a wireline from surface or attached the end of the production tubing from the surface to the zone of interest. The well, in this case, is first completed with a packer attached to a tubing string and have special downhole gauges to record flowing temperatures and pressures in real time. The surface would have the proper “Christmas Tree” wellhead equipment and be flow line connected to the test separator through a choke manifold. Well fluids (gas, oil and water) would then be handled in a similar manner as described previously. In an EFT however, the drilling rig would be removed to drill another well while the drilled well is prepared for testing.

Depending on drilling success several wells in different prospects would be flow tested simultaneously. As each well is drilled and drill stem tested to evaluate its candidacy for extended testing, it is left in a safe, secure state for further testing to take place after the drilling rig has been removed. It may become necessary to mobilize a small service rig to perform the completion work before turning the well to extended testing, but Chance Rig #1 could also perform this task and the solitary drilling/service unit at Eagle Plains. A well service rig has very similar capabilities and equipment as a drilling rig except that it generally has fewer modules and is also lighter equipment. If a service is required, it would be incremental equipment to the drilling rig.

Well testing is normally performed by specialized experts who would provide the specialized equipment, operating and safety procedures and the certification to be able to perform the associated tasks. Extended flow testing however would be handled in the same fashion as production operations and still be conducted by trained professional operators under the direct supervision of a Production Superintendent.

EFTs will require the installation of surface and subsurface equipment and facilities at each well site to measure, store and process produced fluids before it can be safely consumed, transported out of the operating area, or disposed at an approved location. The specific details of this equipment is subject to the nature of the discovery and could include:

- Casing of entire wellbore and perforate casing at zone of interest
- Packer, tubing and downhole gauges
- Wellhead valving assembly
- Flare systems
- Separator vessel
- Treater to do additional phase separation of the fluids
- Storage tanks
- Appropriate artificial lift systems
- Heaters
- Dehydrators
- Flow lines
- Metering equipment
- Portable generators

The Proponent anticipates a period of time to elapse between confirming a discovery worthy of further evaluation and commencing the EFT to allow time to properly design, fabricate, install, and commission the extended flow testing facilities.

The Proponent will conduct EFT on up to 20 successful wells. EFT may be completed within a month for a predominantly natural gas well or up to 2 years for a predominately crude oil well. There may be up to eight EFTs conducted at the same time.

Fluids produced during extended well flow testing will need to be measured, processed and dealt with in an environmentally responsible manner. Depending on the nature of a discovery, the Proponent anticipates that some combination of natural gas, crude oil and possibly formation water will be extracted during the EFTs. These fluids are separated and measured in facilities on the surface.

Natural gas could be flared for short periods of time. However, the Proponent may conserve natural gas and use it to provide fuel for process heating and possibly onsite power generation. Heaters are burners in a contained system of firetubes and the heat given off from combustion is used to provide heat to vessels treating the produced fluids or keeping stored fluids warm. The design of heaters can include heating an intermediate fluid such as glycol at the heater and circulating the glycol in a network of pipes to the places where heat is required. The generators are likely going to be small engines fuelled with natural gas and sized according to the power needs of the location.

Crude oil produced during the EFTs will also be conserved instead of flared to the greatest extent possible. This will require some processing at the well site or the central processing facility to stabilize the crude oil for truck transport to a suitable, approved crude oil marketing point, such as terminals near Ft. Nelson or Ft. St. John in British Columbia or Grand Prairie in Alberta. All of these locations are ready to receive and utilize crude oil produced from Yukon sources in the absence of such destinations within the Yukon. The Proponent may also consider trucking crude oil produced during the EFTs to ports in Alaska such as Skagway, Haines or Valdez for onward shipping to suitable markets elsewhere in North America.

Formation water produced in conjunction with crude oil and/or natural gas will be separated from the hydrocarbon streams and disposed of underground into a compatible and approved formation at Eagle Plains using one of the suspended wells. These procedures to process, transport and dispose of various fluids produced are common practice in every oil and gas province in Canada.

While water injection as a means to replace produced crude oil in the underground reservoir to maintain pressure in the reservoir is universally used in the oil and gas industry. The Proponent does not feel there is enough reservoir information data to predict the need for water injection in the future life of an Eagle Plains producing oilfield. The normal ratio of produced oil to injected water is 1:1. That is for every barrel of oil produced, there will be a requirement for a barrel of water to be injected following an initial period without water injection. The need for and the design of a water injection operational procedure will accompany and be part of a full field development plan should one transpire. One of the objectives of EFT is to gauge whether reservoir pressure maintenance occurs naturally or whether it needs to be done artificially using water or natural gas injection. This information will in turn support any longer term, development plan.

An EFT of any well can only be accomplished when year-round access to the each well is established. Producing wells require periodic inspection by field personnel to ensure the operation is proceeding within design parameters and safely. The well fluids have to be trucked out periodically as well.

During an EFT, all produced fluids will be separated into fluids that can safely be disposed of in the area (clean water) and fluids that must be transported to distant markets or safe disposal sites (crude oil, condensates). The natural gas element will, as previously stated, metered to accurately determine its volume/production rate and likely flared onsite, unless a local use can be identified (or burned for heating, gas lifting and/or power generation).

The average production rate experienced from previous well testing on the Proponent's old wells, 200 barrels of oil per day is expected to be the average per well production and less than 5% water cut is planned for. Therefore 4,000 barrels per day is likely the upper limit and a design limit of 2,000 barrels per day is more realistic for the daily maximums.

1.3.2.5 Well Maintenance (Workovers)

Any well completed for EFT or longer-term production may require workovers during its lifetime. A work over entails the manipulation of the wellbore production equipment (pumps, tubing, packers, etc.) using a suitably sized service rig or occasionally a drilling rig. In this activity the objective would be to change the condition of a well to improve productivity, replace faulty components or extend the well's productive life in some manner.

Over time, a reservoir depletes in such a way at to permit the water interface with crude oil or natural gas in the formation to rise to a point where only water flows from the wellbore. Producing too much water over a period of time could impair the ultimate recovery of crude oil or natural gas and possibly shorten the life of a producing well. Measures are needed to reduce or shut off the water flow to allow continued recovery of crude oil or natural gas. These include plugging some or all of the perforations and perforating at different section of the wellbore casing. Other factors that impair production of crude oil and natural gas include scale buildup, asphaltene (a constituent of some crude oils) plugging, etc. need remediation and this work is done using service rigs, wireline services and so on. These practices are commonly used by the oil and gas industry and conforms to the regulatory requirements to optimize the recovery of the resources from the reservoir.

The well completion design and installation phase is critical in ensuring the well maintains a longer period of uninterrupted production. To this end completions are designed to require minimal intervention for many years by installing simple less mechanically operated systems, superior corrosion protection, erosion protection, possible use of internally coated production tubing etc. All such actions are focused on making product flow as smoothly as possible. Furthermore, the actual tubular components are selected to minimize changes in internal diameter, prevent areas where turbulence is generated and reduce if not eliminate leakage paths.

The completion is also designed to make its installation as trouble free and time saving as possible (have components which could assist in pressure testing the tubing internally while being run to eliminate leaks. The simplest completion should comprise of tubing and perhaps a tubing anchor or packer. Seating or landing nipples are installed to enable internal pressure testing of a completion string as well as land

downhole pressure gauges while flowing, permit circulation of kill fluids from the annulus into the tubing bore or reverse and possibly plug a well at a certain depth. The term “kill fluid” describes a fluid of sufficient density that creates a hydrostatic pressure at the bottom of the fluid column that is equal to or great than the formation pressure and prevents formation fluid from flowing into the wellbore.

Work overs nearly always start with “killing the well” to prevent further flow and circulating the wellbore contents to be replaced with a stable, non-flammable fluid. The kill fluid is normally weighted brine with corrosion inhibitive features. Salt dissolved in water (Brine) makes the water “heavier” (denser) and therefore an over balance medium fluid to keep formation fluids in the formation and not allow then to enter the casing/well. Normal completion brines are Sodium Chloride, Potassium Chloride and Calcium Chloride depending on the bottom hole pressures encountered. Eagle Plains conventional wells can be completed with Sodium Chloride (common salt) brine mediums. Only additives that may be added to the workover brine is corrosion inhibitors and/or biocide.

Following that activity, the wellhead is removed and a blowout preventer is installed to provide additional control of the well during the work over. The production tubing is recovered to surface for reuse or disposal if it is too eroded or corroded for future use. The wellbore would be cleaned of debris accumulating over a production period (normally a bit and casing scraper run accomplishes this). The remedial work is done to the well to fix whatever problems were encountered and the well is returned to a condition that allows production to resume.

1.3.2.6 Drilling By-Products

Within the described drilling program, two forms of drilling by-products will be produced. The following sections will describe and detail their creation and industry wide solutions for dealing with these by-products.

Please note, the Proponent is drilling within a sedimentary basin. Drill cuttings consist of sandstone, shale, and carbonate rock and are therefore, not significantly sulphide bearing. These rocks have been examined by Chance geologists and do not contain the materials that cause acid creation and as such the potential for acid rock drainage caused by the disposal of drill cuttings is remote to non-existent.

Naturally occurring radioactivity will be measured by gamma ray or spectral gamma ray wireline logs, which is a regulatory requirement in the Yukon Government Drilling and Production Regulations. GR is a radioactivity detection device (similar to a Geiger Counter) and therefore detects any existence of radioactive Uranium, Thorium and/or Potassium isotopes in the rock formations drilled. To date no abnormal detections have been made other than that attributed to natural rock formation radioactivity and therefore, radioactivity appears absent or undetectable in the fluid of the Eagle Plains sedimentary formations.

Solid Drill Cuttings

When drilling a well, cuttings are produced. These cuttings are a direct by-product of the drilling action caused by the bit grinding rock. After being drilled, these cuttings are brought to surface with the drilling fluid and separated from the drilling fluid using sophisticated equipment (e.g., shale shakers and centrifuges). These cuttings are stored onsite in metal bins referred to as shale bins. Close attention is

given to the dryness of the cuttings coming across the shale shakers and collected in the shale bins. It is important that as much fluid as possible be recovered from the cuttings for a few reasons:

- Less total weight in the cuttings, hence less cost associated with future handling of the drill cuttings.
- In the winter, it is easier to handle and move dry cuttings as they do not freeze and create large blocks of material.
- Reduces the need for additional make-up drilling fluid by recycling more fluid that is separated from the cuttings.

Drilling Fluid

The Proponent is proposing to use water-based drilling fluid systems. It is not uncommon that after drilling a few wells using the recycled drilling fluids, a mud system may need to be partially or fully reconstituted (disposal of the current system and mixing of fresh water and new drilling fluid products). This ensures the drilling fluid is fresh and capable of drilling through the different rock types found in the proposed wells. It is unclear how often a reconstitution process will be needed. The Proponent has had success with re-using drilling fluid systems across multiple wells to reduce the overall need for make-up water and reduce ultimate disposal of material at the conclusion of its use. As drilling is likely confined to a winter drilling season, the Proponent will likely re-use drilling fluid throughout one drilling season.

The first stage of fluid and material management is called ‘Stripping’; this is the process of running the drilling fluid as it returns to surface through centrifuges multiple times to separate the water from any solids suspended in the fluid stream. The fluid is then either recycled back into the mud system or used elsewhere on the rig

The disposal options outlined for the drilling program have been directly influenced by both the proposed drilling system and the site conditions present at the drilling locations and in the Eagle Plains area generally.

- Accordingly, the following conditions were established for selection of the drilling mud system: a low-toxicity mud system confirmed through laboratory analysis; and
- Meet operational requirements (maintain formation stability, hole cleaning and well control, etc.)
- The following conditions were established for selection of a cutting disposal method:
  - minimize the extent of surface disturbance; and
  - minimize transporting the material off-site for disposal.

In response to both these sets of conditions, the Proponent plans to select a water-based mud system as generally described which has been previously proven suitable for the MBC disposal process in an approved nearby site.

Any drill fluid selected will first have to satisfy Section 32 “Approved Drilling Fluid” of YOGA Drilling and Production Regulations. The type and chemistry of the drilling fluid will be a key part of the drilling Program issued in application for a Well Licence. This is explained and described further in this section.

1.3.2.7 Mix Bury Cover Sump

The Yukon has accepted AER Directive 50 as the governing regulation to determine the eligibility and applicability of various disposal alternatives for various drilling by-products and mud systems. Mix-bury-cover, as described and detailed in AER Directive 50 Section 13, is a method of disposing of drilling waste (both drill cuttings and drilling fluid or just drill cuttings) by which the by-products and spent mud is mixed with a local receiving soil at a specific mix ratio, then deposited into a sump, and then covered with clean subsoil.

A typical MBC sump design consists of three distinct layers:

- A clean subsoil layer 1 to 1.5 m in depth. This layer acts as an insulator between the subsoil/drill cutting mix and the vegetative layer to ensure that, after final reclamation, the site is returned to its original state.
- The subsoil/drill cutting mix layer is where the receiving subsoil is mixed at a specified mix ration with the disposed material (e.g., drill cuttings, spent drilling mud, etc.).
- Clayey material exceeding 1 m in depth, or alternative impermeable liner, acting as a hydraulic isolator.

Sump Suitability

Initial investigation into sump locations is required. AER Directive 50 Section 6.3 specifies the procedures and parameters for sump site investigation. Any proposed location will have cores drilled and the subsoil will be analyzed to confirm the following for a proposed sump:

- Sump soil has appropriate deposits of clayey soils.
- Must have appropriate clayey material of 1 m beyond the horizontal and vertical dimensions of the sump to ensure hydraulic containment.
- Absence of hydraulic defects or ways for fluid to leak out of sump.
- A composite sample, made up of five subsamples, is required for every 3 000 m² proposed to be used for MBC.

In the instance where the subsoil is found to be saline, special care will be taken when these sumps are excavated to ensure the non-saline active layer and subsurface materials are returned to the surface allowing the site to return to its equivalent land capability.

The Proponent has begun a sump suitability study of chosen locations throughout the area proposed in this application. Core samples, from existing and potential future locations for MBC style disposal, are being examined and analyzed by qualified experts. The results of this work will determine the course the Proponent will pursue for MBC at Eagle Plains.

The actual drilling fluid system that the Proponent plans to use has not yet been determined due to the exploratory nature of the drilling program (uncertainty of lithology), more information about this can be found in the Environmental Conditions report (Appendix D) describing the geology in the area. Before the Proponent begins the drilling of a well, a test sample of the drilling fluid will be prepared. The properties of

this fluid will be analyzed and compared against the receiving soils at the MBC site(s) to estimate the soil/waste mix ratio to ensure the final soil composition complies with AER Directive 50 section 3.

The Proponent intends to assign cuttings disposal management and direction to a competent individual representing an organization with the most experience operating under the terms and conditions of AER Directive 50.

MBC is not a viable disposal option if:

- Suitable sump site that meets all of the requirements established under AER directive 50 cannot be found.
- Drilling fluid that is incompatible with receiving soils or prohibited for MBC under AER Directive 50 is used.
- Drilling by-products/receiving-soil properties require a mix ratio greater than 7.

In order to minimize the potential for deep permafrost exposure during summer exploratory drilling program, the following mitigating procedures will be adopted:

- The sump will be excavated as disposal volume is required, in order to minimize the area of basal and wall permafrost exposure at any time. This may be in the form of narrow compartments oriented E-W to maximize shading of the basal permafrost surfaces or any other field procedure determined superior at the time.
- The top of the open area of the sump may be covered if environmental/geotechnical monitoring indicates degradation of wall structures in the sump trench due to thaw.

While an MBC sump is actively being used, the Proponent will monitor and inspect the site to evaluate sump integrity, volumes of material involved and to assess if further work is needed to the sump location. The drilling operations will utilize practices that minimize the volume of drill cuttings and drilling by-products generated.

The Proponent will arrange for full-time disposal expertise, provided from the selected mud services contractor, who will be available for Project management and consultation regarding disposal operations.

As noted above, all materials to be disposed of in the sump will meet AER Directive 50. If materials to be disposed of do not meet AER Directive 50, the disposal material will be transported to an appropriate permitted facility for disposal consistent with the practice employed in previous exploratory wells drilled at Eagle Plains. The Proponent has used permitted facilities that can accept specified waste in Whitehorse and northeast British Columbia.

Drill cuttings and fluids will be held in containers for minimal periods before disposal. After drill cuttings are circulated out of the hole, they are separated from the drilling fluid and stored in 3-sided metal bins. For final disposal, the cuttings are transported to the proposed MBC site for mixing with the subsoil. After the three-sided bins have been emptied, they will be moved, along with the rig, to the next drilling location. Disposal will take place as and when required during drilling or when the shale bins contain a full truck load of material.

For the proposed Project, drill cuttings will be transported to and disposed of at the MBC sump site, while fluids will be reused until the end of the Project. The Proponent plans to construct a new MBC sump adjacent to the Devon sump area to the same specifications to dispose of drill cuttings from the proposed 30 wells (see **Figure 1.9**). The Proponent has not used the Devon site for any drill cuttings or drilling fluid disposal to date and does not intend to use the site for disposal in the future. The Proponent's preferred disposal site is separate from where Devon drill cuttings and drilling fluid were buried but in an adjacent, previously undisturbed area,The Proponent has not monitored or inspected any of the Devon sumps. The proposed exploration drilling program will be performed under a comprehensive drilling fluids management process managed by a services supplier competent in AER Directive 50 and fully versed in safe MBC techniques in use in western Canada.

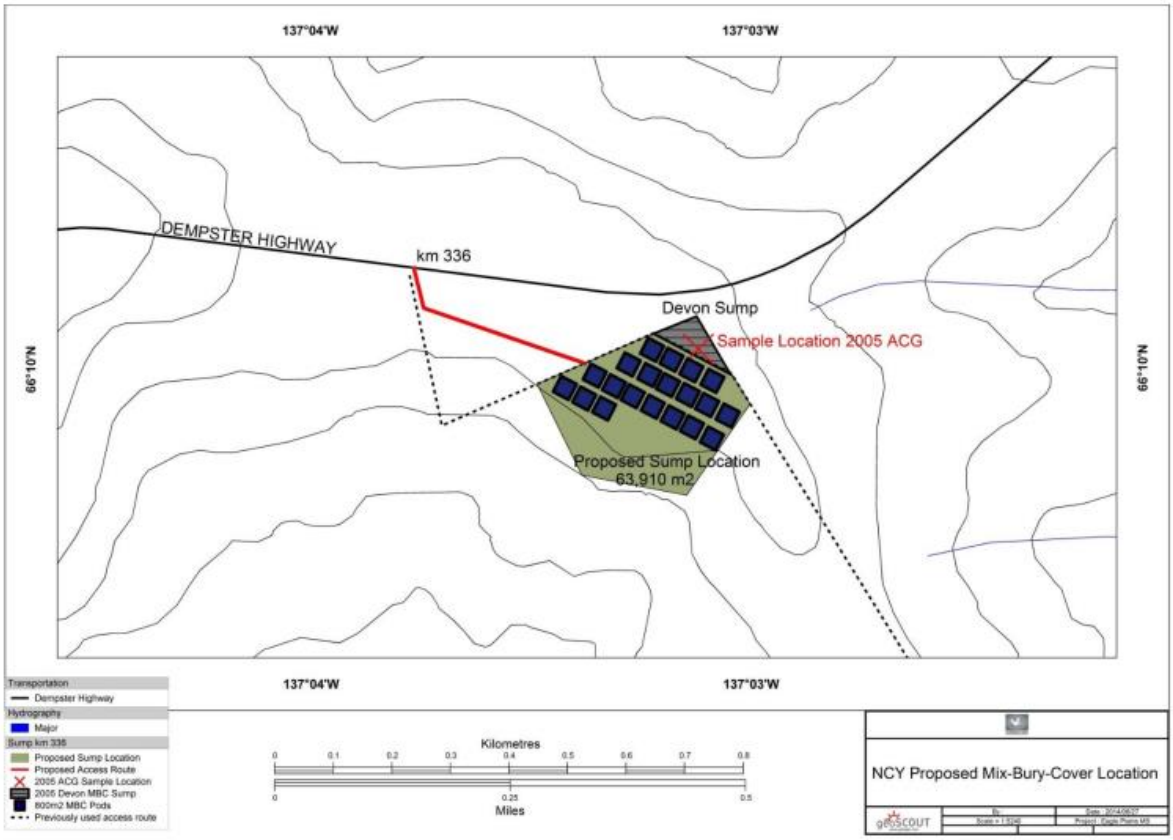

Figure 1.9 General Location and Typical Plan of MBC Sump Site

Figure 1.9 shows the 63,910 m² area proposed for MBC disposal. This area was determined based on the estimated area required for disposal. Each 800 m² MBC pod signifies an estimate of how much area would be required to dispose of one well's drill cuttings. The additional area, a rough estimate, would allow for spacing between MBCs for truck access and to pile excavated material before MBC commences. All estimated calculations, as required by Yukon Government Drilling and Production Regulations (Government of Yukon 2004), were made in accordance with the requirements of AER Directive 50. Typical operational practice is to have only one MBC open at a time.

MBC pods will be sized based on the anticipated volume of drill cuttings disposal required per well. This will ensure that the MBC opening time is minimal. As mentioned previously, a typical well would produce up to 300 m³ of drill cuttings and require an area of approximately 800 m² to dispose the drill cuttings. The Proponent proposes to only use the site described in **Figure 1.9** for the MBC sump. The section of area where the Devon 2005 MBC was located and whose exact location is known, will not be disturbed by any of the proposed operations. The Proponent aims to minimize surface disturbance by using a single previously disturbed area for multiple MBC pods. The site is adjacent to an already disturbed site used by previous oil and gas activity (Devon access road 2004) and it has already proven to have the soil characteristics required as stated in AER Directive 50 Section 6.3. There is no operational need to establish other discrete MBC locations.

1.3.2.8 Injection Well

DIR 50 covers the disposal of drilling fluid. In this case the fluid would be added to the drill cutting and then mixed with the required amount of soil in accordance with AER Dir 50. Drilling fluid may also be stripped back to just the clear portion and disposed of using an approved water injection well.

Well choice requires further injectivity and suitability investigations. This cannot occur until the wells are re-entered and made ready for the investigation trials. Chance Candidate wells could be one or more of the following suspended well(s): Chance J-19, Chance M-08, Chance G-08, Blackie M-59 and Chance E-78 all located within the Chance licence areas. Any well that is not a preferred EFT or future production candidate could be an injection well if strategically located in close proximity to a usable well or wells and if it exhibits the required characteristics for injecting fluids.

The YOGA Drilling and Production Regulations require reservoir produced water not be disposed of at the surface unless its quality and/or salinity is equal to or better than the quality limits set out in producing filed facility licence.

Any plans or intention to dispose of produced water from reservoir fluids separation have to be submitted to the regulatory authority and must meet the pertinent environmental standards as well the oilfield waste disposal standards and limits (reference YOGA Drilling and Production Regulations Sections 122. 123. 124, 130 and 165). The YOG regulator will only authorize produced water disposal when the operator demonstrates all legislation in force requirements have been met and that good oilfield exploitation and reservoir management practices are satisfied.

Once their disposal suitability is established, the following liquid materials (all treated with bactericide) and their volumes may be disposed of:

- Produced water per well (water cut 20% to 60% for 200 BOPD) = 40 to 120 barrels water/day
- Workover fluids: Maximum 7” casing volume full= 276 barrels
- Rig wash: hose flowing at 5gpm water for one hour = ±7 barrels per day in summer
- Saline fluids (completion brines) same as workover fluids = 276 barrels
- Liquid fraction of drilling fluids = approximately 200 cubic metres at end of Project

The zone must have an impermeable barrier above it to prevent migration of the injected fluid and be deeper than 750 metres. Permeability and porosity of the rock must permit pumping of the fluid at low surface pressure and especially well below formation breakdown pressure. Testing will also have to determine injection fluid compatibility between the rock and native reservoir before injection.

The injection pressure and rate, and the pressure in the casing tubing annulus will be monitored at all times. Accurate/calibrated surface pressure gauges will continually monitor pressure readings and any fluctuations. The conditions are injectivity rate, porosity and permeability of the formation being injected into.

Disposal of highly saline produced water at surface disposal sites may be greatly restricted in quality and quantity. To this end and to support best reservoir management practices, it may at times be mandatory to re-inject reservoir produced water back downhole as the only viable and environmentally safe option.

1.3.2.9 Seismic Exploration

The seismic program will consist of approximately 1,500 km² of 3D and 2,000 km² of 2D reflection seismic exploration. Actual final seismic survey location, design and layout will be dependent on drilling outcomes as they progress. Utilization of the low-impact seismic methodology will result in very low impact on the environment. Source lines are limited to 3 metres in width and receiver lines limited to 2 metres in width. The Proponent intends to leave a small amount of snow on the lines so that the tundra and permafrost are not disturbed. The low-impact seismic drills are outfitted with air hammers and as a result will not require water for drilling.

The Proponent plans to deploy a wireless recording system. This wireless system is preferred since a cabled system could present a hazard for migrating animals and requires a larger hand cut line than is necessary for a cable-less system where the layout crew only requires a path 2 metre or less through the land. A cable-less system is also less impactful on the environment as it is easier to carry down the receiver lines and requires fewer personnel on the recording crew.

Preflagging (Cruising)

Prior to line preparation, a detailed line by line spatial analysis (area examination) is performed utilizing a combination of air photos (2011 vintage with 2 m resolution), LIDAR (Light Detecting and Ranging), field scout information, GIS information, First Nation cultural inputs, and any information identified by the preflagging/cruising phase. This greatly helps reduce time spent in the field dealing with localized line preparation issues.

Preflagging (cruising) will be conducted to identify and mark line locations, areas containing riparian areas, difficult terrain, historical/archaeological areas, animal sites and facilities. This is done by having personnel on the ground marking the line locations and areas of concern for the mulchers and chainsaw operators to follow or avoid. These areas will be added to the Project map. Handheld Global Positioning Systems (GPS) units ensures accurate line placement and automatic notifications are sent to management when the mechanical equipment is approaching a “Hot Spot”, or stations that are encroaching any buffered zones or areas.

Line Preparation

A combination of low-impact seismic mulchers and chainsaw operators will be utilized to prepare source and receiver lines. Both source and receiver lines will be slashed to ensure there are no pokers or leaning trees for safety reasons. On board GPS on all mulching equipment ensures accurate line placement and automatic notifications are sent to management when the mechanical equipment is approaching an area of concern, or stations that are encroaching any buffered zones or areas. Lines will be doglegged or bent from any access point to avoid creation of a line of site and will meander to avoid disturbance of any timber larger than 20 to 30 centimetres in diameter. Source lines will be 3.0 metres wide to accommodate vehicles. A minimum of 20 centimetres of packed snow will be left on line to avoid possible damage to vegetation or permafrost. Receiver lines will be 1.75 metres wide to accommodate personnel.

Survey

After source and receiver lines are prepared, surveyors travel the source lines to mark the location of where the low-impact seismic drills will create the source points, and the receiver lines to mark where the recording crew will place the wireless recording equipment. They do this using GPS which allows for meandering and narrow lines.

Source Point Preparation

Source point holes 9 m in depth and 10 cm in diameter will be drilled every 60 m along the source lines using a small, low-impact seismic air hammer drill. A charge of one kilogram of dynamite is then loaded into the hole to be detonated by the recording crew. Dynamite is transported and stored at one of the staging sites in a federally regulated Explosives Magazine.

Recording

With the use of a long line and helibags, a helicopter will place and retrieve recording equipment at pre-determined intervals along the receiver lines. Recording personnel will access the equipment in the helibags and will place a series of geophones every 60 m along the receiver lines. The recording crew will be using a cable-less recording system. Cable-less recording systems are ideal for gathering seismic data because they reduce the constraints on geophone placement, eliminate downtime for cable repair, and reduces the impact on the environment. The geophones record the vibration created by the charges being detonated on the source lines. The data that is recorded is relayed to the observer truck. Once the data is relayed, personnel and helicopter return to retrieve the equipment and any debris used to mark the surveyed receiver and source locations.

The helicopter will be based out of the camp and the use of the helicopter will be minimal. The Proponent will follow the Flying in Caribou Country guide. Helipads will be built for safety and medevac reasons.

Access Trails/Creek Crossings

For safety reasons, vehicular and personnel movement a minimal amount of access trails will be required within the program area. This will be done on existing trails, historical seismic lines or lines that will also be used for source lines and receiver lines. The width of the access trails will be a maximum width of 5.5 metres wide and will also have a minimum of 20 centimetres of packed snow.

1.3.3 Accessory Project Components

The following activities are expected to be completed, as required, to support the principal activity of drilling completing, and testing exploration wells:

- Well site(s) preparation
- Other Project Facilities (i.e., camps and fuel storage)
- Some surface facilities (e.g., storage, processing, injections)
- Airstrip construction and operations, and 2 fixed-wing aircraft flights per week
- Building and maintenance of access roads (all-season and winter roads)
- Development of borrow sources for airstrip and roads
- Water use for drilling and camp

For drilling: Camp 325 will be the main accommodation facility for the exploration program. The Chance Rig #1 will also have a smaller mobile camp, occupied 24 hours per day, 7 days per week, to house essential personnel (rig supervisors, medic, geologist, etc.).

1.3.3.1 Access Roads

Assuming all wells are successful, all-season roads will then be required to access all 30 wells. Access to wells that are proximate to the Dempster Highway , drilled in proximity, or enroute to a successful well will have all-season access built to them. Wells undergoing EFTs, including the legacy suspended wells located on the Chance Significant Discovery Licence, will require all-season access. The Chance Road will be established as an all-season road regardless of the results of the drilling program.

After drilling several wells and depending on success in discovering hydrocarbon-bearing formations, access roads will be upgraded to all-season roads constructed from rock material from borrow fill sites. The diagram below, prepared by Boreal Engineering Ltd., illustrates a typical road construction design. The pad will be constructed to be approximately 7 m in width, sufficient for safely accommodating a transport truck, but also having roadside passing areas to allow 2 trucks to pass beside one another. Passing bays will likely have frequency of 1 approximately every 750 m allowing vehicles coming from opposite directions to have a clear view and prepare to enter the nearest passing area on their side of the road.

The estimated distance between pull outs to be 1 km; however, they should occur as/when required when the roads winds and visibility for oncoming traffic is impaired. Pullouts will be 150 m long, at inter-visible locations and identified with signs indicating the km / station. It is intended that the maximum distance between pullouts will be 1 000 m; however, they may be as close as 300 m to provide a passing lane to ensure that pullouts are inter-visible. The purpose is that if a vehicle were on the road without radio control, a widened road would be available for passing transport trucks. For the purpose of volume calculations, it is estimated that average distance between pullouts will be 750 m. Well site access roads would, in turn, also be constructed using a similar design.

The base road pad will be ultimately covered with a sandy material for protection of the road surface and endurance. All-season roads will require periodic maintenance as surface material is removed or eroded by the elements or vehicular traffic.

Winter road construction will utilize similar techniques as previously applied. Once snow cover equals or exceeds 10 cm there should be adequate snow to build winter roads. Well site access roads will also be constructed in a similar fashion using accumulated snow to construct berms on the road margins and filling the space between with amounts of snow and water trucked from approved sources. All roads will be supervised by a competent and qualified geotechnical engineer to ensure their ability to safely support the drilling rig and other similar heavy loads that will be transported across them.

Water Crossings

The access routes are designed to have as few water crossings as possible by following previously travelled trails and roads located on ridges or higher areas well above the water drainage valleys in between. The normal techniques applied when constructing water crossings is to lay a culvert of a sufficient outside diameter as to not reduce or obstruct the water flow, nor impeded fish movement along the water course. To this end, the Proponent has directed that water crossings must meet all the Yukon Government land use and transportation requirements.

Culverts will be installed per the Yukon Government Highways and Public Works standard drawing for culverts in permafrost conditions. Culverts will be installed using standard engineering practice in permafrost areas and per the attached Yukon Government standard drawing 06010-5. Culverts will be sized following a hydrological assessment by a Professional Engineer registered in Yukon to determine flow volumes. Culverts will be sized accordingly to the 100-year return event. Minimum culvert size will be 600 millimetres (mm). Culvert installation methods will follow those methods provided by *Best Management Practices for Contractors and Inspectors* handbook. The hydrological assessment is necessary to determine the stream flow for culvert sizes of each water crossing. The Alaska document urges the understanding and appreciation for the thermal effects of standing and running water because water can initiate thaw settlement and erosion that can destroy the road.

It is recommended that “the velocity and volume of water running beside the toe of a road should be carefully evaluated, providing for a series of culverts, rather than large culverts at discrete intervals rather than large culverts at great distances” (Author year) The Guidelines further recommend “Culverts should be considered in three distinct phases: 1) during the original deployment, 2) during the first summer after snow is gone and actual drainage cane be seen and reassessed and 3) in subsequent summers when perhaps the roadway and culverts have settled or other factors have influenced their effectiveness” (Author year).

The Proponent will commission a fully qualified road Arctic construction organization currently operating in Yukon who are versed in the construction techniques applied to remote areas as Eagle Plains.

Water courses will not be diverted. A culvert will be installed within the flow path of the stream. Following completion of the culvert installation, water will be directed through the culvert prior to placement of fill for road construction. Following closure of the road, the culvert will be removed and the water course will be returned to its natural state.

MBC Sump Access Road

The Proponent also proposes to construct a 400 m all-season access road to MBC sump area (Error! Reference source not found.). This road will be constructed as early in Project as possible (soon after mid-

January as snow and weather permit) and will take approximately 2 weeks to complete. The minority of the road follows an existing access trail, and no major clearing will be required. Please see photos of access and terrain. The road does not span any waterways and is 800 m away from the nearest water drainage. The road dimensions will be approximately 400 m long by 6 m wide. The material used for road construction will be approximately 3,000 m³ of locally sourced granular material.

Well Site Access – Summer

All material used for road construction will be locally sourced granular material. Materials utilized will be those approved for use as a road construction material. Several identified borrow sites have been cored and evaluated for quality and quantity of fill material by geotechnical engineers from Tetra Tech/EBA and Yukon Engineering Services. Kryotek Engineering and Boreal Engineering have also been consulted for expert advice regarding Arctic road construction techniques in Yukon. A combination of the previously mentioned engineering organizations will be contracted to undertake road design, construction, and general project management. The construction of a summer access road will be completed as described above.

Well Site Access – Winter

Winter access will only be constructed if the ground and water bodies are frozen and if there is adequate snow coverage. The Proponent will ensure there is a minimum packed snow cover of 10 cm to the vegetation layer. Where required, an increased snow depth will be maintained to avoid disturbing surface vegetation and duff (i.e., tussock terrain).

The factors that will be considered while making the determination will be terrain features, vegetation present, and local topography. If this snow depth (minimum of 10 cm) is not sufficient in certain areas, additional snow depth will be ensured to provide adequate protection to surface vegetation and duff (i.e., tussock terrain). If this is required, snow will be removed from appropriate locations in the direct vicinity of the winter road (i.e., surrounding areas that have ample snow coverage) and added to the snow pack on the winter road. Vegetation will be cut, with no disturbances to the vegetation mat. Access routes will be constructed using equipment appropriate for packing snow.

Several water bodies may require ice bridges/snow construction. All water bodies will be treated as fish-bearing and will be constructed as per Fisheries and Oceans Canada's (DFO's) Operational Statement on Ice Bridges and Snowfill (http://www.pac.dfo-mpo.gc.ca/habitat/oseo /icebridge-pontsduglace-eng.htm) as well as the Safety Guide for Operations over Ice. As well, if water is required to be withdrawn from nearby water sources, adequately sized intakes will be used and screened to prevent debris blockage and fish mortality (refer to DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 1995).

A minimum snowpack of 10 cm is required for the winter road. However, if the amount of snowfall in the area allows for a thicker snowpack (i.e. 15 cm to 20 cm) during initial road construction, a thicker snowpack will be used. As the winter progresses, the Proponent will continue to add to the snowpack.

If natural snowfall is below the minimum required to commence access and well site construction, the Proponent will consider artificially making snow to make up the shortfall. This is a contingent consideration and could require up to 300 m³ of water per day for a short period of time (several days to a week) if more than 1 access route is under construction at any given time. The sources of water are likely to include the

Eagle River, the Ogilvie River, and the water well at Chance's camp once proper treatment facilities are in place. The water to be used to make snow and ice the winter road(s) will be trucked from the source to the point of use. At maximum, between 20 and 30 truckloads per day would be needed. The actual number of trucks being used would be less since a truck can probably complete 4 to 6 deliveries per day. Generally low snowpack is only an issue during the early part of winter, so this provision would only apply on a contingent basis during the months of November, December, and January. The timing for making artificial snow will depend on how late in the winter season winter road construction begins. If, for example, in late December there is little or no snow fall or snow accumulation on the ground, snow making could ensure a sufficient snow base to commence winter road construction. Snow can only be made when the ambient temperature drops to 0 degrees (°) Centigrade.

Access Road Maintenance

Maintenance will involve grading and filling to ensure a smooth travelling surface, cleaning/maintenance of drainage structures, snow removal in winter, and to ensure signage remains suitable for service. Maintenance equipment will include a road grader, a mid-size (D6) dozer, trucks to haul aggregate, and an excavator for maintenance of drainage structures. Maintenance of winter access routes may include low-ground-pressure vehicles, a road grader equipped with a wing snow plow, some water application, and use of matting where required. Grading may be required over certain stretches of the routes, and depressions along the roads will be filled with snow to smooth the surface. If required, water will be withdrawn from approved water sources using adequately sized intakes and screened to prevent debris blockage and fish mortality; refer to DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 1995). The Proponent will avoid using small streams as a water source. Should winter access roads convert to all-season roads, maintenance will be ongoing to ensure road safety and reliability. This will be especially valid when wells are transformed into extended flow sites and require constant year-round access for operational reasons. Road repair and maintenance for all-season roads will require additional machinery, specified and supplied by the selected qualified contractor.

Dust will be kept to a minimum by enforcing reduced speeds on access roads. Dust will also be kept to a minimum by spraying the road surfaces with water whenever they become too dry; some fine airborne dust may become deposited on the surrounding vegetation. The small quantities of fine dust should not cause vegetation to be affected but periodic visual inspections will be made to check for any visible changes to the surrounding areas.

1.3.3.2 Borrow Source Development

Borrow material will be required for the Project for activities such as road and well pad construction. Approximately 21,600 m^3 of borrow material will be needed per well site. The borrow material will come from the closest approved borrow site. In total, the Proponent anticipates requiring up to approximately 1.7 million m^3 of borrow material for the Project.

Borrow Pit locations will be confirmed throughout drilling proposed locations and are identified in **Figure 1.10** and **Table 1.4**. To eliminate any water pooling, borrow pit design and development will be done in the winter while ground is frozen. Borrow pit access roads will be built to the same standards as the main access roads. Timing of construction is for 2016 winter season.

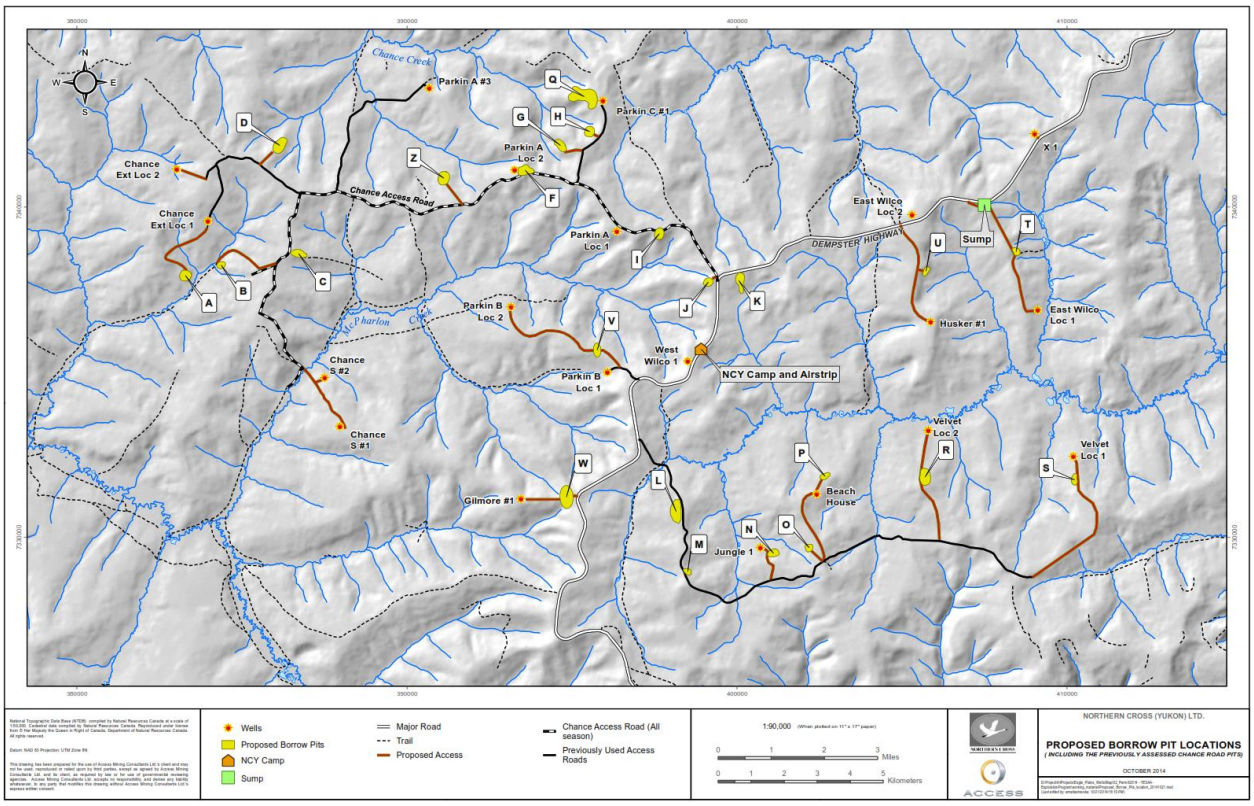

Figure 1.10 Borrow Pit Locations

The Proponent intends that initial access to each well site will be acquired through winter construction of an ice road and placement of rig matting for drilling the well. If the well is successful in finding testable hydrocarbons and it is determined that flow testing will take place, an all-weather road will be constructed. Design and construction of each all-weather access road will only occur once the well has been drilled and a determination has been made whether flow testing will take place. Details of the design of each specific access road including sources, volumes, lifespan, environmental conditions, and closure planning will be provided to regulators prior to construction.

Materials for construction of the access roads will be sourced by drilling the alignment of the proposed access road to each well site to determine the depth of overburden and the geotechnical properties of the bedrock (sand/silt stone, shale, etc.). The general trend has been that those areas higher in elevation along ridges and the crests of hills have less depth of overburden, so materials will be sourced in those locations. There may be a requirement (if the overburden is too deep along the alignment) to source materials from a borrow source off alignment. Access roads will require 15 m^3 per m of road constructed plus pullout and drill pad requirements.

The borrow site locations were determined using lithological data gathered from the shot holes drilled as part of the 2014 3D seismic program. Borrow sites will be accessed in March to April of 2021 when sufficient well results are known to merit access. Summer access could be anytime from May to October any year. Fill sources will be located along the road alignment at those locations identified through drilling at which

lesser amounts of overburden will be required to be excavated. The potential life span of the access will be determined by the drilling and any EFT results. The access life span has the potential to be as long as the life of the well. The closure plan will follow the previously submitted plan. Subject to road design, drill samples will be identified to determine the depth of bedrock of the borrow sources adjacent to the proposed road alignment, and information will be taken from the 3D seismic program.

Organic cover will be removed, and stockpiled for reclamation purposes, using a large crawler tractor. Underlying silts will be excavated by ripping and dozing with a large tractor and stock piled separately for reclamation purposes. Bedrock that consists of siltstone and sandstone or shale (depending on the difficulty of using large equipment, it may be necessary to drill and blast) will be excavated with large excavator and or dozer. The excavated material will be loaded directly from the borrow pit for use in the construction of roads. There will be no water pooling; borrow sources will be constructed to prevent water pooling. Any blasting will be performed by a certified experienced blaster according to all applicable Yukon regulations. The necessary metal sulphides required for acid rock drainage are not present because the borrow sites contain sedimentary rock. To date, acid rock is not known to exist in the Eagle Plains area.

For the purpose of the current assessment the following volumes are expected to be sourced, with the preference to source materials along the alignment. (See **Figure 1.10** and **Table 1.4**).

Borrow sources will be decommissioned when the Proponent deems them no longer useful or necessary for the Project. Decommissioning is described in **Section 1.3.4.2** and will be carried out in accordance with the Decommissioning Plan.

Table 1.4 Borrow Source Material Required and Areas of Disturbance

Length and Volume of Pads and Roads

	Length	Volume	Pullouts	Well Sites	Totals	Borrow Source
Chance rd to Parkin A Loc 1	370	5550	0	21,600	27150	
Chance rd to Parkin C	2950	44250	1770	21,600	67620	
Chance rd to Parkin A Loc 2	450	6750	0	21,600	28350	
Chance rd to Parkin A	4950	74250	2970	21,600	98820	
Chance rd to Chance Ext Loc 2	4500	67500	2700	21,600	91800	
Chance Ext Loc 2 rd to Chance Ext Loc 1	1950	29250	1170	21,600	52020	
Chance rd to Chance S	3200	48000	1920	21,600	71520	
Dempster hwy to Parkin B Loc 2	5350	80250	3210	21,600	105060	V
Parkin B Loc 2 rd to Parkin B Loc 1	550	8250	0	21,600	29850	V
Dempster hwy to Gilmore	1700	25500	1020	21,600	48120	W
Dempster hwy to Velvet Loc 1	19250	288750	11550	21,600	321900	S,R,N,M,L
Velvet Loc 1 rd to Velvet Loc 2	3700	55500	2220	21,600	79320	R
Velvet Loc 1 rd to Beach House	2600	39000	1560	21,600	62160	O
Velvet Loc 1 rd to Jungle 1	1100	16500	660	21,600	38760	N
Dempster hwy to Husker	3500	52500	2100	21,600	76200	U
Dempster hwy to East Wilco Loc 1	4000	60000	2400	21,600	84000	T
Dempster hwy to West Wilco 1	0	0	0	0	0	
Dempster hwy to East Wilco Loc 2	100	1500	0	21,600	23100	U,K
Dempster hwy to X-1	250	3750	0	21,600	25350	T
Chance Road	21400	321000	12840	21,600	355440	
Totals	**81870**	**1228050**	**48090**	**410,400**	**1686540**	

Area of disturbance

	Length	Road	Pullouts	Well Sites	Borrow	Totals
Chance rd to Parkin A Loc 1	350	4550	0	14,400.00	925	19875
Chance rd to Parkin C	2950	38350	1180	14,400.00	7375	61305
Chance rd to Parkin A Loc 2	450	5850	0	14,400.00	1125	21375
Chance rd to Parkin A	4950	64350	1980	14,400.00	12375	93105
Chance rd to Chance Ext Loc 2	4500	58500	1800	14,400.00	11250	85950
Chance Ext Loc 2 rd to Chance Ext Loc 1	1950	25350	780	14,400.00	4875	45405
Chance rd to Chance S	3200	41600	1280	14,400.00	8000	65280
Dempster hwy to Parkin B Loc 2	5350	69550	2140	14,400.00	13375	99465
Parkin B Loc 2 rd to Parkin B Loc 1	550	7150	0	14,400.00	1375	22925
Dempster hwy to Gilmore	1700	22100	680	14,400.00	4250	41430
Dempster hwy to Velvet Loc 1	19250	250250	7700	14,400.00	48125	320475
Velvet Loc 1 rd to Velvet Loc 2	3700	48100	1480	14,400.00	9250	73230
Velvet Loc 1 rd to Beach House	2600	33800	1040	14,400.00	6500	55740
Velvet Loc 1 rd to Jungle 1	1100	14300	440	14,400.00	2750	31890
Dempster hwy to Husker	3500	45500	1400	14,400.00	8750	70050
Dempster hwy to East Wilco Loc 1	4000	52000	1600	14,400.00	10000	15950
Dempster hwy to West Wilco 1	0	0	0	0.00	0	0
East Wilco Loc 2	100	1300	0	14,400.00	250	15950
Dempster hwy to X-1	250	3250	0	14,400.00	625	18275
Chance Road	21400	278200	8560	14,400.00	53500	354660
Totals	**81850**	**1064050**	**32060**	**273600**	**204675**	**1512335**

Borrow Source Volumes from East side of Dempster

Borrow Pit	Volume	Areas	Roads
L	45,000	6,000	Dempster to Velvet 1 - 3 km
M	30,000	4,000	Dempster to Velvet 1 - 2 km
N	111,600	14,000	Velvet 1 road to Jungle 1 - 1.1 km plus Dempster to Velvet 1 road - 4 km
O	54,600	7,000	Velvet 1 road to Beach House - 2.6 km plus pit access 200m
P	4,500	5,000	Used if necessary, 300 m of acces to pit
R	142,000	18,000	Velvet 1 road to Velvet 2 - 3.7 km plus Dempster to Velvet road - 4.2 km
S	111,600	14,000	Dempster to Velvet 1 Road - 6 km
T	116,950	15,000	Dempster to East Wilco plus Dempster to X-1
U	60,000	8,000	Dempster to Husker plus 500 m pit access
V	135,000	17,000	Dempster to Parkin B Loc 2 plus Parkin B road to Parkin A
W	48,000	6,000	Dempster to Gilmore 1

*All volumes, areas and distances are in metres

1.3.3.3 Central Processing Facility

The camp's Central Processing Facility (CPF) will comprise additional multi-stage and multi-phase separators, heater treaters (to help remove remaining amounts of emulsified formation water), vapour and gas collection system, and possibly central power generation facility to power all discrete well batteries. Separated water will be further treated to remove any hydrocarbons, scale, anaerobic bacteria, and other colloidal or suspended solids ready for disposal in a suspended well nearby following in a pre-approved process. The CPF will be located at the furthest (southernmost) point away from the camp for safety of the camp and its occupants. Having the CPF at the far end of the camp area will ensure trucks can turn around and exit safely without encroaching on any other activity or building. This should also ensure the camp remains upwind from the CPF.

The CPF will have enough storage to contain produced crude oil for loading onto longer distance trucks ("B" trains) and hauling to a pre-approved market site in British Columbia, Alberta, or possibly Alaska. It is estimated that the CFP will accommodate approximately 10 days of storage capacity for crude oil at an approximate daily rate of 2,000 barrels of oil per day or total 20,000 barrels. The volume (stored in up to 5 surface tanks in full compliance with Yukon and Canadian standards and regulations) also ensures the safe crude stabilization before loading onto southbound trucks. In terms of maintenance, the only treatments appearing necessary at this stage of design are fluid separation (to separate oil from gas and water into 3 distinct streams), heat treating the crude to remove water remnants from the separated crude, and gas dehydration to make the gas useable as a fuel.

1.3.3.4 Airstrip

The Proponent will construct an airstrip located along the existing Chance winter trail at a location approximately 4 km off the Dempster Highway. The airstrip will be approximately 1,500 m long and will be part of the road network west of the Dempster Highway. In the early years of the Project, this airstrip will likely be used only during the winter, but could graduate to year-round usage if discoveries support the investment. Until the Chance road airstrip becomes serviceable each winter, or at the end of the winter season operations when trail conditions deteriorate, the Proponent will continue to use the Dempster Highway adjacent to the camp as a periodic airstrip.

1.3.3.5 Transportation

For the majority of the exploration program, the Proponent will attempt to limit traffic on the winter access roads to authorized personnel. Traffic will include approximately 8 to 9 light-weight service trucks (for supplies and personnel), 1 water truck, and one fuel truck. The fuel and water trucks will come to the Project site approximately once per week or as demand dictates, and there will be occasional transport of drill cuttings from the well sites to the sump location. Air traffic estimated at 2 flights in/out per week (normal arrival times from approximately 10:30 a.m. to 12:00 p.m.).

A majority of the traffic volume will be related to mobilizing the drill rig and constructing the site infrastructure. As mentioned above, the setup of the well sites will take approximately 5 days to complete. Included in this amount, the drill rig will require 15 to 20 loads to mobilize. Unauthorized vehicles will not be permitted on the winter roads and the roads will be restricted from public access. The Proponent will be transporting crews using company vehicles; all vehicles will be equipped with radio communication and,

particularly during busy times (i.e., setup and demobilization), traffic will be radio controlled. For safety reasons, any personnel accessing the areas (i.e., winter roads) will be required to notify appropriate staff (i.e., security personnel and/or managers/supervisors) when they leave the Dempster Highway and when they arrive at the well sites. Access to the winter roads will be monitored by Chance staff hired as wildlife monitors/ security personnel.

A typical description of road traffic during the prime operating periods (January 1 to April 15; May 1 to December 1) is presented in **Table 1.5** below and road users will follow the Operations Activity Schedule introduced in **Section 1.4**.

Table 1.5 Typical Road Traffic during Prime Operating Hours

Table 3-4 Typical Road Traffic During Prime Operating

	Activity Description	Peak Traffic	Normal Traffic
1	Early Season Mobilization (Winter)	High	Medium
2	Rig Mobilization (Winter)	Very High	Medium
3	Winter Operating (Drilling)	Very High/High	Medium
4	Access Road Construction (Winter)	Very High	Medium
5	Summer Mobilization	Very High	Medium
6	Summer Rig Mobilization	Very High	Medium
7	Summer Normal Operating (Drilling)	Medium/High	Medium
8	Extended Testing Winter	High/Medium	Light
9	Extended Flow Testing Summer	Medium	Light

LEGEND:

Very High	More than 50 vehicles per 24 hour day
High Traffic	50 or more vehicles per 24 hour day
Medium Traffic	20-50 vehicles per 24 hour day
Light Traffic	Less than 20 vehicles per 24 hour day

The Proponent expects exploration drilling operations activities will range between medium and light traffic volumes. Crude oil produced during the flow-testing phases of exploration work, as described in this document, will be transported to an acceptable market.

Trucking of a stabilized crude cargo in specially constructed transporting tanks presents the same risk as transporting the diesel fuel required and used in Yukon. The process of loading and dispatching trucks at regular intervals will be planned and handled by professionals who will also maintain constant communication and GPS tracking of trucks as they travel down the Dempster and on other connecting routes to their destination. Trucking is by nature a very controlled process. Truck drivers are only permitted a fixed number of driving hours per 24-hour period and are expected to stop for refresher breaks at regular intervals. All their movements are accurately tracked through their onboard GPS, which can provide any truck's location to within a few metres anywhere in Canada or the USA.

The Proponent has practised Journey Management on its previous exploration drilling work at Eagle Plains. In this instance, any unit transporting materials to Chance's camp 325 will be called and tracked periodically by its company dispatcher. The exact location when reaching certain pre-determined check points will be relayed to Chance camp management and Logistics coordinator; this will ensure road safety for the truck driver and other road users and safety of the vital cargo and provides critical planning information for receiving staff to plan for offloading its cargo and possibly loading backhauls.

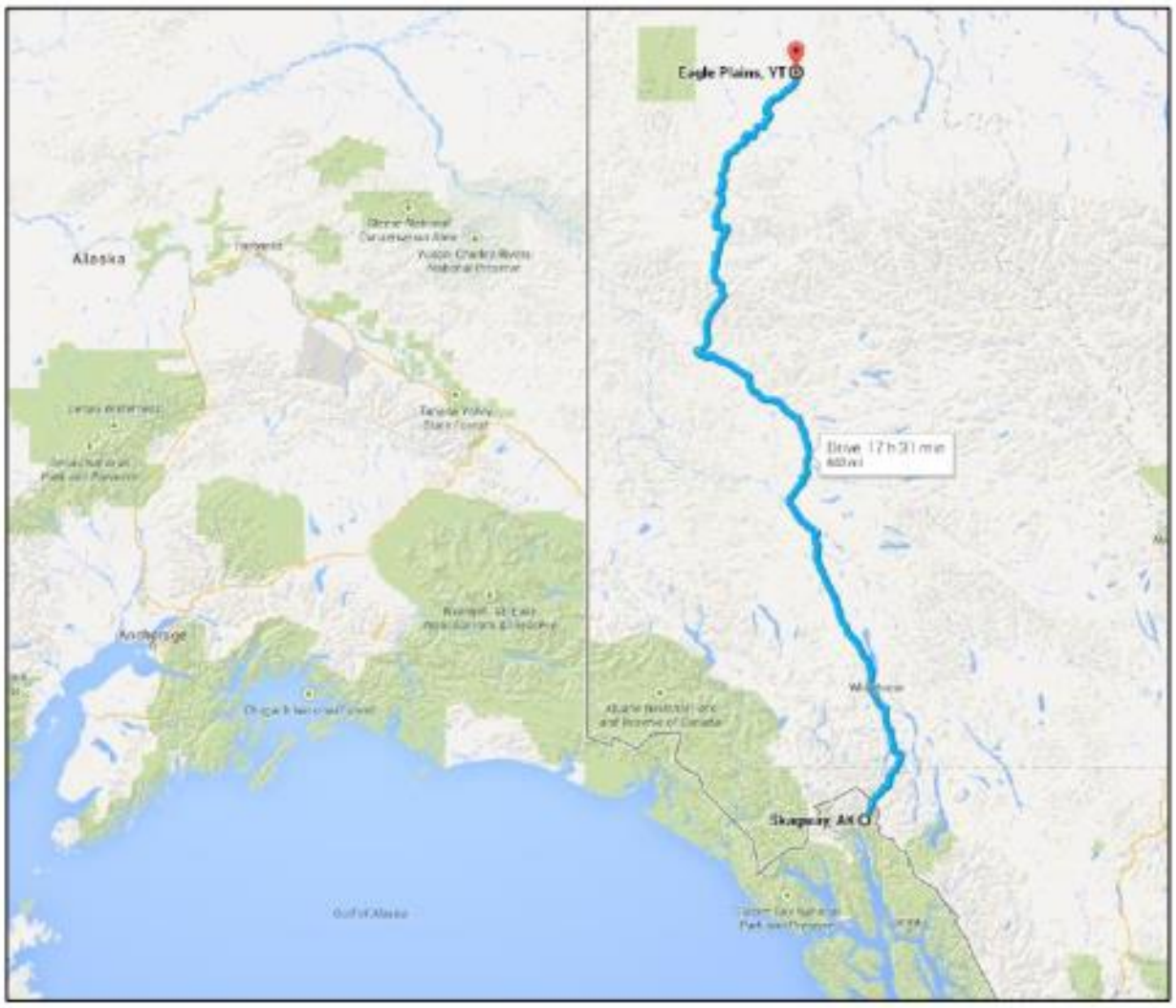

Figure 1.11 Typical Export Truck Route to Skagway, Alaska

Figure 1.11 illustrates one of the possible export truck routes to Skagway Alaska. The journey distance is 1,029 km from Eagle Plains to Skagway. The journey duration is approximately 17.5 hours driving at an average speed 59 km/hr. Other options exist, which include delivery by truck to terminals in Fort Nelson and Fort St. John, British Columbia, or Grand Prairie, Alberta. Depending on which of these options is used, the driving times will vary but the management procedures will remain the same.

The Proponent and its trucking contractor(s) will develop and Alert and Emergency Response Plan to address any incident or accident while in transit on Yukon roads and highways. The same plan will also address any other Provincial routes and routes within the United States border. All reputable trucking contractors versed with transporting flammable liquids and petroleum products in general are mandated to follow the Transportation of Dangerous Goods Federal Legislation. The legislation dictates such activities as how truck contents are identified on the outside of the tank; how the tank is installed on the truck body and strengthened; the level of knowledge and training the driver and any assistant travelling with them must

have to be eligible to operate the particular truck; and the spill response equipment needed to be readily available. Ensuring the truck is safety-checked and the drivers are qualified and adheres to their company's safety policies are the key means of preventing an incident or accident. Tracking the drivers to check on transit speed on a real-time basis means the truck's progress is never neglected and the driver is on notice to observe all road traffic rules at all times.

All incidents affecting the Proponent's trucking contractor are reported back to Chance Operations Management and form part of the Proponent's safety statistics. Every incident is investigated and the causes for each occurrence are closely analyzed and discussed with the truck owner. Should any trucking contractor exhibit an undue number of close calls/near misses or a series of incidents with the same causes, they would be removed from the contract without delay and replaced with a more competent and safety-minded contractor.

1.3.3.6 Workforce

Work force requirements will vary over the life of the Project and will ultimately be limited by the existing camp capacity. During past drilling and seismic exploration programs undertaken between 2012 and 2014, the Proponent had no more than 75 to 80 people onsite at any one time. During drilling, the Proponent operated on a 24-hour clock with a 20-day-on and 10-day-off crew rotation cycle, which means that one-third of the crew was off duty at any point in time. For the seismic exploration program, the Proponent operated on a 12-hour clock and cycled the various services through as the program unfolded with only limited crew changes, mostly connected with the camp catering operation.

The Proponent has an arrangement with Northern First Nation groups and will have time to define their involvement to participate during this exploration program. It is Chance's objective to provide all available work and contracts to its FN/Yukon partners as identified in sec. 68 of YOGA. Chance was successful during its last drilling/seismic program hiring a workforce from the communities from Old Crow, Fort McPherson, Dawson, Whitehorse, and Inuvik.

1.3.4 Reclamation and Closure

1.3.4.1 MBC Sump Site Reclamation

Before the MBC Sump disposal site is opened, the top soil and the vegetative layer will be removed and stored separately from the lower subsoils. This material will then be re-applied after the MBC Sump has been covered by the 1 m of unmixed subsoil. This will bring the disturbed area back to its equivalent land capability. No further reclamation plan is warranted. The standard Directive 050 Drilling Waste Management (D50) plan (AER 2016) of action entails the following:

- The environmental monitor must be onsite during drilling to conduct D50 sampling to ensure that drilling waste is compliant and accurate records are being kept and respond to any spills that may occur.
- The environmental monitor will sample pre- and post-MBC.
- Upon completion of the Project, remote disposal locations will be covered with a minimum of 1.0 m of capping material and contoured to meet background topography.

- A Phase 1 Environmental Site Assessment (ESA) will be completed for each well and corresponding remote MBC location to identify any potential areas of environmental concern.
- If the Phase 1 ESA triggers a Phase 2 ESA, soil samples will be collected and analyzed at an accredited laboratory.
- If contamination is identified, a Remediation Action Plan will be prepared and upon approval, the remedial program will be completed. Once all contamination is addressed either in the Phase 1 ESA, Phase 2 ESA, or Remediation, a surface program including soil and vegetation will be conducted.
- Once vegetation is established, a Detailed Site Assessment; comparing soil lithology and vegetation onsite to offsite) will be completed.

For clarification, environmental monitors will be sampling the following, as per ref AER DIR 50; table 13.1 of this directive lists the Testing Requirements (AER 2016):

1. Receiving soil
    a. Electrical conductivity and sodium adsorption ratio
2. Waste (solids or total waste)
    a. pH, electrical conductivity, sodium adsorption ratio, Sodium (Na)
    b. Nitrogen (N), if additives/products added to the drilling mud/waste system contain any amount of N or if N content was unknown
    c. metals, if concentrations exceeding limits were added to the drilling mud system or if the metal content of additives/products is not known
    d. hydrocarbons, if a hydrocarbon flag was encountered
    e. toxicity, if toxicity data are unknown for any of the mud additives/ products used in the drilling mud system or if concentrations used exceeded pass threshold for luminescent bacteria toxicity test
3. Waste/soil mix (post-disposal)
    a. EC, SAR, and Na, if drilling waste EC > 10 dS/m or Na > 3000 mg/L (saturated paste extract or filtrate from oversaturated waste)
    b. metals, if concentrations in drilling waste exceed concentrations listed
    c. hydrocarbons, if concentrations in the drilling waste exceed concentrations
    d. N, if the nitrogen concentration in the drilling waste (wet weight) is ≥6 mg/kg for disposals in coarse soil or ≥120 mg/kg for disposals in fine soil.

Furthermore, in terms of soil sampling, commencing operations in winter does not necessarily mean sampling would not be possible or even preferable. Sampling can also be accomplished from the surface snow deposits around the well site. The Proponent selected lease dimensions to ensure there is a sizable perimeter for full containment of generated or airborne wastes from the Project.

The first task on any well site would be to construct the well pad or prepare the surface on which matting could be safely placed. The next step is to lay the mats on previously densified/well-trodden surface to render the suface as flat as possible. The final process, before deploying the drilling equipment, would be to undertake a professional geotechnical check on the stability of the surface and its resultant ability to

support the maximum anticipated loads with a suitable safety factor. Finally, the geotechnical engineer will provide a signed/stamped report attesting to the stability and strength of the facility for the work contemplated.

1.3.4.2 Well Decommissioning and Abandonment

As previously mentioned, the 30 proposed wells are part of an exploration program to help determine the oil and gas potential of the region. Depending on the outcome of results, a given well may be tested and additional plans developed to bring into production or be determined to be unproductive and require decommissioning and abandonment. As the Operator, Chance will always carry the full responsibility for all wells deemed to be its property. This responsibility can never be delegated to any other party unless and until such time the Proponent relinquishes ownership according to YOGA and its regulations.

Wells required for further operational uses such as producing wells, water or gas injectors will be maintained in a suspended state with an ability to be converted for use in the future. The Drilling and Production Regulations under YOGA have specific actions required from an operator to maintain a well in a suspended state; key among these actions is to periodically conduct inspections to ensure that the integrity of the well is intact. While in a suspended status, the regulator requires a sum of money be placed on deposit to cover the cost of abandonment and remediation of the site. Once abandoned, the status becomes permanent and there would not be an option to re-enter such a well.

The normal stages before decommissioning/abandonment of a well are as follows:

- The well is first determined as unusable.
- The perforations are first cemented by placing a cement plug below and above them and squeezing some amount of cement into the formations to permanently isolate them within the wellbore. A mechanical shut-off device called a bridge plug may also be wireline set above the cement plug to add protection or isolation.
- Higher in the production casing and below the estimated permafrost maximum depth, a second cement plug would be set. This plug is normally set on top of a bridge plug to ensure it does not leak down in the casing. The plug is also “felt” with a drill bit to confirm its existence and hardness.
- The casing at surface is cut 1 m below the original ground and buried under the soil to finally remediate the location entirely.
- The lease is remediated by removing fill material to restore the location to original status. The surface location would be revegetated with what is normally growing there in the first place.

When appropriate, a decommissioning/abandonment plan for the well sites will be developed that will comply with Part 7 of the Yukon Government Oil and Gas Drilling Regulations (Sections 95, 96, 97, 99). Wells would require final well abandonment according to the YOGA Drilling and Production Regulations. Wells would be sealed with cement, and casings would be cut off below ground level. The casing stubs would be buried below ground surface as required by the Regulations and a surface-visible sign would be installed for identification. The entire site will then be cleared of all debris and refuse. Finally, the site will be contoured, seeded, and left to naturally reclaim.

An outline procedure prepared by the Proponent in compliance with the YOGA Regulations is presented as follows:

- Seal off all perforations in the casings that are not already sealed with cement squeezes.
- Pressure test the casings to 7000 kilopascals (kPa) to confirm formations are isolated and sealed.
- Cut off the wellhead and casings to 1 m below ground level and weld/install plates to cover each casing string at surface.
- Install well identification marker visible above ground level.
- Bury the cut casings to complete the abandonment.

If the entire Project had to be suspended but not completed, the infrastructure would be preserved and maintained until the Project resumes. If it is decided for whatever reason to terminate the Project, then the infrastructure would be decommissioned. While operations are temporarily suspended, the Proponent will ensure access from the Dempster Highway will be barricaded and visually inspected periodically.

1.4 Project Phases and Scheduling

1.4.1 Project Schedule

The Project plan is to have all necessary permitting and approvals in place by the end of 2021 and begin drilling in December 2021. The construction of winter roads, drilling and testing of the first few wells is anticipated to occur during the winter (December to April) and summer months (May 1 to October 31), commencing in December 2021 with the first winter locations.

In the early years it is assumed that all wells will be drilled in the winter. Summer drilling might happen in future locations that are in reasonably close proximity to yet to be developed all-season access. Well priorities and their drilling order can only be best determined after the program commences and in response to drilling results and Chance corporate exploratory information gathering requirements.

The construction of the 400 m all-season access road to the MBC sump location is anticipated to occur in March 2022 and take not more than 2 weeks to complete.

The Proponent anticipates a period to elapse between confirming a discovery worthy of further evaluation and commencing the EFTs to allow time to properly design, fabricate, install, and commission the extended flow testing facilities. This period could be up to 6 months. If drilling is successful and significant hydrocarbons are discovered, the access roads would be upgraded to year-round access to undertake the EFTs. Year-round access to flowing wells is critical to daily well inspections and safety assurance of all operations.

The previously summarized scope of the Proponent's exploration activity can be expected to start as early as December 2021 and continue over a period up to 10 years to cover the various stages of drilling and extended flow testing of the wells. The actual execution of the EFTs could be phased depending on the nature of the discovery (e.g. natural gas versus crude oil) and the capacity of the base camp and the Eagle Plains Hotel to accommodate the necessary crews. Until there is more information about discovered resources, it is impossible to predict with any precision the full duration of the flow testing program. At least 8 wells could be tested in each year.

In summary, the chronological activities can be best described as follows:

1. Complete 3D seismic processing & interpretation (Chance Exploration rank prospects and establish company exploration objectives to meet Yukon Government lease commitments and CHANCE corporate objectives for exploration)
2. All preparations completed by December 31, 2021 (Seismic, YESAB, Well Licences, Camp, rig upgrade & certify, consumables and services, geotechnical prep work)
3. Prepare first location to mobilize Chance Rig #1 (start January 1, 2022 or soon thereafter)
4. Drill & test winter wells (possibly as many as 4; suspend operations April 15th ±)
5. Prepare for summer drilling (contingent on positive drilling results); ready to construct all-season access to next drill and test targets on schedule. Subsequent wells may be predicated on encouraging well results influencing more follow-up appraisal drilling
6. Continue drilling exploration wells in the remaining prospects to build on positive previous drilling results.
7. Identify wells with positive results meriting extended flow testing to acquire in depth reservoir information.
8. Design order/fabricate well site battery processing equipment in preparation for extended flow testing of selected wells.
9. Re-enter selected wells; install completion tubulars and other accessories, Christmas trees and ready for extended flow testing.
10. Install surface pumping equipment (standard pump jack device to lift the well fluids to surface); hook up well Flowline to well site battery (separator, flare system, crude oil storage tank and water disposal tank).
11. Supervise and operate well pumping, transfer stabilized (crude that has been allowed to “age” in atmospheric storage tanks; made safer for trucking) crude from tanks to truck for transport to the camp’s Central Process Facility.
12. Construct the camp’s Central Process Facility.
13. All vapour and gas removed from the well fluids will either be used for fuel to prevent storage tanks contents from freezing, generating electricity, pumped downhole in an approved manner or flared at site.
14. Progressively more wells would be drilled and brought on stream while extended flow testing and contribute to the accumulated fluid to be removed by trucks to a suitable market.
15. During EFTs flowing information would be gathered including bottom hole pressure profiles to learn about the reservoir flow characteristics and understand more about the prospect’s full development potential.
16. Development would become the subsequent phase of continuing operations. The nature and details of that operation will be described in later submissions as per the YOGA and regulations derived from it.
17. To complete the life cycle of a well, wells drilled, evaluated, tested and completed as part of a field development plan, would be either worked over and recompleted in the event of, for example, water ingress; or, if deemed not having future production potential, would be abandoned according to the YOGA Drilling and Production Regulations. In this instance, all previously perforated producing zones would be cemented shallower cement plugs would be placed and the casing at surface cut

to 1 metre below the normal ground surface. The surface lease would be fully remediated and restored to its original state.

18. The Proponent's future operating schedule for exploratory drilling assumes a continual, year-round program in order to benefit from the economies of scale of uninterrupted operations involving several wells rather than discrete ones with breaks in between. This will also contribute to a stable employment and goods and services market for Yukon residents servicing and supplying operations at Eagle Plains.
19. EFTs involve the flowing of a well or wells. There is no human intervention while wells flow unimpeded for the duration required for the test. In a multi-well producing field, for example, a maximum of three persons can handle all the production operator tasks of a field with 50 or more producing wells (double that number if working a 24-hour day). Field production operators visit each well at least once daily unless there is a need for other demanding work. They record flowing well pressures, ensure fluid pumps operate properly, have enough fuel to continue operating and visually inspect the facility for anything out of the ordinary.
20. The Proponent plans to have three operators managing the EFT wells in any 12-hour cycle. A second set of three will form the cross-shift making a total number of operators 6.

The sequence of wells is dependent on drilling success, discovery, weather and road conditions. The Proponent is continuing the ongoing process of interpreting seismic data in order to better understand the geological setting and size/geometry of potential prospects. Each well drilled will add to that understanding.

In summary: the Proponent will drill up to 30 wells sequentially over a period of 10 years starting in 2022. If a well is successful (i.e., if there is a discovery of crude oil or natural gas in sufficient quantities) the Proponent will conduct an EFT for a period up to 2 years on that particular well. There may be EFTs on up to 20 wells depending on the success of each well. The Proponent will drill one well at a time and up to 5 wells per year. Assuming all wells are successful and EFTs are conducted for 2 years at each well, there may be up to 10 EFTs being conducted at one time.

The schedule illustrates the breakdown as it is known at this time. The maximum time is estimated to be 10 years. The schedule does not account for operations interruptions owing to weather, geological re-interpretation, equipment breakdown or other delays beyond the control of the operator. A normal rate of drilling would be to drill one well at a time during this exploratory phase.

1.4.2 Construction Phase

The mobilization and Construction Phase of the Project is expected to commence in Q4 of 2022. Key activities during the Construction Phase are summarized by Project component in **Table 1.6**.

Table 1.6 Summary of Key Construction Phase Activities

Project Activity	Key Construction Phase Activity
Tree Clearing and Grubbing	Salvage to be completed prior to construction of the well pads and portions of the access roads (winter and all-season)
Road Construction	Completed as roads are required to access facilities and well pads

Project Activity	Key Construction Phase Activity
Quarry Development	Quarries will be developed based on volume of material required to build leases and roads.
Lease Construction	Topsoil and subsoil salvage and local stockpiling
	Lease pads will be constructed on an as-needed basis using material from nearby quarries
Main Camp	Camp will be used to house drilling crew
	Construction of the Central Processing Facility
Accessory Activities	Road construction and upgrades to roads as required
	Construction of an airstrip
	Vehicle traffic related to drilling and construction activities
	Transportation of production fluids to Central Processing Facility and to market
	Follow Blasting Mitigation Plan
	Water use permit for lease and road construction
	Baseline data collection and environmental monitoring
	Monitoring and establishing erosion control features for roads, leases, and the Central Processing Facility
	Updating and following the Emergency Response and Risk Management Plans, as required
	Following a Weed Management Plan for soil stockpiles and leases
	Maintaining and snow-clearing roads and leases for all-season access

1.4.3 Operation Phase

The Operation Phase will begin in Q1 of 2022 and will continue through to the end of 2031. The key activities occurring during this phase are summarized in **Table 1.7**. This section describes the main operational activities that will occur during the Operation Phase.

Table 1.7 Summary of Key Operation Phase Activities

Project Activity	Key Operation Phase Activity
Road Construction	Upgrade roads to all-season roads, with water crossings, as required. Road maintenance will be conducted, as required
Drilling	Up to 30 pads will be constructed and drilled for oil and gas products
	Remote sump access for drilling fluid waste disposal
	Excess drilling mud to be disposed of offsite at the remote sump
	Completing drill stem tests
	Acid stimulation and completion of wells for testing
Well Testing	Facilities to be installed, as needed, for testing and extended well tests
	Routine maintenance of facilities, as needed

Project Activity	Key Operation Phase Activity
	Gas is to be flared off, and oil placed in storage tanks
	Production fluid transport to Central Processing Facility and market
Accessory Activities	Road Maintenance
	Energy may include switching power generation from diesel generators to natural gas produced from the wells
	Updating and following the Emergency Response and Risk Management Plans, as required
	Water permit use for boilers during winter drilling
	Following Weed Management Plan
	Central Processing Facility to handle production fluids, disposal fluids and fuels
	Maintaining and snow-clearing roads and leases for all-season access
	Environmental Monitoring

1.4.4 Reclamation, Abandonment and Closure Phase

Reclamation, abandonment and closure activities will be detailed in a Conceptual Reclamation and Closure Plan. A summary description of key activities is provided below for the Reclamation, Abandonment and Closure phase are described in **Table 1.8**.

Table 1.8 Summary of Key Reclamation Phase Activities

Project Activity	Key Reclamation Phase Activity
Well Abandonment	Wellheads will be abandoned when testing or production phases are complete
	Testing or production facilities are to be removed from each site
MBC Sump Site Reclamation	Site will be reclaimed as per Directive 50
Central Processing Facility	Upon complete field decommissioning activities, the removal of the Central Processing Facility will occur
Well Site Reclamation	Imported material will be removed, and area reclaimed to natural conditions, as much as possible
	Revegetation of disturbed areas to natural conditions and follow-up monitoring
Infrastructure Decommissioning	Water crossings will be removed
	Appropriate sloping and seeding to prevent erosion and scarification to encourage revegetation
Borrow Source Reclamation	To be reclaimed as soon as materials are exhausted or no longer required
	Revegetation to natural conditions and follow-up monitoring
List Accessory Activities	Discussions with YESAB (and other Regulators, as necessary) prior to reclamation work to determine whether there should be changes to the Plan
	Updating the Reclamation Plan to meet new criteria, if required
	Following Weed Management Plan until sufficient revegetation has occurred on reclaimed sites

Project Activity	Key Reclamation Phase Activity
	Annual monitoring until vegetation regrowth deemed satisfactory
	Soil Detailed Site Assessment prior to seeding
	Conduct a Phase 1 Environmental Site Assessment for each location
	Potential Phase 2 environmental assessments of soil and groundwater
	Obtain Regulatory Closure

1.5 References

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APPENDIX 2-C-18. *Eagle Plains Environmental Studies 2018*

Eagle Plains Environmental Studies 2018

Chance Oil & Gas is conducting environmental studies in summer 2019 to collect data on fish, water, permafrost, vegetation and wildlife to support its proposal to conduct exploration activities in the Eagle Plains project area. Chance welcomes participation of local First Nation citizens and traditional knowledge holders in these programs.

All projects will require varying degrees of hiking in steep, rugged terrain and thick bush under production-oriented work conditions. Participants will require average to above average fitness to participate in the work, depending on the survey.

Chance regrets that opportunities for participation in the field studies are limited due to safety and logistical considerations, and all interested citizens may not be able to participate. The logistics of participation in the studies are still being finalized, however, there will be approximately spots for two participants from each First Nation with Traditional Territory overlapping the project area. Travel to and from Eagle Plains Hotel will need to be coordinated by each First Nation.

In addition to these field programs, Chance will be holding a number of community meetings, to provide an opportunity for First Nation citizens, who cannot participate in the field programs to be able to comment on the proposed program.

Access to all work sites will primarily be by helicopter out of Eagle Plains. A small number of sites will be accessed off the Dempster Highway.

A short description of each survey is provided, below.

Bird Surveys

Bird surveys will follow standard 'point count' methods that involve recording all the birds the observers hear and see from an observation station during a 10-minute survey period. Stations are located 500-1500 m apart and are accessed via hiking. This work is very production oriented in order to meet sample size requirements during the relatively short 'dawn chorus' when birds are singing and requires above average fitness to hike quickly between stations. Total hiking distance of 5-10 km per day through rugged terrain and thick bush will be required. The daily work shift is 2:30 am to noon. Participants should have a set of binoculars to get the most out of the survey, but they are not absolutely required.

Vegetation Surveys

Vegetation surveys are being conducted to verify ecosystem/habitat maps and to survey for rare plants. Work will be split over 2 shifts. The daily shift in round 1 will be from 4am to 3pm, to coordinate helicopter use with bird surveys. The shift during the second round is a more civilized 7am-6pm. The work will consist of 15-45-minute vegetation plots where the surveyors record plant occurrences, site conditions, and wildlife sign and habitat. Successive plots will be accessed by a combination of hiking and heli bumps. Participants will need to hike 3-6 km per day through rugged terrain and thick bush, requiring average fitness. No special gear is required.

Seismic Line Study

The purpose of the seismic line study is to document the degree of vegetation regeneration on old lines from past exploration programs 1950-2000's and to characterize the characteristics of new lines (i.e. from 2014) and how they may affect wildlife. The details of survey methodology are still being developed but will likely consist of ~15 minute vegetation plots at multiple spots along different seismic lines. Successive plots will be accessed by a combination of hiking and heli bumps. Participants will need to hike 3-6 km per day through rugged terrain and thick bush, requiring average fitness. No special gear is required.

Aquatic Surveys

Fish and water surveys are being conducted to improve knowledge of fish distribution and water conditions across the proposed project area. Surveys at each site will include electrofishing, stream site descriptions, and water sampling. Each site will take 45-90-minutes to complete. Access to most sites will be via helicopter with a relatively short walk to the stream (i.e. <300m). However, some sites may require hikes of up to 1km to get into.

Chest waders are required to participate in the fish and water surveys.

Required Field Gear for all projects includes:

- Sturdy hiking boots (second pair for when the first get wet is recommended)
- Rain gear
- Appropriate layers of clothes
- Personal first aid/survival kit
- Bug hat/insect repellent
- Hat
- Backpack or cruisers vest
- Bear spray (*Note that EDI does not permit firearms to be carried in the field or brought to a work site).

APPENDIX 2-C-19. Fieldwork Email

From: [redacted]
To: [redacted]
Cc: [redacted]
Subject: Chance Field Surveys
Date: June 17, 2019 5:15:06 PM
Attachments: image001.jpg
Chance FN participant information.docx

Hello,

We have dates set for participation in the Field Surveys that are being conducted in Chance's project area this summer. We are proposing the following logistics for First Nations participation:

- Each First Nation with Traditional Territory overlapping the project area can have up to two members participate in the Field surveys
- This work will be physically demanding requiring hiking in steep, rugged terrain and thick bush under production oriented work conditions. Participants require average to above average fitness to participate and must meet the requirements in the attached role profiles
- There are limited spots for participants to join field surveys due to helicopter constraints and availability at the Eagle Plains Hotel. As such, we are making two spots available to each First Nation with Traditional Territory overlapping the project area. Please respond as soon as possible with the name of the participant, the field survey they would like to take part in, and the dates they would like to attend and Emily and Calista (Hemmera) will confirm availability.
- Participants are encouraged to arrive on the day that the field survey starts, but it is not mandatory that they stay for the duration of the field survey. For example, a participant could join Vegetation Survey #1 from June 25-28 if those are the dates the participant is available.
- All travel, including flights, vehicle travel to Eagle Plains Hotel, and stay in the Eagle Plains Hotel must be booked by the First Nation and billed to Chance.

This table shows the type of survey, details of the work and the number of spots available to participants

Survey	Lead Consultant	Date	Shift	# EDI crews	Participation Opportunities
Vegetation surveys (#1)	EDI	June 25- June 29 July 1 – July 7	4am-3pm	1	1 participant June 25 – June 29 AND 1 Participant July 1 – July 7
Vegetation surveys (#2)	EDI	July 25- 29 Aug 1 - 6	7am-6pm	1	1 participant July 25-29 AND 1 participant Aug 1-6
Seismic line study	EDI	July 25- 29 Aug 1 - 6	7am-6pm	1	1 participant July 25-29 AND 1 participant Aug 1-6
Fish and Water	EDI	July 25- 29	7am-6pm	1	1 participant July 25-29

The purpose of participation will be to observe the fieldwork and gain a firsthand understanding of the research that will inform Chance's project proposal. As space is limited to only a few participants

from each First Nation, there will be future site visit opportunities that will be made available to more participants. Hemmera will approach First Nations about planning these site visits later in the summer.

We apologise for the late notice in getting the above dates sorted.
To participate in Vegetation Survey #1 (starting June 25), the deadline for informing Hemmera is Wednesday June 19 at 5:00pm. Then we can coordinate the logistics on Thursday. For all the other field surveys, please let Hemmera know as soon as possible.

If you have any questions please direct them to Emily or Calista at Hemmera.

Best,

[redacted]

[redacted]



Hemmera, an Ausenco Company
Suite 230-2237 2nd Avenue | Whitehorse, YT | Y1A 0K7
T: 867.456.4865 ext. 719 | F: 604.669.0430
[redacted] | hemmera.com | unsubscribe

@TheHemmeraWay | LinkedIn | YouTube

Please consider the environment before printing this email.

APPENDIX 2-C-20. Consultation and Engagement Letter

Chance
OIL AND GAS LIMITED

December 1, 2021.

Chief and Council
Vuntut Gwitchin Government
P.O. Box 94
Old Crow, YT
Y0B 1N0

sent via email

Attention: Chief [redacted]

Dear Sir:

I am writing to follow up my letter to you dated October 27, 2021 and my subsequent phone calls October 31 and November 1 to both your office phone and your cell phone. I left a voicemail each time in hopes we could schedule a call. As of today's date, I have not received any response.

As expressed in our correspondence to you, Chance Oil and Gas Ltd ("COGL") is asking for a meeting with you, your council, and potentially citizens of Old Crow, to overcome the current engagement impasse and to discuss the exploration project and Cooperation Agreement. COGL is very interested in building partnerships with indigenous communities so they can benefit from opportunities created by proposed exploration activities and potential resource development. We would like to work with you to overcome the termination of discussions you initiated last March to allow fulsome engagement to proceed with the Vuntut Gwitchin Government ("VGG").

At several community presentations hosted by COGL in Old Crow in the past six or seven months, it is clear that the citizens of Old Crow are interested in learning about the planned exploration activities, providing feedback to COGL on issues of concern, and taking advantage of the opportunities.

COGL is continuing to develop its project description and its submission document for the

CHANCE OIL AND GAS LIMITED

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Telephone (867) 456-7805

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Calgary, AB T2R 1L5
Telephone (403) 699-0055
Fax (403) 699-0044

Executive Committee of the Yukon Environmental and Socio-Economic Assessment Board. More community presentations are planned to happen in Old Crow and in the communities of all affected First Nations. COGL hopes that VGG will be able to engage in these presentations and meetings in the future.

Please contact me at your earliest convenience so we can talk about the topics above and discuss next steps.

Yours truly,
Chance Oil and Gas Limited

[redacted]

Chairman and CEO

Cc: [redacted]

APPENDIX 2-C-21. Consultation and Engagement Letter

Chance
OIL AND GAS LIMITED

October 27, 2021.

Chief and Council
Vuntut Gwitchin Government
P.O. Box 94
Old Crow, Yukon
Y0B 1N0

Sent via email

Attention: Chief [redacted]

I am writing in follow up to your letter dated March 31, 2021, and to my subsequent response dated April 12, 2021.

As you are aware, Chance Oil and Gas Limited (COGL) held open houses in Old Crow in the spring of this year. Following a hiatus due to COVID, we have started holding events again this fall. It is evident that citizens of Old Crow are interested in hearing about COGL's activities, but perhaps more importantly, they have expressed an interest in planning and providing feedback to COGL to help design the project and mitigate its potential impacts. COGL's ability to comprehensively and effectively meet the expectations of the community are intimately linked with COGL's commitments under the Vuntut Gwitchin Oil and Gas Engagement Policy (Policy).

Early this year negotiations under the Policy in relation to the Cooperation Agreement were ceased at your direction. COGL would now like to revive these negotiations and work with Vuntut Gwitchin Government (VGG) to repair and enhance our working relationship.

CHANCE OIL AND GAS LIMITED

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☒ **Calgary Office:**
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Calgary, AB T2R 1L5
Telephone (403) 699-0055
Fax (403) 699-0044

In particular, I want to again extend the offer for [redacted] and me to meet with you and your Council at your earliest convenience. At this time, we would like to propose late November/early December and that we meet to discuss the proposed Exploration Project and the Cooperation Agreement. In accordance with your March 31st direction, Chance would be more than happy to meet in Old Crow in an open forum where VGFN Citizens may attend.

As always, COGL remains very interested in building partnerships with Indigenous communities in order for them to benefit from opportunities created by exploration and potential future resource development. COGL is keenly interested in working with you to overcome the impasse that currently prevails between ourselves and to meaningfully re-engage in a cooperative and collaborative manner in full recognition of the interests of all parties.

With these goals in mind, I will follow-up with you via telephone in the next few days in hopes that we can find a way to work together to move this Project forward in a mutually agreeable and beneficial manner.

Thank you for your consideration of this request.

Yours truly,
Chance Oil and Gas Limited

[redacted]

Chairman and CEO

Cc: [redacted], Director of Natural Resources & Heritage, VGG
[redacted], Director of Intergovernmental Relations & Governance, VGG
[redacted]

APPENDIX 2-C-22. *Draft Annual 2019 Report Implementation of the Vuntut Gwitchin Government and Chance Oil and Gas Communication and Engagement Plan*

Hemmera
An Ausenco Company

DRAFT ANNUAL REPORT

Implementation of the Vuntut Gwitchin Government and Chance Oil and Gas Communication and Engagement Plan

DRAFT

Prepared for:

Yukon Energy, Mines and Resources
Oil and Gas Resources (K-11)
Box 2703
Whitehorse, YT Y1A 2C6

Prepared by:

Hemmera Envirochem Inc.
230-2237 2nd Avenue
Whitehorse, YT Y1A 0K7
T: 867-456-4865
F: 604-669-0430
hemmera.com

July 31, 2019

1.0 INTRODUCTION

This report demonstrates implementation of the Vuntut Gwitchin Government (VGG) and Chance Oil and Gas Limited (Chance) Communications and Engagement Plan (Plan) since it was finalized on May 22, 2018. The following sections summarise the discussions held between VGG and Chance, including the purpose, key discussion points, outcomes, and action items of each discussion, to fulfill the requirements of Ministerial Order (MO) 2018/ 42 issued to Chance on August 30, 2018. Please see **Appendix A** for a copy of the Plan and **Appendix B** for MO 2018/ 42.

2.0 BACKGROUND

The development of communications and engagement plans began with Order in Council (OIC) 2016/ 169 that required Chance to file a First Nations communication and engagement plan with the Minister of Energy, Mines and Resources in order to extend tenure on their Northern permits, 0005, 0006, 0007, 0008, 0009, 0010, and 0011 (see map in **Appendix C**). Chance complied with OIC 2016/ 169 and received their tenure extension.

Upon applying for tenure extension on six of Chance's eight Southern permits, 0012, 0013, 0014, 0015, 0016, and 0017, Chance received MO 2017/ 37 that required Chance to revise the consultation and engagement plan filed under OIC 2016/ 169 with each affected First Nation. The affected First Nations listed in MO 2017/ 37 were Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in (TH), First Nation of Na-Cho Nyak Dun (FNNND), Gwich'in Tribal Council (GTC) and Tetlit Gwich'in Council (TGC).

VGG and Chance developed the Communications and Engagement Plan (the Plan) collaboratively through a series of in-person meetings and conference calls. Hemmera was retained by Chance in November 2017 to facilitate the development and completion of the communications and engagement plans with each of the abovementioned First Nations and facilitated all discussions on the Plan between VGG and Chance. VGG and Chance submitted their finalized Plan to Minister [redacted] on May 22, 2018. To complete their obligations under MO 2017/ 37, Chance filed four communications and engagement plans which were approved by the Minister and resultantly Chance received a five-year tenure extension on the six Southern permits.

The completed Plan includes the VGG Oil and Gas Engagement Policy (the Policy). The Policy, developed by VGG and reviewed by Chance, provides structure to engagement between VGG and oil and gas proponents. Chance is following the stages outlined in the VGG Policy with the implementation of the Plan.

3.0 ENGAGEMENT AND COMMUNICATION PLAN IMPLEMENTATION SUMMARY

Since completing the Plan, VGG and Chance have continued to build their relationship, discussed advancing Chance's proposed oil and gas exploration project in Eagle Plain Basin, and formally initiated Stage 1 of the Plan. In the following section, a summary is provided of engagement activities that have occurred since the completion of the Plan.

Chance has had six in-person meetings or teleconferences with VGG, hosted 1 community dinner, and had numerous less formal phone calls and emails since completing the Plan. In addition, Chance hosted an All-

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Party meeting to bring together the affected First Nations listed above along with Yukon Government to discuss their proposed Oil and Gas exploration project in Eagle Plains Basin. The main themes of discussion between VGG and Chance have been the following:

- Exploration project scope
- Cooperation Agreement
- VGG Policy
- Yukon Environmental and Socio-Economic Assessment Board (YESAB) process
- Explanation and understanding of oil and gas activities

July 10, 2018 – In-person Meeting

Location: Old Crow, Sarah Abel Chitze Building

Attendees: VGG Chief and Council and technical staff, Chance management, Hemmera facilitators

The purpose of this meeting was to establish a general understanding of Chance's project plans and communication pathways going forward, as well as to collaboratively decide on next steps in engagement.

Regarding Chance's project plans, Chance explained that they know of oil and gas potential in Eagle Plains but must do more exploration to better understand the resources and hopefully discover commercial quantities. Chance explained the history of exploration in the area that involved seismic data acquisition and exploratory well drilling. The exploration that Chance has planned would involve doing more seismic and drilling, as well as nurturing local capacity building in the form of partnerships, training and jobs. VGG asked about the exploration and development of shale resources and Chance replied they would not be focusing on shales and therefore will not use hydraulic fracturing.

Chance explained their land tenure status, explaining the land tenure extension application that was under review at the time of this meeting, as well as the expiration dates on their permits. Receiving the maximum allowed land tenure is critical to Chance as they need time to go through the YESAB process and undertake the field programs once regulatory approvals are granted.

Regarding communication going forward, VGG and Chance agreed that they need clear flows of information. A good relationship between VGG and Chance would allow them to design a project that meets the needs of the community and technical advisors.

The key outcome of this meeting was that VGG expressed their support for Chance's tenure extension application that was under review at the time of this meeting. In addition, VGG presented a Draft Cooperation Agreement to Chance. VGG explained that this was meant to facilitate conversation moving forward and that more specific project information was needed prior to completing the agreement.

September 11-12, 2018 – Two day In-person Meeting

Location: Whitehorse, Hemmera's Office

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Attendees: VGG Council members and technical staff, Chance management, Hemmera facilitators

The purpose of this meeting was to discuss near-term community engagement and consultation, the Draft Cooperation Agreement, establish key objectives and common goals for the Cooperation Agreement, and discuss project development scenarios.

It was agreed that near-term community engagement and consultation should focus on the following:

- Community understanding of Chance's project and the oil and gas industry in general
- Vuntut Gwitchin Culture and Landscape
- Employment and capacity building
- Traditional Knowledge and Traditional Land Use
- Legislation and regulations

VGG expressed its Cooperation Agreement objectives as they were outlined in the Draft Cooperation Agreement and highlighted important clauses. Chance also expressed its objectives for the Cooperation Agreement and both parties outlined items for future negotiation. Knowledge and information sharing protocols were also discussed along with the topic of having common vs. independent technical advisors for the preparation of the project proposal. Chance and VGG discussed a process for completing the Cooperation Agreement and key contacts for future discussion. The next step was for Chance to review the Draft Cooperation Agreement and provide feedback to VGG.

Chance outlined two project development scenarios and both parties discussed their preferred scenario. Chance was actioned with preparing a brief write-up of exploration project scenarios including the scale, scope, and pace of planned activity.

October 4, 2018 – Teleconference Meeting

Location: Teleconference

Attendees: VGG technical staff, Chance management, Hemmera facilitators

The purpose of this meeting was to review the latest draft of the Cooperation Agreement (Agreement) and discuss how to finalize this; as well as to discuss Chance's exploration project scenarios as they were explained in a word document sent via email.

VGG and Chance decided that, because of the VGG election, it would be best to complete negotiations on the Cooperation Agreement after the new Chief and Council was instated in February 2019. This would also allow time for community consultation on the Cooperation Agreement.

VGG and Chance considered how to align the completion of the Cooperation Agreement, required in Stage II of the Policy, with other project activities. Both parties agreed that a meeting to review the Policy would be beneficial in informing how the parties would implement the stages of the Policy.

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In addition, VGG and Chance discussed Chance's amendments to the Draft Cooperation Agreement and did not come to an agreement on changes. VGG was to provide written feedback on Chance's amendments to the Cooperation Agreement after the meeting.

December 12, 2018, In-person and Teleconference Meeting

Location: Hemmera's Office and teleconference

Attendees: VGG technical staff, Chance Management, Hemmera facilitators

The purpose of this meeting was to have an in-depth discussion on the Policy, increase both party's understanding of how to apply the Policy to Chance's project, and the actions required by each party to comply with each stage of the Policy.

VGG provided background information on the Policy explaining reference documents used to develop the Policy, and the purpose of the Policy for VGG. Community involvement throughout the stages of the Policy was also explained. A Natural Resources Committee (Committee) was being established as per the Policy, and Chance and VGG agreed to schedule a meeting in January in Old Crow to introduce Chance to the Committee and the new Chief and Council.

Chance and VGG discussed agenda items for the proposed February 1, 2019 All Party Meeting.

January 29, 2019 – In-person Meeting

Location: Old Crow, Sarah Abel Chitze Building

Attendees: VGG Chief and Council and technical staff, VGG Natural Resources Committee, Chance management, Hemmera facilitators

The purpose of this meeting was to introduce Chance to VGG's new Chief and Council and the Committee. The meeting was an unstructured conversation in which Chance explained their permits and exploration intentions and provided the opportunity for Chief and Council as well as the Committee to share their thoughts on the Project and ask questions.

The Committee members communicated what they see their role being in the project and what they would like to see in terms of community involvement in the project. The Committee also communicated what they understand to be the Elder's and community's general concerns around the project.

Key meeting outcomes were an introduction of Chance to the new Council and Committee, and an increased understanding of Chance's exploration project and timing, oil and gas industry options and products, disposition tenure, and *Yukon Environmental and Socio-economic Assessment Act (YESAB)*.

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February 1, 2019, All-Party Meeting

Location: Vancouver, Fairmont Waterfront Hotel

Attendees: VGG Chief and Council and technical staff, FNNND Deputy Chief and technical staff, GTC Grand Chief and technical staff, Minister of Energy Mines and Resources and Oil and Gas Department staff, Chance Management, and Hemmera facilitators. The TGC President, and TH Chief and Council and technical staff were invited to the meeting and could not attend.

The purpose of the All-Party Meeting was to bring together VGG, GTC, TGC, FNNND, TH, and YG to discuss future plans and opportunities for collaboration on Chance's proposed exploration project.

An overview of the development of the Communications and Engagement Plans and an update on implementation was provided. All parties were introduced to the VGG Policy, discussed the general format of the policy and the involvement of VGG Chief and Council and Old Crow community.

Chance discussed potential exploration project scenarios, discussing the sequence of exploration, the potential number of exploration wells they would like to drill, the roads this would require, and the approximate number of people they could employ.

The First Nations in attendance requested time within the agenda to have an in-camera session in which they discussed project matters without Chance, Yukon Government, or Hemmera in the room.

Hemmera presented the YESAB process and other regulatory processes outlined in the *Yukon Oil and Gas Act* (YOGA) and the *Water Act*. Hemmera explained the YESAB Designated Office and executive committee processes and how these sequence with other permitting requirements. YESAB is introducing a Pre-Submission Engagement (PSE) process, anticipated to be rolled out in late 2019, which facilitates an iterative process for proponents to develop their project description and valued components with feedback from YESAB prior to submitting their project description. Chance does not anticipate following the PSE process, but has not heard a final answer from YESAB.

The groups discussed next steps which would include the following:

- Chance and First Nations developing confidentiality agreements
- Chance defining their project scope and communicating this with the First Nations
- The First Nations discussing the possibility of shared technical consultants
- Forming adaptive management measures
- Yukon Government hosting Oil and Gas 101 sessions
- Chance and VGG would discuss the completion of stages of the Policy in parallel with other regulatory requirements, or sequentially with other regulatory requirements.

June 6, 2019 – In-person Meeting

Location: Old Crow, Sarah Abel Chitze Building

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Attendees: VGG Chief and Council, VGG Natural Resources Committee, Chance management, Hemmera facilitators

The purpose of this meeting was for Chance to present the Draft Project Description of exploration activities proposed for the Eagle Plain Basin as per the VGG Policy as well as to discuss the annual reporting required for the Plan.

The Draft Project Description Presentation included descriptions of the oil and gas activities involved in exploration and the anticipated scope of these activities. There were questions and discussion regarding the project activities, decision making processes, impacts to environmental and socio-economic values, and remediation.

Hemmera presented the anticipated YESAB process, explaining that Chance is going to submit a project proposal to the Executive Committee of YESAB to screen. The anticipated consultation schedule was presented for discussion along with how this could align with the stages of the Policy.

Key meeting outcomes were Chance's presentation of a package of information to comply with Stage I, Paragraph 24 of the Policy.

June 6, 2019 – Community Dinner

Location: Old Crow, Community Hall

Attendees: 35 Community Members including members of VGG Chief and Council and VGG Natural Resources Committee, Chance management, Hemmera facilitators

Chance provided the community with background information on the company and their work in Eagle Plain Basin. Chance also provided the community with an overview of the project scope and the exploration activities that Chance is proposing to undertake.

Hemmera provided the community with a review of the YESAB process, explaining the community consultation component of the executive committee level screening, and that Hemmera will be conducting the consultation program with Chance for their exploration project.

The engaged audience asked questions and the Chance team and Hemmera provided responses.

4.0 PLANS FOR ONGOING ENGAGEMENT AND NEXT STEPS

VGG and Chance will continue to hold discussions at regular intervals as Chance develops their project proposal for YESAB. Chance will comply with the stages of the Policy while developing the corresponding project proposal information. Upcoming engagement activities are expected to involve the following:

- Meetings between VGG technical staff and technical consultants preparing the project proposal
- Negotiation of a final Cooperation Agreement (Stage II of the Policy)

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- Negotiation of a Stewardship and Benefits Agreement (Stage III of the Policy)
- Community consultation events in Old Crow

5.0 APPROVAL OF IMPLEMENTATION SUMMARY

VGG and Chance have reviewed this report and agree to its contents as an accurate summary of the engagement and consultation meetings executed since the completion of the Plan.

Per: Vuntut Gwitchin Government

Dated: _____

[redacted], Acting Director of Natural Resources

Per: Chance Oil and Gas Limited

Dated: _____

[redacted] Vice-President

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APPENDIX A

Vuntut Gwitchin Government and Chance Oil and Gas Limited Communication and Engagement Plan

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Vuntut Gwitchin Government

Chance OIL AND GAS LIMITED

May 22, 2018

[redacted]
Minister of Energy, Mines and Resources
Government of Yukon
Box 2703
Whitehorse, Yukon Y1A 2C6

Dear [redacted]

Re: Submission of the Vuntut Gwitchin Government and Chance Oil and Gas Limited Communications and Engagement Plan

Ministerial Order 2017/037 of the Yukon Oil and Gas Act states the following in clause 5:

> *5 It is a condition of this Order that Chance Oil and Gas Limited must, in consultation with each affected First Nation, revise the first nations communications and engagement plan filed under O.I.C. 2016/169 to the satisfaction of the Minister on or before August 1, 2018.*

Vuntut Gwitchin Government (VGG) and Chance Oil and Gas Limited (Chance) are pleased to inform you of our collaborative efforts to develop a mutually agreeable framework to facilitate effective and meaningful communications and engagement between VGG and Chance. The framework captured in the enclosed Communications and Engagement Plan (Plan), and its collaborative development, establishes a solid foundation for a respectful relationship that both parties will implement and enjoy as we continue to work together now and into the future.

Please accept the enclosed Plan for the purposes of Ministerial Order 2017/037. We trust that the Plan will be of satisfaction to the Minister, as it meets the needs of VGG and Chance at this time.

[redacted]

Director of Natural Resources
Vuntut Gwitchin Government

Vice President of Government and External Relations
Chance Oil and Gas Limited

Enclosed: Communications and Engagement Plan





COMMUNICATION AND ENGAGEMENT PLAN

VUNTUT GWITCHIN GOVERNMENT & CHANCE OIL AND GAS LIMITED

MAY 17, 2018

1. Background

Chance Oil and Gas Limited ("Chance") is an oil and gas exploration company that currently holds valid permits to perform oil and gas activities in the Eagle Plain basin within the Traditional Territory of the Vuntut Gwitchin First Nation ("VGFN").

As a condition of order-in-council 2016/169 dated August 30, 2016 concerning the return of work deposits to Chance in relation to oil and gas permits nos. 0005 to 0011, Chance was required to file a communication and engagement plan (the "Plan"). The Plan, as it was submitted, was not mutually agreed upon between Chance and the Vuntut Gwitchin Government ("VGG").

As a condition of ministerial order 2017/37 dated August 29, 2017 concerning a one-year extension for oil and gas permit nos. 0012 to 0017, Chance is now required to revise the Plan in consultation with VGFN on or before August 1, 2018.

2. Purpose

The purpose of this document is to revise the Plan in a manner that establishes a mutually agreed upon framework between Chance and VGG to guide communication (i.e. the exchange of information) and engagement (i.e. meaningful participation in planning, problem-solving and decision-making) in relation to all aspects of Chance's activities, including but not limited to, community information programs; existing or proposed oil and gas dispositions; and existing or proposed oil and gas activities.

Nothing in this Plan is intended to address or satisfy any duties or responsibilities of the Government of Yukon that exist or may arise in relation to Chance's exploration program.

3. Application of Oil and Gas Engagement Policy

The *Vuntut Gwitchin Government Oil and Gas Engagement Policy* attached to this Plan as Appendix A (the "Policy") will be the overarching framework that guides engagement between VGG and Chance in relation to Chance's activities. Chance will comply with the Policy and any other applicable VGG policies. To the extent that there may be any inconsistency between this Plan and the Policy, the Policy will prevail.

4. Communication and Engagement

The communication and engagement between Chance and VGFN in relation to Chance's exploration program activities is anticipated to encompass communication and engagement between: (a) Chance and VGG; and (b) Chance and VGFN Citizens.

4.1 Communication and Engagement between Chance and VGG

The VGG committee mandated under part two of the Policy will be the VGG body responsible for managing communications and engagement between Chance and VGG, including informing and seeking views of VGFN Citizens, with the exception of any communications related to any

negotiations of towards a Cooperation Agreement or Benefits and Stewardship Agreement which will occur directly between Chance and Council as set out under the Policy.

Table 1.

Subject Matter	VGG Contact(s)	Chance Contact(s)
Communications related to Chance's exploration program activities, other than those communications excepted below.	• Director of Natural Resources • Chair of the Standing Committee on Natural Resources, Heritage, Tourism and Economic Development	• Management Team
Communications related to the negotiation of a Cooperation Agreement or Benefits and Stewardship Agreement.	• Council	• Management Team

4.2 Communication and Engagement between Chance and VGFN Citizens

VGG does not serve a gatekeeping role with respect to any communications and engagement that Chance may wish to undertake with VGFN Citizens in relation to Chance's exploration program activities; however, VGG and Chance will seek to coordinate communication and engagement efforts with VGFN Citizens to the extent such joint communication and engagement is possible or appropriate. As detailed in the Policy, Chance will submit a written notice to the Director of Natural Resources within a reasonable time prior to any proposed public meetings with VGFN Citizens in order to facilitate coordination between Chance and VGG.

Table 2.

Subject Matter	VGG Contact(s)	Chance Contact(s)
Written notice of proposed meetings with VGFN Citizens in relation to Chance's exploration program activities.	• Director of Natural Resources	• Vice President of Government and Community Relations

4.3 Communication and Engagement Methods and Content

Chance and VGG will use the following methods for carrying out communication and engagement in relation to Chance's exploration program activities:

- In-person meetings;
- Public meetings (for communication and engagement with VGFN Citizens in Old Crow and Whitehorse);

- E-mail correspondence;
- Telephone correspondence (teleconferences and less formal phone calls);
- Power Point presentations (to support in-person meetings);
- Reports (as requested and as required);
- Social media;
- Newsletters; and
- Official websites.

The information exchanged in communication and engagement between Chance and VGFN is anticipated to address the following key items:

- Information programs regarding VGFN culture and history;
- Information programs regarding the oil and gas industry, including its history and regulation in Yukon;
- Any existing or proposed Chance oil and gas dispositions;
- Any existing or proposed Chance oil and gas activities;
- Items set out in the Policy that must be addressed in any Cooperation Agreement and Benefits and Stewardship Agreement between VGFN and Chance; and
- Implementation of the Policy.

5. Records Management

Chance and VGG will use the following records management protocols in relation to communications and engagement between Chance and VGG.

5.1 Records Subject to Disclosure to Regulators and Assessors

Subject to the records management protocols in this Plan, Chance may disclose the following types of relevant records to regulators and assessors:

- meeting agendas;
- meeting minutes;
- meeting participant lists;

- records log which includes summaries of the following: in-person meetings; e-mail and telephone correspondence between Chance and VGG, including supporting materials shared or discussed in the correspondence;

- reports provided by either VGG or Chance to one another; and

- Power Point presentations provided by either VGG or Chance to one another.

5.2 Records Management Procedures and Confidentiality Protocols

Records of communications between VGG and Chance will be made, and any support services retained by either Chance or VGG to those records will be conducted in a fair and unbiased manner. Should VGG and Chance choose not to retain records management support services, VGG and Chance will jointly decide on an individual or individuals from either or both parties to be responsible for records keeping and management.

Chance, VGG and any person or party retained to assist in records management will comply with the following procedures for records management:

- Meeting agendas will be developed collaboratively between VGG and Chance and mutually agreed upon prior to the outset of the meeting.

- Meeting minutes will be taken by a designated records management person or party and sent to Chance and VGG within 2 weeks via e-mail. VGG and Chance may review and provide comment to the records management person or party on these meeting minutes within 30 days of both parties receiving the meeting minutes. Should either party require more time to review the meeting minutes, the party will notify the records management person or party by e-mail within 2 weeks of receiving the minutes. No response by VGG or Chance to meeting minutes will be interpreted as general acceptance of the meeting minutes by that party.

- Action items and key outcomes will be logged during meetings and will be reviewed by both parties at the end of the meeting to ensure that there is general agreement on the list of actions and parties responsible for those actions and on the list of key outcomes from the meeting. The list of action items and the list of key outcomes will be recorded within the meeting minutes.

- Any reports or Power Point presentations provided by either VGG or Chance to one another will be considered final upon delivery unless otherwise specified as drafts.

- A record log will be jointly reviewed and approved by Chance and VGG for accuracy, completeness, and compliance with this Plan prior to being disclosed to any regulator and assessor.

Chance and VGG will comply with the following confidentiality protocols for records management and the disclosure of records to regulators and assessors:

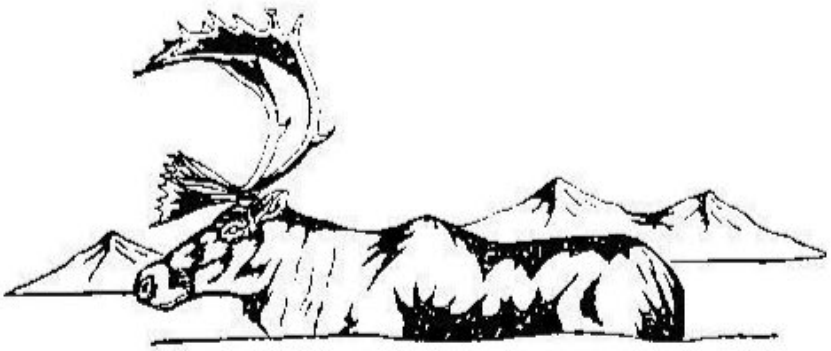
Table 3.

Type of Record	Confidentiality Assumption	Process for Establishing Confidentiality
Meeting Agendas	• Not confidential.	• Should confidential matters need to be discussed, a separate agenda will be created for these matters and remain confidential.
Meeting Minutes	• Not confidential.	• Confidential discussions/content will be identified before the meeting begins, during the meeting, or as part of the minutes review process.
Meeting Participant List	• Not confidential.	• Unless otherwise specified during the meeting, these items are not considered confidential.
Records Log	• Not confidential.	• Should correspondence need to be confidential, it is the responsibility of each party to notify the other when a meeting, e-mail, phone call, or attachment is confidential at the time it occurs or immediately thereafter.
Reports provided by either VGG or Chance to one another	• Not confidential. • Note: Any reports containing traditional knowledge or traditional land use will be subject to separate protocols agreed upon by VGG and Chance.	• Should a report shared between parties need to be confidential, it is the responsibility of each party to notify the other of this when the report is shared.
Power Point presentations provided by either VGG or Chance to one another	• Not confidential.	• Unless otherwise specified during the meeting, these items are not considered confidential.

6. Plan Review and Amendment

Chance and VGG will review and assess this Plan and its implementation on a quarterly basis. Following any review and assessment of the Plan, the Plan may be amended upon the mutual agreement of Chance and VGG.

SCHEDULE A
VUNTUT GWITCHIN GOVERNMENT OIL AND GAS ENGAGEMENT POLICY



VUNTUT GWITCHIN GOVERNMENT
OIL AND GAS ENGAGEMENT POLICY

MAY 2018

PART ONE
GENERAL PROVISIONS

Title

1. This policy may be cited as the *Vuntut Gwitchin Government Oil and Gas Engagement Policy*.

Definitions

2. In this policy:

"**Application**" means an application made by a Proponent in relation to an Oil and Gas Disposition pursuant to the *Oil and Gas Act*, R.S.Y. 2012, c. 162;

"**Benefits and Stewardship Agreement**" means the agreement required in relation to any oil and Gas Activity as set out at Stage III of the Engagement Process under part three of this policy.

"**Board**" means a designated office, executive committee or panel of the Yukon Environmental and Socio-Economic Assessment Board.

"**Citizen**" means a citizen of the Vuntut Gwitchin First Nation pursuant to Appendix II of the Constitution (Citizenship Code).

"**Citizen Representative**" means a Citizen appointed to the Committee by the Council.

"**Committee**" means the lands and resources committee of the Vuntut Gwitchin First Nation as mandated under part two of this policy.

"**Constitution**" means the Constitution of the Vuntut Gwitchin First Nation.

"**Cooperation Agreement**" means the agreement required in relation to any Oil and Gas Activity as set out at Stage II of the Engagement Process under part three of this policy.

"**Council**" means the branch of the Vuntut Gwitchin Government established by the Constitution consisting of the Chief, Deputy Chief and all Councillors.

"**Director of Natural Resources**" means the Director of the Vuntut Gwitchin Government's Natural Resources Department.

"**Elders Representative**" means a member of the Vuntut Gwitchin First Nation Elders Council appointed to the Committee by the Elders Council.

"**Engagement Process**" means the process commencing under part three of this policy for engagement between the Vuntut Gwitchin Government and a Proponent in relation to any Application or Oil and Gas Activity and continuing for so long as required.

"**Intergovernmental Process**" means any engagement process between the Vuntut Gwitchin Government and Government of Yukon on matters related to Oil and Gas Activities, Oil and Gas Dispositions and their regulation.

"**Oil and Gas Activity**" or "**Oil and Gas Activities**" means any existing or proposed oil and gas activity or activities as defined by Section 1 of the *Oil and Gas Act*, R.S.Y. 2012, c. 162 that affects, or has the potential to affect, any rights, responsibilities or interests of the Vuntut Gwitchin First Nation whether or not the oil and gas activity or activities are situated within the Vuntut Gwitchin First Nation Traditional Territory.

"**Oil and Gas Disposition**" or "**Oil and Gas Dispositions"** means any existing or proposed oil and gas disposition or dispositions as defined by as defined by Section 1 of the *Oil and Gas Act*, R.S.Y. 2012, c. 162 that affects, or has the potential to affect, any rights, responsibilities or interests of the Vuntut Gwitchin First Nation whether or not the oil and gas disposition or dispositions grants rights to lands situated within the Vuntut Gwitchin First Nation Traditional Territory.

"**Proponent**" means any proponent of an Oil and Gas Activity or holder of an Oil and Gas Disposition.

"**Proposal**" means a proposal required to be submitted by a proponent to the Board pursuant to Section 50(1) of the *Yukon Environmental and Socio-economic Assessment Act*, S.C. 2003, c. 7.

"**Sustainable Development**" means beneficial socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent as defined in Chapter 1 of the *Vuntut Gwitchin First Nation Final Agreement*,.

"**Standing Committee Chair**" means the Chair of the Vuntut Gwitchin Government Standing Committee on Natural Resources, Heritage, Tourism and Economic Development.

"**Vuntut Gwitchin First Nation"** means the legal entity established pursuant to Article 9 of the *Vuntut Gwitchin First Nation Self-Government Agreement*.

"**Vuntut Gwitchin First Nation Law**" means any law enacted by the Vuntut Gwitchin First Nation in accordance with its law-making powers under Article 13 of the *Vuntut Gwitchin First Nation Self-Government Agreement*.

"**Vuntut Gwitchin Government**" means the government of the Vuntut Gwitchin First Nation.

"**Youth Representative**" means a Citizen between the ages of 14 and 21 appointed to the Committee by the Council.

Purpose

3. The purpose of this policy is to establish a respectful, transparent and meaningful framework to guide the engagements of the Vuntut Gwitchin Government in relation to Oil

and Gas Activities and Oil and Gas Dispositions in a manner that supports and upholds the objective of Sustainable Development.

Application

4. This policy applies to any engagement between the Vuntut Gwitchin Government and a Proponent in relation to any to Oil and Gas Activities and Oil and Gas Dispositions.

Conflict of Law and Policy

5. In the event of a conflict or inconsistency between this policy and the Constitution, the Constitution shall prevail to the extent of the conflict or inconsistency.

6. In the event of a conflict or inconsistency between this policy and any Vuntut Gwitchin First Nation Law, the Vuntut Gwitchin First Nation Law shall prevail to the extent of the conflict or inconsistency.

General

7. Nothing in this policy is to be construed as abrogating or derogating from the *Vuntut Gwitchin First Nation Final Agreement*.

8. Nothing in this policy is to be construed as providing consent or authorizing any past, existing or proposed Oil and Gas Activity or Oil and Gas Disposition.

9. Nothing in this policy shall be construed as limiting, affecting, fulfilling or discharging the honour of the Crown and the Crown's constitutional duty to consult and accommodate the Vuntut Gwitchin First Nation.

10. This policy may be amended from time to time by the Vuntut Gwitchin Government and will make best efforts to notify any Proponent potentially affected by an amendment.

PART TWO
ADMINISTRATION

Committee

11. The Vuntut Gwitchin Government shall establish the Committee with a mandate to fulfill the following roles and responsibilities in accordance with this policy:

    (a) reviewing information about Oil and Gas Activities, Oil and Gas Dispositions and their regulation;

    (b) informing and seeking views from Citizens on Oil and Gas Activities, Oil and Gas Dispositions, the Engagement Process and/or Intergovernmental Process as necessary;

(c) assisting and providing recommendations to the Council throughout the Engagement Process; and

(d) providing recommendations to the Council throughout the Intergovernmental Process if requested by Council.

12. The Committee shall be made of 5 members consisting of the:

(a) Standing Committee Chair;

(b) Director or Natural Resources;

(c) Elders Representative;

(d) Youth Representative; and

(e) Citizen Representative.

13. The Committee shall meet as regularly as may be necessary to fulfill its roles and responsibilities.

14. The Committee shall have a quorum of 3 members.

15. The Standing Committee Chair and Director of Natural Resources shall serve as co-chairs of the Committee.

16. The Committee shall make best efforts to fulfill its roles and responsibilities by consensus.

17. The Committee may at any time request the support of employees or contractors of the Vuntut Gwitchin Government to assist it in carrying out its roles and responsibilities under this policy.

18. The Committee may invite any persons, including any Proponent, to attend or participate in a meeting of the Committee.

19. The Committee shall not use or disclose to any person confidential information except as may be required to fulfill its roles and responsibilities.

Citizen Consultation

20. The Director of Natural Resources shall be responsible for organizing and carrying out any consultation between the Vuntut Gwitchin Government and Citizens regarding Oil and Gas Activities and Oil and Gas Dispositions with the assistance and participation of the Committee as necessary.

21. In that event that a Proponent wishes to organize and carry out any public consultation with Citizens related to any Oil and Gas Activities or Oil and Gas Dispositions, the Proponent shall submit a notice in writing to the Director of Natural Resources within a reasonable time prior to the proposed meeting date in order to facilitate coordination between the

Proponent and Vuntut Gwitchin Government if appropriate. The written notice shall contain:

(a) proposed dates and location;

(b) proposed agenda;

(c) description of the purpose of the consultation; and

(d) any materials to be relied on by the Proponent during the consultation.

22. Any consultations with Citizens related to any Oil and Gas Activities or Oil and Gas Dispositions that are organized and carried out by the Proponent shall not be construed as consultation with the Vuntut Gwitchin Government.

PART THREE
ENGAGEMENT PROCESS

Stage I – Notice Period

23. Proponents shall provide notice in writing to the Director of Natural Resources of any Application in relation to any Oil and Gas Disposition at the earliest possible opportunity. The written notice of the Application shall contain:

(a) letter of introduction;

(b) company profile including organizational structure, profiles of directors and management team members, financial statements for the previous five fiscal years and compliance record;

(c) detailed description of the Oil and Gas Disposition and Application including any relevant maps, plans or schedules; and

(d) designated Proponent spokesperson.

24. Proponents shall provide notice in writing to the Director of Natural Resources of any Oil and Gas Activity at the earliest possible opportunity in the planning phase and prior to submitting a Proposal to the Board. The written notice shall contain:

(a) letter of introduction;

(b) company profile including organizational structure, profiles of directors and management team members, financial statements for the previous five fiscal years and compliance record;

(c) detailed description of the proposed Oil and Gas Activity, including any relevant maps, plans or schedules;

(d) administration fee in the amount of $1,000.00 made payable to the Vuntut Gwitchin First Nation; and

(e) designated Proponent spokesperson.

25. Upon receipt of any written notice from a Proponent in relation to any Application or Oil and Gas Activity, the Director of Natural Resources shall immediately refer the notice to the Committee. The Committee shall meet to review the notice and:

(a) if the Committee determines the notice is incomplete or insufficient the Committee may request in writing further or better information from the Proponent, and the Proponent shall provide such further or better information upon receipt of the written request; or

(b) if the Committee determines the notice is complete and sufficient then:

(i) in the case of a notice regarding an Application, the Director of Natural Resources may provide written comments to the Proponent or request a meeting with the Proponent to discuss the Application; and

(ii) in the case of a notice regarding an Oil and Gas Activity, the Committee shall notify the Proponent of the determination in writing and the Engagement Process shall proceed to Stage II.

Stage II – Cooperation on any Oil and Gas Activity

26. After completion of Stage I and prior to submitting a Proposal to the Board, a Proponent shall negotiate in good faith and enter into a Cooperation Agreement with the Council for the purpose of establishing a meaningful, respectful and transparent process for engagement.

27. Prior to entering into a Cooperation Agreement, the Council shall refer the agreement to the Committee for review. The Council may enter into a Cooperation Agreement on behalf of the Vuntut Gwitchin First Nation if the Committee determines that the terms and conditions adequately consider and address the following items:

(a) compliance with this policy;

(b) capacity funding for the Engagement Process;

(c) communications and correspondence;

(d) information sharing; and

(e) commitment to negotiate a Benefits and Stewardship Agreement.

Stage III – Benefits and Stewardship on any Oil and Gas Activity

28. After the completion of Stage II and prior to submitting a Proposal to the Board, a proponent shall negotiate in good faith and enter into a Benefits and Stewardship Agreement with the Council for the purpose of establishing appropriate stewardship measures and maximizing any potential benefits for the Vuntut Gwitchin First Nation.

29. Prior to entering into a Benefits and Stewardship Agreement, the Council shall refer the agreement to the Committee for review. The Council may enter into a Benefits and Stewardship Agreement on behalf of the Vuntut Gwitchin First Nation if the Committee determines that the terms and conditions adequately consider and address the following items:

    (a) detailed description of the Oil and Gas Activity;

    (b) capacity funding for participation in the Board's regulatory process;

    (c) compliance with the objective of Sustainable Development;

    (d) compliance with applicable land use plans;

    (e) compliance with Vuntut Gwitchin First Nation General Assembly Resolution No. 2013-01 regarding hydraulic fracturing;

    (f) adequate education and training opportunities;

    (g) adequate employment and procurement opportunities;

    (h) adequate revenue sharing or equity arrangements;

    (i) adequate stewardship measures including but not limited to:

        (i) baseline data collection measures;

        (ii) information sharing measures;

        (iii) joint monitoring of environmental and socio-economic effects, and of the effectiveness of mitigation measures;

        (iv) joint advisory and reporting processes;

        (v) joint fish and wildlife management plan;

        (vi) joint heritage resource protection plan;

        (vii) joint access management plan;

        (viii) joint water quality and quantity management plan;

(ix) joint waste management plan;

(x) joint remediation and reclamation plan;

(xi) adaptive management measures in relation to the foregoing stewardship measures, including adaptability to address any recommendations from the Board;

(j) potential socio-economic effects which includes effects on economies, health, culture, traditions, lifestyles and heritage resources;

(k) potential cumulative effects which includes effects to the environment that are caused by an action in combination with other past, present and future human actions;

(l) potential effects on any Vuntut Gwitchin First Nation rights, responsibilities and interests under the *Vuntut Gwitchin First Nation Final Agreement* and *Vuntut Gwitchin First Nation Self-Government Agreement*;

(m) compliance and enforcement measures;

(n) dispute resolution mechanisms; and

(o) Vuntut Gwitchin First Nation approval and ratification process.

30. In addition to a Benefits and Stewardship Agreement, the Council may enter into a separate agreement with a Proponent and other parties for the purpose of addressing the limited requirements under section 68 of the *Oil and Gas Act*, R.S.Y. 2012, c. 162.

APPENDIX B

Ministerial Order 2018/ 42

DRAFT

YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,

(d) oil and gas permit No. 0015,

(e) oil and gas permit No. 0016,

(f) oil and gas permit No. 0017. « *permis visé* »

2 The renewal term of each subject permit is extended by five years (so that it ends on August 30, 2023).

3 The resulting total length of the initial term and the renewal term of a subject permit is 16 years.

YUKON

CANADA

ARRÊTÉ MINISTÉRIEL 2018/42

LOI SUR LE PÉTROLE ET LE GAZ

Le ministre de l'Énergie, des Mines et des Ressources, conformément à la *Loi sur le pétrole et le gaz*, arrête :

1 La définition suivante s'applique au présent arrêté.

« permis visé » Les permis suivants de pétrole et de gaz détenus par Chance Oil and Gas Limited :

a) permis de pétrole et de gaz nº 0012;

b) permis de pétrole et de gaz nº 0013;

c) permis de pétrole et de gaz nº 0014;

d) permis de pétrole et de gaz nº 0015;

e) permis de pétrole et de gaz nº 0016;

f) permis de pétrole et de gaz nº 0017. "*subject permit*"

2 La durée du renouvellement de chaque permis visé est prolongée de cinq ans, de façon à ce qu'elle se termine le 30 août 2023.

3 La durée totale d'un permis visé, y compris la durée initiale et la durée du renouvellement, est de 16 ans.

4(1) In this section

"first nations communications and engagement plan" means the plan filed under O.I.C. 2016/169 and revised in accordance with M.O. 2017/37. *« plan de participation et de communication avec les premières nations »*

(2) It is a condition of this Order that Chance Oil and Gas Limited must file annual reports with the Division Head, in accordance with subsection (3) and to the satisfaction of the Division Head, about the implementation of the first nations communications and engagement plan.

(3) For the purposes of subsection (2), Chance Oil and Gas Limited must file

(a) the first annual report on or before July 31, 2019, in respect of the period beginning on September 1, 2018, and ending on May 31, 2019; and

(b) each subsequent annual report on or before July 31 of each year in respect of the period beginning on June 1 of the preceding year and ending on May 31 of the year in which the report is to be filed.

4(1) La définition suivante s'applique au présent article.

« plan de participation et de communication avec les premières nations » Le plan déposé en vertu du Décret 2016/169 et révisé en conformité avec l'Arrêté 2017/37. *"first nations communications and engagement plan"*

(2) À titre de condition du présent arrêté, Chance Oil and Gas Limited dépose des rapports annuels auprès du chef de division, en conformité avec le paragraphe (3) et à la satisfaction du chef de division, concernant la mise en œuvre du plan de participation et de communication avec les premières nations.

(3) Pour l'application du paragraphe (2), Chance Oil and Gas Limited dépose :

a) le premier rapport annuel au plus tard le 31 juillet 2019, pour la période débutant le 1er septembre 2018 et se terminant le 31 mai 2019;

b) chaque rapport annuel subséquent, au plus tard le 31 juillet de chaque année pour la période débutant le 1er juin de l'année précédente et se terminant le 31 mai de l'année au cours de laquelle le rapport doit être déposé.

Dated at Whitehorse, Yukon,
~~30~~ August 30th 2018.

Fait à Whitehorse, au Yukon,
le August 30th 2018.

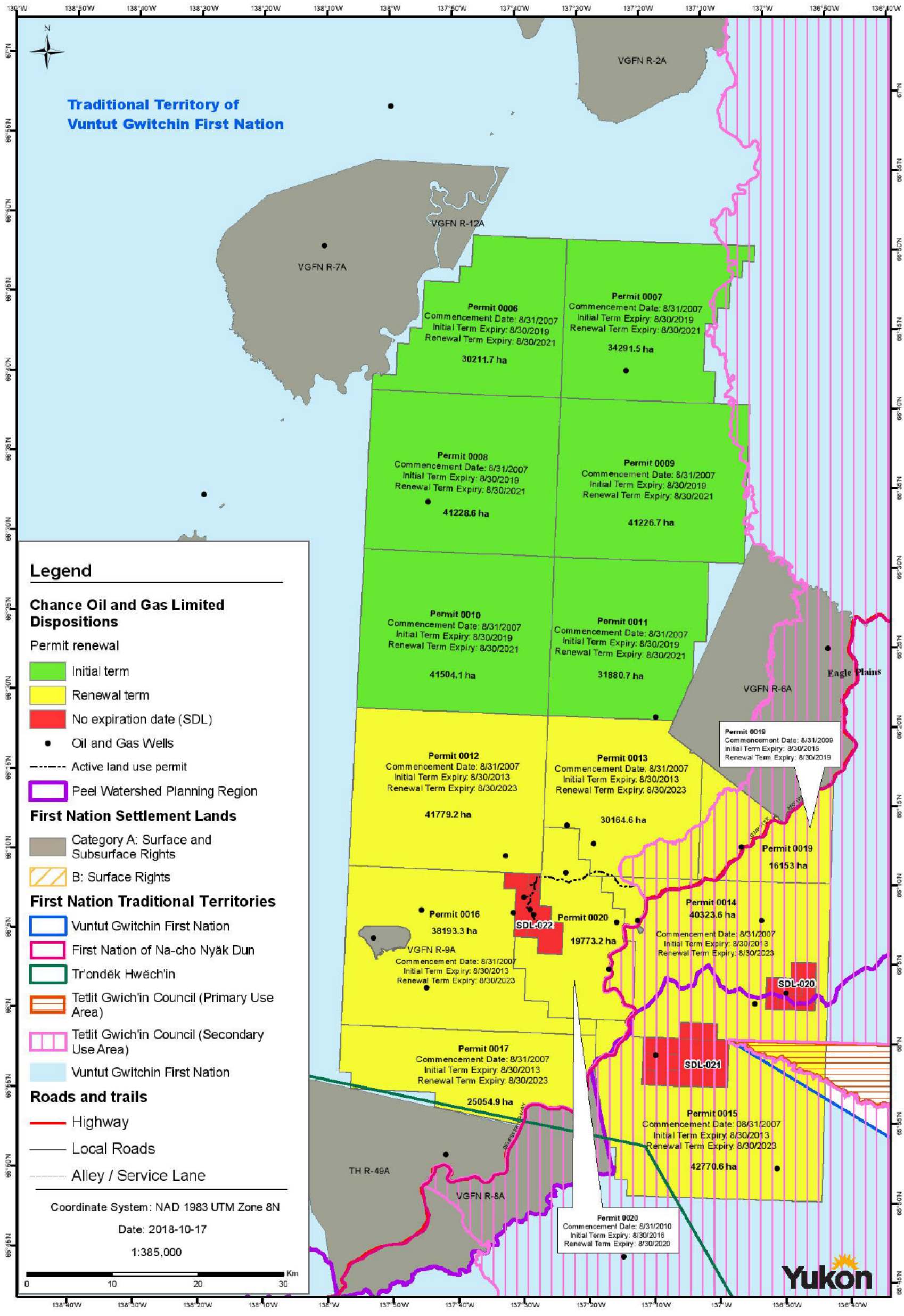
[redacted]

Minister of Energy, Mines and Resources/Ministre de l'Énergie, des Mines et des Ressources

APPENDIX C
Map of Chance Dispositions and Wells

DRAFT

Chance Oil and Gas Limited Dispositions and Wells



APPENDIX 2-C-23. *Annual 2019 Report Implementation of the Vuntut Gwitchin Government and Chance Oil and Gas Communication and Engagement Plan* - document not available at time of submission.

APPENDIX 2-C-24. Consultation and Engagement Letter

VUNTUT GWITCHIN GOVERNMENT

Government of Vuntut Gwitchin First Nation

NATURAL RESOURCES DEPARTMENT

P.O. Box 94,
Old Crow, Yukon
Y0B 1N0

Phone: (867)966-3261
Fax: (867)966-3800
Web: www.vgfn.ca

May 4, 2020

VIA E-MAIL – [redacted]

[redacted]
President
Chance Oil and Gas Limited
Suite 1000, 340 – 12th Avenue SW
Calgary, AB T2R 1L5

Dear [redacted]:

RE: Chance Oil and Gas Limited ("COGL") Correspondence

I am writing to confirm our receipt of recent correspondence from COGL.

We acknowledge COGL's letter and enclosures dated April 9, 2020 regarding the Cooperation Agreement discussions with you under our *Oil and Gas Engagement Policy*. We also acknowledge COGL's letter dated April 20, 2020 regarding COGL's request to extend oil and gas permit no. 20 and we confirm our acceptance of this as sufficient notice under our *Oil and Gas Engagement Policy*.

These matters remain under our consideration. Due to the exceptional circumstances currently being experienced by our community and government as a result of the COVID-19 pandemic, including the closure of non-essential government offices and limited non-essential government activities, our consideration may be prolonged or delayed. A more substantive response to your correspondence will be forthcoming as soon as practicable.

We appreciate your understanding during these times.

Sincerely,

[redacted]
Director of Natural Resources Department

APPENDIX 2-C-25. *Work Plan* – document not available at time of submission.

APPENDIX 2-C-26. *Gap Analysis of YESAB Project Proposal based on VG registry comments*

MEMORANDUM

Date:	January 24, 2020
To:	Chance Oil and Gas
From:	Hemmera Envirochem Inc.
File:	103545-01
Re:	Gap Analysis of YESAB Project Proposal based on VG registry comments

1.0 INTRODUCTION

Northern Cross (Yukon) Ltd. (now Chance Oil and Gas Ltd.) submitted a Project proposal to the Dawson Designated Office of the Yukon Environmental and Socio-economic Assessment Board (YESAB) for assessment on July 20, 2014. The proposed Project included drilling and conducting extended flow tests on up to 20 exploratory oil and gas wells in the Eagle Plain region. The Dawson Designated Office initiated the assessment which included several opportunities for stakeholders and the public to provide comments on the Project.

The outcome of the Dawson Designated Office assessment was to recommend that the Project be referred to the Executive Committee of YESAB for a Screening. As such, Chance Oil and Gas Ltd. (Chance) is required to prepare a new Project proposal to be submitted to the Executive Committee. Chance has developed and circulated a revised Project description (dated June 5, 2019) and is now in the process continuing consultation with affected First Nations in order to prepare a Project proposal for submission to the Executive Committee of YESAB.

1.1 Approach

Hemmera reviewed available information submitted by Vuntut Gwitchin First Nation (VG) to the Dawson Designated Office for the assessment of the Eagle Plains Multi-well Exploration Program (YESAB Project number 2014-0112) in order to identify concerns, gaps and recommendations. Among other communications, VG provided three comment submissions to the Dawson Designated Offices (YESAB YOR document numbers 123-1, 157-1, and 250-1). These submissions outlined:

- Background information
- Values and interests in the Project area
- Issues and concerns with the Project and activities
- Gaps in information contained in the Project proposal
- Questions and recommendations to address concerns and gaps

Hemmera reviewed the three submissions to identify issues/concerns and questions/recommendations raised by VG. This analysis was conducted in order to identify concerns and information requirements to be addressed in preparing a new Project proposal for submission to the Executive Committee of YESAB. Hemmera has also identified approaches that Chance may take in order to address the concerns and gaps raised in developing the Project description and Project proposal for submission to YESAB. This analysis is provided below in **Table 1**.

1.2 Further Consideration

The analysis in **Table 1** does not include comments from other parties received by the YESAB Designated Office in relation to their assessment. These comments will be reviewed and taken into consideration when developing the new Project Proposal.

Currently, Chance is preparing a new Project proposal to be submitted to the YESAB Executive Committee. There are additional information and process requirements for Project proposals to be submitted to the YESAB Executive Committee; one of which is the requirement to consult with potentially affected First Nations and residents of communities under Section 50(3) of the *Yukon Environmental and Socio-economic Assessment Act*.

Chance has taken the opportunity to re-evaluate the proposed activities they would like to undertake. A revised Project description was developed and distributed on June 5, 2019. Chance anticipates that this Project description will be refined as consultation with VG and other affected First Nations progresses and as the new Project proposal is developed.

It is acknowledged that comments submitted by VG to the YESAB Designated Office for the previous assessment were based on prior Project description being undertaken at a DO level evaluation. While the concerns and recommendations identified as well as the proposed approach to addressing concerns will be a good starting point in developing the new Project proposal, the list in **Table 1** below should not be considered a complete list of gaps for a future Project Proposal submission. Additionally, Chance is expecting to consult and engage with VG and other affected First Nations at various stages through the process. Furthermore, there will be several opportunities for participation during the YESAB Executive Committee Screening process.

2.0 GAP ANALYSIS

The first 3 columns of **Table 1** present the information submitted by VG in their comment submissions to the Dawson Designated Office. Columns 1 and 2 identify the document number and the page number for reference back to the specific issue raised by VG. Columns 3 and 4 are copied from the submissions and identify issues and concerns as well as questions and recommendations to address those concerns. Column 5 outlines potential next steps suggested by Hemmera to address the issues and concerns identified by VG. The suggested next steps are based off:

- VG concerns, questions and recommendations to address those concerns
- Understanding that a new Project proposal will be developed for submission to the Executive Committee of YESAB
- Understanding that the Project has been significantly modified, and will likely be further refined through the consultation process, from the Project presented in the Designated Office assessment
- Consultation with VG and other affected First Nations conducted to date, and anticipated future consultation processes.

It is expected that Hemmera's suggested next steps to addressing concerns may change as consultation efforts progress and the new Project proposal is being developed. This may be as a result of consultation activities and input from VG and other affected First Nations, as well as engagement with assessors and

regulators; refinement of the Project Description; conducting the effects assessment, development of mitigation measures, and creation of management plans.

Table 1 – VG Gap Analysis of YESAB Designated Office Project Proposal

Vuntut Gwitchin Comment Submissions to YESAB				Hemmera Proposed Next Steps to Addressing Concerns Raised
YOR Doc #	**Page #**	**Issues and Concerns**	**Questions and Recommendations**	
123-1	3	The proposal outlines NCY environmental objectives, but does not adequately describe the activities necessary to achieving these goals; how these activities will be monitored for compliance and effectiveness, and how they will be reported. For example: Appendix L Blasting Plan for Wildlife Environmental/Wildlife monitors will survey the surrounding area for any sign of focal wildlife species: moose, caribou and bears. They will look for high value habitat features, such as dens, raptor nests, mineral licks and wallows (Monitors may need special training to detect bear dens, best to discuss with Regional Biologist). If high value wildlife feature (s) are found more detailed mitigation plans will be made in consultation with Regional Biologist. If focal species are found during surveys avoid blasting till they move further than 1km from site.	• A monitoring protocol is required that describes the survey design: when wildlife surveys will take place in relation to a planned activity, the size of the area surveyed, frequency of survey, general survey effort etc. Use of a reporting form that indicates the survey took place and showing results and mitigations/actions taken, if any, would demonstrate compliance and capture information useful for future management decisions.	Chance will develop a Wildlife Mitigation and Monitoring Plan (WMMP). A conceptual WMMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The WWMP will be finalized based on input from VG and other affected First Nations and stakeholders. The WMMP will include details such as required monitoring (e.g., species, survey areas, and frequency of surveys), mitigation requirements and options, reporting, and communication with First Nations and stakeholders. Chance anticipates developing the WMMP based on the new Project description and baseline date collected for the new Project proposal. In addition, Chance will consult with VG and other affected First Nations on the development of the WMMP. Chance will also develop a detailed description of activities and required mitigation measures. For example, Chance will provide details on blasting activities related seismic exploration and will ensure that wildlife mitigations in relation to blasting are well described and understood.
123-1	3	The project, as described, may be within the cumulative effects indicator levels (surface and linear disturbance) outlined in the NYRLUP, but general management direction, recommended management strategies and best management practices recommended in the plan are often not incorporated into the project design. For example, Special Management Consideration for LMU #9 Eagle Plains: Potential new all-season access roads into LMU #9 from Dempster Highway corridor require careful assessment and management.	• Was this management direction taken into consideration by NCY, with six new, all-season access roads from the Dempster Highway proposed? • Careful assessment and management of access points should include evaluation of the number of access points - are they all necessary? • Are they all necessary at any one time, or could they be limited to three or less, with decommissioning/reclamation required before new access points are developed? • Is there a plan for monitoring access? • How will NCY restrict public access when gates prove ineffective?	Chance will incorporate the North Yukon Regional Land Use Plan (NYRLUP) in refining the Project description and Project proposal for submission to YESAB. Chance will work to understand the cumulative effects indicator levels (surface and linear disturbance) and determine whether the proposed Project falls within those levels or not. This includes consideration of winter and all-season access roads, access points to the Dempster Highway, infrastructure locations footprints, and seismic exploration work. Further consideration will be given to phases and scheduling of the Project activities (e.g., when activities are required and progressive decommissioning and reclamation). Chance will implement recommendations from the NYRLUP including general management direction, recommended management strategies and best management practices, in

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				refining the Project description and Project proposal for submission to YESAB. Additionally, Chance will develop an Access Management Plan (AMP) to monitor access to the site. A conceptual AMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The AMP will be finalized based on input from VG and other affected First Nations and stakeholders. Additional access management mitigation measures will be considered and included in the Project proposal as needed. Chance will consider and develop effective measures to restrict access if gates prove ineffective.
123-1	4	The role of monitors, is confusing and ambiguous. Throughout the proposal, reference is made to 'wildlife monitors', 'environmental monitors', 'environmental technicians' and, to the 'NCY technical team (wildlife monitors)'. Are these one and the same, with a single job description? Similarly, the reporting mechanism by which the monitors convey information to NCY managers, YG Regional Biologist and Conservation Officer, to the First Nations and others is poorly described. For example, Section 6.4 Mitigations and Conclusions (Wildlife) NCY technical team (wildlife monitors) will communicate with members of the PCMB, affected FN, and Regional Biologists to discuss issues concerning caribou and caribou habitat during operations. Issues concerning caribou and caribou habitat are of utmost importance to VGG. NCY has not adequately described how communication 'concerning caribou and caribou habitat during operations' will take place. In several instances, project details are poorly described as the specific work undertaken by NCY will not be known until individual well test results are known. NCY has not described how post-assessment decisions will be communicated to VGG, and how concerns of VGG will be incorporated into project planning, monitoring and mitigations.	• What would trigger these discussions, and what is the intended outcome? • NCY is proposing 'to discuss', which implies two-way communication of information, issues and concerns. How will NCY incorporate the outcome of these discussions into management actions and decisions? How will these discussions be recorded? • It would be helpful to understand future needs for baseline data as development of the Eagle Plains oil and gas basin proceeds, for example air quality monitoring and air dispersion modeling and to begin these programs immediately.	Chance will develop a WMMP. A conceptual WMMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The WWMP will be finalized based on input from VG and other affected First Nations and stakeholders. The WMMP will include details such as required monitoring (e.g., species, survey areas, and frequency of surveys), mitigation requirements and options, reporting, and communication with First Nations and stakeholders. Chance anticipates developing the WMMP based on the new Project description and baseline date collected for the new Project proposal. In addition, Chance will consult with VG and other affected First Nations on the development of the WMMP. This includes discussions on communications protocols with First Nations and stakeholders which will be included in the WMMP. Chance is reviewing baseline data requirements for the Project and identifying areas where additional data is required. Chance anticipates engaging with VG and other affected First Nations to discuss baseline data requirements, reports, and future needs for baseline.

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		The fact that NCY is proposing to advance a 20 well drill program without adequate baseline data to determine effects is concerning. It's difficult to understand why NCY did not initiate collection of baseline data earlier.		
123-1	4	[redacted]	• Improved communication and transparency in describing, monitoring and evaluating what is expected to happen on the landscape and what is currently happening • Opportunities to improve VGG and VGFN citizen involvement in project monitoring and adaptive management mitigations: ▫ integration of TK ▫ capacity development re. environmental monitoring ▫ rigorous monitoring protocol and transparent reporting	Chance will work with VG in developing the Project proposal through the implementation of the Oil and Gas Engagement Policy. This includes developing a Cooperation Agreement and completing a Benefits and Stewardship Agreement, before submitting a Project Proposal to YESAB. Chance will consult with VG and other affected First Nations in developing the Project description and the YESAB Project Proposal. This includes: • Providing details on the proposed Project activities (i.e., June 2019 Project Description) • Seeking input on Project activities, areas of concern, and what people value in the Project area • Providing opportunities for VG and other affected First Nations to provide their input • Considering any input received when developing the YESAB Project Proposal. Chance will also work with VG to identify opportunities where VG and VG Citizens can be involved in monitoring and adaptive management activities. Chance will work with VG to determine the most appropriate approach to conducting a TK study for the project footprint area and incorporate the results into all aspects of the effects assessment. In the scoping stage and through the identification of valued components the Project proposal team can also discuss selecting VCs such as "Traditional Economy" or "Sense of Place" to further integrate VG values into the effects assessment in a more holistic way.

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123-1	6	[redacted]	• The future development of an access management plan for this area should encompass potential conflicts between industrial and subsistence harvest (trapping) use of the area. • Long term subsistence and licenced harvest (caribou) in the vicinity of the project area should be monitored to determine how the project affects harvest activities. This information would inform future management decisions.	Additionally, Chance will develop an Access Management Plan (AMP) to monitor access to the site. A conceptual AMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The AMP will be finalized based on input from VG and other affected First Nations and stakeholders. Additional access management mitigation measures will be considered and included in the Project proposal as needed. Chance will consider implications of subsistence and licensed harvesting (trapping and caribou) in the area when developing the AMP and identifying effective mitigation measures. Trapping and other land-based activities will be incorporated into the socio-economic VCs of the effects assessment, typically as part of a land use VC. Also as noted above, the intangible cultural aspects of land use by VG citizens can be incorporated in other culturally based VCs holistically.
123-1	6	[redacted]	• Evaluation of potential conflicts between proposed borrow pit locations with heritage resource potential should be completed prior to extraction of gravel resources. • Heritage assessment of First Nation traditional land use of the area should be undertaken. • Heritage identification training should be mandatory for all NCY employees working in the field.	Chance will consider potential impacts to heritage resources and identify required mitigation measures in developing the Project description and Project proposal for submission to YESAB. A new Heritage Resources Overview Assessment (HROA) may be required based on a revised Project description and footprint. Hemmera will review the existing HROA to determine what additional work needs to be completed. Hemmera will also develop a Chance Find Procedure for the Project to be included as a mitigation measure.

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		[redacted]		
123-1	7	[redacted]	• Actions to prevent contamination of water for activities completed above ground, and mitigative measures to be taken in case of accidental contamination should be described. • The quality of produced water, and the handling, temporary and long-term storage and the disposal of produced water should be described. • Long-term effects modeling to determine the impacts of test wells on permafrost and resulting effects on the water cycle should be developed. • Baseline monitoring for a period of 2 years is required. • Water monitoring programs should be reviewed and updated annually based on proposed and approved activities. • A community based water monitoring program that addresses the priorities of Vuntut Gwitchin people should be implemented by VGG and YG through the Yukon Water Strategy.	Chance will consider potential impacts to water quality and quantity and identify required mitigation measures in developing the Project description and Project proposal for submission to YESAB. Hemmera will identify and describe potential pathways of effects to water quality and quantity. This may include pathways such as stream crossings with winter roads, water withdrawal for use in exploration activities, and disposal of waste water produced from drilling. Potential pathways of effects will be assessed and mitigation measures will be developed to ensure the Project will not result in adverse effects surface and groundwater quality and quantity. Additionally, water monitoring requirements will be identified and monitoring programs developed.

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		[redacted]		
123-1	8	The Porcupine Caribou Herd (PCH) is the most important and valued ecological and socio- cultural resource in the Vuntut Gwitchin Traditional Territory (NYRLUP). The dynamic and unpredictable behaviour of the PCH necessitates an adaptive approach to management decisions as they apply to this project. Key to achieving this objective is the development of a management and communications framework in advance of needing one. The PCH Technical Working Group, tasked with determining what would be considered a 'significant number' of caribou to warrant moving or even shutting down the 3D seismic project last winter was unable to accomplish this task, nor was the group able to come to consensus on the need for a census flight to determine the number of caribou in the area. These failures are due in part to the impossibility of completing these tasks mid-season, when the consequences of these decisions had deep ramifications to the economic status of the project. Apart from assurances that, 'the most current information or caribou distribution and habitat is used during planning and implementation' NCY proposal is not explicit in how	• An Environmental Management and Monitoring Plan should be developed for this project. A comprehensive environmental monitoring plan and communications framework would • As work on an access management plan advances, the contribution of NCY in an advisory role to the plan development should be explored. • As work on 'caribou guidelines' advances, the contribution of NCY in an advisory role should be explored. These management tools should be adopted by NCY when complete.	It is likely that Wildlife, including caribou, will be selected as a Valued Component in the effects assessment, depending on the results of consultation. If selected as a VC a more thorough discussion and evaluation of the potential impacts of the project on the PCH can be undertaken. Chance will develop numerous plans including WMMP and an AMP. A conceptual WMMP and AMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The WWMP and AMP will be finalized based on input from VG and other affected First Nations and stakeholders. Chance will also coordinate with various parties such as the Porcupine Caribou Herd Technical Working Group and the NYRLUP implementation parties to incorporate appropriate information in the YESAB Project proposal. A specific subsection in the WMMP related to caribou can be created in order to address the management approaches for this species specifically as it relates to project operation. Specific adaptive management and communications protocols

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		management decisions will be made if large numbers of caribou over-winter or migrate through the project area. Implementation parties to the NYRLUP (VGG and VG) have begun work on an access management plan for Eagle Plains (Fall 2014). The group is currently working on establishing a terms of reference and determining the scope of work. In response to the above, and the YESAB recommendation to determine 'significant numbers' (Eagle Plains 3D Seismic Survey 2013-0067) NYRLUP implementation parties (VG and YG) are currently working on establishing 'caribou guidelines'.		can be developed to ensure that predictions are being evaluated in real time with project operations.
123-1	11	The NYRLUP outlines several management recommendations regarding access: 1. As a general guideline, in order to minimize potential impacts to valued ecological and heritage/cultural resources it is recommended that where road access is required, winter roads, ice roads and other temporary access techniques be utilized preferentially over all- season roads. 2. Best Management Practices - Transportation and Access Reclamation requirements and decommissioning strategies should be considered during planning and assessment of new road and access features.		Chance will incorporate the North Yukon Regional Land Use Plan (NYRLUP) in refining the Project description and Project proposal for submission to YESAB. If needed, Chance will implement management recommendations from the NYRLUP including general management direction, recommended management strategies and best management practices, in refining the Project description and Project proposal for submission to YESAB. Additionally, Chance will develop an Access Management Plan (AMP) to monitor access to the site. A conceptual AMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The AMP will be finalized based on input from VG and other affected First Nations and stakeholders.
123-1	11	3. Best Management Practices - Wildlife/General When new access creation is necessary: • Non-permanent winter access routes should be developed and utilized versus all-season access routes. • Gate or otherwise restrict hunting along new access routes. • Where possible, direct new access routes through less significant wildlife habitats. • Section 5.2.1 Ecological Resources/Wildlife Habitat (page 5-7)	• development of all-season roads should not occur until a resource is proven (at the extended flow testing stage as originally proposed) • a strategy for decommissioning roads that clearly outlines when roads will be decommissioned and/or reclaimed is required • requirements for temporarily decommissioning access points from the highway and other access routes should be in place when the road is not actively being used	Chance will incorporate the NYRLUP, including general management direction, recommended management strategies and best management practices, in developing the Project description and Project proposal for submission to YESAB. In addition, Chance will develop numerous plans including WMMP and an AMP. A conceptual WMMP and AMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The WWMP and AMP will be finalized based on input from VG and other affected First Nations and stakeholders. Considerations in identifying mitigation measures and developing the WMMP and AMP will include winter vs. all-season access roads, decommissioning and reclamation,

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		NCY has structured a summer drilling program requiring all season roads to areas with unknown resource potential, and has not provided adequate information regarding how access will be restricted (gates are not adequate).	• information regarding how access will be limited and how effectiveness of restrictions will be monitored and adjusted is required • describe how construction of all-season access roads built to access exploratory drilling locations, candidate summer wells will mitigate destruction of wildlife habitat (nest birds etc) required snow depth of 10cm will not offer enough protection to tussock-y ground, or at staging areas • Environmental Monitors should be tasked with monitoring compliance with regulatory requirements for access road construction • Reclamation of roads should include the removal and reuse of gravel resources.	points of access form the Dempster Highway, specific measures to address access management, and monitoring requirements.
123-1	12	Cumulative effects of this project may affect the following VGFN values: 1. landscape (soils, vegetation, permafrost) - surface and linear disturbance, particularly as it affects the PCH and VGFN sense of place; loss of permafrost, destruction, contamination and alteration of soils and vegetative layer 2. water - use, diversion and contamination 3. fish and wildlife - destruction, fragmentation and alienation of habitat; disruption of migratory routes and behaviour 4. cultural and spiritual values - incremental increases in perceived threat of loss and change effects of climate change An Environmental Management and Monitoring Plan is needed for this project because: 1. A robust and comprehensive monitoring plan will address potential environmental impacts and cumulative effects, compliance monitoring, and the collection of necessary baseline data. 2. A single framework will track the numerous environmental monitoring commitments made by NCY; although some will	• VGG recommends that an Environmental Management and Monitoring Plan is developed for this project. A comprehensive environmental monitoring plan and communications framework would set forth a clear protocol for monitoring changes to the environment over the long term and will establish a feedback loop whereby data collected through the monitoring program becomes meaningful to subsequent decision making and mitigations. • Develop an Environmental Management and Monitoring Plan to record and track environmental goals and monitoring activities required for this project.	Chance will develop an Environmental Monitoring Plan (EMP). A conceptual EMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The EMP will be finalized based on input from VG and other affected First Nations and stakeholders. The EMP will include details such as required monitoring, mitigation options, reporting, and communication with First Nations and stakeholders. Chance will consider potential impacts to values identified by VG such as: • Soils, vegetation and permafrost • Water quality and quantity • Fish and wildlife • Cultural and spiritual values Hemmera will identify and describe potential pathways of effects to these values. Potential pathways of effects will be assessed and mitigation measures will be developed to ensure the Project will not result in adverse effects to these values. This assessment will be used in developing the Project description and Project proposal for submission to YESAB.

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		appear as permit requirements, numerous others would otherwise remain buried in various source documents. Additional environmental monitoring requirements are anticipated following the YESAB assessment and Water Board licencing process. 3. An Environmental Management and Monitoring Plan will provide clear oversight and direction to Environmental Monitors and will help managers easily determine the success of mitigative measures, and recognize when further corrective actions are required. 4. An Environmental Management and Monitoring Plan will serve as a communication tool, effective in delivering information about the Eagle Plains environment and the work of NCY to maintain valued ecosystem components, both internally and as the basis of a public record.		
123-1	13	Environmental Monitors have been under-utilized in previous NCY projects. Responsible for baseline, compliance and effects monitoring, fully empowered Environmental Monitors serve a key role in the achieving the project's environmental requirements and meeting corporate objectives. Adequate reporting though field data and compliance sheets, and record of this data keeping in the annual report made public to VGG would be in keeping with objectives of an Environmental Management and Monitoring Plan.	• Develop the role of Environmental Monitors to meet the objectives of the Environmental Management and Monitoring Plan.	Chance will use Environmental Monitors during various stages of the Project. Chance will work with VG and other affected First Nations to define the role of Environmental Monitors which will then be outlined in the EMP.
123-1	14	The purpose of a communications framework is to identify roles and procedures required to meet the objectives of the Environmental Management and Monitoring Plan. This includes developing a two-way dialogue between NCY and the FN's concerning adaptive management issues and decisions, and establishing how information provided by the FN's (including TK) will be incorporated at the technical level. The Project Oversight Committee, established through the Benefits Agreement with NCY, is another aspect of a communications framework. The role of the Project Oversight Committee is to provide higher level review of project activities, and to respond to issues that require quick remediation, such	• A communications framework is an essential component to a Environmental Management and Monitoring Plan. • The PCH Technical Working Group was established to serve as a conduit for technical information (including Traditional Knowledge) between NCY, FN's and others. The need for a formalized group to discuss adaptive management decisions remains a relevant and essential component of an effective communications framework. Preparation of a Terms of Reference and Statement of Purpose would contribute to the ongoing success and usefulness of this group.	Chance is committed to ongoing constructive and effective communications and consultation with VG and other affected First Nations. Chance will continue consultation efforts as they develop their Project description and various components of the YESAB Project proposal. As needed, Chance will develop communications protocols which will form parts of various management plans such as the WMMP or the AMP. Further discussion with VG can flesh out the specific role and responsibilities and membership of a Project Oversight Committee. It would be prudent to discuss if this body is still needed based on how this project has evolved over the years and the creation of the Oil and Gas Policy and the NRC identified within that.

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		as a fuel spill. Within the Adaptive Management, Communications Framework, the Project Oversight Committee addresses issues at the senior policy and inter- governmental levels.		
157-1	1	Access Management Planning (YESAB Question#25) The North Yukon Regional Land Use Plan (NYRLUP) recommends the development of an access management plan for the Eagle Plains LMU, and parties to the NYRLUP (VGG and YG) are currently in the initial stages of developing this plan. While VGG and several other agencies raised numerous concerns with the access described in the NCY proposal, requiring NCY to develop an access management plan may lead to confusion with the broader access management planning process undertaken by the parties, and could potentially establish precedent for the development of future access management plans. It would be more appropriate to require NCY to develop mitigations for the potential effects of access development. If NCY is not prepared to provide this information at this stage of project assessment, YESAB project assessment recommendations should include specific mitigation measures enforceable as permit requirements.	• Mitigations should address potential conflicts between industrial use and subsistence harvest (specifically trapping) by VGFN citizens in the area.	Chance will develop an Access Management Plan (AMP) to monitor access to the site. A conceptual AMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The AMP will be finalized based on input from VG and other affected First Nations and stakeholders. Additional access management mitigation measures will be considered and included in the Project proposal as needed. Chance will consider the potential conflicts between the Project and subsistence and licensed harvesting (trapping and caribou) in the area when developing the AMP and identifying effective mitigation measures.
157-1	2	Wildlife Monitoring (YESAB Question #27) The NCY response to this question does not acknowledge that a change in monitoring regime is what is recommended. Incidental wildlife observations based on NCY staff being in the vicinity does not address monitoring objectives as described in the VGG and other comment submissions, and does not meet NCY's own wildlife mitigation objectives. If NCY is not prepared to provide information as to how these objectives will be achieved at this time, specific details as to how these objectives will be achieved should be detailed as YESAB project assessment recommendations. Porcupine Caribou Herd Technical Working Group (YESAB Question #29)		Chance will develop a WMMP. A conceptual WMMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The WWMP will be finalized based on input from VG and other affected First Nations and stakeholders. The WMMP will include details such as required monitoring (e.g., species, survey areas, and frequency of surveys), mitigation requirements and options, reporting, and communication with First Nations and stakeholders. Chance anticipates developing the WMMP based on the new Project description and baseline date collected for the new Project proposal. In addition, Chance will consult with VG and other affected First Nations on the development of the WMMP.

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		While a Terms of Reference is required to ensure the success of a technical working group, a common understanding of the role and objectives of this group is paramount and should be clearly described by YESAB. Based on the difficulties that arose through implementation of the PCH Technical Working Group established through the 3D seismic project, VGG does not feel comfortable leaving this task to NCY to undertake post-assessment. As stated in the VGG comment submission, 'The dynamic and unpredictable behaviour of the PCH necessitates an adaptive approach to management decisions as they apply to this project. Key to achieving this objective is the development of a management and communications framework in advance of needing one.'		
157-1	2	Heritage Resource Assessment (YESAB Question #34) [redacted] The VGG response to other questions encompassed in YESAB Question #34 are directly related to VGFN use of the area for trapping, and are answered below, in response to YESAB Question #35.		Chance will consider potential impacts to heritage resources and identify required mitigation measures in developing the Project description and Project proposal for submission to YESAB. A new Heritage Resources Overview Assessment (HROA) may be required based on a revised Project description and footprint. Hemmera will review the existing HROA to determine what additional work needs to be completed. Hemmera will also develop a Chance Find Procedure for the Project to be included as a mitigation measure. With permission, Chance will consider the submission from VG (Van Tat & Dagoo use of Eagle Plains area, compiled from Vuntut Gwitchin Oral History Interview Database, December 2014).
157-1	2	Trapping (YESAB Question #35) The NCY statement that, ' No trapping has been observed on NCY operated lands to date.' is not entirely factual. The GEOTIR - Eagle Plains 3D Seismic Project 2013-14, Environmental and Wildlife Monitoring Report (April 2014) stated that, 'Several traps [trap boxes] were found throughout the project area; all of them were left undisturbed.'		Chance will consider potential impacts to subsistence harvesting, including trapping, and identify required mitigation measures in developing the Project description and Project proposal for submission to YESAB, as described above. Hemmera will identify and describe potential pathways of effects to subsistence harvesting. Potential pathways of effects will be assessed and mitigation measures will be developed to ensure the Project will not result in adverse effects subsistence

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		[redacted]		harvesting. As noted above – the effects assessment can consider a variety of VCs to more fulsomely address tangible and non-tangible cultural impacts. Chance will consult with VG and other affected First Nations to identify potential pathways of effects, impacts and mitigation measures.
157-1	3	Cultural and Economic Significance [redacted]	• Access to trapping areas along existing routes and roads must be ensured for VGFN citizens, regardless of upgrades and usage by NCY. • A communication strategy is needed to address uncertainty and confusion that exists regarding subsistence harvest and trapping rights within and in close proximity to the project area. • Wildlife monitoring protocols and management actions that effectively mitigate local effects of the project on furbearers and other wildlife, and communication of this information to VGG for dissemination to citizens.	Chance will develop numerous plans including WMMP and an AMP. A conceptual WMMP and AMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The WWMP and AMP will be finalized based on input from VG and other affected First Nations and stakeholders. Considerations in identifying mitigation measures and developing the WMMP and AMP will include access to trapping areas, communications, monitoring requirements, and mitigation options. Consideration will be given to furbearers and other wildlife. As noted above – the effects assessment can consider a variety of VCs to more fulsomely address tangible and non-tangible cultural impacts.

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250-1	2	Caribou Mitigations The hierarchy of caribou mitigation measures described in the WMMP does not adequately acknowledge the range of effects project activities may have on displacing and disturbing caribou, and appears to focus on active drilling sites only. Level 2 caribou mitigations apply when 1 collared caribou is known to be within 6km of an active drill site; with approximately 50 GPS collars on a herd size estimated at 197,000 animals, (2003 survey results) detection of one collar could mean thousands of caribou in the area. Level 2 mitigation measures call for restrictions of "non-essential activities on Project roads to reduce disturbance" and deferment of "non-essential Project activities" to "a later time", but does not adequately describe what is a considered a "non-essential activity". Blasting and construction are identified as activities that will cease under Level 3 mitigations, implying they are considered essential activities that would not be affected under Level 2 mitigations. This sets up a situation where road, pad and infrastructure construction and/or blasting could take place during peak times of caribou migration, displacing and disturbing thousands of caribou. The reliance on collar data alone to trigger Level 2 and Level 3 mitigations is not adequate as there are not enough collars on the herd to estimate local caribou abundance at the scale required for this mitigation plan. Furthermore, most collars are on female animals and may not accurately represent the location or travel patterns of the herd as a whole, particularly at such a small geographic scale. The WMMP does not provide for contingencies when collar data may not be available or when collar data does not reflect what is observed on the ground.	• Caribou mitigations apply to quarry sites, areas undergoing road construction and maintenance, and other project activities, as well as active drill sites. • Level 2 and Level 3 mitigations apply when "significant numbers" of caribou are observed in close proximity to the job site, regardless of collar data. • Level 2 mitigations will trigger an over-flight to determine if Level 3 mitigations are required. • Level 2 mitigations will restrict all project activities that are likely to cause disruption to the herd, including blasting and construction, except in situations when ceasing activities is unsafe.	It is likely that Wildlife, including caribou, will be selected as a Valued Component in the effects assessment, depending on the results of consultation. If selected as a VC a more thorough discussion and evaluation of the potential impacts of the project on the PCH can be undertaken. Chance will develop a WMMP. A conceptual WMMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The WWMP will be finalized based on input from VG and other affected First Nations and stakeholders. The WMMP will include details such as required monitoring (e.g., species, survey areas, and frequency of surveys), mitigation requirements and options, reporting, and communication with First Nations and stakeholders. Chance anticipates developing the WMMP based on the new Project description and baseline date collected for the new Project proposal. In addition, Chance will consult with VG and other affected First Nations on the development of the WMMP. A specific subsection in the WMMP related to caribou can be created in order to address the management approaches for this species specifically as it relates to project operation. Specific adaptive management protocols can be developed to identify mitigation measures and conditions which would trigger action and implementation of mitigations. Chance will also develop a detailed description of activities and required mitigation measures. For example, Chance will provide details on blasting activities related seismic exploration and will ensure that wildlife mitigations in relation to blasting are well described and understood.
250-1	3	Adaptive Management Oil and gas exploration activities and caribou use periods in the Eagle Plains area are not temporally separated. The North Yukon Regional Land Use Plan (NYRLUP) recommends significant numbers of caribou as a management tool to guide the appropriate level of industrial activity allowable on the landscape when caribou are present. This NYRLUP	• NCY will formalize the establishment of a technical advisory group through a memorandum of understanding and terms of reference with affected First Nations • NCY will meet with the technical advisory group on an annual basis to review project activities, field data and compliance sheets, and monitoring results. This	Chance will develop numerous plans including WMMP and an AMP. A conceptual WMMP and AMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The WWMP and AMP will be finalized based on input from VG and other affected First Nations and stakeholders.

Vuntut Gwitchin Comment Submissions to YESAB				Hemmera Proposed Next Steps to Addressing Concerns Raised
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		implementation task is outstanding, and NCY skirts the issue by relying on collar data as a vague indicator of caribou abundance. The Porcupine Caribou Herd Technical Working Group established during the NCY 3D Seismic Program was tasked with determining significant numbers, but was unable to do so. Understandably, this is a difficult task, and a stakeholder group representing the interests of both industry and conservation would require more time and cooperation to reach consensus. Determining significant numbers is further compounded by the complexity of barren ground caribou herd dynamics, and the large population fluctuations that can occur within a relatively short timeframe. Acceptable levels of disturbance would presumably vary with herd size and composition, and activity (migration vs overwintering). NCY is at the exploratory stage, and VGG is not suggesting the need for an environmental monitoring agency, but there are common themes emerging across Canada with regard to the effective participation of Aboriginal groups in the environmental monitoring/adaptive management framework1 that could inform this project. Actions that have been shown to work include: developing a formal agreement with affected FNs; establishing a committee; ensuring the opportunity to review and comment on all permits, licenses and authorizations, and on the design of environmental management and monitoring plans; providing funding; and formalizing a dispute resolution process.	information will form the basis for an annual review of the WMMP. • NCY will contact the technical advisory group when triggers identified in the WMMP indicate revisions to described mitigations are required. • Traditional Knowledge will be included in the development of mitigation measures. • Duties of the Environmental Monitor will include monitoring and reporting all relevant proponent commitments as appended to the Decision Document. • Standardized survey protocols will be developed for each survey/monitoring activity described in the WMMP. • Standardized field data collection and monitoring compliance forms will be used by the Environmental Monitor, and shared periodically with the technical advisory group.	Chance will also coordinate with various parties such as the Porcupine Caribou Herd Technical Working Group and the NYRLUP implementation parties to incorporate appropriate information in the YESAB Project proposal.
250-1	4	Roads NCY's proposed approach to project roads, as described in the WMMP and Access Management Plan, raises several concerns: exclusion of VGFN trappers from historically used routes; ineffective measures to limit and monitor public access; and, development and use of all season roads for exploratory drilling. NCY plans to exclude VGFN citizens from the Chance Road and other access routes commonly used by VGFN citizens who trapped the area in the past. Measures to limit public access (caribou harvesters from other user groups) on project roads are inadequate as described.	• VGFN citizens will be granted access on project roads (including the Chance Road) for the purposes of trapping and trapping related activities. • NCY will work with VGG and Yukon Government to establish a process by which VGFN citizens will be able to access to the project site using project roads. • Low impact winter roads will be used for all exploratory drilling. All season roads (including existing routes) will be used only if required for extended flow testing (i.e. when resource is proven).	Chance will develop numerous plans including WMMP and an AMP. A conceptual WMMP and AMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The WWMP and AMP will be finalized based on input from VG and other affected First Nations and stakeholders. Chance will also coordinate with various parties including VG and Yukon Government to incorporate appropriate information in the YESAB Project proposal. Additional access management mitigation measures will be considered and included in the Project proposal as needed. In addition, Chance will consult with VG on their recommendations

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		Gates are not successful in restricting public access over the long term, especially when the roads they are barring are not actively used for project activities. NCY has not described an adequate regime for monitoring public access to project roads that are gated, or, on the longer term, to project roads that have been decommissioned. NCY's intended use of low impact winter roads is limited to "as much as possible" (WMMP) with contradictory language in the access management plan referring to the development of all season roads, "when initial drilling results are sufficiently encouraging to undertake extended flow testing" or "to meet the Project's seasonal drilling or permitting schedules" creating uncertainty with what is intended and what will actually happen on the ground. This approach does not correspond with recommendations of the NYRLUP and is problematic for numerous reasons identified in YESAB submissions by various parties. Exploratory drilling should utilize winter roads, with all-season access developed and/or used only when required for extended flow testing.	• All project roads that lead off the Dempster Highway will be monitored for public access on a daily basis when caribou are in the area. • NCY will develop alternative mitigations when gates prove ineffective. The trigger to implement alternative mitigations will be when one gate or decommissioned road is circumvented. • All project roads (not just new roads) that lead from the Dempster Highway or branch from an actively used road that leads from the Dempster Highway will be decommissioned and made impassable when wells are suspended, capped, or abandoned. • All roads and clearings will be decommissioned to state of functional habitat restoration as soon as practical. • Reclamation of roads will include the removal and reuse of gravel resources, when practical. • Snow embankments and windrows will be limited to 1.5m in height, with breaks every 500m to facilitate caribou movement. Breaks will be established opposite one another, not offset. • Environmental Monitors will monitor compliance with regulatory requirements for access road construction and maintenance.	in developing mitigations in relation to access management, access development and reclamation.
250-1	6	Connection to Dagoo ancestral homeland • Exclusion from the area • Destruction of the area	• Gwitchin culture and language presence on site (Gwitchin signage, cultural orientation etc.) • Site visits	Chance will consider potential impacts to various socio-economic valued components in relation to the Project and identify required mitigation measures in developing the Project description and Project proposal for submission to YESAB. As noted above – the effects assessment can consider a variety of VCs to more fulsomely address tangible and non-tangible cultural impacts. Chance will consult with VG and other affected First Nations on VC selection.

Vuntut Gwitchin Comment Submissions to YESAB				Hemmera Proposed Next Steps to Addressing Concerns Raised
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250-1	6	Long-ago physical evidence of Gwitchin Ancestors • Unintentional destruction of artifacts • Destruction of elements that are used in traditional practices	• Mandatory heritage identification training for all NCY employees working in the field	Chance will consider potential impacts to heritage resources and identify required mitigation measures in developing the Project description and Project proposal for submission to YESAB. A new Heritage Resources Overview Assessment (HROA) may be required based on a revised Project description and footprint. Hemmera will review the existing HROA to determine what additional work needs to be completed. Hemmera will also develop a Chance Find Procedure for the Project to be included as a mitigation measure. Chance will ensure that all NCY employees working in the field will implement the Chance Find Procedure.
250-1	6	Cultural preservation • Negative impacts of increased accessibility on ability of culture to preserve values	• Gwitchin cultural orientation • Minimize development of all season access roads	Chance will consider potential impacts to various socio-economic valued components in relation to the Project and identify required mitigation measures in developing the Project description and Project proposal for submission to YESAB. As noted above – the effects assessment can consider a variety of VCs to more fulsomely address tangible and non-tangible cultural impacts. Chance will consult with VG and other affected First Nations on VC selection.
250-1	6	Vuntut Gwitchin unique sense of place and relationship with the land • Anxiety about development - specifically that destruction and contamination of land, water and wildlife will destroy strong and enduring, spiritual and cultural connections	• VGFN citizen involvement in project monitoring and adaptive management mitigations • Site visits	Chance will develop an EMP. A conceptual EMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The EMP will be finalized based on input from VG and other affected First Nations and stakeholders. The EMP will include details such as required monitoring, mitigation options, reporting, communication with First Nations and stakeholders, and the role of Environmental Monitors. Chance anticipates developing the EMP based on the new Project description and baseline date collected for the new Project proposal. In addition, Chance will consult with VG and other affected First Nations on the development of the EMP. This includes discussions on communications with stakeholders which will be included in the EMP.

Vuntut Gwitchin Comment Submissions to YESAB				Hemmera Proposed Next Steps to Addressing Concerns Raised
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250-1	6	Subsistence reliance on wild food sources (caribou, moose, salmon and other fish, berries etc.) • Destruction/degradation of ecological values resulting in disruption of the life cycle of migratory mammals such as caribou and salmon • Increased harvest pressure resulting from increased access • Loss of access to immediate vicinity for subsistence harvest • Negative effects of harvest pressure pushed to other areas Trapping • Exclusion from established trapping areas and trapping • infrastructure (trails and cabins etc.) • Destruction, degradation and fragmentation of furbearer habitat	• Adaptive management model that allows for the inclusion of VGFN values, and knowledge, in project design and implementation • Harvest monitoring and access management • Inventory of existing trapping infrastructure and trails • Access agreement between VGFN trappers and NCY • Management actions to reduce impacts to furbearers	Chance will develop numerous plans including WMMP and an AMP. A conceptual WMMP and AMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The WWMP and AMP will be finalized based on input from VG and other affected First Nations and stakeholders. Considerations in identifying mitigation measures and developing the WMMP and AMP will include potential impacts to subsistence harvesting in the Project area and identify required mitigation measures in developing the Project description and Project proposal for submission to YESAB.
250-1	7	Human resources • Depletion of workforce in Old Crow • Overshadowing of the value of the traditional economy • Diminished health and wellbeing of oil field employees	• Collect baseline data of social determinants of health, and track ongoing effects • Work with Yukon College and VGG to create ongoing education and training opportunities in the community of Old Crow • Provide scheduling flexibility to allow for traditional pursuits (e.g. special leave) • Expedite transportation between worksite and community of Old Crow Establish an employee support program that addresses financial management and includes an employee assistance program • Establish and enforce zero tolerance policy for drugs and alcohol, and work place drug and alcohol testing	Chance will consider potential impacts to various socio-economic valued components in relation to the Project and identify required mitigation measures in developing the Project description and Project proposal for submission to YESAB. As noted above – the effects assessment can consider a variety of VCs to more fulsomely address tangible and non-tangible cultural impacts. Chance will consult with VG and other affected First Nations on VC selection.

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250-1	7	Eco/cultural tourism • Negative impact of industrial landscape • Increased accessibility of industrial activity • Negative impacts of increased road access to wilderness areas	• Preserve view-scape to ensure marketable for eco/cultural tourism • Access management plan that includes monitoring and enforcement	Chance will develop an AMP to monitor access to the site. A conceptual AMP will be developed for discussion with VG and will be submitted with the YESAB Project proposal. The AMP will be finalized based on input from VG and other affected First Nations and stakeholders. Additional access management mitigation measures will be considered and included in the Project proposal as needed. Chance will consider potential impacts to tourism in the Project area and identify required mitigation measures in developing the Project description and Project proposal.

APPENDIX 2-C-27. Chance Oil and Gas Limited Intention to Submit Proposal Letter

VUNTUT GWITCHIN GOVERNMENT
Government of Vuntut Gwitchin First Nation
NATURAL RESOURCES COMMITTEE
P.O. Box 94,
Old Crow, Yukon
Y0B 1N0
Phone: (867)966-3261
Fax: (867)966-3800
Web: www.vgfn.ca

February 27, 2020

VIA E-MAIL – [redacted]

[redacted] President
Chance Oil and Gas Limited
Suite 1000, 340 – 12th Avenue SW
Calgary, AB T2R 1L5

Dear President [redacted]:

RE: Chance Oil and Gas Limited ("COGL") Intention to Submit Proposal

This letter is provided in response to our discussions with COGL on February 10, 2020 and the subsequent correspondence received from COGL regarding the intention to submit a proposal for a multi-well oil and gas exploration program ("Proposal") to the Yukon Environmental and Socio-economic Assessment Board ("YESAB") in June 2020.

The Committee has carefully considered COGL's request for a waiver of the requirement under the Vuntut Gwitchin Government's Oil and Gas Engagement Policy ("Policy") for the negotiation and ratification of a Benefits and Stewardship Agreement with the Vuntut Gwitchin First Nation prior to the submission of the Proposal to YESAB. This consideration has included meeting with community members in Old Crow, the Elders Council and Council. Based on the feedback and input received by the Committee, COGL's request for a waiver cannot be granted. The engagement process set out under the Policy must be respected and adhered to by COGL.

COGL has been aware of the Policy since its development in the fall of the 2017 where it was communicated to COGL that, once approved, the Policy would be the framework for all engagement with the Vuntut Gwitchin Government. In January 2018, prior to the approval of the Policy, it was shared with COGL for review. In May 2018, following the approval of the Policy, COGL agreed in the Communication and Engagement Plan required by Ministerial Order 2017/37 that it would comply with the Policy in relation to any oil and gas activities within the Vuntut Gwitchin First Nation Traditional Territory.

On numerous occasions both prior to and following COGL's formal notice of the Proposal submitted on June 6, 2019 pursuant to section 24 of the Policy, the Vuntut

Gwitchin Government has met with COGL to discuss in good faith the Policy, including the staged requirements for a Cooperation Agreement and a Benefits and Stewardship Agreement. This has included a meeting with Minister Pillai, Energy, Mines and Resources on February 1, 2019 at which our Policy requirements were discussed together and most recently a two-day facilitated dialogue between the Committee and COGL in November 20-21, 2019 where the importance of terms under a Cooperation Agreement that ensure compliance with the Policy was discussed and mutually endorsed.

After over two years of good faith engagement with COGL, the notice that it is prepared to submit the Proposal to YESAB in less than three months and in non-compliance with the Policy is deeply disappointing to the Committee. It is contrary to the guiding purposes of the Policy which we are mandated to fulfill: "to establish a respectful, transparent and meaningful framework to guide the engagements of the Vuntut Gwitchin Government in relation to Oil and Gas Activities and Oil and Gas Dispositions in a manner that supports and upholds the objective of Sustainable Development." We acknowledge receipt of the Cooperation Agreement delivered by COGL on February 22, 2020; however, in the absence of terms that ensure compliance with the Policy in relation to the Proposal, the Committee cannot recommend it to Council for approval under section 27 of the Policy.

In the event that COGL chooses to proceed with its intention to submit the Proposal to YESAB in non-compliance with the Policy, Vuntut Gwitchin Government will not be in a position to support the Proposal. As we have discussed extensively with COGL, the engagement process under the Policy is informed by our experiences with past YESAB proposals, the shortcomings in the existing territorial oil and gas regulatory regime, emerging best practices for Indigenous-led assessments in the Arctic environment and the minimum international human rights standards for the survival, dignity and well-being of Indigenous peoples. To advance the Proposal contrary to the Policy undermines the fundamental objective of sustainable development enshrined under the Final Agreement and North Yukon Regional Land Use Plan.

Notwithstanding a lack of support for the Proposal from the Vuntut Gwitchin Government that will arise in the event of non-compliance with the Policy, the Committee will continue to fulfill its mandate to inform and seek the views of Vuntut Gwitchin First Nation citizens in relation to the Proposal. Nothing in the Policy prevents COGL from carrying out consultation activities with Vuntut Gwitchin First Nation citizens in relation the Proposal as may be required by YESAB; however, it is expected that COGL will adhere to the notice requirement under section 21 of the Policy. In this regard, the Committee has considered COGL's notice to meet in Old Crow on March 5, 2020 for the purposes of consultation with Vuntut Gwitchin First Nation citizens. The Elders Council has recommended instead that COGL schedule its consultation meeting after the

community meeting with the YESAB Executive Committee scheduled for March 24, 2020 in Old Crow. The Committee supports this recommendation.

We ask that any communications regarding any of the foregoing be directed to me as Co-chair of the Committee.

Sincerely,

[redacted]

Director of Natural Resources and Co-chair of the Natural Resources Committee

Cc: Chief and Council
Elders Council
Mike Chernoff

APPENDIX 2-C-28. Consultation and Engagement Letter

Chance
OIL AND GAS LIMITED

March 10, 2020.

Natural Resources Committee
Vuntut Gwitchin Government
P.O. Box 94
Old Crow, Yukon
Y0B 1N0

Attention: [redacted] Co-Chair of the Natural Resources Committee

Dear Ms. [redacted]

I am responding to your correspondence dated February 27, 2020. Chance Oil and Gas Limited ("COGL") is disappointed that the Natural Resources Committee ("NRC") was not able to provide the waiver requested by COGL to accommodate a parallel process of undertaking the Yukon Environmental and Socio-Economic Assessment Board ("YESAB") process and negotiating the Benefits and Stewardship Agreement in place of the sequence processes described in the Oil and Gas Engagement Policy.

COGL is however interested in continuing discussions related to the Cooperation Agreement and wishes to meet with the NRC, possibly the Chief and Council and the community at large. Based on your letter of February 27, 2020, a meeting after March 24, 2020 would work for the NRC. COGL requests a meeting or a series of meetings, as may be appropriate, between April 1 and April 8, 2020 in Old Crow. I suggest some topics to discuss at the meeting(s) are:

1. Continuation of the Cooperation Agreement negotiations and scheduling future discussions, if needed;
2. Tenure management and the application to extend the tenure of Exploration Permit 0020 beyond the current expiry deadline of August 30, 2020;
3. Upcoming YESAB Designated Office application for well maintenance work as requested by the Yukon Government Oil and Gas Operations Manager
4. Discussions related to the information gathering processes needed to support a submission to YESAB Executive Committee;
5. Other consultation related to anticipated YESAB Executive Committee assessment of the proposed exploration drilling and seismic data gathering project ("Project"); and
6. Initiating discussions related to the Benefits and Stewardship Agreement connected to the Project including discussions about the timeline needed to reach agreement.

COGL is also interested in hosting a community dinner to provide an update about the Project while in Old Crow for meeting(s) with the NRC.

Depending on the topic, COGL would like representatives of Hemmera to attend for some of the discussions given its expertise in YESAB submissions for both Executive Committee and the Designated Office in Dawson. From COGL, attendees will likely include [redacted] and me.

COGL is interested in working in a constructive, cooperative and collaborative way with the NRC, the Chief and Council and the citizens of the Vuntut Gwitchin First Nation. I look forward to hearing from you as soon as possible regarding the requested meeting or meetings.

Yours truly,
Chance Oil and Gas Limited

[redacted]
President

Cc: [redacted]

APPENDIX 2-C-29. Chance Oil and Gas Limited Meeting Request Letter

VUNTUT GWITCHIN GOVERNMENT
Government of Vuntut Gwitchin First Nation

NATURAL RESOURCES COMMITTEE

P.O. Box 94,
Old Crow, Yukon
Y0B 1N0

Phone: (867)966-3261
Fax: (867)966-3116
Web: www.vgfn.ca

March 18, 2020

VIA E-MAIL – [redacted]

[redacted], President
Chance Oil and Gas Limited
Suite 1000, 340 – 12th Avenue SW
Calgary, AB T2R 1L5

Dear President [redacted]

RE: Chance Oil and Gas Limited ("COGL") Meeting Request

Thank you for your letter dated March 10, 2020 requesting a meeting to discuss a number of suggested topics. The Natural Resources Committee ("Committee") requests further clarity on COGL's request and proposed topics of discussion in keeping with Committee's role under the Vuntut Gwitchin Government's ("VGG") Oil and Gas Engagement Policy ("Policy") in ensuring a respectful, transparent and meaningful engagement process.

With respect to COGL's requests to discuss the continuation of Cooperation Agreement discussions and the initiation of Benefits and Stewardship Agreement discussions, it is unclear if COGL still intends to submit a proposal for a multi-well oil and gas exploration program ("Proposal") to the Yukon Environmental and Socio-economic Assessment Board ("YESAB") irrespective of the requirements under the Policy. As the Committee is not able to recommend a Cooperation Agreement or a Benefits and Stewardship Agreement to Council that does not address the Policy requirements, we request clarity on COGL's commitment to compliance with the Policy in relation to the Proposal prior to any further discussions on these topics. This clarity is also required in order to understand the purpose and focus of any meeting with the Committee or community regarding Proposal-related information gathering and consultation activities as may be required by the *Yukon Environmental and Socio-economic Assessment Act* ("*YESAA*").

With respect to COGL's requests to discuss its application to extend permit no. 0020 under the *Oil and Gas Act (Yukon)* and its proposal to YESAB to conduct well maintenance work, the Committee requests COGL submit sufficient notice as required under sections 23 and 24 of the Policy in advance of any discussions with the Committee on these topics.

With respect to the request to hold a community consultation meeting related to the Proposal, as we have previously stated, nothing in the Policy restricts COGL from carrying out consultation activities with community members in relation to the Proposal or any other oil and gas activities; however it is expected that COGL will adhere to the notice requirement under section 21 of the Policy by providing a description of the purpose of the community consultation and any materials that will be relied upon for community consultation purposes. This notice, which is consistent with the nature of COGL's consultation obligations under *YESAA*, is important for the Committee to have in advance so that it can best ensure community members will be properly informed in the community consultation process.

For clarity, and as previously stated, in the event that COGL chooses to proceed with its intention to submit the Proposal to YESAB in non-compliance with the Policy, VGG will not be in a position to support the Proposal and will avail itself of all opportunities available under YESAA to bring any concerns or issues with the Proposal forward to regulators and decision-makers as necessary to uphold the fundamental objective of sustainable development enshrined in the Final Agreement and North Yukon Regional Land Use Plan.

The Committee awaits clarification from COGL on the matters outlined in this letter before a meeting can be planned. However, it should also be noted that precautions around COVID-19 have led to the cancellation of community meetings in Old Crow, and we do not know at this time when they will resume. Teleconferences remain a safe and expedient, although not perfect, means of communicating in the interim.

Finally, we kindly ask again that any communications regarding any of the foregoing be directed to Erika-Tizya-Tramm who as Director of Natural Resources is mandated by VGG as the sole contact person for proponents as part of ensuring a respectful, transparent and meaningful engagement process. COGL communications to other Committee members and Council should cease in relation to its Proposal or any other oil and gas activities or dispositions.

Sincerely,

[redacted]

Councillor and Co-Chair of the Committee

APPENDIX 2-C-30. Cooperation Agreement Letter

Chance
OIL AND GAS LIMITED

April 9, 2020.

Natural Resources Committee
Vuntut Gwitchin Government
P.O. Box 94
Old Crow, YT
Y0B 1N0

sent via email: [redacted]

Attention: [redacted]**, Co-Chair of the Natural Resources Committee**

Dear Ms. [redacted]:

This letter responds in part to the letter dated March 18, 2020 from Councillor and Co-Chair of the Natural Resources Committee, [redacted] to help clarify the status of the Cooperation Agreement ("CA") discussions as it relates to the proposed multi-well exploration drilling and seismic data acquisition project ("Project"). In separate correspondence to come to you soon, the topics of extending tenure of Exploration Permit 0020 and well maintenance work will be addressed.

Chance Oil and Gas Limited ("Chance") is writing to advise you that it will comply with the Vuntut Gwitchin Government's Oil and Gas Engagement Policy ("Policy"). To help move this process along, a draft CA is enclosed with this letter for your consideration. As in previous drafts, this draft includes explanatory notes in various clauses to provide context. There are still areas of the draft that need to be completed or upgraded and we look forward to working with you in as timely a manner as possible to get this CA finalized and executed.

Given the impact of COVID 19, it is anticipated that some combination of electronic exchange of correspondence, holding web based meetings and teleconferencing will be needed to continue negotiations since travel restrictions, social distancing requirements, and other preventative measures to control the spread of the corona virus make face to face meetings impossible until the pandemic has run its course. Once you have had some time to consider the attached documents, please contact [redacted] to arrange a virtual meeting to continue discussions.

CHANCE OIL AND GAS LIMITED

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Calgary, AB T2R 1L5
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In closing, I wish you all good health and hope that your families stay healthy, too. Please forward this letter and the attachments to [redacted] for his review. We look forward to working cooperatively on this Project to move through the process as laid out in the Policy.

Yours truly,
Chance Oil and Gas Limited

[redacted]

President

Attachments

Cc: [redacted]

APPENDIX 2-C-31. Tenure Extension of Exploration Permit 0020 Letter

Chance
OIL AND GAS LIMITED

April 20, 2020.

Natural Resources Committee
Vuntut Gwitchin Government
P.O. Box 94
Old Crow, YT
Y0B 1N0

sent via email: [redacted]

Attention: [redacted]**, Co-Chair of the Natural Resources Committee**

Dear [redacted]:

As previewed in my letter of April 9, 2020, this letter confirms what had already been mentioned in emails, correspondence and conversations of the past several months regarding tenure extension of Exploration Permit 0020 ("Permit"). On March 12, 2020, Chance Oil and Gas Limited ("Chance") applied to the Yukon Government to extend tenure of the Permit that will otherwise expire on August 30, 2020, unless extended. Chance requested the maximum permissible tenure extension of five years to allow sufficient time to continue engagement with affected First Nation Governments and communities, undergo Yukon Environmental and Socio-Economic Assessment Board Executive Committee impact assessment of proposed exploration activities as described in the project description ("Project Description") delivered to the Vuntut Gwitchin Government ("VGG") on June 5, 2019, and ultimately to undertake exploration activities. In the interest of transparency, this letter highlights the importance of this Permit to Chance and the reasons for the tenure extension request.

The application sets in motion a consultation process between the VGG, other affected First Nation Governments, and the Yukon Government in accordance with the Yukon Oil and Gas Act and associated disposition regulations. This letter is simply a courtesy to both alert you to the pending consultation and also share with you the rationale for the tenure extension request.

It is important to Chance that this Permit be continued for several reasons. First of all, there is a suspended well, McParlon A-25, that has significant value either as a potential producing well, a potential disposal well for water and other by products that may be produced in association with oil or natural gas, or as an observation well to periodically monitor permafrost changes. Secondly, part of a significant shale oil discovery made in 2012 is located throughout this Permit. Under the moratorium preventing hydraulic

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fracturing, this resource is stranded, and forms part of the claim made by Chance against Yukon for compensation for the damages caused by the moratorium. Thirdly, the Permit has significant conventional oil and natural gas resource potential (i.e. hydraulic fracturing is NOT required to produce any discovered resources) that could be evaluated as part of the program described in the Project Description. Fourthly, Chance has good 3D seismic data covering most of the permit to support future exploration work to define prospects to drill.

In closing, Chance would like the support of the VGG so Chance can get the requested tenure extension and continue exploring. If you have any questions or comments about this letter, please feel free to contact any of [redacted] or me. Please forward this letter and the attachments to [redacted] for his review.

Yours truly,
Chance Oil and Gas Limited

[redacted]
President

Cc: [redacted]

APPENDIX 2-C-32. Chance Oil and Gas Limited Correspondence Letter

Chance
OIL AND GAS LIMITED

April 12, 2021.

Chief and Council
Vuntut Gwitchin Government
P.O. Box 94
Old Crow, Yukon
Y0B 1N0

Sent via Email.

Dear [redacted]:

Re: Communication and Engagement

I am writing this letter to respond to your letter dated March 31, 2021 regarding communication and engagement proceedings between the Natural Resources Committee (NRC) and Chance Oil and Gas Limited (COGL). Before I get into my response to the specifics of your letter, I would like to provide a personal perspective.

My History and Goals in the Eagle Plain Sedimentary Basin
I am in my 85th year and have a long history exploring for oil and gas in the Eagle Plain Sedimentary Basin. Starting in 1959, the year that oil was first discovered in Yukon at Chance M-08, I had boots on the ground doing geological mapping and rock sampling at Eagle Plain. I love the north Yukon and that love continues to lure me back year after year.

All of my exploration geologist peer group long ago abandoned any hope that the Eagle Plain Sedimentary Basin could host economically recoverable amounts of crude oil and natural gas. This explains why COGL is the only company exploring in Eagle Plains. No other operator is interested. In 2007 when we first acquired our Exploration Permits (Permits), we were aware of this consensus and that is the primary reason why we, initially, pursued an exploration program to assess the unconventional resource potential of the basin which would require the use of hydraulic fracturing subsequently banned in 2015.

But I have a dream to prove all of my peers wrong. A very well-known geologist, Wallace E. Pratt, was a very successful finder of oil. He once said: "Where oil is first found is in the minds of men." For over 60 years, I have dedicated my exploration work at Eagle Plains to identifying resource opportunities worthy of testing by drilling. Pratt is my inspiration, and I am not about to give up on Eagle Plain like so many others have already done.

CHANCE OIL AND GAS LIMITED

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As further testament to our resolve, COGL has been in Yukon, focused exclusively on exploration to crystallize the value of the oil and natural gas resource potential of the Eagle Plain Basin, since 1994. We are not about to abandon this effort now.

As I have explained at various meetings with you and your colleagues on Council and in government, COGL seeks to build partnerships with Indigenous communities, allowing them to benefit from the opportunities created by our exploration work and with luck, future resource developments.

Responding to the Letter of March 31, 2021

Let me now turn to my response to your letter of March 31, 2021. I disagree with your accusation that COGL failed to adhere to the Communication and Engagement Plan (Plan) dated May 17, 2018 and the Vuntut Gwitchin Government (VGG) Oil and Gas Industry Engagement Policy (Policy). COGL has done its utmost to follow both the Plan and the Policy.

COGL believes it has been very cooperative, respectful, and transparent in all its dealings with VGG in respect of both the proposed exploration program and the suspended well maintenance program. The communication and engagement log that COGL is required to maintain and present to the Yukon Government (YG) on an annual basis demonstrates the effort that COGL has made to engage with the VGG, the NRC and the citizens of the Vuntut Gwitchin First Nation (VGFN). [redacted]

[redacted]

a. COGL's Efforts at Collaboration

COGL has shared a lot of information with the NRC regarding these projects and has commissioned expert consultants such as Hemmera, Environmental Dynamics, Palmer Environmental, Boreal Engineering, Vertex, and Peer Solutions to variously assist with engagement activities, prepare submissions, and undertake a variety of environmental and technical assessments of the project area to inform the design and routing of access routes, the design of seismic programs, and the design of drilling and well maintenance programs. As represented recently, COGL is arranging meetings to share the information that these consultants have prepared in the coming months with the hope that the knowledge of the VGG and its citizens can be shared with COGL to inform the scopes of the exploration and maintenance projects and to help address any concerns or issues.

I am concerned that the VGG has not reciprocated COGL's good faith efforts, and that the VGG has not demonstrated an interest in partnering with COGL during the next phase of exploration work.

b. COGL's Regulatory Requirements

As has been represented to VGG and the NRC on numerous occasions, COGL has to comply with various laws and policies operating in Yukon, particularly the Yukon Oil and Gas Act (YOGA) and

Yukon Environmental and Socio-Economic Assessment Act (YESAA) among others, and the North Yukon Regional Land Use Plan. The Permits issued under YOGA carry obligations to undertake work in specified time periods. In acknowledgment of the time required to undertake consultation processes with affected First Nations, complete impact assessments, obtain regulatory permissions and eventually execute work plans, at COGL's request, YG has extended the timelines on these Permits several times, but it is very uncertain whether future extensions will be granted notwithstanding the diligence of COGL to continue with its exploration work. As hard as COGL has tried to operate under the Plan and associated Policy, there is an obvious disconnect between the lengthy experience to date and the deadlines imposed by land tenure of the Permits. **COGL invites any suggestions as to how this disconnect can be resolved in a timely way and in a manner that equitably addresses the interests of the parties.**[1]

Now faced with acute time pressure, COGL is compelled to prepare and complete a submission document to the Executive Committee (ExCom) of the Yukon Environmental and Socio-Economic Assessment Board (YESAB) in respect of the proposed exploration project. The timing for this submission is planned to be around the end of September or into October. A proposed schedule of meetings in Old Crow which are needed to be able to complete the ExCom submission was shared with the NRC a couple of weeks ago. We invite NRC's engagement with COGL in the preparation of this submission within the time frame outlined.

c. Opportunities to Work Together

COGL is disappointed with the steps VGFN has taken to terminate further engagement with us in respect of the proposed exploration project. COGL wants the VGFN to be its partner in the planned exploration work. We are aware of successful partnerships created across Canada's oil industry for procuring goods and services from Indigenous businesses and hiring Indigenous citizens. The Canadian oil industry is the single largest industry in Canada when it comes to procuring goods and services from Indigenous businesses, exceeding Indigenous procurement by the Canadian government and more than all of the other sectors in the Canadian economy combined. COGL hopes to see the experience of other First Nations elsewhere in Canada replicated in north Yukon.

When COGL committed to the Plan three years ago, it was with high hopes that we would develop a great relationship and work cooperatively, constructively and in a timely manner to advance the exploration project. In meetings with you since that time, we heard your endorsement of the arrangement and your encouragement to work together. VG citizens have told us they want the oil and gas industry to provide opportunities to their families and the community. Sadly, progress has been very slow under the Plan and the Policy and has put these goals at risk.

[1] As an aside, I point out that in the VGFN Final Agreement in Chapter 1 – Definitions, subclause (b) under the definition of Consult or Consultation means: "a reasonable period of time in which the party to be consulted may prepare its views on the matter, and an opportunity to present such views to the party obliged to consult." COGL has been providing information about its projects for almost three years and we are still awaiting the VGG and/or the NRC to present its/their views in accordance with the Plan and the Policy.

a. COGL's Next Steps

For COGL, time is of the essence given the steady ticking of the land tenure clock and the anticipated time frame to complete the ExCom assessment. COGL intends to submit the exploration project to the ExCom of YESAB this Fall. Notwithstanding your decision to terminate engagement, COGL will continue to share information with the NRC and will welcome its input in the future in respect of the project scope and scale, management plans, and sharing local knowledge that will help guide the project design and its execution. COGL will always respect the VGFN Land Claim Agreement and will be guided by Chapters 11, 12, 13, 16 and 22 which relate to economic, environmental, cultural and heritage interests of the VGFN. Despite your termination of negotiations, we leave our door open for the VGG and NRC to resume engagement at any time. In the meantime, we will proceed with the steps needed to preserve our tenure interests and advance our projects. We look forward to the day when we can again work together cooperatively and collaboratively in full recognition of the interests of all parties.

Should you have an interest in information about the oil and gas industry and the projects we are undertaking, please contact any of Richard Wyman, Greg Charlie, Cindy Dickson, or me. We would be pleased to re-engage with you at your convenience.

In closing, I suggest that Richard and I have a meeting with you and your Council at your earliest convenience to share plans, answer any questions and perhaps overcome this impasse.

Yours truly,

Chance Oil and Gas Limited

[redacted]

Chairman and CEO

Cc: [redacted]

Directors of Chance Oil and Gas Ltd.

[redacted]

APPENDIX 2-C-33. VGG Oil and Gas Engagement Policy Stage 1 (Policy) regarding Well Maintenance Work (Project) Letter

Chance
OIL AND GAS LIMITED

May 27, 2020.

Natural Resources Committee
Vuntut Gwitchin Government
PO Box 94
Old Crow, Yukon
Y0B 1N0

Attention: [redacted] **Director of Natural Resources**

Dear [redacted]

Re: VGG Oil and Gas Engagement Policy Stage 1 (Policy) regarding Well Maintenance Work (Project)

This letter follows up the letter dated May 22, 2020 from Greg Charlie to provide additional information and payment in accordance with the Policy in order to complete the requirements of Section 24. Enclosed with this letter is a copy of the Audited Financial Statements of Chance Oil and Gas Limited for the year ended December 31, 2019. This information is marked "Confidential." Also enclosed with this letter is a cheque in the amount o[redacted]as payment for the administration fee.

We look forward to collaborating with you on this Yukon Government mandated Project as soon as possible. In order to be able to ensure that the necessary oil field services are contracted to be able to do the work during the winter of 2020-2021, a submission to the YESAB Designated Office in Dawson will need to be submitted in the first part of June. A benefits agreement will be needed since the project is likely going to exceed $[redacted]in expenditures. Please contact Greg Charlie to set up a virtual meeting to address any questions or comments you may have regarding the Project.

I hope you and your family are well and looking forward to summer in Old Crow.

Yours truly,
Chance Oil and Gas Limited

[redacted]
President
Encls

CHANCE OIL AND GAS LIMITED

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APPENDIX 2-C-34. Follow Up to Stage 1 Notification: Draft Project Description for Proposed Well Maintenance Work Letter

Chance
OIL AND GAS LIMITED

1000, 340 – 12th Avenue SW
Calgary, AB T2R 1L5

June 10, 2020

Natural Resources Committee
Vuntut Gwitchin Government
PO Box 94
Old Crow, Yukon
Y0B 1N0

Attention: [redacted], **Director of Natural Resources**

Dear [redacted]

Re: Follow Up to Stage 1 Notification: Draft Project Description for Proposed Well Maintenance Work

This purpose of this letter is to follow up correspondence Chance Oil and Gas Limited (Chance) sent on May 25, 2020 and May 27, 2020. In an effort to fulfill Vuntut Gwitchin Government (VGG) requirements under Stage I, paragraph 24 of the VGG Oil and Gas Engagement Policy (the Policy), Chance has provided notice to VGG of its proposed project for Eagle Plain Well Maintenance. If there are any questions or issues with respect to the notification package, please let me know as soon as possible so they can be addressed or rectified.

The proposed well maintenance work is the result of direction from Government of Yukon, Department of Energy, Mines and Resources, Oil and Gas Resources Branch. Government of Yukon has directed Chance to assess the integrity of, and conduct maintenance on, eight suspended wells: M-59, M-08, J-19, G-08, A-25, B-73, H-28, and E-78. This maintenance work is required in order for Chance to receive an extension of the suspended status of those eight wells.

Chance is aiming to submit its proposal for Yukon Environmental and Socio-economic Assessment Board (YESAB) Designated Office (DO) evaluation at the end of June or in early July. This timeline takes into consideration multiple factors: DO evaluation timelines, securing essential equipment, seasonal working constraints, and tenure extension timelines. Subsequent to the YESAA process, Chance will be required to seek a number of other licenses, permits and authorizations from various departments of Yukon Government, such as a Land Use Permit from Energy Mines and Resources, and Well Licenses from the Chief Operations Officer as designated under the Drilling and Production Regulations of the Yukon *Oil and Gas Act* (YOGA). Finally, in accordance with Section 68 of YOGA, a Benefits Agreement is required for this project. As a result of this comprehensive set of permits and approvals processes, in addition to the VGG Oil and Gas Policy, we feel confident that we can work with VGG to collaboratively address any issues

or concerns with the Well Maintenance Program throughout the next few of months. In order to commence these discussions, Chance hopes to schedule a meeting, via video or conference call, to discuss any issues or concerns you may have specifically related to the Well Maintenance Program. Moving forward, to facilitate timely communication and engagement, and consistent responses to the YESAB DO in Dawson in respect of this Well Maintenance Program submission, please use Hemmera as the principal point of contact. I have copied this letter to Shena Shaw at Hemmera as the primary contact for future correspondence and to set up next steps.

We look forward to working with you and interested Vuntut Gwitchin citizens.

Yours truly,
Chance Oil and Gas Limited

[redacted]

Vice President Government and Community Relations

[redacted]

Cc : [redacted]

APPENDIX 2-C-35. *COVID-19 Community Engagement and Consultation Procedures*

COVID-19 COMMUNITY ENGAGEMENT AND CONSULTATION PROCEDURES

1.0 OVERVIEW

The following procedures have been developed to address COVID-19 exposure risks while conducting community engagement sessions. It should be noted that COVID-19 is a global pandemic and is a rapidly changing situation. Local Health Authority guidance must be consulted prior to every engagement program and checked daily during field programs to confirm exposure control measures are in accordance with the most recent requirements and advice.

2.0 BACKGROUND

Coronaviruses are a large family of viruses found mostly in animals. In humans, they can cause diseases ranging from the common cold to more severe diseases such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). The disease caused by the new coronavirus has been named COVID-19.

While many of the characteristics of COVID-19 are still unknown, mild to severe illness has been reported for confirmed cases. Common symptoms for COVID-19 are:

- Fever
- Cough
- Sneezing
- Sore throat
- Difficulty breathing

Coronavirus is transmitted via larger liquid droplets when a person coughs or sneezes. The virus can enter through these droplets through the eyes, nose or throat if you are in close contact. The virus is not known to be airborne (e.g. transmitted through the particles floating in the air) and it is not something that comes in through the skin. It can be spread by touch if a person has used their hands to cover their mouth or nose when they cough.

Droplet Contact: Some diseases can be transferred by large infected droplets contacting surfaces of the eye, nose, or mouth. For example, large droplets that may be visible to the naked eye are generated when a person sneezes or coughs. These droplets typically spread only one to two metres and are too large to float in the air (i.e. airborne) and quickly fall to the ground. Influenza and SARS are two examples of diseases capable of being transmitted from droplet contact. **Currently, health experts believe that coronavirus can also be transmitted in this way.**

Airborne transmission: This occurs when much smaller evaporated droplets or dust particles containing the microorganism float in the air for long periods of time. **Currently, health experts believe that coronavirus cannot be transmitted through airborne transmission.**

2.1 Vulnerable Populations

Most people with COVID-19 recover; however, some people are more vulnerable to developing severe illness or complications from COVID-19 including older people and those with chronic health conditions such as diabetes, heart disease, lung disease, and kidney disease, anyone with a suppressed immune system, and anyone receiving cancer treatment.

3.0 LOCAL HEALTH AUTHORITY GUIDANCE

The following information is from the Yukon Government (YG) and BC Centre for Disease Control.

3.1 Travel within Yukon

- Intra-territorial travel is currently permitted within Yukon with recommendations that travellers limit unnecessary travel and follow the guidelines of YG and First Nation governments.

3.2 Physical Distancing

- Physical distancing involves remaining 2 metres away from anyone who is not withing a person's social bubble.

3.3 Hand hygiene

In addition to physical distancing, handwashing is very important in reducing the spread of COVID-19

- Wash your hands often with soap and water for at least 20 seconds. Using soap and water is the single most effective way of reducing the spread of infection.
- If a sink is not available, hand sanitizer can be used to clean your hands if they are not visibly soiled. If they are visibly soiled, use a wipe and then hand sanitizer to effectively clean them.
- Do not touch your face, eyes, nose or mouth with unwashed hands.
- Cover your mouth and nose with a disposable tissue or the crease of your elbow when you sneeze or cough.
- Do not share food, drinks, utensils, etc.

3.4 Cleaning

- Regularly clean and disinfect frequently touched surfaces.

3.5 Gatherings

- Gatherings of 10 people indoors and 50 people outdoors while maintaining physical distancing is allowed.

3.6 Self Isolation

Self isolation is required for:

- Anyone who has returned to Yukon from somewhere other than British Columbia, Nunavut, or Northwest Territories
- Anyone who has been in contact with someone diagnosed with COVID-19.

4.0 PRE-MEETING REQUIREMENTS

Our response to COVID-19 requires additional measures not normally required for many community engagement sessions-based assignments. When planning the work liaise with the client or site representative to confirm the local site response to the pandemic. Specifically, the following questions maybe helpful to understand the mitigation measures implemented at the worksite:

1. Have any members of the team experienced any impacts to-date (illness or self-isolation) as the result of COVID-19?
2. Does the meeting anticipate any disruptions as a result of COVID-19? If so, what are the anticipated nature of the disruptions (if known)?
3. What measures have been implemented at the meeting to reduce the risk of COVID-19 transmission on site (e.g. Increased attention to hygiene, availability of cleaning and disinfectant products, social distancing, etc.)?

Availability of personal protective equipment (PPE) such as nitrile gloves, safety glasses, and face masks, hand sanitizers, cleaning solutions, and disinfectants should also be confirmed in advance of mobilisation to site.

4.1 Fit for Duty – Field Team Selection

All team members must answer the following information prior to mobilising to the site:

1. In the last 10 days have you experiencing any of the following symptoms: cough, fever and /or shortness of breath?
2. Are you caring for, or have you been in contact with, someone who has a confirmed or probable diagnosis of COVID19?
3. Have you been recommended to quarantine, self-isolate, or received medical attention due to a concern with COVID19 in the last 14 days?
4. Have you been at a gathering of 50 people or more in a small space?
5. Have you returned from international or domestic (outside of the BC/YT/NWT/Nu bubble) travel within the past 14 days or do you share a household with someone that returned from international or domestic (outside of the BC/YT/NWT/Nu bubble) travel within the past 14 days? Travel includes passing through an airport.

The same questions must be answered again once onsite. Field team members must answer “No” to all questions otherwise the work cannot continue. Prior to transportation to the field all project team members are required to take their temperature and if it is above 37.6C they will not be permitted to travel.

5.0 TRANSPORTATION CONSIDERATIONS

5.1 Land Transport

Wherever possible, field team members should travel to and from the project site in their own personal vehicle. Public transport must not be used, and taxis or other services such as Uber should be avoided. Car-share transportation is less preferred than personal vehicle use, however this option is permitted if the

Car-share cleaning protocols are confirmed in advance. Passengers are not permitted in personal vehicles or Car-share transportation options.

5.2 Air Transport

Currently there are many restrictions placed on air transportation. A risk analysis must be completed prior to using air transportation and the need for air transportation must be assessed on a case by case basis. Sign off by the business line president may be required.

6.0 ACCOMMODATIONS

6.1 Hotels

Maintain social distancing and keep touch points in your room clean. Other considerations include:

- Booking a room with a kitchen so you can cook your own food
- Re-cleaning high touch points or eating tools.
- Ask your room not to be cleaned daily; only as often as you require it. Only you in/out will reduce the possibility of transmission.
- If you must eat out, get takeout.

7.0 COMMUNITY MEETING REQUIREMENTS

7.1 Pre-Start Health and Safety Meetings

Pre-start meetings must be held outside, social distancing requirements must be maintained, and participants should be limited to those that are directly involved with the Project. One person should be designated to complete meeting documentation, and the same person should sign off on behalf of all meeting attendees. Items such as clipboards, pens, and meeting documents must not be passed along to other meeting attendees. During the meeting, the location(s) of handwashing and washroom facilities must be confirmed.

7.2 Personal Hygiene Practices

The following best practices must be reviewed with field team members and monitored for compliance:

- Avoid touching surfaces such as handrails, tables, tools, and equipment unless required and consider the use of hand protection such as nitrile gloves.
- Keep your hands at your side when possible.
- Avoid all hand to face contact
- Designate a separate area for eating and breaks.
- Wash hands with soap and water (preferred) or use alcohol-based hand rubs frequently (e.g. after removal of PPE, prior to breaks, prior to eating, at the end of the day, etc.).

7.3 Public Safety

Attendees of the meeting will also be required to follow the guidelines described in this document and should be instructed on how to do so through easy to read information posted at the event.

Guidelines for hosting a public event include:

- The event should be hosted outdoors where possible and set up to allow for physical distancing (poster board and chairs spaced at least 2 meters apart).
- Hand sanitizer must be available to all visitors and will be required for admission to the event.
- A sign in sheet will be required in order to facilitate contact tracing if necessary. Sign in sheets and comment sheets will require attendees use a new, clean pen each time. Two piles of pens should be created, one labelled “clean” and one labelled “used”. Used pens should be cleaned periodically by a gloved member of the Project team.
- Food or drinks provided to attendees must be pre-packaged and handed out by a gloved member of the Project team.
- Take home information must be handed out by a gloved member of the Project team.
- Masks will be provided for anyone who chooses to wear one. Project team members are required to wear a mask.
- All commonly touched surfaces, tools, and equipment must be cleaned and disinfected after use. Hand protection must be donned when cleaning and disinfecting.
- Washroom facilities will be assessed on a case by case basis and arrangements to ensure social distancing and cleaning will be determined at the pre-start meeting. Multi-stall washroom facilities may be limited to one person at a time.
- Hand sanitizing stations must be set up at the entrance to the public event, and placed near any potential commonly touched areas
- Signs near poster boards will encourage social distancing, such as “one person per poster” and “please wait here until the area is clear” and “ensure physical distancing” the frequency and distribution of the signage will be location dependant and determined by the Project manager at the pre-start Health and Safety Meeting.

8.0 REFERENCES

BC Centre for Disease Control Website

Yukon Government COVID-19 Information Website

APPENDIX 2-C-36. *Draft 2020 Annual Report Implementation of the Vuntut Gwitchin Government and Chance Oil and Gas Communication and Engagement Plan*

DRAFT 2020 ANNUAL REPORT

Implementation of the Vuntut Gwitchin Government and Chance Oil and Gas Communication and Engagement Plan

DRAFT

Prepared for:

Yukon Energy, Mines and Resources
Oil and Gas Resources (K-11)
Box 2703
Whitehorse, YT Y1A 2C6

Prepared by:

Hemmera Envirochem Inc.
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July 31, 2020

1.0 INTRODUCTION

This report demonstrates implementation of the *Vuntut Gwitchin Government and Chance Oil and Gas Limited Communications and Engagement Plan* (Plan) (see **Appendix A**) finalized on May 22, 2018. It summarizes discussions held between Vuntut Gwitchin Government (VGG) and Chance Oil and Gas Limited (Chance) since the *2019 Annual Report: Implementation of the Vuntut Gwitchin Government and Chance Oil and Gas Engagement and Communication Plan* was submitted July 31, 2019. The purpose, objectives, and outcomes of each discussion are explained below to fulfill the requirements of Ministerial Order (MO) 2018/ 42 (See **Appendix B**) issued to Chance on August 30, 2018.

2.0 BACKGROUND

The development of communications and engagement plans began with Order in Council (OIC) 2016/169. OIC 2016/169 required Chance to file a First Nations communication and engagement plan with the Minister of Energy, Mines and Resources in order to extend tenure on their northern permits: 0005, 0006, 0007, 0008, 0009, 0010, and 0011 (see **Appendix C**). Chance complied with OIC 2016/169 and received their tenure extension.

Chance subsequently received MO 2017/37 when applying for tenure extension on six of eight southern permits: 0012, 0013, 0014, 0015, 0016, and 0017. MO 2017/37 required Chance to revise, in consultation with affected First Nations, the consultation and engagement plan filed under OIC 2016/169. The affected First Nations listed in MO 2017/37 were Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Tetlit Gwich'in Council.

VGG and Chance collaboratively developed their Plan through a series of in-person meetings and conference calls. Hemmera was retained by Chance in November 2017 to facilitate the development and completion of the communications and engagement plans with the affected First Nations.

VGG and Chance submitted their finalized Plan to Minister Ranj Pillai on May 22, 2018. To complete its obligations under MO 2017/37, Chance filed a total of four communications and engagement plans. All four plans were approved by the Minister and Chance received a five-year tenure extension on the six southern permits.

A condition of the five-year tenure extension, issued via MO 2018/42, required that Chance submit annual reports summarizing actions taken to implement each communications and engagement plan.

The Plan incorporates VGG's Oil and Gas Engagement Policy (the Policy). The Policy, developed by VGG and reviewed by Chance, provides a protocol for engaging with VGG on oil and gas matters.

See **Appendix C** for a map of Chance's current permits.

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3.0 ENGAGEMENT AND COMMUNICATION PLAN IMPLEMENTATION SUMMARY

3.1 Summary

In the past year, VGG and Chance have continued to build their relationship. Parties have advanced discussions on Chance's proposed projects (see **Table 1**) and the implementation of VGG's Policy (e.g., Chance and VGG develop a Cooperation Agreement).

Table 1 Chance proposed projects

Project Name	Date Draft Project Description was Shared with VGG	YESAB Assessment Process	Anticipated Submission to YESAB
Eagle Plains Exploration Project	June 2019	Executive Committee Screening	Spring 2021
Eagle Plain Well Maintenance Project	May 2020	Designated Office Evaluation	July/August 2020

Between August 1, 2019 and June 30, 2020, a number of engagement activities have occurred, including, in-person meetings, conference calls, formal letters, and informal phone calls and emails.

The main themes of discussion between VGG and Chance have been the following:

- Drafting/negotiating a Cooperation Agreement
- Implementation of the Policy
- Draft Project Description and scope of activities for Chance's proposed Eagle Plains Exploration Project
- Draft Project Description for Chance's proposed Eagle Plain well Maintenance Project
- Proposal submission processes to Yukon Environmental and Socio-economic Assessment Board (YESAB)

The correspondence between Chance and VGG is documented in the Engagement Log (see **Appendix D**).

3.2 August 9, 2019 – Presentation at Vuntut Gwitchin General Assembly (In-Person)

Location: Old Crow Community Centre

Attendees: VGG Chief and Council and Technical Staff, Old Crow Community Members, Chance Management, Hemmera

Chance was invited to present their Eagle Plains Exploration Project (the Project) at the 2019 Vuntut Gwitchin General Assembly. For this presentation, Chance presented a description of their oil and gas exploration project activities, including where they would be located, the equipment that would be required, and potential opportunities for First Nations. Hemmera joined Chance for this presentation and explained the YESAB application process that Chance would be undergoing, and opportunities for community engagement and consultation during the process of completing the project proposal for YESAB as well within the YESAB process. After the presentation, Chance answered questions from community members.

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The purpose of this presentation was for Chance to explain their project to a broad audience in Old Crow and to answer questions asked by community members.

3.3 October 31, 2019 – VGG, Natural Resource Committee, and Chance Meeting (Conference Call)

Attendees: VGG Staff and Natural Resources Committee members, Chance Management, Hemmera

The purpose of this conference call was for parties to coordinate their activities moving forward. Chance provided an update on summer 2019 fieldwork and data being gathered. Chance provided a brief description of the proposed Eagle Plains Exploration Project. VGG requested that Chance provide a list of services (e.g., business, equipment) the project would require, over the long term, so the First Nation can strategize employment/training opportunities. VGG stated it could review Chance's 2018 4-page project description and provide feedback, however reviewing the 2019 50-page project description would require considerably more effort. VGG also indicated that advancing work on both the project description review and the cooperation agreement, at the same time, would take a considerable level of effort. VGG would likely need Chance to identify a priority. Parties discussed the evolution of the Cooperation Agreement to date, some of the outstanding issues, and decided to plan an in-person workshop for November 2019 for parties to advance the agreement.

3.4 November XX-XX – Cooperation Agreement Negotiation Workshop (In-Person)

Location: Whitehorse

Attendees: VGG Technical Staff, Chance Management, Third Party Facilitator

Chance and VGG retained a third-party facilitator to mediate negotiation of the Cooperation Agreement required under Stage II of the Policy. Both parties met for two days to discuss objectives and content of the Cooperation Agreement. Meeting details as well as the subsequent draft of the Cooperation Agreement are confidential.

3.5 December 2, 2019 – VGG, Chance and Hemmera Meeting (Conference Call)

Attendees: VGG Technical Staff, Chance Management, Hemmera

VGG, Chance, and Hemmera met to discuss the completion of Chance's YESAB Project Proposal for proposed Eagle Plains Exploration Project. VGG had been provided capacity funding from Chance to engage technical consultants and their review of Chance documents was under way. VGG provided an overview of its preferred approach which included a gap-analysis led by the First Nation, a community workshop, and subsequent state of knowledge workshop. Parties and their consultants would have to work together to harmonize activities and timelines. All parties discussed a timeline for working together and proposed future meetings. Hemmera offered to have a meeting with VGG staff to discuss YESAB processes, requirements under legislation, and Hemmera's past experiences.

3.6 Winter and Spring 2020

Chance and VGG have continued to exchange formal letters as well as informal emails and phone calls since last meeting in December 2019.

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Chance is currently developing a YESAB Designated Office submission for its proposed Eagle Plain Well Maintenance Project. Chance sent a letter to VGG May 25th, 2020 with the purpose of introducing the project and initiating engagement.

Covid-19 has had significant effects on VGG and Chance's ability to move forward on items, particularly as it relates to meetings and engagement activities.

4.0 PLANS FOR ONGOING ENGAGEMENT AND NEXT STEPS

VGG and Chance will continue to hold discussions at regular intervals as Chance develops its project proposals for YESAB, and Chance will comply with the stages of the Policy moving forward. Meetings have occurred and are being planned for July 2020, but due to timing constraints this report only summarizes engagement to the end of June 2020.

Upcoming engagement activities are expected to involve the following:

- Share data collected during 2019 Summer/Fall field season
- Correspondence and meeting between VGG and Chance on Chance's proposed Eagle Plain Well Maintenance Project
- Meetings between VGG technical staff and technical consultants preparing the Project Proposal for proposed Eagle Plains Exploration Project
- Completing the Cooperation Agreement under Stage II of the Policy

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5.0 APPROVAL OF IMPLEMENTATION SUMMARY

VGG and Chance have reviewed this report and agree to its contents as an accurate summary of the engagement activities carried out between August 1, 2019 and June 30, 2020.

Per: Vuntut Gwitchin Government

Dated: _____

Erika Tizya-Tramm, Director Natural Resources Department

Per: Chance Oil and Gas Limited

Dated: _____

Greg Charlie, VP Government and Community Relations

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APPENDIX A

Vuntut Gwitchin Government and Chance Oil and Gas Limited Communication and Engagement Plan

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Vuntut Gwitchin Government

Chance OIL AND GAS LIMITED

May 22, 2018

Honourable Ranj Pillai
Minister of Energy, Mines and Resources
Government of Yukon
Box 2703
Whitehorse, Yukon Y1A 2C6

Dear Minister Pillai,

Re: Submission of the Vuntut Gwitchin Government and Chance Oil and Gas Limited Communications and Engagement Plan

Ministerial Order 2017/037 of the Yukon Oil and Gas Act states the following in clause 5:

> *5 It is a condition of this Order that Chance Oil and Gas Limited must, in consultation with each affected First Nation, revise the first nations communications and engagement plan filed under O.I.C. 2016/169 to the satisfaction of the Minister on or before August 1, 2018.*

Vuntut Gwitchin Government (VGG) and Chance Oil and Gas Limited (Chance) are pleased to inform you of our collaborative efforts to develop a mutually agreeable framework to facilitate effective and meaningful communications and engagement between VGG and Chance. The framework captured in the enclosed Communications and Engagement Plan (Plan), and its collaborative development, establishes a solid foundation for a respectful relationship that both parties will implement and enjoy as we continue to work together now and into the future.

Please accept the enclosed Plan for the purposes of Ministerial Order 2017/037. We trust that the Plan will be of satisfaction to the Minister, as it meets the needs of VGG and Chance at this time.

Sincerely,

William Josie
Director of Natural Resources
Vuntut Gwitchin Government

for, Greg Charlie
Vice President of Government and External Relations
Chance Oil and Gas Limited

Enclosed: Communications and Engagement Plan





COMMUNICATION AND ENGAGEMENT PLAN

VUNTUT GWITCHIN GOVERNMENT & CHANCE OIL AND GAS LIMITED

MAY 17, 2018

1. Background

Chance Oil and Gas Limited ("Chance") is an oil and gas exploration company that currently holds valid permits to perform oil and gas activities in the Eagle Plain basin within the Traditional Territory of the Vuntut Gwitchin First Nation ("VGFN").

As a condition of order-in-council 2016/169 dated August 30, 2016 concerning the return of work deposits to Chance in relation to oil and gas permits nos. 0005 to 0011, Chance was required to file a communication and engagement plan (the "Plan"). The Plan, as it was submitted, was not mutually agreed upon between Chance and the Vuntut Gwitchin Government ("VGG").

As a condition of ministerial order 2017/37 dated August 29, 2017 concerning a one-year extension for oil and gas permit nos. 0012 to 0017, Chance is now required to revise the Plan in consultation with VGFN on or before August 1, 2018.

2. Purpose

The purpose of this document is to revise the Plan in a manner that establishes a mutually agreed upon framework between Chance and VGG to guide communication (i.e. the exchange of information) and engagement (i.e. meaningful participation in planning, problem-solving and decision-making) in relation to all aspects of Chance's activities, including but not limited to, community information programs; existing or proposed oil and gas dispositions; and existing or proposed oil and gas activities.

Nothing in this Plan is intended to address or satisfy any duties or responsibilities of the Government of Yukon that exist or may arise in relation to Chance's exploration program.

3. Application of Oil and Gas Engagement Policy

The *Vuntut Gwitchin Government Oil and Gas Engagement Policy* attached to this Plan as Appendix A (the "Policy") will be the overarching framework that guides engagement between VGG and Chance in relation to Chance's activities. Chance will comply with the Policy and any other applicable VGG policies. To the extent that there may be any inconsistency between this Plan and the Policy, the Policy will prevail.

4. Communication and Engagement

The communication and engagement between Chance and VGFN in relation to Chance's exploration program activities is anticipated to encompass communication and engagement between: (a) Chance and VGG; and (b) Chance and VGFN Citizens.

4.1 Communication and Engagement between Chance and VGG

The VGG committee mandated under part two of the Policy will be the VGG body responsible for managing communications and engagement between Chance and VGG, including informing and seeking views of VGFN Citizens, with the exception of any communications related to any

negotiations of towards a Cooperation Agreement or Benefits and Stewardship Agreement which will occur directly between Chance and Council as set out under the Policy.

Table 1.

Subject Matter	VGG Contact(s)	Chance Contact(s)
Communications related to Chance's exploration program activities, other than those communications excepted below.	• Director of Natural Resources • Chair of the Standing Committee on Natural Resources, Heritage, Tourism and Economic Development	• Management Team
Communications related to the negotiation of a Cooperation Agreement or Benefits and Stewardship Agreement.	• Council	• Management Team

4.2 Communication and Engagement between Chance and VGFN Citizens

VGG does not serve a gatekeeping role with respect to any communications and engagement that Chance may wish to undertake with VGFN Citizens in relation to Chance's exploration program activities; however, VGG and Chance will seek to coordinate communication and engagement efforts with VGFN Citizens to the extent such joint communication and engagement is possible or appropriate. As detailed in the Policy, Chance will submit a written notice to the Director of Natural Resources within a reasonable time prior to any proposed public meetings with VGFN Citizens in order to facilitate coordination between Chance and VGG.

Table 2.

Subject Matter	VGG Contact(s)	Chance Contact(s)
Written notice of proposed meetings with VGFN Citizens in relation to Chance's exploration program activities.	• Director of Natural Resources	• Vice President of Government and Community Relations

4.3 Communication and Engagement Methods and Content

Chance and VGG will use the following methods for carrying out communication and engagement in relation to Chance's exploration program activities:

- In-person meetings;
- Public meetings (for communication and engagement with VGFN Citizens in Old Crow and Whitehorse);

- E-mail correspondence;
- Telephone correspondence (teleconferences and less formal phone calls);
- Power Point presentations (to support in-person meetings);
- Reports (as requested and as required);
- Social media;
- Newsletters; and
- Official websites.

The information exchanged in communication and engagement between Chance and VGFN is anticipated to address the following key items:

- Information programs regarding VGFN culture and history;
- Information programs regarding the oil and gas industry, including its history and regulation in Yukon;
- Any existing or proposed Chance oil and gas dispositions;
- Any existing or proposed Chance oil and gas activities;
- Items set out in the Policy that must be addressed in any Cooperation Agreement and Benefits and Stewardship Agreement between VGFN and Chance; and
- Implementation of the Policy.

5. Records Management

Chance and VGG will use the following records management protocols in relation to communications and engagement between Chance and VGG.

5.1 Records Subject to Disclosure to Regulators and Assessors

Subject to the records management protocols in this Plan, Chance may disclose the following types of relevant records to regulators and assessors:

- meeting agendas;
- meeting minutes;
- meeting participant lists;

- records log which includes summaries of the following: in-person meetings; e-mail and telephone correspondence between Chance and VGG, including supporting materials shared or discussed in the correspondence;

- reports provided by either VGG or Chance to one another; and

- Power Point presentations provided by either VGG or Chance to one another.

5.2 Records Management Procedures and Confidentiality Protocols

Records of communications between VGG and Chance will be made, and any support services retained by either Chance or VGG to those records will be conducted in a fair and unbiased manner. Should VGG and Chance choose not to retain records management support services, VGG and Chance will jointly decide on an individual or individuals from either or both parties to be responsible for records keeping and management.

Chance, VGG and any person or party retained to assist in records management will comply with the following procedures for records management:

- Meeting agendas will be developed collaboratively between VGG and Chance and mutually agreed upon prior to the outset of the meeting.

- Meeting minutes will be taken by a designated records management person or party and sent to Chance and VGG within 2 weeks via e-mail. VGG and Chance may review and provide comment to the records management person or party on these meeting minutes within 30 days of both parties receiving the meeting minutes. Should either party require more time to review the meeting minutes, the party will notify the records management person or party by e-mail within 2 weeks of receiving the minutes. No response by VGG or Chance to meeting minutes will be interpreted as general acceptance of the meeting minutes by that party.

- Action items and key outcomes will be logged during meetings and will be reviewed by both parties at the end of the meeting to ensure that there is general agreement on the list of actions and parties responsible for those actions and on the list of key outcomes from the meeting. The list of action items and the list of key outcomes will be recorded within the meeting minutes.

- Any reports or Power Point presentations provided by either VGG or Chance to one another will be considered final upon delivery unless otherwise specified as drafts.

- A record log will be jointly reviewed and approved by Chance and VGG for accuracy, completeness, and compliance with this Plan prior to being disclosed to any regulator and assessor.

Chance and VGG will comply with the following confidentiality protocols for records management and the disclosure of records to regulators and assessors:

Table 3.

Type of Record	Confidentiality Assumption	Process for Establishing Confidentiality
Meeting Agendas	• Not confidential.	• Should confidential matters need to be discussed, a separate agenda will be created for these matters and remain confidential.
Meeting Minutes	• Not confidential.	• Confidential discussions/content will be identified before the meeting begins, during the meeting, or as part of the minutes review process.
Meeting Participant List	• Not confidential.	• Unless otherwise specified during the meeting, these items are not considered confidential.
Records Log	• Not confidential.	• Should correspondence need to be confidential, it is the responsibility of each party to notify the other when a meeting, e-mail, phone call, or attachment is confidential at the time it occurs or immediately thereafter.
Reports provided by either VGG or Chance to one another	• Not confidential. • Note: Any reports containing traditional knowledge or traditional land use will be subject to separate protocols agreed upon by VGG and Chance.	• Should a report shared between parties need to be confidential, it is the responsibility of each party to notify the other of this when the report is shared.
Power Point presentations provided by either VGG or Chance to one another	• Not confidential.	• Unless otherwise specified during the meeting, these items are not considered confidential.

6. Plan Review and Amendment

Chance and VGG will review and assess this Plan and its implementation on a quarterly basis. Following any review and assessment of the Plan, the Plan may be amended upon the mutual agreement of Chance and VGG.

SCHEDULE A
VUNTUT GWITCHIN GOVERNMENT OIL AND GAS ENGAGEMENT POLICY



VUNTUT GWITCHIN GOVERNMENT
OIL AND GAS ENGAGEMENT POLICY

MAY 2018

PART ONE
GENERAL PROVISIONS

Title

1. This policy may be cited as the *Vuntut Gwitchin Government Oil and Gas Engagement Policy*.

Definitions

2. In this policy:

"**Application**" means an application made by a Proponent in relation to an Oil and Gas Disposition pursuant to the *Oil and Gas Act*, R.S.Y. 2012, c. 162;

"**Benefits and Stewardship Agreement**" means the agreement required in relation to any oil and Gas Activity as set out at Stage III of the Engagement Process under part three of this policy.

"**Board**" means a designated office, executive committee or panel of the Yukon Environmental and Socio-Economic Assessment Board.

"**Citizen**" means a citizen of the Vuntut Gwitchin First Nation pursuant to Appendix II of the Constitution (Citizenship Code).

"**Citizen Representative**" means a Citizen appointed to the Committee by the Council.

"**Committee**" means the lands and resources committee of the Vuntut Gwitchin First Nation as mandated under part two of this policy.

"**Constitution**" means the Constitution of the Vuntut Gwitchin First Nation.

"**Cooperation Agreement**" means the agreement required in relation to any Oil and Gas Activity as set out at Stage II of the Engagement Process under part three of this policy.

"**Council**" means the branch of the Vuntut Gwitchin Government established by the Constitution consisting of the Chief, Deputy Chief and all Councillors.

"**Director of Natural Resources**" means the Director of the Vuntut Gwitchin Government's Natural Resources Department.

"**Elders Representative**" means a member of the Vuntut Gwitchin First Nation Elders Council appointed to the Committee by the Elders Council.

"**Engagement Process**" means the process commencing under part three of this policy for engagement between the Vuntut Gwitchin Government and a Proponent in relation to any Application or Oil and Gas Activity and continuing for so long as required.

"**Intergovernmental Process**" means any engagement process between the Vuntut Gwitchin Government and Government of Yukon on matters related to Oil and Gas Activities, Oil and Gas Dispositions and their regulation.

"**Oil and Gas Activity**" or "**Oil and Gas Activities**" means any existing or proposed oil and gas activity or activities as defined by Section 1 of the *Oil and Gas Act*, R.S.Y. 2012, c. 162 that affects, or has the potential to affect, any rights, responsibilities or interests of the Vuntut Gwitchin First Nation whether or not the oil and gas activity or activities are situated within the Vuntut Gwitchin First Nation Traditional Territory.

"**Oil and Gas Disposition**" or "**Oil and Gas Dispositions"** means any existing or proposed oil and gas disposition or dispositions as defined by as defined by Section 1 of the *Oil and Gas Act*, R.S.Y. 2012, c. 162 that affects, or has the potential to affect, any rights, responsibilities or interests of the Vuntut Gwitchin First Nation whether or not the oil and gas disposition or dispositions grants rights to lands situated within the Vuntut Gwitchin First Nation Traditional Territory.

"**Proponent**" means any proponent of an Oil and Gas Activity or holder of an Oil and Gas Disposition.

"**Proposal**" means a proposal required to be submitted by a proponent to the Board pursuant to Section 50(1) of the *Yukon Environmental and Socio-economic Assessment Act*, S.C. 2003, c. 7.

"**Sustainable Development**" means beneficial socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent as defined in Chapter 1 of the *Vuntut Gwitchin First Nation Final Agreement*,.

"**Standing Committee Chair**" means the Chair of the Vuntut Gwitchin Government Standing Committee on Natural Resources, Heritage, Tourism and Economic Development.

"**Vuntut Gwitchin First Nation"** means the legal entity established pursuant to Article 9 of the *Vuntut Gwitchin First Nation Self-Government Agreement*.

"**Vuntut Gwitchin First Nation Law**" means any law enacted by the Vuntut Gwitchin First Nation in accordance with its law-making powers under Article 13 of the *Vuntut Gwitchin First Nation Self-Government Agreement*.

"**Vuntut Gwitchin Government**" means the government of the Vuntut Gwitchin First Nation.

"**Youth Representative**" means a Citizen between the ages of 14 and 21 appointed to the Committee by the Council.

Purpose

3. The purpose of this policy is to establish a respectful, transparent and meaningful framework to guide the engagements of the Vuntut Gwitchin Government in relation to Oil

and Gas Activities and Oil and Gas Dispositions in a manner that supports and upholds the objective of Sustainable Development.

Application

4. This policy applies to any engagement between the Vuntut Gwitchin Government and a Proponent in relation to any to Oil and Gas Activities and Oil and Gas Dispositions.

Conflict of Law and Policy

5. In the event of a conflict or inconsistency between this policy and the Constitution, the Constitution shall prevail to the extent of the conflict or inconsistency.

6. In the event of a conflict or inconsistency between this policy and any Vuntut Gwitchin First Nation Law, the Vuntut Gwitchin First Nation Law shall prevail to the extent of the conflict or inconsistency.

General

7. Nothing in this policy is to be construed as abrogating or derogating from the *Vuntut Gwitchin First Nation Final Agreement*.

8. Nothing in this policy is to be construed as providing consent or authorizing any past, existing or proposed Oil and Gas Activity or Oil and Gas Disposition.

9. Nothing in this policy shall be construed as limiting, affecting, fulfilling or discharging the honour of the Crown and the Crown's constitutional duty to consult and accommodate the Vuntut Gwitchin First Nation.

10. This policy may be amended from time to time by the Vuntut Gwitchin Government and will make best efforts to notify any Proponent potentially affected by an amendment.

PART TWO
ADMINISTRATION

Committee

11. The Vuntut Gwitchin Government shall establish the Committee with a mandate to fulfill the following roles and responsibilities in accordance with this policy:

    (a) reviewing information about Oil and Gas Activities, Oil and Gas Dispositions and their regulation;

    (b) informing and seeking views from Citizens on Oil and Gas Activities, Oil and Gas Dispositions, the Engagement Process and/or Intergovernmental Process as necessary;

(c) assisting and providing recommendations to the Council throughout the Engagement Process; and

(d) providing recommendations to the Council throughout the Intergovernmental Process if requested by Council.

12. The Committee shall be made of 5 members consisting of the:

(a) Standing Committee Chair;

(b) Director or Natural Resources;

(c) Elders Representative;

(d) Youth Representative; and

(e) Citizen Representative.

13. The Committee shall meet as regularly as may be necessary to fulfill its roles and responsibilities.

14. The Committee shall have a quorum of 3 members.

15. The Standing Committee Chair and Director of Natural Resources shall serve as co-chairs of the Committee.

16. The Committee shall make best efforts to fulfill its roles and responsibilities by consensus.

17. The Committee may at any time request the support of employees or contractors of the Vuntut Gwitchin Government to assist it in carrying out its roles and responsibilities under this policy.

18. The Committee may invite any persons, including any Proponent, to attend or participate in a meeting of the Committee.

19. The Committee shall not use or disclose to any person confidential information except as may be required to fulfill its roles and responsibilities.

Citizen Consultation

20. The Director of Natural Resources shall be responsible for organizing and carrying out any consultation between the Vuntut Gwitchin Government and Citizens regarding Oil and Gas Activities and Oil and Gas Dispositions with the assistance and participation of the Committee as necessary.

21. In that event that a Proponent wishes to organize and carry out any public consultation with Citizens related to any Oil and Gas Activities or Oil and Gas Dispositions, the Proponent shall submit a notice in writing to the Director of Natural Resources within a reasonable time prior to the proposed meeting date in order to facilitate coordination between the

Proponent and Vuntut Gwitchin Government if appropriate. The written notice shall contain:

(a) proposed dates and location;

(b) proposed agenda;

(c) description of the purpose of the consultation; and

(d) any materials to be relied on by the Proponent during the consultation.

22. Any consultations with Citizens related to any Oil and Gas Activities or Oil and Gas Dispositions that are organized and carried out by the Proponent shall not be construed as consultation with the Vuntut Gwitchin Government.

PART THREE
ENGAGEMENT PROCESS

Stage I – Notice Period

23. Proponents shall provide notice in writing to the Director of Natural Resources of any Application in relation to any Oil and Gas Disposition at the earliest possible opportunity. The written notice of the Application shall contain:

(a) letter of introduction;

(b) company profile including organizational structure, profiles of directors and management team members, financial statements for the previous five fiscal years and compliance record;

(c) detailed description of the Oil and Gas Disposition and Application including any relevant maps, plans or schedules; and

(d) designated Proponent spokesperson.

24. Proponents shall provide notice in writing to the Director of Natural Resources of any Oil and Gas Activity at the earliest possible opportunity in the planning phase and prior to submitting a Proposal to the Board. The written notice shall contain:

(a) letter of introduction;

(b) company profile including organizational structure, profiles of directors and management team members, financial statements for the previous five fiscal years and compliance record;

(c) detailed description of the proposed Oil and Gas Activity, including any relevant maps, plans or schedules;

(d) administration fee in the amount of $1,000.00 made payable to the Vuntut Gwitchin First Nation; and

(e) designated Proponent spokesperson.

25. Upon receipt of any written notice from a Proponent in relation to any Application or Oil and Gas Activity, the Director of Natural Resources shall immediately refer the notice to the Committee. The Committee shall meet to review the notice and:

(a) if the Committee determines the notice is incomplete or insufficient the Committee may request in writing further or better information from the Proponent, and the Proponent shall provide such further or better information upon receipt of the written request; or

(b) if the Committee determines the notice is complete and sufficient then:

(i) in the case of a notice regarding an Application, the Director of Natural Resources may provide written comments to the Proponent or request a meeting with the Proponent to discuss the Application; and

(ii) in the case of a notice regarding an Oil and Gas Activity, the Committee shall notify the Proponent of the determination in writing and the Engagement Process shall proceed to Stage II.

Stage II – Cooperation on any Oil and Gas Activity

26. After completion of Stage I and prior to submitting a Proposal to the Board, a Proponent shall negotiate in good faith and enter into a Cooperation Agreement with the Council for the purpose of establishing a meaningful, respectful and transparent process for engagement.

27. Prior to entering into a Cooperation Agreement, the Council shall refer the agreement to the Committee for review. The Council may enter into a Cooperation Agreement on behalf of the Vuntut Gwitchin First Nation if the Committee determines that the terms and conditions adequately consider and address the following items:

(a) compliance with this policy;

(b) capacity funding for the Engagement Process;

(c) communications and correspondence;

(d) information sharing; and

(e) commitment to negotiate a Benefits and Stewardship Agreement.

Stage III – Benefits and Stewardship on any Oil and Gas Activity

28. After the completion of Stage II and prior to submitting a Proposal to the Board, a proponent shall negotiate in good faith and enter into a Benefits and Stewardship Agreement with the Council for the purpose of establishing appropriate stewardship measures and maximizing any potential benefits for the Vuntut Gwitchin First Nation.

29. Prior to entering into a Benefits and Stewardship Agreement, the Council shall refer the agreement to the Committee for review. The Council may enter into a Benefits and Stewardship Agreement on behalf of the Vuntut Gwitchin First Nation if the Committee determines that the terms and conditions adequately consider and address the following items:

    (a) detailed description of the Oil and Gas Activity;

    (b) capacity funding for participation in the Board's regulatory process;

    (c) compliance with the objective of Sustainable Development;

    (d) compliance with applicable land use plans;

    (e) compliance with Vuntut Gwitchin First Nation General Assembly Resolution No. 2013-01 regarding hydraulic fracturing;

    (f) adequate education and training opportunities;

    (g) adequate employment and procurement opportunities;

    (h) adequate revenue sharing or equity arrangements;

    (i) adequate stewardship measures including but not limited to:

        (i) baseline data collection measures;

        (ii) information sharing measures;

        (iii) joint monitoring of environmental and socio-economic effects, and of the effectiveness of mitigation measures;

        (iv) joint advisory and reporting processes;

        (v) joint fish and wildlife management plan;

        (vi) joint heritage resource protection plan;

        (vii) joint access management plan;

        (viii) joint water quality and quantity management plan;

(ix) joint waste management plan;

(x) joint remediation and reclamation plan;

(xi) adaptive management measures in relation to the foregoing stewardship measures, including adaptability to address any recommendations from the Board;

(j) potential socio-economic effects which includes effects on economies, health, culture, traditions, lifestyles and heritage resources;

(k) potential cumulative effects which includes effects to the environment that are caused by an action in combination with other past, present and future human actions;

(l) potential effects on any Vuntut Gwitchin First Nation rights, responsibilities and interests under the *Vuntut Gwitchin First Nation Final Agreement* and *Vuntut Gwitchin First Nation Self-Government Agreement*;

(m) compliance and enforcement measures;

(n) dispute resolution mechanisms; and

(o) Vuntut Gwitchin First Nation approval and ratification process.

30. In addition to a Benefits and Stewardship Agreement, the Council may enter into a separate agreement with a Proponent and other parties for the purpose of addressing the limited requirements under section 68 of the *Oil and Gas Act*, R.S.Y. 2012, c. 162.

APPENDIX B

Ministerial Order 2018/42

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YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,

(d) oil and gas permit No. 0015,

(e) oil and gas permit No. 0016,

(f) oil and gas permit No. 0017. « *permis visé* »

2 The renewal term of each subject permit is extended by five years (so that it ends on August 30, 2023).

3 The resulting total length of the initial term and the renewal term of a subject permit is 16 years.

YUKON

CANADA

ARRÊTÉ MINISTÉRIEL 2018/42

LOI SUR LE PÉTROLE ET LE GAZ

Le ministre de l'Énergie, des Mines et des Ressources, conformément à la *Loi sur le pétrole et le gaz*, arrête :

1 La définition suivante s'applique au présent arrêté.

« permis visé » Les permis suivants de pétrole et de gaz détenus par Chance Oil and Gas Limited :

a) permis de pétrole et de gaz nº 0012;

b) permis de pétrole et de gaz nº 0013;

c) permis de pétrole et de gaz nº 0014;

d) permis de pétrole et de gaz nº 0015;

e) permis de pétrole et de gaz nº 0016;

f) permis de pétrole et de gaz nº 0017. "*subject permit*"

2 La durée du renouvellement de chaque permis visé est prolongée de cinq ans, de façon à ce qu'elle se termine le 30 août 2023.

3 La durée totale d'un permis visé, y compris la durée initiale et la durée du renouvellement, est de 16 ans.

4(1) In this section

"first nations communications and engagement plan" means the plan filed under O.I.C. 2016/169 and revised in accordance with M.O. 2017/37. *« plan de participation et de communication avec les premières nations »*

(2) It is a condition of this Order that Chance Oil and Gas Limited must file annual reports with the Division Head, in accordance with subsection (3) and to the satisfaction of the Division Head, about the implementation of the first nations communications and engagement plan.

(3) For the purposes of subsection (2), Chance Oil and Gas Limited must file

(a) the first annual report on or before July 31, 2019, in respect of the period beginning on September 1, 2018, and ending on May 31, 2019; and

(b) each subsequent annual report on or before July 31 of each year in respect of the period beginning on June 1 of the preceding year and ending on May 31 of the year in which the report is to be filed.

4(1) La définition suivante s'applique au présent article.

« plan de participation et de communication avec les premières nations » Le plan déposé en vertu du Décret 2016/169 et révisé en conformité avec l'Arrêté 2017/37. *"first nations communications and engagement plan"*

(2) À titre de condition du présent arrêté, Chance Oil and Gas Limited dépose des rapports annuels auprès du chef de division, en conformité avec le paragraphe (3) et à la satisfaction du chef de division, concernant la mise en œuvre du plan de participation et de communication avec les premières nations.

(3) Pour l'application du paragraphe (2), Chance Oil and Gas Limited dépose :

a) le premier rapport annuel au plus tard le 31 juillet 2019, pour la période débutant le 1er septembre 2018 et se terminant le 31 mai 2019;

b) chaque rapport annuel subséquent, au plus tard le 31 juillet de chaque année pour la période débutant le 1er juin de l'année précédente et se terminant le 31 mai de l'année au cours de laquelle le rapport doit être déposé.

Dated at Whitehorse, Yukon,
~~Dc~~ August 30th 2018.

Fait à Whitehorse, au Yukon,
le August 30th 2018.

Minister of Energy, Mines and Resources/Ministre de l'Énergie, des Mines et des Ressources

APPENDIX C

Map of Chance Dispositions and Wells

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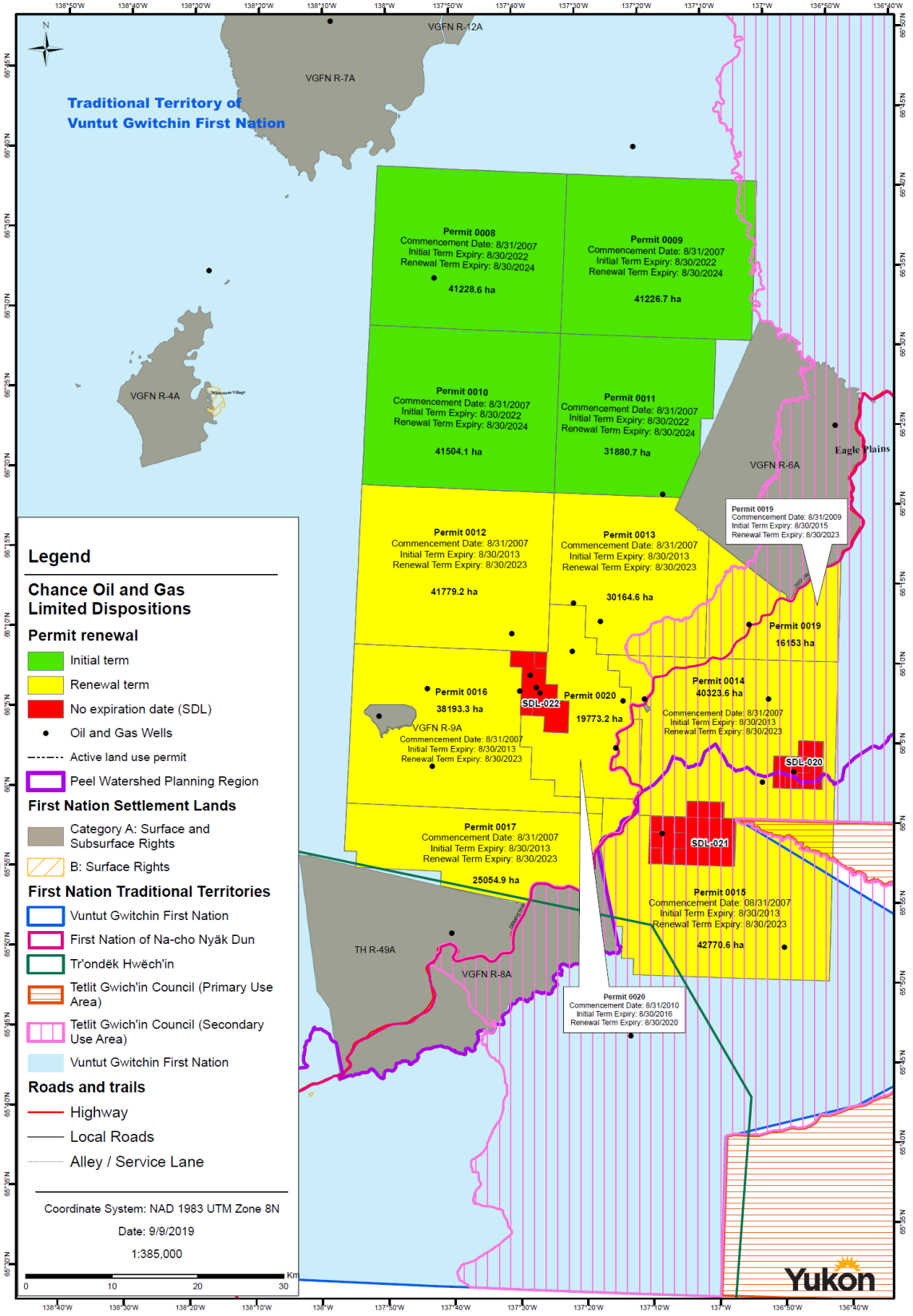
Chance Oil and Gas Limited Dispositions and Wells



APPENDIX D
Engagement Log

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APPENDIX 2-C-37. *Eagle Plains Well Maintenance and Winter Activities*

Eagle Plains Well Maintenance and Winter Activities

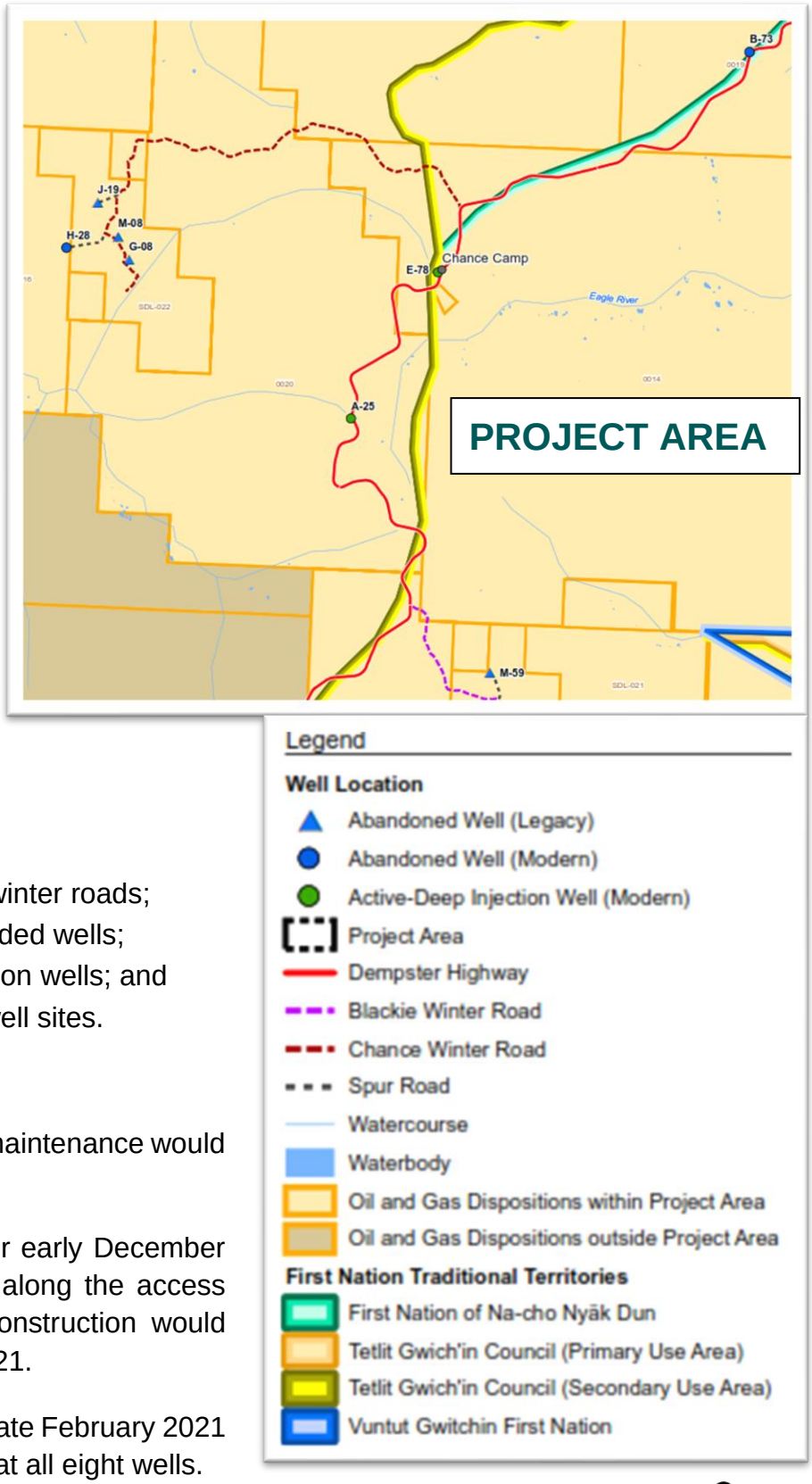
Project Information Handout **September 3, 2020**

PROJECT INFORMATION

Chance is responsible for eight wells, presently in “suspended status”, located on Eagle Plains. Four are legacy wells drilled by other operators between 1959 and 1968, and four are modern wells drilled by Chance in 2012 and 2013.

Government of Yukon, Oil and Gas Branch, has directed Chance to carryout inspection and maintenance activities for all eight suspended wells. Then Chance must either abandon or bring those wells into active status (i.e., end the period of well suspension).

Chance is proposing to abandon six wells and to bring two wells into active status as deep-injection wells.



MAIN PROJECT ACTIVITIES

Chance proposes to:

- Re-establish the Chance and Blackie winter roads;
- Conduct maintenance on eight suspended wells;
- Convert two wells to active deep injection wells; and
- Abandon six wells and reclaim those well sites.

PROJECT TIMELINES

Construction of the winter roads and well maintenance would occur during the winter of 2020/2021.

Site visits would start in late November or early December 2020 in order for Chance to pack snow along the access routes with snowmobiles. Winter road construction would finish in late January or early February 2021.

Well maintenance activities would start in late February 2021 and take about 70 days to finish the work at all eight wells.

Chance
OIL AND GAS LIMITED

Eagle Plains Well Maintenance and Winter Activities

Project Information Handout **September 3, 2020**

WINTER ROADS

The Project is accessed via the Dempster Highway. Wells A-25, E-78, and B-73 are located beside the Dempster Highway.

Well M-59 will be accessed using the Blackie winter road. From the original route, a short spur will be used to access the well site. This route is located slightly east of the original access, but offers a gentler, safer route for vehicles and will require less vegetation clearing.

Wells J-19, M-08, G-08, and H-28 will be accessed using the Chance winter road. Two additional spurs will be used to access well sites J-19 and H-28. These spurs will follow their original routes.

SUMMARY OF WELL MAINTENANCE ACTIVITIES

Type	Well Name	Final State (Abandoned or Deep-Injection)	Wellhead Inspection	Pressure Test	Surface Casing Vent Flow	Gas Migration	Temperature Log	Cement Bond Log	Hydraulically Isolated Formations	Wellbore Fluid Test	Downhole Well Suspension
Legacy	Socony Mobil WM Blackie No 1 M-59	A	-	X	X	X	X	X	X	-	X
	Western Minerals Chance YT No 1 M-08	A	-	X	X	X	-	X	X	-	X
	Wells Canoe River Chance YT J-19	A	X	X	X	X	X	X	X	-	X
	Socony Mobil WM Chance YT No 1 YT G-08	A	X	X	X	X	X	X	X	-	X
Modern	NCY Ehnjuu Choo B-73	A	X	X	X	X	X	X	X	-	X
	NCY West Chance H-28	A	X	X	X	X	X	X	X	-	X
	NCY McParlon A-25	DI	X	-	X	X	X	-	-	X	-
	East Chance E-78	DI	X	-	X	X	X	-	-	X	-

ACCOMMODATION

Chance anticipates using either the Eagle Plains Hotel or the existing Chance Camp for housing workers. However, the decision to use one or the other will be made by October 2020, at the latest, and will consider:

- The Hotel's ability to accommodate Chance workers
- COVID-19 related self-isolation requirements

STAFF NEEDED

It is anticipated ten people will always be on site, with up to 17 at any one time (including staff on standby) and up to 25 during rig mobilization.

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Eagle Plains Well Maintenance and Winter Activities

Project Information Handout **September 3, 2020**

TYPES OF MAINTENANCE ACTIVITIES AND TESTS

Wellhead Inspection: The wellhead is the equipment on the surface used to maintain safe operation and manage the flow of oil and gas. A wellhead inspection is done to make sure all surface equipment is in good condition and operating as it should (e.g., providing a barrier against hydrocarbon leakage, reliable in emergency situations). This inspection follows the standard Yukon Government Oil and Gas Resources Well Inspection Report.

Pressure Test: A test to determine the strength or fracture pressure of the rock around a borehole. During the test, the well is shut in and fluid is pumped into the wellbore to gradually increase the pressure on the rock. At a certain pressure, fluid will enter the rock surrounding the borehole, either moving through small holes in the rock or by creating a space by fracturing the rock. The results of a pressure test show the maximum pressure that may be applied to the well during drilling operations.

Surface Casing Vent Flow (also referred to as a "Bubble Test") and Gas Migration Tests: When a well is drilled, it must be cased with steel pipe to provide stability to the wellbore and to ensure fluids are contained within the well. Multiple casings are used within a well. The shallowest casing is the surface casing. The surface casing isolates usable groundwater from the well and stabilizes the well. After the casing is installed, cement is pumped in the space between the casing and the rock around the wellbore, as well as between casings, to achieve a seal. Surface Casing Vent Flow involves the movement of gas, in rare cases liquid, between the surface casing and the next string of casing upward and out of the surface casings. Gas Migration is the flow of gas outside the surface casing of a well and may be tested by doing a soil vapor survey.

Temperature Log: A detailed record of temperature down the well. The temperature log is interpreted by looking for anomalies from a baseline (i.e., a log recorded before production or recorded with the well shut in). Temperature logs have many applications, mainly to identify areas where the wellbore is taking in fluid, to evaluate a cement or hydraulic fracture treatment, and to locate casing leaks. A temperature log tends to reflect the behavior of a well over a longer time than other measurements.

Cement Log: A log that uses a sound travelling down the casing wall between a transmitter and receiver to determine of the quality of cement bond on the exterior casing wall.

Hydraulically Isolate Formations: An activity where holes are put in the casing at a specific depth. Tubing is then used to inject cement through the holes, allowing cement to flow from the well into the surrounding rocks in sufficient quantity to ensure hydraulic isolation. Then pressure is applied from surface to force the cement into the holes. Once the cement has cured, the cement will be pressure tested as per the *Yukon Oil and Gas and Drilling Production Regulations*. This process is repeated until all formations are hydraulically isolated and pressure tested. These operations begin with the deepest non-isolated formation and progress to the shallowest non-isolated formation. Once all the isolation/testing procedures are complete, the tubing will be pulled from the well, a new well head assembly will be installed, and the well head will be pressure tested once more.

Wellbore fluid test: A test, or series of tests, performed to check that no unwanted reactions occur with a specific fluid. The testing process may include checks for compatibility with other treating fluids, wellbore fluids, reservoir fluids, and the reservoir formation.

Chance
OIL AND GAS LIMITED

APPENDIX 2-C-38. *Draft YESAB Project Proposal Eagle Plains Well Maintenance and Winter Activities Chance Oil and Gas Limited*

DRAFT YESAB PROJECT PROPOSAL

Eagle Plains Well Maintenance and Winter Activities

Chance Oil and Gas Limited

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August 28, 2020
File No. 104709-01

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ABBREVIATIONS AND UNITS OF MEASURE

Acronym	Definition
Agent	Hemmera Envirochem Inc.
BC	British Columbia
Chance	Chance Oil and Gas Limited
ELC	Ecological and Landscape Classification
FNNND	First Nation of Na-Cho Nyäk Dun
GCLCA	Gwich'in Comprehensive Land Claim Agreement
GTC	Gwich'in Tribal Council
HRIA	Heritage Resource Impact Assessment
HROA	Heritage Resource Overview Assessment
LMU	Land Management Unit
NE	northeast
Northern Cross	Northern Cross (Yukon) Limited
NW	northwest
NWT	Northwest Territories
NYLUP	North Yukon Land Use Plan
OGDPR	Oil and Gas Drilling and Production Regulations (Yukon)
Project	Eagle Plains Well Maintenance Project
Proponent	Chance Oil and Gas Limited
PWLUP	Peel Watershed Land Use Plan
QEP	Qualified Environmental Professional
SCVF	surface casing vent flow
SE	southeast
SW	southwest
TGC	Tetlit Gwich'in Council
TH	Tr'ondëk Hwëch'in
UAV	unmanned aerial vehicle
VC	valued component
VG	Vuntut Gwitchin
VG	Vuntut Gwitchin
VLAA	Vegetation Local Assessment Area
VRAA	Vegetation Regional Assessment Area
workovers	well maintenance activities
YESAA	*Yukon Environmental and Socio-economic Act*
YESAB	Yukon Environmental and Socio-economic Assessment Board
YOGA	*Yukon Oil and Gas Act*
YTA	Yukon Transboundary Agreement

Symbol	Unit of Measure
°C	degrees Celsius
cm	centimetre
ft.	foot/feet
ha	hectare
kg/m	kilograms per metre
km	kilometre
km^2	square kilometres
km/day	kilometres per day
km/h	kilometres per hour
kN	kilonewton
m	metre
mKB	metres below Kelly bushing
mm	millimetre

1.0 INTRODUCTION

Chance Oil and Gas Limited (Chance or Proponent) is proposing to conduct routine maintenance on 8 of its suspended wells near Eagle Plains, Yukon. The Government of Yukon Oil and Gas Branch has notified Chance that well maintenance is required to maintain the suspended well status on the following 4 wells: NCY McParlon A-25, NCY Ehnjuu Choo B-73, NCY East Chance E-78, and NCY West Chance H-28. In addition, maintenance work will be undertaken on the following wells: Wells Canoe River Chance J-19, Socony Mobil WM Blackie No. 1 M-59, Socony Mobil WM Chance YT No. 1 YT G-08, and Western Minerals Chance YT No. 1 M-08.

There is a distinct difference between a suspended well and an abandoned well. A suspended well is considered a well that is not producing and has been safely secured, and production could be restarted later. An abandoned well has been permanently shut down, plugged, and the well head removed; it is considered safe and secure by regulators (CAPP 2019).

The Proponent will execute well maintenance activities within the confines of the Oil and Gas Drilling and Production Regulations, SOR/2009-315 (OGDPR). Well maintenance activities, also known as workovers, generally include the following activities:

- Pressure testing to confirm integrity of the casing and well head valves
- Removal of equipment in the well bores such as tubing and plugs
- Wireline investigations to measure temperatures and cement integrity and convey any perforating equipment
- Remedial work such as cement squeezes
- Wellbore integrity analysis to determine possible well abandonment.

To enable crews to mobilize to the site with maintenance equipment, the Eagle Plains Well Maintenance Project (Project) will require re-establishment of the Chance and Blackie winter roads.

The proposal is being submitted to the Yukon Environmental and Socio-economic Assessment Board (YESAB) for an assessment under the *Yukon Environmental and Socio-economic Act*, SC 2003, c. 7 (YESAA), which is required to obtain the necessary permits and authorizations to perform the work.

1.1 Proponent Contact Information

The Proponent has retained Hemmera Envirochem Inc. (Hemmera or Agent) to prepare and submit the Project Proposal to the Dawson Designated Office.

The Proponent's contact information is listed as follows:

[redacted], Vice President
Chance Oil and Gas Limited
Suite 202, 208 Main Street
Whitehorse, Yukon, Y1A 2A9
[redacted]
[redacted]

The Agent contact information is listed as follows:

[redacted], Project Manager
Hemmera Envirochem Inc.
230 - 2237 2nd Avenue
Whitehorse, Y1A 0K7 Yukon
Email: [redacted]
Phone: [redacted]

The preferred method of communication for the Proponent and Agent is via email. The Agent authorization form has been submitted to the Dawson Designated Office as part of the Project Proposal documents.

1.2 Location

The Project is located 30 kilometres (km) to 70 km south of Eagle Plains Hotel, in northeast Yukon (**Figure** 1-1). The project area is within the Traditional Territories of the Vuntut Gwitchin (VG) and the First Nation of Na-Cho Nyäk Dun (FNNND), as well as the Tetlit Gwich'in Secondary Use Area of the Gwich'in Settlement Region (**Figure 1-1**). Tr'ondëk Hwëch'in (TH) Traditional Territory and Settlement Land is also located immediately south of the project area.

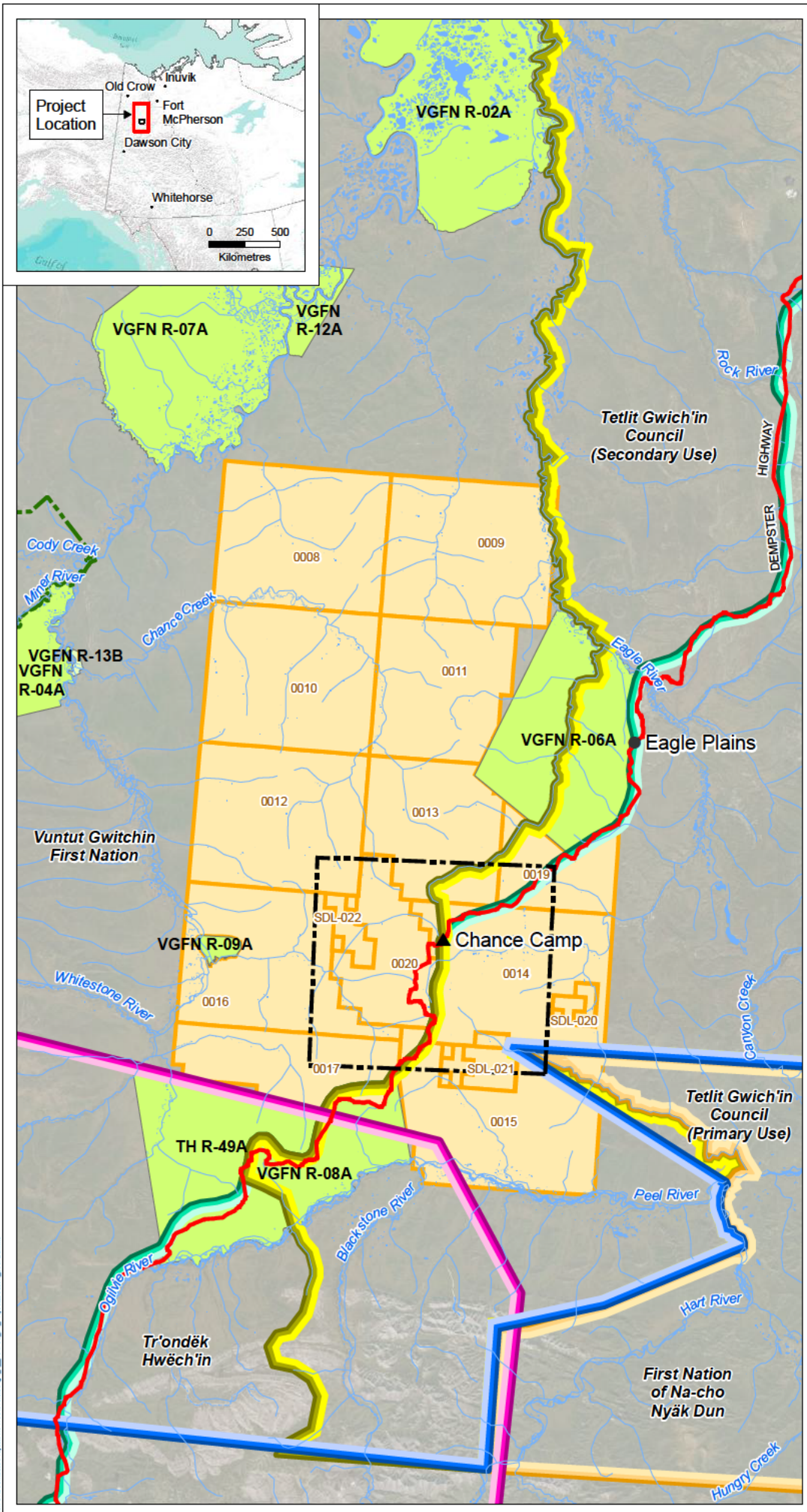
Seven of the wells are located in the upper reaches of the Porcupine River watershed on the west side of the Dempster Highway, and 1 is located in the upper reaches of the Peel River watershed on the east side of the Dempster Highway. The nearest watercourse to the wells situated in the Porcupine watershed are McParlon Creek, which has 2 tributaries framing the south and western sides of the Chance Significant Discovery Licence and Ehnjuu Choo Creek. The watercourse nearest the Blackie M-59 well is Dalgleish Creek, which flows into the Ogilvie River. There are no waterbodies (i.e., lakes or ponds) in the area of proposed activities.

Details of the exploration wells requiring maintenance are presented in **Table 2-1** and **Figure 2-1**.

The Dempster Highway transects the project area and provides all-season access to the Blackie winter road, the Chance winter road, and the suspended wells at McParlon A-25 and Ehnjuu Choo B-73, which are located immediately adjacent to the Dempster Highway. The nearest outpost is the Eagle Plains Hotel and Highway Maintenance Base, which is located approximately 30 km to 70 km north of the locations where the workovers are planned to occur. (**Figure 2-1**).

The latitude and longitude coordinates for the proposed Project are presented as follows:

NW:	66.20808719	(lat/northing)	−137.6280058	(long/easting)
NE:	66.21832565	(lat/northing)	−136.9320243	(long/easting)
SW:	65.96218433	(lat/northing)	−137.6037058	(long/easting)
SE:	65.97269282	(lat/northing)	−136.9164459	(long/easting)



Eagle Plains Exploration Project
Yukon

Project Location

Legend

- Chance Camp
- Project Area
- Dempster Highway
- Watercourse
- Waterbody
- Oil and Gas Dispositions
- Protected Area

First Nation Traditional Territories

- First Nation of Na-cho Nyäk Dun
- Tetlit Gwich'in Council (Primary Use Area)
- Tetlit Gwich'in Council (Secondary Use Area)
- Tr'ondëk Hwëch'in
- Vuntut Gwitchin First Nation

First Nation Settlement Lands

- Surface Rights
- Surface and Subsurface Rights

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licensed under the Open Government Licence - Yukon
- Aerial Image: ESRI World Imagery
- Inset Basemap: ESRI World Terrain Base

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Hemmera An Ausenco Company

Chance Oil and Gas Limited

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1.3 Regional Land Use Plans

The Project is located within the boundaries of the North Yukon Planning Region and Peel Watershed Planning Region and is therefore subject to the North Yukon Land Use Plan and (NYLUP) Peel Watershed Land Use Plan (PWLUP). Locations of proposed Project activities are within Land Management Unit (LMU) 9 of the NYLUP and LMU 7 of the PWLUP. (**Table 1-1**). Both are located within the Eagle Plains basin, with the highest potential for oil and gas development. Details regarding how the Project will meet the requirements of the NYLUP and PWLUP are provided in **Section 7.5** and **Table 7-2**.

Table 1-1 Landscape Management Units Overlapping the Project

Landscape Management Unit Number	Landscape Management Unit Name	Integrated Management Area
9 (NYLUP)	Eagle Plains	4
7 (PWLUP)	Dalglish Creek	4

1.4 YESAA Triggers

The Project requires an evaluation by a YESAB Designated Office for the following reasons:

1. The Project location is in the Yukon.
2. The Assessable Activities, Exceptions and Executive Committee Projects Regulations (SOR/2005-379) identifies several triggers for the Project:
   a. Schedule 1, Part 3, Oil and Natural Gas, Item 2:

      On other than an Indian reserve, drilling, operation, modification, decommissioning or abandonment of, or other activity in relation to, an oil or natural gas well or seismic shot hole, but not including a hole drilled to obtain geological information.

   b. Schedule 1, Part 13, Miscellaneous, Item 13:

      On Crown land or settlement land, levelling, grading, clearing, cutting or snow ploughing of a route that provides access to land for the purposes of a geophysical, geological or engineering survey.

3. An authorization by a government agency is required for the activities to be undertaken.

The Dawson Designated Office is expected to carry out the evaluation.

1.5 Regulatory Requirements

Chance currently holds a Type B Water Licence (MN12-061-1) approvals from previous activities at the Project site.

To complete the Project the following approvals are required:

- Air Emission Permit
- Land Use Permits
- Dempster Highway Authorization Permit
- Storage Tank Permit
- Waste Management Permit

- Work within Highway Right-of-Way Permit.

1.6 Alternatives

Currently, no alternatives are being considered. The proposed well maintenance work has been directed by the Government of Yukon and is designed in accordance with Part 7 of the OGDPR. Alternative technologies and methods for accessing the well sites are also not feasible. Winter access and work are proposed to reduce or eliminate potential effects to various valued components (VCs) such as permafrost and vegetation, and Project activities have been designed according to best practices and Government of Yukon standards. Other means of access such as by helicopter are not feasible during winter as low light conditions pose additional personnel health and safety considerations.

2.0 PROJECT DESCRIPTION

Chance is responsible for eight wells, presently in suspended status, located on Eagle Plains. Of these wells, four are legacy wells drilled by other operators between 1959 and 1968, and four are modern wells drilled by Chance (formerly called Northern Cross (Yukon) Limited) in 2012 and 2013. As directed by the Government of Yukon, Oil and Gas Branch, Chance must conduct inspection and maintenance activities for all eight suspended wells, then abandon or bring into active status (i.e. end the period of well suspension). Chance proposes to abandon six wells, and to bring the final two wells into active status as deep-injection wells. Waste fluid produced during the abandonment of the six wells can then be disposed of via injection into the deep-injection wells, enabling Chance to minimize the distance the waste fluid is transported. No oil or gas is expected to be produced from the two active wells; they would specifically be used for disposal of waste fluid. The work is planned for December 2020 to March 2021, although the specific timeframe is weather-dependent (temperatures must be consistently below 0 degrees Celsius (°C) and adequate snowfall is required for access to some of the wells).

This section describes in detail the activities, equipment and schedule making up the Eagle Plains Well Maintenance Program (the Project),

2.1 Project Activities

The main components of the Project are:

- Re-establishment of the Chance and Blackie winter roads (constructed via compaction on a minimum snow base of 10 cm).
- Maintenance activities on the eight suspended wells (well workover).
- Convert two wells to active deep injection wells.
- Abandonment of the remaining six wells, and reclamation of the associated well sites.

The well maintenance activities followed by conversion to deep injection wells or abandonment and reclamation will satisfy a direct order from the Oil and Gas Branch of the Government of Yukon. Construction and re-establishment of the winter roads is required to access five of the well sites while three of the well sites are accessed directly off the Dempster Highway. A letter outlining the order from the Government of Yukon, Oil and Gas Branch is provided in **Appendix A**. Locations for each of the wells is provided in **Table 2-1** and **Figure 2-1**.

Table 2-1 Well Locations and Access

Well Name	Location		Access Route
	Latitude	Longitude	
Socony Mobil WM Blackie No 1 YT M-59	65° 58' 54.9" N	137° 18' 58.2" W	Blackie winter road
Western Minerals Chance YT No 1 M-08	66° 07' 46.0" N	137° 31' 27.3" W	Chance winter road
Wells Canoe River Chance YT J-19	66° 08' 31.0" N	137° 32' 27.0" W	Chance winter road
Socony Mobil WM Chance YT No 1 YT G-08	66° 07' 18.1" N	137° 30' 50.8" W	Chance winter road
NCY Ehnjuu Choo B-73	66° 12' 10.3" N	136° 59' 01.5" W	Dempster highway
NCY West Chance H-28	66° 07' 29.8" N	137° 34' 05.6" W	Chance winter road
NCY East Chance E-78	66° 07' 18.5" N	137° 14' 46.8" W	Dempster highway

Well Name	Location		Access Route
	Latitude	Longitude	
NCY McParlon Creek A-25	66° 04' 10.3" N	137° 18' 58.2" W	Dempster highway

2.1.1 Site Access and Winter Roads

The Project is accessed via the Dempster Highway. Wells A-25, E-78 and B-73 are located immediately adjacent to the Dempster Highway in cleared areas and are readily accessible in all seasons. Well M-59 will be accessed by re-establishing approximately 5.95 km of the Blackie winter road, which runs east from Km 305 of the Dempster Highway, approximately 20 km south of the Chance Camp. From the original route, a 1.12 km spur north will be used to access the well site (**Figure 2-1**); this route is located slightly east of the original access to the well site, but offers a gentler, safer gradient for vehicles and will require less vegetation clearing.

Wells J-19, M-08, G-08, and H-28 will be accessed by re-establishing approximately 25 km of the Chance winter road, which runs west from the highway, approximately 3 km north of the Chance Camp. Two additional spurs will connect to well sites for J-19 and H-28 from the winter road (**Figure 2-1**); these spurs will follow the original access routes and will be approximately 2.85 km in total.

Both winter roads will be approximately 8 metres (m) to 10 m wide. The total surface area and footprint of both the Chance winter road, Blackie winter road, and spur roads will be approximately 35 hectares (ha). Exact dimensions of the well sites are dependent on topography and may not be exact squares but will cover an area approximately 1 ha per well site, with the wellhead located approximately in the center. As such, the total footprint of the project will be approximately 43 ha.

2.1.1.1 Winter Road Construction Methods

Chance will use similar techniques for winter road construction as described during prior assessments (YESAB # 2006-0237, 2006-0285, 2007-0219, 2008-0047, and 2012-0140). Before any winter road construction, a minimum, verified, snow depth of 10 centimetres (cm) must be present; this depth of snow cover is considered sufficient to protect the ground surface from tires or vehicle tracks. To promote snow compaction and thorough freezing, snowmobiles and snowcats will be used to drive the Chance and Blackie winter roads during late fall/early winter (after the first few snow falls). Re-establishing the Chance winter road will be prioritized due to the larger number of wells accessed by this route and because minimal vegetation clearing is expected (the Chance winter road was last used in April 2014 and substantial regrowth of woody vegetation since is unlikely).The Blackie winter road will provide access to only 1 well; it is also more overgrown.

If the snow depth (minimum of 10 cm) is not sufficient in certain areas during re-establishment of the Blackie winter road, additional snow will only be collected from areas where a surplus of snow is available or from areas where there is no potential for disturbance to the surrounding environment. These areas may include depressions with accumulation of significant amounts of snow. Chance will only remove snow from areas where 10 cm of compacted snow will remain as a base to protect surface vegetation. Alternatively, as the Proponent has done in previous years, crews may remove additional snow from the Chance camp laydown area (approximately 13 ha area). Only clean snow that is free of deleterious substances will be used for re-establishing winter roads.

Once the snow depth is adequate (i.e., 10 cm or greater without compaction), any vegetation along either winter road route will be cleared using a bulldozer and a mulcher. The bulldozer blade will be raised off the ground to avoid cutting the tops of hummocks, tussocks, or high spots. Any trees or large brush encountered will be removed at the ground surface using a mulcher to avoid tearing the surface organic layer, thereby reducing the chance of thawing ice-rich mineral soil beneath. The removed vegetation will then be mulched with a track-mounted mulcher and distributed on the road. The mulch helps keeps the soil in place while protecting the root system of ground cover plants and natural grasses. Where it is safe and practical to do so, crews will save standing live or dead trees along the route that provide wildlife habitat.

If the minimum snow depth base is not present in areas along the Blackie winter road, additional snow may be collected from areas where a surplus is available or from areas with no potential for disturbance to the surrounding environment (such as depressions with significant accumulations of snow). Chance will only remove snow from areas where 10 cm of compacted snow will remain as a base to protect surface vegetation. Alternatively, additional snow from the Chance camp area (approximately 13 ha area) may be used (as Chance has done previously); only clean snow, confirmed free of deleterious substances will be used for re-establishing winter roads. If natural snowfall is below the minimum required depth to construct and maintain the winter roads, snow making equipment could also be used to make up the shortfall, although this would be dependent on the timing of winter road construction and ambient temperatures (requires temperatures below 0°C. Generally, low snowpack is only an issue during the early part of winter, so this provision would only apply on a contingent basis during the months of November, December, and January.

Following vegetation removal, the surface of the road will be constructed using accumulated snow packed into the roadbed and construction of shallow berms on the road margins, into which snow and water trucked from approved sources will be flooded/packed. A combination of snowcats and bulldozers using drags will be used to push and compact the snow along the access routes. To ensure the roads will be stable enough to safely support the service rig and other heavy loads, all construction activities will be supervised by an experienced construction supervisor.

The same construction methods will be utilized to establish access to well sites and clear any vegetation surrounding the well site to accommodate equipment and site infrastructure.

2.1.1.2 Water Withdrawal

Water for the service rig and winter road icing will be primarily sourced from existing withdrawal locations on the Eagle River, with locations on the Ogilvie River as an alternative source. The Eagle River is preferred (closer proximity to the Project), although the Ogilvie River will be more convenient for operations on wells M-59 and A-25. No more than 100 cubic metres (m^3) of water will be withdrawn daily. All water withdrawal will follow the Fisheries and Oceans Canada's Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 2020).

If natural snowfall is below the minimum required depth to construct and maintain the winter roads, snow making may be used to make up the shortfall. This is a contingent consideration and could require up to 100 m^3 of water per day for a short period (a few days to a week). The sources of water include the Eagle River and the Ogilvie River. The water to be used to make snow and ice for the winter road(s) will be trucked from the source to the point of use, with each truck expected to complete between 1 and 3 deliveries per day.

2.1.1.3 Winter Road Maintenance

Maintenance of winter access routes may include low ground pressure vehicles (e.g., snow cats), a road grader equipped with a wing snow plow, and some water application. Grading may be required over certain stretches and depressions along the snow-filled roads to smooth the surface.

2.1.1.4 Access Control

Chance understands that increased winter access into the area is of significant concern to First Nations and Indigenous Groups, local residents, trappers, and outfitters. Chance also has safety concerns regarding unauthorized use of Chance and Blackie winter roads due to narrow access routes and the potential presence of sour gas at some wells. In order to ensure crew safety, Chance cannot allow the use of firearms in areas where crews are working. Chance will have radio control of these access routes to ensure authorized personnel gain unobstructed access, but this will not prevent unauthorized use of the roads and area. To address access concerns, gates will be placed at the junction connecting the Blackie and Chance winter roads to the Dempster Highway. The gates will be constructed of heavy materials and positioned with obstacles on either side as much as possible (e.g., heavy forest) to restrict vehicle access.

2.1.1.5 Anticipated Road Use

The majority of anticipated Project traffic on the winter roads will involve mobilizing and setting up the service rig and site infrastructure. At each well site, approximately 11 flatbed truck loads will be required to mobilize equipment, and service rig setup will take approximately 1 day to complete at each well site. Once a site is established and maintenance equipment set up, approximately 1 to 2 pickup trucks will transport supplies and personnel to and from site each day for the duration of work at the site. Additionally, 1 water truck and 1 fuel truck will supply the well site (via the winter roads) every 3 days or as demand dictates.

Public access and use of both the Chance and Blackie winter roads will be restricted. All Project vehicles will be equipped with radio communication and traffic on the roads will be radio monitored and controlled.

2.1.1.6 Road Equipment

Equipment will be required for clearing, grading, and transporting water and materials. Light equipment for transporting personnel, fuel, and other supplies will also be required periodically during construction and well maintenance.

It is anticipated that Challenger cats, D6 cats, snow cats, graders, snow-making equipment, water trucks, and drags will be the primary construction equipment used to re-establish the winter roads. Pickup trucks will be used to transport work crews, fuel, and other supplies, and water trucks will be used to carry water from the Eagle River and Ogilvie River to the Project. Flatbed trailers will be used to transport equipment and larger supplies.

2.1.2 Well Maintenance Activities

Under the Yukon OGDPR, a well is deemed suspended when it is safely secured, but not producing oil or natural gas. The Yukon Oil and Gas Branch has indicated that the wells listed in **Table 2-1** have exceeded the allowable time period for remaining in suspended status and must be either abandoned or brought into active status.

Well maintenance is required on each well prior to abandonment or conversion to active injection wells. Well maintenance equipment may include a service rig, wireline truck, and cementing trucks along with associated support equipment. All equipment will be mobilized to each of the wells on a sequential basis (one at a time) to complete the required maintenance work, which will include downhole suspension of wells to be abandoned, wellbore fluid replacement, and replacement of substandard equipment). The following 8 wells will require maintenance:

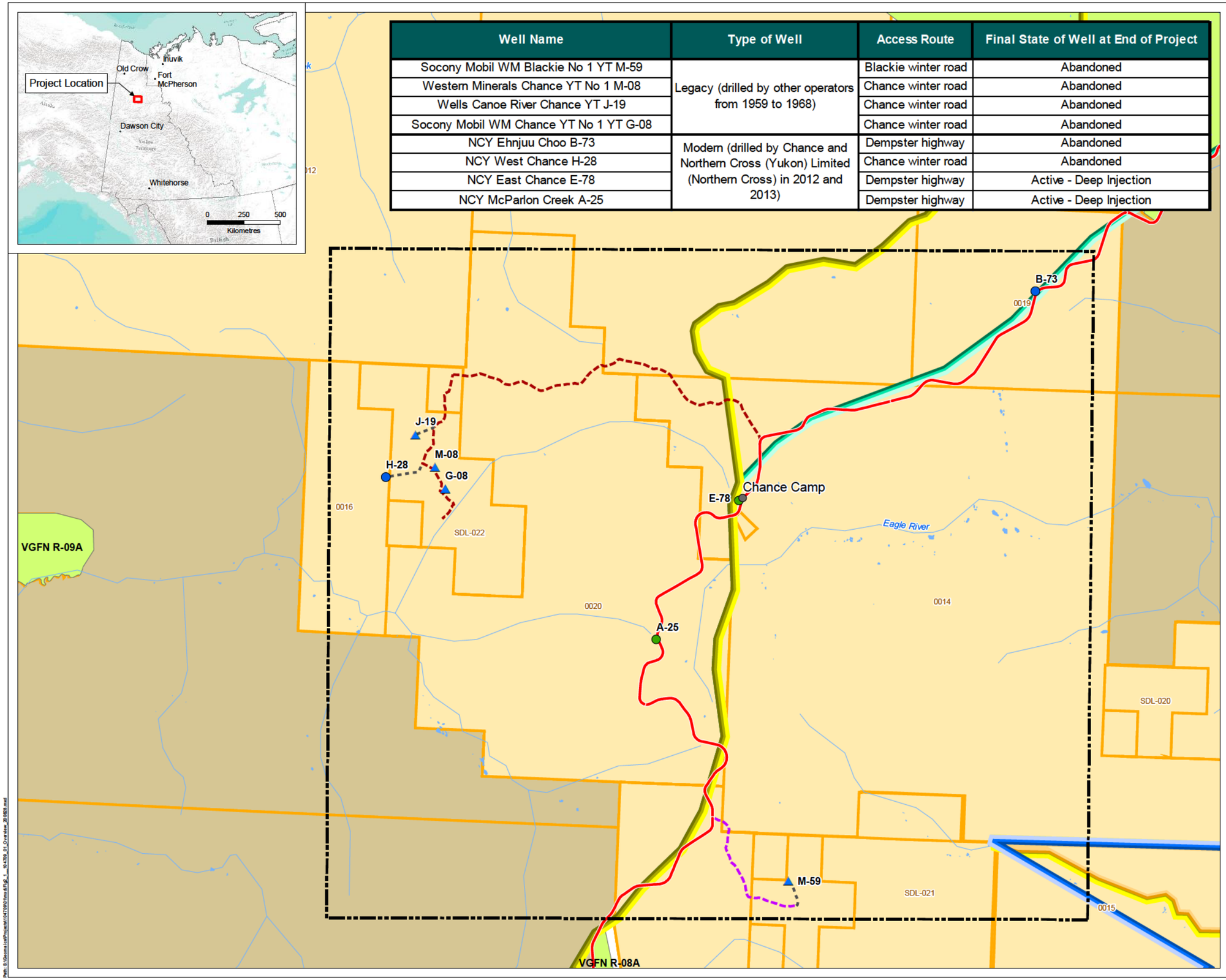
- Socony Mobil WM Blackie No 1 M-59 (M-59)
- Western Minerals Chance YT No 1 M-08 (M-08)
- Canoe River Chance YT J-19 (J-19)
- Socony Mobil WM Chance YT No 1 YT G-08 (G-08)
- NCY McParlon A-25 (A-25)
- NCY Ehnjuu Choo B-73 (B-73)
- NCY West Chance H-28 (H-28)
- NCY East Chance E-78 (E-78).

A detailed description of the planned maintenance activities at each well is presented in the following sections. A summary of the activities anticipated to be required at each well is provided in **Table 2-2**.

Table 2-2 Summary of Well Maintenance Activities

Type	Well Name	Final (Abandoned or Deep-Injection)	Wellhead Inspection	Pressure Test	Surface Casing Vent Flow	Gas Migration	Temperature Log	Cement Bond Log	Hydraulically Isolated Formations	Wellbore Fluid Test	Downhole Well Suspension
Legacy	Socony Mobil WM Blackie No 1 M-59	A	-	X	X	X	X	X	X	-	X
	Western Minerals Chance YT No 1 M-08	A	-	X	X	X	-	X	X	-	X
	Wells Canoe River Chance YT J-19	A	X	X	X	X	X	X	X	-	X
	Socony Mobil WM Chance YT No 1 YT G-08	A	X	X	X	X	X	X	X	-	X
Modern	NCY Ehnjuu Choo B-73	A	X	X	X	X	X	X	X	-	X
	NCY West Chance H-28	A	X	X	X	X	X	X	X	-	X
	NCY McParlon A-25	DI	X	-	X	X	X	-	-	X	-
	East Chance E-78	DI	X	-	X	X	X	-	-	X	-

Well Name	Type of Well	Access Route	Final State of Well at End of Project
Socony Mobil WM Blackie No 1 YT M-59	Legacy (drilled by other operators from 1959 to 1968)	Blackie winter road	Abandoned
Western Minerals Chance YT No 1 M-08		Chance winter road	Abandoned
Wells Canoe River Chance YT J-19		Chance winter road	Abandoned
Socony Mobil WM Chance YT No 1 YT G-08		Chance winter road	Abandoned
NCY Ehnjuu Choo B-73	Modern (drilled by Chance and Northern Cross (Yukon) Limited (Northern Cross) in 2012 and 2013)	Dempster highway	Abandoned
NCY West Chance H-28		Chance winter road	Abandoned
NCY East Chance E-78		Dempster highway	Active - Deep Injection
NCY McParlon Creek A-25		Dempster highway	Active - Deep Injection



Eagle Plain Well Maintenance
Yukon

Well and Winter Road Locations

Legend

Well Location
- Abandoned Well (Legacy)
- Abandoned Well (Modern)
- Active-Deep Injection Well (Modern)
- Project Area
- Dempster Highway
- Blackie Winter Road
- Chance Winter Road
- Spur Road
- Watercourse
- Waterbody
- Oil and Gas Dispositions within Project Area
- Oil and Gas Dispositions outside Project Area

First Nation Traditional Territories
- First Nation of Na-cho Nyäk Dun
- Tetlit Gwich'in Council (Primary Use Area)
- Tetlit Gwich'in Council (Secondary Use Area)
- Vuntut Gwitchin First Nation

First Nation Settlement Lands
- Surface and Subsurface Rights

Notes

1. All mapped features are approximate and should be used for discussion purposes only.
2. This map is not intended to be a "stand-alone" document, but a visual aid of the information contained within the referenced Report. It is intended to be used in conjunction with the scope of services and limitations described therein.

Sources

- Contains information licensed under the Open Government Licence - Yukon
- Aerial Image: ESRI World Imagery
- Inset Basemap: ESRI World Terrain Base

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104709-01	Production Date: Aug 28, 2020	Figure 2.1

Hemmera
An Ausenco Company

Chance
OIL AND GAS LIMITED

2.1.2.1 Legacy Wells

Legacy wells were drilled by other operators from 1959 to 1968 and are located on Significant Discovery Licences Blackie (021) and Chance (022).The following Legacy wells require maintenance:

- Socony Mobil WM Blackie No 1 YT M-59
- Western Minerals Chance YT No 1 M-08
- Canoe River Chance YT J-19
- Socony Mobil WM Chance YT No 1 YT G-08.

Pressure Test and Surface Casing Vent Flow Test and Gas Migration Test

A pressure test will be conducted at each Legacy well to evaluate the integrity of the wellhead and the existing wellbore casing. The well will then be tested for surface casing vent flow (SCVF) and gas migration; SCVF occurs when fluid or gas is flowing from the surface casing vent assembly. Gas migration testing is intended to identify movement of gas from a subsurface zone to the surface through a barrier that should otherwise prevent its movement; barriers can be natural (overburden, shale, permafrost) or artificial (cement sheath, external casing packed, pipe joints, etc.). The Proponent reports that during annual inspections, no SCVF has ever been detected. If SCVF is identified, the well will be inspected and test results logged using a variety of tools (e.g., noise tool, temperature tool, bond log tool) to determine the source of the SCVF and/or gas migration. The logs will be analyzed, and a plan will be formulated to complete a downhole shut off at the source of the SCVF and/or gas migration.

Temperature Log and Cement Bond Log

Once pressure, SCVF, and gas migration testing is complete, the service rig, support equipment, and wireline will be moved to the well site. A blowout preventer, (a specialized pressure control unit to seal, control, and monitor the well and prevent the uncontrolled release of crude oil or natural gas during well operations) will be installed on the wellhead seal. A temperature log will be recorded from the surface to a depth of 300 m below Kelly Bushing (mKB). The data in the temperature log will be analysed for anomalies or departures from the reference gradient; the reference gradient may be the geothermal gradient, a log recorded pre-production, or a log recorded with the well shut in, depending on the well. Most anomalies are related to fluids entering the formation through the borehole or fluid exit.

Following analysis of the temperature log, a cement bond log will be run. The cement log uses the variations in amplitude of an acoustic signal travelling down the casing wall between a transmitter and receiver to determine the quality of a cement bond on the exterior casing wall. The acoustic signal will be more attenuated in the presence of cement than if the casings were uncemented. The cement log is used to identify sections of the well bore that will need interventions to isolate porous formations from adjacent formations.

Isolate Hydraulically Connected Formations

To isolate a formation from an adjacent formation, the casing will be perforated at the appropriate depth using a wireline-conveyed perforating gun. Tubing will then be used to inject cement through the perforations in sufficient quantity to ensure adjacent formations are isolated from each other, at which point pressure will be applied from surface to force the cement into the perforations. Once the cement has cured,

the cement will be pressure tested as per the Yukon OGDPR. The process will then be repeated until all formations are isolated from one another and pressure tested. The isolation operations will begin with the deepest non-isolated formation and progress to the shallowest non-isolated formation.

2.1.2.2 Modern Wells

The modern wells were drilled by Chance and Northern Cross (Yukon) Limited (Northern Cross) in 2012 and 2013. The following modern wells require maintenance:

- NCY McParlon A-25
- NCY Ehnjuu Choo B-73
- NCY West Chance H-28
- NCY East Chance E-78.

Of the modern wells, B-73 and H-28 will then be abandoned and A-25 and E-78 will be converted to active deep-injection wells.

Pressure Test and Surface Casing Vent Flow Test and Gas Migration Test

A pressure test will be conducted at each Modern well to evaluate the integrity of the wellhead and the existing wellbore casing. The well will then be tested for SCVF and gas migration, as for the Legacy wells. The Proponent reports that during annual inspections, no SCVF has ever been detected. If SCVF is identified, the well will be inspected and test results logged using a variety of tools (e.g., noise tool, temperature tool, bond log tool) to determine the source of the SCVF and/or gas migration. The logs will be analyzed, and a plan will be formulated to complete a downhole shut off at the source of the SCVF and/or gas migration

Temperature Log and Cement Bond Log

Once SCVF, and gas migration testing is complete, the service rig, support equipment, and wireline will be moved to the well site. A temperature log will be recorded from the surface to a depth of 300 mKB, and used to identify anomalies or departures from the reference gradient (as for Legacy wells, the reference gradient may be the geothermal gradient, a log recorded pre-production, or a log recorded with the well shut in). Most anomalies are related to fluids entering the formation through the borehole or fluid exit.

Following analysis of the temperature log, a cement bond log will be run. The cement log uses the variations in amplitude of an acoustic signal travelling down the casing wall between a transmitter and receiver to determine the quality of a cement bond on the exterior casing wall. The acoustic signal will be more attenuated in the presence of cement than if the casings were uncemented. The cement log is used to identify sections of the well bore that will need interventions to isolate porous formations from adjacent formations.

Wellbore Fluid

The wellbore fluid in wells B-73 and H-28 will be sampled and tested prior to abandonment to determine if the fluid meets the standards in the OGDPR; wellbore fluid is presently a stabilized dilute potassium chloride (KCl) solution (saline) which is non-corrosive and non-freezing, and is used to preserve casing integrity. A

wellbore fluid test is a test or series of tests to check that no undesirable reactions are occurring with a specific fluid. The testing process may include checks for compatibility with other treating fluids, wellbore fluids, reservoir fluids, and the reservoir formation. If the wellbore fluid does not meet the requirements of the OGDPR, a service rig will be moved in to replace it with fluid conforming to the Yukon OGDPR 99(a) and 99(b). The removed fluid from the wellbore will be recycled if permissible and re-used in the well. If it cannot be recycled the fluid will be disposed of via deep-well injection following conversion to active deep-well injection wells.

2.1.2.3 Wellbore Integrity Analysis

The wellbore integrity analysis incorporates all data collected from the Legacy and Modern wells and identifies whether any actions are required prior to well abandonment or deep-injection conversion. The wellbore integrity analysis comprises the following:

- Pressure testing of the wellhead and casing
- Bit and scraper run on tubing to ensure the wellbore is still full drift
- Analysis of the cement behind the production casing and liner casing with a cement bond log tool to determine the cement quality
- Geological analysis to determine what formations need to be isolated after the cement analysis
- Sampling of wellbore fluid on the wells (if necessary)
- Location of the well with respect to the other remaining wells.

The wellbore integrity analysis is required to formulate the final plan for each of the wellbores. The analysis will determine if any the following are required, prior to surface abandonment or conversion:

- Cement squeezes to isolate formations from other formations in accordance with OGDPR Part 7 Section 95(1)(b)
- Casing patches to repair any casing breaches
- Cement plugs or bridge plugs set to suspend or abandon producing formations in accordance with Section 97 (1) and Section 97 (2) of OGDPR Part 7

If any work is required to isolate a formation to satisfy OGDPR Part 7 Section 95(1)(b), cement squeezes will entail perforating an interval close to the formation top and squeezing Arctic-compatible cement in to the annular space between the production casing and the formation face to create a cement sheath that will isolate the formation from other formations above it in the wellbore. The cement squeeze and remaining plug left in the wellbore will conform to the requirements set out in OGDPR Section 98 (1)(b) and Section 98(2). The location of the remaining cement plug will be located after the cement squeezes using the method of setting down on the cement plug with a minimum 90 kilonewton (kN) force with the cementing string after 12 hours as set out in OGDPR Section 100(1)(b). Fluid in the wellbore may have to be replaced if it does not meet the requirements of OGDPR Part 7, Section 99.

2.1.3 Well Abandonment

Once all testing and isolation procedures are complete on each well intended for abandonment (**Table 2-2**), the following procedures will be completed for abandonment:

- Legacy wells (M-59, M-08, J-19, G-08): the existing wellbore fluid will be removed (existing wellbore fluid consists of diesel or stabilized crude oil) and replaced with stabilized KCl solution (freeze-resistant, anti-corrosive and protective of the well casing). The waste wellbore fluid will be burned by the skid boiler (part of the well maintenance equipment) to minimize distance transported and thus potential for spills. The tubing will be pulled from wells J-19 and G-08 (of the wells planned for abandonment, only these two have tubing present) and a 3-4 m deep bell hole excavated for access to the casing located immediately below the wellhead. The casings (surface casing, intermediate casing, and production casing) will be cut off at 2-3 m below ground level and a steel plate will be welded over each casing string, then covered over with the original excavated material.
- Modern wells (H-28 and B-73): if the existing wellbore fluid (stabilized KCl solution) does not meet the standards of the OGDPR, it will be removed and replaced with new stabilized KCl solution. The waste wellbore fluid will be transferred to insulated 400 bbl tanks located at A-25 and E-78 for storage prior to injection into one of the two wells. The casings (surface casing, intermediate casing, and production casing) will be cut off at 2-3 m below ground level and a steel plate will be welded over each casing string, then covered over with the original excavated material. To complete the abandonment of H-28 and B-73 (modern wells), rig matting at the well sites will be removed, as will the cement barricades and metal fencing that surrounds the well heads. In the case of B-73, aggregate material which was brought in to level the site will be removed and returned to its source of origin, a borrow pit north of B-73 at about Km 342, and the impermeable liner will be cut up and removed to allow natural regeneration of the site.

The service rig, all support equipment and all waste materials produced during the maintenance and abandonment activities will then be removed from the site. If the tubing is salvageable, it will be stored at the Chance Camp for re-use; if not, it will be transported to an appropriately accredited recycling or disposal facility offsite in Yukon on BC (please also see **section 2.5**).

2.1.4 Well Conversion to Deep-Injection Wells

Once well maintenance activities are complete on wells A-25 and E-78, they will be set up as deep-injection wells. Each well will be perforated in the geological zone, with the exact location/depth determined by the analysis of the open hole logs. A concrete packer will be set approximately 5 m above the perforated interval and plastic-coated tubing will be run and attached to the packer. The space between the tubing and casing will be filled with non-corrosive / non-freezing fluid (most likely a potassium-chloride (KCl) saline solution) to preserve casing integrity. The wellhead will be upgraded with plastic coated parts to allow for fluid injection. The packer will be pressure tested annually to conform with the required regulations. Once complete, wells A-25 and E-78 will be classified as active deep-injection wells and will no longer be considered “suspended” under the OGDPR.

At each wellhead, a surface facility consisting of 4-8 insulated 400 bbl (barrel equivalents, or 63,600 liters) tanks, tank containment measures, a triplex pump, 2-3 1000 gallon propane storage tanks and associated piping, will be set up on the lease. Wellbore fluids removed from A-25 and E-78 (and possibly from H-28 and/or B-73 if the existing wellbore fluid is found to not meet the standard of the OGDPR) will be stored in the insulated 400 bbl tanks temporarily, prior to injection into the wellbore of A-25 or E-78 using the pump. Propane will be used to heat the tanks to prevent freezing as needed. A small building will be installed over the pump and piping to keep the facility heated.

2.1.5 Well Equipment

Equipment required for well maintenance, and abandonment or conversion will be stored on site, mainly on trucks and flatbed trailers (**Table 2-3**)

Table 2-3 Equipment and Infrastructure Components

Quantity	Component	Description
Re-establishment of Winter Road		
Multiple as needed	Construction Equipment	Challenger cats, D6 cats, snow cats, graders, snow-making equipment, water trucks, and trucks with drags (small trailers pulled behind trucks) will be utilized during the initial phase of the Project to prepare the roads and well pads for well maintenance activities.
Mobilization and Demobilization for Well Maintenance and Abandonment or Injection Conversion		
6	8 ft. x 40 ft. mats	These mats can be wooden or steel and are placed on the ground in an interlocking manner for positioning the service rig and connected equipment.
1	Skid service rig structure (likely 32 – 40 wheeled loads)	Components required to service the well include: • Sub-structure, or base where the derrick (i.e., framework to support drilling apparatus) is fixed • Derrick that supports the draw works and handling equipment • Draw works that lift and lower the handling equipment in the derrick/mast to run pipe in and out of the hole • Blowout preventers, which are pressure control equipment that can hydraulically shut in a well in the event of unplanned influxes of formation fluids into the wellbore.
1	Skid dog house	Skid-mounted unit that contains a generator for supplying power to the rig, an office and change rooms for the crew, and a hydraulic control system to remotely operate the blowout preventer stack.
1	Skid pump	Skid-mounted unit that contains a pump to provide hydraulic pumping power to pump fluids into the wellbore (same as pumps below).
1	Skid tank	Skid-mounted fluid storage tank for the service rig. The skid tank can store fluid to be pumped into the wellbore or store fluid that is pumped out of the wellbore.
1	Skid boiler	Used extensively in very cold and Arctic climates for preventing equipment and fluids from freezing.
1	Junk skid	Skid-mounted trailer with an inventory of spare parts and equipment used during well maintenance work.
1	Catwalk and pipe racks	Used to store tubing or tools that will be removed from or run into the wellbore and for picking up or laying down tubing or tools.
1	Enclosed trailer (chemicals, tools, etc)	Dry storage trailer to keep tools and chemicals to be used during the maintenance operations.
5	Baskets of tools	Tools used to operate the service rig.
350	Tubing storage: Joints of 73.0 mm, L-80, 9.67 kg/m tubing (9.5 m average length)	Storage for tubing that will be stored on location until required to be run in the hole.
1	Super single shack	Skid-mounted office and accommodation for well site supervisors.
3	20-kilowatt generator / light towers, miscellaneous equipment	Light towers will be required on the well sites as the operations will run 24 hours per day.
10-16	400 bbl tanks	These skid-mounted cylindrical steel tanks are about 10 ft. in diameter and approximately 20 ft. high and are used for fluid storage.

Quantity	Component	Description
1	Miscellaneous equipment	Additional equipment transported to site on a trailer for operation of the service rig (e.g., downhole tools, fan heaters).
1	Skidded office/medic trailer	Essential personnel trailers that serve as offices. All office trailers will have self-contained sewage storage, and sewage will be moved periodically to the sewage lagoon at the Chance camp at km 324.
1	Fuel storage	Fuel storage will be needed for equipment such as the service rig, pumps, generators, etc. Bulk fuel will be staged at the Chance camp at km 324 and will be distributed each day as needed via pickup trucks with slip tanks during crew changes.
1	Tank truck	Vehicle used to transport fluid to the service rig during operations (mainly fresh water).
1	Vacuum truck	Vehicle used for removal and transportation of wastewater and sewage from the medic/first aid trailer for disposal.
1	Cement bulker	Used to store and mix cement for use in wells.
1	Cementing unit	Unit used to pump cement into the wellbore during the required cementing operations.
1	Cement bins	Large tanks, normally upright, fully enclosed, and pressurized, where cement products are stored. Cement is pneumatically pumped from the tank into the cementing unit.
1	Wireline unit	Unit to convey tools into the wellbore on wire rope to enable analysis of the casing integrity, setting of bridge plugs, and casing perforation.
1	Slickline unit	Unit to convey tools into and out of the wellbore on steel wire to enable bridge plugs to be pulled or set in the tubing.
2	Pumps	Used to circulate the fluid down the pipe, then around and up the annular space between the pipe and the casing to surface.
1	Main workover fluid storage	Storage location for all the fluid additive materials. Normally these materials are neatly stacked on pallets and shrink wrapped to protect them during the truck journey north.
1	Flare tank and flare	The flare tank is a reservoir to ensure the flare used to burn combustible gas from the well does not starve of combustible gases. Flaring is only planned in the unlikely event the wells that have perforated intervals require depressurization prior to the planned workover operations. The flaring cannot be scheduled in an operation as it may or may not be required depending on the circumstances encountered. The flare stack will be a minimum of 18 m off the ground.
1	Water storage and treatment	Water storage tank and treatment containers to provide potable water for the rig crew and personnel.
6-10	Half-ton trucks	Pickup trucks will be used to transport work crews, fuel, and other supplies between the camp, Eagle Plains Hotel, and the well sites.
Throughout Project		
1	Cement bulker (2 -3 times throughout Project)	A transport truck to deliver cement to the sites for cementing operations.
1	Fuel tank bulker (7-8 times throughout Project)	A transport truck to deliver fuel (diesel and gasoline) to fueling equipment on the sites.

2.1.6 Well Site and Winter Road Reclamation

The Project proposes to re-establish the Blackie winter road to access 1 existing well site (M-59), and the Chance winter road to access wells J-19, M-08, G-08, and H-28. Wells A-25, E-78, and B-73 are adjacent to the highway, readily accessible, and have either rig matting in place or are in a pre-existing cleared area, such as a borrow pit or Chance's Base Camp.

Reclamation activities will aim to return the site as closely as possible to its pre-Project condition, with the exception of well sites around wells A-25 and E-78, where the insulated fluid tanks and structure enclosing the pumps and piping will remain at the sites.

Well site and winter road reclamation activities will be designed to meet the following objectives:

- Leave the site clean following Project completion.
- Remove all garbage, petroleum products, and equipment.
- Prevent long-term erosion or slumping and promote successful natural revegetation of disturbed areas.

Given the winter road construction methods that will be employed (i.e., allowing for 10 cm of snow cover before building the winter road), no additional reclamation is anticipated to be required for the winter roads. As discussed in **Section 2.2.3**, access to each of the roads will be restricted during operations and following the completion of the proposed activities. Restricting access will ensure that the road can fully melt in spring, thus reducing the potential for additional disturbance from outside users and reducing risk to Chance employees.

2.2 Camp Facilities

Chance anticipates using either the Eagle Plains Hotel or the existing Chance Camp for housing workers over the duration of the Project. The Eagle Plains Hotel, located at km 371 of the Dempster Highway, has been operating since the late 1970s and provides a variety of services including hotel facilities, accommodations (64 people during peak use), a restaurant, lounge, public washroom, laundromat, and service garage. The hotel is a recognized tourist destination and provides support services to the Eagle Plains Maintenance Camp operated by the Yukon Department of Highways and Public Works.

Chance's existing camp, office, and storage yard was established in October 2011 and is located at km 325 of the Dempster Highway. It is accessible year-round unless the highway is closed due to weather or construction. For this Project, Chance plans to utilize the camp for storing and transporting equipment and supplies needed for operations and may also utilize the camp for personnel accommodations. The Camp has accommodations for up to 75 people, in trailers, as well as kitchen, sanitary and potable water facilities. The decision to utilize the Eagle Plains Hotel or the Chance Camp will be made by October 2020 at the latest, and will consider:

- The Hotel's ability to accommodate Chance workers over the full duration of the Project
- COVID-19 related self-isolation requirements (see **Section 2.3** for further details)

Over the course of the entire Project, approximately 7 to 12 fixed wing flights will be required to transport workers during shift changes, with up to 2 flights per week. Flights will be privately chartered from Edmonton to Inuvik and then to the Wiley airstrip located at km 389.5 of the Dempster Highway or the Chance Camp airstrip, located at km 325 of the Dempster Highway.

A small medic/first aid trailer equipped with heat, water, and sewer service may be installed at the well site during workover operations to provide essential first aid supplies and refuge for workers. All wastewater and sewage will be collected in tanks approved by the Canadian Standards Association and transported off site for disposal at an approved facility in Fort McPherson.

2.3 COVID-19 Safety Considerations

Coronaviruses are a large family of viruses found mostly in animals. In humans, they can cause diseases ranging from the common cold to more severe diseases such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). The disease caused by the new coronavirus has been named COVID-19.

While many of the characteristics of COVID-19 are still unknown, mild to severe illness has been reported for confirmed cases. Common symptoms for COVID-19 are fever, cough, sneezing, sore throat, and difficulty breathing. Coronavirus is transmitted via larger liquid droplets from a person's mouth and nose. The virus can spread through these droplets through the eyes, nose, or throat to anyone in close contact with an infected person. The virus is not known to be airborne (e.g., transmitted through the particles floating in the air) and it does not enter the body through the skin, although it can be spread by touch if people touch their mouth or nose before thoroughly washing their hands .

Droplet Contact: Some diseases can be transferred by large infected droplets contacting surfaces of the eye, nose, or mouth. For example, large droplets that may be visible to the naked eye are generated when a person sneezes, coughs, or even talks. These droplets typically spread only 1 m to 2 m and are too large to become airborne and quickly fall to the ground. Influenza and SARS are 2 examples of diseases capable of being transmitted from droplet contact. Currently, health experts believe that coronavirus can also be transmitted in this way.

Airborne transmission: When much smaller evaporated droplets or dust particles containing certain microorganisms float in the air for long periods of time, they can be transmitted to people. Currently, health experts believe that coronavirus cannot be transmitted through the air.

At present, COVID-19 is a public health emergency in Yukon. Guidelines for ensuring public safety have been established by the Chief Medical Officer of Health for Yukon. These guidelines include physical distancing, enhanced cleaning, infectious disease control strategies, and hand hygiene. The state of the pandemic and the responding guidelines are rapidly evolving, and Chance will continue to monitor and follow all policies and guidelines throughout the duration of the Project.

The camp utilized for Project activities and the Eagle Plains Hotel or the camp accommodations used for crew housing will also adhere to all guidelines including physical distancing and sanitization procedures to ensure a healthy environment for workers. The Eagle Plains Hotel currently abides by all guidelines established by the Chief Medical Officer of Health for Yukon. Crew members will be provided with up-to-date information regarding the current state of the pandemic and the procedures in place to address it while they are at camp. A screening procedure conducted prior to a worker's arrival at the Eagle Plains Hotel or the Chance camp will include questions related to symptoms, travel, and known interaction with an infected person; crew members who fail the pre-screening will not be permitted to travel to site. Face masks will be worn during air travel to the site. As per the Yukon Government guidelines, only staff arriving from outside British Columbia (BC), Yukon, NWT, and Nunavut will be required to self-isolate prior to their travel to site.

Throughout the duration of the Project, daily screening, including temperature checks will occur and workers will be instructed to monitor and report any symptoms they may develop. If a crew member reports a COVID-19 symptom, they will be isolated until a COVID-19 test result can be confirmed. Confidential documentation of Project information including crew member names, arrivals and departure details, and worker origin will be maintained for use in contact tracing as needed.

2.4 Fuel Storage

A draft Spill Response Plan has been developed and is available in **Appendix B**. The plan will outline the procedures to be followed in the event of a petroleum product spill during all phases of the Project. It will also include safety procedures for personnel and proper equipment usage during or after a spill.

Fuel (gas or diesel) will be stored in portable tanks (i.e. slip tanks), and tanker trucks, and small volumes of propane stored in 2 or 3 1000 gallon tanks at each wellhead will be stored at A-25 and E-78 to heat the 400 bbl tanks while waste wellbore liquid is being stored (prior to injection into the wells). Fuel volumes will not exceed 8,000 L in aggregate. Fuel storage will only occur during road construction and well maintenance and will be removed upon completion of these activities. All fuel caches will be located a minimum of 60 m from the high-water mark of any nearby watercourse, and fuel will be transported in tidy tanks or by tanker truck, as required. A fuel spill contingency plan will be posted at all storage areas and fuelling stations.

The fluid additives including potassium chloride, fluid inhibitor, and cement will be stored in the Chance laydown yard located at km 325 of the Dempster Highway. These materials will be stored in a dry trailer in their original packaging. The cement will be transported to site in a bulk trailer and stored in the laydown yard.

2.5 Waste Management

All garbage and recyclable materials will be taken off site and disposed of at a licensed disposal facility.

Once all the well testing and isolation procedures are complete, the tubing will be pulled from wells J-19 and G-08 (only these two wells have tubing present, of the wells planned for abandonment). If the tubing is deemed still usable, it will be stored at Chance's camp; if not, it will be transported to an approved recycling or disposal facility in Yukon, Alberta, or BC. Cement waste and wastewater will also be collected and transported to an approved disposal facility.

Waste wellbore fluid from the modern wells (stabilized KCl solution) will be transported to wellsites A-25 or E-78 and stored in the insulated tanks until injected into one of the active deep-injection wells. Wellbore fluid extracted from the legacy wells (diesel or stabilized crude oil) will be burned in the well maintenance skid boiler, which is used to heat the well maintenance equipment. These disposal methods minimize the distance the waste wellbore fluid must be transported for disposal, in turn minimizing Project-related traffic on public highways and spill potential. Wellbore fluid is a dilute potassium chloride solution (saline).

2.6 Project Schedule and Temporal Scope of Activities

Construction of the winter roads and well maintenance is anticipated to occur during the winter of 2020/2021. Initial site visits are expected to occur in late November or early December of 2020 and will be timed to coincide with occurrence of the minimum snowpack to enable crews to pack the access routes

using snowmobiles. Winter road construction is anticipated to occur in late December to February. Well maintenance activities are expected to commence in February and take up to 70 days to complete work at all 8 wells, with completion slated for mid-April 2021.

3.0 SUMMARY OF CONSULTATION

The Proponent recognizes the importance of consulting affected First Nations governments prior to making decisions about the Project.

3.1 Potentially Affected Parties

The Project and all Project activities are located within the Traditional Territories of VG and FNNND, as well as the Tetlit Gwich'in Secondary Use Area of the Gwich'in Settlement Region. The Project is also located to the north of TH Traditional Territory.

Based on the location of the Project either within a First Nation's Traditional Territory or in proximity to a First Nation's Traditional Territory (with the potential for indirect effects), the Project team identified the following First Nations as potentially affected parties:

- Vuntut Gwitchin
- First Nation of Na-Cho Nyäk Dun
- Gwich'in Tribal Council (GTC)
  - Tetlit Gwich'in Council (TGC)
- Tr'ondëk Hwëch'in

Engagement activities were designed to inform potentially affected parties of the Project and provide those parties with a reasonable opportunity to engage with the Project team, learn more about the Project, and provide input or feedback. Chance's approach to engagement was guided by existing engagement and communications plans that Chance has with each of the potentially affected First Nations identified above.

3.2 Summary of Engagement Activities

The following sub-sections provide brief summaries of engagement activities with each potentially affected First Nation.

3.2.1 Initiation

Written communication was sent via email to FNNND, the GTC (including the TGC), and TH to initiate engagement. Initial communication packages for these First Nations included a high-level overview of the Project (e.g., Project activities, components, goals, outcomes), the regulatory submissions Chance would be making, a brief introduction to Hemmera and its role, as well as a request to discuss any concerns the affected party may have and an offer to arrange a conference call should they so desire. Also included was a 4-page Project summary and map of the Project location.

A distinct communication package was sent via email to initiate engagement activities with VG. This package was structured in accordance with protocols outlined in the *Vuntut Gwitchin Government Oil and Gas Engagement Policy* (VG 2018). As such, this package included an earlier draft of the Project Description dated May 22, 2020.

3.2.1 Vuntut Gwitchin

Initial notification was sent to VG's Director of Natural Resources on May 25, 2020. VG and Chance organized a conference call July 9, 2020 wherein VG requested a high-level overview of the Project. VG asked Chance questions to attain additional information for the First Nation to complete their review of the draft Project Description dated May 22, 2020. To assist Chance in preparing meeting materials for the July 9th meeting, VG provided an agenda and questions ahead of time. On July 10, 2020, VG provided Chance with formal information requirements related to the Project. VG requested the following additional information:

- Mitigation measures to avoid or minimize potential environmental effects (specifically with respect to Porcupine Caribou)
- Regulatory context
- Well tests (e.g., varying tests between the wells, how Chance would address evidence of gas migration, what would be done with removed fluid)
- Project components (e.g., which materials would be stored on site, which materials will be incinerated, vehicles planned to be used)
- Water withdrawal (e.g., sources, volume, schedule).

The additional information requested by VG was gathered, drafted, and refined during the effects assessment and development of the Project Proposal. However, feedback from VG impacted the development of mitigation measures and contributed to identifying additional information that was not provided in the earlier draft of the Project Description and the Project Proposal as a whole (e.g., additional information on the regulatory context and the rationale for maintaining the wells in suspended well status versus abandonment).

Chance responded to VG in the format requested on July 22, 2020. This document can be provided upon request. In addition, Chance shared a draft of the Project Proposal with VG on July 22, 2020. In the coming weeks, Chance will be initiating discussions with VG to meet benefit agreement requirements under section 68 of the *Yukon Oil and Gas Act*, RSY 2002, c.162 (YOGA).

3.2.2 First Nation of Na-cho Nyäk Dun

Initial notification was sent to FNNND on May 25, 2020. Additional communications followed on June 9, June 24, and July 20, 2020. Chance did not receive feedback from FNNND while the Project was being refined or when the Project Proposal was being drafted. A draft of the Project Proposal was shared with FNNND July 24, 2020.

Chance looks forward any feedback FNNND may provide in the future and to initiating discussions with FNNND to meet benefit agreement requirements under section 68 of YOGA.

3.2.3 Gwich'in Tribal Council

Chance initially notified the GTC and TGC on May 25, 2020. On June 12, 2020, the GTC provided input from its departments of Lands and Resources, Cultural Heritage, and Economic Development. The following themes were raised by the GTC:

- High environmental standards in the Peel River watershed and protection of scattered wetlands within the LMU 7
- Protection of wildlife and wildlife habitats
- Protection of the environment, water quality and quantity, and risks related to potential spills
- Protection of cultural heritage resources and values.

The GTC also requested that Chance share the Project Description and any other materials related to the Project that might be available. Chance sent a draft Project Description dated May 22, 2020 to both the GTC and TGC; however no other materials (e.g., effects assessments, summaries of mitigation measures, management plans) were available at that time.

The GTC's original feedback helped Chance select VCs, identify mitigation measures, and identify where additional detail was needed in the Project Description. Chance provided a response to the GTC on July 9, 2020. Chance and the GTC then organized a conference call for July 22, 2020, and parties were able to further discuss the Project. During this call, Chance provided an update to the GTC regarding changes that had been made to the Project design since the draft Project Description dated May 22, 2020 and GTC posed follow-up questions to Chance about potential Project-related impacts. A draft of the Project Proposal was subsequently shared with the GTC and TGC on July 24, 2020. The GTC also flagged potential services that Gwich'in businesses might be able to offer Chance and inquired as to what Project-related employment opportunities would be available. Chance indicated that it welcomes the opportunity for additional discussions with the GTC to identify and facilitate potential economic development and employment opportunities. Chance will balance these interests with requirements to source specific equipment and professions for the maintenance work as well as requirements under section 68 of YOGA (i.e., benefits agreements with Yukon First Nations).

3.2.4 Tr'ondëk Hwëch'in

Initial notification was sent to TH on May 25, 2020. A conference call was organized between Chance and TH for June 17, 2020. The purpose of that meeting was for Chance to provide an overview of the Project and an opportunity for TH to ask questions and provide feedback on the Project. During the conference call, TH requested to be identified as a potentially affected First Nation. While Project activities will not occur in TH Traditional Territory, TH will be indirectly affected by activities (e.g., increased traffic, impacts to wildlife in the region). TH also requested additional information on the following themes:

- Potential risks associated with the Project and identified mitigation measures
- The Project's Wildlife Management Plan and how Project activities would be affected if Porcupine Caribou are in the area (possibly the 40 Mile Caribou Herd and Hart River Caribou Herd).

TH also recommended that Chance research the availability of traffic data in the Project area and surrounding region. Knowledge of the available traffic data in the region would inform Chance on any additional baseline studies Chance may need to conduct for future Project proposals.

At the time of the initial call between Chance and TH, no other materials were available (e.g., effects assessments, summaries of mitigation measures, management plans); however, Chance shared the draft Project Proposal with TH when it was completed on July 24, 2020.

3.3 Ongoing Engagement Activities

Chance remains committed to engaging with potentially affected First Nations, welcomes opportunities to discuss the Project in more detail, and looks forward to their input and involvement throughout the Designated Office evaluation process.

4.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS ASSESSMENT METHODOLOGY

The assessment methodology outlined in this section provides a structured framework that is consistently applied to all VCs. Chance considered the Proponent's Guide to Project Proposal Submission to a Designated Office (YESAB 2010) when developing the methodology for the Project's effects assessment. This methodology includes definitions and descriptions of assessment terms such as VCs, which are defined as elements of the environmental and socio-economic systems valued for environmental, scientific, social, aesthetic, or cultural reasons.

The assessment methodology for VCs follows the main steps described below:

- Conduct assessment scoping (i.e., identify VC subcomponents and establish assessment boundaries).
- Establish baseline and existing conditions.
- Identify Project-related interactions and potential effects.
- Apply mitigation measures to address potential effects.
- Conduct effects characterization and significance determination.

4.1 Assessment Scope

The scope of the effects assessment focuses on the Project activities with the greatest potential to cause significant adverse effects on selected VCs. The VCs for this assessment were selected based on Project relevance and importance to First Nations, government agencies, and stakeholders, as well as previous assessment documents for related oil and gas and winter road projects in Yukon. The VCs selected for the Project are discussed further in **Section 5.0**.

4.2 Establishing Assessment Boundaries

Assessment boundaries have been identified to define the spatial and temporal extent of the assessment. The spatial assessment boundaries are based on the spatial characteristics of the Project and the VCs, and the areas where the Project–VC interactions and effects are expected to occur. Temporal boundaries encompass periods when the Project is expected to affect VCs and were determined based on the timing and duration of the Project. The spatial and temporal boundaries for the assessment of the Project are defined in **Table 4-1**.

Table 4-1 Spatial and Temporary Boundary Definition

Boundary	Definition
Spatial Boundaries	The spatial boundaries of the Project area are outlined in **Figure 2-1**.
Temporal Boundaries	The temporal boundaries for the Project's assessment cover the construction, operation, and maintenance of the winter roads and maintenance of the wells. To include permitting and construction timelines with some contingency, the temporal scope of this assessment is 2 years.

4.3 Establishing Baseline Conditions

The first step in performing an environmental and socio-economic effects assessment is to understand the existing environmental and socio-economic conditions present within the assessment area. A number of sources were consulted to help characterize the existing environmental and socio-economic conditions within the Project area including historic literature, recent technical reports, databases, monitoring programs, government information, and first-hand knowledge. A summary of existing conditions is provided as part of each VC assessment to establish the setting for the assessment of Project-related effects on each VC. The level of detail provided for the existing conditions is sufficient to enable potential Project–VC interactions to be identified and understood.

4.4 Identifying Project-Related Interactions and Potential Effects

A key step in performing the environmental and socio-economic effects assessment is to understand the Project-related activities and how they might interact with the selected VCs. The intensity of the interaction will result in the potential effect on the VC and will ultimately dictate the mitigation measures implemented to minimize the effect of that interaction. The intensity of the interaction can be defined as “none,” “negligible,” or “potential.” All Project components and activities that will not interact with a VC and will not result in potential effects are not considered further in the assessment. If a potential interaction is predicted, a potential effect is identified and carried forward in the assessment. Mitigation measures are developed when there is potential for the effect to be significant.

Consistent with direction provided in YESAA, each VC assessment section includes descriptions of mitigation measures relevant to the VC to eliminate, reduce, or control adverse Project-related effects, as well as mitigation measures contained in industry codes and standards. The effectiveness of mitigation measures in reducing the potential effect is considered in the characterization of effects.

4.5 Characterization of Effects and Determination of Significance

Effects are characterized for each VC and the potential Project-specific effects are predicted following the implementation of the mitigation. Effects are characterized based on their direction, magnitude, geographic extent, timing, frequency, duration, reversibility, and probability of occurrence. In addition, each VC assessment section provides a description of the relative context for the assessment in terms of the resiliency and sensitivity of the VC. General definitions for these characteristics are presented in **Table 4-2.**

Table 4-2 Residual Effects Characteristics

Residual Effect Characteristic	General Definition	General Rating
Direction	Identifies whether the residual effect will be adverse or positive	• Adverse • Positive
Magnitude	Size or severity of the residual effect relative to the existing condition of the VC, generally measured in terms of the proportion of the VC affected within the Project area, relative to the range of natural variation (or historic variation in the case of human environment VCs)	• Low • Moderate • High
Geographic Extent	Geographic area where the residual effect is likely to occur	• An area within the Project area
Timing	Occurrence of the residual effect with respect to a temporal attribute important to the VC (e.g., time of day, season, stage in life cycle, etc.)	• VC-specific
Frequency	How often the residual effect is likely to occur considering VC-specific temporal characteristics	• Infrequent • Frequent • Continuous
Duration	Length of time the residual effect to the VC is likely to persist, considering VC-specific temporal characteristics	• Short term • Long term • Permanent
Reversibility	Degree to which the residual effect can be reversed once the causal factors cease; irreversible effects are considered permanent	• Fully reversible • Partially reversible • Irreversible
Context	The extent to which the VC has been affected by past and present environmental and socio-economic processes and conditions, and its potential sensitivity to the Project-related residual effect, and its ability to recover from that effect	• Undisturbed • Disturbed • Resilient • Sensitive
Probability of occurrence	Likelihood that the residual effect will occur, considering the probability of a disturbance to actually be caused by the Project, or the likelihood that a specific mitigation will be successful	• Likely • Unlikely

The significance of effects on the VC will be assessed based on the effects characteristics, and the likelihood of each effect. The likelihood of the effect is in part determined by the scientific certainty relative to the quantification of the effect, the effectiveness of the proposed mitigation, and professional judgement based on prior experience in assessing effects and the known effectiveness of proven mitigation measures. The rationale for the determination of significance is provided for each VC.

5.0 VALUED COMPONENT SCOPING

This section identifies and presents information on the ecological, social, cultural, and economic VCs identified for the Project that form the basis of the assessment (**Section 6.0**). These components were selected based on the results of environmental and archaeological field studies, literature reviews, engagement and consultation with First Nations, and professional expertise. The VCs are described in **Section 5.1**, along with a rationale for their selection. The assessment in **Section 6.0** focuses on these VCs.

Potential VCs and VC subcomponents were selected based on the following criteria:

1. Their value as ecological, social, cultural, or economic factors
2. Spatial, temporal, and mechanistic ability to interact with the Project
3. The technical feasibility of conducting an assessment.

Ecological values included consideration of foundational environmental factors or processes, species of conservation concern (e.g., caribou), and more general information on species or processes that represent biodiversity. Social and cultural values were primarily based on current and historic human use such as hunting, recreation, and heritage values. Economic values relate to existing or future use of resources to derive monetary benefits. Often, potential VC subcomponents can include multiple value types. For example, furbearers have ecological, cultural, and economic values.

VCs and subcomponents were also screened based on their ability to interact with the Project, including the degree of spatial and temporal overlap with the Project and mechanism to be affected by the Project. For example, birds are sometimes included as a VC subcomponent for some project environmental assessments because of the numerous species that contribute to biodiversity and diverse habitat associated with the group. However, for this Project the potential to interact with biophysical VCs is low because most species have migrated south during the winter when the Project will be active and the Project has low potential to affect the few resident birds that are present in the Project area.

Finally, technical feasibility was considered for selection of VC subcomponents. These criteria relate to technical factors that could affect the effects assessment, such as the availability of baseline data or the level of understanding of how the Project could affect a VC subcomponent.

Potential VCs that were considered in the scoping exercise but were not carried through for assessment are described in **Section 5.2**. These issues were investigated for potential interactions with the Project and were determined to not require further assessment. **Section 5.2** provides a description of the issues, and a rationale for not including some candidate VCs as Project VCs. Mitigation measures and best practices are also identified for these issues where applicable.

5.1 Valued Components Selected

The VCs selected for assessment are wildlife and wildlife habitat, vegetation and wetlands, and heritage resources. The rationale for selecting these VCs and specific subcomponents for assessment within each VC are provided below.

5.1.1 Wildlife and Wildlife Habitat

Wildlife and wildlife habitat were selected as a VC because there is a potential for interaction between Project activities and wildlife and wildlife habitat, which are considered important ecological components for aesthetic and cultural reasons and are subsistence food sources. Sensitive species and habitats will be given special consideration within this VC assessment. The indicators used to describe and evaluate potential Project-related effects on wildlife and wildlife habitat include habitat, movement and distribution, and mortality or injury.

As a group, wildlife encompasses numerous taxa with diverse habitat requirements. Effects assessments for most resource development projects include a suite of species or species groups as subcomponents to represent the diversity encompassed within the wildlife VC. The suite of species and species groups that were considered during VC selection are outlined in **Table 5-1**. Based on the selection process, caribou (*Rangifer tarandus*) and moose (*Alces alces*) were selected as VC subcomponents for the Project's effects assessment.

Table 5-1 Summary of Selection Process for Wildlife Valued Components

Potential Subcomponent	Value (Ecological, Social, Economic)	Potential to Interact with Project (Spatial, Temporal, Mechanism)	Evaluation Outcome
Caribou	High. The Porcupine Caribou Herd is highly valued for subsistence hunting and is associated with both cultural and ecological values.	Moderate. The Project occurs within the Porcupine Caribou Herd's winter range, and Project activities will occur when caribou may be present; however, caribou do not use the Project area every year. If caribou do occur, the Project may affect local movements and habitat availability.	Selected as a VC subcomponent
Moose	Moderate. Moose are valued as a secondary species for subsistence hunting, after caribou.	Moderate. The Project occurs within annual moose range and Project activities could have a localized effect on moose distribution and habitat availability.	Selected as a VC subcomponent
Furbearers	Moderate. Marten and lynx have high cultural and moderate economic value for trapping, but the area has not been actively trapped for several years.	Low. The Project occurs within marten and lynx ranges, but these species tend to be tolerant or adaptive to low levels of industrial work, as required for this Project. The Project will not create new snowmobile access.	Not selected as a VC subcomponent, but mitigations are provided
Grizzly Bears	Moderate. Grizzly bears are often a species of conservation concern because they occur at low densities and can be sensitive to human disturbance.	Very Low. Grizzly bears will be denning while the Project is active and the chance of a den occurring near work areas is very low.	Not selected as a VC subcomponent, but mitigations are provided
Wolves	Moderate. Wolves play an important role in large mammal predator-prey relationship in northern ecosystems; however, they generally have low social and economic value.	Low. Wolves occur within the Project area but tend to relatively tolerant or adaptive to low levels of industrial work, such as required for this Project.	Not selected as a VC subcomponent; no specific mitigations
Birds	Moderate. Birds are often included as a VC subcomponent in effects assessments because numerous bird species contribute to biodiversity and have diverse habitat associations.	Very Low. The Project has very low potential because the majority of birds in the area are migratory and will be on their wintering grounds, the timing of work is outside the breeding season when birds may be sensitive to disturbance, and effects to bird habitat will be very limited.	Not selected as a VC subcomponent; no specific mitigations

5.1.2 Vegetation and Wetlands

Vegetation and wetlands were selected as a VC because there is a potential for interactions with Project activities, and because of their role supporting biodiversity and wildlife habitat. Further, vegetation and wetlands are valued by First Nations and local residents who may use certain species as a subsistence and economic resource. Project activities may disturb, change, or remove vegetated areas, habitat containing traditional and medicinal plants, and ecological communities that may host rare plants or wetlands.

5.1.3 Heritage Resources

Heritage resources were selected as a VC since the potential for interactions with Project activities and the value of heritage sites and historic resources rests within their context in the landscape where they are located. Once disturbed or removed, that value cannot be restored. Heritage resources refers to archaeological, historical, and paleontological resources collectively (i.e., all are considered types of heritage resources). In Yukon, the *Historic Resources Act* (RSY 2002, c.109) and Archaeological Sites Regulation contain legislation that mandates the management and protection of Yukon archaeological, historical, and paleontological resources. This legislation applies to heritage resources on both private and public land that are older than 45 years. Archaeological, historical, and paleontological resources are protected from unpermitted surveys, disturbances, alterations, or excavations.

5.2 Other Considerations

Other candidate VCs considered for this Project Proposal but not included in the effects assessment include fish and fish habitat, groundwater and groundwater quality, permafrost, air quality, fish and wildlife harvesting, community safety and well-being of Indigenous peoples; tourism and aesthetics; economic activity; land use and recreation; traditional land use; health and safety; and site access and traffic.

5.2.1 Fish and Fish Habitat

While fish and fish habitat are recognized as important values in the Eagle Plains area, they are not included as VCs for this Project due to the negligible potential for interaction with the Project. No direct effects to fish and fish habitat are expected to occur because access roads do not cross any streams and all well sites and access roads are greater than 200 m from mapped water courses or waterbodies. Indirect effects such as sedimentation or water quality are deemed to be negligible because winter roads have minimal effect on natural drainage patterns and do not expose soil for sediment transfer (i.e., there will be no ditching along the winter roads and the duff layer and ground vegetation will be protected).

5.2.2 Groundwater and Groundwater Quality

Groundwater and groundwater quality was considered as a potential VC for the assessment based on the use of wells NCY McParlon A-25 and East Chance E78 for deep well injection. Given the nature of deep well injection and the maintenance activities, there is no anticipated interaction between proposed activities and groundwater in the Eagle Plains area.

The characteristics of the A-25 and E-78 wells and the nature of deep well injection address potential interactions and effects in relation to deep well injection and groundwater. The geological formations proposed for injection are hundreds of metres below the surface. The depth of the proposed zones for injection at A-25 are either or both of Permian aged Jungle Creek sandstone formation which is situated

between approximately 1,063 and 1,102 metres and the Orange Marker which is situated between approximately 768 and 780 metres subsurface. The depth of the proposed zone for injection at E-78 is the Cretaceous aged Fishing Branch sandstone which is situated between approximately 483 and 510 metres subsurface.

Above each of the zones planned for injection are thick (i.e., hundred of metres) of shales that are exceptionally low permeability rocks which means that they serve as very effective barriers to fluid flow. In addition, permafrost is a barrier preventing vertical migration of fluids and has been measured to a depth of about 220 metres subsurface at the J-19 location.

Finally, the entire casing of both wellbores, meaning the annular space between the outside of the steel pipe (i.e., casing) and the country rock surrounding the well bore, has been cemented to prevent and flow to surface outside the casing. The collective effect of these design criteria of the well bores themselves and the geological setting surrounding the geological formations planned for injection prevents migration of injected fluid outside of the injection interval. As such, it is highly unlikely that injected fluid will migrate and interact with groundwater in the Eagle Plains area.

5.2.3 Permafrost

Permafrost was considered as a potential VC for the assessment; however, the timing of Project activities (in the winter) and the relatively short duration of the Project greatly limit any potential effects on permafrost in the area. Additionally, the methods proposed for winter road construction are designed to reduce ground disturbance by mulching large vegetation (trees) rather than pushing it over with a bulldozer, which could potentially pull up root systems and expose underlying sediments. Winter road construction will leave the surface organic mat (moss and peat) intact and uncompressed, thereby minimizing effects on permafrost.

Winter roads actually promote penetration of wintertime cold into the ground due to higher thermal conductivity of ice than adjacent snow, and this response will help counteract any minor reduction in cold penetration below road-edge berms. Excess accumulation or snow piling will not occur to avoid potential effects on local ground temperatures. In addition, since well maintenance activities are not anticipated to adversely affect permafrost, this candidate VC was not considered further in the Project's effects assessment.

5.2.4 Air Quality

Air quality was considered as a potential VC for the assessment; however, given the remoteness of the Project site and the relatively short duration of the Project, the air quality within the Project area will not deteriorate with the re-establishment of the winter roads or well maintenance activities. The Project will involve burning fossil fuels to operate the equipment used for the winter roads and maintenance activities, although emissions from equipment will be relatively low and localized to the areas of active construction and at each well. Additionally, the construction phase of the Project is only projected to last 1 winter, at which point air quality will return to baseline conditions and will not have a lasting effect on local air quality. For these reasons, air quality was not considered further in this effects assessment.

5.2.5 Fish and Wildlife Harvesting

Fish and wildlife harvesting were considered as a potential VC given the importance of this activity for both traditional and subsistence purposes. In this context, harvesting includes hunting, fishing, and berry picking.

Harvesting is important for First Nations to maintain their connections to their Traditional Territories and helps to preserve and enhance their culture, identity, and values. Since Project activities will be located primarily in previously established well sites and where roads have historically been constructed, effects to opportunities to practice harvesting caused by the Project are anticipated be minimal. If Project activities overlap spatially and temporally with Porcupine Caribou Herd migration, there could be potential interactions between Project activities and caribou hunters, specifically related to human health and safety. Any future adverse effects caused by these interactions will be mitigated by implementation of measures described in **Section 6.1**. Therefore, fish and wildlife harvesting were not considered further as a VC in this assessment.

5.2.6 Community Safety and Well-being of Indigenous People

Community safety and well-being of Indigenous peoples were considered as a potential VC in response to the Calls for Justice for Extractive and Development Industries from the National Inquiry into Missing and Murdered Indigenous Women and Girls (2019b). Resource extraction and development projects can exacerbate issues of violence against Indigenous women and girls (MMIWG 2019a).This potential VC was not carried forward in the assessment due to the Project's approach to staffing the site. Staff will not be spending time in nearby communities or along public roadways during their transit to site and instead will arrive onsite via a fixed wing aircraft directly to either the Chance airstrip or the Wiley airstrip.

5.2.7 Tourism and Aesthetics

Tourism and aesthetics were considered as a potential VC due to the Klondike and Dempster Highway's use as a popular tourism route in the territory. Two of the wells are located immediately adjacent to the highway and already have access routes with rig matting in place. These wells will be visible to the public; however, tourism and aesthetics were not carried forward in the assessment because the Project activities likely to affect tourism and aesthetics will be limited to the construction period during winter of 2020 and 2021, during the tourism off season. Project activities will also be localized to the areas of active construction and will return to baseline conditions following the end of the construction period.

5.2.8 Economic Activity

Economic activity in the area surrounding the Project site was considered as a potential VC because it has been identified as an area of interest for the affected First Nations. The Project will have limited interaction with local businesses aside from necessary stops (i.e., fuel stations) by resource delivery drivers during construction and is therefore not considered further in this assessment.

5.2.9 Land Use and Recreation

Land use and recreation were considered as a potential VC given the high volume of traffic along the Dempster Highway and use of the area for land use activities and recreational purposes. The Project is not likely to overlap with land use and recreation activities potentially occurring in the area, however. Effects will be localized to the areas where roads had previously been built and to previously established well sites and camp facilities. Furthermore, the proposed activities are anticipated to be completed during the course of 1 winter (December 2020 to March 2021). As a result, Project activities are not expected to have lasting interactions with land use and recreation beyond the Project's construction schedule and is therefore not considered further in this assessment.

5.2.10 Traditional Land Use

Traditional land use was considered as a potential VC for the Project. Give the location of the Project, Project activities are not expected to have lasting interaction with traditional land use beyond the Project's construction schedule; therefore, this candidate VC was not considered further in this assessment. In addition, the Project is not likely to overlap with land use and recreation activities potentially occurring in the area. Effects will be localized to the areas where winter roads had previously been built and to previously established well sites and camp facilities, and the proposed activities will be completed during 1 winter (December 2020 to March 2021).

5.2.11 Site Access and Traffic

Site access and traffic were considered a potential VC for the assessment given the high volume of traffic along the Klondike and Dempster Highway and a potential increased level of access among travellers to the surrounding lands and site area via the winter access road that will be constructed for the Project. Due to the implementation of security measures (including a gated entrance) at the commencement of re-establishing the winter access roads, this candidate VC was not considered further in the assessment.

6.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS ASSESSMENT

6.1 Wildlife and Wildlife Habitat

This section presents the results of the effects assessment on wildlife and wildlife habitat, specifically, caribou and moose. Existing conditions are provided in the sub-section that follow, along with a discussion of potential Project-wildlife interactions and effects, as well as mitigation measures, effects characterization, and significance determinations for caribou and moose.

6.1.1 Existing Conditions

6.1.1.1 Caribou

The Project occurs exclusively within the range of the Porcupine Caribou Herd. In addition, during transport of equipment to and from the Project, likely from Alberta or northeastern BC, truck drivers will travel through the migration routes of several additional caribou herds, including the Forty Mile Herd and the Hart Herd along the Dempster Highway. However, the incremental amount of additional Project-related traffic will be small compared to regular highway traffic; as such, the effects of travel to and from the Project are not included in this assessment. Project equipment comprises approximately 2 dozen trucks travelling to and from the Project area over a 3 to 5 day period.

The Porcupine Caribou Herd is a subpopulation of barren-ground caribou, which is known for large aggregations of individuals, dramatic population fluctuations, lengthy migrations, and significant cultural and social value to northern Indigenous peoples and other Canadians (COSEWIC 2016). Barren-ground caribou have been assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2016). Within Yukon barren-ground caribou are considered Vulnerable/Apparently Secure (Yukon Government 2020). Although many barren-ground caribou are declining, the Porcupine Caribou Herd has been increasing at a rate of approximately 4% from 123,000 animals in 2001 to 218,000 in 2017 (Yukon Government 2018).

The Porcupine Caribou Herd's annual range extends approximately 250,000 square kilometres (km^2) from Alaska, through Yukon, and into the western edge of NWT. The herd undertakes long-distance migrations across seasonal ranges necessary for key aspects of their life cycle. Seven primary life cycle periods occur for the Porcupine Caribou Herd, which are summarized in **Table 6-1** (PCTC 1993). The timing of this Project (December to mid-April) coincides with the early, mid, and late winter season and the spring, spring migration, and pre-calving season of the Porcupine Caribou Herd.

Winter is considered the season of lowest importance to the herd (PCTC 1993). The herd is at its most dispersed stage during winter, both in terms of the extent of the range it uses and in terms of group aggregations. Average daily movement distances (2 km per day [km/day] to 5 km/day) (Russell and Gunn 2017) are lower than other seasons, except for cows during calving.

Winter range use varies from year to year depending on snow depth and condition. In Yukon during deep snow years, use is concentrated in the Richardson Mountains and the Ogilvie-Hart basins. In low snow years, the Whitestone River and Eagle Plains areas, which contain abundant lichen resources, are used more. Forage for primarily lichens is generally not limiting during the winter, and in shallow to normal snow years, the caribou appear to maintain neutral to surplus energy balances. The Porcupine Caribou Herd are relatively tolerant to human activity during the winter (PCTC 1993).

During the spring, spring migration, and pre-calving season, caribou begin moving north toward the calving grounds. Average daily movement rates increase from approximately 6 km/day at the start of the season to approximately 24 km/day through May. Caribou, especially pregnant cows, typically enter an energy deficit during spring due to reduced forage availability as they leave the lichen-rich taiga and before forbs have emerged; in addition, higher energy expenditure is associated with migration. Spring is rated as higher in importance than winter, but still relatively low overall, due to lack of association with specific habitats, relatively low threats from predators, and lack of insect harassment (PCTC 1993).

No key wildlife areas occur for caribou within the Project area (Environment Yukon 2016a).

Table 6-1 Key Life Cycle Periods for the Porcupine Caribou Herd

Season	Dates	Characteristics	Importance
Early, mid, and late winter	Dec. 1 – Mar. 31	The herd is at its most dispersed at this time across 2 winter ranges: in Yukon, mostly south of the Porcupine River in boreal taiga and in Alaska, centred in the Chandalar River/Arctic Village area. Winter range use varies from year to year depending on snow depth and condition. Caribou at this time of year are relatively tolerant to human activity. In shallow to normal snow years, animals can gain weight.	4 (Lowest)
Spring, spring migration, and pre-calving	Apr. 1 – May 31	Herd distribution varies depending on snow melt; migration routes vary from year to year. Pregnant females are typically in energy deficit due to reduced forage once they leave the lichen-rich taiga.	3
Calving (cows)	June 1 – 10	Calving occurs on the coastal plain of NE Alaska and, to a lesser degree, NW Yukon. This area offers reduced predators and abundant spring forage; no alternative range is available. Cows are at the lowest point of physical condition and are least tolerant to human disturbance.	1 (Highest)
Post-calving and movement (cows)	June 11 – 30	As calves develop over the first 2 weeks of life, the cows and calves tend to aggregate into larger groups and increase movement rates to track plant green-up. The post-calving period imposes high energetic demands on lactating females, and cow/calf groups are relatively intolerant of disturbance. The post-calving range is primarily in Alaska and cows that calved in Yukon tend to move west along the foothills into Arctic National Wildlife Refuge. Insect avoidance can affect distribution by the end of June.	1 (Highest)
Calving to movement (bulls)	June 1 – 30	Bulls, non-pregnant cows, and subadults tend to concentrate east of the calving grounds in northern Yukon. Animals track the progression of green-up from the coastal plains to the northern foothills and into intermountain regions.	3
Early summer	July 1–15	Cows continue to require high-energy intake for milk production, but insect avoidance also drives distribution. Key areas selected for insect avoidance are the coastal plain adjacent to the Beaufort Sea (mostly cows/calves) and mountains in the Brooks and British Mountains (mostly bulls and cows without calves). Long-distance movements during this period are also an insect avoidance behaviour.	2
Mid-summer	July 16 – Aug. 7	Mid-summer continues to be a period of high insect harassment. Two areas are consistently used – the northern Richardson Mountains in Yukon and the southern portion of the Brooks Range in Alaska. Females with cows may be in energy deficit.	2
Late summer and fall migration	Aug. 8 – Oct. 7	As insect activity declines, the herd disperses widely but mostly stays north of the tree line until the latter part of the period – in Alaska south of the Brooks Range and in Yukon north of the Porcupine River. Animals exhibit high feeding rates and gain fat for the winter.	3
Rut and late fall	Oct 8 – Nov 30	The region where rut occurs has no affinity from year to year; rut occurs wherever the herd happens to be along fall migration. In Yukon distribution can occur from the southern Olgilvie Mountains to the Richardson Mountains.	4 (Lowest)

Source: PCPC 1993

6.1.1.2 Moose

Moose occur throughout the Project area and are present in all seasons; however, population levels are poorly known. The Regional Biologist with Environment Yukon has suggested that the density of moose in Eagle Plains is low compared to populations in central and southern Yukon, but relatively high compared to other areas in northern Yukon, and may be rising (M. Suitor, pers. comm.). Extensive wildfires within the Eagle Plains area over the last 30 years are currently in shrub-dominated successional stages that offer productive summer and winter forage for moose, which are expected to support higher numbers of moose than later successional black spruce forests. In November 2000, an aerial moose survey was conducted for a study area that mostly overlapped with the Project area for this Project (Access and EBA 2001). That survey observed 30 moose and estimated a total population of 60 to 90 based on additional tracks seen and a low sight ability factor.

Winter is normally a limiting season for moose when reduced forage, higher energy expenditures due to snow and cold, and higher vulnerability to predation all contribute to limit moose fitness. During winter, moose are primarily associated with shrub-dominated habitats for forage, which include regenerating burns, riparian areas, shrub-carrs, wetlands, stream valleys, and upland deciduous and mixed forest (Suring and Sterne 1998, Environment Yukon 2016b, McCulley et al. 2017). In other regions in Yukon, moose typically use higher-elevation areas in early winter and move to lower elevations in late winter to avoid deep snow and utilize habitats such as riparian areas with shrubs for forage (Environment Yukon 2016b). It is unverified whether migration this occurs in the Project area, but winter snow depths often exceed 50 cm in the Eagle Plains area (Russell and Gunn 2017), which is the threshold at which moose tend to exhibit winter movements to seek lower snow packs (Poole and Stuart-Smith 2005).

No Wildlife Key Areas for moose occur within the Project area (Environment Yukon 2016a)

6.1.2 Project Interactions and Potential Effects

Potential effects to VC subcomponents were evaluated based on the degree of spatial and temporal overlap between Project activities and the VC subcomponents and the type of interactions the Project could have on the VC subcomponents. Types of interaction include both direct effects, such as displacing animals due to sensory disturbances, and indirect effects, such as increasing mortality risk from hunters or natural predators. Project activities and interactions could result in effects to wildlife and wildlife habitat during 3 primary Project stages (**Table 6-2**).

Table 6-2 Potential Interactions between Project Activities and Wildlife and Wildlife Habitat

Activity	Project Interactions	Potential Effects
Winter road construction	• Vegetation removal • Use of heavy equipment • Human presence	• Sensory disturbance • Localized effects to movement and distribution • Direct and indirect habitat effects
Road travel (along the Dempster Highway and winter roads)	• Vehicle travel	• Sensory disturbance • Localized effects to movement and distribution • Indirect habitat effects • Direct and indirect mortality

Activity	Project Interactions	Potential Effects
Well site maintenance	• Vegetation removal • Use of heavy equipment • Human presence	• Sensory disturbance • Localized effects to movement and distribution • Mortality or injury

6.1.2.1 Project Interactions with Caribou

A detailed assessment of potential effects of oil and gas activities in Eagle Plains on caribou was conducted by Russell and Gunn (2017). This assessment draws from their work and has been adapted to align with the limited scope of this Well Maintenance Program.

There is increasing evidence that ungulates, including caribou, tend to respond to human presence and activities in similar manners to how they respond to predators (Frid and Dill 2002). The most common response of caribou is to avoid human activity areas or exhibit greater vigilance behaviours. Reported response distances of caribou vary widely but are mostly in the magnitude of several hundred metres (e.g., 600 m) (Murphy and Curatolo 1987). Caribou may also change their distribution relative to disturbance. In most studies, avoidance of roads is less than 4 km (Vistnes and Nellemann 2001, Cameron et al. 2005), but avoidance of the Dempster Highway varied from 18 km to 30 km over a 20-year period depending on land use and hunting regulations (Johnson and Russell 2014). Caribou responses to human disturbances vary widely, and causal relationships are often poorly understood.

Caribou patterns of avoidance to human disturbances are often affected by the nature of the human activity, specifically, whether caribou are directly hunted or harassed by humans, and time since disturbance began. Reduced behavioural response and apparent avoidance in distribution patterns (i.e., habituation) appear to be associated with lack of hunting and predation (Lawhead et al. 2006, Haskell and Ballard 2008), which highlights the importance of factoring hunting management into mitigations. However, effects on distribution can occur outside of hunted areas and several years after the disturbance began (Johnson et al. 2019).

Russell and Gunn (2017) frame their assessment in terms of sensitivity of the Porcupine Caribou Herd to potential effects and degree of exposure to effects. Sensitivity relates to factors such as herd size and trends, seasonal body condition, ecological life history activities, and environmental stressors such as insects. Caribou are generally more sensitive to effects when populations are low and declining, when their body condition is low, or when they are exposed to other stresses (e.g., insect harassment), and during critical life history periods, notably calving. In the context of the current condition of herd and the timing when Project interactions could occur, the sensitivity of the herd is considered low for the following reasons:

- The herd is at a historically high population level and showing an increasing trend.
- During winter when the Project would occur, Porcupine Caribou are typically in good body condition and free of stressors such as insects.
- The winter period is not associated with a critical life history stage.

Exposure relates to the degree of spatial and temporal overlap between caribou and potential human effects, as well as the mechanisms of effects (e.g., type, magnitude, and duration of effects). The most likely Project-related effects on caribou distribution will be localized and temporary, resulting in potential indirect habitat effects. The only potential source of direct mortality from the Project would be vehicle

collisions, and those can be effectively mitigated. Linear features can indirectly affect the caribou mortality rate caused by natural predators and hunters due to increasing ease of travel. Chance will minimize creating new linear features by re-establishing existing sections of the Chance and Blackie winter roads with short spur roads to access well sites where needed. In total, Chance will re-establish approximately 25 km of the Chance winter road with 2 new spur roads totaling 2.85 km, and approximately 5.95 km of the Blackie winter road with a 1.12 km spur road. The Project goal is to pose a neutral effect on hunting to help balance mitigating effects to caribou while maintaining Indigenous hunting opportunities. Although hunting will not be available along the Blackie and Chance winter roads, the Project will not inhibit Indigenous hunting opportunities in the broader area, which may be accessed from the Dempster Highway.

Russell and Gunn (2017) assessed the potential spatial and temporal overlap between the Porcupine Caribou Herd and a similar project, but with a slightly larger extent as this Project, using 30 years of telemetry data. Their primary analysis area was a 30 km buffer around the Project, based on the maximum distance that caribou avoided the Dempster Highway in another study (Johnson and Russell 2014). Russell and Gunn (2017) found that a collared caribou occurred in the 30 km buffer area during the months of January to April in 15% to 22% of the years. The average percentage of the herd using the 30 km buffer area ranged from 3% in January to approximately 1% in the period from February to April. Average residency times varied from 9 to 17 days per month during the January to April period. In other words, on average, 98% of the herd's movements during the winter occur outside the 30 km buffer surrounding the Project and, for any animal that does occur in the area, they typically spend a third to half of a month there before moving out of the area.

6.1.2.2 Project Interactions with Moose

Moose can be affected by human land use activities, although moose are generally less sensitive than caribou. As outlined below, Project activities could result in 4 types of effects to moose.

1. **Sensory disturbance:** Human presence, work activities, vehicle travel, and equipment operation will generate noise and other sensory effects that may elicit a response in moose. The most likely response to sensory disturbance is to avoid areas where disturbances are occurring, which could result in localized effects to moose movement and distribution as well as indirect habitat effects (Lykkja et al. 2009) (see 2 and 3, below, respectively). When moose are unable to move away from sensory disturbances, they may exhibit physiological stress responses and behavioural modifications (e.g., increased vigilance). However, these responses are not anticipated to occur for this Project because moose can move away from the work areas to avoid them.
2. **Localized effects to movement and distribution:** Numerous studies have examined responses of moose to human activities, including industrial activity, use of roads, and activities associated with rural residences (Andersen et al. 1996, Burson et al. 2000, Yost and Wright 2001, Lykkja et al. 2009). Most studies found avoidance of human activity areas out to approximately 300 m (EDI 2017). However, also in other cases moose appear to choose to be nearer to human activity to avoid natural predators (Muhly et al. 2011). Similar to caribou, responses are greatest when moose are directly harassed or hunted.
3. **Indirect habitat effects:** A consequence of localized avoidance of human activity areas is that habitat within the zone of influence is temporarily not used by animals. As per the effects on movement and distribution, the zone of influence for indirect habitat effects is approximately 300 m.
4. **Direct and indirect mortality:** The Project has the potential to directly affect moose mortality via vehicle collisions (EDI 2015). In addition, the Project could have an indirect effect on mortality by

improving access along the winter roads for human hunters and natural predators; however the mitigation measures presented in the sub-sections below are expected to effectively eliminate the risk of vehicle collisions.

6.1.3 Mitigation Measures

This section presents the mitigation measures developed to reduce and minimize Project-related adverse effects on wildlife and wildlife habitat.

6.1.3.1 General Mitigation Measures for Wildlife and Wildlife Habitat

The following general mitigation measures are proposed for wildlife and wildlife habitat:

- All Project personnel will be required to complete formal orientation and training related to wildlife mitigation measures.
- Work will be scheduled to minimize the spatial extent of concurrent Project activities.
- Access to the well sites will be provided by utilizing existing and historic winter roads, with short spur roads to access well sites in order to minimize the creation of new linear features.
- Project footprints, notably the widths of winter roads, will be minimized as much as possible. On the Chance Road, the width will not exceed the extent of the existing right-of way.
- Project personnel will be prohibited from carrying or using firearms on site. No hunting or shooting rules will be in effect.
- A policy of no harassment of wildlife will apply to all personnel including attempts to chase, catch, divert, follow, photograph, feed, or otherwise harass wildlife, whether on foot or from on-road or off-road vehicles, heavy equipment, or aircraft.
- The use of on-road and off-road vehicles, including snowmobiles, will be restricted to essential Project access routes.
- Personal use of unmanned aerial vehicles (UAVs) will be prohibited.

6.1.3.2 Road Operations

The following measures are designed to mitigate the risk of vehicle collisions and effects of road use on wildlife movements:

- Do not exceed the maximum speed limit along the Dempster Highway of 90 kilometres per hour (km/h).
- Do not exceed the maximum speed along winter roads of 30 km/h.
- Wildlife will always have the right-of-way. Stop when wildlife are observed on or beside the road and allow the wildlife to cross safely. If wildlife stays on the road or right-of-way for more than 5 minutes, resume travel and pass the animals at 10 km/h or less.
- When moose and caribou are on a road, they will sometimes run down the road away from a vehicle. If this happens, stop and wait at least 5 minutes to allow the animal to move off the road. If the animal remains on the road, drive forward at 10 km/h, then stop again when the animal begins to run away. Wait 2 minutes and repeat this procedure. If the animal still does not leave the road, wait 10 minutes and repeat the procedure, alternating with a 2- and 10-minute stop between driving attempts.

- Use two-way radio communication and communicate the location of any wildlife observed along Project roads to other road users on the radio.
- Do not exit the vehicle to chase, catch, divert, follow, photograph, or otherwise harass wildlife.
- Along winter roads, maintain snowbanks at heights of less than 1 m to reduce the hinderance to wildlife crossing them.
- Where snowbanks exceed 60 cm in height, create regular breaks (at least every 500 m) to facilitate easier animal crossing and create escape routes off the road.
- Create matched breaks on either side of the road that animals can use to cross.
- On corners, create run-outs in each direction that are obvious alternative routes for animals to use, instead of following the road.
- Avoid breaks at seismic lines, which could provide human access.

Special rules will apply to caribou within 100 m from the road:

- Stop as far back as possible.
- Alert other drivers.
- Wait until caribou have crossed and moved beyond 500 m from the road or are lost from sight before proceeding.
- Proceed with caution.

For caribou beyond 100 m from the road the following rules will apply:

- Proceed with caution.
- Alert other drivers.
- Watch for direction of movement and change in behaviour.

6.1.3.3 Aircraft Operations

The following measures are designed to mitigate the effects of aircraft use on wildlife:

- Maintain altitudes of greater than 300 m above ground level at all times of the year.
- Maintain altitudes of greater than 600 m above ground level during sensitive times of the year.
- Avoid areas where caribou have been observed in the past.
- Design flight paths to avoid important areas during sensitive times of the year.
- Do not fly toward, circle, or otherwise harass observed caribou.
- If caribou be in a panic or startled the plane will ascend to a higher elevation.

6.1.3.4 Caribou

The majority of potential effects to caribou will be mitigated via measure for general wildlife, road operations and aircraft operations. Additional measures specific to caribou:

- Do not pack snow on any linear features that are not essential to Project work.
- Minimize access to linear features off the winter roads by avoiding creation of breaks in snow berms at junctions with linear features.

- Report all sightings of caribou to the Environmental Monitor.
- If more than a dozen caribou are observed, or if any number of caribou are observed in the same location for longer than a 3-day period, consult a Qualified Environmental Professional (QEP) to determine if site-specific mitigations may be warranted.

Due to the variable nature of caribou occurrence and snow conditions from year to year, Chance will conduct a pre-operations assessment in December, prior to Project initiation, to assess local conditions and gain information about caribou occurrence and snow conditions, which could warrant tailored management measures. For example, if telemetry data indicate that several collared caribou have used in the Project area or are situated near work areas, additional measures may be implemented to mitigate potential effects.

6.1.4 Effects Characterization and Significance

6.1.4.1 Caribou

After application of mitigation measures listed in **Section 6.1.3**, Project activities are not predicted to result in significant effects to habitat, movement and distribution, and mortality or injury to caribou. Detailed effects assessments are provided for each indicator in **Table 6-3**, **Table 6-4**, and **Table 6-5**, respectively. The following key factors have been used to produce this significance determination:

- Although the timing of the Project does overlap with the potential occurrence of the Porcupine Caribou Herd in the area, the extent of the Project area, including a zone of influence, comprises a small proportion of the herd's total winter range. If caribou choose to avoid the work areas (i.e., due to sensory disturbance), alternative habitat will be readily available.
- The timing of the Project, during winter, is a season of lowest importance for the ecology of the Porcupine Caribou Herd and represents a period when the caribou are relatively tolerant of human disturbance (PCTC 1993).
- The most likely potential effect to caribou is temporary, localized avoidance of work areas due to sensory disturbance.
- Chance will minimize creating new linear features by re-establishing existing sections of the Chance and Blackie winter roads with short spur roads to access well sites where needed; thus, a change in access is not anticipated for human hunters and natural predators.

Table 6-3 Characterization of Potential Effects to Caribou Habitat

Potential Project Interaction with Caribou Habitat The Project will consist of work at 8 well sites plus access via approximately 34.92 km of winter roads. Project activities will result in direct habitat effects due to vegetation clearing along the access routes and well sites. The Project may also result in indirect habitat effects if caribou choose to avoid areas near the roads and well sites due to sensory disturbance or perceived predation risk.		
Residual Effect Characteristic	General Definition of Residual Effect Characteristic	Project Effect Characteristic Rating
Direction	Effects to habitat will be adverse.	Adverse
Magnitude	The magnitude of effects is low due to the small extent and narrow width of affected areas.	Low
Geographic Extent	Direct habitat will be limited to the footprint of the winter roads and well sites (approximately 60 ha). Indirect effects can extend out to 4,000 m, depending on site conditions and variation in caribou behaviour. These extents are considered small relative to the herd's total winter range.	Low
Timing	The timing of the Project, during winter, is a season of lowest importance for the ecology of the Porcupine Caribou Herd and a period when the caribou are relatively tolerant of human disturbance.	Low
Frequency	Direct effects will be continuous, though diminishing, in magnitude as vegetation regenerates. Indirect effects will be continuous during active Project work.	Continuous
Duration	Road and well site footprints will take years to regenerate, resulting in long-term direct effects. Indirect effects will be short term and will cease once work activities are completed.	Short term Long term
Reversibility	The effects to habitat are fully reversible. Indirect effects will cease immediately after work activities cease. Direct effects along the winter roads will take several years for vegetation to regrow.	Fully reversible
Context	Work for this Project will occur on previously disturbed sites. Measures to protect the duff layer and ground vegetation will maximize the resiliency of the site to regenerate to similar habitat.	Existing Disturbed/ Resilient
Probability of occurrence	Based on historic telemetry data caribou will likely encounter areas affected by this Project at some point in the future. The likelihood that caribou will be present during the year the Project is active is moderate (over 24, years collared caribou occurred within 4 km of the Project area in 17% of the years).	Likely

Table 6-4 Characterization of Potential Effects to Caribou Movement and Distribution

Potential Project Interaction with Caribou Movement and Distribution The Project will consist of work at 8 well sites and provide access via approximately 34.92 km of winter roads. This work will result in sensory disturbance that could cause caribou to avoid the areas. Responses to sensory disturbance will be mostly less than or equal to (≤) 4 km but will vary in relation to site conditions and caribou behaviour. Effects are most likely to be expressed as temporary, localized avoidance of work areas. No effects to migration are expected because the extent of the Project area is small relative to the extent of winter range available for caribou to travel through.		
Residual Effect Characteristic	**General Definition**	**Rating**
Direction	Effects to movement and distribution could be adverse.	Adverse
Magnitude	The magnitude of effects is predicted to be low due to the limited consequence if caribou choose to avoid work areas. Alternative habitat is available, and avoidance of the area would not hinder migration or sub-regional movements within the winter range.	Low
Geographic Extent	Responses to sensory disturbance are mostly ≤4 km but vary in relation to site conditions and caribou behaviour. These extents are small relative to the herd's total winter range.	Low
Timing	The timing of the Project during winter is a season of lowest importance for the ecology of the Porcupine Caribou Herd and a period when the caribou are relatively tolerant of human disturbance.	Low
Frequency	Potential effects to movement will occur daily and will correspond to periods when Project activities are active.	Frequent
Duration	Project work will occur daily for approximately 12 hours over an 8- to 12-week work period from mid-January to mid-April.	Short term
Reversibility	The potential effects to movement are fully reversible and will cease immediately upon cessation of work activities.	Fully reversible
Context	Oil and gas exploration activities have occurred intermittently in the Eagle Plains area over the last 50 years. Responses of caribou have not been studied in detail, but use of the area by caribou has continued, demonstrating general resiliency to exploration activities.	Existing Disturbed/ Resilient
Probability of occurrence	Based on historic telemetry data it is possible, but uncertain, that caribou will occur in the Project area when Project work is actively underway. Over 25 years, collared caribou occurred within 4 km of the Project area in 17% of the years.	Possible

Table 6-5 Characterization of Potential Effects to Caribou Mortality and Injury

Potential Project Interaction with Caribou Mortality and Injury The Project will consist of work at 8 well sites and provide access over approximately 34.92 km of winter roads. Road use has the potential to cause direct mortality to caribou via vehicle collisions; however, that risk has been reduced to negligible after implementation of mitigation. The Project may also have an indirect effect on mortality through packing of winter roads, which could enhance travel rates by wolves or improve access for hunters. This effect can be reduced if both caribou and wolves avoid work areas in response to human activity/sensory disturbance and if hunter access is restricted.		
Residual Effect Characteristic	**General Definition**	**Rating**
Direction	Effects to mortality or injury could be adverse.	Adverse
Magnitude	The magnitude of potential effects of direct mortality is negligible after mitigations are applied. The effects of indirect mortality are estimated to be low due to caribou and wolves potentially avoiding work areas and restricting hunter access.	Low
Geographic Extent	The winter roads total approximately 34.92 km; this extent is small relative to the herd's total winter range, and the number of caribou that are likely to encounter the road is small.	Low
Timing	The timing of the Project during winter coincides with the potential occurrence of the Porcupine Caribou Herd in the area.	Moderate
Frequency	The potential encounter rate between caribou and wolves or hunters along or adjacent to winter roads is unknown but will likely be infrequent due to factors listed above. Caribou would have the potential to encounter Project traffic daily (i.e., frequently), but the risk of mortality is negligible following mitigation.	Infrequent
Duration	Project work will occur approximately 12 hours per day over an 8- to 12-week work period from mid-January to mid-April.	Short term
Reversibility	The potential effects to mortality are fully reversible. Potential direct effects will cease immediately upon completion of work activities. Vegetation regeneration will take several years to reach a stage that will hinder travel by hunters and natural predators.	Fully reversible
Context	A network of winter roads and seismic lines exists in the area from past exploration. This work will not add significant new features, but it will clear some regenerating vegetation and temporarily pack snow, which could temporarily enhance access by hunters and natural predators.	Existing Disturbed/ Resilient
Probability of occurrence	Based on historic telemetry data it is possible, but uncertain, that caribou will occur in the Project area when work is active. Over 24 years, collared caribou occurred within 4 km of the Project area approximately 17% of the time. If caribou do occur in the area during the year that work occurs, there is a low probability that the Project will contribute to indirect mortality.	Unlikely

6.1.4.2 Moose

Following application of mitigation measures listed in **Section 6.1.3**, Project activities are not predicted to result in significant effects to moose habitat, movement and distribution, or mortality or injury. Detailed effects assessments are provided for each indicator in **Table 6-6**, **Table 6-7**, and **Table 6-8** for each indicator, respectively. The following key factors have been used to produce this significance determination:

- Although the timing of the Project does occur during winter, which is a sensitive season for moose, the extent of the Project area, including a zone of influence, comprises a small proportion of the winter range available to the species. If moose choose to avoid the work areas (i.e., due to sensory disturbance) alternative habitat is available.
- The most likely potential effect to moose is temporary, localized avoidance of work areas due to sensory disturbance.
- Chance will minimize creating new linear features by re-establishing existing sections of the Chance and Blackie winter roads, and new access will be limited to short spur roads to access well sites where needed, and will not result in a significant change in access for human hunters and natural predators.

Table 6-6 Characterization of Potential Effects to Moose Habitat

Potential Project Interaction with Moose Habitat The Project will consist of work at 8 well sites plus access via approximately 34.92 km of winter roads, which will result in direct habitat effects due to vegetation clearing along the access routes and well sites. Indirect habitat effects may also result if moose choose to avoid areas near roads and well sites due to sensory disturbance or perceived predation risk.		
Residual Effect Characteristic	**General Definition**	**Rating**
Direction	Effects to habitat will initially be adverse but may switch to positive for several years if shrubs regenerate on the winter roads.	Adverse/Positive
Magnitude	The magnitude of effects to habitat is low due to the small extent and narrow width of affected areas.	Low
Geographic Extent	Direct habitat will be limited to the footprint of the winter roads and well sites (approximately 60 ha). Indirect effects to habitat are mostly within 300 m, depending on site conditions and variation in moose behaviour. These extents are small relative to the total winter range available to moose.	Low
Timing	The timing of the Project, during winter, is a sensitive season for moose due to limited forage and higher energetic outputs due to snow and cold temperatures.	Moderate
Frequency	Direct effects will be continuous, though diminishing in magnitude, as vegetation regenerates. Indirect effects will be continuous when work activities are active.	Continuous
Duration	Direct effects to the road and well site footprints will take years to regenerate (long term). Indirect effects will cease once work activities are completed (short term).	Short term Long term
Reversibility	The effects to habitat are fully reversible. Indirect effects will cease immediately upon stoppage of work activities. Direct effects along the winter roads will extend several years as vegetation regrows.	Fully reversible
Context	Work for this Project will occur on previously disturbed sites. Measures to protect the duff layer and ground vegetation will maximize the resiliency of the site to regenerate to similar habitat. The extent of this Project, like other historic oil and gas disturbances, are small relative to that natural disturbances (i.e., fire) that affect moose habitat. Approximately two-thirds of the area along the Chance Road has burned in the last 30 years.	Existing Disturbed/ Resilient
Probability of occurrence	Moose are known to use the Project area in winter, and some moose in the area will encounter the Project-related effects on habitat.	Likely

Table 6-7 Characterization of Potential Effects to Moose Movement and Distribution

Potential Project Interaction with Moose Movement and Distribution The Project will consist of work at 8 well sites and provide access via approximately 34.92 km of winter roads. This work will result in sensory disturbance that could cause moose to avoid the areas. Responses to sensory disturbance are mostly less than or equal to (≤1) km but vary in relation to site conditions and moose behaviour. Effects are most likely to be expressed as temporary, localized avoidance of work areas. Moose do not normally make seasonal movements in the Eagle Plains area.		
Residual Effect Characteristic	**General Definition**	**Rating**
Direction	Effects to movement and distribution could be adverse.	Adverse
Magnitude	The magnitude of effects is low due to the limited consequence if moose chose to avoid work areas. Alternative habitat is available, and avoidance of work areas is unlikely to impair within-range movements.	Low
Geographic Extent	Responses to sensory disturbance are mostly ≤300 m but vary in relation to site conditions and moose behaviour. These extents are small relative to the total winter range available in the area.	Low
Timing	The timing of the Project, during winter, is a sensitive season for moose due to limited forage and higher energetic outputs due to snow and cold temperatures.	Moderate
Frequency	Potential effects to movement will occur daily and correspond to periods when Project activities are active.	Frequent
Duration	Project work will occur approximately 12 hours per day over an 8- to 12-week period from mid-January to mid-April.	Short term
Reversibility	The potential effects to movement are fully reversible. Effects will cease immediately upon cessation of work activities.	Fully reversible
Context	Oil and gas exploration activities have occurred intermittently in the Eagle Plains area over the last 50 years. Responses of moose have not been studied in detail, but use of the area by caribou has continued, demonstrating general resiliency to exploration activities. The extent of this Project, and historic oil and gas disturbances, are small relative to natural disturbances (i.e., fire that affect moose habitat and distribution).	Existing Disturbed/ Resilient
Probability of occurrence	Moose are known to use the Project area in winter and some of the moose in the area will likely encounter the work areas and experience sensory disturbance associated with Project activities in those areas.	Likely

Table 6-8 Characterization of Potential Effects to Moose Mortality or Injury

Potential Project Interaction with Moose Mortality or Injury The Project will consist of work at 8 well sites plus access via approximately 34.92 km of winter roads. Road use has the potential to cause direct mortality to moose via vehicle collisions; however, that risk is negligible after mitigations. The Project may also have indirect mortality effects via packing of winter roads, which could enhance travel rates by wolves or access by hunters. However, the potential for this effect will be reduced with both moose and wolves potentially avoiding work areas due to human activity/sensory disturbance and the decision to restrict hunter access for crew safety.		
Residual Effect Characteristic	**General Definition**	**Rating**
Direction	Effects to mortality or injury could be adverse.	Adverse
Magnitude	The magnitude of potential effects of direct mortality is negligible after mitigations. Effects of indirect mortality are estimated to be low due to potential avoidance of the work areas by both moose and wolves and hunter access management.	Low
Geographic Extent	The winter roads total approximately 34.92 km. This extent is small relative to the herd's total winter range, and the number of moose that are likely to encounter winter roads and well sites is small.	Low
Timing	The timing of the Project, during winter, is a sensitive season for moose due to limited forage and higher energetic outputs due to snow and cold temperatures.	Moderate
Frequency	The potential encounter rate between moose and wolves or hunters along or adjacent to winter roads is unknown, but is expected to be infrequent, due to factors listed above. Moose would have the potential to encounter Project traffic daily (i.e., frequent), but the risk of mortality is negligible after mitigation.	Infrequent
Duration	Project work will occur approximately 12 hours per day over an 8- to 12-week period from mid-January to mid-April.	Short term
Reversibility	The potential effects to moose mortality are fully reversible. Potential direct effects will cease immediately upon completion of work activities. Vegetation regeneration will take several years to reach a stage that will hinder travel by hunters and natural predators.	Fully reversible
Context	A network of winter roads and seismic lines exists in the area from past exploration. This Project will not add significant new features, but it will clear some regenerating vegetation and temporarily pack snow, which could temporarily enhance access by hunters and natural predators.	Existing Disturbed/ Resilient
Probability of occurrence	Moose are known to use the Project area in winter, and some of the moose in the area will likely encounter the work areas. However, following implementation of mitigation measures, the probability of direct and indirect mortality associated with Project activities is low.	Unlikely

6.2 Vegetation

The Project falls within the Taiga Cordillera Ecozone and Eagle Plains Ecoregion. Descriptions of the Ecoregion are drawn from the Yukon Ecoregions Working Group (2004). The following sections describe the known baseline information for vegetation and wetlands in these regions, the likely Project interactions and potential effects resulting from Project activities, mitigation measures to reduce or eliminate those effects, and a summary statement concluding the overall significance of the Project on vegetation and wetlands.

6.2.1 Existing Conditions

The Project falls within the Eagle Plains Ecoregion, a 20,400 km^2 region in north Yukon between the Richardson and Ogilvie Mountains. Most of the region is low-altitude rolling topography, between 300 m and 600 m above sea level, with few scattered peaks to approximately 1,000 m above sea level outside the Project area. Most of the watercourses in the Ecoregion drain north into the Yukon River via the Whitestone, Porcupine, and Eagle rivers. The southeastern corner of the region drains east to the Mackenzie River via the Peel, Wind, and Ogilvie rivers. The few lakes that exist in the region are generally oxbow or thermokarst lakes (Yukon Ecoregions Working Group 2004). The Eagle Plains Ecoregion is within the continuous permafrost zone where permafrost can be found up to 200 m thick. Several permafrost-produced landforms and processes can be found across the region, including ice-wedge polygons, cryoturbation, solifluction, soil creep, and active layer detachment slides on shale (Yukon Ecoregions Working Group 2004).

The Eagle Plains Ecoregion experiences a moderate amount of precipitation, with annual amounts around 400 millimetres (mm). Most of the precipitation falls as rain throughout the summer months, averaging 50 mm to 80 mm per month from June through August. Precipitation is lighter from September to April and typically falls as snow. Average winter temperatures on the Eagle Plains Plateau are around −30°C and −5°C, with extremes as low as −60°C. Winter conditions usually last from October to May. Average summer temperatures are around 13°C, with extremes as high as 30°C. Due to its proximity to the Arctic Circle, this region experiences brief periods of continuous sun above and below the horizon (Yukon Ecoregions Working Group 2004).

The vegetation of the Eagle Plains Ecoregion is primarily boreal forest. The most common climax forest community is black spruce woodland associated with hummocks. Tree growth is often limited by the presence of permafrost in many areas of the Ecoregion, causing open, stunted forests and shrub-dominated communities at tall and low shrub structural stages. Upland black and white spruce forests typically have well-developed shrub communities, including Labrador tea, shrub birch, willow, alder, rose, spiraea, and blueberry, with a ground cover of lichen and moss. Moderately well to well-drained sites commonly have white spruce or deciduous stands with lichen ground cover. More poorly drained areas with low slope gradients and fine-textured soils are associated with overstorey species such as black spruce, shrub birch, Labrador tea, and occasionally tamarack, and often have ground cover dominated by cottongrass tussocks. Deciduous or mixed stands are also often found in areas of recent anthropogenic disturbance, such as old roads, drill sites, and gravel pits. Deciduous trees in the Eagle Plains Ecoregion include Alaskan paper birch, balsam poplar, trembling aspen, and willow (Yukon Ecoregions Working Group 2004).

Graminoid and shrubby fens, shrubby bogs and graminoid marshes are scattered throughout the Ecoregion. Several sedge species are dominant in both the graminoid fens and marshes, including narrow-leaf cottongrass, aquatic sedge, northern beaked sedge, and mud sedge. Shrub species in fens include

leatherleaf and bog rosemary. The ground cover of the shrubby bogs is dominated by sphagnum, sometimes with extensive lichen cover. Shrub species typically include low bush cranberry, bog cranberry, bog rosemary, cloudberry, Labrador tea, shrub birch, willow, black spruce and occasionally tamarack. Riparian forests of white and black spruce are found as narrow strips along most major watercourses in the Ecoregion (Yukon Ecoregions Working Group 2004).

Evidence of forest fires can be observed throughout the Project area, as fires are relatively common. Regenerating burns are dominated by shrubby vegetation, including willow, shrub birch, and alder. Alaskan paper birch is commonly the first tree species to colonize burn areas. Occasionally, on well-drained sites trembling aspen and balsam poplar may be the first tree species to re-colonize. The extent of old burns can be recognized by the presence of the current black spruce – Alaskan paper birch woodlands (Yukon Ecoregions Working Group 2004).

Ecological and Landscape Classification (ELC) mapping was completed for the Eagle Plains Exploration Project in 2019 and 2020, which encompassed the Project area. The ELC mapping was based on manual delineation and attribution of digital ortho-imagery following the Yukon Ecological and Landscape Classification and Mapping Guidelines, Version 1.0. (Environment Yukon 2016c) and the Standard for Terrestrial Ecosystem Mapping in British Columbia (RIC 1998). ELC mapping was further informed by extensive field sampling of vegetation communities across a diversity of ecosystems, slope positions, and moisture and nutrient regimes throughout the Eagle Plains Exploration Project.

Vegetation was examined at 3 scales to assess potential effects of the Project: Vegetation Regional Assessment Area (VRAA), Vegetation Local Assessment Area (VLAA), and the road footprint itself. The VRAA includes vegetation within a 2 km buffer on either side of the Chance and Blackie winter roads and represents the vegetation communities surrounding the roads to provide context for more localized potential effects. The VLAA includes vegetation within a 100 m buffer on either side of the Chance and Blackie winter roads and represents the extent where potential direct and indirect Project-related effects may occur. The area encompasses the 20-m-wide path of the access roads (10 m buffer on the centreline) and the well sites where tree and shrub clearing will occur.

The ELC units (ecosites) comprising the VRAA and VLAA are summarized in **Table 6-9** (the footprint is not included because it is such a narrow strip that ELC mapping does not accurately reflect the previous disturbance along it at that fine a scale). Comparison of the VRAA and the VLAA indicates that the relative proportions of ecosites are similar across both study areas. Both areas are dominated by the following species:

- Moist Spruce – Labrador Tea forest (shrub structural stage)
- Moist Spruce – Labrador Tea forest (mature forest structural stage)
- Moist Spruce – Alder – Labrador Tea forest
- Mesic White Spruce – Alaska Paper Birch – Alder.

A small number of ecosites occur more frequently in the VLAA than the VRAA in 2 circumstances. The first are ecosites associated with prior anthropogenic disturbance along the roads and well sites: Mesic birch-willow, Anthropogenic, and Road. The second group includes sites associated with upper and crest topographic positions, where the existing winter roads were previously situated, and will be situated for the Project: Mesic black spruce – Labrador tea (conifer), Dry spruce – lichen (conifer).

One ecosite that occurs less frequently in the VLAA than in the VRAA is Moist Shrub \ Scrub Birch – Labrador Tea – Willow, which is associated with lower slope and valley bottom positions and which the Project access routes avoid.

Both the Chance and Blackie winter roads have been cleared and used for access in previous years. Their footprints are in early- to mid-seral stages and differ from the surrounding vegetation. Chance Road was last used in 2014 and is currently regenerating to low and tall shrub communities undergoing either normal or stagnated succession. Chance Road is dominated by dense shrub birch, willow, alder, and paper birch, ranging from 25% to 60% cover, and with thick herbaceous vegetation (i.e., graminoids and forbs), ranging from 40% to 75% cover (**Photo 1**). In burned areas, Chance Road is similar to the surrounding vegetation, while in unburned areas, the surrounding vegetation consists of taller, more mature black spruce forest. Blackie Road has not been used in several decades and is more successionally advanced – dominated by fairly open (25% cover) black spruce and shrub birch at a tall shrub structural stage (**Photo 2**).This represents a similar vegetation community but in a different structural stage than the surrounding vegetation, which is characterized by taller, mature black spruce forest with willow and paper birch shrub layers. No rare nor invasive plants have been documented in the VRAA, VLAA, or footprint, although targeted rare and invasive plant surveys have not been conducted in the Project area.

As documented in the ELC mapping, wetlands and watercourses cover 49.9 ha in the VRAA and include rivers and black spruce bogs. There are no wetlands nor mapped watercourses within 200 m of the road and well site footprints.



Photo 1. View of a typical section of Chance Road, regenerating to a low shrub vegetation community dominated by deciduous shrubs.



Photo 2. View of a section of Blackie Road, regenerating to a tall shrub vegetation community dominated by black spruce.

Table 6-9 Vegetation Communities Occurring within the Vegetation Regional Assessment Area and Local Assessment Area

Ecosite Code	Ecosite Name	VRAA		VLAA	
		Area (ha)	Area (%)	Area (ha)	Area (%)
02	Mesic birch-willow	66.6	0%	31.8	5%
04	Mesic white spruce – Alaska paper birch - alder	1111.0	8%	39.6	7%
05	Mesic Alaska paper birch (deciduous)	654.6	5%	24.7	4%
06	Mesic black spruce – Labrador tea (conifer)	685.9	5%	40.8	7%
14	Dry spruce-lichen (conifer)	138.9	1%	15.7	3%
15	Dry aspen-lichen (deciduous)	2.3	0%	0.0	0%
16	Dry spruce-birch-lichen (mixed wood)	173.0	1%	1.6	0%
20	Shrubby riparian birch – willow	8.0	0%	0.0	0%
22	Riparian spruce – birch – willow	15.2	0%	0.0	0%
23	Drainage shrubby riparian	195.4	1%	4.6	1%
31	Moist shrub \ scrub birch – Labrador Tea – willow	590.3	4%	5.6	1%
33	Moist spruce – Labrador tea (shrub stage)	5422.9	40%	227.2	37%
33	Moist spruce – Labrador tea (mature forest stage)	1202.1	9%	67.0	11%
34	Moist spruce – alder – Labrador tea	1446.1	11%	70.0	12%

Ecosite Code	Ecosite Name	VRAA		VLAA	
		Area (ha)	Area (%)	Area (ha)	Area (%)
35	Moist spruce – scrub birch – Labrador tea	591.7	4%	23.2	4%
36	Moist birch – willow	2.7	0%	0.9	0%
41	Wet shrub – tamarack	1.0	0%	0.0	0%
42	Wet shrub – black spruce – tussock cottongrass	654.3	5%	25.0	4%
43	Wet shrub – black spruce – sphagnum	28.2	0%	0.0	0%
44	Wet shrub – scrub birch – tussock cottongrass	150.3	1%	0.0	0%
46	Wet black spruce – Labrador tea – cladonia	228.7	2%	20.5	3%
47	Wet black spruce – tussock cottongrass – sphagnum	169.7	1%	0.0	0%
48	Wet black spruce – carex	0.3	0%	0.0	0%
AN	Anthropogenic	18.9	0%	5.2	1%
B1	Bog – black spruce – lichen	10.2	0%	0.0	0%
B2	Bog – black spruce – sphagnum	24.4	0%	0.0	0%
ES	Exposed soil	9.2	0%	1.0	0%
RI	River	15.2	0%	0.0	0%
RZ	Road	21.2	0%	3.5	1%
Total		**13,638.5**	**100%**	**608.0**	**100%**

6.2.2 Project Interactions and Potential Effects

Re-establishment and construction of the winter roads and spur roads will result in alteration of up to 60.4 ha of vegetation within the road footprint. The footprint will be cleared of vegetation through mulching and manual felling. The cutters of the mulcher will be raised off the ground to minimize disturbance to hummocks, tussocks, and high spots, but will remove taller shrubs and trees to allow safe vehicle and equipment travel. Mulching will remove shrubs and trees while protecting the moss layer, soil, and root systems of low-growing plants.

In addition to the direct loss of vegetation within the road footprint due to clearing, winter road re-establishment, spur road construction, and travel within the road footprint may cause potential effects to vegetation by altering underlying soils. These potential effects include soil disturbance, soil compaction, root damage, altered soil moisture regime, and permafrost thaw. Soil disturbance and root damage would most likely be caused by physical interactions from machinery during clearing, while soil compaction, altered soil moisture, and permafrost thaw would most likely be caused by repeated travel of heavy equipment compressing underlying soils, which can lead to altered thermal and hydrological characteristics.

Vegetation clearing within the road footprint may result both direct and indirect effects. Potential direct effects include change to earlier successional stage, change of wildlife habitat and forage, loss of primary productivity and carbon sequestration, reduction of biodiversity, and aesthetic impacts. Potential indirect effects may extend into the VLAA and are generally attributable to edge effects, including altered light availability, altered temperature regimes, altered wind patterns, increased nutrient availability from cleared

and mulched vegetation, altered seed dispersal, changes to vegetation composition and growth such as infiltration of early seral plants, and altered herbivory patterns.

Potential effects to rare plants include disturbance or destruction during construction if rare plants occur within the footprint of project activities and changes to habitat characteristics caused by vegetation removal and edge effects in the VLAA. There are no tracked shrub or tree species occurring within the Eagle Plains Ecoregion, so only rare ground cover plants (e.g., forbs, graminoids, mosses, lichens) would be at risk of physical disturbance (Yukon Conservation Data Centre 2019). Ensuring a minimum 10 cm snowpack on all areas to be cleared will greatly reduce the potential for physical disturbance or destruction of any rare plants occurring in the footprint.

Potential effects to invasive plants include introduction and spread of invasive plants via equipment or personnel brought in from infested areas.

All of the aforementioned effects have the potential to affect wetlands within the footprint or VLAA, often with increased significance due to the sensitivity of wetlands (e.g., more sensitive soils, hydrological regimes, higher biodiversity and wildlife value, wetland-obligate species). No wetlands are documented within the footprint or VLAA in the ELC mapping, so these effects are unlikely.

The construction phase of the Project could also result in degradation of vegetation due to spills (e.g., hydraulic fluid, fuel etc.) along the access roads.

6.2.3 Mitigation Measures

The following mitigation measures have been developed to minimize potential effects to vegetation and wetlands:

- Existing and historic winter roads, with short spur roads to access well sites, will be used as the primary access routes to minimize the amount of vegetation that is cleared.
- Winter roads will consist of packed and frozen snow and ice to maintain ground vegetation and to avoid site disturbance to the underlying duff layer, soil, and permafrost. A minimum 10 cm snowpack will be required over all road surfaces.
- The extent of vegetation clearing, notably the widths of winter roads and areas at well sites, will be minimized. On the Chance Road, the width will not exceed the existing right-of-way extent, which will minimize the direct loss of vegetation and reduce potential edge effects from Project activities.
- Shrubby vegetation will be cut as high as possible, normally at least 30 cm above the ground. Where possible, shrubs will be pushed over instead of cut.
- The winter roads are located primarily on crest and upper slope positions, which minimizes potential overlap with wetlands and riparian areas. If small wetlands or riparian areas along non-classified drainages are encountered, special efforts will be made to minimize effects by enhancing the thickness of the packed snow/ice base and minimizing the right-of-way width.
- To avoid the spread of invasive plants, equipment will be washed and inspected prior to transport to site.

6.2.4 Effects Characterization and Significance Determination

With the mitigation measures listed in **Section 6.2.3** applied, Project activities are not predicted to result in significant effects to vegetation and wetlands. Most of the effects will be low to moderate in magnitude and considered unlikely to occur and/or reversible over the long term.

Loss and Alteration of Vegetation

The loss and alteration of vegetation will be mitigated primarily by using existing and historic access roads to minimize the area to be disturbed and by limiting use to winter. A maximum of 60.4 ha of vegetation will be cleared within the footprint of Project activities, which represents only 0.44% of the VRAA. Existing and historic winter roads in the area typically support early to mid-seral vegetation at a lower structural stage than the surrounding vegetation. By re-activating previously used roads and construction of short spur roads to access well sites, Chance will minimize disturbance to mature forests and surrounding vegetation and minimizes the overall change in seral stage. By limiting activities to winter and maintaining a 10 cm snowpack overlying frozen ground, the ground vegetation in the surrounding area, along with its root structure and litter layer, will be protected from physical disturbance. Cutting vegetation as high as possible will similarly reduce the total amount of vegetation loss, reduce disturbance to root structure, and increase the potential for regrowth from the root mass, which will in turn accelerate regeneration after the winter roads have been decommissioned.

Overall, the potential effects of loss and alteration of vegetation are low in magnitude and reversible with regeneration. In addition, the loss and alteration of vegetation will be limited to a small area that has been previously disturbed, will only involve removal of trees and shrubs greater than 30 cm tall while leaving ground vegetation intact, and will facilitate regeneration. Potential effects are limited in geographic and temporal extent will primarily occur in the footprint of existing roads during a single winter and will start to regenerate the following spring. With mitigations applied, the potential effects of loss and alteration of vegetation are not considered significant.

Creation of Edge Effects

Creation of edge effects (e.g., light availability, temperature regime, wind patterns, vegetation composition and growth, seed dispersal) will be mitigated by using existing and historic access roads, minimizing length of spur roads, and by limiting use to winter. Primarily using previously disturbed access roads that already experience some edge effects will minimize the creation of new edges and thus reduce overall edge effects. Some additional edge effect will be created by establishment of approximately 3.97 km of spur roads to well sites. Limiting use to winter and minimizing disturbance to ground vegetation will preserve ground vegetation integrity, which will further reduce the potential effects of forest edges. Potential edge effects will decrease as vegetation in the footprint regenerates following completion of well maintenance activities.

Overall potential effects of edge creation are low in magnitude and reversible with regeneration. The majority of the footprint and VLAA already experience some edge effects from past disturbance along the proposed routes. The Project may reinforce pre-existing edge effects but will minimize new edge creation. Potential effects are limited in geographic and temporal extent; they will only occur in the footprint and VLAA and will diminish as regeneration progresses. With mitigations applied, the potential effects of edge creation are not considered significant.

Disturbance to Soils

The disturbance to soils will be mitigated by creating a frozen snow and ice surface on primarily existing and historic winter roads, which will minimize effects to soils and permafrost. In addition, using previously disturbed access roads will avoid potential effects to undisturbed sites. Re-activating and using access roads during winter while the soil is frozen and maintaining a 10 cm snowpack will also protect the duff layer, soil surface, and soil structure from disturbance while minimizing potential permafrost thaw.

Overall, potential effects of soil disturbance are low in magnitude and unlikely to occur, as well as being limited in geographic and temporal extent, will only occur in the footprint. In addition, work will only occur over a single winter. With mitigations applied, the potential effects of soil disturbance are not considered significant.

Disturbance to Rare Plants

Disturbance to rare plants will be mitigated by limiting road re-establishment, spur road construction, and use to winter, and by minimizing ground disturbance. There are no rare shrub or tree species documented within the Eagle Plains Ecoregion; only rare ground vegetation species have the potential to be affected by the Project. Ground vegetation will be dormant in winter and protected by a minimum 10 cm snowpack, thus protecting any rare plants occurring within the footprint. Potential changes to habitat characteristics affecting rare plants will be mitigated by minimizing the creation of edge effects and overall vegetation loss and alteration.

Overall, potential effects to rare plants are low in magnitude, unlikely to occur, and limited in geographic and temporal extent; they would only occur in the footprint and VLAA, and physical disturbance would only occur during road re-establishment and use during a single winter. With mitigations applied, potential effects to rare plants are not considered significant.

Spread of invasive species

Spread of invasive species will be mitigated by limiting road re-establishment, spur road construction, and use to winter and inspecting equipment for cleanliness. Vegetation will be dormant in winter, so the potential for seed dispersal from plants within the footprint will be low. In addition, potential introduction of invasive species from off-site sources will be minimized by inspecting equipment brought on site for cleanliness, including any dirt wads or old vegetation that may be harbouring seeds.

Overall, potential effects of invasive species are moderate in magnitude but unlikely to occur. Potential effects are limited in geographic and temporal extent and they may only occur in the footprint and VLAA, and the risk of introduction of invasive plants would only occur during road re-establishment and use in a single winter. With mitigations applied, the potential effects of invasive species are not considered significant.

Alteration of Wetlands

Alteration of wetlands will be mitigated by using existing and historic access roads, and construction of spur roads, that follow upland topography such as ridges to avoid wetland areas. Although there are no wetlands

or named watercourses documented within the footprint or VLAA, snowpack depth will be increased if small wetlands or riparian areas are encountered along non-classified drainages.

Overall potential effects to wetlands are low in magnitude, unlikely to occur, limited in geographic and temporal extent, and would only occur in the footprint and VLAA during road re-establishment and use over a single winter. With mitigations applied, the potential effects to wetlands are not considered significant.

Degradation of Vegetation or Wetlands Due to Spills

Spills will be mitigated by implementing the Spill Contingency Plan, which is currently in development.

Overall potential effects of spills are moderate in magnitude but unlikely to occur. Potential effects are limited in geographic and temporal extent; they can occur only in the footprint, and potential occurrence is limited to a single winter. Potential effects would be short term and would be at least partially reversible. With mitigations applied, the potential effects of spills are not considered significant.

6.3 Heritage Resources

The human history of Yukon, from the earliest Indigenous groups to the arrival of fur traders and prospectors in the 19th century and beyond, is preserved in the Yukon's heritage and historic resources.

According to the *Historic Resources Act*, RSY 2002, c 109, historic resources include historic sites, historic objects, and any work or assembly of works of nature or human endeavour that is valued for its archaeological, palaeontological, pre-historic, historic, scientific, or aesthetic features. Historic sites generally date to a time of written history (i.e., the past 100 to 150 years in Yukon) and typically contain examples of built heritage or structures (e.g., cabins, caches, graves, brush camps) (Gotthardt and Thomas 2007). Archaeological sites are typically older than 150 years and can be found on the surface (i.e., artifacts that have been exposed or were never buried) or buried in the ground (e.g., stone tools and chips, animal bone fragments, remains of ancient hearths and campfires) (Gotthardt and Thomas 2007).

Archaeological sites and resources are culturally meaningful, connecting community members to the past and representing a collective identity. These resources offer ways of knowing and generational knowledge that are passed on through the generations. Every Indigenous group manages cultural heritage in a unique way, but always with respect for the past and future generations.

6.3.1 Existing Conditions

In 2013, a Heritage Resources Overview Assessment (HROA) was conducted by Matrix Research Ltd. in support of the 2013 Seismic Program at Eagle Plains on behalf of Northern Cross. The intent of this assessment was to determine the heritage potential within the proposed development area and provide recommendations for managing heritage resources.

The HROA determined that a "significant portion" of the study area is considered to have low pre-contact heritage resources potential (Matrix Research 2013). However, the HROA also identified several areas considered to have high heritage resources potential associated with locations along streams and the upland areas overlooking these tributaries. The HROA recommended that further heritage resources investigations, specifically a Heritage Resource Impact Assessment (HRIA), be conducted within the zones

of high heritage resource potential prior to any potentially land-altering development activities (Matrix Research 2013).

An HRIA was then conducted later in 2013 by Matrix Research, further assessing the identified zones of high potential (**Appendix C**). As indicated in a letter report dated May 15, 2014 to Northern Cross, Matrix Research concluded that the proposed well sites and access roads do not conflict with any of the areas containing heritage values (**Appendix D**). Matrix Research did, however, identify areas within the study area containing heritage values, identified as high potential areas to avoid and labelled as 'avoidance areas'. Matrix Research recommended that these areas, "be avoided by any potential land-altering activities and that if avoidance was not possible further heritage assessment should be conducted prior to any development (Matrix Research 2014)."

6.3.2 Project Interactions and Potential Effects

Results of the 2013 HROA and HRIA conducted by Matrix Research indicate that no Project interactions or potential effects are anticipated for heritage resources. Should the Project development areas or locations be altered and fall outside of the currently assessed area, additional assessment of heritage resources will be undertaken.

6.3.3 Mitigation Measures

The following list describes the mitigation measures to eliminate, reduce, or control potential effects to heritage resources caused from Project activities:

- Develop and implement a Project-specific Heritage Resources Chance Find Procedure to manage the discovery process for encounters with any unanticipated heritage resources. If a heritage resource is encountered, all development activities in the vicinity of the heritage resources will be suspended immediately. In such cases, the Cultural Services Branch, Department of Tourism and Culture, Government of Yukon, VGFN, and FNNND will be contacted immediately with information on the heritage remains and nature of the disturbance.
- Chance will avoid any land-altering activities in the avoidance areas identified in the Matrix Research 2014 letter report (**Appendix D**) to further protect heritage resources.

6.3.4 Effects Characterization and Significance Determination

Following the application of mitigation measures, Project activities are not expected to result in significant effects to heritage resources. Should the Project development areas/locations be altered and fall outside of the currently assessed area or within avoidance areas or areas identified as high potential, additional heritage resource assessment will be undertaken to determine the extent of potential effects to heritage resources.

7.0 SUMMARY OF MITIGATION MEASURES

The following sections describe the Proponent's proposed mitigation measures to eliminate, reduce, or control potential effects of the Project to the selected VCs.

7.1 Wildlife and Wildlife Habitat

7.1.1 General Mitigation Measures for Wildlife and Wildlife Habitat

- All Project personnel will be required to complete formal orientation and training related to wildlife mitigation measures.
- Work will be scheduled to minimize the spatial extent of concurrently occurring work.
- Access to the well sites will utilize existing and historic winter roads, with short spur roads to access well sites in order to minimize the creation of new linear features.
- Project footprints, notably the widths of winter roads, will be minimized as much as possible. On the Chance Road, the width will not exceed the existing right-or way extent.
- Project personnel will be prohibited from having firearms on site.
- A no harassment of wildlife policy will apply to all personnel, including attempts to chase, catch, divert, follow, photograph, feed, or otherwise harass wildlife whether on foot, in on-road or off-road vehicles, heavy equipment, or aircraft.
- The use of on-road and off-road vehicles, including snowmobiles, will be restricted to essential Project access routes.
- Personal use of UAVs) will be prohibited.

7.1.2 Road Operations

The following measures are designed to mitigate the risk of vehicle collisions and effects of road use on wildlife movements:

- The maximum speed limit along the Dempster Highway is 90 km/h.
- The maximum speed along winter roads will be 30 km/h.
- Wildlife will always have the right-of-way. This requires vehicle operators to stop when wildlife species are observed on or beside the road, allowing them to cross safely. If wildlife stays on the road or right-of-way for more than 5 minutes, drivers may resume travel and pass the animals at less than 10 km/h. Special rules apply to caribou within 100 m from the road:
  - Stop as far back as possible.
  - Alert other drivers.
  - Wait until caribou have crossed and moved beyond 500 m from the road or are lost from sight before proceeding.
  - Proceed with caution.
- The following rules will guide encounters with caribou beyond 100 m from the road:
  - Proceed with caution.
  - Alert other drivers.
  - Watch for direction of movement and change in behaviour.

- When moose and caribou are on a road, they will sometimes run down the road away from a vehicle. If this happens, stop and wait at least 5 minutes to allow the animal to move off the road. If the animal remains on the road, drive forward at 10 km/h, then stop again when the animal begins to run away. Wait 2 minutes and repeat this procedure. If the animal still does not leave the road, wait 10 minutes and repeat the procedure, alternating with a 2- and 10-minute stop between driving attempts.
- Drivers will be required to use two-way radio communication and communicate the location of any wildlife observed along Project roads to other road users on the radio.
- Drivers will be prohibited from exiting the vehicle to chase, catch, divert, follow, photograph, or otherwise harass wildlife.
- Along winter roads, the Proponent will:
  - maintain snowbanks at heights greater than 1 m to reduce the hinderance to crossing wildlife
  - create regular breaks (at least every 500 m) where snowbanks exceed 60 cm in height to facilitate animal crossing and provide off-road escape routes
  - create matched breaks that animals can use to cross on either side of the road
  - on corners, create run-outs in each direction that are obvious alternative routes for animals to use, instead of following the road
  - avoid breaks at seismic lines that could provide human access.

7.1.3 Aircraft Operations

The following measures are designed to mitigate the effects of aircraft use on wildlife:

- Maintain altitudes of more than 300 m above ground level at all times of the year.
- Maintain altitudes of more than 600 m above ground level during sensitive times of the year.
- Avoid areas where caribou have been observed in the past.
- Design flights paths to avoid important areas during sensitive times of the year.
- Do not fly toward, circle, or harass any observed caribou.
- If caribou appear to be in a panic or startled, ascend to a higher elevation.

7.1.4 Caribou

The majority of potential effects to caribou will be mitigated via measure for general wildlife, road operations and aircraft operations. Additional measure specific to caribou include the following:

- Do not pack snow on any linear features that are not essential to Project work.
- Minimize access to linear features off the winter roads; avoid creating breaks in snow berms at junctions with linear features.
- Report all sightings of caribou to the Environmental Monitor.
- If more than a dozen caribou are observed, or if any number of caribou are observed in the same location for longer than a 3-day period, consult a QEP to determine if site-specific mitigations may be warranted.

Due to the variable nature of caribou occurrence and snow conditions from year to year, Chance will conduct a pre-operations assessment in December, prior to initiating the Project to assess local conditions (specifically including information about caribou occurrence and snow conditions) that could warrant tailored management measures. For example, if telemetry data indicate that several collared caribou are in the Project area near work areas, additional measures may be implemented to mitigate potential effects.

7.2 Vegetation and Wetlands

Mitigation measures related to vegetation and wetlands include the following:

- Existing and historic winter roads, with short spur roads to access well sites, will be used as the primary access routes to minimize the amount of vegetation that is cleared.
- Winter roads will consist of packed and frozen snow and ice to maintain ground vegetation and avoid site disturbance to the underlying duff layer, soil, and permafrost. A minimum 10 cm snowpack will be required over all road surfaces.
- Minimize the extent of vegetation clearing, notably the widths of winter roads and areas at well sites. On the Chance Road, the width will not exceed the existing right-or way extent, which will minimize the direct loss of vegetation and reduce potential edge effects.
- Cut shrubby vegetation as high as possible, normally at least 30 cm above the ground. Where possible, push shrubs over instead of cutting them.
- The winter roads are located primarily on crest and upper slope positions, which minimizes potential overlap with wetlands and riparian areas. If small wetlands or riparian areas along non-classified drainages are encountered, special efforts will be required to minimize effects by enhancing the thickness of the packed snow and ice base and minimizing the right-of-way width.
- To avoid the spread of invasive plants, wash and inspect equipment prior to transporting it to site.

7.3 Heritage Resources

The following mitigation measures are proposed to eliminate, reduce, or control potential effects to heritage resources from Project activities:

- Develop and implement a Project-specific Heritage Resources Chance Find Procedure to address the discovery of any unanticipated heritage resources. If heritage resources are encountered, immediately suspend all development activities in the vicinity of the heritage resources. In such cases, contact the Cultural Services Branch, Department of Tourism and Culture, Government of Yukon, VGFN, and FNNND immediately and provide information on the heritage remains and nature of the disturbance.
- Avoid any land-altering activities in the avoidance areas identified in the Matrix Research 2014 Letter Report to protect heritage resources.

7.4 Fish and Fish Habitat

The Project has no direct interaction with fish and fish habitat. Potential indirect effects are also limited due to the location of winter roads and well sites at least 200 m from streams and waterbodies. The following measures are designed to further mitigate indirect effects relating to water quality:

- If non-classified drainages are encountered, minimize effects to downstream water quality and sedimentation risk. These special efforts include:
  - enhancing the thickness of the packed snow/ice base over and adjacent to the drainage area
  - minimizing the width of the right-of-way through the area
  - removing slash from vegetation clearing away from the area so it will not be transported downstream during spring run-off.
- If any site disturbance occurs during winter road construction or operation (i.e., exposure of organic or mineral soil), document the location and extent of the site during operations and treat the area to control sediment control and regenerate vegetation the following summer.
- In the event of a hydrocarbon spill, follow measures described in the Spill Contingency Plan to contain the spill and prevent the spill from affect adjacent water courses.

7.5 Regional Land Use Plans

The Project is located within the boundaries of the North Yukon Planning Region and Peel Watershed Planning Region and is therefore subject to the NYLUP and PWLUP. Locations of proposed Project activities are also within LMU 9 of the NYLUP and LMU 7 of the PWLUP. (**Table 7-1**). Both are located within the Eagle Plains basin, which has the highest potential for oil and gas development. Details regarding how the Project will meet the requirements of the NYLUP and PWLUP are provided in **Table 7-2.**

Table 7-1 Landscape Management Units Overlapping the Project

Landscape Management Unit Number	Landscape Management Unit Name	Integrated Management Area
9 (NYLUP)	Eagle Plains	4
7 (PWLUP)	Dalglish Creek	4

Table 7-2 Commitments and Mitigations to Meet the Requirements of the North Yukon Land Use Plan and Peel Watershed Land Use Plan

Topic	Recommendation		Best Management Practices		Commitment/Mitigation
	NYLUP	PWLUP	NYLUP	PWLUP	
Surface Disturbances	• Develop and monitor site closure/remediation plans that will result in significant disturbance. • To provide a benchmark for the monitoring cumulative effect indicator levels, document the status of existing surface disturbances.	• In the Integrated Management Area (IMA), maintain the amount of surface disturbance below the cumulative effects indicator levels recommended in the plan.	• Reduce the size, intensity, and duration of all surface disturbances. • Use native endemic plants for active reclamation of disturbed sites.	• Reduce size, intensity, and duration of human-caused physical surface disturbances (e.g. utilize low impact seismic, winter roads and follow the principle of full reclamation).	• Mitigate the size, intensity, and duration of human-caused physical disturbances primarily by using existing and historic access roads to minimize the disturbance area and limiting use to winter.
Wildlife Habitat	• Reduce size, intensity, and duration of human-caused physical surface disturbances (e.g., utilize low impact seismic, winter roads and enhanced reclamation). • Reduce other human land use impacts such as noise, smell, and light. • Avoid or reduce activities in significant wildlife habitats during important biological periods (e.g., utilize timing windows). • Coordinate, manage, and minimize new road and trail access.	• In the IMA, give special consideration to the protection of Boreal caribou habitat when assessing the potential development. • Collect adequate wildlife and habitat baseline data prior to commencing any development activities.	• Avoid or minimize the creation of new access roads and trails; utilize existing routes unless their use will cause additional long-term environmental impacts. • Avoid or minimize the size, extent, duration, and level of activities in concentrated seasonal use areas. • Use appropriate operational timing windows in significant wildlife habitats to minimize activities wherever possible, during periods of wildlife use. • When new access creation is necessary: ▫ Develop and use non-permanent winter access routes should instead of all-season access routes. ▫ Gate or otherwise restrict hunting along new access routes. ▫ Where possible, direct new access routes through less significant wildlife habitats.	• Coordinate and manage new road and trail access. ▫ To the extent possible, avoid routing new roads and trails through concentrated seasonal use areas and significant habitats. ▫ Avoid using or crossing seasonal migration corridors. • Avoid or reduce activities in significant wildlife habitats during important biological periods (e.g. utilize timing windows). ▫ Porcupine Caribou are typically in the region during winter period (December to March). ▫ Avoid concentrated woodland caribou use areas. • Reduce other human land use-related disturbances such as noise, odours, light.	• Mitigate the size, intensity, and duration of human-caused physical disturbances primarily by using existing and historic access roads to minimize the area to be disturbed and limiting use to winter. • The timing of the Project, during winter, is a season of lowest importance for the ecology of the Porcupine Caribou Herd and a period when the caribou are relatively tolerant of human disturbance (PCTC 1993). • Schedule work to minimize the spatial extent across Concurrently occurring work. • Minimize access to linear features off the winter roads by avoiding the creation of breaks in snow berms at junctions with linear features. • Do not pack snow on any linear features that are not essential to Project work. • Report all sightings of caribou to the Environmental Monitor. • If more than a dozen caribou are observed, or if any number of caribou are observed in the same location for longer than a 3-day period, consult a QEP to determine if site-specific mitigations may be warranted. • Restrict the use of on-road and off-road vehicles, including snowmobiles, to essential Project access routes. • Prohibit personal use of UAVs.
Focal Species Management – Porcupine Caribou Herd (NYLUP)	See recommendations for wildlife habitat.		• Avoid or minimize the size, extent, duration, and level of activities in concentrated seasonal use areas. • Avoid using or crossing seasonal migration corridors with new access routes. • Define and implement safe operation distances from the herd. • Consider the following seasons when determining appropriate operational timing windows (seasons when Porcupine caribou occupy the region): ▫ Spring migration – April 1 to May 31 ▫ Early summer – July 1 to July 15 ▫ Mid to late summer – July 16 to August 7 ▫ Fall migration – August 8 to October 7 ▫ Rut – October 8 to ▫ Winter – December 1 to March 31.	Not applicable	

Topic	Recommendation		Best Management Practices		Commitment/Mitigation
	NYLUP	PWLUP	NYLUP	PWLUP	
Fish Habitat	• Prohibit water withdrawals in over-wintering areas with sensitive fish.	• Complete adequate fish, waterbird, aquatic habitat, and water quality baseline data collection prior to commencing any development activities .	• Do not us ice roads or winter roads as river/creek crossings as they inadequately mitigate potential impacts to fish and fish stocks.	• Minimize surface and vegetation disturbance in riparian areas. • Avoid or minimize industrial land use activities in wetlands and riparian areas. • Prohibit significant levels of in-stream water withdrawals in sensitive over-wintering fishing habitat during winter. • Avoid large scale-industrial and/or infrastructure projects within major river corridors. • Minimize stream crossings; if stream crossings are required design and use proper bridge and crossing structures for ease of removal (i.e., temporary structure).	The Project has no direct interaction with fish and fish habitat. Potential indirect effects are also limited due to the location of winter roads and well sites at least 200 m from streams and waterbodies. The following measures are designed to further mitigate indirect effects relating to water quality and fish habitat. • If non-classified drainages are encountered, make special efforts to minimize effects to downstream water quality and sedimentation risk by: ▫ enhancing the thickness of the packed snow/ice base over and adjacent to the drainage area ▫ minimizing the width of the right-of-way through the area ▫ removing vegetation clearing slash from the area so it will not be transported downstream during spring run-off.

8.0 CONCLUSION

The Project requires an evaluation by a YESAB Designated Office because the Assessable Activities, Exceptions and Executive Committee Projects Regulations of YESAA identified 3 assessable activities:

1. The Project location is in the Yukon.
2. The Assessable Activities, Exceptions and Executive Committee Projects Regulations identifies several triggers for the Project including:
    a. Schedule 1, Part 3, Oil and Natural Gas, Item 2:

    On other than an Indian reserve, drilling, operation, modification, decommissioning or abandonment of, or other activity in relation to, an oil or natural gas well or seismic shot hole, but not including a hole drilled to obtain geological information.

    b. Schedule 1, Part 13, Miscellaneous, Item 13:

    On Crown land or settlement land, levelling, grading, clearing cutting or snow ploughing of a route that provides access to land for the purposes of a geophysical, geological or engineering survey.

3. A government agency authorization is required to undertake the activities.

The Proponent understands that the purpose of the YESAB Designated Office evaluation process in Yukon is to inform planning and decision-making by governments to avoid or minimize significant environmental and socio-economic effects while realizing development objectives. The Proponent also recognizes that the YESAB Designated Office evaluation process provides an integrated means of identifying, evaluating, and mitigating a proposed project's potential adverse environmental and socio-economic effects. VCs for the assessment were selected based on the potential for Project activities for this proposal to interact with the identified VC and result in adverse effects. Where effects assessments indicated that adverse effects could occur to a VC, the assessment proposes technically feasible and appropriate mitigation measures to avoid or minimize those effects. Following the implementation of the proposed mitigation measures, Project-related residual adverse effects to the selected VCs will likely be not significant.

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APPENDIX A

Letter from Yukon Government Oil and Gas Branch

APPENDIX B
Spill Contingency Plan

APPENDIX C

Heritage Resource Impact Assessment

APPENDIX D

Letter Report for the Heritage Review of 2014 Proposed Well Sites and Access Roads

APPENDIX 2-C-39. Communication and Engagement with the Vuntut Gwitchin Government (“VGG”) in relation to Chance Oil and Gas Limited’s (“COGL”) notice of Proposed Oil and Gas Activity dated June 5, 2019 (“Proposed Exploration Program”) under VGG’s Oil and Gas Engagement Policy (“Policy”) Letter

VUNTUT GWITCHIN GOVERNMENT
Government of Vuntut Gwitchin First Nation
CHIEF AND COUNCIL

P.O. Box 94,
Old Crow, Yukon
Y0B 1N0

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SENT VIA E-MAIL

March 31, 2021

Board of Directors
Chance Oil and Gas Limited
Suite 1000, 340 – 12 Ave SW
Calgary, AB T2R 1L5

Attention: [redacted]

Dear [redacted]

RE: Communication and Engagement with the Vuntut Gwitchin Government ("VGG") in relation to Chance Oil and Gas Limited's ("COGL") notice of Proposed Oil and Gas Activity dated June 5, 2019 ("Proposed Exploration Program") under VGG's Oil and Gas Engagement Policy ("Policy")

I am writing to you as Chief of the Vuntut Gwitchin First Nation ("VGFN") and Chief Executive Officer of VGG to bring directly to your attention our serious concerns with COGL's consistent failure to adhere to our Policy and the joint VGG-COGL Communication and Engagement Plan dated May 17, 2018 ("Plan") in communication and engagement with us about the Proposed Exploration Program. VGG has raised our concerns with COGL about this pattern of communication and engagement on several occasions in the past, including bringing concerns directly to the attention of COGL directors, to no avail. This has significantly frustrated VGG's good faith efforts to establish and maintain a respectful, transparent and meaningful process for communication and engagement with COGL as required under our Policy and the Plan we agreed upon together.

As VGG has communicated throughout our engagement with COGL, we are committed as a government to upholding the objective of sustainable development enshrined in our Land Claim Agreement and the human rights of VGFN citizens to free, prior and informed consent in relation to the Proposed Exploration Program through the implementation of the Policy. As clearly described by the UN Expert Mechanism on the Rights of Indigenous Peoples[1], this means, among other things, that:

- "The context or climate of the process should be free from intimidation, coercion, manipulation and harassment."
- "Features of the relationship between the parties should include trust and good faith, and not suspicion, accusations, threats."

[1] Free, Prior and Informed Consent: A Human Rights-based Approach: Study of the Expert Mechanism on the Rights of Indigenous Peoples, UNHRC, 39th Sess, UN Doc A/HRC/39/62 (2018) available online at https://undocs.org/en/A/HRC/39/62. See also International Finance Corporation, Performance Standard 7: Indigenous Peoples (January 1, 2012) available online at: https://www.ifc.org/ps7.

- “Indigenous peoples should have the freedom to be represented as traditionally required under their own laws, customs and protocols.”
- “Indigenous peoples should have the freedom to guide and direct the process of consultation… They should exert sufficient control over the process and should not feel compelled to get involved or continue.”
- “Indigenous peoples should have the freedom to set their expectations and to contribute to defining methods, timelines, locations and evaluations.”
- “Providing the time necessary for Indigenous peoples to absorb, understand and analyse information and to undertake their own decision-making processes.”
- “Indigenous peoples may withhold consent temporarily because of deficiencies in the process. Such deficiencies often consist of non-compliance with the required standards for the consent to be free, prior and informed.”
- “If Indigenous peoples choose to give their consent to a project, consent should be consistent with Indigenous peoples’ own laws, customs, protocols and best practices, including representation by legal counsel whenever possible and as required by law.”

Please therefore take notice that following recent events at a special meeting of the VGFN General Assembly, and consultation between the Council and the Natural Resources Committee, VGG is implementing the following measures effective immediately which will remain in effect until further notice to COGL:

- All communication and engagement between VGG and COGL about the Proposed Exploration Program will be ceased including all negotiations under the Policy towards a Cooperation Agreement and Benefits and Stewardship Agreement. This includes COGL directors, officers, employees, consultants, professional advisors and representatives ceasing all public and private communications with VGFN Council, VGG employees and contractors, and members of the VGG Natural Resources Committee regarding the Proposed Exploration Program.
- VGG will be conducting an internal review of the Plan for its consistency with the Policy and the adequacy of measures for maintaining a respectful, transparent and meaningful process for communication and engagement as provided for under s. 6 of the Plan. The Policy continues to be the paramount and overarching framework applicable to COGL until our internal review of the Plan is complete.
- COGL directors, officers, employees, consultants, professional advisors and representatives, while acting in such a capacity, may only participate by invitation in our internal governance processes and mechanisms regarding the Proposed Exploration Program, such as VGG planned consultation meetings with VGFN citizens and meetings of the VGFN General Assembly.
- COGL will submit advance written notice of any COGL planned consultation activities with VGFN citizens to the VGG Director of Natural Resources pursuant to s. 21 of the Policy. Any COGL planned consultation activities with VGFN citizens, including any activities of COGL’s “Community Engagement Committee” do not constitute consultation with VGG and is not representative of our internal governance processes and mechanisms.
- Future communication and engagement between VGG and COGL about the Proposed Exploration Program will be initiated upon invitation directly from me as the Chief to you as Chairman of the

Board. Any future meetings will be held in Old Crow in an open forum where VGFN citizens may attend, observe and participate in discussions.

- Future negotiations of a Cooperation Agreement or Benefits and Stewardship Agreement in relation to the Proposed Exploration Program will also be held in Old Crow in an open forum where VGFN citizens may attend and observe.

These measures are being implemented by VGG to prioritize the completion of deep consultation by VGG with VGFN citizens through our own internal governance processes and mechanisms before VGG decides to continue any further in communication and engagement with COGL under stage 2 of the Policy regarding the Proposed Exploration Program. Your direct involvement and participation in the conduct of future meetings between VGG and COGL will be respectfully and strongly encouraged.

Yours truly,

[redacted]

VUNTUT GWITCHIN FIRST NATION

Cc: [redacted], President, Chance Oil & Gas Limited
[redacted], Director of Intergovernmental Relations & Governance, VGG
[redacted], Director of Natural Resources & Heritage, VGG
VGG Natural Resources Committee

APPENDIX 2-C-40. Communication and Engagement Letter

Chance
OIL AND GAS LIMITED

July 15, 2019

Natural Resources Committee
Vuntut Gwitchin Government **sent via email:** [redacted]
P.O. Box 94
Old Crow, YT
Y0B 1N0

Attention: [redacted] **Councillor and Co-Chair of the Natural Resources Committee**

Dear [redacted]:

I am writing in response to your letter of July 10, 2019. We would be pleased to meet with the Natural Resources Committee ("NRC") in August to discuss both the matter you have raised in your letter regarding the financial circumstances of Chance Oil and Gas Limited ("Chance", the "Company") and other matters related to ongoing engagement. [redacted]nd I will be in Old Crow during the General Assembly ("GA") where we have been invited to make a presentation to the community on August 9. The three of us will be in Old Crow from late morning on August 8 until the morning of August 10 although both [redacted] and [redacted] will arrive before August 8. In addition to Chance representatives, [redacted] [redacted]and [redacted]f Hemmera will also be in Old Crow for the entire week of August 5-9 doing some engagement work with the community as part of the process of pre-submission consultation required by the Yukon Environmental and

CHANCE OIL AND GAS LIMITED

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Whitehorse, YT Y1A 2A9
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Calgary, AB T2R 1L5
Telephone (403) 699-0055
Fax (403) 699-0044

Socio-Economic Assessment Board ("YESAB"). Hopefully there is a time while the three of us from Chance are in Old Crow to meet with the NRC, perhaps during an evening depending on the GA agenda. Please let us know what you are able to arrange.

In anticipation of the discussion surrounding the financial situation of Chance, I would like to highlight a few points for you and the NRC to consider:

1. Chance is an exploration company with a 25-year corporate history in Yukon;
2. Chance has a very supportive shareholder base to help finance the Company's business plan;
3. To demonstrate this fact, Chance has successfully raised almost $150 million to undertake a variety of exploration projects during the past 25 years;
4. An important aspect of financial management is to fund the Company on a "needs only basis" given the unknown time frame to complete impact assessments, obtain licenses to undertake activity, and manage the uncertainties inherent with oil and gas exploration;
5. The Eagle Plain area is under explored and the understanding of the oil and natural gas resource potential is still relatively immature, but through our efforts, it is improving all the time;
6. Notwithstanding the knowledge gains that Chance has made in the past 25 years, there is still considerable uncertainty in terms of outcomes from exploration activities so there is not yet a basis for any sustainable development in the area;
7. Successful exploration work will attract further investment, but the timeframe needed to graduate from exploration to resource development is unpredictable;
8. Yukon Government policies and YESAB processes have shown themselves to be unpredictable and variable both of which harm investment prospects in Yukon.

Although the foregoing comments have been presented in the context of Chance's situation, they equally apply to any oil and gas company, big and small, wishing to get involved in exploration activities at Eagle Plain.

Because of previously made commitments to continue engagement with the other affected First Nations who have interests in and around Eagle Plain and scheduled annual leave during the next two months, it is most convenient for Chance to meet with the NRC while we are in Old Crow to participate at the annual GA. Also, to the extent that this proposed meeting with the NRC relates to Chance's outstanding application to the Yukon Government seeking extension in tenure to exploration permits 0006-0011 and 0019, having our meeting while we are in Old Crow is worthwhile to accommodate the Yukon Government processes outlined in the Yukon Oil and Gas Act prior to the August 30, 2019 deadline for the permits to be either continued or expire.

Thank you for the invitation to meet and hopefully you are able to accommodate the suggested timing during the GA. We look forward to continuing working with you preparing the YESAB submission and other engagement activities.

Yours truly,
Chance Oil and Gas Limited

[redacted]

President

Cc: NRC members
Chief and Council

[redacted]

APPENDIX 2-C-41. Open House Sign-in Sheet

Chance
OIL AND GAS LIMITED

Location: CZ School Old Crow Date: April 20, 2021

Sign-In Form

Name	~~Organization~~ Phone Number
[redacted]	

Chance
OIL AND GAS LIMITED

Location: Old Crow Date: April 20, 2021

Sign-In Form

Name	Organization
[redacted]	

CHANCE OIL + GAS

[redacted]

APPENDIX 2-C-42. Open House Sign-in Sheet

Chance
OIL AND GAS LIMITED

Location: CFZ School, old Crow Date: April 21, 2021

Sign-In Form

Name	~~Organization~~
[redacted]	

APPENDIX 2-C-43. *Vuntut Gwitchin Heritage Act*

VUNTUT GWITCHIN HERITAGE ACT

An Act to provide direction for the management of Yukon First Nations heritage and culture, in order to:

i. recognize and affirm the inherent right of the Vuntut Gwitchin over its heritage and culture;
ii. recognize and affirm the Vuntut Gwitchin Self-government Agreement Section 13 powers over Vuntut Gwitchin heritage and culture;
iii. recognize the uniqueness of Yukon First Nations concepts of heritage; and
iv. fulfil the Vuntut Gwitchin Final Agreement Chapter 13 provisions to respect and foster the culture, history and values of Yukon First Nations People.

Yukon First Nations Culture and Heritage

Each Yukon First Nation has its own unique cultural practices and languages. Yukon First Nations also share a common heritage with many common laws, principles and values. This document articulates our shared understandings and core heritage values — in order to distinguish what our Elders call "our way" from the "western" or "English way."

What Our Elders Say About Our Heritage

Living heritage – the Vuntut Gwitchin way

"Our culture is our inheritance. When we live our culture we are keeping it alive, we are sustaining it. You don't know traditional knowledge, you have to live it – the way we grow up, the way we hunt, the way we live on the land. The land is our university and our church. We went to school out on the land. That's our university."

Storytelling

"In our way, we tell stories to get something out. The story comes from a true incident or experience and it tells us how someone had learned from that event. Because it is based on a true incident it is a valid lesson. Rather than trying to teach someone something, you tell a story about something you experienced. This shows the listener that they are not the only one who has experienced that kind of situation. It is a way of teaching so that the listener doesn't become offended or defensive. We live our culture, that's how we were taught."

Living "in a good way"

"Heritage is our way of life. The stories about creation and how we learn from the animals and the land teach us about how to take care of ourselves and to survive on the land and to do it "in a good way." And I guess that "in a good way" means respect. That is our biggest law. Respect is the one that encompasses everything. When you go against doing things "in a good way," that is with respect, that's when traditional law comes in. When we do things in a bad way, it is disrespect – meaning that you have gone against all the natural laws. You bring all the negative to yourself. It is the same concept as – the idea that what you put out there comes back to you."

"We are part of the land, part of the water"

"Heritage is our knowledge of and connection to the land. We are part of the land. When we are out there on that land, we are part of it, but we are not the be-all and end-all. Every rock, plant, tree and animal are part of the land and the water is part of it. Everything has a spirit. Our connection to the land is a spiritual connection."

Place and identity

"The land is part of our culture. People connect themselves to place. Place is very critical for us. In the past, we had no maps but there were lots of sacred areas – and landmarks that always provided for us. The land is who we are."

Responsibility and survival

"The land ensures our survival. You have to look after the land, you have to look after the animals. The land is our heritage: because we use it, because it is everything, everything comes from the land. Keep your land clean, keep your animals, they are your friends. You look after them, they look after you. You look after your water, land, trees, you look after the land, you respect it. That's our spirituality."

Relatedness and "what is called 'ownership' in the English way"

"My grandma always said when we were out on the land 'you remember, this is the animals' home, and the home of every living thing.' In our way, they are all an integral part of the land. Everything is an integral piece, we humans are just one part. The land is our lifeblood. The land is not our land. We belong to this land: we are born on it, we are raised up on it and we are going to die on it. This land owns us, we don't own the land."

Yukon First Nations Way of Life, Traditional Laws and Core Values Pertaining to Heritage

Way of Life Summary

Our heritage is a way of life in which knowledge and understanding of history, culture, and survival is passed on from generation to generation by parents and Elders.

The oral, cultural, experience-on-the-land basis of our heritage makes it flexible, adaptive and evolving. It is a dynamic, living heritage and culture based on traditions which are shaped by our history in a harsh environment. Balancing tradition and adaptability has ensured our survival. In our way, change and adaptation are aspects of our laws, practices and values, that have guided and protected us for millennia.

Our sense of relationship and relatedness is distinct from the Western concept of autonomous individuality. Our way of life includes relationships with people, other animals, plants, the spirit world, and the land – rivers, lakes, mountains, wetlands, etc. All parts of the land are interdependent.

The land is central to our identity; it is the source of life, we understand ourselves as part of the land, related to the entire natural environment and to everything in it. In our way, we see the interconnectedness of all aspects of life. Everything is imbued with spirit.

Our kinship ties are based on people who honour the same relationships, and are not dependent on blood relations, language, or geography. Our concept of relatedness underlies our stewardship responsibilities to one another, to our heritage, and to the land.

Our law requires us to respect and honour our heritage, practices and protocols, including respect for the land and acceptance of our stewardship responsibilities towards it.

Our heritage is our way of life as part of the land. In our way we do not divide heritage into separate categories. What we consider directly related to our history and culture is not affected by western classification.

Principles and Values Pertaining to our Heritage

Our holistic perspective produces concepts of reciprocity, moderation, balance, harmony that beget a code of conduct based on the principle of reciprocity (a concept of moderation and self-control, of taking and giving back) and the supreme value of respect (an attitude of humility and gratitude). These principles guide the interplay of values like humility, adaptability, openness, responsibility, honour, truthfulness, and self-reliance that are reflected in expected behaviors that people demonstrate between each other and the land.

Historically, land was to be shared by everyone regardless of family, language, or nation. When conflict arose it was resolved in accordance with traditional practices. Resolution of conflict was based on reciprocity and balance between people. Members of the group with knowledge and experience would discuss the issue and come to an agreement that would resolve the situation. The goal was to maintain balance between the individuals, families, or groups. It was imperative that solutions did not create undue hardship for either group nor create excessive benefit for the other. In this way moderation, humility, balance, and respect were reinforced.

Moderation and balance govern paradoxical values like interdependence and self-reliance. In our way “tradition” includes “openness to new things.”

Harmony and balance pertain to maintaining the greater good, in our holistic perspective. In our code of conduct, collaboration, working together collectively in the interest of the greater community are essential; consensus decision-making is expected; resources and work are shared. All things are cared for.

Adaptability and openness to new things, resourcefulness, ingenuity and self-reliance are essential characteristics and values for survival in our harsh environment.

Accountability, taking responsibility for actions and stewardship obligations, honouring relationships, being truthful and doing what we say we are going to do are valued behaviours and habits that guarantee the sustainability of the land and our peoples.

The supreme value of respect pervades our traditional laws, customs and practices. Treating every person and every living thing respectfully is deeply ingrained in our way of life and traditional practices. Respect is core in all aspects of life and should be reflected in thoughts, words and actions. Respect for Elders is particularly important.

Citation

1. This Act may be cited as the Vuntut Gwitchin Heritage Act.

Purpose

2. This Act:

   (a) affirms the Yukon First Nations inherent right to define our heritage, culture, history and values;
   (b) ensures the preservation and promotion of the Vuntut Gwitchin's heritage in and on the Traditional Territory of the Vuntut Gwitchin, in a manner that is consistent with Chapter 13 (and the inherent right);
   (c) ensures that Heritage Resources in Vuntut Gwitchin Traditional Territory are managed in a manner that is consistent with Yukon First Nations values and the Vuntut Gwitchin Final Agreement;
   (d) articulates Yukon First Nations values and principles related to heritage and provides definitions required for the implementation of this Act;
   (e) provides a mechanism for resolving conflicts between the Vuntut Gwitchin and other Yukon First Nations, and between the Vuntut Gwitchin and other governments, regarding the stewardship and management of Heritage Resources; and
   (f) such other matters ancillary to the foregoing.

Interpretation

3. In this Act the following definitions apply,

   (a) **Act** means the Vuntut Gwitchin Heritage Act approved by the Vuntut Gwitchin General Assembly, as amended from time to time;

   (b) **Archaeological** means relating to the field of archaeology, the scientific study of cultures through the examination of their material remains such as buildings, graves, tools, and other artefacts.

(c) **Council** means the Chief and Council identified in the *Vuntut Gwitchin Constitution*.

(d) **Cultural Landscape** refers to the unity of culture, history, the spirit world, the land and its inhabitants.

(e) **Ethnographic**

i. means relating to the branch of anthropology called ethnography, concerned with ethnicity or ethnic groups, used to describe an object or other tangible or intangible aspects of a particular ethnic/cultural group; and

ii. can include archaeological and paleontological objects.

(f) **Heritage Resources** has the same meaning as in the Final Agreement which includes, Moveable Heritage Resources, **Heritage Sites** and Documentary Heritage Resources.

(g) **Heritage Site** has the same meaning as in the Final Agreement, and includes intangibles associated with the Yukon First Nations concept of "cultural landscape."

(h) **Historic Resources** means relating to the field of history. Yukon First Nations history is a dimension of a dynamic living heritage that is transmitted through stories, place names, families and a way of life. In the holistic Yukon First Nations worldview the term "Historic" is included within the term "heritage." This act therefore does not distinguish between Historic Resources and Heritage Resources. Historic Resources include tangible and intangible evidence of Yukon First Nations heritage.

(i) **Paleontological** means relating to the field of palaeontology, the scientific study of past life using fossil and paleontological evidence.

(j) **Yukon First Nations**

i. has the same meaning as in the Vuntut Gwitchin Final Agreement and includes "Yukon Indian People."

ii. refers to the collective and shared ethnicity of "Yukon Indian People," and may also refer collectively to the group of First Nations located in Yukon.

(k) **Yukon First Nations Heritage** refers to

i. the way of life and worldview inherited from previous generations, and

ii. both tangible and intangible elements of Yukon First Nations heritage.

Application

4. Vuntut Gwitchin heritage shall be managed in accordance with this Act and in accordance with the Vuntut Gwitchin Final Agreement and the inherent right of the Vuntut Gwitchin respecting heritage and culture.

5. Vuntut Gwitchin Heritage Resources shall be managed in a manner that is consistent with Yukon First Nations values and the Vuntut Gwitchin Final Agreement.

6. "What our Elders Say" and "Yukon First Nations Worldview, Traditional Laws and Core Values Pertaining to heritage" sections shall guide the interpretation and understanding of Yukon First Nations heritage, and this Act.

7. This Act applies to the Traditional Territories of the Vuntut Gwitchin.

Authority

8. **Definition:**

   (a) **Yukon Heritage Resources Board** means the board referred to in the Vuntut Gwitchin Final Agreement;

   (b) **Authorized Body** means the body authorized by the Vuntut Gwitchin to determine direct relatedness and to settle disputes.

9. Defining the culture and values of Vuntut Gwitchin is within the exclusive jurisdiction and authority of the Vuntut Gwitchin.

10. The determination of whether or not a Heritage Resource discovered or found within the Traditional Territory of the Vuntut Gwitchin can be readily identified as directly related to Yukon First Nations history and culture is the exclusive jurisdiction of the Vuntut Gwitchin, and shall be made in accordance with this Act.

11. The Authorized Body shall be established by the Vuntut Gwitchin Council for the purposes of:

   (a) determining direct relatedness and providing recommendations to the Yukon Heritage Resources Board and

   (b) addressing and resolving any conflicts or disputes over stewardship responsibilities towards heritage interests between different Yukon First Nations, and advising the Yukon Heritage Resources Board.

12. The Authorized Body shall attempt to make decisions by consensus, and may consult with any individuals, members of the community or bodies (including other Authorized Bodies) in making their decision.

13. Any dispute with respect to the stewardship and custody of Heritage Resources between different First Nations shall be resolved by one or more designated representatives of each First Nation Authorized Body, or by representative(s) appointed by the respective Council of each First Nation.

   (a) Any resolution of a dispute shall be documented and forwarded to the Yukon Heritage Resources Board.

   (b) Any dispute resolution failure shall be documented and forwarded to the Yukon Heritage Resources Board.

Determining Relatedness

14. **Definition:**

    (a) **Determining Direct Relatedness** means determining whether or not a Yukon Heritage Resource, Site or other intangible heritage interest is "directly related to" the culture and history of Yukon First Nations.

15. Any determination of relatedness (that is, whether or not a Heritage Resource is directly related to the culture and history of Yukon First Nations, as required for the implementation of the Vuntut Gwitchin Final Agreement) shall be made by the Authorized Body.

16. In rendering its decision on the relatedness of a Heritage Resource to a Yukon First Nation, the Authorized Body shall provide written reasons why the Heritage Resource is connected to the Yukon First Nation.

17. If the Authorized Body is not able to readily identify whether a Heritage Resources found on non-settlement land is directly related to the culture and history of Yukon First Nations, the Authorized Body shall refer the matter to the Heritage Resources Board, with recommendations regarding the manner in which the relatedness to Yukon First Nations should be determined.

Ownership

18. This Act recognizes the custody and stewardship responsibilities for heritage and the land that Yukon First Nations customary laws require.

19. For the purposes of determining the ownership of Heritage Resources under the Vuntut Gwitchin Final Agreement 13.3.2, **ethnographic** Heritage Resources can include everything of heritage value – whether found in or on the land or water, whether animal or human or any other product of the land, that at any time was or is related to the culture and history of Yukon First Nations Peoples – regardless of whether it might also be described in the "western way" as *archaeological* or *paleontological* resources.

General Provisions

Regulations

20. The Council may make regulations it considers advisable for the purposes of this Act, including, but not limited to, the following matters:

    (a) stewardship standards in the management and care of Vuntut Gwitchin Heritage Resources, including Heritage Sites;

    (b) stewardship standards with respect to developments taking place in the Vuntut Gwitchin Traditional Territory;

    (c) research being conducted with Vuntut Gwitchin people or on the Traditional Territory of the Vuntut Gwitchin;

    (d) place names in the Traditional Territory of the Vuntut Gwitchin;

(e) communication protocols between

i. researchers and the Vuntut Gwitchin,

ii. a person (including an official of another government) or a company conducting business who discovers anything of Yukon First Nations heritage value,

iii. different governments regarding anything of Yukon First Nations heritage value and including information being provided about the Vuntut Gwitchin; and

(f) any other matter the Council considers advisable for the operation of this Act.

Discovery of Heritage Resources

21. **Definitions:**

(a) **Person** means any person including officials of other governments or a company conducting business.

22. Any person who finds a Heritage Resource as defined in this Act in the Traditional Territory of the Vuntut Gwitchin that is or may be related to the history or culture of Yukon First Nations on or in the Traditional Territory of the Vuntut Gwitchin must report the finding to the Vuntut Gwitchin within 5 days or as soon as is practicable.

23. A person who finds a Heritage Resource under Section 22 shall not damage or remove it from the place it was found without the written consent of the Vuntut Gwitchin, unless the discovery is accidental and the object may be difficult to re-locate if it is left where it was found.

(a) If a Heritage Resource is discovered accidentally and may be difficult to relocate then the finder shall report the finding and deliver the object to the Vuntut Gwitchin, immediately or as soon as is practicable.

24. If there is any inconsistency or conflict between the provisions of this Act and the provisions of the Final Agreement, the Final Agreement shall prevail to the extent of the inconsistency or conflict.

Penalties

25. A person who contravenes this Act commits an offence is liable to:

(a) a fine up to $5,000, or 6 months imprisonment or both; or

(b) any other culturally prescribed remedy that is not in conflict with Canadian or Yukon Law.

Commencement

26. This Act comes into force on the date proclaimed by the Vuntut Gwitchin Council.

APPENDIX 2-C-44. *Draft 2021 Annual Report: Implementation of the Vuntut Gwitchin Government and Chance Oil and Gas Engagement and Communication Plan*

Hemmera
An Ausenco Company

DRAFT 2021 ANNUAL REPORT

2021 Annual Report: Implementation of the Vuntut Gwitchin Government and Chance Oil and Gas Engagement and Communication Plan

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Prepared for:

Yukon Government
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Oil and Gas Resources
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July 30, 2021

1.0 INTRODUCTION

This report demonstrates implementation of the *Vuntut Gwitchin Government and Chance Oil and Gas Limited Communications and Engagement Plan* (Plan) (see **Appendix A**) finalized on May 22, 2018. It summarizes discussions held between Vuntut Gwitchin Government (VGG) and Chance Oil and Gas Limited (Chance) between June 1, 2020 and May 31, 2021. The purpose, objectives, and outcomes of each discussion are explained below to fulfill the requirements of Ministerial Order (MO) 2018/ 42 (See **Appendix B**) issued to Chance on August 30, 2018.

2.0 BACKGROUND

The development of communications and engagement plans began with Order in Council (OIC) 2016/169. OIC 2016/169 required Chance to file a First Nations communication and engagement plan with the Minister of Energy, Mines and Resources in order to extend tenure on their northern permits: 0005, 0006, 0007, 0008, 0009, 0010, and 0011 (see **Appendix C**). Chance complied with OIC 2016/169 and received their tenure extension.

Chance subsequently received MO 2017/37 when applying for tenure extension on six of eight southern permits: 0012, 0013, 0014, 0015, 0016, and 0017. MO 2017/37 required Chance to revise, in consultation with affected First Nations, the consultation and engagement plan filed under OIC 2016/169. The affected First Nations listed in MO 2017/37 were Vuntut Gwitchin First Nation (VGFN), Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Tetlit Gwich'in Council.

VGG and Chance collaboratively developed their Plan through a series of in-person meetings and conference calls. Hemmera was retained by Chance in November 2017 to facilitate the development and completion of the communications and engagement plans with the affected First Nations.

VGG and Chance submitted their finalized Plan to Minister Ranj Pillai on May 22, 2018. To complete its obligations under MO 2017/37, Chance filed a total of four communications and engagement plans. All four plans were approved by the Minister and Chance received a five-year tenure extension on the six southern permits.

A condition of the five-year tenure extension, issued via MO 2018/42, required that Chance submit annual reports summarizing actions taken to implement each communications and engagement plan.

The Plan incorporates VGG's Oil and Gas Engagement Policy (the Policy). The Policy, developed by VGG and reviewed by Chance, provides a protocol for engaging with VGG on oil and gas matters.

See **Appendix C** for a map of Chance's current permits.

3.0 ENGAGEMENT AND COMMUNICATION PLAN IMPLEMENTATION SUMMARY

3.1 Overview

Parties have advanced discussion on Chance's proposed Eagle Plains Exploration Project and Chance's proposed project for Well Maintenance and Extended Flow Testing. The following sections provide separate

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summaries of engagement activities that occurred for each of Chance's projects between June 1, 2020 and May 31, 2021. Engagement activities pertaining to the Well Maintenance and Extended Flow Testing Project are summarized first followed by engagement activities/events in relation to the Eagle Plains Exploration Project.

3.2 Summary of Engagement – Well Maintenance and Extended Flow Testing Project

Initial notification was sent to VGG's Director of Natural Resources on May 25, 2020. A distinct communication package was sent via email to initiate engagement activities with VGG. This package was structured in accordance with protocols outlined in the *Vuntut Gwitchin Government Oil and Gas Engagement Policy*. This package included a draft of the project description dated May 22, 2020.

VGG and Chance organized a conference call July 9, 2020 wherein VGG requested a high-level overview of the project. To assist Chance in preparing meeting materials for the July 9th meeting, VGG provided an agenda and questions ahead of time. VGG informed Chance that its questions were meant to gather additional information necessary for the First Nation to complete their detailed review of the draft project description (dated May 22, 2020). On July 10, 2020, VGG provided Chance with formal information requirements related to the project. VGG requested the following additional information:

- Mitigation measures to avoid or minimize potential environmental effects (specifically with respect to Porcupine Caribou)
- Regulatory context
- Well tests (e.g., varying tests between the wells, how Chance would address evidence of gas migration, what would be done with removed fluid)
- Project components (e.g., which materials would be stored on site, which materials will be incinerated, vehicles planned to be used)
- Water withdrawal (e.g., sources, volume, schedule).

The additional information requested by VGG was gathered, drafted, and refined during the effects assessment and development of the project proposal. Feedback from VGG impacted the development of mitigation measures and contributed to identifying additional information that was previously missing from the earlier draft of the project description and the project proposal (e.g., additional information on the regulatory context and the rationale for maintaining the wells in suspended well status versus abandonment) as it was being developed.

On July 22, 2020, Chance responded to VGG's July 10, 2020 information request in the format requested by VGG. This document can be provided upon request. In addition, Chance shared a draft of the project proposal with VGG on July 22, 2020.

Following additional conversations with the regulator (Government of Yukon), Chance was required to make changes to its project design. On August 7, 2020, VGG was provided notice that revisions were being made to the project and that additional information would be forthcoming. A revised project proposal was provided, via email, to VGG on August 28, 2020, along with a cover letter summarizing the revisions and providing a rationale for each.

Chance held a community open house in Old Crow on September 3, 2020 and was able to have an in-person meeting with the members of the VGG Natural Resource Committee that same day. Members of

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the committee and VGG Government took the opportunity to question Chance on the revised project and, while high level feedback was provided, VGG informed Chance that they would be providing detailed comments the following week. Chance representatives also met with the Old Crow Development Corporation (September 2, 2020), and the North Yukon Renewable Resources Council (September 3, 2020) during that week. For both of those meetings Chance provided an overview of the proposed project and answered questions related to the Project design and effects assessment.

Chance submitted an initial project proposal to YESAB on September 11, 2020. On October 9, 2020, VGG informed Chance that their questions, alluded to following the VGG Natural Resource Committee meeting (September 3, 2020), were finalized and would be incorporated into VGG's submission into YESAB. At that time, Chance was not provided a copy.

After additional consideration, Chance determined that changes were required for its project proposal. On November 2, 2020, via email, Chance notified VGG that it had decided to withdraw its project proposal from YESAB and submit a revised version. In that email Chance stated that once a revised proposal had been drafted, Chance would notify VGG by sharing a draft and requesting a meeting to discuss the changes further, and Chance stated at that time that after it had the opportunity to discuss those changes with VGG, the project proposal would be finalized and resubmitted to the Dawson Designated Office (DO).

On November 3, 2020, Chance and the VGG Natural Resource Committee had a meeting wherein Chance was able to provide additional information pertaining to reasons for the withdrawal of the original application from the DO. At that time, VGG representatives expressed concern regarding the significance of the changes from the previous iterations (i.e., inclusion of extended flow testing (EFT)). VGG indicated that, after receiving the new version in writing, it would require time to review and formulate a response. VGG suggested that an additional meeting between Chance and VGG would be needed. Chance agreed to schedule a meeting with VGG and that the meeting would occur after the First Nation had received the revised project proposal.

The revised draft project proposal was provided, via email, to VGG on November 19, 2020. However, in that email, Hemmera indicated that Chance would be submitting the proposal to YESAB the following day. VGG responded that same day and expressed concern about Chance not meeting with VGG prior to submission to YESAB and the short timeframe for VGG to be able to provide comments prior to submission. VGG indicated that it would likely not be able to provide comments in that timeframe, especially given the significant shift in Chance's proposed activities. On November 20, 2020, Hemmera informed VGG that Chance would delay submission to YESAB until the following week.

On November 25, 2020, VGG informed Chance, via email, that it was not able to provide detailed comments within the short timeline provided by Chance. From their initial and limited review of the revised proposal, VGG identified several questions that required clarification from Chance. VGG also stated that they reserved the ability to provide further and more detailed comments and views in the future once they had an opportunity to understand the revised proposal more fully. VGG advised Chance that the questions included in their email were in addition to any outstanding questions and information requests previously sought by VGG pertaining to Chance's original proposal (i.e., to the extent that they remained relevant). To facilitate an accurate and comprehensive response, Chance requested VGG provide an updated document containing their comprehensive feedback and questions.

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On December 14, 2020, Chance shared an updated project proposal in response to VGG's November 15th questions. Chance and VGG subsequently held a meeting on December 17, 2020 where parties discussed Chance's responses and additional questions VGG had at that time. The discussion centered around Chance's consideration of potential interactions between EFT activities and birds, air quality, caribou, and permafrost. Additional detail is provided below:

- Chance clarified a flare stack height of 30.5 m is planned in order to minimize possible interactions with permafrost, vegetation and/or trees.
- Text was added to demonstrate consideration of Air Quality as a potential valued component and rationale as to why it was not carried forward for assessment.
- Text was added clarifying that while flaring, and other activities related to EFT, could cause additional potential disturbance and effects on wildlife, the assessment of potential project effects on caribou assumed 24h noise and light disturbances, so that including EFT activities was not considered a material change.

Additionally, in correspondence leading up to the December 17th meeting and during the meeting itself, VGG expressed the importance of addressing concerns of Yukon First Nation partners prior to the Proposal's submission to YESAB. The project proposal was submitted to YESAB on December 24, 2020.

3.3 Summary of Engagement – Eagle Plains Exploration Project

Between June 1, 2020 and May 31, 2021, Chance and VGG exchanged emails/letters and met in relation to their ongoing negotiations of a Cooperation Agreement. Meeting details as well as subsequent drafts of the Cooperation Agreement are confidential and not addressed in this report.

While Chance and VGG did not meet to discuss the Eagles Plains Exploration Project between June 1, 2020 and May 31, 2021, in the Spring of 2021 two key letters were exchanged between VGG and Chance. They are summarized in the following section.

3.3.1 Correspondence Summaries

Date: March 31, 2021
Location: Letter via email
Addressed: [redacted]

Chief [redacted] and the VGG Chief Executive Officer of VGG addressed a letter to [redacted], Chairman and CEO of Chance. The topic of the letter was on communication and engagement with the VGG. Chief [redacted] stated that Chance had, in relation to the Eagle Plains Exploration Project, consistently failed to adhere to the Policy and the joint Plan. Chief [redacted] explained that VGG has effectively communicated that they are committed to sustainable development, and the rights of VGFN Citizens to free, prior, and informed consent. Additionally, Chief [redacted] referenced constituent elements of free, prior, and informed consent from the UN Expert Mechanism on the Rights of Indigenous Peoples.

The letter gave notice that, following events at a special meeting of the VGFN General Assembly and consultation between VG Council and the Natural Resources Committee, VGG was immediately implementing the following measures:

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1. Ceasing all communication and engagement between VGG and Chance, including negotiations under the Policy.
2. VGG would be conducting an internal review of the Plan for consistency with the Policy.
3. Requiring that all Chance staff, directors, consultant, and advisors, while acting in such a capacity, may only participate by invitation in VGG internal governance processes and mechanisms regarding the Eagle Plains Exploration Project (e.g., VGG planned consultation meetings with VGFN Citizens and meetings of the VGFN General Assembly).
4. Instructing Chance to submit advance written notice of any planned consultation with VGFN Citizens, which would not be considered consultation with VGG, accordance with section 21 of the Policy.
5. Stating future communication and engagement between Chance and VGG would be initiated from Chief [redacted] to [redacted] and any future meetings would be held in Old Crow in an open forum where VGFN Citizens could attend and participate.
6. Stating future negations of the Cooperation Agreement or Benefits and Stewardship Agreements would be held in Old Crow for VGFN Citizens to attend and observe.

VGG informed Chance that these measures would remain in effect until further notice.

Date: April 12, 2021
Location: Letter via email
Addressed: To [redacted]*. From* [redacted]

Before addressing the VGG's letter (dated March 31, 2021), [redacted] provided a background description of his personal interests and commitments for oil and gas exploration in the Eagle Plains Basin. Chernoff stated that despite hydraulic fracking being banned in 2015, he is still committed to exploration in the Eagle Plains Basin. Chernoff referenced the letter from VGG and disagreed with Chief [redacted], stating that Chance has followed both the Policy and the Plan. [redacted] described that Chance believes it has been cooperative, respectful, transparent in its dealings with VGG.

[redacted] described some of Chance's efforts at collaboration, stating that they have shared significant information with the Natural Resources Committee and that Chance would be arranging meetings so its consultants could share information with VGG and VGFN Citizens. [redacted] shared concerns that he believed VGG had not reciprocated Chance's good faith efforts. Chernoff described how Chance has complied with various regulatory requirements: Yukon *Oil and Gas Act*, *Yukon Environmental and Socio-Economic Assessment Act*, and the North Yukon Regional Land Use Plan. [redacted] invited suggestions from VGG on how the disconnect between Chance and VGG could be resolved in a timely manner while equitably addressing the interests of the parties.

[redacted] shared his disappointment with VGG was taking steps to terminate further engagement. He declared Chance's ongoing respect for the VGFN Land Claim Agreement and the economic, environmental, cultural and heritage interests of the VGFN. As a result of time restraints pertaining to Chance's tenures, [redacted] stated that Chance would move ahead with steps needed to preserve its tenure interests and that Chance intended to submit the Eagle Plains Exploration Project to YESAB fall 2021. [redacted] closed with a suggestion that that [redacted] and himself should meet with VG Chief and Council at their earliest convenience.

3.4 Communication Log

The correspondence between Chance and VGG is documented in the Engagement Log (see **Appendix D**).

4.0 PLANS FOR ONGOING ENGAGEMENT AND NEXT STEPS

No additional engagement activities are expected for the Well Maintenance and Extended Flow Testing Project while it is undergoing YESAB's review.

For the Eagle Plains Exploration Project, upcoming engagement activities may include open houses in Old Crow, subject to COVID restrictions, as well as meetings with the North Yukon Renewable Resource Council.

Consultation and engagement activities between the VGG will continue to be guided by the March 31 letter from Chief [redacted] to [redacted], as well as the Plan and the Policy therein.

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5.0 APPROVAL OF IMPLEMENTATION SUMMARY

VGG and Chance have reviewed this report and agree to its contents as an accurate summary of the engagement activities carried out between June 1, 2020 and May 31, 2021.

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APPENDIX A

Vuntut Gwitchin Government and Chance Oil and Gas Limited Communication and Engagement Plan

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Vuntut Gwitchin Government

Chance OIL AND GAS LIMITED

May 22, 2018

Honourable [redacted]
Minister of Energy, Mines and Resources
Government of Yukon
Box 2703
Whitehorse, Yukon Y1A 2C6

Dear Minister [redacted]

Re: Submission of the Vuntut Gwitchin Government and Chance Oil and Gas Limited Communications and Engagement Plan

Ministerial Order 2017/037 of the Yukon Oil and Gas Act states the following in clause 5:

> *5 It is a condition of this Order that Chance Oil and Gas Limited must, in consultation with each affected First Nation, revise the first nations communications and engagement plan filed under O.I.C. 2016/169 to the satisfaction of the Minister on or before August 1, 2018.*

Vuntut Gwitchin Government (VGG) and Chance Oil and Gas Limited (Chance) are pleased to inform you of our collaborative efforts to develop a mutually agreeable framework to facilitate effective and meaningful communications and engagement between VGG and Chance. The framework captured in the enclosed Communications and Engagement Plan (Plan), and its collaborative development, establishes a solid foundation for a respectful relationship that both parties will implement and enjoy as we continue to work together now and into the future.

Please accept the enclosed Plan for the purposes of Ministerial Order 2017/037. We trust that the Plan will be of satisfaction to the Minister, as it meets the needs of VGG and Chance at this time.

[redacted]

Director of Natural Resources
Vuntut Gwitchin Government

Vice President of Government and External Relations
Chance Oil and Gas Limited

Enclosed: Communications and Engagement Plan





COMMUNICATION AND ENGAGEMENT PLAN

VUNTUT GWITCHIN GOVERNMENT & CHANCE OIL AND GAS LIMITED

MAY 17, 2018

1. Background

Chance Oil and Gas Limited ("Chance") is an oil and gas exploration company that currently holds valid permits to perform oil and gas activities in the Eagle Plain basin within the Traditional Territory of the Vuntut Gwitchin First Nation ("VGFN").

As a condition of order-in-council 2016/169 dated August 30, 2016 concerning the return of work deposits to Chance in relation to oil and gas permits nos. 0005 to 0011, Chance was required to file a communication and engagement plan (the "Plan"). The Plan, as it was submitted, was not mutually agreed upon between Chance and the Vuntut Gwitchin Government ("VGG").

As a condition of ministerial order 2017/37 dated August 29, 2017 concerning a one-year extension for oil and gas permit nos. 0012 to 0017, Chance is now required to revise the Plan in consultation with VGFN on or before August 1, 2018.

2. Purpose

The purpose of this document is to revise the Plan in a manner that establishes a mutually agreed upon framework between Chance and VGG to guide communication (i.e. the exchange of information) and engagement (i.e. meaningful participation in planning, problem-solving and decision-making) in relation to all aspects of Chance's activities, including but not limited to, community information programs; existing or proposed oil and gas dispositions; and existing or proposed oil and gas activities.

Nothing in this Plan is intended to address or satisfy any duties or responsibilities of the Government of Yukon that exist or may arise in relation to Chance's exploration program.

3. Application of Oil and Gas Engagement Policy

The *Vuntut Gwitchin Government Oil and Gas Engagement Policy* attached to this Plan as Appendix A (the "Policy") will be the overarching framework that guides engagement between VGG and Chance in relation to Chance's activities. Chance will comply with the Policy and any other applicable VGG policies. To the extent that there may be any inconsistency between this Plan and the Policy, the Policy will prevail.

4. Communication and Engagement

The communication and engagement between Chance and VGFN in relation to Chance's exploration program activities is anticipated to encompass communication and engagement between: (a) Chance and VGG; and (b) Chance and VGFN Citizens.

4.1 Communication and Engagement between Chance and VGG

The VGG committee mandated under part two of the Policy will be the VGG body responsible for managing communications and engagement between Chance and VGG, including informing and seeking views of VGFN Citizens, with the exception of any communications related to any

negotiations of towards a Cooperation Agreement or Benefits and Stewardship Agreement which will occur directly between Chance and Council as set out under the Policy.

Table 1.

Subject Matter	VGG Contact(s)	Chance Contact(s)
Communications related to Chance's exploration program activities, other than those communications excepted below.	• Director of Natural Resources • Chair of the Standing Committee on Natural Resources, Heritage, Tourism and Economic Development	• Management Team
Communications related to the negotiation of a Cooperation Agreement or Benefits and Stewardship Agreement.	• Council	• Management Team

4.2 Communication and Engagement between Chance and VGFN Citizens

VGG does not serve a gatekeeping role with respect to any communications and engagement that Chance may wish to undertake with VGFN Citizens in relation to Chance's exploration program activities; however, VGG and Chance will seek to coordinate communication and engagement efforts with VGFN Citizens to the extent such joint communication and engagement is possible or appropriate. As detailed in the Policy, Chance will submit a written notice to the Director of Natural Resources within a reasonable time prior to any proposed public meetings with VGFN Citizens in order to facilitate coordination between Chance and VGG.

Table 2.

Subject Matter	VGG Contact(s)	Chance Contact(s)
Written notice of proposed meetings with VGFN Citizens in relation to Chance's exploration program activities.	• Director of Natural Resources	• Vice President of Government and Community Relations

4.3 Communication and Engagement Methods and Content

Chance and VGG will use the following methods for carrying out communication and engagement in relation to Chance's exploration program activities:

- In-person meetings;
- Public meetings (for communication and engagement with VGFN Citizens in Old Crow and Whitehorse);

- E-mail correspondence;
- Telephone correspondence (teleconferences and less formal phone calls);
- Power Point presentations (to support in-person meetings);
- Reports (as requested and as required);
- Social media;
- Newsletters; and
- Official websites.

The information exchanged in communication and engagement between Chance and VGFN is anticipated to address the following key items:

- Information programs regarding VGFN culture and history;
- Information programs regarding the oil and gas industry, including its history and regulation in Yukon;
- Any existing or proposed Chance oil and gas dispositions;
- Any existing or proposed Chance oil and gas activities;
- Items set out in the Policy that must be addressed in any Cooperation Agreement and Benefits and Stewardship Agreement between VGFN and Chance; and
- Implementation of the Policy.

5. Records Management

Chance and VGG will use the following records management protocols in relation to communications and engagement between Chance and VGG.

5.1 Records Subject to Disclosure to Regulators and Assessors

Subject to the records management protocols in this Plan, Chance may disclose the following types of relevant records to regulators and assessors:

- meeting agendas;
- meeting minutes;
- meeting participant lists;

- records log which includes summaries of the following: in-person meetings; e-mail and telephone correspondence between Chance and VGG, including supporting materials shared or discussed in the correspondence;

- reports provided by either VGG or Chance to one another; and

- Power Point presentations provided by either VGG or Chance to one another.

5.2 Records Management Procedures and Confidentiality Protocols

Records of communications between VGG and Chance will be made, and any support services retained by either Chance or VGG to those records will be conducted in a fair and unbiased manner. Should VGG and Chance choose not to retain records management support services, VGG and Chance will jointly decide on an individual or individuals from either or both parties to be responsible for records keeping and management.

Chance, VGG and any person or party retained to assist in records management will comply with the following procedures for records management:

- Meeting agendas will be developed collaboratively between VGG and Chance and mutually agreed upon prior to the outset of the meeting.

- Meeting minutes will be taken by a designated records management person or party and sent to Chance and VGG within 2 weeks via e-mail. VGG and Chance may review and provide comment to the records management person or party on these meeting minutes within 30 days of both parties receiving the meeting minutes. Should either party require more time to review the meeting minutes, the party will notify the records management person or party by e-mail within 2 weeks of receiving the minutes. No response by VGG or Chance to meeting minutes will be interpreted as general acceptance of the meeting minutes by that party.

- Action items and key outcomes will be logged during meetings and will be reviewed by both parties at the end of the meeting to ensure that there is general agreement on the list of actions and parties responsible for those actions and on the list of key outcomes from the meeting. The list of action items and the list of key outcomes will be recorded within the meeting minutes.

- Any reports or Power Point presentations provided by either VGG or Chance to one another will be considered final upon delivery unless otherwise specified as drafts.

- A record log will be jointly reviewed and approved by Chance and VGG for accuracy, completeness, and compliance with this Plan prior to being disclosed to any regulator and assessor.

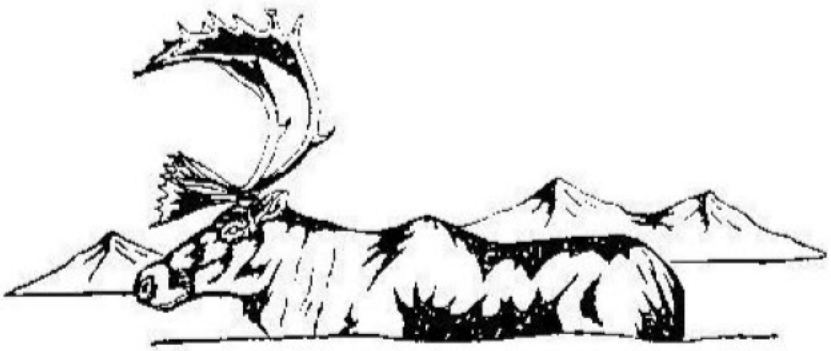
Chance and VGG will comply with the following confidentiality protocols for records management and the disclosure of records to regulators and assessors:

Table 3.

Type of Record	Confidentiality Assumption	Process for Establishing Confidentiality
Meeting Agendas	• Not confidential.	• Should confidential matters need to be discussed, a separate agenda will be created for these matters and remain confidential.
Meeting Minutes	• Not confidential.	• Confidential discussions/content will be identified before the meeting begins, during the meeting, or as part of the minutes review process.
Meeting Participant List	• Not confidential.	• Unless otherwise specified during the meeting, these items are not considered confidential.
Records Log	• Not confidential.	• Should correspondence need to be confidential, it is the responsibility of each party to notify the other when a meeting, e-mail, phone call, or attachment is confidential at the time it occurs or immediately thereafter.
Reports provided by either VGG or Chance to one another	• Not confidential. • Note: Any reports containing traditional knowledge or traditional land use will be subject to separate protocols agreed upon by VGG and Chance.	• Should a report shared between parties need to be confidential, it is the responsibility of each party to notify the other of this when the report is shared.
Power Point presentations provided by either VGG or Chance to one another	• Not confidential.	• Unless otherwise specified during the meeting, these items are not considered confidential.

6. Plan Review and Amendment

Chance and VGG will review and assess this Plan and its implementation on a quarterly basis. Following any review and assessment of the Plan, the Plan may be amended upon the mutual agreement of Chance and VGG.



VUNTUT GWITCHIN GOVERNMENT
OIL AND GAS ENGAGEMENT POLICY

MAY 2018

PART ONE
GENERAL PROVISIONS

Title

1. This policy may be cited as the *Vuntut Gwitchin Government Oil and Gas Engagement Policy*.

Definitions

2. In this policy:

"**Application**" means an application made by a Proponent in relation to an Oil and Gas Disposition pursuant to the *Oil and Gas Act*, R.S.Y. 2012, c. 162;

"**Benefits and Stewardship Agreement**" means the agreement required in relation to any oil and Gas Activity as set out at Stage III of the Engagement Process under part three of this policy.

"**Board**" means a designated office, executive committee or panel of the Yukon Environmental and Socio-Economic Assessment Board.

"**Citizen**" means a citizen of the Vuntut Gwitchin First Nation pursuant to Appendix II of the Constitution (Citizenship Code).

"**Citizen Representative**" means a Citizen appointed to the Committee by the Council.

"**Committee**" means the lands and resources committee of the Vuntut Gwitchin First Nation as mandated under part two of this policy.

"**Constitution**" means the Constitution of the Vuntut Gwitchin First Nation.

"**Cooperation Agreement**" means the agreement required in relation to any Oil and Gas Activity as set out at Stage II of the Engagement Process under part three of this policy.

"**Council**" means the branch of the Vuntut Gwitchin Government established by the Constitution consisting of the Chief, Deputy Chief and all Councillors.

"**Director of Natural Resources**" means the Director of the Vuntut Gwitchin Government's Natural Resources Department.

"**Elders Representative**" means a member of the Vuntut Gwitchin First Nation Elders Council appointed to the Committee by the Elders Council.

"**Engagement Process**" means the process commencing under part three of this policy for engagement between the Vuntut Gwitchin Government and a Proponent in relation to any Application or Oil and Gas Activity and continuing for so long as required.

"**Intergovernmental Process**" means any engagement process between the Vuntut Gwitchin Government and Government of Yukon on matters related to Oil and Gas Activities, Oil and Gas Dispositions and their regulation.

"**Oil and Gas Activity**" or "**Oil and Gas Activities**" means any existing or proposed oil and gas activity or activities as defined by Section 1 of the *Oil and Gas Act*, R.S.Y. 2012, c. 162 that affects, or has the potential to affect, any rights, responsibilities or interests of the Vuntut Gwitchin First Nation whether or not the oil and gas activity or activities are situated within the Vuntut Gwitchin First Nation Traditional Territory.

"**Oil and Gas Disposition**" or "**Oil and Gas Dispositions"** means any existing or proposed oil and gas disposition or dispositions as defined by as defined by Section 1 of the *Oil and Gas Act*, R.S.Y. 2012, c. 162 that affects, or has the potential to affect, any rights, responsibilities or interests of the Vuntut Gwitchin First Nation whether or not the oil and gas disposition or dispositions grants rights to lands situated within the Vuntut Gwitchin First Nation Traditional Territory.

"**Proponent**" means any proponent of an Oil and Gas Activity or holder of an Oil and Gas Disposition.

"**Proposal**" means a proposal required to be submitted by a proponent to the Board pursuant to Section 50(1) of the *Yukon Environmental and Socio-economic Assessment Act*, S.C. 2003, c. 7.

"**Sustainable Development**" means beneficial socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent as defined in Chapter 1 of the *Vuntut Gwitchin First Nation Final Agreement*,.

"**Standing Committee Chair**" means the Chair of the Vuntut Gwitchin Government Standing Committee on Natural Resources, Heritage, Tourism and Economic Development.

"**Vuntut Gwitchin First Nation"** means the legal entity established pursuant to Article 9 of the *Vuntut Gwitchin First Nation Self-Government Agreement*.

"**Vuntut Gwitchin First Nation Law**" means any law enacted by the Vuntut Gwitchin First Nation in accordance with its law-making powers under Article 13 of the *Vuntut Gwitchin First Nation Self-Government Agreement*.

"**Vuntut Gwitchin Government**" means the government of the Vuntut Gwitchin First Nation.

"**Youth Representative**" means a Citizen between the ages of 14 and 21 appointed to the Committee by the Council.

Purpose

3. The purpose of this policy is to establish a respectful, transparent and meaningful framework to guide the engagements of the Vuntut Gwitchin Government in relation to Oil

and Gas Activities and Oil and Gas Dispositions in a manner that supports and upholds the objective of Sustainable Development.

Application

4. This policy applies to any engagement between the Vuntut Gwitchin Government and a Proponent in relation to any to Oil and Gas Activities and Oil and Gas Dispositions.

Conflict of Law and Policy

5. In the event of a conflict or inconsistency between this policy and the Constitution, the Constitution shall prevail to the extent of the conflict or inconsistency.

6. In the event of a conflict or inconsistency between this policy and any Vuntut Gwitchin First Nation Law, the Vuntut Gwitchin First Nation Law shall prevail to the extent of the conflict or inconsistency.

General

7. Nothing in this policy is to be construed as abrogating or derogating from the *Vuntut Gwitchin First Nation Final Agreement*.

8. Nothing in this policy is to be construed as providing consent or authorizing any past, existing or proposed Oil and Gas Activity or Oil and Gas Disposition.

9. Nothing in this policy shall be construed as limiting, affecting, fulfilling or discharging the honour of the Crown and the Crown's constitutional duty to consult and accommodate the Vuntut Gwitchin First Nation.

10. This policy may be amended from time to time by the Vuntut Gwitchin Government and will make best efforts to notify any Proponent potentially affected by an amendment.

PART TWO
ADMINISTRATION

Committee

11. The Vuntut Gwitchin Government shall establish the Committee with a mandate to fulfill the following roles and responsibilities in accordance with this policy:

    (a) reviewing information about Oil and Gas Activities, Oil and Gas Dispositions and their regulation;

    (b) informing and seeking views from Citizens on Oil and Gas Activities, Oil and Gas Dispositions, the Engagement Process and/or Intergovernmental Process as necessary;

(c) assisting and providing recommendations to the Council throughout the Engagement Process; and

(d) providing recommendations to the Council throughout the Intergovernmental Process if requested by Council.

12. The Committee shall be made of 5 members consisting of the:

(a) Standing Committee Chair;

(b) Director or Natural Resources;

(c) Elders Representative;

(d) Youth Representative; and

(e) Citizen Representative.

13. The Committee shall meet as regularly as may be necessary to fulfill its roles and responsibilities.

14. The Committee shall have a quorum of 3 members.

15. The Standing Committee Chair and Director of Natural Resources shall serve as co-chairs of the Committee.

16. The Committee shall make best efforts to fulfill its roles and responsibilities by consensus.

17. The Committee may at any time request the support of employees or contractors of the Vuntut Gwitchin Government to assist it in carrying out its roles and responsibilities under this policy.

18. The Committee may invite any persons, including any Proponent, to attend or participate in a meeting of the Committee.

19. The Committee shall not use or disclose to any person confidential information except as may be required to fulfill its roles and responsibilities.

Citizen Consultation

20. The Director of Natural Resources shall be responsible for organizing and carrying out any consultation between the Vuntut Gwitchin Government and Citizens regarding Oil and Gas Activities and Oil and Gas Dispositions with the assistance and participation of the Committee as necessary.

21. In that event that a Proponent wishes to organize and carry out any public consultation with Citizens related to any Oil and Gas Activities or Oil and Gas Dispositions, the Proponent shall submit a notice in writing to the Director of Natural Resources within a reasonable time prior to the proposed meeting date in order to facilitate coordination between the

Proponent and Vuntut Gwitchin Government if appropriate. The written notice shall contain:

(a) proposed dates and location;

(b) proposed agenda;

(c) description of the purpose of the consultation; and

(d) any materials to be relied on by the Proponent during the consultation.

22. Any consultations with Citizens related to any Oil and Gas Activities or Oil and Gas Dispositions that are organized and carried out by the Proponent shall not be construed as consultation with the Vuntut Gwitchin Government.

PART THREE
ENGAGEMENT PROCESS

Stage I – Notice Period

23. Proponents shall provide notice in writing to the Director of Natural Resources of any Application in relation to any Oil and Gas Disposition at the earliest possible opportunity. The written notice of the Application shall contain:

(a) letter of introduction;

(b) company profile including organizational structure, profiles of directors and management team members, financial statements for the previous five fiscal years and compliance record;

(c) detailed description of the Oil and Gas Disposition and Application including any relevant maps, plans or schedules; and

(d) designated Proponent spokesperson.

24. Proponents shall provide notice in writing to the Director of Natural Resources of any Oil and Gas Activity at the earliest possible opportunity in the planning phase and prior to submitting a Proposal to the Board. The written notice shall contain:

(a) letter of introduction;

(b) company profile including organizational structure, profiles of directors and management team members, financial statements for the previous five fiscal years and compliance record;

(c) detailed description of the proposed Oil and Gas Activity, including any relevant maps, plans or schedules;

(d) administration fee in the amount of $1,000.00 made payable to the Vuntut Gwitchin First Nation; and

(e) designated Proponent spokesperson.

25. Upon receipt of any written notice from a Proponent in relation to any Application or Oil and Gas Activity, the Director of Natural Resources shall immediately refer the notice to the Committee. The Committee shall meet to review the notice and:

(a) if the Committee determines the notice is incomplete or insufficient the Committee may request in writing further or better information from the Proponent, and the Proponent shall provide such further or better information upon receipt of the written request; or

(b) if the Committee determines the notice is complete and sufficient then:

(i) in the case of a notice regarding an Application, the Director of Natural Resources may provide written comments to the Proponent or request a meeting with the Proponent to discuss the Application; and

(ii) in the case of a notice regarding an Oil and Gas Activity, the Committee shall notify the Proponent of the determination in writing and the Engagement Process shall proceed to Stage II.

Stage II – Cooperation on any Oil and Gas Activity

26. After completion of Stage I and prior to submitting a Proposal to the Board, a Proponent shall negotiate in good faith and enter into a Cooperation Agreement with the Council for the purpose of establishing a meaningful, respectful and transparent process for engagement.

27. Prior to entering into a Cooperation Agreement, the Council shall refer the agreement to the Committee for review. The Council may enter into a Cooperation Agreement on behalf of the Vuntut Gwitchin First Nation if the Committee determines that the terms and conditions adequately consider and address the following items:

(a) compliance with this policy;

(b) capacity funding for the Engagement Process;

(c) communications and correspondence;

(d) information sharing; and

(e) commitment to negotiate a Benefits and Stewardship Agreement.

Stage III – Benefits and Stewardship on any Oil and Gas Activity

28. After the completion of Stage II and prior to submitting a Proposal to the Board, a proponent shall negotiate in good faith and enter into a Benefits and Stewardship Agreement with the Council for the purpose of establishing appropriate stewardship measures and maximizing any potential benefits for the Vuntut Gwitchin First Nation.

29. Prior to entering into a Benefits and Stewardship Agreement, the Council shall refer the agreement to the Committee for review. The Council may enter into a Benefits and Stewardship Agreement on behalf of the Vuntut Gwitchin First Nation if the Committee determines that the terms and conditions adequately consider and address the following items:

(a) detailed description of the Oil and Gas Activity;

(b) capacity funding for participation in the Board's regulatory process;

(c) compliance with the objective of Sustainable Development;

(d) compliance with applicable land use plans;

(e) compliance with Vuntut Gwitchin First Nation General Assembly Resolution No. 2013-01 regarding hydraulic fracturing;

(f) adequate education and training opportunities;

(g) adequate employment and procurement opportunities;

(h) adequate revenue sharing or equity arrangements;

(i) adequate stewardship measures including but not limited to:

(i) baseline data collection measures;

(ii) information sharing measures;

(iii) joint monitoring of environmental and socio-economic effects, and of the effectiveness of mitigation measures;

(iv) joint advisory and reporting processes;

(v) joint fish and wildlife management plan;

(vi) joint heritage resource protection plan;

(vii) joint access management plan;

(viii) joint water quality and quantity management plan;

(ix) joint waste management plan;

(x) joint remediation and reclamation plan;

(xi) adaptive management measures in relation to the foregoing stewardship measures, including adaptability to address any recommendations from the Board;

(j) potential socio-economic effects which includes effects on economies, health, culture, traditions, lifestyles and heritage resources;

(k) potential cumulative effects which includes effects to the environment that are caused by an action in combination with other past, present and future human actions;

(l) potential effects on any Vuntut Gwitchin First Nation rights, responsibilities and interests under the *Vuntut Gwitchin First Nation Final Agreement* and *Vuntut Gwitchin First Nation Self-Government Agreement*;

(m) compliance and enforcement measures;

(n) dispute resolution mechanisms; and

(o) Vuntut Gwitchin First Nation approval and ratification process.

30. In addition to a Benefits and Stewardship Agreement, the Council may enter into a separate agreement with a Proponent and other parties for the purpose of addressing the limited requirements under section 68 of the *Oil and Gas Act*, R.S.Y. 2012, c. 162.

APPENDIX B
Ministerial Order 2018/42

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YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,

(d) oil and gas permit No. 0015,

(e) oil and gas permit No. 0016,

(f) oil and gas permit No. 0017. « *permis visé* »

2 The renewal term of each subject permit is extended by five years (so that it ends on August 30, 2023).

3 The resulting total length of the initial term and the renewal term of a subject permit is 16 years.

MO-OGA-18-07 (ExtPrmt)-E06-F01-FIN

YUKON

CANADA

ARRÊTÉ MINISTÉRIEL 2018/42

LOI SUR LE PÉTROLE ET LE GAZ

Le ministre de l'Énergie, des Mines et des Ressources, conformément à la *Loi sur le pétrole et le gaz*, arrête :

1 La définition suivante s'applique au présent arrêté.

« permis visé » Les permis suivants de pétrole et de gaz détenus par Chance Oil and Gas Limited :

a) permis de pétrole et de gaz nº 0012;

b) permis de pétrole et de gaz nº 0013;

c) permis de pétrole et de gaz nº 0014;

d) permis de pétrole et de gaz nº 0015;

e) permis de pétrole et de gaz nº 0016;

f) permis de pétrole et de gaz nº 0017. "*subject permit*"

2 La durée du renouvellement de chaque permis visé est prolongée de cinq ans, de façon à ce qu'elle se termine le 30 août 2023.

3 La durée totale d'un permis visé, y compris la durée initiale et la durée du renouvellement, est de 16 ans.

4(1) In this section

"first nations communications and engagement plan" means the plan filed under O.I.C. 2016/169 and revised in accordance with M.O. 2017/37. *« plan de participation et de communication avec les premières nations »*

(2) It is a condition of this Order that Chance Oil and Gas Limited must file annual reports with the Division Head, in accordance with subsection (3) and to the satisfaction of the Division Head, about the implementation of the first nations communications and engagement plan.

(3) For the purposes of subsection (2), Chance Oil and Gas Limited must file

(a) the first annual report on or before July 31, 2019, in respect of the period beginning on September 1, 2018, and ending on May 31, 2019; and

(b) each subsequent annual report on or before July 31 of each year in respect of the period beginning on June 1 of the preceding year and ending on May 31 of the year in which the report is to be filed.

4(1) La définition suivante s'applique au présent article.

« plan de participation et de communication avec les premières nations » Le plan déposé en vertu du Décret 2016/169 et révisé en conformité avec l'Arrêté 2017/37. *"first nations communications and engagement plan"*

(2) À titre de condition du présent arrêté, Chance Oil and Gas Limited dépose des rapports annuels auprès du chef de division, en conformité avec le paragraphe (3) et à la satisfaction du chef de division, concernant la mise en œuvre du plan de participation et de communication avec les premières nations.

(3) Pour l'application du paragraphe (2), Chance Oil and Gas Limited dépose :

a) le premier rapport annuel au plus tard le 31 juillet 2019, pour la période débutant le 1er septembre 2018 et se terminant le 31 mai 2019;

b) chaque rapport annuel subséquent, au plus tard le 31 juillet de chaque année pour la période débutant le 1er juin de l'année précédente et se terminant le 31 mai de l'année au cours de laquelle le rapport doit être déposé.

Dated at Whitehorse, Yukon,
~~Dc~~ August 30th 2018.

Fait à Whitehorse, au Yukon,
le August 30th 2018.

[redacted]

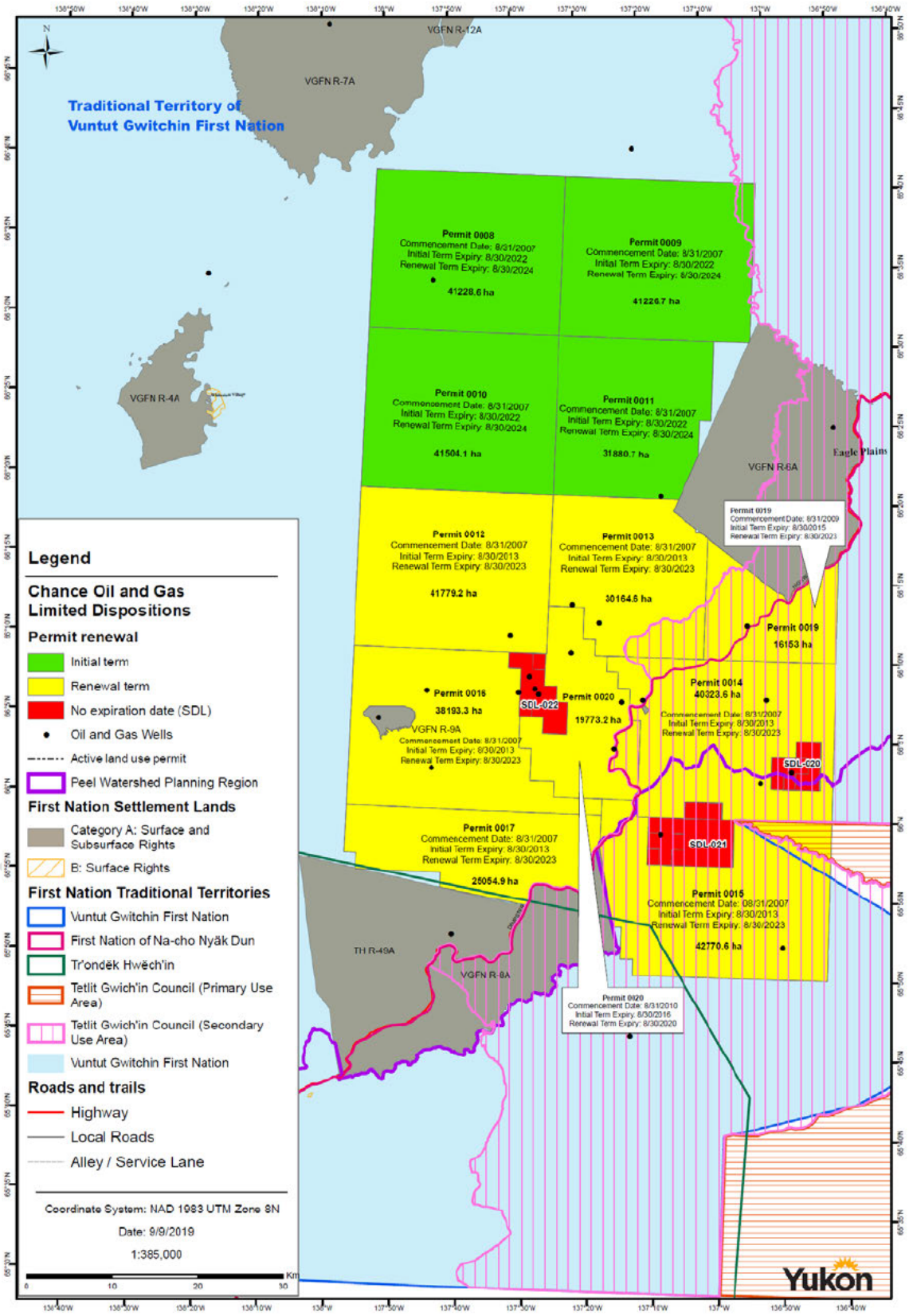
Minister of Energy, Mines [redacted]le, des Mines et des Ressources

MO-OGA-18-07 (ExtPrmt)-E06-F01-FIN

APPENDIX C
Map of Chance Dispositions and Wells

DRAFT

Chance Oil and Gas Limited Dispositions and Wells



APPENDIX D
Engagement Log

DRAFT

APPENDIX 2-C-45. Consultation and Engagement Letter

VUNTUT GWITCHIN GOVERNMENT
Government of Vuntut Gwitchin First Nation
NATURAL RESOURCES COMMITTEE
P.O. Box 94,
Old Crow, Yukon
Y0B 1N0
Phone: (867)966-3261
Fax: (867)966-3116
Web: www.vgfn.ca

August 26, 2019

VIA E-MAIL – [redacted]

[redacted]
Government and Community Relations
Chance Oil and Gas Limited
Suite 200, 208 Main Street
Whitehorse, YT Y1A 2A9

Dear Greg:

RE: Chance Oil and Gas Limited's ("Chance") Notices

This letter is responding to the following notices submitted by Chance to the Vuntut Gwitchin Government's ("VGG") Natural Resources Committee ("Committee"):

- The notice submitted March 15, 2019 pursuant to section 23 of the VGG Oil and Gas Engagement Policy ("Policy") of Chance's intention to apply to extend the tenure of oil and gas permits 0006, 0007, 0008, 0009, 0010, 011, and 0019 ("Section 23 Notice").
- The notice submitted June 6, 2019 pursuant to section 24 of the Policy of Chance's proposed oil and gas activities in the Eagle Plains basin ("Section 24 Notice").

The Committee has reviewed both the Section 23 Notice and Section 24 Notice, along with Chance's financial statements and information shared during the August 8th, 2019 meeting in Old Crow, and has determined that both notices are complete and sufficient in accordance with Section 25 of the Policy.

Section 23 Notice

The Committee has determined that the Section 23 Notice is complete and sufficient pursuant to subparagraph 25(b)(i) of the Policy.

The Committee has no written comments to provide in relation to the Section 23 Notice and therefore our consideration of this matter under the Policy is concluded.

Section 24 Notice

The Committee has determined that the Section 24 Notice is complete and sufficient pursuant to subparagraph 25(b)(ii) of the Policy. Accordingly, the engagement between VGG and Chance in

relation to the proposed oil and gas activities that are the subject of the Section 24 Notice has advanced to Stage II of the Engagement Process under the Policy.

The Committee wishes to make clear that its determination that the Section 24 Notice is complete and sufficient is a determination only in relation to the satisfaction of the criteria set out in section 24 of the Policy. This determination should not be construed or understood as acceptance or agreement on behalf of VGG with respect to Chance's proposed oil and gas activities and related plans. VGG's consideration of the substantive contents of the proposed oil and gas activities, including the detailed description of proposed plans, will occur if engagement advances to Stage III of the Engagement Process under the Policy in which Committee would be seeking to ensure a number of considerations are adequately addressed as set out in section 29 of the Policy.

Next Steps

The Policy now requires the negotiation of a Cooperation Agreement between the Council and Chance in relation to the proposed oil and gas activities that are the subject of the Section 24 Notice. If these negotiations result in proposed terms and conditions that the Committee determines adequately addresses the considerations under section 27 of the Policy then Council may enter into that Cooperation Agreement. Practically speaking the negotiation of a Cooperation Agreement will be primarily carried out on behalf of VGG through the direction of the members of the Committee with the support and advice of VGG staff and advisors.

VGG and Chance engaged in preliminary discussions towards a Cooperation Agreement in 2018. Following further review the most recent version of the Cooperation Agreement dated October 20, 2018 has been updated to reflect the evolution of engagement. The Committee encloses to this letter a draft Cooperation Agreement dated August 26, 2019 as a preferred form of agreement for discussions with Chance under Stage II.

VGG proposes that the Committee and Chance seek to schedule a meeting to discuss the draft Cooperation Agreement together in September 2019. In the meantime, the Committee welcomes any written comments and feedback on the draft Cooperation Agreement in order to allow the Committee to review and consider prior to the next meeting.

Sincerely,

[redacted]

Chair, Natural Resources Committee

Attach. Cooperation Agreement (draft August 26, 2019)

APPENDIX 2-C-46. Consultation and Engagement Letter

VUNTUT GWITCHIN GOVERNMENT
Government of Vuntut Gwitchin First Nation

NATURAL RESOURCES COMMITTEE

P.O. Box 94,
Old Crow, Yukon
Y0B 1N0

Phone: (867)966-3261
Fax: (867)966-3116
Web: www.vgfn.ca

July 10, 2019

VIA E-MAIL – [redacted]

[redacted]
Chance Oil and Gas Limited
Suite 200, 208 Main Street
Whitehorse, YT Y1A 2A9

Dear Greg:

RE: Chance Oil and Gas Limited's ("Chance") Notices

On behalf of the Vuntut Gwitchin Government's ("VGG") Natural Resources Committee ("Committee") this letter is responding to the following notices submitted by Chance in accordance with the VGG Oil and Gas Engagement Policy ("Policy"):

- The notice of Chance's application to extend the term of oil and gas permits 0006, 0007, 0008, 0009, 0010, 011, and 0019 submitted on March 15, 2019 pursuant to section 23 of the Policy.
- The notice of Chance's proposed oil and gas activities in the Eagle Plains basin submitted on June 6, 2019 pursuant to section 24 of the Policy.

The Committee has reviewed both notices [redacted]
Following this review the Committee has questions regarding the financial circumstances of the company and potential risks this may pose to ensuring the fundamental objective of sustainable development is adhered to within our Traditional Territory. The Committee has determined by consensus that we are not in a position to recommend VGG proceed to any further stage of engagement with Chance unless the potential risks we are concerned about could be addressed. The Committee requests a meeting with Chance to discuss these matters further. The Committee proposes that we schedule a meeting in Old Crow in August 2019 for this purpose.

Sincerely,

[redacted]
Councillor and Co-Chair of the Natural Resources Committee

cc: Committee members
Chief and Council

APPENDIX 2-C-47. Land Tenure Extension Request for Exploration Permits 0008-0017, 0019 and 0020 Letter

Chance
OIL AND GAS LIMITED

December 15, 2021

Government of Yukon
Department of Energy, Mines and Resources
P.O. Box 2703
Whitehorse, YT
Y1A 1B2

sent via email: [redacted]

Attention: Hon. [redacted], Minister of Energy, Mines and Resources
Dear Sir:

Re: Land Tenure Extension Request for Exploration Permits 0008-0017, 0019 and 0020 ("Permits")

Chance Oil and Gas Limited ("Chance", the "Company") hereby requests that the referenced Permits be extended for an additional five years pursuant to Sections 27(b), 28(1)(c) and (d) and 31.01 of the Yukon *Oil and Gas Act* (the "Act"). The basis for this extension request is described in the following paragraphs and has not materially changed since the last request for tenure extension was made on March 11, 2020 for one of the Exploration Permits. Timelines to be able to exercise exploration rights in Yukon are long and growing.

The actions of Chance and its predecessor, Northern Cross (Yukon) Limited, in respect of the rights under the Permits have been consistent with the Act by diligently trying to conduct an exploration program at Eagle Plains to evaluate the crude oil and natural gas resource potential. These efforts are substantially documented in the records of a variety of government departments, including Energy Mines and Resources. The Company has only been partially successful accomplishing its exploration objectives.

Unfortunately, Chance has been subjected to external influences beyond the control of the Company. These include the indefinite, perhaps permanent, moratorium on hydraulic fracture

stimulation ("Moratorium") in the Eagle Plain Sedimentary Basin, the impact of the Peel Watershed Land Use Planning exercise which challenged access, and the inconsistent, unpredictable and expanded time and information requirements of environmental impact assessment processes with the Yukon Environmental and Socio-economic Assessment Board ("YESAB"). Timelines and conditions related to the conduct of exploration activities are further increased by the requirement under Ministerial Orders whereby Chance has established Engagement and Communication Plans ("Plans") with four First Nations, including designated organizations. The Company is using its best efforts to actively implement these Plans in respect of a significant exploration project, but the pace of this implementation is slow and uneven and has been dramatically affected by Covid 19. The collective impact of these influences was not reasonably foreseen at the time Chance was awarded the Permits nor after exploration activities commenced, but they have adversely affected the ability of the Company to exercise its exploration rights either in a timely way or at all.

Since the Permits were originally awarded during the period between 2007 and 2010, Chance has demonstrated its commitment to oil and gas exploration in Yukon by diligently undergoing several YESAB assessments, obtaining regulatory approvals, and executing drilling and seismic data acquisition programs within the area of the Permits. This work was conducted in an environmentally and corporately responsible manner and in full compliance with various permits and licenses issued to undertake this exploration work. The efforts of the Company have advanced the geological understanding of the Eagle Plain Sedimentary Basin while providing very significant benefits to Yukon in the form of employment, training, and business opportunities. Well over $100 million has been spent, which is about five times the amount that was committed at the time these Permits were originally awarded. Most of this investment is now stranded in view of the Moratorium.

Chance has undertaken or consultants acting on behalf of Chance have undertaken the following activities related to the proposed multi-well exploration and seismic data acquisition program:

1. Geological field program to sample rocks at various outcrops at Eagle Plain to help mature new prospects,
2. Purchased under license vintage 2D seismic data in the Eagle Plain area,
3. Bird survey,
4. Fish and other aquatic surveys,
5. Site investigations of vintage and modern seismic lines to understand use by wildlife and humans and regeneration patterns,
6. Field studies covering a range of permafrost processes;
7. Water sampling at various locations in the proposed area of exploration interest;
8. Porcupine Caribou studies in collaboration with the Porcupine Caribou Management Board,
9. LiDAR and aerial photography surveys; and

10. Meetings with affected First Nations in Old Crow, Inuvik, Tsiigehtchic, Ft. McPherson, Aklavik, Dawson City, Mayo and Whitehorse in respect of a proposed multi-well exploration and seismic data acquisition plan.

More field work is planned for the winter of 2022-2023 to evaluate the condition of 8 suspended wells operated by Chance with the objective of remediating any problems so the wells can remain suspended until used in future operations, converting two wells to become deep zone injectors or disposal wells, extended flow testing of three natural gas formations in three vintage wells and abandoning at least 3 of the suspended wells. Where possible, Chance hires First Nation citizens to participate in these field programs. In the past three years, the approximate expenses incurred to undertake these activities was $6.7 million. Spending at this level or higher is anticipated to continue for additional exploration work and related activities as described above for well maintenance and continuance. Preserving suspended status of wells that are sound and secure supports the request for tenure extension as well.

Chance is hopeful that it will be in a position to submit to the Executive Committee of YESAB under new processes expected to commence in the first quarter of 2022 to begin the assessment of the multi-well exploration drilling and seismic data acquisition project, but First Nation engagement under the Plans may be a rate determining step.

The maintenance program planned for the winter of 2022-2023 offers a great opportunity to measure the depth of permafrost and Chance plans to run a temperature survey in a number of the suspended wells to determine the geographic extent of permafrost and any variability of its depth.

Notwithstanding very limited oil field service and supply capacity resident in Yukon, the historical exploration drilling and seismic data gathering programs operated by the Company were organized and executed in a way that responded to concerns expressed by many Yukon stakeholders to maximize Yukon participation and mitigate the historical experience of intensive, short term projects punctuated by lengthy periods of inactivity that collectively had the effect of restricting local participation in employment, training and business opportunities. For almost two years, Chance's drilling and seismic programs provided reasonably steady employment for many Yukon citizens working directly or indirectly on the projects. Going forward, to overcome the frustration of starting and stopping, future activities are expected to be small scale and be undertaken over longer time periods. This style of operation has the objective of providing opportunities for Yukon citizens and businesses to invest in training and equipment to be able to assume growing roles in any activities that Chance might propose while benefitting from learning curve efficiency and economy of scale arising from steady, predictable operations. Environmental impacts are expected to be significantly reduced by operating on a small scale over longer periods of time, too.

Future exploration activities will require maximum allowable tenure extensions in order to satisfy commitments anticipated to be made under the Plans as they are implemented, undergo higher level YESAB impact assessments, obtain required regulatory approvals and ultimately undertake any planned activities. For example, in several meetings with your officials, Chance has outlined an exploration plan to drill up to thirty (30) exploration and appraisal wells, acquire up to fifteen hundred (1,500) square kilometres of new 3-D seismic data and acquire up to two thousand (2,000) kilometres of new 2-D seismic data. This plan will take years to complete especially if the scale of operations is small in order to minimize environmental impacts and maximize participation of Yukon citizens and businesses. Prior to undertaking this program, environmental impact assessments are required which are expected to take at least a couple of years to complete with more time needed to execute on approved activities.

Developing Yukon energy resources will also have a beneficial impact on greenhouse gas emissions by displacing imported fuels extracted and processed thousands of kilometres away from Yukon. In addition, as the energy market transitions to a lower or no carbon condition, the hydrocarbons in Yukon offer a great source of hydrogen and the geological formations at Eagle Plains provide opportunities to sequester CO2.

This letter has been prepared on a "Without Prejudice" basis given the unresolved legal claim that the Company has made against Yukon in respect of the damages caused by the Moratorium. Tenure extension is needed to continue implementing the Plans and advance the proposed exploration project through the YESAB process to execution.

In conclusion, Chance believes that it has diligently acted and continues to act in a manner that is consistent with the Act, that the exercise of its exploration rights has been significantly impaired by circumstances that were neither foreseen nor within the Company's control. Throughout the evolving landscape of procedural changes, political sensitivity and growing obligations to engage with aboriginal communities, Chance has taken numerous and costly measures to mitigate the impediments where it can.

Chance trusts that you will consider this tenure request in the face of expanding timelines and complexities associated with the undertaking of exploration projects.

Yours truly,
Chance Oil and Gas Limited

[redacted]

FOR

Cc: [redacted]

[redacted]f

Chief [redacted]

Chief [redacted]

Chief [redacted]

Grand Chief [redacted]

APPENDIX 2-C-48. Communication and engagement on Chance Oil and Gas Limited's (COGL) proposed multi-year, multi-well oil and gas exploration program (Proposal) Letter

VUNTUT GWITCHIN GOVERNMENT
Government of Vuntut Gwitchin First Nation
CHIEF AND COUNCIL

P.O. Box 94,
Old Crow, Yukon
Y0B 1N0

Phone: (867) 966-3261
Fax: (867) 966-3116
Web: www.vgfn.ca

SENT VIA E-MAIL

August 5th, 2022

Michael N. Chernoff
Chairman and Chief Executive Officer
Chance Oil and Gas Limited
Suite 1000, 340 – 12 Ave SW

Calgary, AB T2R 1L5

Dear Mr. Chernoff:

RE: Communication and engagement on Chance Oil and Gas Limited's (COGL) proposed multi-year, multi-well oil and gas exploration program (Proposal)

I am writing to you as Chief of the Vuntut Gwitchin First Nation (VGFN) and Chief Executive Officer of the Vuntut Gwitchin Government (VGG) in follow-up to my previous correspondence to you by letter dated March 31, 2021, and your correspondence by letters dated April 12, 2021, and October 27, 2021, respectively. VGG has now completed an internal review and consideration of the circumstances that resulted in VGG ceasing communication and engagement with COGL under the VGG Oil and Gas Engagement Policy (Policy) with respect to the Proposal last year.

I appreciate you sharing with me your perspective from your 60+ years of personal history and experience pursuing oil and gas within the Eagle Plain basin. However, it is not merely in the "minds of men" where the oil you seek may be found but also the VGFN Traditional Territory which past and present generations of Vuntut Gwitchin have collectively governed and managed for millennia to ensure our continued survival, dignity and well-being as a community.

The ancient history of VGFN includes the more recent emergence over the past 70 years of private companies seeking to exploit the oil and gas resources and build oil and gas infrastructure in areas within or adjacent to the Traditional Territory. As recently described by the Yukon Supreme Court based on a review of the Vuntut Gwitchin historical record, the search for oil in the Traditional Territory "without Vuntut Gwitchin consent or involvement has caused significant harm to the integrity and health of the Vuntut Gwitchin as a collective" and that "Vuntut Gwitchin continue to address and recover from these harms as they implement self-government."[1]

[1] *Cindy Dickson v Vuntut Gwitchin First Nation*, 2020 YKSC 22 at para 13.

The late Justice Thomas Berger described the beginning of this period of immense change and disruption in his 1977 final report of the Mackenzie Valley Pipeline Inquiry following days of listening to public testimony directly from VGFN Citizens in the community of Old Crow:

> "The caribou have been the mainstay of the native people of Old Crow for thousands of years. Today these people are apprehensive, because they fear that the caribou, and thus they themselves, are threatened. They know the power of the white man. They know that elsewhere the great animal herds have died off with the advance of agriculture and industry. They have seen the white man come and dominate them and their land. Exploration crews, bulldozers and the airstrip that crowds their village against the Porcupine River are continuing reminders of this encroachment. These people fear that the white man may destroy their land and the caribou. They and the caribou have made a long journey together across time and the continents. Is this journey to end now?
>
> …
>
> This ecosystem, with its magnificent wildlife and scenic beauty, has always been protected by its inaccessibility. With pipeline construction, the development of supply and service roads, the intensification of the search for oil and gas, the establishment of an energy corridor, and the increasing occupation of the Northern Yukon, it will no longer be inaccessible to man and his machines.
>
> The proposal by Arctic Gas to build a pipeline across the Northern Yukon confronts us with a fundamental choice. It is a choice that depends not simply upon the impact of a pipeline across the Northern Yukon, but upon the impact of the establishment of a corridor across it. Opening up this country to industrial development will have lasting effects on the great wilderness and on the native people who live there."[2]

Throughout this period and still continuing today over 40 years later, VGFN has always navigated these challenges through the guidance of our Elders, community knowledge keepers, and traditional decision-making processes of deliberation and consensus to carry out our highest mandate: to protect and maintain our physical, cultural, spiritual and economic relationships to the lands, waters and animals for the benefit of future generations. As VGG recently submitted to the US Bureau of Land Management in its assessment of proposed oil and gas exploration adjacent to the VGFN Traditional Territory on the coastal plain of Alaska:

> "Vadzhaii, the caribou, are the heart of Vuntut Gwich'in culture and subsistence economy. The Porcupine caribou migrate north each spring

[2] Thomas R. Berger, "Northern Frontier, Northern Homeland: Mackenzie Valley Pipeline Inquiry" (1997) vol 1. See also Transcripts of proceedings of the Mackenzie Valley Pipeline Inquiry in Old Crow, Yukon (July 11, 1975) vol 14; Transcripts of proceedings of the Mackenzie Valley Pipeline Inquiry in Old Crow, Yukon (July 12, 1975) vol 15; and Transcripts of proceedings of the Mackenzie Valley Pipeline Inquiry in Old Crow, Yukon (July 13, 1975) vol 16.

> through the Vuntut Gwitchin First Nation Traditional Territory to critical calving and nursery grounds in Alaska, where most calves are born. In the fall, the Porcupine caribou return to our homeland, fattened and healthy. For tens of thousands of years the Porcupine caribou herd has occupied the Traditional Territory of the Vuntut Gwitchin First Nation, providing sustenance to our people.
>
> The Vuntut Gwich'in fear the proposed oil and gas leasing program in the Coastal Plain will result in environmental pollution, contamination and habitat disturbance that will degrade and permanently alter the intricate wholeness and habitat integrity of the calving and post-calving grounds, migratory movements and long-term stability of the Porcupine caribou herd. A threat to the health of the Porcupine caribou herd is a threat to Vuntut Gwich'in physical, cultural and spiritual survival."[3]

VGFN's 20-year journey to negotiate the reclamation of our inherent self-government authority and the protection of VGFN rights and interests through our Treaty with Canada and Yukon was indeed largely driven by the rush of outsiders to discover oil and gas without the free, prior and informed consent of the community or respect for VGFN's plans and strategies for the use and development of the Traditional Territory.[4] The monumental achievement of the VGFN Final Agreement and Self-Government Agreement in 1995 set forward a pathway for the pursuit of our self-determination with a fundamental objective of Sustainable Development:

> "'Sustainable Development' means beneficial socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent."[5]

The objective of Sustainable Development was included in the development and approval of the North Yukon Regional Land Use Plan (NYRLUP).[6] Sustainable Development is the "core principle" of the NYRLUP with the complementary guiding principles of precaution, conservation and adaptive management.[7] Today, VGG continues to seek to uphold the fundamental objective of Sustainable Development in the implementation of the VGFN Final Agreement, Self-Government Agreement, NYRLUP, the United Nations Declaration on the Rights of Indigenous Peoples, and our internal policies, procedures and mechanisms such as those provided for under the Policy. It is within this important context in which VGG considers our relationship with COGL and the Proposal.

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[3] Vuntut Gwitchin Government, "Comments of the Vuntut Gwitchin Government on the Draft Environmental Impact Statement for the Coastal Plain Oil and Gas Leasing Program" (March 13, 2019).

[4] See for example Old Crow Indian Band Council Resolution (October 26, 1971) and Old Crow Indian Band Council Resolution (December 21, 1971).

[5] Vuntut Gwitchin First Nation Final Agreement at Chapter 1.

[6] See Vuntut Gwitchin First Nation Final Agreement at 11.1.1.6 which provides that an objective of regional land use planning under Chapter 11 of the Final Agreement is "to ensure that social, cultural, economic and environmental policies are applied to the management, protection and use of land, water and resources in an integrated and coordinated manner so as to ensure Sustainable Development."

[7] North Yukon Regional Land Use Plan at 1.4.

Communication and Engagement

As a result of our internal review and consideration, VGG has determined that COGL's conduct to-date in communication and engagement with VGG regarding the Proposal has consistently undermined the purpose of the Policy to establish and maintain a respectful, transparent and meaningful process for communication and engagement and fails to adhere to the human rights standard of free, prior and informed consent.

Despite VGG providing a clear and transparent process to COGL under the Policy for seeking the free, prior and informed consent of VGFN to the Proposal over 5 years ago, COGL's initial commitment to comply with the Policy in the joint Communication and Engagement Plan (Plan), and VGG's support for a 5-year extension of COGL's exploration permits in reliance on COGL's commitments to the Policy, COGL has repeatedly reneged on its commitments to VGG throughout the process and has engaged in conduct inconsistent with the Policy. This includes, but is not limited to, the following:

- COGL directors, officers, employees, consultants, professional advisors and representatives making public and private communications to VGG Council, employees, contractors, and Natural Resources Committee members regarding the Proposal instead of VGG's designated and agreed to point of contact.

- COGL on several occasions has repudiated its agreement to comply with the Policy by taking positions inconsistent with the Policy, and in particular, COGL's position that the VGFN General Assembly should have no role in decision-making and final approval of the Proposal.

- COGL conduct has interfered in VGG internal decision-making procedures and engaged in practices that cause division related to the Proposal, in particular, through improper influence at meetings of the VGFN General Assembly and the creation of an alternative COGL committee that undermines the role, function and mandate of the VGG Natural Resources Committee in ensuring a respectful, transparent and meaningful engagement process for Citizens.

VGG does not condone this type of conduct and takes it very seriously. We cannot and will not participate in an engagement process unless it is built on trust and good faith and not suspicion, accusations, threats; free from intimidation, coercion, manipulation and harassment; and respects our internal decision-making procedures and mechanisms as a self-governing First Nation. Therefore, VGG will not be continuing any direct communication and engagement with COGL related to the Proposal. The joint Plan between us is terminated effective immediately by notice of this letter with copy to the honourable John Streicker, Minister of Energy, Mines and Resources, who is responsible for the administration of the Plan under Ministerial order.

The Proposal

VGG has also taken this time in our internal review of communication and engagement with COGL to consider a number of other policy considerations in relation to the Proposal. VGG has determined that the Proposal is incompatible with the fundamental objective of Sustainable Development enshrined in our constitutionally protected Treaty, NYRLUP and the Policy which only permits "beneficial socio-

economic change that does not undermine the ecological and social systems upon which communities and societies are dependent." This determination is made based upon the potential environmental, social, cultural, economic and climate impacts of the Proposal, including but not limited to, the following:

- The Proposal is likely to cause significant adverse impacts to the special relationship between the Porcupine caribou herd and the Vuntut Gwitchin, including our ability to meaningfully exercise our Treaty rights to access and harvest the Porcupine caribou.

- The Proposal does not consider or address impacts to the Gwich'in Nation as a whole, including downriver Gwich'in communities in Alaska, contrary to the terms of the Agreement Between the Government of Canada and the Government of the United States of America on the Conservation of the Porcupine Caribou Herd.

- The feasibility of oil and gas production in the North is increasingly diminished with a high probability of oil and gas infrastructure becoming stranded assets.

- Any potential economic benefits that may accrue to Vuntut Gwitchin from the Proposal will be limited and short-term and are greatly outweighed by the potential risks to the land, water, animals and Vuntut Gwitchin way of life.

- The Proposal is inconsistent with VGG's climate plans and strategies, Gwich'in knowledge and science which confirms that no new oil and gas exploration activities should occur in a global pathway to reaching net zero emissions by 2050.

- The Proposal is inconsistent with the Yeendoo Diinehdoo Ji'heezrit Nits'oo Ts'o' Nan He'aa Declaration which called to action local, national and international communities, governments, organizations and movements to respect the traditional knowledge of Indigenous peoples and the established science to prevent the rise of global temperatures beyond the 1.5°C threshold.

- This Proposal is inconsistent with the Gwich'in Nation's right to self-determination as expressed by the Biennial Gwich'in Gathering through the Gwich'in Niintsyaa resolutions for protection of our relationships to Vadzaih (caribou) and Łùk Choo (salmon), the Ni'inlii Declaration calls to "support a global just transition from destructive fossil fuels" and the joint objectives and priorities committed to under the Gwich'in Nation Accord – Gwiyiinji ILak Hah T'igweedi'yaa Sriinatr'igwihee'aa ("We Will Act With One Mind To Make Things Right").

- The Proposal is inconsistent with Government of Yukon's climate policies to reduce Yukon's greenhouse gas emissions to 45% lower than 2010 levels by 2030 and which does not contemplate or address the emergence of a local oil and gas industry in the Yukon or any increase in greenhouse gas emissions arising from new oil and gas exploration and production, including associated activities such as transportation.

- The Proposal is inconsistent with Government of Canada's climate policies to phase out public financing for the oil and gas sector and to set a cap on greenhouse gas emissions for the oil and gas sector with reduction targets starting in 2025.

Based on our determination that the Proposal is incompatible with the objective of Sustainable Development, VGG does not support the Proposal or any other proposal for new oil and gas exploration and development in North Yukon. In the event that COGL submits the Proposal to the Yukon Environmental and Socio-economic Assessment Board (YESAB) despite the express lack of VGG consent, VGG will be fully engaged as a government in the process, including in dialogue within the Gwich'in Nation and with our Treaty partners, to ensure the fundamental objective of Sustainable Development is adhered to and our collective rights are respected.

VGG will also continue to ensure that VGFN Citizens are able to be fully and independently informed of the Proposal and its potential environmental, social, cultural, economic and climate impacts so that they may meaningfully and effectively share their personal views and perspectives with YESAB. Given our commitments under the Gwich'in Nation Accord, VGG will also seek to ensure meaningful opportunities for participation of affected Gwich'in communities in Alaska are provided in relation to the Proposal as required under the Agreement Between the Government of Canada and the Government of the United States of America on the Conservation of the Porcupine Caribou Herd.

Moving Forward

As VGG will no longer be in direct communication and engagement with COGL on the Proposal and have terminated the joint Plan, we ask that all COGL directors, officers, employees, consultants, professional advisors and representatives respect the following protocols moving forward:

- COGL shall provide VGG with 2 weeks advance written notice of any planned activities in VGFN Traditional Territory that are in any way related to the Proposal such as consultation meetings and research activities. A copy of the agenda and any presentation materials used for consultation meetings with VGFN Citizens shall be included.

- COGL directors, officers, employees, consultants, professional advisors and representatives shall not attend the VGG offices in Old Crow or Whitehorse without prior appointment.

- All notices shall be sent by COGL directly to Erika Tizya-Tramm, Strategic Lead, Stewardship and Sustainability (erika.tizyatramm@vgfn.net). COGL shall not solicit or seek to communicate with any other VGG employee, contractor, or Natural Resources Committee members regarding the Proposal.

- COGL directors, officers, employees, consultants, professional advisors and representatives shall not participate in deliberations, decisions and votes of the General Assembly related to the Proposal or VGG's relationship to COGL.

Sincerely,



Chief Dana Tizya-Tramm
VUNTUT GWITCHIN FIRST NATION

Cc: Chief Simon Mervyn, First Nation of Na-Cho Nyäk Dun
Chief Roberta Joseph, Tr'ondëk Hwëch'in
Grand Chief Ken Kyikavichik, Gwich'in Tribal Council
Honourable John Streicker, Minister, Government of Yukon, Energy, Mines and Resources
Honourable Dan Vandal, Government of Canada, Minister of Northern Affairs
Annie Blake, Member of Yukon Legislative Assembly (Vuntut Gwitchin)
Brendan Hanley, Member of Parliament (Yukon)

APPENDIX 2-C-49. Communication and Engagement Plans Letter

Chance
OIL AND GAS LIMITED

April 5, 2023

Chief and Council
Vuntut Gwitchin First Nation
P.O. Box 94
Old Crow, Yukon
Y0B 1N0

Dear Chief [redacted] Deputy Chief [redacted], and Councilor [redacted]

Re: Communication and Engagement Plans

I am writing to follow up our meeting in Vancouver on January 26, 2023 with you and your Vuntut Gwitchin Government ("VGG") staff, representatives of the Gwich'in Tribal Council ("GTC"), and representatives of the First Nation of the Na-Cho Nyak Dun ("NND"). We appreciated the time you and your team gave to participate in the meeting.

As discussed in our meeting, Chance Oil and Gas Limited ("Chance") has plans to undertake an exploration project comprising drilling and testing up to 30 exploration wells, obtaining up to 1,500 square kilometers of new 3D seismic data and obtaining up to 2,000 kilometers of new 2D seismic data. Chance expects to submit a project proposal to the Executive Committee ("ExCom") of the Yukon Environmental and Socio-economic Assessment Board for this project later this year.

Chance is planning to share information such as the detailed project description, baseline environmental studies including heritage surveys and permafrost studies, and details about the exploration work shortly. This information will be provided to all the affected First Nation Governments ("FNG's") to review and provide feedback. In addition to providing information, Chance is also planning to meet with FNG's and the communities at large to discuss the project and expand the opportunities for feedback. In the spirit of the Communication and Engagement Plans, Chance is hoping that engagement with each of the affected FNG's will be done in a constructive, cooperative, and collaborative manner.

Since there are many consultants retained by Chance that will be involved in the engagement process with each of the affected FNG's, long lead time planning is required to address the logistics of travel, accommodation, and availability of each party. As such, Chance and its consultants are planning to visit Old Crow on May 15, 2023. We would like to meet with VGG Chief and Council during this visit as well as host a broader community open house. Please let us know if you are available to meet and we can work with you to prepare an agenda and provide information ahead of time.

CHANCE OIL AND GAS LIMITED

☐ **Whitehorse Office:**
Suite 202, 208 Main Street
Whitehorse, YT Y1A 2A9
Telephone (867) 456-7805

☒ **Calgary Office:**
Suite 1000, 340 - 12th Ave S.W.
Calgary, AB T2R 1L5
Telephone (403) 699-0055
Fax (403) 699-0044

In addition, as a required part of the ExCom submission, Chance needs to gather socio-economic data in each of the affected First Nation Communities. Two Worlds Consulting ("TWC"), who provides advice and support to Chance for Communication and Engagement activities, has been retained to undertake socio-economic studies. TWC is looking to initiate socio-economic data collection during Chance's project engagement visit to Old Crow on June 11, 2023. This work will involve conducting interviews with community members, VGFN government representatives, and organizations in order to understand potential project-related effects to socio-economic conditions (e.g., community well-being, employment and economy, community infrastructure and services etc.). Additional socio-economic interviews will be scheduled for later this summer.

Attached to this letter is a two page summary of the Exploration Project and some indicative scheduling for engagement with FNG's and communities.

We look forward to meeting with you, your officials, and citizens of Old Crow in the coming months.

Yours truly,
Chance Oil and Gas Limited

[redacted]

President

Attachment

Cc: [redacted]

Exploration Project
Update
April 2023

Chance
OIL AND GAS LIMITED

Project Location



Who is Chance? What Do We Plan to Do?

- Exploration company focused on assessing Yukon's oil and natural gas potential
- Hoping for government and community support to explore in the Eagle Plains area
- If approved, investigation would include drilling more wells and carrying out seismic surveys for up to 10 years
- Small scale, to provide steadier long-term jobs and contracts to local residents and businesses
- Once investigations are complete, we would know how much oil vs. how much gas, and whether it's economical to proceed to development
- No fracking anticipated, now or later

What We've Been Working On in 2022/2023

- Refining our plans for how to address concerns related to sensitive environmental factors including caribou
- Preparing to start the regulatory process
- Understanding what information regulators and communities want and need
- Collecting scientific data to understand effects and create options for how to manage effects
- Preparing to show communities our plans before entering the regulatory process in 2023





Where and How We Hope to Engage

- Old Crow, Dawson, Mayo, Inuvik, and Whitehorse
- Respect community preferences on timing, approach
- Share our draft plans, get feedback, adjust/amend plans

CHANCE OIL AND GAS LIMITED

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Greg Charlie
gcharlie@chanceyukon.ca
Cindy Dickson
cdickson@chance.yukon.ca

What Do Our Plans Look Like for Restarting the Regulatory Process?

Relationship-building, Information-sharing

Engagement 1:
What is the Project?

When: May 15 – 18, 2023

Where: Old Crow, Mayo, Dawson, Inuvik, Whitehorse

With whom: Vuntut Gwitchin First Nation (VGFN), First Nation Na-cho Nyak Dun (FN NND), Tr'ondëk Hwëch'in (TH), Gwich'in Tribal Council, and members of the communities of Old Crow, Mayo, Dawson, Inuvik

What we hope to discuss:

- Who is Chance, what do we stand for?
- What is exploration?
- What is Chance's plan?
- How do communities wish to engage with Chance?

Methods of engagement:

- Meetings with leadership
- Community open houses

Engagement 2
What are Project effects, and how could we manage them?

When: June 12 – 15, 2023

Where: Old Crow, Mayo, Dawson, Inuvik, Whitehorse

With whom: Vuntut Gwitchin First Nation (VGFN), First Nation Na-cho Nyak Dun (FN NND), Tr'ondëk Hwëch'in (TH), Gwich'in Tribal Council, and members and businesses of the communities of Old Crow, Mayo, Dawson, Inuvik

What we hope to discuss:

- What are the potential positive and negative effects of exploration?
- What are community concerns?
- How could Chance address these concerns?

Methods of engagement:

- Meetings with leadership
- Community open houses
- Socio-economic interviews

Regulatory process begins

Yukon Environmental and Socioeconomic Assessment Board (YESAB) begins

- The project will be assessed under YESAB's Executive Committee process
- YESAB will see how Chance has reflected the results of Engagement 1 and Engagement 2 in its submission documents
- Under Yukon Environmental and Socioeconomic Assessment Act (YESAA 2003), YESAB may engage First Nations and communities as needed. Typically, YESAB hosts multiple public comment periods
- Chance will work with YESAB to support their efforts to engage First Nations and communities on the Project
- Chance will be available to share information, listen and learn

APPENDIX 2-C-50. January 24, 2018 Meeting Summary - document not available at time of submission.

APPENDIX 2-C-51. February 22, 2018, Meeting Summary

Vuntut Gwitchin Government and Chance Oil and Gas Limited Meeting

Date: February 22, 2018

Location: Community Hall, Old Crow YT

Attendees:
No sign-in sheet was used.

Vuntut Gwitchin Government:

[redacted], Executive Director, VGG
[redacted] Lands Manager, VGG
Elder [redacted]
Elder [redacted]

Chance Oil and Gas Limited:

[redacted], Board Chair and CEO
[redacted], Board member and Chair of Community Relations Committee
[redacted], President
[redacted], Vice President of Community and Government Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator

Hemmera:
[redacted]

Introduction: Purpose and Objectives

The purpose of this meeting is reset the relationship between Chance Oil and Gas and VGG.

Meeting Objectives:

- Allow opportunities for participants to share their feelings on past relationship building;
- Introduce team members and discuss roles and responsibilities; and
- Chart a new path forward for Chance and VGG.

Key Outcomes for Chance:

- Agreement to work together on an engagement and communication plan (plan);
- Identification of team members to lead on developing the plan; and
- Get some direction/information on engagement with other First Nations and Government.

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Discussion of Key Topics:

Opening Remarks:

Vuntut Gwitchin Government (VGG[redacted]) reviews the agenda and asks if any attendees have changes to the agenda. [redacted] requests time to review the January 29th letter with Chance Oil and Gas Limited (Chance)'s feedback on VGG's Oil and Gas Engagement Policy. All agree to add this to the agenda. [redacted] proceeds with opening remarks:

- VGG appreciates Chance's efforts and thanks Chance for coming to Old Crow for the meeting;
- VGG is here to move forward with Chance and is looking forward to learning more about Chance's plans;
- Chance is welcome to return to Old Crow any time.

[redacted] discusses his personal motivations behind joining the Chance team as a Vuntut Gwitchin citizen, noting the evolution of VGG over the years, VGG's Final Agreement, and settlement lands selected for oil and gas exploration. [redacted] notes that neighbouring First Nations such as Tr'ondëk Hwëch'in and Na-cho Nyäk Dun are busy being engaged on mining development in their traditional territories and are moving forward with these projects. [redacted] and [redacted], who work for Chance and are also Vuntut Gwitchin citizens want to facilitate feedback from Vuntut Gwitchin citizens to Chance and make sure the Vuntut Gwitchin voices are heard. [redacted] highlights the importance of their Whitehorse office and the value that the Chance representatives who are Vuntut Gwitchin citizens bring to the Chance team.

Chief [redacted] highlights that this is a learning opportunity for both Chance and VGG, and that Yukon Government has an opportunity to be part of the learning. VGG recognizes that there is an opportunity with Chance to take advantage of; however, the Vuntut Gwitchin do not have 100 years of experience with oil and gas like other First Nations have with mining. Because of this, VGG is taking careful steps and the process is slower with VGG and Chance than it may be elsewhere. As VGG learns more about Chance and oil and gas, the process may move more quickly. [redacted] notes that it is important to provide information to the younger generation as well to include them in this process.

[redacted] thanks VGG for being willing to re-set the relationship with Chance and describes the history of Northern Cross Yukon and past applications to the Yukon Environmental and Socio-economic Assessment Board (YESAB). Northern Cross Yukon was previously owned by the China National Offshore Oil Corporation and came under new ownership by [redacted] in late 2016. With this new ownership comes a desire to renew relationships with VGG and to re-build the internal team in the company. Also, with the new ownership, Northern Cross Yukon decided to undergo a name change as part of this overall company renewal. The name is now Chance Oil and Gas, as the original oil and gas discoveries were called "Chance" and there is a creek nearby called Chance Creek. The new logo for the company incorporates the colours of the aurora borealis and Yukon's bird, the raven. These Yukon-centric elements are being incorporated into the company as Chance's only interests are in the Yukon, and the goal is to bring opportunities to VGG and Yukoners. Chance is looking to rebuild relationships and reputation in Yukon and looks forward to building the relationship with VGG.

Chief [redacted] appreciates Chance's comment and notes that VGG is ready to move forward with Chance.

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Community Relations Committee:

[redacted] describes Chance's Community Relations Committee of the Board:

- Developed by the Board of Directors;
- Focused on identifying initiatives that Chance can pursue to promote collaborative community engagement;
- [redacted] is the Chair of the Committee;
- Chance is seeking input from VGG on the Committee and wants someone from the Vuntut Gwitchin community on the Committee;
- The mandate of the Committee is to achieve collaboration whichever way both VGG and Chance want that to occur; and
- The Committee is to find ways to engage and work together in a meaningful way.

[redacted] asks for VGG representation on that committee. Chance agreed.

[redacted] notes that the VGG Oil and Gas Engagement Policy (Policy) is VGG's guiding document for engagement and has agreed internally that the Police will be adaptive and VGG will review the Policy after 1 year. [redacted] notes that the Engagement and Communications Plan that VGG and Chance will develop together can be adaptive as well.

[redacted] and [redacted] introduce themselves and their role as Hemmera in facilitating engagement between VGG and Chance. Hemmera's role is open and can support both VGG and Chance in engagement. Chance and Hemmera will work directly with VGG. While Hemmera is hired by Chance, Hemmera is a neutral party and is not hired for project advocacy.

[redacted] and [redacted] both describe some of their relevant project experience and various options for how Hemmera can support and provide capacity to VGG and Chance.

[redacted] explains VGG's recent work on developing an access management plan and a regional management plan. VGG is looking for opportunities to collaborate with Chance on things like this and is looking forward to working together in the future. Right now, VGG is looking to work on the vision of oil and gas with Chance. Further to this VGG agrees that the Community Relations Committee should have a Vuntut Gwitchin citizen on it, as Vuntut Gwitchin citizens have opinions and can inform many aspects of engagement, including engagement with other communities.

Q: Is the Community Relations Committee is open for other communities to have a role in it?

A: [redacted] explains that this depends on what the other communities want, noting that Chance's permits are 100% within Vuntut Gwitchin territory with some overlap with Tr'ondëk Hwëch'in and Na-cho Nyäk Dun, as well as with the Gwich'in Tribal Council primary use area.

[redacted] describes previous engagement with other First Nations, and that other Nations look to VGG to lead engagement with Chance. [redacted] notes that Chance also seeks advice from VGG on engaging other First Nations, [redacted] thinks that VGG should play a lead role in engagement and how the community is involved in developing management plans and mitigations.

[redacted] notes that VGG wants to be part of the Community Relations Committee and thinks that it is a good initiative, but also wants to ensure that the Vuntut Gwitchin voice on this Committee is given space to be heard and has a greater weight than voices from other communities. VGG suggests a Terms of Reference for the Committee that incorporates this.

Hemmera proposes that they draft a suggested Terms of Reference for Chance and VGG to review.

Engagement and Communications Plan Development:

[redacted] notes that VGG needs to have some internal conversations about who the leads will be on the VGG side for developing the Engagement and Communications Plan; [redacted] will email G. Charlie to let the Chance team know the people who will be involved from the VGG side. VGG has many things on the go and wants to make sure that the Engagement and Communications Plan moves and is done in a robust way where there are alternate representatives from VGG who can fill in and move things forward when other representatives are unavailable.

VGG Oil and Gas Engagement Policy – Chance's Feedback Letter:

[redacted] reviews the letter from Chance to VGG at a high level and asks VGG if there are any specific questions about Chance's feedback.

[redacted] replies that the third bullet requires some clarification.

(note: the statement is copied below for reference.)

- *In 'Citizen Consultation' s.20 the Policy describes the contents of a written notice to be provided by the proponent regarding the description of the purpose of the consultation and associated materials. Chance is happy to comply with this request for future engagement efforts however we do hope that agendas, description of the purpose of consultation and appropriate materials can be collaboratively built between Chance and VGG such that the citizens have the opportunity to specifically direct the topics that are important to them and provide advice to Chance on the appropriate level of detail that materials are to be prepared in.*

[redacted] and [redacted] explain that the citizen consultation described in the VGG Oil and Gas Engagement Policy was interpreted by Chance to be more of a hand-off of documents such as agendas and meeting materials, rather than a collaborative process to develop these materials together. Chance's feedback suggests more of a back-and-forth collaborative development of agenda items and determining presentation materials.

[redacted] thanks Chance for clarifying and notes that VGG is looking to establish a front-heavy approach to engagement for a proponent to gain a social license; this would then help with the YESAB process.

[redacted] notes that collaboration early on with VGG is important to Chance.

[redacted] moves on to Chance's feedback regarding stage 2, asking for clarification on the first bullet.

(note: the statement is copied below for reference)

- *Stages II and III of the Policy describe a requirement for a proponent and VGG to enter into a Benefits and Stewardship agreement, which is outlined in detail in section 28 of the Policy. Several of the items in section 28 of the Policy are identical to the requirements under section 68 of the Yukon Oil and Gas Act for a proponent to enter into a Benefits agreement, which is a tri-partite agreement between an affected First Nation government, Yukon Territory Government, and a proponent. It could be unproductive for all parties to be negotiating similar yet distinct agreements simultaneously and as such the VGG may*

wish to consider revising the wording to more clearly identify how those two agreements could co-exist without being redundant and/or contradictory.

[redacted] and [redacted] explain that the feedback was about making sure that VGG and Chance are clear in understanding the specific items covered off in each agreement to ensure as little confusion as possible.

[redacted] explains that VGG wants to make sure that the community is commenting on what a proponent is proposing, noting that if there is acceptance by VGG then a project would move quickly through the permitting processes. VGG wants to clarify and make sure that the YESAB processes and the processes in VGG's Oil and Gas Engagement Policy align, so VGG will look at the policy and make sure that they are maintaining control of the process.

[redacted] notes that the YESAB process includes comments from the public at large, and there were many comments from the public on the last submission. Collaboration between Chance and VGG on any documents going in to the YESAB process will be ideal moving forward, as it is important to be submitting documents that are workable.

Role of Policy vs Plan:

[redacted] notes that the VGG leads for developing the Engagement and Communications Plan will be identified. VGG has not signed off on the Oil and Gas Engagement Policy yet as VGG needs to have some more internal discussions and work some more on the policy, which is close to complete. The Oil and Gas Engagement Policy will guide VGG and Chance as they work to develop an Engagement and Communication Plan and will act to create an anchor of corporate knowledge moving forward. Outside of the Oil and Gas Engagement Policy, there are specifics about moving forward with engagement that VGG might consider creating a strategic plan for. For example, there are timelines for engagement that need to be shared in advance.

[redacted] describes how there are two types of policy, one that is written down and one that is not. There is public policy, like environmental protection and economic interests, that is not written down, and then there is written policy that is more of an implementation plan for engagement and communications. [redacted] notes that a plan is not an agreement, it can change over time. There is a long way for VGG to go on policy. Vuntut Gwitchin is developing lands legislation, which will need policy as well. [redacted] notes that the Oil and Gas Engagement Policy has a benefits agreement aspect which can help foster the development of policies moving forward.

[redacted] describes how the Vuntut Gwitchin community will want to be part of engagement with Chance and will want to help set priorities for engagement. There are community members with oil and gas experience. [redacted] explains that VGG would like to see a working group for the Engagement and Communications Plan development that involves multiple levels of decision making, which includes principles at the top, senior officials, and directors. Those working at the ground level should be empowered to make decisions and move things ahead, where the more senior levels of representation from both sides will only be involved as necessary and updated periodically.

[redacted] notes the representatives from Chance and Hemmera that will be involved in developing the Engagement and Communications Plan: [redacted], [redacted], [redacted], and [redacted]. [redacted] describes the timeline for developing the Engagement and Communications Plan to meet the August 30th deadline as set out in the Order In Council. The Chance team would like to get the Plan established prior to summer, as many people go away, so June is the soft deadline for VGG and Chance to have the Plan complete. [redacted] describes

attempts made to engage Na-cho Nyäk Dun (NND), Tr'ondëk Hwëch'in, Gwich'in Tribal Council (GTC), and Tetlit Gwich'in on developing Engagement and Communication Plans, with some response from GTC and NND and no response from the other First Nations. Chance would like to look to VGG for guidance on this and to take the lead, if this is acceptable.

[redacted] notes that Hemmera can take the lead on developing a timeline and plan for developing the Engagement and Communication plan, which includes identifying moving parts and how they work together. [redacted] also sees VGG taking the lead on engagement with other First Nations as required. [redacted] notes that once the timeline for VGG and Chance developing the Engagement and Communication Plan is finalized, it could be shared with the other First Nations so that they can determine where and when they fit in. [redacted] explains that there will be long term engagement and impacts for Chance and VGG, so VGG is taking careful steps.

Closing Remarks:

Chief [redacted] identifies for Chance to contact [redacted] for now, as he holds the portfolio at this time. [redacted] notes that VGG will produce VGG milestones for the Oil and Gas Engagement Policy and can move forward from there, VGG may share the Policy one more time. [redacted] will provide the formal point of contact and an alternate by March 2nd.

End of meeting at 5:00 pm.

Attachments:

No attachments.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Draft Terms of Reference for Community Relations Committee	Hemmera to draft and provide to VGG and Chance for review and input	Mid-March 2018.
Identify the VGG representatives responsible for leading the Engagement and Communications Plan development with Chance	VGG	No later than March 9, if possible.
Develop a timeline and plan for developing an Engagement and Communication Plan	Hemmera to draft and provide to VGG and Chance for review and input	Early April 2018
Share next iteration of VGG Oil and Gas Engagement Policy	VGG to determine if this is the next step	TBD

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APPENDIX 2-C-52. March 22, 2018, Meeting Summary - document not available at time of submission.

APPENDIX 2-C-53. May 3, 2018, Meeting Summary – document not available at time of submission.

APPENDIX 2-C-54. June 19, 2018, Meeting Summary – document not available at time of submission.

APPENDIX 2-C-55. July 10, 2018, Meeting Summary – document not available at time of submission.

APPENDIX 2-C-56. September 11 & 12, 2018, Meeting Summary

Vuntut Gwitchin Government and Chance Oil and Gas Limited Meeting

Date: September 11 – 12, 2018

Location: River Vista Boardroom, Hemmera's Whitehorse Office

Attendees:

Vuntut Gwitchin Government:

Councillor [redacted] (Day 1 only)
[redacted], Lands Manager, Vuntut Gwitchin
[redacted], Heritage Manager and Acting Director of Natural Resources
[redacted], Intergovernmental Coordinator

Chance Oil and Gas Limited:

[redacted], Chairman/ CEO
[redacted], President
[redacted], VP Government and Community Relations (Day 1 only)
[redacted] Regulatory, Environmental and Community Relations Coordinator
[redacted], Board member and Chair of Community Relations Committee (Day 1 only)

Hemmera:

[redacted], VP Community Engagement and Social Sciences (Day 2 only)
[redacted], Senior Project Manager
[redacted] Community Engagement and Consultation Specialist

Purpose and Objectives

The purpose of this meeting was to set the stage for Vuntut Gwitchin Government (VGG) and Chance Oil and Gas Limited (Chance) to develop a Cooperation Agreement to work together on matters related to Chance's Oil and Gas exploration.

Meeting Objectives:

- Review the results of the Engagement Plan process and discuss next steps for implementation;
- Identify options for project development scenarios;
- Establish key objectives and common goals for a Cooperation Agreement;

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- Determine the required content for the proposed Cooperation Agreement;
- Establish roles and responsibilities between the Parties;
- Determine key items for negotiation and establish priorities; and
- Decide on a process and a schedule for completing a Cooperation Agreement.

Day One Discussion:

Introduction

[redacted] opened the meeting by conducting a roundtable of introductions and providing an overview of the agenda. [redacted] gave an introductory statement on behalf of VGG. [redacted] said that he is happy Chance and VGG are meeting and this is a good signal of things to come. VGG looks forward to working closely with Chance on the Cooperation Agreement and creating something mutually beneficial that VGG can take back to the community. [redacted] then gave an introductory statement on behalf of Chance. [redacted] said that Chance is pleased to be meeting with VGG and also hopes to develop a mutually beneficial partnership. Chance hopes for significant opportunities but is still in the exploration phase. Chance and VGG will learn what the realistic project opportunities will be through exploration and Chance hopes to develop a project that will bear fruit for everyone. [redacted] followed up by saying that Chance and VGG can work through a more defined process now that they have the Communications and Engagement Plan (Plan) and have better communication on each side. Chance is still working on project details and wants everyone to be comfortable with the project and understand that the project is adaptive.

[redacted] then added that he wants to keep this meeting confidential and specified that the information shared during the meeting was to be passed along on a need-to-know basis only. VGG agreed and [redacted] said that this followed the process that was outlined in the Plan.

Communications and Engagement Plan Context

[redacted] provided a background about the making of the Communications and Engagement Plans saying that they were required by a Ministerial Order issued in August of 2017 and Hemmera was hired to help Chance develop the plans in fall of 2017. Chance and VGG first met about the Plans in February of 2018 and completed the Plan in May of 2018. Chance completed Plans with all five First Nations listed in the Ministerial Order by August of 2018. Moving forward, Chance and VGG have begun to discuss next steps and share information with the community. Chance received a five-year renewal on its tenure of key permits in August of 2018 and Chance and VGG are now looking to discuss a Cooperation Agreement and collaborate on planning the scope and scale of the project. In addition, Chance will be implementing the Plans with each First Nation and creating reports for Yukon Government on progress made in implementation. See the Appendix for the slides used in this portion of the meeting.

[redacted] asked, looking at near-future Community Engagement and Consultation Planning, on what would VGG like to focus? [redacted] listed topics that included:

- Oil and Gas Activity
- Vuntut Gwitchin Culture and Landscape

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- Employment and Capacity Building
- Traditional Knowledge and Traditional Land Use
- Legislation and Land Use Plan

[redacted] responded that Chance and VGG are currently between Phase I and Phase II of the VGG Oil and Gas Engagement Policy (the Policy). VGG is looking to learn about the scope and scale of Chance's potential project and would therefore like to prioritize learning about Oil and Gas Activity so they can engage the community in exploration project discussions. [redacted] said that Chance is considering a few different scenarios for exploration and project design that would be worth sharing. As well, they will need engagement on environmental issues such as caribou and ground water. [redacted] replied to [redacted] and said that the North Yukon Land Use Plan was formed to address problems with caribou. She emphasized that Engagement on legislation and plans such as the North Yukon Land Use Plan was very important.

[redacted] raised the Oil and Gas 101 session that had been previously discussed saying that planning this would require some lead time and it may be beneficial to get Yukon Government involved. [redacted] agreed the Oil and Gas 101 session would be beneficial in creating foundational knowledge while also engaging the community in the Cooperation Agreement. He suggested that the Oil and Gas 101 type of engagement could be presented in conjunction with the finalized Cooperation Plan in the community.

[redacted] suggested that asking the communities what Sustainable Development means to them would be useful in creating a common understanding. [redacted] agreed with [redacted] emphasized that they need to build a cohesive relationship, she is worried that they may end up with two concurrent processes and would prefer to focus on the Cooperation Agreement.

[redacted] raised a point about the uncertainty of Oil and Gas activity in relation to Community Engagement and the fact that information that is shared may be subject to change. R. Wyman explained that Chance can have a plan to drill a specific number of wells for exploration, but once Chance starts testing the wells, the plans may change based on results. Chance may start knowing where three wells are and then move around as they gain more information. Chance would prefer to not get too rigid early on and structure a program in a way the ensures operational momentum. It is expensive to start and stop and this does not allow for efficiency or stability in employment. There are five First Nations with interests in Eagle Plain basin and with varying degrees of exposure, however, all of Chance's plans involve working in Vuntut Gwitchin Territory. Chance is wondering if VGG might take a leadership role when dealing with all First Nations.

Now that Chance has their tenure extended for five-years in the south permits, they are reviewing seismic data again to decide where to drill. They must do exploration to define a significant resource, so they can attract investment to build capital to go into development. Once a significant discovery is found, Chance would do production testing for two years to see how the well performs and to inform what the development plan would look like. Chance has to do more testing in Eagle Plain relative to a more southern location due to remoteness and the fact that not much is known about the location in general.

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Project Next Steps

[redacted] explained that Chance has two approaches to exploration projects. (**NTD**: [redacted] forthcoming memo outlining these in scenarios in more detail will serve as a more robust description of the scenarios than these meeting notes)

The first scenario is that, in accordance with the North Yukon Land Use Plan Zone 4, designated for the highest level of economic development, Chance could do a 'regional impact assessment' for wells in a certain area. they could do the maximum number of wells that the North Yukon Land Use Plan would tolerate. This is complicated by having five First Nations with varying degrees of exposure.

The second scenario involves Chance looking at a smaller area and drilling a smaller number of wells to do appraisal drilling to better understand the region. This would involve multiple YESAB applications. [redacted] asked if the second scenario would also involve two years of production testing and [redacted] responded that it would. [redacted] added that things are iterative in exploration testing. Work would allow Chance and VGG time to build working dynamics and demonstrate that everyone can work together.

[redacted] then raised that Chance's exploration plans are contingent on the results of Chance's lawsuit against Yukon Government. [redacted] emphasized that this information was confidential. Chance has proposed a settlement in which a large central area of the southern dispositions is transferred into long-term leases with more lenient tenure terms. Chance would give up the outside border area of the Southern permits as well as the three northern permits. If this settlement offer is accepted Chance would no longer have a border with TH.

[redacted] then asked [redacted] to explain why the Northern permits are not as good for development. [redacted] explained that there is a data gap in the Northern Permits. The North geological potential is in hydraulic fracturing. Many of the areas that have been evaluated were done using old technology and new technology can provide more information. Chance does not intend to use Hydraulic Fracturing on any permits now. Referring to past work, [redacted] asked if Chance had drilled wells in permits 10 and 11 in winter of 2012 or 2013. [redacted] responded that they could not complete the drilling because of bad weather.

[redacted] said that of the two exploration project scenarios, one large and one small, he has an opinion on which way to go. The larger program would allow Chance to start a continuous program. [redacted] fears that going with a smaller program makes it more expensive because they have to go to YESAB in the middle of drilling and pay for the time delay. Chance is not sure what YESAB will allow, but the large program would decrease costs.

[redacted] said that a stable long-running program is preferable for VGG, however VGG would struggle if there was not an ongoing role for them and if sharing information protocols were not well determined or executed. They need to establish on-going momentum, sharing of data and adaptive management as a true partner. [redacted] said that in either scenario, plans need flexibility, so they can adapt to changes. They must make sure the structure of an agreement does this. [redacted] followed and said that R. Brown addressed this well, through partnerships and sharing of documents they can keep operational momentum and also quell any uncertainties in the community. [redacted] said that is it hard to know what YESAB would think of their proposed projects as they look at input from the broader public. In addition, people with experience in Oil and Gas from YESAB are no longer there and therefore YESAB, as an

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organization, has a steep learning curve. [redacted] followed that, in the past, Chance's multi-well program had delays and political interference. Chance may have to meet with YESAB to figure out their application. [redacted] said that attempting to predict YESABs direction is an unproductive discussion, and that the best approach to the assessment process is for VGG and Chance to work together on an ideal scenario and present it to YESAB jointly for discussion purposes. [redacted] said that they would slide through YESAB with First Nations collaboration on an application as could be demonstrated by joint letterhead.

[redacted] said he would prefer the first scenario where Chance proposes the maximum number of wells. Chance would propose this, but they would probably not reach this. Each well as a small surface footprint, but a deep reach. [redacted] said there are challenges with regional assessments and gaps in legislative tools. Access into the area is a primary concern as there isn't a legislative tool to restrict public access, and this is a concern because this is a caribou migration corridor. *Yukon Oil and Gas Act* gives authority to shut down access to public roads, but you cannot build an all-season road until resources are proven. [redacted] stated that he would hope that the area would never have public access. [redacted] suggested that they could have a radio-controlled road. [redacted] agreed that this was a good thing to consider, and to determine when you move from a winter road to a permanent road. R. Wyman concluded that there are a lot of different ways to manage this to allow for dialogue. [redacted] added that Chance and VGG are going into YESAB together, there is no question about that. Including people is a learning process for everyone and develops local capacity.

[redacted] prompted a further discussion on the scale of the project. [redacted] said that Chance and VGG will need to have further discussion if they are going to try and negotiate the Cooperation Agreement before the election is called. They will need regular meetings. [redacted] added that they will need to figure out the level of capacity funding support required given the scale of the exploration project. [redacted] agreed that VGG needs to think about how to develop capacities. [redacted] then emphasized that the Cooperation Agreement needs to acknowledge a high degree of uncertainty. [redacted] said that he understands and appreciates Chance's need for flexibility in the agreements. VGG is not looking for a rigid description but is looking for a starting point to understand potential activity and make everyone feel comfortable about moving ahead. [redacted] reiterated that making everyone comfortable with the is what is important to VGG and they understand the give and take on available information because of uncertainties.

[redacted] added that any contract work would try to include local employees as much as possible. [redacted] added that a challenge for Chance is how to attract equipment and get participation.

[redacted] recapped that Chance is to provide VGG with a description of the wells. [redacted] added that a one-pager on each scenario described to the best of Chance's knowledge would be appreciated. [redacted] asked if Chance would consider an Executive Committee assessment, and that perhaps this information could be included in the one-pager. [redacted] said Chance would, but the five-year tenure creates a tight timeline. R. Brown asked if Chance would consider scoping out a project for district-level review? [redacted] noted that because Chance got bumped to an Executive Committee level assessment in the past, if the project looks similar, they will get bumped to Executive Committee again. [redacted] suggested that the application could be staggered. [redacted] responded that YESAB would be scrutinizing that sort of scenario for any suggestion of 'project splitting' and noted that YESAB was hard to predict but any project Chance

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submits will be looked at closely. VGG and Chance working together can create a compelling argument for YESAB.

[redacted] stated that it is good to learn about where Chance is on their exploration activity planning, VGG had not internally thought about the larger exploration project option. [redacted] added that it makes sense to go big from an industry perspective, however would Chance consider changing to a smaller project if perhaps this was what VGG preferred? [redacted] said that Chance has the tenure clock to keep in mind, the does not want to get into a situation where they have just gained a reasonable prediction about affairs and then they run out of time to evaluate. [redacted] suggested they can enter into a Cooperation Agreement in the early stages of the project then VGG can evaluate the project as it is developed. R. Wyman raised the significance of the pace of the project as a slow pace would cause for the project to seem small because this would involve spreading a large project out over a longer timeframe and only a few wells would be drilled at a time. [redacted] said that for Chance it makes operational sense to move slowly, they can build certainty in the project and then build capital. [redacted] said that even with a slow the pace, VGG must review a large project up front.

[redacted] asked if VGG would be bringing in someone from education because there is the potential to create opportunities for community members to participate through high school and college courses that prepare students for the industry. [redacted] said that the Oil and Gas Committee has room to incorporate education. Education is a critical discussion, but the project is not quite there yet.

[redacted] asked what is needed to ratify the Cooperation Agreement, presentations to the community or a Chief and Council decision? [redacted] responded that they get direction from the community and the Oil and Gas Committee and then Chief and Council make a decision.

[redacted] said that VGG needs to have more discussion about the project and the North Yukon Land Use Plan. [redacted] added that Management Plans can address shortcomings in legislations and regulations. [redacted] said that they need to do a gap analysis to figure out the scale of operation for a number of years and determine what the application is going to look like. [redacted] said that the current camp at Chance's site can only hold 75 people and that this is full when they are running a seismic program. They would need two rigs running, if they think about a slow pace the current camp could be workable. [redacted] suggested that community preparedness for a large amount of activity is a concern. [redacted] said that they have experience in working with people from communities. In past activity 15 people were hired from Old Crow and there is room to add more people. They do not want to make people afraid to have these conversations. [redacted] added that a small-scale project for a long time helps to reach sustainability.

[redacted] asked to whom Chance should send future correspondence regarding the Cooperation Agreement and VGG responded that it should go to [redacted] and [redacted] and [redacted] could be CC'd.

[redacted] asked what happens if Yukon Government does not accept Chance's confidential settlement proposa[redacted] [redacted] responded that this is an area of interest and everything is in play until the lawsuit is settled. [redacted] asked if Chance needs a resolution on their lawsuit before they move forward with a project and [redacted] responded that they do.

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Cooperation Agreement Objectives

[redacted] asked VGG if they had any specific objectives for the Cooperation Agreement. [redacted] referred to the draft Cooperation Agreement provided by VGG and acknowledged that a few clauses were no longer relevant such as the one that addressed tenure renewal. Section 4 was important to VGG in that they collaboratively define scale and scope of the project, Chance agrees not to go to YESAB without VGG, and they have a commitment on capacity funding. VGG would also require in the Cooperation Agreement that Chance not acquire new dispositions and focus on the area that they have. [redacted] responded and said that the only reason they would consider another area is to compete with other businesses. [redacted] suggested that maybe the could agree on alternate wording where Chance makes decisions on acquiring new dispositions with VGG.

[redacted] raised that the most Northern permit (number 5) is now against a park. [redacted] confirmed that yes, that permit abuts a protected area. M. Chernoff said that Chance could give up the three most northern permits.

[redacted] concluded the meeting and asked if there were any more objectives to share and [redacted] responded that this depends on the exploration scenario and he looks forward to reading more about Chance's exploration scenarios. [redacted] followed that this had been a great discussion and that he looks forward to follow-up.

Day Two Discussion:

Review of Shared Objectives

[redacted] began Day 2 of the meetings with a recap of the first day's discussion. [redacted] then went over each party's objectives as they were discussed throughout the Day 1 discussion and also expressed in the draft Cooperation Agreement.

[redacted] expressed VGG's objectives as the following:

- Clear commitment from Chance to not go into an assessment process before discussing plans with VGG;
- No Hydraulic Fracturing;
- Avoid activity in the Northern dispositions;
- Clearly outlined goals for stewardship measures;
- Understanding of scale, scope and pace of the project;
- Capacity Funding;
- Adhere to process in the policy; and
- VGG has time internally to review information that is provided.

[redacted] expressed Chance's objectives as the following:

- Cooperation Agreement accepts inherent uncertainties;
- Flexible in nature;
- Operational Momentum; and
- Chance wants the Cooperation Agreement to retain local capacity for employment.

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[redacted] asked Chance if these objectives were for now or for later, and [redacted] specified that they were for the whole time. [redacted] asked when, in the process outlined by the VGG Oil and Gas Engagement Policy, the Cooperation Agreement ended and [redacted] answered that it ended when it was entered and then Chance and VGG would start a Benefits and Stewardship Agreement.

[redacted] commented on VGG's objective that Chance not acquire new dispositions. [redacted] said that he understands Chance's position and did not hear from Chance about their interests before. [redacted] said that Oil and Gas is competitive, and he does not want to be handcuffed before their knowledge matures. [redacted] clarified that VGG's sentiment behind the clause is that VGG be involved in the process and know Chance's long-term objectives. [redacted] expressed that VGG does not want to be caught off guard when a bid comes up.

[redacted] then explained that their overarching theme is to be as sustainable as possible in their actions, but they do not know if something may come up in seismic testing that would trigger Chance or other companies to want to acquire more land. [redacted] asked for an example scenario. [redacted] responded that Chance may discover hydrocarbons in a currently unknown area because of unknown geologic events. You cannot see what you are working with until you get the hole in the ground. Exploration will mean exploring ideas of where they think significant oil deposits may be. [redacted] clarified that in terms of operation this would shift focus and sequencing? [redacted] responded that that was correct and explained that there are broad characterizations that you are looking for in exploration, but you cannot know until you dig a well. [redacted] further explained that you need seismic to help, you cannot identify a deposit based on geography alone.

[redacted] suggested that it would be useful to VGG to have access to data to form their own opinions. The more information VGG has, the better. [redacted] explained that most of Chance's data is an interpretation and there are commonly disagreements on how to interpret data. [redacted] suggested that it might be better to have the disclosure VGG is looking for after exploration. [redacted] explained that VGG can still make us of information and [redacted] further explained that VGG tries to find areas where all research may be useful and beneficial to VGG. [redacted] explained that Chance has not spent that much time exploring on settlement blocks and [redacted] followed and said that if information is known, VGG would want to know so they could make the decisions together. [redacted] explained that some information would need to be protected as propriety information, however, once they are into development there is a degree of exposure that is required. Chance is not currently trying to be evasive.

[redacted] sought to clarify if the distinction in data that Chance could share was in whether it was raw data vs. interpreted data? [redacted] explained that some raw data is proprietary, some data that has to be disclosed to Yukon Government is private. [redacted] concluded that the information sharing is something that needs to be discussed further.

[redacted] asked if Yukon Government had disclosed anything about the lawsuit? [redacted] answered that only Chance's claim was public information.

Cooperation Agreement Contents and Items for Negotiation

[redacted] then shifted the discussion to the next agenda item saying that for the rest of the morning Chance was going to frame out the agreement and discuss process. [redacted] asked the group, what should the agreement contain, what are bucket items?

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[redacted] responded that Chance would like to see each party's objectives laid out, have some description of information sharing, and Terms of Reference for how the parties act in executing the exploration. [redacted] said that Chance should provide feedback on the draft that was prepared as this contains VGG's objectives.

[redacted] interjected and recapped VGG's objectives. [redacted] expressed that both parties should start from a place that is as simple as possible. Moving forward, it is probably most productive to work within the current draft and include all points of view such as flexibility for future project decisions that are not currently predictable and that each party should keep the other party fully informed. The Agreement should specify what information should be shared at which stage of the project and address needs for confidentiality. Chance should come up with a revised draft that includes these items in short order because October is not far away. [redacted] added that the Plan and Policy need to be reviewed when considering what needs to be included in this agreement and future agreements. The agreement that is being developed now does not need to define long-term project information but create a building block for those discussions. [redacted] suggested Chance have a look at the document and figure out what more they need and what they do not need.

[redacted] expressed that Chance does not mean to say that they have not carefully looked at the documents, because they have spent some serious time looking at them. [redacted] asked if the Benefits and Stewardship agreement would follow the Cooperation Agreement. [redacted] responded that it would. [redacted] clarified that the Benefits and Stewardship Agreement is not triggered by an operational phase, but that it would apply to multiple phases. [redacted] said yes, and its purpose would be to put measures in place if there was a significant discovery.

[redacted] stated that Chance would like clarity on the types of information that VGG is looking for and would like to know what VGG would do with this information. [redacted] said that often VGG would contract staff to help them work with data that they do not have internal expertise to analyze. North Yukon is heavily researched, and it benefits VGG to have access to this data. For example, many research permits require that data is given to the Polar Knowledge Data Catalogue, so they are aware of what research has been done. They often receive metadata. [redacted] added that geological information can be helpful. [redacted] gave an example of a winter road becoming an all-season road and Chance and VGG might as well be using the same information to make a decision. [redacted] said that Chance would have no problem sharing environmental, geophysical and geological data. They would need a disclosure/ disclaimer about the interpretation. They cannot provide all their raw data as they purchased this from someone else and Chance is the only one with a license to use it. Anything that is licensed they cannot pass along. [redacted] asked if VGG could have access to future seismic data and [redacted] replied that there could be a condition attached for VGG sole use, but the information could not be disclosed.

[redacted] recapped next steps for the draft wherein Chance would take Kris's version and [redacted] Wyman and [redacted] would provide feedback. [redacted] then asked what the process should be moving forward to continue discussion on topics of the agreement that require more time to resolve. [redacted] asked if further discussions would be topical or address changes to the who[redacted] document as they come. [redacted] said that VGG would need time to address the feedback and then decide how to proceed. He then asked how they were going to meet the election target deadline. [redacted] recommended moving backwards from that deadline to build a timeline and [redacted] recommended including the approval

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process of both parties.

raised that hiring joint technical consultants could be of interest to both parties and responded that VGG would like independent advice until they have a Benefits and Stewardship Agreement. expressed that they would gather data together to avoid duplication and said that it does not make sense if everyone hires their own consultant. said that VGG would like to develop plans based on what they know. said that they could do a joint management plan but clarified that both parties might want the ability throughout creating the plan to seek independent advice. clarified that VGG was trying to avoid the situation where they leave issues to be resolved in a YESAB assessment because then the process for issue resolution is much more difficult. VGG understands that they and Chance have different objectives, they need an adaptive management loop where they have access to information and management reports to strengthen information and resolve issues upfront. clarified that they would go to YESAB with the detailed work done in a way that both parties are confident in.

asked if VGG would expect independent advice to be in the field and replied that Chance and VGG could discuss the specifics later. said that this situation may actually be coming up quickly as Chance may take advantage of a having a helicopter to do geological studies and also do some fish studies. said that it would be nice for VGG to have their own experts. added the importance of getting local advice and oversight as well. agreed and said that VGG has a lot of knowledge in house, however, VGG would require additional knowledge to be confident.

suggested that there could be joint development of a baseline program where feedback is incorporated that meets the needs of both parties. Generally, they would try to make sure everyone feels that they are jointly conducting the program and that duplication of research is in no one's interest. agreed that Chance and VGG have the same views.

summarized the Cooperation Agreement topics that require further discussion. These include:

- Capacity funding;
- Information Sharing;
- Flexibility on project information;
- Future acquisition of dispositions;
- Schedule for completion; and
- Ratification processes of both parties.

Cooperation Agreement Process

said that VGG would have to plan to share the Cooperation Agreement with the community in Old Crow and in Whitehorse. The Cooperation Agreement itself is something Chief and Council would sign off on, but community feedback might require further discussion and edits. S. Shaw suggested that Chance schedule a board meeting to make sure they have enough lead-up time.

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[redacted] clarified what happens after October 19 if they have the Cooperation Agreement complete, or if perhaps it is not completely done. [redacted] said that technical work can continue there will just be no large decisions made. [redacted] clarified that if they have 90% of the agreement complete and it is not signed by the 19th of October, is there the functional ability to overlap the developments of the agreements and [redacted] replied that there was.

The group then discussed a schedule for meetings over the next few weeks and [redacted] committed to sending out schedulers for meetings and placeholder meetings.

[redacted] asked for definition of meta data, as expressed earlier by VGG. [redacted] responded that it is a description of data, mainly dates and methodology.

[redacted] said that they will try to address capacity funding requests as best they can before October 19th given the time constraints and figure out mechanics of who is working on what. [redacted] said that VGG will better understand by the Chance summary what they are considering and be better positioned to plan out the Cooperation Agreement moving forward. [redacted] asked if VGG had prepared a project description for Designated Office before and [redacted] said that they had.

[redacted] concluded the meeting by reviewing action items listed in the table below.

Attachments:

No attachments.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Prepare a brief write-up of exploration project scenarios including the scale, scope and pace of planned activity.	Chance	Friday, September 16, 2018
Review Draft Cooperation Agreement and provide feedback for VGG.	Chance/ Hemmera	Friday, September 16, 2018
Next Cooperation Agreement meeting	All	Friday, September 28, 2018 9am to 12pm PST

Key Meeting Outcomes

Outcome	Responsible Party	Notes
Chance and VGG expressed their objectives for the Cooperation Agreement and short-term activity in the Eagle Plain Basin.	VGG	

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Outcome	Responsible Party	Notes
Chance and VGG decided on a process for completing the Cooperation Agreement with the aim to have the agreement completed by October 19, 2018 when the VGG election is called.	All	
Future correspondence regarding the Cooperation Agreement should go to D. Tizya-Tramm and R. Brown.	All	

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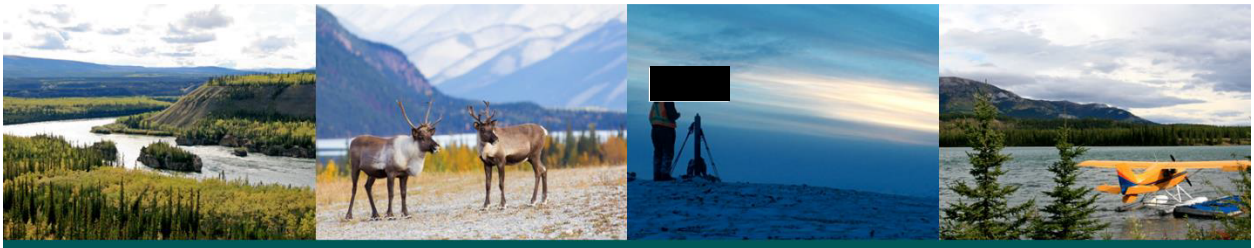
Appendix



Negotiation Planning Meeting

Vuntut Gwitchin Government and Chance Oil and Gas Limited

September 11, 2018

Hemmera
An Ausenco Company

Context - Background

- **August 2017** – MO 2017/37 required Chance to create Communications and Engagement Plans (Plans) with five First Nations
- **Fall 2017** – Hemmera was hired to help complete the Plans
- **February 2018** – Chance and VGG met to re-set their relationship and agree to work together on a Plan
- **May 2018** – Chance and VGG's Plan was completed and the VGG Oil and Gas Engagement Policy was appended
- **August 2018** – Chance completed Plans with all five First Nations

Context - Next Steps

- **Summer 2018** – Discussions of Next steps and community celebration
- **August 2018** – Chance's tenure for key permits was extended by five years
- **Fall 2018** – Planning and discussion on next steps
  - Cooperation Agreement Negotiation
  - Chance will begin to scope out the project
  - Engagement Plan implementation with other four First Nations
- **2019** – Continue Engagement Plan Implementation and Annual Reports to Yukon Government

Implementation

What are short-term objectives for Community Engagement and Consultation?

Possible Topics:

- Oil and Gas Activity
- Vuntut Gwitchin Culture and Landscape
- Employment and Capacity Building
- Traditional Knowledge and Traditional Land Use
- Legislation and Land Use Plan

APPENDIX 2-C-57. October 4, 2018, Meeting Summary

Vuntut Gwitchin Government and Chance Oil and Gas Limited Meeting

Date: October 4, 2018

Location: Teleconference

Attendees:

Vuntut Gwitchin Government:

[redacted]
[redacted] Lands Manager
[redacted] Intergovernmental Coordinator

Chance Oil and Gas Limited:

[redacted] President
[redacted] VP Government and Community Relations
[redacted] Regulatory, Environmental and Community Relations Coordinator

Hemmera:

[redacted] VP Community Engagement and Social Sciences
[redacted] Senior Project Manager

Purpose and Objectives

The purpose of this meeting was to review the latest draft of the Cooperation Agreement (Agreement) containing changes made since meeting last on September 11 and 12, 2018; as well as to further discuss Chance's Exploration Project Description as it was presented in the word document sent via email on September 20, 2018.

Meeting Objectives:

- Review VGG's and Chance's changes to the Draft Cooperation Agreement
- Discuss next steps for finalizing the Cooperation Agreement
- Discuss Chance's Exploration Project Plan in more detail and provide clarity on any items if needed

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Meeting Discussion:

[redacted] opened the meeting by discussing the timeline for finalizing the Agreement. Originally, Chance and VGG were striving for a timeline that would allow for the Agreement to be completed before October 19, when it is expected the VGG election will be called. However, this timeline would not afford time for community engagement. There are benefits to waiting for the incoming council in that they will be the ones to sign off on the agreement and then be responsible for implementing the agreement. [redacted] suggested moving forward with the discussion of the Agreement keeping a new longer timeline in mind. Chance and VGG are likely looking at February 2019 as the earliest date on which an Agreement could be signed off.

[redacted] followed and spoke to the benefits of having a longer timeline for finalizing the Agreement. The community vetting process takes time to be done properly. [redacted] does not see extending the timeline as increasing uncertainty in the Agreement or slipping backwards. Extending the timeline provides more opportunity for engaging members of the community, they will get direction throughout the process, and secure a stronger transition from one council to the next. [redacted] does not see this as problematic.

[redacted] asked how VGG sees the interim between now and February in terms of moving forward. For example, does VGG see any value in having Chance participate in community engagement? [redacted] responded that Chance and VGG can continue the work, they want to bring something non-divisive and clear to Council. Out of the Agreement meetings they will plan the community engagement. [redacted] asked for clarity on what [redacted] meant by non-divisive. [redacted] clarified that they do not want to see scenarios where the community is divided due to uncertainty of process. [redacted] added that VGG wants Chance to provide clarity to the community on the Policy and what the Agreement is and what it is not.

[redacted] asked VGG if they could explain their engagement process. [redacted] said that the Oil and Gas Committee (Committee) membership will have the responsibility of doing community engagement. [redacted] asked if the Committee was formed yet? [redacted] said that the Committee was quite close to being formed and will hopefully be formed before October 19th when the election is called. They are looking at more community membership, including youth and Elders, and membership of a couple different departments. [redacted] said that the community will be tasked with a few initiatives, so it is in everyone's interest to get it set-up as soon as possible.

[redacted] reiterated his question regarding Chance's timelines moving forward. [redacted] replied that Chance has sent a letter to Chief [redacted] relinquishing permit 5. Exploration permits 6-11 are set to expire August 2019, so time pressure exists on these permits as well as permit 19. These permits are part of the legal claim against Yukon Government. [redacted] asked if any advancement with the project required settlement with Yukon Government? [redacted] replied that advancement could be dependent on the settlement, they would want some clarity from Yukon Government moving forward. [redacted] asked if Chance had any problems with the new timeline VGG was proposing. [redacted] responded that Chance does not have problems with this timeline as long as February 2019 remained the target end date for finalizing the Agreement, as this seems to be the realistic deadline.

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The conversation then moved onto reviewing the latest version of the Agreement that was emailed on September 20, 2018. [redacted] started the conversation by saying that VGG has issues with Chance's amendments and comments to Section 4.3, specifically Chance's reluctance to attach the Policy, and wish to have the freedom to submit a YESAB proposal prior to the end of this Agreement and therefore prior to signing a Benefits Agreement. [redacted] asked if Chance and VGG could potentially complete some aspects of the Policy at the same time rather than sequentially? Due to the facts that YESAB has public components and Chance cannot do anything without permits, it may be time inefficient to advance things sequentially. [redacted] asked for an example of items that Chance would want to develop in paralleled sequences. [redacted] elaborated that Chance and VGG could develop at YESAA application at the same time as a Benefits Agreement. [redacted] reminded the group that a fundamental aspect of the policy is to have a front-end process. [redacted] suggested going over the policy together. [redacted] said that this process is not meant to be onerous.

[redacted] said they would go through the Policy in tandem with the scenarios document and provide written feedback within a week. [redacted] specified that when it comes to engaging with YESAB, they will not be duplicating any work necessarily. Regarding the pace of the project, smaller projects are easier for VG and larger projects are easier for Chance. [redacted] said that Chance and VGG need to drill down in more detail and discuss the North Yukon Regional Land Use Plan (NYRLUP) and what they mean by conformity with the recommendations in the Plan. [redacted] acknowledged that some technology, for example seismic, is different now. [redacted] raised other recommendations in NYRLUP, such as a preference for winter roads and determining safe operating distances from caribou that will require some work to find solutions to comply with recommendations. [redacted] suggested that Chance support the gaps to help conform with the recommendations that are throughout NYRLUP.

Chance and VGG agreed to spend some time at the next meeting on discussing the Policy and NYRLUP in more detail. With a new timeline in mind, Chance and VGG concluded this meeting deciding to meet again during the week of October 15th.

Attachments: None

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Provide written feedback on the Cooperation Agreement (Version emailed from Chance to VGG on September 20, 2018)	VGG	October 12, 2018

Key Meeting Outcomes

Outcome	Responsible Party	Notes
Chance and VGG agreed to a February 2019 deadline for finalizing the Cooperation Agreement	All	

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APPENDIX 2-C-58. December 12, 2018, Meeting Summary

Vuntut Gwitchin Government and Chance Oil and Gas Limited Meeting

Date: December 12, 2018

Location: Hemmera's Whitehorse Office and Teleconference

Attendees:

Vuntut Gwitchin Government:

Councillor [redacted]
[redacted] Lands Manager
[redacted] Intergovernmental Coordinator
[redacted] Fish and Wildlife Manager

Chance Oil and Gas Limited:

[redacted] President
[redacted] VP Government and Community Relations
[redacted] Regulatory, Environmental and Community Relations Coordinator

Hemmera:

[redacted] Vice President, Human Environment
[redacted] Business Leader, Human Environment
[redacted] Human Environment Specialist
[redacted] Human Environment Specialist

Purpose and Objectives

The purpose of this meeting was to have an in-depth discussion on the Vuntut Gwitchin Government (VGG) Oil and Gas Engagement Policy (Policy). This meeting sought to increase understanding of the stages of the Policy and the action required by each party to comply with each stage. This included pinpointing which stage of the Policy Chance and VGG are at currently and understanding how the stages of the Policy align with project design and environmental assessment in practice.

Meeting Objectives:

- Provide a forum in which discussion can be held around the Policy before beginning to move forward again with the Cooperation Agreement and other Policy action items
- Increase understanding of the Policy, the reasons behind the Policy, and each stage of the Policy

- Increase understanding of how the Policy will be executed in practice

Meeting Discussion:

[redacted] started the meeting by providing time for attendees to introduce themselves and provided an overview of the agenda. An additional agenda item was added to touch base on the February 1, 2019 All-Party Meeting and discuss logistics.

[redacted] provided opening remarks for VGG. [redacted] thanked Chance for having this meeting and said that he looks forward to establishing where Chance and VGG are within the process and Policy. It is important that Chance and VGG collectively understand where they are so that they can move forward with the Policy. [redacted] wants to bring something back to the Vuntut Gwitchin people and champion a successful project. R. Wyman followed with opening remarks for Chance. [redacted] agreed with [redacted] and stated that Chance wants to build a good partnership.

[redacted] then began his presentation. The presentation was meant to provide background to the Policy, explain the need for the Policy and its contents. Referring to Slide 3, [redacted] explained that the development of the Policy was informed by the VGG Final Agreement and the North Yukon Regional Land Use Plan (NYRLUP). VGG will look to these documents to inform engagement at all stages of the Policy. VGG is aiming for sustainable development and they are not anti-development. The NYRLUP provides a broad overview of sustainable development, and this overview guided how sustainable development was viewed in the making of the Policy. [redacted] explained that the Policy was also guided by past engagement with Northern Cross which provided learning experiences of what worked, what did not work, and how to get through the YESAB process. VGG expects any engagement on potential oil and gas activity in the VGFN Traditional Territory to be a robust process given the significance of Caribou to VGFN and the potential impacts from development in the region. The community should also be involved in this process.

On Slide 4, [redacted] referenced Chance's last multi-well program as an example of a proposal failing where details around the project were not sufficiently defined at the outset with community support. On Slide 5, [redacted] explained that there are existing gaps in the regulatory regime and there are areas that could be improved upon, especially section 68, the Benefits Agreement section of the *Yukon Oil and Gas Act,* and regulations around the development of access roads. VGG is trying to ensure that the Policy addresses these issues. [redacted] said that Yukon Government was working on the roads issue and asked if Chance could follow up on this. [redacted] also suggested that [redacted] Director of Oil, Gas and Mineral Resources with Yukon Government's Department of Energy, Mines and Resources, could provide a summary and provide input on the roads issue at the All-Party Meeting. [redacted] added that VGG is trying to push Yukon Government to work with VGG and all First Nations on resource roads. [redacted] said that Chance will follow what is in the regulations and [redacted] added that in some instances the regulations do not provide enough guidance to follow through with a project, and more research must be done to fully implement the recommendations of the North Yukon Regional Land Use Plan.

[redacted] asked where to find the NYRLUP annual reports. [redacted] replied that they are on the Yukon Government website and every year the Vuntut Gwitchin and Yukon governments agree on implementation priorities for the year ahead.. The NYRLUP is a good reflection of what the people envisioned for the area. The challenge is in the implementation of the plan, and the tendency to overlook

detailed recommendations of the plan by focussing on cumulative effects thresholds instead. The recommendations need to be enacted, and in some cases this is not through government regulation, meaning project proponents need to take action on their own. [redacted] suggested that Chance and VGG go back and look at how VGG referenced the NYRLUP in the YESAB assessment of the Northern Cross Multi-Well project. [redacted] said that Stage III of the Policy reflects this need to fill gaps within the NYRLUP. Referring to Slide 6, [redacted] said that the VGFN GA Resolution No. 2017-02 also ties into this.

Referring to Slide 7, [redacted] explained the United Nations Declaration for the Rights of Indigenous Peoples (UNDRIP) describes the rights of Indigenous people internationally. [redacted] said, that the Council for Yukon First Nations (CYFN) has a process for implementing the Free, Prior and Informed Consent (FPIC) aspect of UNDRIP. However, what does the FPIC process mean for Chance, can there be information sessions? [redacted] said that they could do a presentation and that FPIC is a process for any stage of the project. [redacted] asked if [redacted] only looked at were the United Nations (UN), or if there were examples at the country-level to ground truth FPIC processes. [redacted] explained that Article 43 of UNDRIP sets out minimum standards for Indigenous Rights that should apply to Indigenous people world-wide. [redacted] stated that FPIC is the benchmark that the Policy is based upon.

On Slide 8, [redacted] explained a Gwich'in Council International report in which FPIC principals were applied to Impact Assessment. This is not exactly what you see in the Policy, but this report informed the development of the Policy. [redacted] added that the report referenced on Slide 8 will be circumpolar and when it is published, they will get a copy. [redacted] asked if YESAB would adopt or amend sections to meet the Gwich'in Council International report. [redacted] said that is unknown, however, the Policy fills the gap where YESAB does not address FPIC.

[redacted] said that given the relative lack of development in the VGFN Traditional Territory, and the significance of caribou, VGG wants to gain as much information as possible to figure out what information is absent and what is needed to address Vuntut Gwitchin interests before going to YESAB. VGG worked on the Policy process for eight months and it was finalized in March of 2018. [redacted] contributed. It went to Council, and before it was finalized, it was published on the website and announced at community meetings. A draft was provided to Chance, and Chance provided comments before it was finalized.

Referring to Slide 9, [redacted] explained that many of definitions in the Policy were incorporated from Yukon legislation. It was important that the Policy facilitate discussion with Vuntut Gwitchin Citizens and have community members involved to provide feedback. The Natural Resources Committee (Committee) is mandated with this task. [redacted] asked how the Committee and the proponent will be involved. [redacted] said that the Committee makes their own rules and they can invite anyone to their meetings. There is nothing stopping the proponent from approaching citizens, the proponent just must inform the Committee to arrange logistics and to avoid scheduling conflicts. [redacted] said that the Committee will add to the capacity of the Natural Resources Department by improving direct communication between the department and VGFN citizens. The community and VGG do not have the capacity to support multiple committees under the Natural Resources Department; therefore one committee will handle oil and gas in addition to other files of the department.

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[redacted] said that some citizens are saying that it is difficult to get on boards and committees and she suggested that vacancies for boards and committees be posted on the website. [redacted] replied that vacancies for the board had been advertised.

[redacted] asked if VGG could reveal the names of the three board members. [redacted] said that VGG should be able to reveal the names as they are trying to be transparent. The three citizen members of the Committee are [redacted]. The other two members of the Committee are the Standing Chair and the Director of the Natural Resources Department. The Committee will meet for the first time in the New Year after the new Government is sworn [redacted] said that Chance and Hemmera would be available to provide any briefing material to the Committee.

[redacted] went on to explain Slide 10, saying that when trying to coordinate and facilitate engagement with citizens, Chance should provide reasonable notice. [redacted] said that Chance will send VGG a scheduled workplan and that VGG will have lots of notice as to when Chance needs to speak to the community. [redacted] asked about educational sessions in addition to Consultation. [redacted] explained that the Committee would come up with its Terms of Reference to guide operation, and there is the possibility to hold educational sessions. Any additional sessions outside of Consultation would depend on the needs of the community. Consultation is not tied to a specific stage of the Policy.

[redacted] said that Chance is obliged to follow a legislated timeline when designing the Consultation timeline, what if Chance's Consultation timeline and the Committee's timelines do not align? Chance needs time to coordinate with and educate VGG, the Committee, and the community, and is concerned about duplicating Consultation and education efforts prior to and during the YESAB process. [redacted] said that a lot of the coordinating and communicating should be done at the front end before YESAB. [redacted] that nothing should be a surprise during YESAB, the Policy process is supposed to alleviate pressure during the YESAB process. [redacted] suggested that if issues have been addressed then few new items should be raised during the YESAB process. [redacted] clarified that this would mean developing the proposal together with VGG and [redacted] agreed that this summarized the Policy process.

Referring to Slide 10, [redacted] explained section 24 of the Policy and the details of what the proponent's notice should contain. VGG understands that many projects details may not be available when beginning the Policy process, however, Chance should give VGG enough information to understand what upcoming project discussions will contain. When notice is received by the Director of Natural Resources, it is sent to the Committee to review and the Committee decides if they have enough information. They may request more information. [redacted] asked if there were timelines for these stages? [redacted] explained that they initially had strict timelines for each stage, but this was thought to be too restrictive. The wording was designed to suggest some immediacy, and VGG would generally like to know information as early as possible.

[redacted] asked if, when Chance informed VGG about their tenure extension application in the summer of 2018, that was the first time Chance had reached out to VGG separate from Yukon Government. [redacted] thought that is was. [redacted] wondered how much time VGG would generally require to review notification documents and also require with each stage of the Policy.

[redacted] then raised the issue that, when Yukon Government calls for proponents to bid on new opportunities, it is confidential, and the name of the proponent would only be revealed after there is an

award. Some things are hidden by government practices to protect competitive processes. [redacted] added a follow-up question, how does VGG see the Policy meshing with Yukon Government Policies? [redacted] replied to [redacted] question; the wording of the Policy is at the "earliest possible opportunity" and therefore if something is confidential, the earliest time it could be shared is when it is not confidential anymore. The Policy is not meant to intervene in the competitive bidding process.

On Slide 12, [redacted] explained that, for the Cooperation Agreement in Stage II of the Policy, the Proponent and the VGG Chief and Council would enter into the Cooperation Agreement and the Committee's role would be fulfilling its mandate to inform the community. Stage II is meant to be a step where parties are committing to the process.

For slide 13, [redacted] explained that the items in Stage III, that comprise the negotiation for a Benefits and Stewardship Agreement, contain the mechanisms for enacting FPIC. This is the same process as the Cooperation Agreement but is more extensive because there are more items to address. The Committee is tasked with deciding if they are going to recommend the Benefits and Stewardship Agreement to Council. The Committee will be responsible for determining a sufficient ratification process for any Benefits and Stewardship Agreement which could include a community vote or General Assembly Resolution, for example. This Stage is meant to maximize benefits and minimize risks.

[redacted] addressed [redacted] earlier question and said that the timelines are however long it takes to discuss the matters of each Stage. VGG has had issues with Section 68, the Benefits Agreements section of the *Yukon Oil and gas Act*. The First Nation can waive the agreement if the Benefits and Stewardship Agreement for Stage III of the Policy satisfies the First Nation, and then the proponent could satisfy Yukon Government requirements separately. G. Charlie said that he likes this possibility and asked what would happen if the community was not supportive? K. Statnyk replied that this is a possibility, however, if people are informed and included as partners throughout this process and the development of plans and Agreements, then there is a greater likelihood of community support. [redacted] added that it is beneficial to have the Chair of the Committee be an individual that is part of VGG as well as the Committee to help share information. The goal is to provide objective information and have the Committee fulfil their mandate.

[redacted] raised that the YESAB process collects feedback from the general public whereas the VGG Policy is focused on the community. [redacted] said that the Committee can choose to meet with other groups and other groups can meet with members of the community. [redacted] raised concerns around fear mongering or sensationalizing the project during the YESAB process. [redacted] said that there would be public consultation prior to the YESAB process, as is typically done when submitting a proposal to the YESAB Executive Committee.

[redacted] asked how the community and Committee are meant to help in establishing economic benefits and opportunities. [redacted] replied that the Committee is the conduit and that VGG does not expect the Committee to come up with specifics. The Committee can help to make sure that the benefits and opportunities are fair and meet the needs of the community. In January, [redacted] said he would like to have a community event to accelerate and stimulate thinking on Chance's project. [redacted] added that they need someone with experience to help figure out what the benefits and opportunities are. [redacted] said that he is excited to go back to the community and share information about the

project. The Committee may not have membership that is representative of all of VGG's interests as this would require too many people to make a functional committee, however, the Committee will have to reach out to other departments and experts to make decisions. [redacted] said it would be good to provide a historical overview to the Committee, so they could understand what has led Chance and VGG to this point. [redacted] agreed.

[redacted] asked what if YESAB causes amendments to the Benefits and Stewardship Agreement, would Chance and VGG have to go through the ratification process again? [redacted] replied that this is possible, it would depend how the agreement is drafted. Chance and VGG will have to take this into account when drafting the document. [redacted] raised that there is often a debate over stewardship measures and management plans, for example, there could be issues over what YESAB would consider adequate in a conceptual management plan. [redacted] asked if VGG had thought about what adequate means within the Policy. [redacted] said that adequacy would be determined by the community and there will be a lot of things that the community wants to understand.

[redacted] asked, for Item (n) in Stage III of the Policy regarding dispute resolution, what are scenarios that would require dispute resolution and when would this be enacted? Dispute resolution may be required prior to completing the agreement? [redacted] said that disputes will be evaluated on a case by case basis, and parties will figure out mechanisms by which they can get to an agreement. [redacted] said that they will create a process where both parties understand that certain circumstances need to be resolved or negotiated and parties will commit to this. [redacted] suggested that a dispute resolution committee could have members from VGG, Yukon Government, and Chance.

[redacted] began to describe the process of executing the Policy. Once Chance and VGG get through Stage I, he does not see Stage II as being onerous because the parties have already started the Cooperation Agreement, discussed objectives, and provided feedback between each other. [redacted] added to the process that Chance will have to meet with YESAB to discuss the project and get an official decision on whether they are submitting a Designated Office or Executive Committee level proposal. In addition, [redacted] asked if Chance could share the Policy with YESAB and Yukon Government. [redacted] replied that Chance could share the Policy as it is public.

[redacted] informed VGG that Chance is in various stages of engagement with each First Nation. Chance originally thought that they could collaboratively develop the project description. However, they need to be mindful of all the parties when doing so. Chance would like to discuss how to collaborate at the February 1st All-Party Meeting. [redacted] agreed that is was important to keep the other First Nations informed and he thinks that they agree that VGG is the most impacted. [redacted] said that he thinks that VGG can educate the other First Nations about what VGG is doing, but VGG does not think that they need to be involved in the benefits discussions of the other First Nations. [redacted] said that he does not think it is the proponent's responsibility to figure out the division of benefits either, he thinks that is Yukon Government's role. There may be issues with Gwich'in Partners because they are not included in Yukon Legislation.

[redacted] asked that VGG suggest agenda items for the February 1st meeting if they have any additions. [redacted] added that [redacted] from Yukon Government would let Chance know early in the New Year

about the Minister and Deputy Minister's attendance. [redacted] said that an agenda will be sent out a couple of weeks before the meeting.

For the next meeting, it was suggested that VGG and Chance meet in Old Crow. [redacted] reminded the group of the pending law suit with Yukon Government and how Chance was waiting to hear about a settlement. [redacted] wondered if meeting in January may be too soon. [redacted] said that it would be good to talk to the community, provide an update, and introduce the project to new Council members and the Committee. [redacted] said that this would be an introduction before officially starting Stage I of the Policy. January 17th was proposed as the date for the meeting, and Chance was meant to send something in writing to [redacted] the Acting Director of Natural Resources, to connect with the Committee.

[redacted] closed the meeting by saying that the Policy was built on VGG's existing agreements and enacting the Policy will make them Champions of the North. VGG looks forward to next steps and gaining traction in the process. The Policy provides guidance for the project and collaboration between VGG and Chance.

Appended:

- Appendix 1: Vuntut Gwitchin Government Oil and Gas Engagement Policy Background and Overview Presentation

Key Meeting Outcomes

Outcome	Responsible Party	Notes
A thorough presentation of the background of the Policy and its stages. Leading to a discussion on how to implement the Policy with Chance.	VGG	The presentation is appended to the notes for reference.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Contact [redacted] to schedule a meeting with the Natural Resources Committee on January 17, 2019 and send a scheduler to the group for the meeting.	Hemmera	ASAP

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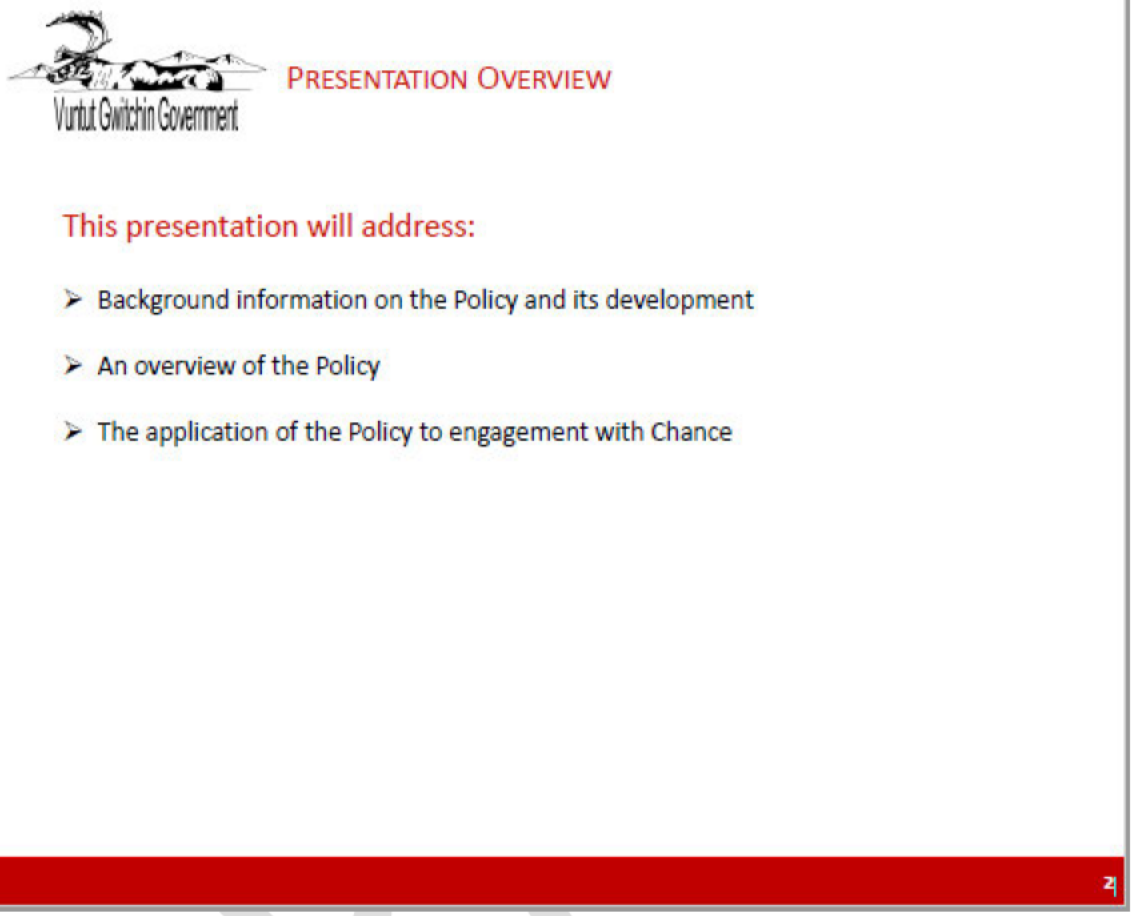
Appendix 1: Vuntut Gwitchin Government Oil and Gas Engagement Policy Background and Overview Presentation




Vuntut Gwitchin Government
PRESENTATION OVERVIEW
This presentation will address:
Background information on the Policy and its development
An overview of the Policy
The application of the Policy to engagement with Chance
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BACKGROUND

The development of the Policy was informed by:

- The principle of sustainable development as enshrined in the VGFN Final Agreement and North Yukon Regional Land Use Plan
  - "'Sustainable Development' means beneficial socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent" [VGFN Final Agreement, Chapter 1].
  - "The core principle that guides the Plan is sustainable development, as defined in the VGFNFA... Sustainable development requires consideration of the economic, social and ecological consequences of land use decisions, and management of lands and resources in an integrated and coordinated manner" [NYRLUP]
- The principles, goals, recommendation and best management practices provided for in the North Yukon Regional Land Use Plan

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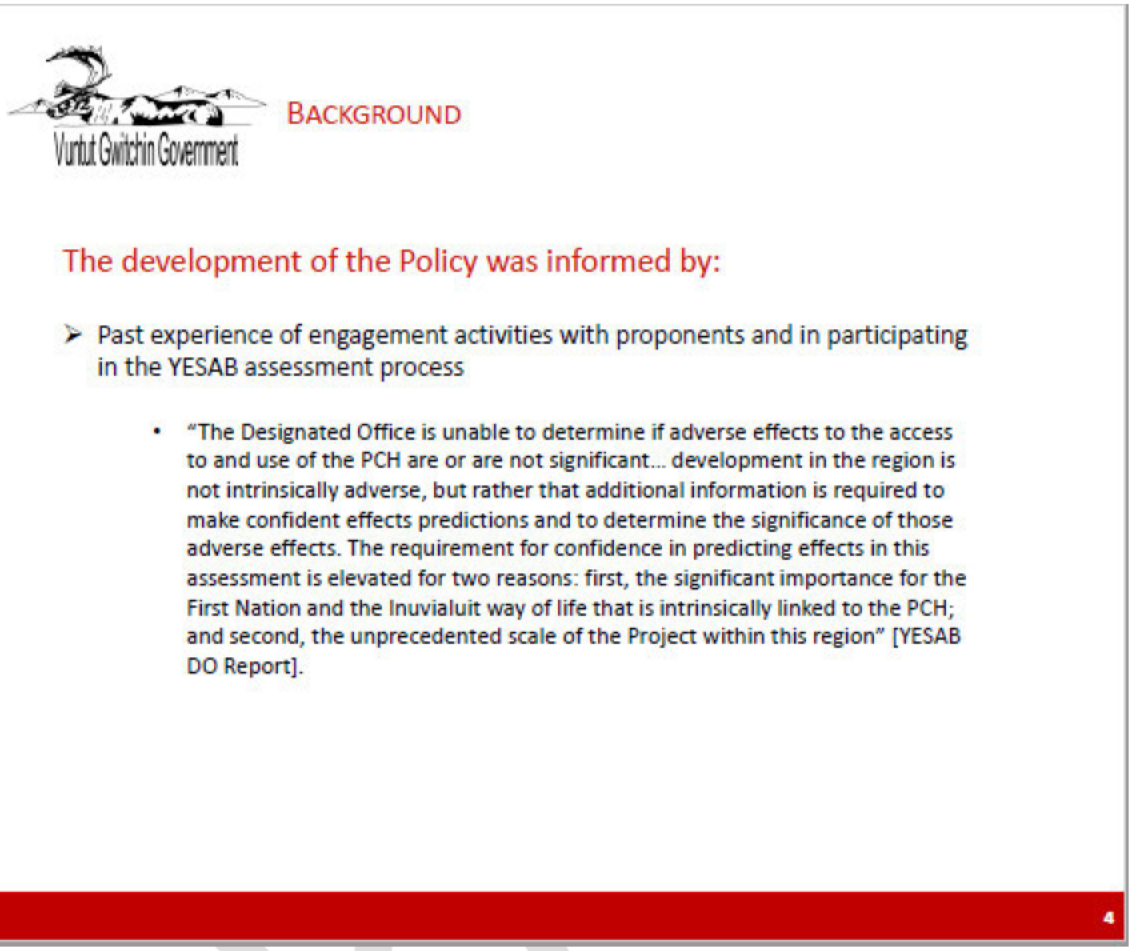
Vuntut Gwitchin Government
BACKGROUND
The development of the Policy was informed by:
Past experience of engagement activities with proponents and in participating in the YESAB assessment process
"The Designated Office is unable to determine if adverse effects to the access to and use of the PCH are or are not significant... development in the region is not intrinsically adverse, but rather that additional information is required to make confident effects predictions and to determine the significance of those adverse effects. The requirement for confidence in predicting effects in this assessment is elevated for two reasons: first, the significant importance for the First Nation and the Inuvialuit way of life that is intrinsically linked to the PCH; and second, the unprecedented scale of the Project within this region" [YESAB DO Report].
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BACKGROUND

The development of the Policy was informed by:

- Shortcomings in the existing territorial regulatory regime
  - "VGG would like to address our concerns with provisions of the Yukon Oil and Gas Act, R.S.Y. 2002, c. 216 and its associated regulations as it relates to benefits agreements and permit extensions. Additionally, VGG would like to resume the development of resource access roads regulations under the Territorial Lands (Yukon) Act, S.Y. 2003, c. 17" [VGG Letter to Premier Silver, May 10, 2017].
  - "The most recent annual report for the NYRLUP stresses the need for baseline data collection and development of best management practices in order to better understand and predict effects. Industrial development in the region is predicated upon fulfillment of goals for information collection as set out in the NYRLUP and associated annual reports" [YESAB DO Report].

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Vuntut Gwitchin Government

BACKGROUND

The development of the Policy was informed by:

- An identified need for public policy that establishes a framework for respectful, meaningful and transparent engagement
  - "It is a condition of this Order that Chance Oil and Gas Limited must, in consultation with each affected First Nation, revise the first nations communications and engagement plan filed under O.I.C. 2016/169 to the satisfaction of the Minister on or before August 1, 2018" [Ministerial Order 2017/37].
  - "[THEREFORE BE IT RESOLVED] That VGG proceed with efforts that lead to constructive engagement with oil and gas industry proponents and government agencies including partnerships in the areas of employment and training, environmental stewardship and business development" [VGFN GA Resolution No. 2017-02].

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Vuntut Gwitchin Government
BACKGROUND
The development of the Policy was informed by:
International standards and best practices
"Indigenous peoples have the right to determine and develop priorities and strategies for the development or use of their lands or territories and other resources… [and to] free and informed consent prior to the approval of any project affecting their lands or territories and other resources, particularly in connection with the development, utilization or exploitation of mineral, water or other resources" [UNDRIP, Article 32].
"FPIC is relevant… in relation to development projects encompassing the full project cycle, including but not limited to assessment, planning, implementation, monitoring, evaluation and closure" [UN Permanent Forum on Indigenous Issues, Report of the International Workshop on Methodologies regarding Free, Prior and Informed Consent and Indigenous Peoples].
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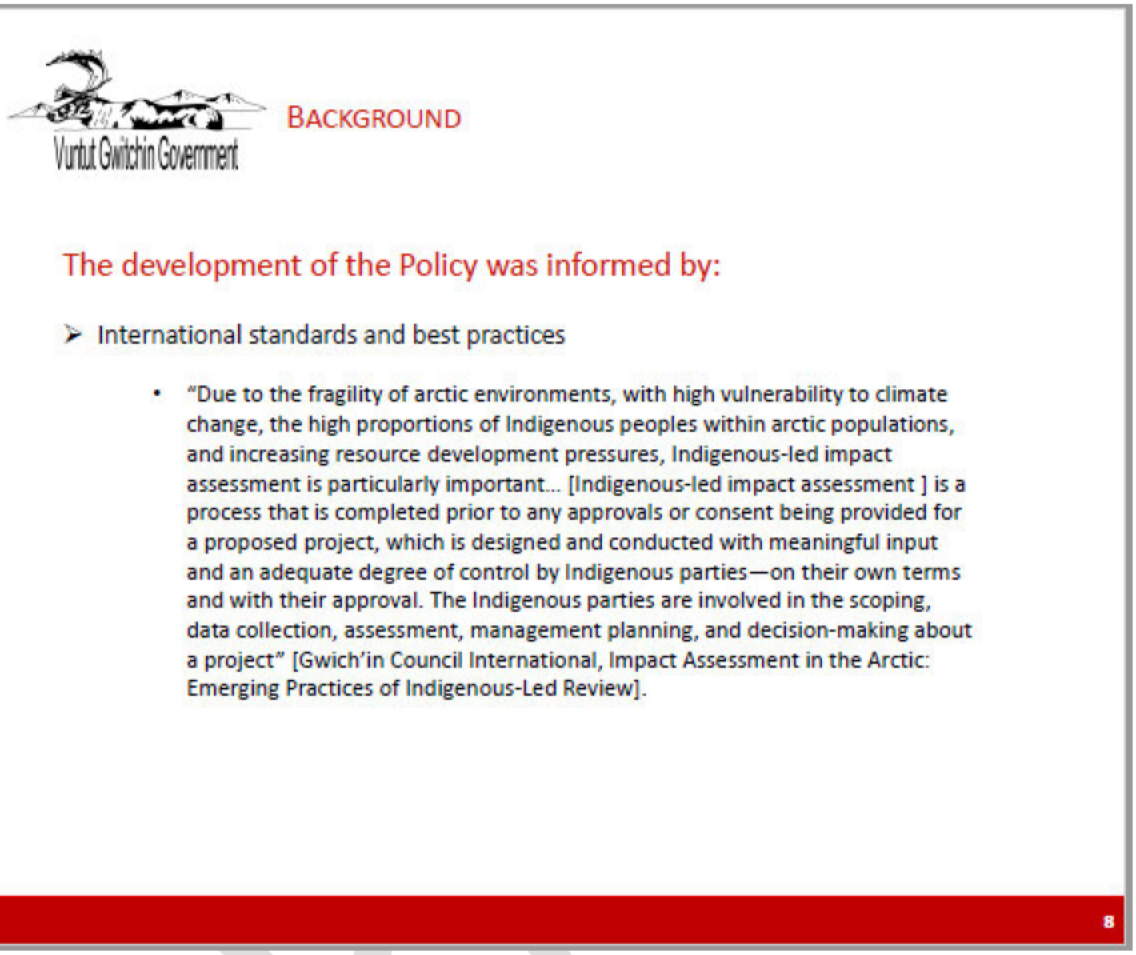
Vuntut Gwitchin Government
BACKGROUND
The development of the Policy was informed by:
International standards and best practices
"Due to the fragility of arctic environments, with high vulnerability to climate change, the high proportions of Indigenous peoples within arctic populations, and increasing resource development pressures, Indigenous-led impact assessment is particularly important... [Indigenous-led impact assessment] is a process that is completed prior to any approvals or consent being provided for a proposed project, which is designed and conducted with meaningful input and an adequate degree of control by Indigenous parties—on their own terms and with their approval. The Indigenous parties are involved in the scoping, data collection, assessment, management planning, and decision-making about a project" [Gwich'in Council International, Impact Assessment in the Arctic: Emerging Practices of Indigenous-Led Review].
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Overview of the Policy

The main components of the Policy include:

- A clearly defined purpose section
  - "The purpose of this policy is to establish a respectful, transparent and meaningful framework to guide the engagements of the Vuntut Gwitchin Government in relation to Oil and Gas Activities and Oil and Gas Dispositions in a manner that supports and upholds the objective of Sustainable Development" [section 3].
- The establishment and mandating of a committee to facilitate the participation of Citizens in the engagement and decision-making process
  - Membership consists of Standing Committee Chair on Natural Resources, Director of Natural Resources, Elders Representative, Youth Representative and Citizen Representative [section 12].
  - Mandate includes informing and seeking views from Citizens, and assisting and providing recommendations to the Council throughout the Engagement Process [section 11].

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Overview of the Policy

The main components of the Policy include:

- A process to guide the organizing and carrying out consultations with Citizens regarding Oil and Gas Activities and Oil and Gas Dispositions

  - Director of Natural Resources has primary responsibility for organizing and carrying out any consultation between the Vuntut Gwitchin Government and Citizens regarding Oil and Gas Activities and Oil and Gas Dispositions with the assistance of the Committee as necessary [section 20].

  - Proponents are to coordinate any of its consultation with Citizens by submitting written notice to the Director of Natural Resources that sets out proposed date, location, agenda, description of the purpose of the meeting and any materials to be shared with Citizens [section 21].

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Overview of the Policy

The main components of the Policy include:

- A three stage process for engagement with Proponents in relation to any Oil and Gas Activity to be completed prior to the Proponent submitting any Proposal to the Board
- Stage 1: Notice Period
  - Sufficient notice of a proposed Oil and Gas Activity must be provided to the Director of Natural Resources at the earliest opportunity [section 24].
  - Director of Natural Resources will refer the notice it receives from the Proponent to the Committee who will review it for sufficiency. The Committee will notify the Proponent in writing of its determination. If notice is not sufficient then more information will be requested. If notice is sufficient then engagement on the Oil and Gas Activity can proceed to Stage 2 [section 25].

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Overview of the Policy

The main components of the Policy include:

- Stage 2: Cooperation
  - A Cooperation Agreement must be negotiated and entered into following Stage 1 and before proceeding to Stage 3 [section 26].
  - Prior to entering into a Cooperation Agreement, Council must refer the Cooperation Agreement to the Committee. The Council can enter into the Cooperation Agreement if the Committee determines that the Cooperation Agreement adequately addresses items related to compliance with the policy, communications, information sharing and capacity funding [section 27].
  - If a Cooperation Agreement is entered into in relation to an Oil and Gas Activity then the engagement process proceeds to Stage 3. A Cooperation Agreement does not provide free, prior and informed consent to any Oil and Gas Activity.

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Overview of the Policy

The main components of the Policy include:

- Stage 3: Benefits and Stewardship

  - A Benefits and Stewardship Agreement must be negotiated and entered into following Stage 2 and before proceeding to the Board with a Proposal. It is the mechanism in which the free, prior and informed consent of the Vuntut Gwitchin First Nation is effectively to be provided in relation to any Oil and Gas Activity [section 28].

  - Prior to entering into a Benefits and Stewardship Agreement, Council must refer the Benefits and Stewardship Agreement to the Committee. The Council can enter into the Benefits and Stewardship Agreement if the Committee determines that the Benefits and Stewardship Agreement adequately addresses various items related to economic benefits and environmental stewardship [section 29].

  - Benefits and Stewardship Agreement will be subject to an approval and ratification process deemed adequate by the Committee.

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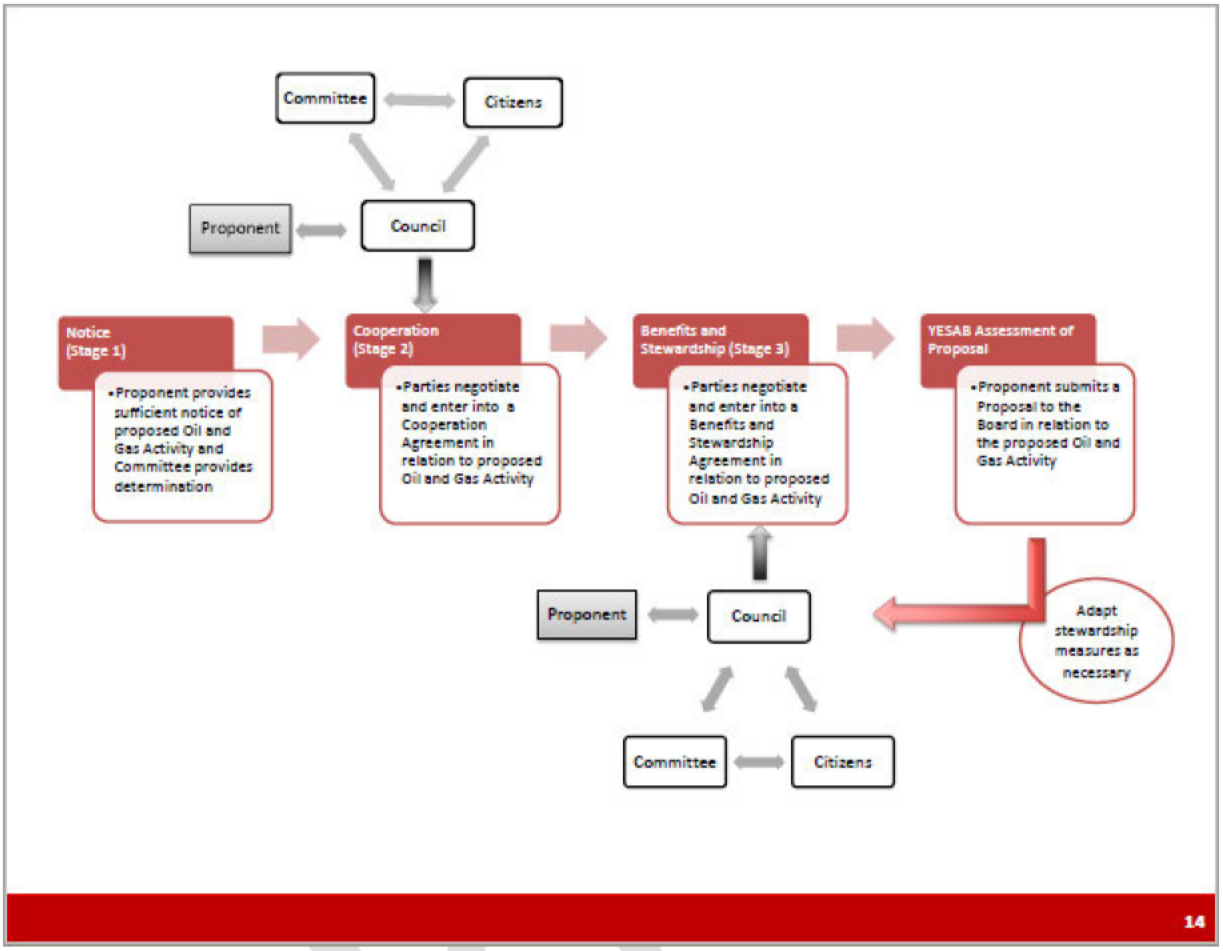
Committee
Citizens
Proponent
Council
Notice (Stage 1)
•Proponent provides sufficient notice of proposed Oil and Gas Activity and Committee provides determination
Cooperation (Stage 2)
•Parties negotiate and enter into a Cooperation Agreement in relation to proposed Oil and Gas Activity
Benefits and Stewardship (Stage 3)
•Parties negotiate and enter into a Benefits and Stewardship Agreement in relation to proposed Oil and Gas Activity
YESAB Assessment of Proposal
•Proponent submits a Proposal to the Board in relation to the proposed Oil and Gas Activity
Adapt stewardship measures as necessary
Proponent
Council
Committee
Citizens
14

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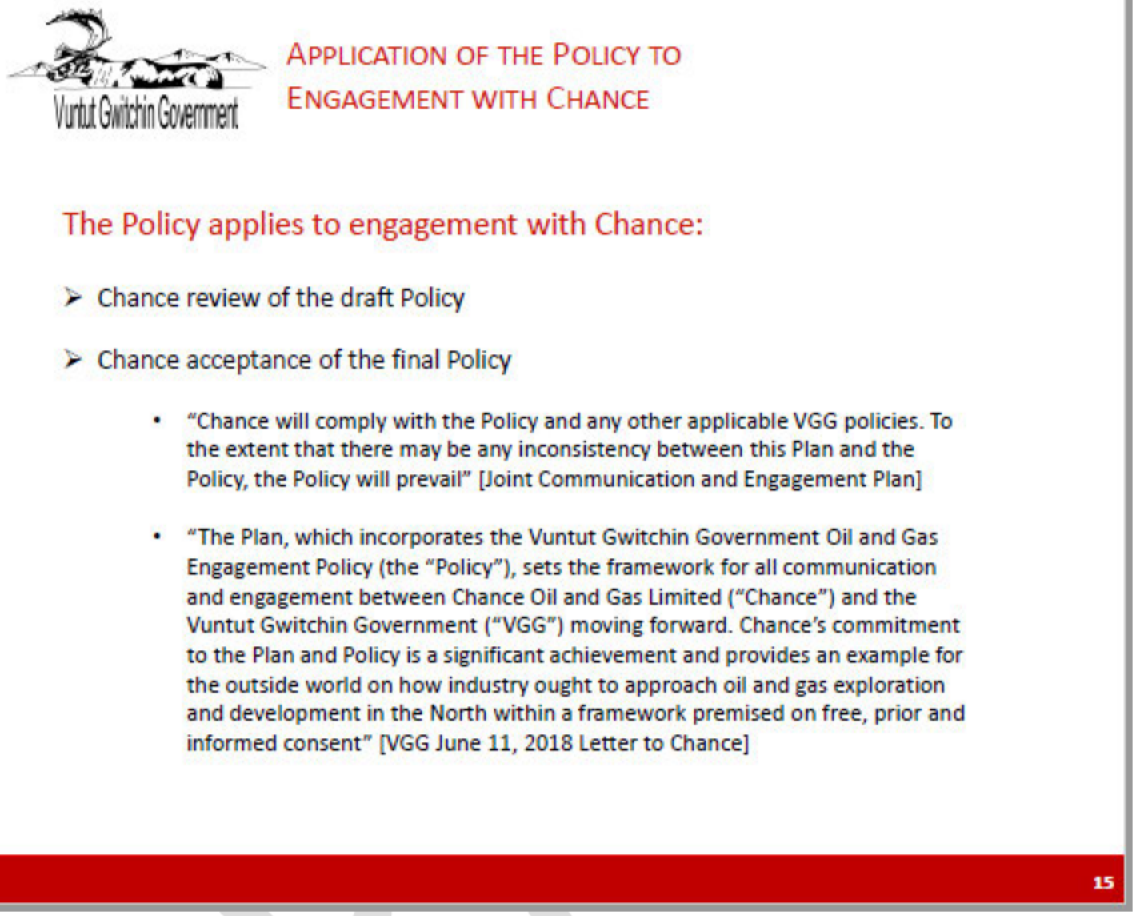
Vuntut Gwitchin Government
APPLICATION OF THE POLICY TO ENGAGEMENT WITH CHANCE
The Policy applies to engagement with Chance:
Chance review of the draft Policy
Chance acceptance of the final Policy
"Chance will comply with the Policy and any other applicable VGG policies. To the extent that there may be any inconsistency between this Plan and the Policy, the Policy will prevail" [Joint Communication and Engagement Plan]
"The Plan, which incorporates the Vuntut Gwitchin Government Oil and Gas Engagement Policy (the "Policy"), sets the framework for all communication and engagement between Chance Oil and Gas Limited ("Chance") and the Vuntut Gwitchin Government ("VGG") moving forward. Chance's commitment to the Plan and Policy is a significant achievement and provides an example for the outside world on how industry ought to approach oil and gas exploration and development in the North within a framework premised on free, prior and informed consent" [VGG June 11, 2018 Letter to Chance]
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Application of the Policy to Engagement with Chance

The Policy applies to engagement with Chance:

- VGG and Chance engagement is currently in Stage 1 (Notice)
- Chance has shared scenarios for various Oil and Gas Activities at different scales but has not submitted notice of an Oil and Gas Activity it wishes to advance for further consideration under the Policy
- VGG has shared a draft Cooperation Agreement for discussion purposes prior to the completion of Stage 1 (Notice) and in advance of Stage 2 (Cooperation)
- Next steps: Chance to provide written notice of any proposed Oil and Gas Activity to the Director of Natural Resources at the earliest possible opportunity as provided under section 24 of the Policy

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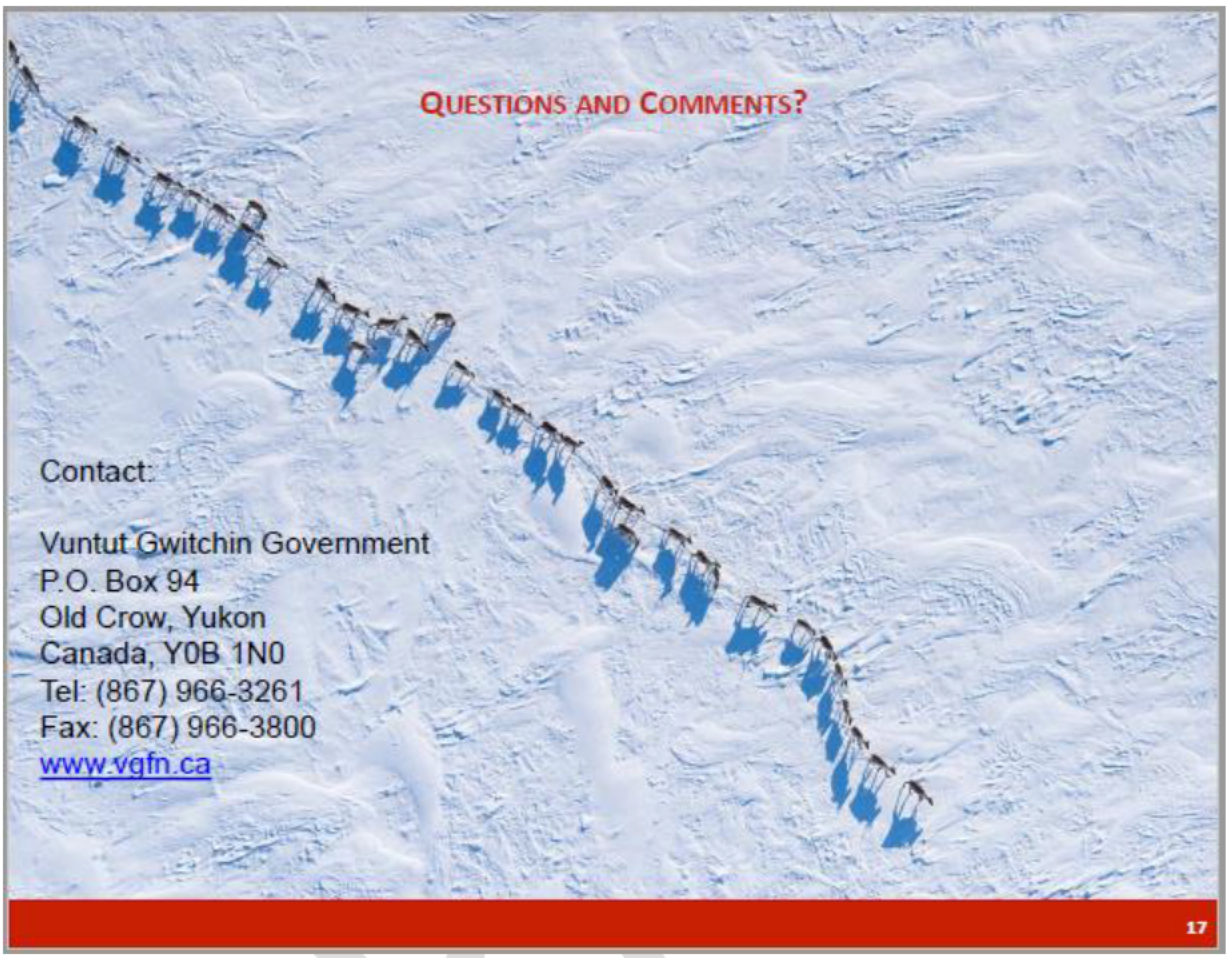
QUESTIONS AND COMMENTS?
Contact:
Vuntut Gwitchin Government
P.O. Box 94
Old Crow, Yukon
Canada, Y0B 1N0
Tel: (867) 966-3261
Fax: (867) 966-3800
www.vgfn.ca
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APPENDIX 2-C-59. January 29, 2019, Meeting Summary

Vuntut Gwitchin Government and Chance Oil and Gas Limited Meeting

Date: January 29, 2019

Location: Old Crow, Yukon

Attendees:

Vuntut Gwitchin Government:

Councillor [redacted]
[redacted], Lands Manager
[redacted], Intergovernmental Coordinator
[redacted], Standing Committee H&S
[redacted] Standing Chair, Natural Resources Committee
[redacted] Natural Resources Committee
[redacted], Natural Resources Committee
[redacted], Director of Health and Social, Seven Generations Energy

Chance Oil and Gas Limited:

[redacted], Chairman/ CEO
[redacted], President
[redacted], VP Government and Community Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator
[redacted], Board member and Chair of Community Relations Committee

Hemmera:

[redacted], Business Leader, Human Environment

Purpose and Objectives

The purpose of this meeting was to introduce Chance Oil and Gas Limited (Chance) to Vuntut Gwitchin Government's (VGG) new Chief and Council and Natural Resources Committee (Committee). The meeting was an unstructured conversation in which Chance explained their permits and exploration intentions and provided the opportunity for Council and the Committee to share their thoughts on the project and ask questions.

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Meeting Objectives:

- Create a common understanding of Chance's permits in Eagle Plains and their exploration project plans
- Meet and greet with the New Chief and Council, the Committee, Chance, and Hemmera

Meeting Discussion:

[redacted] opened the meeting saying that there has been a lot of progress to date between VGG and Chance. The Committee is up to date and has been briefed on the Policy. [redacted] thanked VGG for the invitation to come to Old Crow and introduce Chance to the new Council members and the Committee. [redacted] discussed the process to re-set the relationship between the First Nations and Chance, as well as the company's rebranding from Northern Cross Yukon to Chance Oil and Gas Limited. Chance is entirely Canadian owned and is a small company. In late fall 2017, Chance began the process of creating the Engagement and Communications Plan (Plan) with VGG and completed the Plan in May 2018. Chance went through the same process of creating Engagement and Communications Plans with the other First Nations listed in MO 2017/37 (Gwich'in Tribal Council (GTC), Tetlit Gwich'in Council (TGC), First Nation of Na-cho Nyak Dun (FNNND), and Tr'ondëk Hwëch'in (TH)).

[redacted] described the overlap of Traditional Territories on which Chance's permits are located. [redacted] In meetings with VGG previously, Chance has emphasized that they are still in the exploration phase as the resources Chance has found to date are not sufficient enough for them to go into operation.

[redacted] explained Chance's disposition map (see Appendix 1). Chance released their northern-most permit, 0005, to support the creation of the Ch'Ihilii Chik Habitat Protection Area in the Whitefish Lakes Area. Looking at Chance's permitted area, the green dispositions and the yellow permit, 0019, have upcoming expiry dates in August 2019. The rest of the yellow permits, except permit 0020, were extended in August 2018 for five years and expire in August 2023. Permit 0020 expires in August 2020. Chance has purchased the Significant Discovery Licenses (red blocks on the map) and Chevron has a minor interest in them. The Significant Discovery Licenses have indefinite tenure. Chance's main area of interest is on the west side of the Dempster Highway, with some interest on the east side. Chance is planning to apply to extend their tenure on the green permits sometime this spring.

Next, [redacted] explained how Chance has no plans to do hydraulic fracturing. Previously, Northern Cross Yukon had planned to do this. The testing Northern Cross Yukon did in 2012-2014 was to evaluate shale resources and they spent a lot of money doing so before hydraulic fracturing was disallowed in the Eagle Plain Basin. Chance has legal proceedings underway with Yukon Government and has no plans to pursue non-conventional resources. [redacted] explained that in the green dispositions there is the opportunity for shale, but Chance has not explored this area. Chance found good results for shale in the yellow dispositions and prepared a report saying there was eight billion barrels of recoverable resources if hydraulic fracturing was used for extraction. Without hydraulic fracturing, there is an estimated 10 million barrels available.

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[redacted] asked for Chance to expand on their plans for extraction and use of resources. [redacted] answered that they need to understand if there are large enough resources to extract and also evaluate the resources to determine what products they could produce. Though more exploration is needed, what they have found in the significant discovery areas is reasonable for diesel. [redacted] asked about refining to make gas and if the crude oil would have to be shipped out. [redacted] said that Chance would try to do as much treating and processing as possible on site and possibly have a few distillation towers for separating different products.

[redacted] explained that Chance is focused on community relations and they want to make sure that no projects go ahead without community approval. [redacted] highlighted that hydraulic fracturing is a serious undertaking in areas with a mature oil and gas industry and lots of resources and it also requires a lot of water. Because of the remote location of the Chance project, it would be difficult to service the area to do hydraulic fracturing regardless of regulatory or legislative impediments, such as the current ban in Eagle Plain Basin.

[redacted] explained Chance's possible next steps in terms of the oil industry. Upstream industry is exploration and production. Midstream industry is storing, marketing and transporting products such as crude oil and natural gas liquids. Chance is not interested in midstream options and [redacted] proposed that that midstream options in the Yukon be sold to Yukoners. There is less risk in developing the midstream products and Chance would love to see midstream industry options available to Yukoners.

[redacted] said that Chance plans to displace a portion of the local import of fuel which currently totals 300 million liters per year. There are opportunities for Vuntut Gwitchin in environmental stewardship and with s. 68 of the Yukon Oil and Gas Act which outlines Benefits Agreements. The doors are open to explore all the opportunities of the Final Agreement including the purchase of midstream operations by a First Nation. [redacted] added that the end game is very speculative. [redacted] raised that the Vuntut Gwitchin Final Agreement Chapter 22, Economic Development Measures, was applicable to this project. They also must keep in mind the North Yukon Forum with TH and FNNND. C. Charlie recognized that it is important that the proponent have the length of tenure required to get through the YESAB process and acknowledged the work that went into creating the Plans.

[redacted] asked when Chance would start their exploration project. [redacted] responded that Chance needs lead time. They have a 70 to 80-person camp that somewhat limits the size of their operation, however, they also have the Eagle Plain Hotel. All the specialty equipment must come from Northern BC or Alberta and they must wait for the ground to freeze to install infrastructure off the Dempster. Chance's current time constraints are seasonal issues and the required lead times to get going.

[redacted] said that, in the past, the Vuntut Development Corporation (VDC) had received more opportunity, however this time, she envisions more economic opportunity going to the citizens and Vuntut Gwitchin First Nation. G. Charlie said that, at this point, the VDC has a mandate from Chief and Council and they understand that citizens want more opportunities. [redacted] explained that the Community Relations Committee will be focused on understand what the community wants. [redacted] will be providing high-level input as chair of the Community Relations Committee. [redacted] said that it would be important to educate people on opportunities and processes. [redacted] added that the VGG would need lead time to educate and prepare people for opportunities and that the OCDC can

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provide training. [redacted] explained that they are also part of the community education process as members of the Committee.

[redacted] then explained that this project is difficult because of the mix of opinions in the community regarding the oil and gas industry. The community has a negative perception of Oil and Gas companies due to drilling in Crow Flats, the most important wetland for the Vuntut Gwitchin. Community members would also recall the Berger Inquiry that halted the development of the Mackenzie Valley Pipeline. In addition, the issues surrounding the Arctic National Wildlife Refuge (ANWR) are on the minds of community members making Chance an important decision for people in Old Crow. The land use planning process is important as is carrying out its recommendations. The Vuntut Gwitchin Elders were not against the development of the R-Block in Eagle Plain Basin. However, the resource should be developed in the safest and most sustainable way with measures taken to mitigate impact to caribou and tundra. [redacted] responded by saying that everyone needs to have input into the management and mitigations. There are never zero impacts and Chance will seek to minimize negative impacts and enhance benefits.

[redacted] explained that it is not the Committee's role to explain Oil and Gas to the Community, instead, the Committee should be viewed as an executive council of the Community. [redacted] acknowledged that there is no way to get rid of hydro-carbons in the local market, however, Vuntut Gwitchin needs to set standards in the world that are not what you find in the 1002 Lands. [redacted] followed and said that the area around the Camp has not been visited by caribou in recent years. There have been a lot of forest fires in the area, which could have something to do with it. [redacted] said that there have been a lot of caribou discussions and they would like to see some support from YG on this topic.

After a short break [redacted] explained more about the project. This is a small-scale exploration over a long period of time. Chance will drill sequentially with only one rig at any one time. Staging exploration over a long period of time is beneficial as Chance will aim to be operating as steadily as possible and can therefore offer more steady employment. They will need to be flexible in case any changes arise. B. Kyikavichik said that another beneficial thing about this project is that the First Nation has control compared to ANWR where they have no control.

[redacted] followed and said that the Elders are always concerned about the environmental impacts of any development because the land could be changed and damaged. It is important that processes are followed to ensure that the lands are not damaged. It is also very important to the community to see people working. There should be an effort made to make sure everyone understands the environmental impacts of the project as well as benefits to the community. For example, the community benefitted from the Airport design and construction because they understood the environmental impacts and were able to shape the project. The Elders are happy because they have young leaders now. The community has specific concerns which are water and the inclusion of Traditional Knowledge in the project design. [redacted] said that Chance is there to listen, and Traditional Knowledge will be featured in the project.

[redacted] explained that First Nations develop relationships in a different way and this is a slow process. As a Committee member, [redacted] will help bring information to the community to educate them so that they will then make decisions. For example, the Committee can educate people that pipelines are low-

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risk, or that in Grand Cache, Alberta, lichen doesn't grow there anymore as a result of environmental damage. They will take the time to inform people and make a good decision.

[redacted] further explained that two-thirds of the Yukon's gas come from the United States as far south as South Dakota. One-third of the gas is from Alberta which is either fracked or from oil sands. Displacing imported gas in the Yukon reduces greenhouse gases. B. Kyikavichik added that there would be a reduced carbon footprint.

[redacted] explained that VGG and Chance can form a strong partnership by following the VGG Oil and Gas Engagement Policy. Through this project, VGG can develop capacity internally and funnel money into renewable energy. VGG currently has a young government, and they are motivated to do as much as they can. They have a clear mandate to build a bridge for both industry and citizens.

[redacted] asked about upstream operations. When Chance sells off, will Vuntut Gwitchin still have mechanisms of control? G. Charlie responded that now was the time to start having those conversations. [redacted] followed and said that when the project gets to midstream, Vuntut Gwitchin would still be part of the process and maybe even owners. [redacted] said that there are options for midstream industry and they could identify who is in the midstream business and then approach them. [redacted] asked Chance if they see themselves in this process. [redacted] responded that he is 82 years-old and that he wants to see something happen. If Chance and VGG say "yes" to the project, they can go to YESAB and be drilling in maybe three-years. Chance is the only company interested in Yukon oil.

[redacted] discussed what the project proposal would look like. An Executive Committee assessment would be better for Chance; however, a smaller project is better for Vuntut Gwitchin. Through the front-heavy approach with the Policy, Chance and VGG can circumvent S.68, Benefits Agreement, of the Yukon Oil and Gas Act. It was also suggested that Chance and VGG could do a double track approach such that one proposal can go in and then they could start another. [redacted] emphasized that being flexible is important.

[redacted] explained how they met with YESAB to introduce Chance and provide some information as to what Chance has been doing since it was Northern Cross Yukon. [redacted] said that Chance and VGG are working collaboratively and potentially scoping a project in the fall. [redacted] asked if Chance had a Cooperation Agreement, would that give comfort to the process. [redacted] said that for him a big win would be continued access. Three to four wells would not create an oil industry.

[redacted] asked what other First Nations were thinking. [redacted] responded and said that they are looking to VGG and understand everything that has been discussed thus far. In terms of First Nations relationships, [redacted] that Northern Yukon First Nations, VGG, TH, and FNNND have an agreement and the Gwich'in also have an agreement.

[redacted] said that this project could present more opportunities than VGG can bite off. There should be room enough to do everything and VGG and Chance have the template to forge the path. VGG would like to create a full-time position in Oil and Gas. [redacted] emphasized that relationships with First Nations are so important and that Chance still must establish relationships with the other First Nations. [redacted] agreed. [redacted] reminded everyone that there is only one chance in the YESAB process and through the Policy they can achieve confidence in the process.

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[redacted] explained plans for the upcoming summer. Chance is hoping to do field work and invite someone from the VG committee to the site. [redacted] added that Chance will do their annual inspection of the suspended wells ahead of time. Chance will be doing flow testing and looking at building a permanent road.

[redacted] concluded the meeting by saying that Chance and VGG will follow-up on the items discussed in the meeting. This has been a good exchange of information and Chance and VGG will continue to exchange information and figure out action items and next steps. [redacted] thanked the new Natural Resources Council.

Attachments: None

Key Meeting Outcomes

Outcome	Responsible Party	Notes
Introduction of Chance to the new Council and Committee.	All	
Increased understanding of Chance's exploration project and timing, oil and gas industry options and products, disposition tenure, and YESAA.	All	

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Chance and VGG will communicate when they are ready to plan the next meeting.	VGG and Chance	When needed.

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APPENDIX 2-C-60. February 1, 2019, Meeting Summary

Summary

Chance Oil and Gas Limited All-Party Meeting

Date: February 1st, 2019 **Time:** 8:00 am to 4:15 pm

Location: Princess Louisa Room, Fairmont Waterfront Hotel, Vancouver, BC V6C 3L5

Meeting Participants:

Vuntut Gwitchin Government:

- Chief [redacted]
- [redacted] Fish and Wildlife Manager
- [redacted] Lands Manager
- [redacted] Intergovernmental Coordinator

First Nation of Na-cho Nyak Dun:

- [redacted] Deputy Chief
- [redacted] Lands and Resources Manager
- [redacted] Strategic Advisor

Gwich'in Partners (Gwich'in Tribal Council and Tetlit Gwich'in Council):

- Chief [redacted]
- [redacted] Director, Lands and Resources

Yukon Government

- Minister [redacted] Energy, Mines and Resources and Economic Development
- [redacted] Assistant Deputy Minister, Oil, Gas and Mineral Resources, Energy, Mines and Resources
- [redacted] Director, Oil, Gas and Mineral Resources, Energy, Mines and Resources

Chance Oil and Gas Limited:

- [redacted] Chairman/ CEO
- [redacted] President
- [redacted] Vice President of Community and Government Relations
- [redacted] Regulatory, Environmental and Community Relations Coordinator

Hemmera:

- [redacted] VP Human Environment
- [redacted] Business Leader, Human Environment
- [redacted] Human Environment Specialist
- [redacted] Human Environment Specialist

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Summary:

Topic	Lead
Introduction to Meeting • Review of Agenda • Meeting purpose and objectives Summary: Hemmera was hired in 2017 to assist with the consultation and engagement activities for Chance's exploration project in Eagle Plains.	[redacted]
Round Table Introductions and Opening Statements by Chiefs Summary: Chief [redacted], Minister [redacted] Chief [redacted], and [redacted] provided opening statements.	All Parties
First Nation Engagement Plans • Overview of how we got here and an update on implementation Summary: Chance's current round of engagement was spurred by the 2016 OIC, followed by the 2017 Ministerial Order. A series of meetings started in 2018 to collaboratively create engagement plans, starting with a template, then building out from there. This resulted in unique documents between Chance and each First Nation. Annual reports are required under the 2018 Ministerial Order. Likely not an onerous task, and along the lines of a communication summary. Level of detail will likely be decided by individual First Nations. ***See Appendix 1 – Chance All-Party Meeting: Engagement Plan Presentation***	[redacted]
Overview of Vuntut Gwitchin Government Oil and Gas Engagement Policy Summary: Vuntut Gwitchin Government (VGG) wanted an opportunity to share with the group the work VGG has done over the past year. Guiding principles of the VGG Oil and Gas Engagement Policy (Policy): sustainable development; the NYRLUP; VGG Final Agreement; past learning experiences with YESAB (e.g., gaps in regulatory regime in the Yukon); international standards. The development of oil and gas is a community decision. The Policy is two pieces/themes: internal engagement within the community and how the community will decide on oil and gas; and, external engagement with industry (i.e., the Policy establishes a committee). The Policy itself has three phases. All phases are meant to occur prior to a YESAB submission. VGG believes the new YESAB process (i.e., Pre-Submission Engagement process) largely aligns with the objectives of the Policy. Currently, we are before stage one – waiting for notification from Chance Question: Regarding the format/structure diagram – in terms of YESAB, once an application is complete and there is feedback, does that go to the Council? VGG: Feedback goes back into the whole loop – the loop including Council, the committee, and citizens. The committee isn't an interface between the VGG and YG. The committee would be tasked, as per its specific role, and then they would	[redacted]

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report back to the Chief and Council after having done their work. At a later date VGG could expand on the internal processes for clarity.

See Appendix 2 – Chance All-Party Meeting: VGG Oil and Gas Engagement Policy Presentation

Exploration Project Description and Discussion

- Overview of the exploration project plans, oil and gas disposition plans, and YESAB application
- Answer questions or provide clarity on the Exploration Project Description

[redacted]

Summary: First exploration of oil and gas occurred in the Yukon when it was still being permitted by Ottawa back in the 50s, 60s, 70s. Red polygons on the permit map – legacy of exploration done approximately 1959-1968 when oil was found in the Yukon. These properties by themselves are not adequate to move forward with development – more needs to be discovered.

Question: For the discoveries, are conventional or non-conventional means required?

Chance: Do not need to stimulate the rock to facilitate production. Conventional means of extraction would be used.

Winter 2013/2014 had 3D seismic activity, the first in the Yukon. Chance has a base camp that can house 75 people. A limiting factor is man power (i.e., limited places to stay). Land tenure is the period of time that a permit is valid. On the Permits Map, the colour pertains to how the tenures have been extended.

Exploration activities can entail a number of things. Seismic: now lines carved through the bush are not straight, there is no line of sight, and the line are much narrower than those in the 1950s and 1960s. 3D seismic allows you to collect subsurface information in all directions. Exploration activities will include running a basecamp. Chance has to bring up everything needed in order to undertake an activity. Exploration is the riskiest part of the oil and gas industry, and the hardest part of the industry to get money allocated. A population of wells, in order to drill, learn more, and increase your probability of success is preferred.

Question: If Chance went with a 35 well program – is it 35 well pads on the surface with horizonal drilling under ground, or 35 wells total?

Chance: Not certain if we've thought well enough ahead to know that. Not all 30 wells will be exploratory. If something is found, then may need to drill in the vicinity. Possibly drill from the same well pad or one close to it in order to get a better idea of the resource.

YTG: Each well would be authorized. Not by pad.

Question: Would activities be primarily seismic first?

Chance: We do not necessarily have to shoot seismic in order to drill right now as there is legacy data. Chance does not have to do new seismic in all cases.

Chance's goal is to discover and develop a resource that meets the needs of the North and then expand. Chance wants to build local capacity. Around 80% of what Chance needs to

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execute a program they cannot get from the Yukon (i.e., a supply line from the Edmonton area is required). If the supply chain can be shortened, it is building capacity and economy in the Yukon. Additionally, it is cheaper to operate in a continuous fashion as opposed to stopping and starting (more costly).

Question: Would activity be year-round?

Chance: Depends on the production, depends on the nature of the access. All weather access is the Dempster. However, if discoveries are made elsewhere, may need to consider all weather access off the Dempster.

Chance would assess before going out on the land to minimize footprint (e.g., build winter access on existing access routes is preferable)

Chance's drilling plan would have one rig maybe two at any given point. Trying to have a smaller scale over a longer period of time. This gives people/community time to get ready, buy equipment, get training.

Question: The concept around winter road versus summer road. All season road would be required if you need to flow test, correct? A year-round fixture on the land?

Chance: Yes, if you are flow testing then you are taking a product out of the ground, over longer periods of time, and you need to get equipment to test it (e.g., trucking operations in the testing period).

Question: For the purpose of the proposal, would that be addressed?

Chance: Yes, it would be covered off in the proposal.

First Chance would go with winter access. and then explain what would happen in the future with a well (e.g., if a well bears fruit, then this is where permanent access would need to be). This would be in the proposal to YESAB.

A multi-well program in an identified area of interest would ensure flexibility. If something is discovered, there will be a significant green house gas reduction (i.e., supply line will be reduced). The camp location was the location used when the highway was under construction – Chance is trying to reactivate/reuse previously disturbed areas.

Question: What does 300 million litres mean?

Chance: The amount of fuel trucked around the Yukon. Fuel is carried in two truck trailers that carry 50,000L each. Chance is likely not going to take out the full 300 million litres but could reduce it to 200 million litres. 2000-3000 barrels a day would remove the need to get fuel to the Yukon. The source would be local instead of foreign. 2000 barrels is about 11 truck loads.

Question: VGG has about 20 monitoring stations to keep a close eye on what's going on in the watershed – how can Chance participate in that?

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Chance: Will need clarification, but Chance will be identifying data gaps. E.g., creeks in the area of interest. There is going to be monitoring place for parties to track what's going on. With respect to the Policy. There are stages to go through, and they align well with YESAB processes. Fairly soon Chance is going to have to work on/refine its project scope. Chance's objective is to build capacity and try to operate as continuously as possible. Sequencing of project activities would need to meet Chance's capacity. In the start limited to winter activities. Steady work gives the basis for local businesses to commit to local training. YESAB takes quite a bit of time, and the tenure clock is always ticking. There is a cost associated with multiple entries into YESAB. Question: 400 km/sq area? What area? Chance: Area of interest is about 40% of the total area under permits (See Appendix 3) Question: Expectation of timing for field work and the YESAB process? Chance: Ideally, field work two years from now, after YESAB. Also, likely an application to the Yukon Water Board. Confirming scale and scope with the hope to enter YESAB later this year. Have to satisfy the Policy and any new changes to YESAB. VGG: Can see the benefits but weigh it with concerns for the land and waters. Parties have different mandates but there is overlap. Cooperation Agreement and the front-end approach could be beneficial. Time pressure yes, but it will facilitate YESAB and YOGA agreement. A balance to be struck with timelines and capacity. There is limited oil and gas experience in the Yukon, and the Yukon is nothing like the rest of the country because there is robust land use planning and the power of the people. Mandates come from the people and this will benefit the people. Both sides have significant investments. Acknowledges that parties have and are seeking different requirements: certainty versus flexibility. Question: Is the NYRLUP up for review? It was completed in 2009, parties to the plan have been talking about what a review looks like. Currently assessing the plan to see where it's doing its job and where it might not be (Note: the plan will have new lines/boundaries). Minister Ranj Pillai departed 11:26 am. ***See Appendix 4 – Chance All-Party Meeting: Chance Oil and Gas Project Description Presentation***	
In-camera First Nations Session	
Review of Afternoon Agenda and Opportunity for Statements/Questions Following In-camera Session and Lunch Summary: No questions or comments.	[redacted] All Parties

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Presentations and Discussion • Yukon Environmental Assessment Process • Other regulatory processes such as YOGA and the Water Act Summary: YESAA, YOGA, and the Water Act each have various regulations that could apply to any number of activities. There are other departments involved as well (e.g., workers compensation). No work or activity can occur before a decision document and a water license has been issued. Question: What will be the decision body be for Chance's project? YG: Likely Oil and Gas Branch if YESAB process is District Office (DO), or Major Projects Office if it is an Executive Committee (EC). There are three types of processes. DO, EC (typically a longer process and handled out of the head office in Whitehorse, has timelines, specific requirements for consultation prior to submitting an application to YESAB), and panel process. January 2019 YESAB released information around a new process. Pre-Submission Engagement process (PSE). Currently, proponents are creating the entirety of the project proposal and submitting it all at once. Proponents have not had a facilitated process with YESAB prior to submission (i.e., opportunity to receive feedback on scope and size) and this has downsides. It's possible to have 5-10 years of exploration and baseline data. Then have YESAB require baseline data on a separate matter. Providing guidance and direction around scope and valued components would be beneficial to the process and ensure that a proposal is moving in the right direction during development. There are information sessions in the coming weeks, and the process may come into force fall 2019. It is possible that this could reduce time spent on information requests. The intention being to take time away for the stages/process after submission. Question: How will this mirror or link into VGG Oil and Gas Policy? VGG: VGG is also new to what is being proposed by YESAB. After looking at preliminary materials, it appears to align well with the Policy. Question: If Chance proceeds through the three stages of VGG, is the new YESAB process a requirement? Hemmera: Not a requirement yet, but it will be. If a proposal is submitted to YESAB before the new process is in effect, it would proceed under the old/current process. The new PSE process is consistent with what the Federal Government has done and also what BC has done with their new Environmental Assessment process. Question: If Chance proceeded prior to the implementation of the PSE and followed the Policy, would Chance be doing the same activity? Hemmera: The Policy is only for VGG. The PSE process is for everyone, including VGG. Additionally, YESAB collects the views of all of the Yukon. Question: Should Chance implement the PSE process before it is mandatory?	[redacted] All Parties

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Hemmera: That is for the group to weigh the pros and cons and decide. Nov 2019 is an estimated date and a Federal election may cause more delays. Question: Is this legislation? Is parliamentary time required? Is this a policy, regulatory, or legislative change? Hemmera: This is a question for YESAB. YESAB is independent of the government and they are changing their rules. Maybe gazetting? Because YESAA is a Federal act. YESAA will set out the rules for processes and what consultation is necessary. ***See Appendix 5 – Chance All-Party Meeting: Regulatory Processes Presentation***	
YESAB Application Process • Where are we? • Anticipated timelines and mapping next steps Suggestion (Chance): Moving forward there will need some form of information exchange. Depending on the information, may need to be exchanged in a confidential manner. Finish Confidentiality Agreements. Chance has shared project ideas. Chance is open to feedback. Look into which steps can be done concurrently. Budget estimates and items associated with capacity will assist Chance with internal approval processes. Suggestion (Chance): Future discussion on whether or not there could be agreement or interest in using common consultants – where needed for professional and technical advice. Trying to get common recommendations. Feedback: This may be a good idea on the technical front and a capacity one. However, a biological or cultural assessment, First Nations may want to do that independently. Question: Is YG interested in doing oil and gas 101? YG: YG is amenable to doing oil and gas 101s. Different presentations could be tailored for different audiences Suggestion (VGG): Use previous documents (multi-well project) and analyze the criticism against them, to work on the areas within them, and bring them to a place where the parties support them. E.g., are concerns some that were raised by multiple people, or ones born of miscommunication? Feedback: Hemmera will be conducting a gap analysis to evaluate what is needed to apply to YESAB again (i.e., looking at everything from the DO screening and, if there is an EC, what more is needed). Take those comments from the registry (from the DO process) and evaluate whether there were adequate responses or if since then, different information has arisen, or more adequate best practices have been developed. Suggestion (VGG): Put our minds to the monitoring plan and whether mitigation measures are doing what they should (i.e., applying adaptive management). **Next steps as they were listed on the flipchart** • **Confidentiality Agreements**	[redacted] All Parties

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• **Project Scope** • **Processes in Parallel vs. Sequentially** • **Shared consultants – technical disciplines** • **Oil and Gas 101** • **Adaptive Management**	
Wrap Up and Closing Statements Question: Is it useful to have All-Party meetings? Summary: Parties agreed it was valuable. Future All-Party meetings could be timed with key milestones and planned to proceed/follow other key dates/events. VGG: Offered to send a list of key dates/events that could be used. Summary: Chief [redacted], Chief [redacted], and Yukon Government provided closing statements.	S. Shaw

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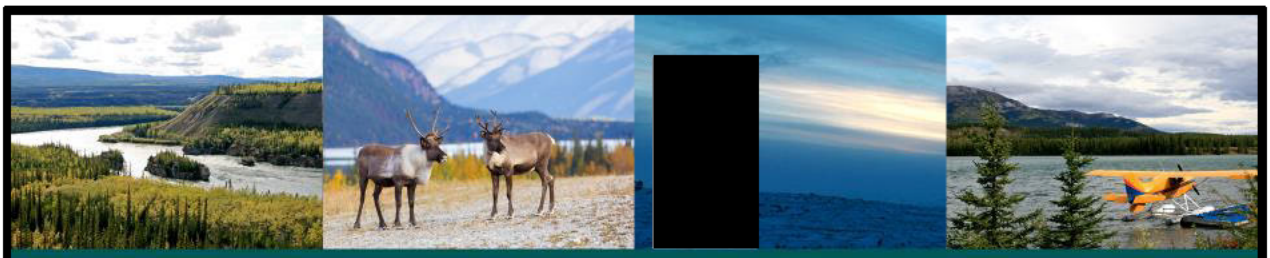


The Engagement Plans:
Development and Next Steps

Hemmera
An Ausenco Company

Creating the Engagement Plans

- Chance's current engagement with First Nations was prompted by M.O. 2017/37
- M.O. 2017/37 requested that Chance file Engagement Plans with each of the affected First Nations listed in the M.O.
- All Engagement Plans were filed in summer 2018

O.I.C. 2016/169
OIL AND GAS ACT

OIL AND GAS ACT

Pursuant to section 10 of the *Oil and Gas Act* and subsection 12(6) of the *Oil and Gas Disposition Regulations*, the Commissioner in Executive Council orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by the subject permittee

(a) oil and gas permit No. 0005,

(b) oil and gas permit No. 0006,

M.O. 2017/37
OIL AND GAS ACT

OIL AND GAS ACT

Pursuant to section 31.01 of the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"affected First Nation" means each of the Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in First Nation, First Nation of Na-Cho Nyak Dun, Gwich'in Tribal Council and Tetlit Gwich'in Council; « *Première nation concernée* »

"subject permit" means each of the following oil and

Next Steps

- M.O. 2018/ 42 orders that Chance submit annual reports on the First Nations Engagement Plans (due on July 31 of each year)
- Continue with Plan implementation
- Continue engagement with each First Nation individually, and also as a group

YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

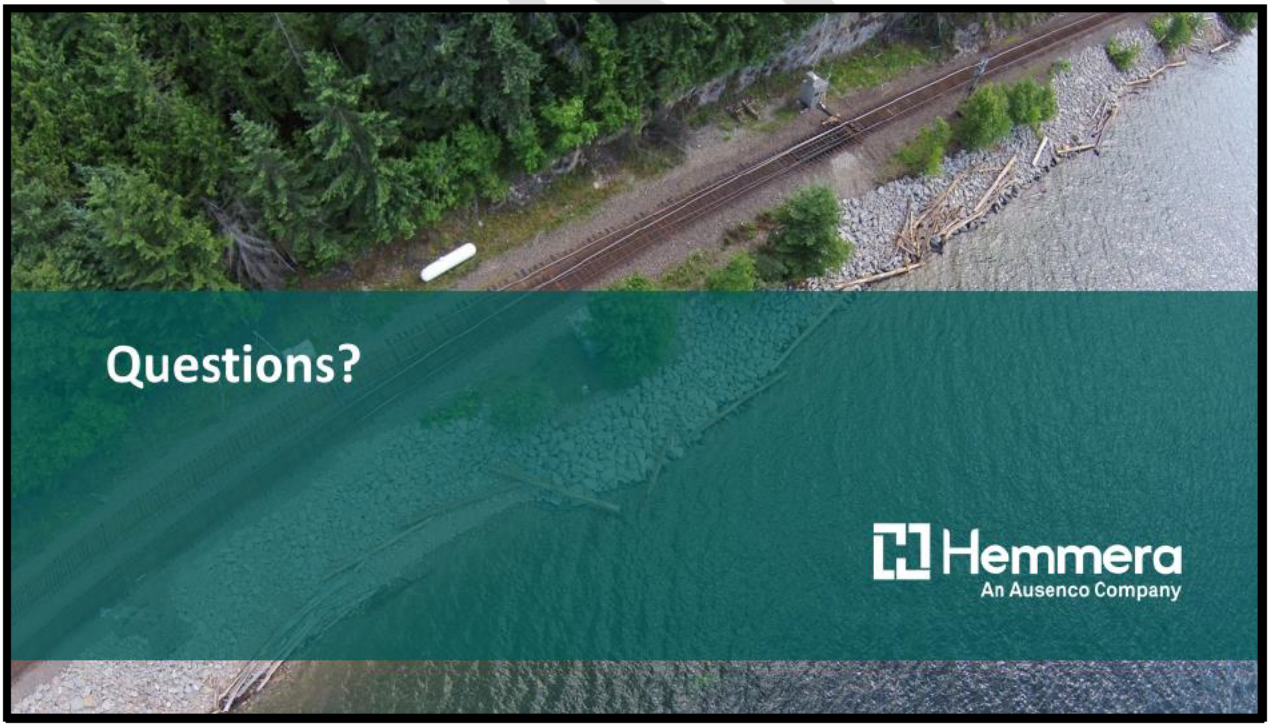
1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

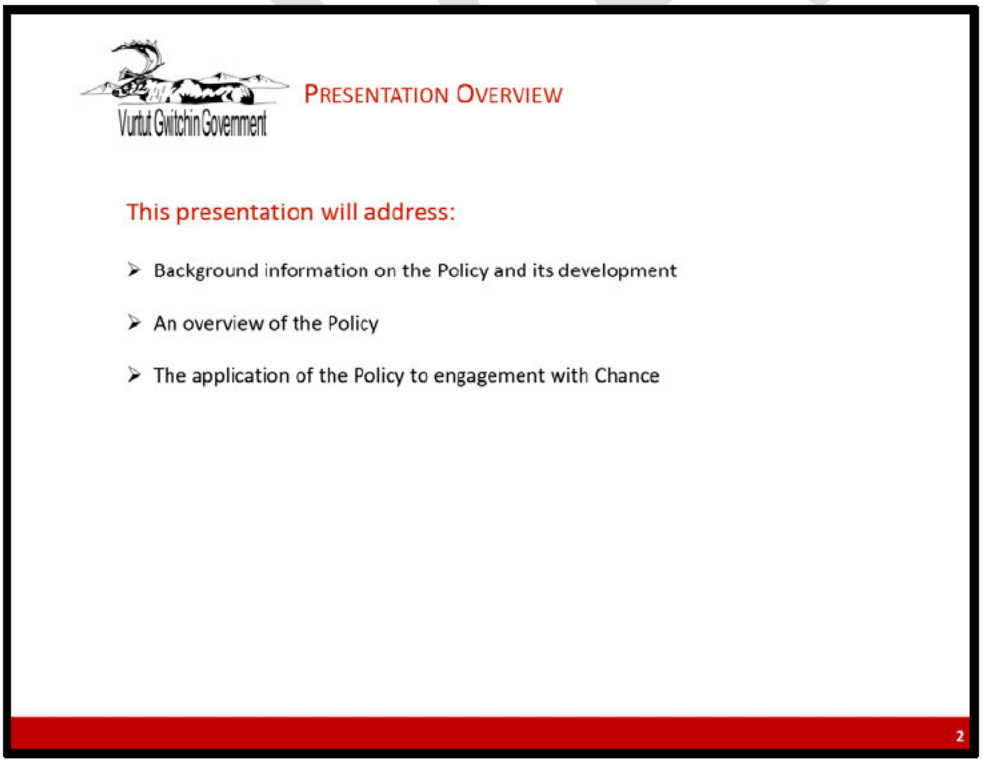
(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,




VUNTUT GWITCHIN GOVERNMENT
OIL AND GAS ENGAGEMENT POLICY:
BACKGROUND AND OVERVIEW
Vuntut Gwitchin Government
This presentation was prepared by the Vuntut Gwitchin Government for discussions with Chance Oil and Gas on December 12, 2018 in the traditional territories of the Kwanlin Dün and Ta'an Kwäch'än


Vuntut Gwitchin Government
PRESENTATION OVERVIEW
This presentation will address:
Background information on the Policy and its development
An overview of the Policy
The application of the Policy to engagement with Chance
2

Vuntut Gwitchin Government

BACKGROUND

The development of the Policy was informed by:

- The principle of sustainable development as enshrined in the VGFN Final Agreement and North Yukon Regional Land Use Plan
  - "'Sustainable Development' means beneficial socio-economic change that does not undermine the ecological and social systems upon which communities and societies are dependent" [VGFN Final Agreement, Chapter 1].
  - "The core principle that guides the Plan is sustainable development, as defined in the VGFNFA... Sustainable development requires consideration of the economic, social and ecological consequences of land use decisions, and management of lands and resources in an integrated and coordinated manner" [NYRLUP]
- The principles, goals, recommendation and best management practices provided for in the North Yukon Regional Land Use Plan

3

Vuntut Gwitchin Government

BACKGROUND

The development of the Policy was informed by:

- Past experience of engagement activities with proponents and in participating in the YESAB assessment process
  - "The Designated Office is unable to determine if adverse effects to the access to and use of the PCH are or are not significant... development in the region is not intrinsically adverse, but rather that additional information is required to make confident effects predictions and to determine the significance of those adverse effects. The requirement for confidence in predicting effects in this assessment is elevated for two reasons: first, the significant importance for the First Nation and the Inuvialuit way of life that is intrinsically linked to the PCH; and second, the unprecedented scale of the Project within this region" [YESAB DO Report].

4

BACKGROUND

The development of the Policy was informed by:

- Shortcomings in the existing territorial regulatory regime
  - "VGG would like to address our concerns with provisions of the Yukon Oil and Gas Act, R.S.Y. 2002, c. 216 and its associated regulations as it relates to benefits agreements and permit extensions. Additionally, VGG would like to resume the development of resource access roads regulations under the Territorial Lands (Yukon) Act, S.Y. 2003, c. 17" [VGG Letter to Premier Silver, May 10, 2017].
  - "The most recent annual report for the NYRLUP stresses the need for baseline data collection and development of best management practices in order to better understand and predict effects. Industrial development in the region is predicated upon fulfillment of goals for information collection as set out in the NYRLUP and associated annual reports" [YESAB DO Report].

5

BACKGROUND

The development of the Policy was informed by:

- An identified need for public policy that establishes a framework for respectful, meaningful and transparent engagement
  - "It is a condition of this Order that Chance Oil and Gas Limited must, in consultation with each affected First Nation, revise the first nations communications and engagement plan filed under O.I.C. 2016/169 to the satisfaction of the Minister on or before August 1, 2018" [Ministerial Order 2017/37].
  - "[THEREFORE BE IT RESOLVED] That VGG proceed with efforts that lead to constructive engagement with oil and gas industry proponents and government agencies including partnerships in the areas of employment and training, environmental stewardship and business development" [VGFN GA Resolution No. 2017-02].

6

Vuntut Gwitchin Government

BACKGROUND

The development of the Policy was informed by:

- International standards and best practices
  - "Indigenous peoples have the right to determine and develop priorities and strategies for the development or use of their lands or territories and other resources... [and to] free and informed consent prior to the approval of any project affecting their lands or territories and other resources, particularly in connection with the development, utilization or exploitation of mineral, water or other resources" [UNDRIP, Article 32].
  - "FPIC is relevant... in relation to development projects encompassing the full project cycle, including but not limited to assessment, planning, implementation, monitoring, evaluation and closure" [UN Permanent Forum on Indigenous Issues, Report of the International Workshop on Methodologies regarding Free, Prior and Informed Consent and Indigenous Peoples].

7

Vuntut Gwitchin Government

BACKGROUND

The development of the Policy was informed by:

- International standards and best practices
  - "Due to the fragility of arctic environments, with high vulnerability to climate change, the high proportions of Indigenous peoples within arctic populations, and increasing resource development pressures, Indigenous-led impact assessment is particularly important... [Indigenous-led impact assessment] is a process that is completed prior to any approvals or consent being provided for a proposed project, which is designed and conducted with meaningful input and an adequate degree of control by Indigenous parties—on their own terms and with their approval. The Indigenous parties are involved in the scoping, data collection, assessment, management planning, and decision-making about a project" [Gwich'in Council International, Impact Assessment in the Arctic: Emerging Practices of Indigenous-Led Review].

8



Overview of the Policy

The main components of the Policy include:

- A clearly defined purpose section
  - "The purpose of this policy is to establish a respectful, transparent and meaningful framework to guide the engagements of the Vuntut Gwitchin Government in relation to Oil and Gas Activities and Oil and Gas Dispositions in a manner that supports and upholds the objective of Sustainable Development" [section 3].
- The establishment and mandating of a committee to facilitate the participation of Citizens in the engagement and decision-making process
  - Membership consists of Standing Committee Chair on Natural Resources, Director of Natural Resources, Elders Representative, Youth Representative and Citizen Representative [section 12].
  - Mandate includes informing and seeking views from Citizens, and assisting and providing recommendations to the Council throughout the Engagement Process [section 11].

9



Overview of the Policy

The main components of the Policy include:

- A process to guide the organizing and carrying out consultations with Citizens regarding Oil and Gas Activities and Oil and Gas Dispositions
  - Director of Natural Resources has primary responsibility for organizing and carrying out any consultation between the Vuntut Gwitchin Government and Citizens regarding Oil and Gas Activities and Oil and Gas Dispositions with the assistance of the Committee as necessary [section 20].
  - Proponents are to coordinate any of its consultation with Citizens by submitting written notice to the Director of Natural Resources that sets out proposed date, location, agenda, description of the purpose of the meeting and any materials to be shared with Citizens [section 21].

10

Overview of the Policy

The main components of the Policy include:

- A three stage process for engagement with Proponents in relation to any Oil and Gas Activity to be completed prior to the Proponent submitting any Proposal to the Board
- Stage 1: Notice Period
  - Sufficient notice of a proposed Oil and Gas Activity must be provided to the Director of Natural Resources at the earliest opportunity [section 24].
  - Director of Natural Resources will refer the notice it receives from the Proponent to the Committee who will review it for sufficiency. The Committee will notify the Proponent in writing of its determination. If notice is not sufficient then more information will be requested. If notice is sufficient then engagement on the Oil and Gas Activity can proceed to Stage 2 [section 25].

11

Overview of the Policy

The main components of the Policy include:

- Stage 2: Cooperation
  - A Cooperation Agreement must be negotiated and entered into following Stage 1 and before proceeding to Stage 3 [section 26].
  - Prior to entering into a Cooperation Agreement, Council must refer the Cooperation Agreement to the Committee. The Council can enter into the Cooperation Agreement if the Committee determines that the Cooperation Agreement adequately addresses items related to compliance with the policy, communications, information sharing and capacity funding [section 27].
  - If a Cooperation Agreement is entered into in relation to an Oil and Gas Activity then the engagement process proceeds to Stage 3. A Cooperation Agreement does not provide free, prior and informed consent to any Oil and Gas Activity.

12

Vuntut Gwitchin Government

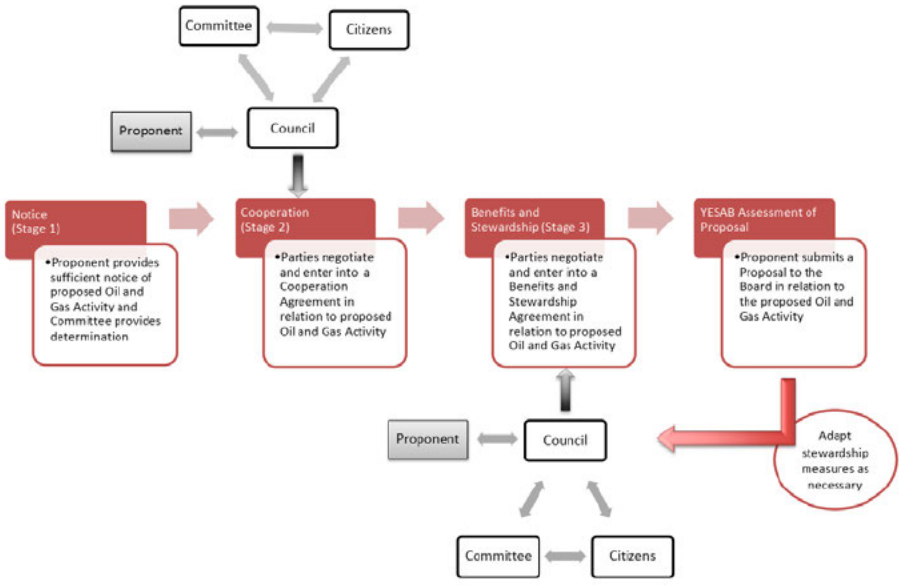
Overview of the Policy

The main components of the Policy include:

- Stage 3: Benefits and Stewardship

  - A Benefits and Stewardship Agreement must be negotiated and entered into following Stage 2 and before proceeding to the Board with a Proposal. It is the mechanism in which the free, prior and informed consent of the Vuntut Gwitchin First Nation is effectively to be provided in relation to any Oil and Gas Activity [section 28].
  - Prior to entering into a Benefits and Stewardship Agreement, Council must refer the Benefits and Stewardship Agreement to the Committee. The Council can enter into the Benefits and Stewardship Agreement if the Committee determines that the Benefits and Stewardship Agreement adequately addresses various items related to economic benefits and environmental stewardship [section 29].
  - Benefits and Stewardship Agreement will be subject to an approval and ratification process deemed adequate by the Committee.

13



14

Application of the Policy to Engagement with Chance

The Policy applies to engagement with Chance:

- Chance review of the draft Policy
- Chance acceptance of the final Policy
  - "Chance will comply with the Policy and any other applicable VGG policies. To the extent that there may be any inconsistency between this Plan and the Policy, the Policy will prevail" [Joint Communication and Engagement Plan]
  - "The Plan, which incorporates the Vuntut Gwitchin Government Oil and Gas Engagement Policy (the "Policy"), sets the framework for all communication and engagement between Chance Oil and Gas Limited ("Chance") and the Vuntut Gwitchin Government ("VGG") moving forward. Chance's commitment to the Plan and Policy is a significant achievement and provides an example for the outside world on how industry ought to approach oil and gas exploration and development in the North within a framework premised on free, prior and informed consent" [VGG June 11, 2018 Letter to Chance]

15

Application of the Policy to Engagement with Chance

The Policy applies to engagement with Chance:

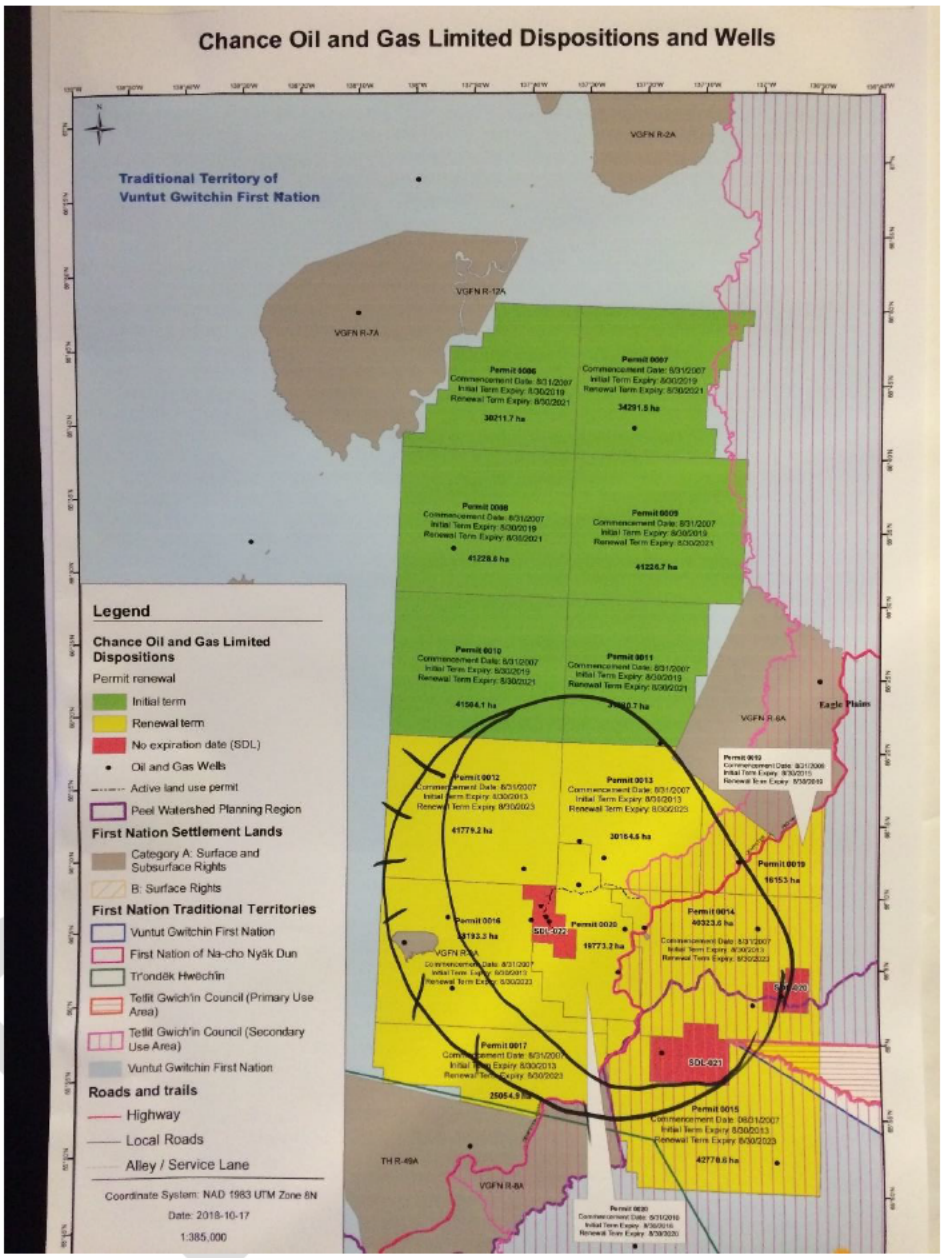
- VGG and Chance engagement is currently in Stage 1 (Notice)
- Chance has shared scenarios for various Oil and Gas Activities at different scales but has not submitted notice of an Oil and Gas Activity it wishes to advance for further consideration under the Policy
- VGG has shared a draft Cooperation Agreement for discussion purposes prior to the completion of Stage 1 (Notice) and in advance of Stage 2 (Cooperation)
- Next steps: Chance to provide written notice of any proposed Oil and Gas Activity to the Director of Natural Resources at the earliest possible opportunity as provided under section 24 of the Policy

16

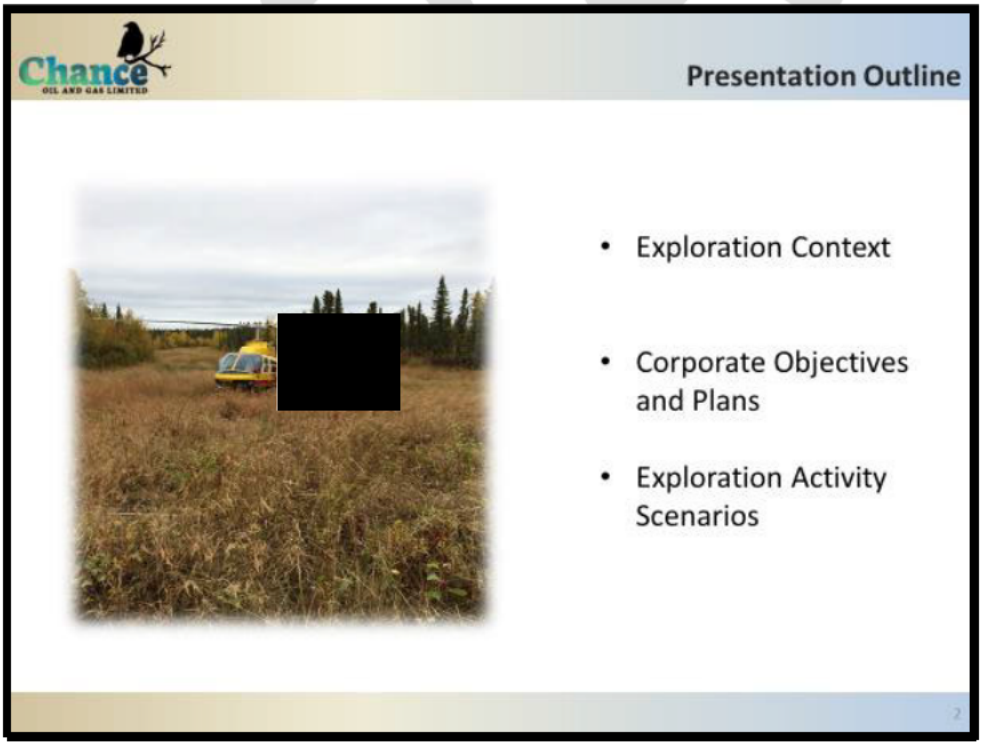

QUESTIONS AND COMMENTS?
Contact:
Vuntut Gwitchin Government
P.O. Box 94
Old Crow, Yukon
Canada, Y0B 1N0
Tel: (867) 966-3261
Fax: (867) 966-3800
www.vgfn.ca
17

DRAFT

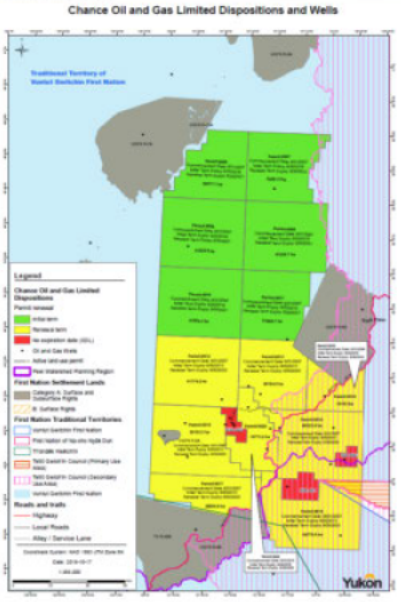
Appendix 3 – Chane All-Party Meeting: Permits map with area of interest highlighted




Chance
OIL AND GAS LIMITED
CONFIDENTIAL
Corporate Presentation
Presentation to the All Parties Meeting
Chance Oil and Gas Limited
February 1st, 2019


Chance
OIL AND GAS LIMITED
Presentation Outline
[redacted]
• Exploration Context
• Corporate Objectives and Plans
• Exploration Activity Scenarios

Land Holdings Eagle Plain, Yukon



- 14 Exploration Permits (0006-0017, 0019-0020 expiring between Aug 30, 2019 and Aug 30, 2023
- 3 Significant Discovery Licenses ("SDL's") with indefinite tenure with discovered oil and natural gas
- Landholdings total about 490,000 hectares
- North Yukon Regional Land Use Plan indicates that this area is suitable for multiuse, including oil and gas industry activities
- Chance surrendered ep. 0005 in 2018 to allow the creation of Ch'ihilii Chik - HPA

3

Infrastructure and Support



- Eagle Plains is an underexplored sedimentary basin
- Discovered resources located at the SDL's is not sufficient to proceed to development
- Oil and gas exploration began in the 1950's and both oil and natural gas have been discovered
- Almost 40 wells have been drilled at Eagle Plains
- Over 10,000 kms. of 2D and about 325 sq. kms. of 3D seismic data has been acquired

4

Land Tenure



- Tenure is the length of time that exploration permits or leases are valid
- Tenure has a large influence on obtaining financing, planning activities and doing the work
- For a remote area like Eagle Plains, longer tenure is better than shorter tenure
- How the legal action against Yukon gets resolved will have an impact on tenure

5

Exploration Activities





- Field work to investigate the geological opportunities
- Acquiring more seismic data (both 2D and 3D)
- Exploration drilling of new wells
- Production testing of any discoveries showing commercial potential
- Construction of seasonal and year-round access trails and roads
- Installing and operating processing facilities connected with production testing

6

Exploration Activities



- Operating the base camp
- Converting wells for injection of water produced with oil and natural gas
- Logistical support for the camp and exploration activities
- Environmental data gathering and monitoring of operations
- No plan to do hydraulic fracturing

Exploration Activities



- Exploration work is the most expensive and most uncertain activity which affects funding commitments
- Exploration activities are unpredictable because results guide the future steps
- Plans are subject to change as priorities change with new information
- Even though Chance has several prospects to evaluate, drilling may find something that could not be predicted before hand that changes the plans
- Flexibility is needed from Assessors, regulators and goods and service providers to accommodate the uncertainties and need to adapt the activity as the work progresses

Objectives and Plans



- Based on current geological understanding, the area of exploration focus includes parts or all of Exploration Permits 0012-0016 and 0019-0020 and the three SDL's
- Acquire more seismic data and drill more wells to evaluate the resource potential
- Discover sufficient oil and natural gas resources to support future development
- Develop discoveries to serve the regional market needs and possibly export markets if the resource base is large enough
- Undertake the exploration program on a small scale over a long period of time to minimize the environmental and social impacts
- Try to operate as continuously as possible to provide steady employment and minimize the high costs of starting up and shutting down

9

Benefits



- Develop local capacity to participate in the projects and displace high cost imported services and equipment
- Diversify the regional economy
- New business, training and employment opportunities
- Reduced GHG's by substituting imported fuel that is shipped thousands of kilometres with Yukon sourced fuel
- Potential to reduce the cost of fuel in the Yukon and surrounding area

10

Project Alternatives



- YESAB assessments are required in order to obtain regulatory approvals to undertake any exploration work
- Depending on the scale and scope of the program, the YESAB assessment could be done by the Designated Office in Dawson or by Executive Committee in Whitehorse
- Two project execution scenarios can be considered: 1) a series of short duration, limited activity projects each with its own YESAB assessment; or 2) one longer duration, but limited scale project over the entire exploration region that undergoes one comprehensive YESAB assessment
- All work is exploration to evaluate the resource potential in order to understand whether the opportunities can eventually be developed commercially

11

Activity Scenarios- Issues to Manage



- YESAB processes are expensive and lengthy
- Lengthy assessment processes grind the tenure clock
- The cost of multiple assessments could hurt the amount of exploration work
- Multiple YESAB assessments of shorter duration, limited scope exploration work means intermittent employment
- Financial and project management are more efficient under a regional YESAB assessment of exploration in a broader area, but still small-scale operation (e.g. a single drilling rig or a single seismic survey)

12


Chance
OIL AND GAS LIMITED
Thank-you
T. Allen, 2013; YOS Report 2015-02
13

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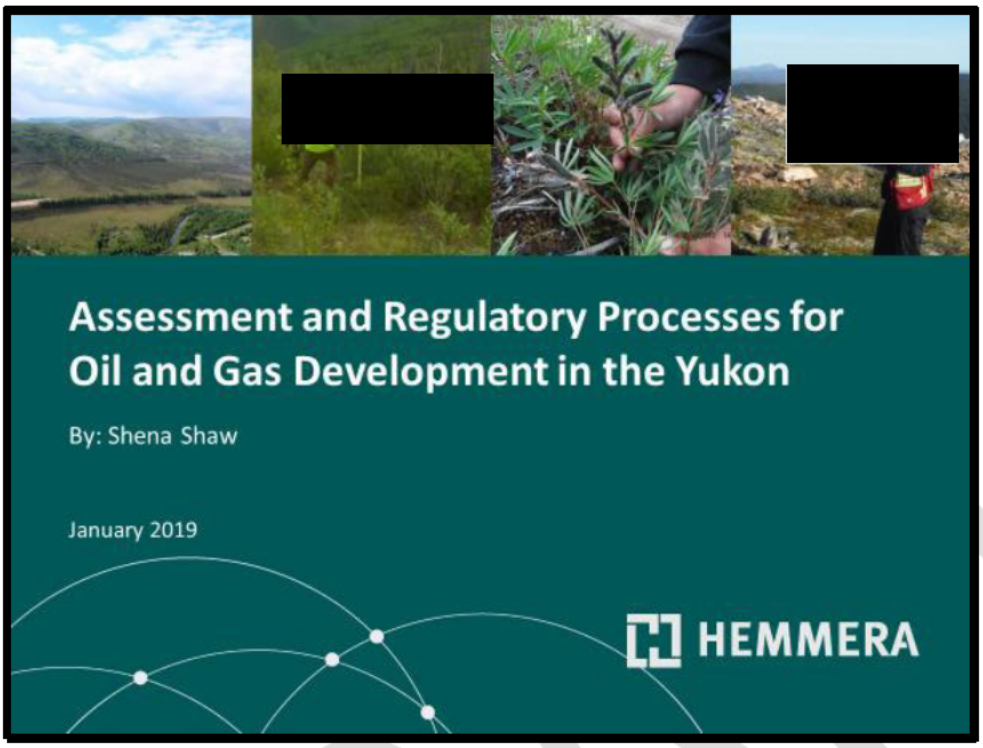
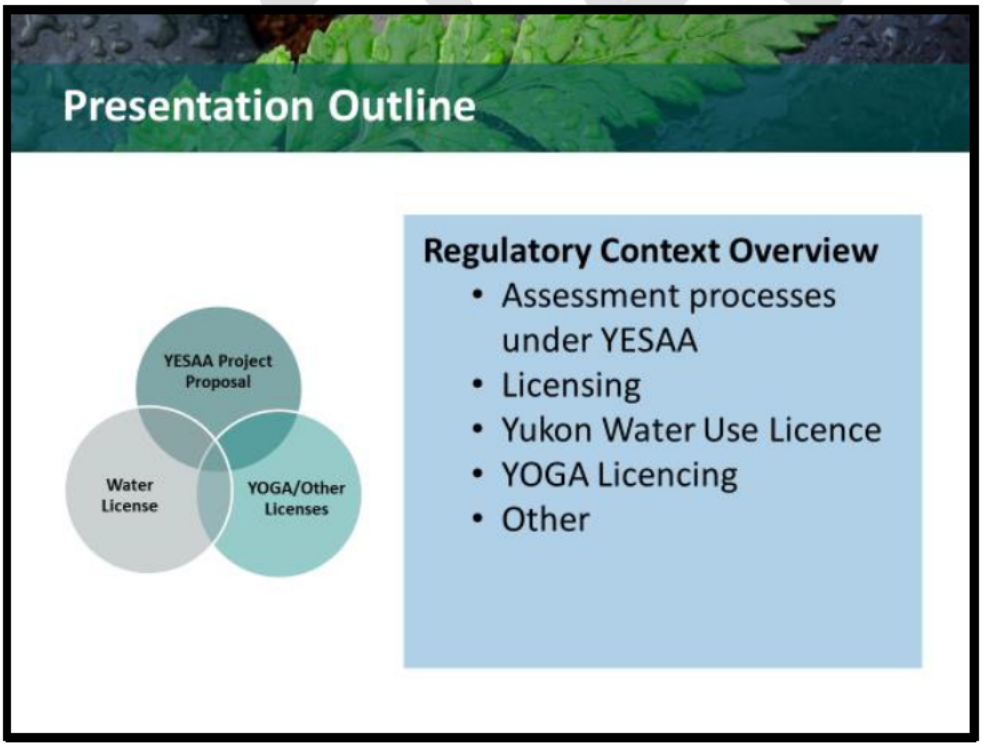
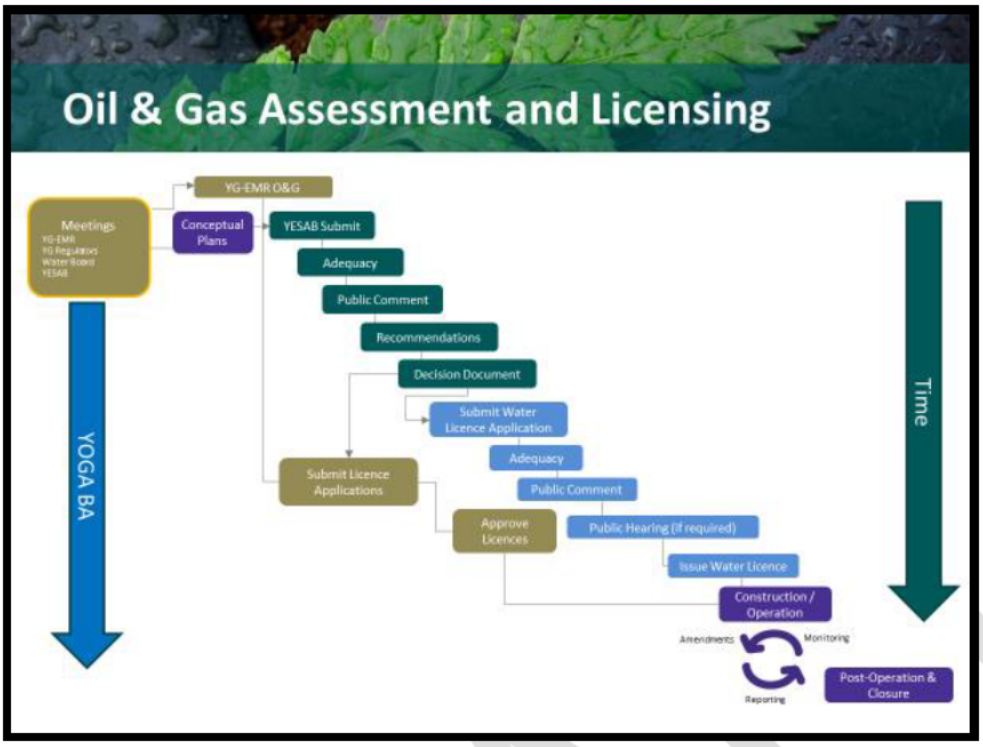
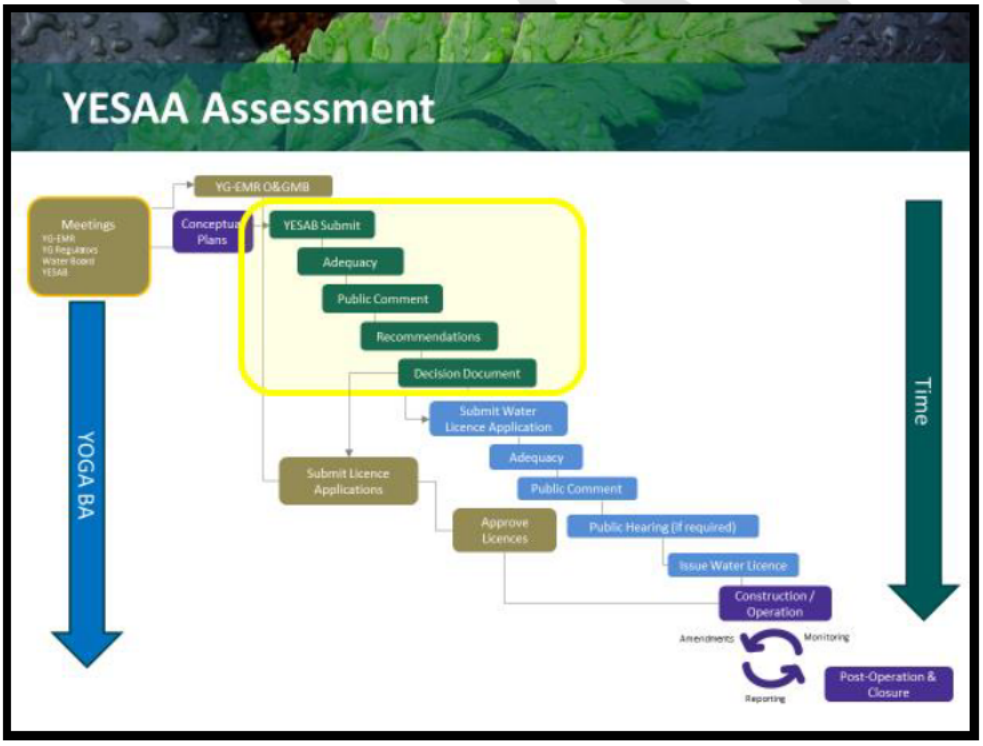

Assessment and Regulatory Processes for Oil and Gas Development in the Yukon
By: Shena Shaw
January 2019
HEMMERA


Presentation Outline
YESAA Project Proposal
Water License
YOGA/Other Licenses
Regulatory Context Overview
• Assessment processes under YESAA
• Licensing
• Yukon Water Use Licence
• YOGA Licencing
• Other


Oil & Gas Assessment and Licensing
YG-EMR O&G
Meetings
YG-EMR
YG Regulators
Water Board
YESAB
Conceptual Plans
YESAB Submit
Adequacy
Public Comment
Recommendations
Decision Document
Submit Water Licence Application
Adequacy
Public Comment
Submit Licence Applications
Approve Licences
Public Hearing (if required)
Issue Water Licence
Construction / Operation
Amendments
Monitoring
Reporting
Post-Operation & Closure
YOGA BA
Time


YESAA Assessment
YG-EMR O&GMB
Meetings
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Water Board
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Conceptual Plans
YESAB Submit
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Construction / Operation
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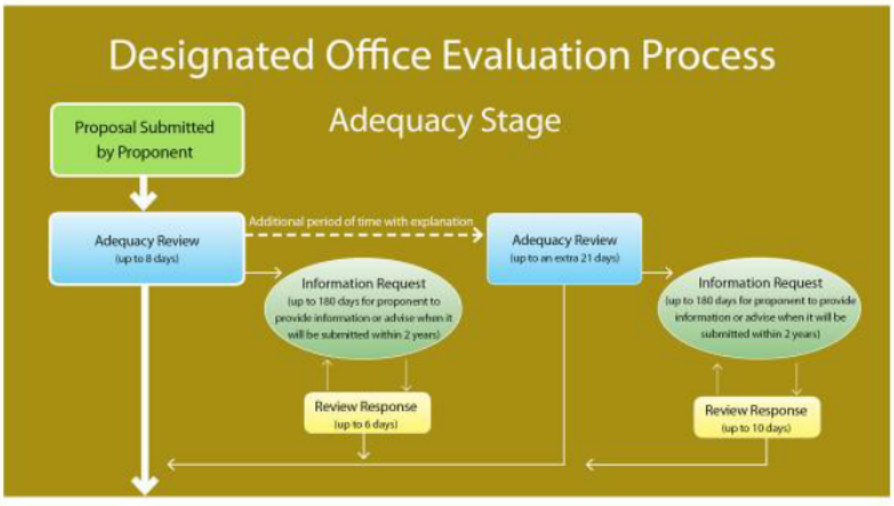
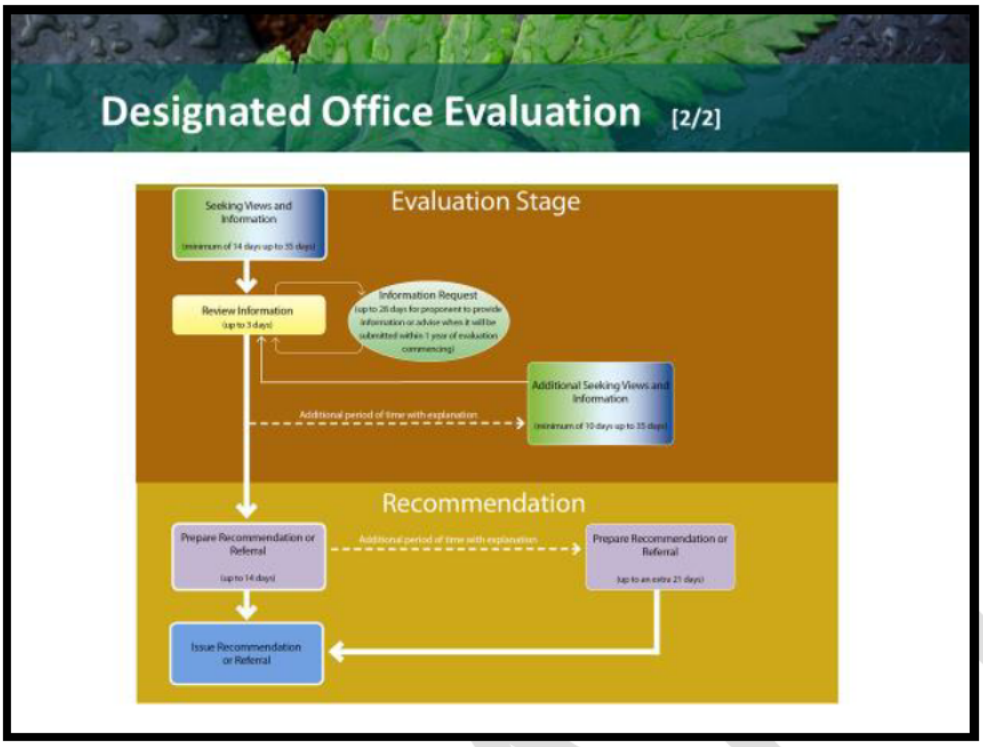
YOGA BA
Time

YESAA Assessment Process

- Assessors look at the potential environmental and socio-economic effects of proposed activities and recommend whether the activities should proceed, proceed with terms and conditions, or not proceed.
- When assessments are complete, recommendations are sent to the relevant Decision Body(s)
  - Designated Office Evaluation
  - Executive Committee Screening
  - Panel of the Board of Review
- Decision Body(s) decide to accept, reject, or vary YESAB's recommendation
- Decision Document issued

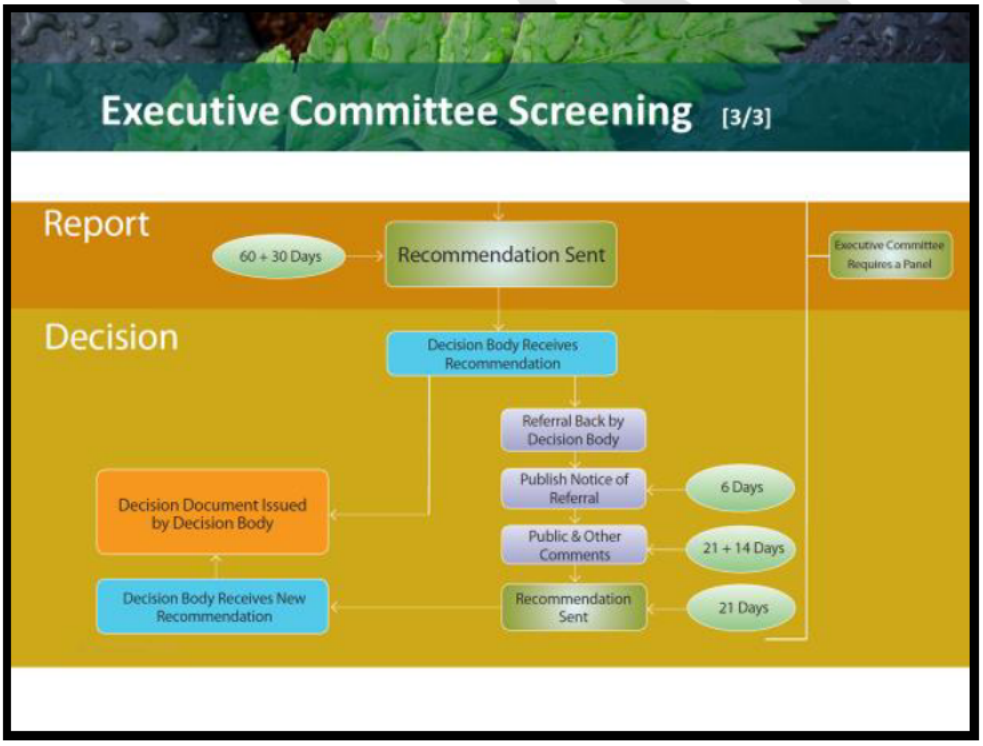
Designated Office Evaluation [1/2]




Designated Office Evaluation [2/2]
Evaluation Stage
Seeking Views and Information
Review Information
Information Request
Additional Seeking Views and Information
Additional period of time with explanation
Recommendation
Prepare Recommendation or Referral
Additional period of time with explanation
Prepare Recommendation or Referral
Issue Recommendation or Referral


Executive Committee Screening [1/3]
Executive Committee Screening Process
Proposal Submitted by Proponent
Adequacy
Proposal Checklist
30 + 30 Days
More Info from Proponent
Adequacy Review
60 + 30 Days


Executive Committee Screening [2/3]
Screening
Publish Notice of Screening
6 Days
Public & Other Comments on Proposal
30+30 Days
21 + 21 Days
More Info from Proponent
Assess Comments & Need for More Information
21 Days
Complete Draft Screening Report
120 + 270 Days
Public & Other Comments on Draft Report
30 + 30 Days
21 Days
More Info from Proponent
Assess Comments Need for More Information
21 Days

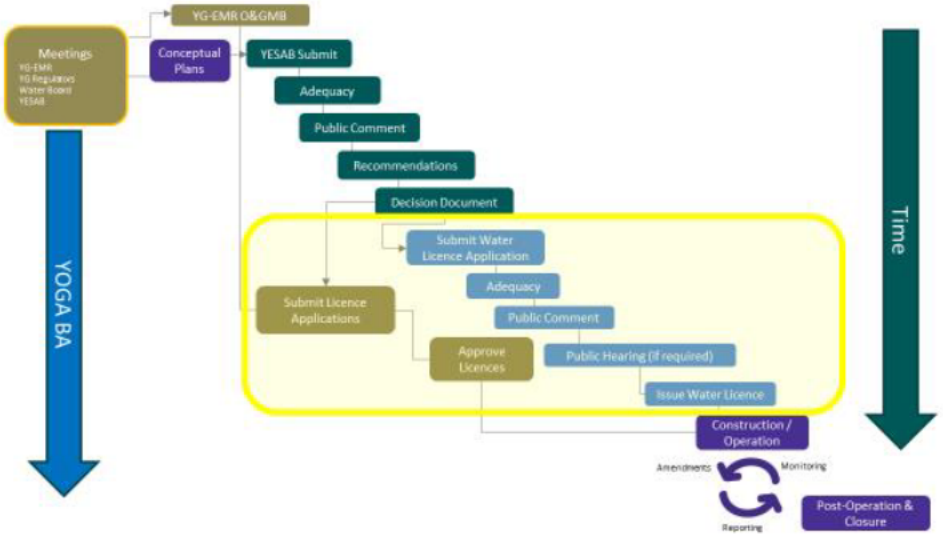

Executive Committee Screening [3/3]
Report
60 + 30 Days
Recommendation Sent
Executive Committee Requires a Panel
Decision
Decision Body Receives Recommendation
Referral Back by Decision Body
Publish Notice of Referral
6 Days
Public & Other Comments
21 + 14 Days
Recommendation Sent
21 Days
Decision Document Issued by Decision Body
Decision Body Receives New Recommendation

YESAA Assessment Process

New: Pre-Submission Engagement (PSE) process

- YESAB approved the PSE and it will come into effect late Fall 2019 (estimated).
- For Executive Committee screenings only.
- Brings parties together to review project requirements in advance of proposal submission.
- Helps identify gaps and issues of concern, define values and baseline information requirements, and ensure a timely and certain screening process.
- "Terms of Reference" style of process

Licensing Process



Yukon Water Use Licence [1/2]

- Use of water or deposit waste into water
- Petroleum exploration/development are "Industrial Undertakings"
- Interim - Oil and Gas Information Package for Applicants (2013)
- Quasi-judicial board supported by Yukon Water Board Secretariat

Yukon Water Use Licence [2/2]

Choice of Type A vs Type B will drive information requirements, process, and timelines

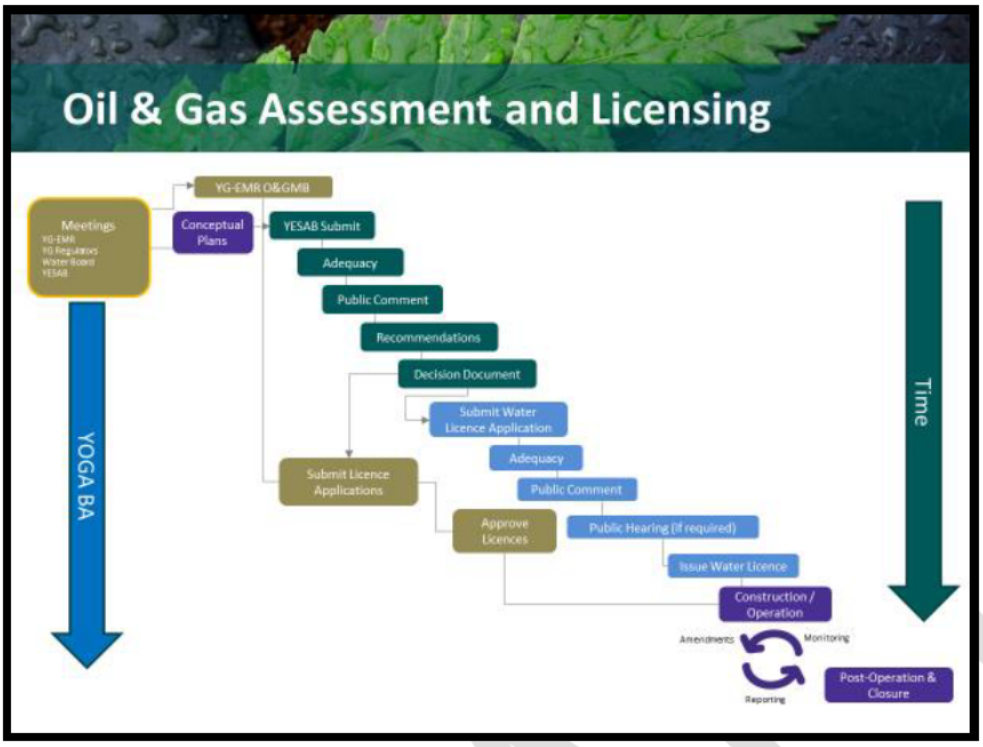
- Hearing required for Type A
- Both require YESAA decision document prior to issuance

Permitting and Licensing

1. Land Use Permit (YG – EMR, Land Management)
2. Well Licence and Well Operation Approval (YG – EMR, Oil and Gas Resources)
3. Permit for Air Emissions (YG – ENV)
4. Temporary Highway Access Permits (YG – HPW, Transportation Branch)
5. Water Licence/Notification of Water Use (YG, Water Board)
6. Dempster Highway Area Authority Authorization

YOGA Well Licence

- First Nation and community consultation prior to application
- Benefits Agreement for projects >$1M/year
- Requires YESAA decision document prior to issuance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YG-EMR O&GMB
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YESAB Submit
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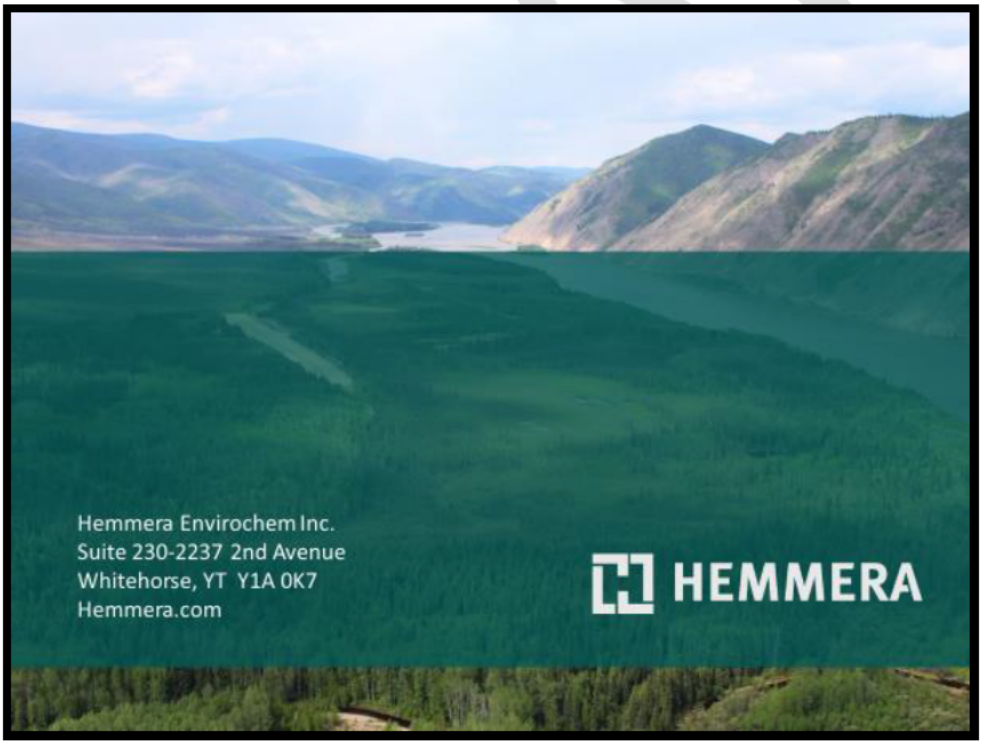
Submit Licence Applications
Approve Licences
YOGA BA
Time


Hemmera Envirochem Inc.
Suite 230-2237 2nd Avenue
Whitehorse, YT Y1A 0K7
Hemmera.com
HEMMERA

APPENDIX 2-C-61. June 6, 2019, Meeting Summary

Old Crow Community Dinner

Date: June 6, 2019

Location: Old Crow Community Hall

Attendees: 35 Community Members including staff of Vuntut Gwitchin Government (VGG), and members of the Natural Resources Council

Dinner Presentation:

[redacted] opened the meeting and provided welcoming comments. [redacted] then welcomed everyone to the meeting and introduced the members of the Natural Resources Committee (Committee) who attended the dinner.

[redacted] started the Chance presentation by introducing the team and providing an overview of the presentation. As background information, [redacted] explained that Chance was formerly called Northern Cross Yukon and has been in operation for 25 years. Northern Cross Yukon Changed its name to Chance two years ago. An overview of the project area was provided and the 2400 km^2 area of focus was highlighted. [redacted] explained that there will be up to 30 wells drilled with 1500km^2 of 3D seismic and 2000km of 2D seismic. The modern seismic techniques are much lower impact than what was used in the 1950s and 1960s to explore Eagle Plain. The project will be a series of small-scale projects done over ten years, depending on success. They are looking to find sufficient resources to develop; the aim is for crude oil, but Chance is also interested in natural gas. The operation activities Chance is proposing have been tested in the North. This will be a year-round project; access roads and seismic access will be seasonal to year-round. The schedule of operations will alternate between drilling and seismic activity from year to year. Chance's camp can hold approximately 75 people, and this will be the size of the workforce needed for seismic, with some staff able to stay at the Eagle Plains Hotel and some support staff needed outside the camp. [redacted] explained that Chance wishes to build an air strip beside the existing Chance road.

[redacted] presented on the Yukon Environmental and Socio-economic Assessment Board (YESAB) process. Chance is following the VGG Oil and Gas Engagement Policy (the Policy) and within the Policy the Committee has the role of communicating with the community. Chance's project will be evaluated by the Executive Committee in YESAB. This is second tier of evaluation for larger projects. Chance's project is being evaluated by the Executive Committee instead of the Designated Office, meant for smaller projects, because the Designated Office referred the project up to the Executive Committee saying that they need to better understand effects on caribou to resubmit their project.

There was an audience comment on calving ground and winter range of the Porcupine Caribou. This is important for Vuntut Gwitchin as a whole. Caribou research has demonstrated that caribou are sensitive. The people's dependence on caribou is equally as important as the economy and this will challenge anything that could affect the range. Caribou is assumed to be a large topic of conversation surrounding

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the project and will be talked about a lot over the summer. The times are changing. Vuntut Gwitchin have had winters with no caribou which is a challenging for the community.

[redacted] explained that the purpose of this meeting is to introduce the project. Future meetings will address concerns with caribou, and management plans will be developed.

Question on if the airstrip Chance is planning could land a hawker airplane and if this could be used to resupply fuel to Old Crow.

[redacted] replied that the airstrip would be approximately 1500m and could land a hawker airplane, however, he is not sure if it could be used for purposes outside of Chance's purposes. This will have to be evaluated at a later date.

Question on road access decimating caribou herds. Will land be protected and how will this be managed?

[redacted] responded that Yukon Government manages roads to resources. The roads that Chance is planning will be managed roads, not public roads. They will have access controls such as gates. This is especially important because there are safety concerns with hydrogen sulfide.

Question about Chance will deal with caribou in the project area. What will be done if caribou are around project activities?

[redacted] responded that he does not know exactly what the plan is, but that Chance and First Nations will develop joint management plans. [redacted] added that Chance has Caribou experts evaluating the project area, and they will be coming up to Old Crow to talk with the Committee and the Community.

Question on the new project. Does the new project look the same as the previously submitted project?

[redacted] responded that they are now pursuing a larger project and well locations have not yet been determined.

Question about whether Chance is ready to develop their new project proposal for YESAB.

[redacted] responded no, they have not started engaging with everyone. [redacted] adds that they will be spending time in Dawson, Mayo, Inuvik, Fort McPherson, Whitehorse and Old Crow to make sure they engage with all affected First Nations and communities.

Question about whether Chance will use Vuntut Gwitchin Government members for environmental monitoring.

[redacted] answered that yes, this can work.

Comment that they should take some people to see an active well or a similar active site. This would be important to Elders and provide proof that the project will be fine and show them what will be left behind.

[redacted] responded that there will opportunities to see the Chance site. They could maybe see similar sites in Northern British Columbia and Alberta.

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Question about the phasing of drilling and seismic. There is a concern that the dynamite would affect moose and trappers, for example if pregnant cows are present during dynamite explosions. How do they know the impact it will have on them?

[redacted] responded that they can use existing seismic data, so they do not have to do seismic before drilling when they are starting the first well.

Question about issues with Hydraulic Fracturing.

[redacted] responded that there will be no hydraulic fracturing.

Question about seismic lines. Is there a risk for these becoming a highway for predators such as wolves?

[redacted] responded that seismic lines are narrower and not straight, so they don't get line of sight.

Question asked about the remediation of old sites.

[redacted] answered that wells Chance drilled in the past are suspended for future use.

[redacted] concluded the question period by saying that there will be future community meetings to discuss access and caribou and to talk about what the project might look like.

[redacted] concluded the meeting by saying that he was happy to see this discussion happening. The Vuntut Gwitchin Government has an oil and gas policy; Chance has triggered the first Stage of the Policy. This document is available for the community to see. The Natural Resources Committee operates like the Heritage Committee but there are other regulatory controls on this process such as the Yukon Oil and Gas Act. [redacted] was happy to see that the community is asking questions and hopes that this meaningful conversation continues. Approach [redacted] youth representative [redacted] R[redacted] with any questions.

Key Meeting Outcomes

Outcome	Responsible Party	Notes
Chance presented the Draft Project Description to the Old Crow Community	Chance	
Hemmera provided information on the YESAB project proposal preparation process. Hemmera emphasized that they will be back in the community for future consultation.	Chance and Hemmera	

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Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Future community meetings will be held to discuss caribou and access management issues.	Chance	As information is developed and conversations happen with the Committee.

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APPENDIX 2-C-62. October 17, 2019, Meeting Summary

DRAFT MINUTES

Meeting between Chance Oil and Gas Limited and Vuntut Gwitchin Government

October 17, 2014, 9:05 AM – 10:027AM

Vuntut Gwitchin Government Board Room

Old Crow, Yukon

Present:

[redacted], President, Chance Oil and Gas Limited

[redacted], VP, Community and Government Relations

[redacted], Regulatory, Environmental and Community Relations Coordinator

[redacted] Chief, Vuntut Gwitchin First Nation (VGFN)

[redacted], Deputy Chief, Vuntut Gwitchin First Nation

[redacted], Councilor, and Standing Committee Chair, Natural Resources, Vuntut Gwitchin First Nation

[redacted], Councilor, Vuntut Gwitchin First Nation

Absent:

[redacted], Jr., Councilor, Vuntut Gwitchin First Nation

Recorder:

[redacted]

TOPIC: Update by Chance Oil and Gas Limited – Cooperation Agreement, Capacity Needs, Moving Forward

Review Agenda:

The agenda was reviewed and accepted by the members present. The agenda items included

1. Update of project activities
2. Discuss each party's desire to work cooperatively and collaboratively to advance the exploration activities
3. Discuss each party's objectives for cooperation and collaboration in respect of the exploration activities
4. Identify capacity funding needs of the VGG to complete and implement the Cooperation Agreement
5. Other business

1. [redacted] welcomed Chance Oil and Gas Limited to the meeting. [redacted] then proceeded with a review of the agenda and asked if there were any additions or deletions. The Agenda was accepted. [redacted] provided an update on the last few months with baseline gathering, LiDAR and photo-imagery. [redacted] mentioned Environmental Dynamics Inc. (EDI) completed a bird survey in late June, two ecosystem mapping surveys in late June and beginning of August, an aquatic survey in late July/early August, and examination of old and new seismic lines. EDI has been waiting for the LiDAR data to complete its interpretation of the data that has been gathered so far. It is intended to share the data and the interpretations as soon as EDI is ready. A VG citizen was hired by EDI to help with the second ecological mapping work and the aquatic survey.
2. [redacted] also mentioned the geological survey that occurred in July that included the hiring of local VGFN citizens from the community to assist. A report will be shared once all the rock samples that were gathered have been evaluated by the laboratory and the data interpreted by our geological staff.
3. Peer Solutions consultants undertook an aerial scouting mission over the entire area of interest to help them develop the programs to acquire new seismic data in the future. Chance retained Peer Solutions because of its experience designing and project managing seismic programs at Eagle Plains with a previous company called GeoTir who worked for Chance in 2013-2014.
4. [redacted] said that in the coming months, we would get back together and host a series of workshops to provide the data from the assessments and obtain input from the VGG and VG citizens. There is a consultation process that Chance Oil and Gas Limited has to follow. He said that as we go through the exercise of consultation, we need to make sure it is wholesome and has community input.
5. On the subject of working together (cooperatively and collaboratively), the VG is very willing to participate in ongoing project development with the ultimate objective of supporting the project. [redacted] Dana Tizya-Tramm said that VGG will send the updated maps.

6. On the subject of resetting the Cooperation Agreement discussion to an earlier stage in order to build the agreement from first principles, the first step is to have each party lists its objectives to be achieved by the Cooperation Agreement. There was acceptance to do so by all parties. [redacted]
7. On the subject of Capacity Funding, it was accepted that there are a number of legal considerations and good corporate governance practices that affect how and the extent that Chance can provide funding. The VG needs to give more thought about the details and timing of its funding needs to satisfy its own needs and comply with the governing laws and practices required of Chance.
8. Other matters related to these broader topics included suggestion that VG would take the leading role in the FN engagement process on behalf of all the affected First Nations to mitigate the potential risks of multiple advisors representing individual FN's providing contradictory advice. As well the lead FN would be responsible for developing the FN relationships so all could benefit in some agreeable manner. In addition, the broader consultation process was discussed with particular attention paid to ensuring that consultation would be sufficiently comprehensive to demonstrate not only VG government engagement, but also broad community engagement. The idea of a part time position be funded by COG under Capacity Funding arrangements to ensure a means of obtaining broad community input and address the concerns of meeting fatigue and shyness.

We concluded by mentioning the National Coalition of Chiefs conference in Calgary on November 4 and 5 and an update on the status the lawsuit Chance has with Yukon.

APPENDIX 2-C-63. November 26 & 27, 2019 Meeting Summary - document not available at submission.

APPENDIX 2-C-64. July 9, 2020, Meeting Summary

VUNTUT GWITCHIN AND CHANCE OIL AND GAS MEETING

PROPOSED WELL MAINTENANCE PROGRAM

Date: July 9, 2020

Location: Conference Call

Attendees:

Vuntut Gwitchin/Firelight:

[redacted], Director of Natural Resources, Vuntut Gwitchin Government
[redacted] Lands Manager, Vuntut Gwitchin Government
[redacted] Senior Researcher, Firelight
[redacted] Researcher, Firelight

Chance Oil and Gas Limited:

[redacted], President
[redacted], VP Government and Community Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator

Vertex/Hemmera:

[redacted] Vertex
[redacted] Human Environment Business Leader, Hemmera
[redacted] Senior Environmental Specialist, Hemmera
[redacted] Human Environment Specialist, Hemmera

Purpose and Objectives

The purpose of this meeting was for Chance to provide an overview of the proposed Eagle Plain Well Maintenance Project and to answer initial questions provided by Vuntut Gwitchin Government (VGG). Additional clarity around the project would allow VGG to provide more official feedback on the project description at a later date.

Meeting Discussion:

Introductions

VGG – Indicated that this meeting/call is not for the purpose of consultation. This is for clarity around the well work in order for VGG to provide feedback at a later date. Quick updates before we get started, we have completed review and comments on the cooperation agreement and should be sending that soon. Hoping there is time to talk about the Old Crow community meeting at the end of the call. We all have the correct PowerPoint and ready to get started.

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[redacted] – Chance and Clive will be speaking to the presentation. If during the presentation we discover a technical error in the PowerPoint, we will send out an updated version.

[redacted] – Work proposed is required by YG for Chance to maintain the suspended well status of 4 wells. Chance submitted this application last year. Despite the age of some of these wells, we do annual maintenance checks (i.e., surface infrastructure). The Project will require a YESAB assessment at the Dawson Designated Office. In order to be able to execute this work during the winter of 2020/2021, Chance needs to be in the position to contract suppliers in October, meaning the submission to the DO would need to happen in the next couple weeks. Programs in BC and Saskatchewan for funding orphan and active wells will apply pressure to this project by causing a shortage of equipment and professional services. The main project activities being proposed are well integrity assessment and maintenance work on 8 wells. The work is dictated by regulations. Winter roads will have to be re-activated and some water will be needed for that operation, contingent on the snow-pack. Based on scheduling we have now, it will likely take 2-3 months to do this work. We do have a camp; however it is currently closed/shut down. That camp could be used, or we could use the Eagle Plains Hotel for staff. At this time, for the purpose of the DO screening, we will include both options. Equipment will be needed to open up the winter roads (bulldozers, mulchers, drags to help pack the snow, water trucks) in order to get the winter roads to a state that will allow the equipment to get in. We may run snowmobiles along the winter road routes to start some initial snow packing. Some work at each site will be conducted to ensure equipment can be properly set up at/around each well. The order of which well is addressed first is flexible and can be impacted by presence of wildlife in the area, for example. A pressure test of the casing is the first step, then investigations to confirm if there is casing-vent flow. This is actually checked each year and there have been no issues so far. The temperature check is to figure out the depth of permafrost and to see if there have been any changes in its depth. The tests/procedures will ensure the wells conform to modern regulatory conditions. Their subsurface infrastructure is in-line with the regulations that were in place at the date they were established. The objective is to have all wells be suspended, maybe abandoned, at depth. Suspended is preferable as it allows Chance to possibly use them in the future (for production or disposal). We will have to be prepared for a variety of scenarios. Maps have been provided showing the permits and wells [at this time [redacted]eft the call].

[redacted] – The plan is down hole suspension and to bring wells into compliance with the Oil and Gas Drilling and Production Regulations (OGDPR). We may take some wells to surface abandonment. We plan on inspecting all wells this summer. One of the suspended wells (A-25) is on Permit 25 that is set to expire. We are working on extending that tenure. We are going up to analyze the integrity of the wells and take on the remedial work that we need to. If in the future plans are made to bring them into production or use them as a disposal well that will be a component of a future project.

Firelight – Inquired how Section 91 (5) of OGDPR applies to Chance's suspended wells. Commenting that suspended status is not an indefinite prospect. Section 91 (5) has a condition that suspended wells must be put back into operation or abandoned within a period of three years from the date of suspension or any longer period specified by the Chief Operations Officer.

[redacted] – The Executive Committee Project Proposal may include those wells and activities with those wells and that would hopefully occur within 3 years. We can add that detail to the Executive Committee Project Proposal in order to provide additional clarity. We will also add additional regulatory context and detail.

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[redacted] – Effectively we are downhole abandoning these wells. Some of these wells have not been perforated.

Firelight – Downhole abandonment, is that the same as downhole suspension? Is that the same as cement squeezes?

[redacted] – Correct. Cement squeezes ensure that they are isolated. Depending on the assessment during the maintenance activities that we are proposing, we would like to use them as an injection/disposal well or production as a part of the Executive Committee Project Proposal. All work will be in accordance with OGDPR.

Firelight – VG is interested in clarifying some of these terms. Suspension versus abandonment and clarity on what that means. Additionally, there appears to be discrepancy between May 2020 proposal to YG for abandonment and workover. According to that proposal, you planned for abandonment of 6 wells and workover of 2 wells. That is different than the project description that you have shared. They are not the same.

[redacted] – When we originally went to YG, the initial thought on the legacy wells (the four on the Significant Discovery Licensee) was abandonment. After additional examination we wanted to adjust the plan. Once we started understanding the processes and options for the maintenance activities, the proposed project evolved. This application is designed to allow us to do that work, understand what we have at each well, then determine the next steps in the field.

Firelight – Then it seems like YG is providing dated information to VG. We want to make sure that these activities are in accordance with the Act. So YG is aware and apprised of this change?

[redacted] – That is correct. YG is fully aware of the program we are proposing. The Director will be facilitating further discussions with other departments within YG to help implementation.

Firelight – You mentioned that work will be done sequentially, do you have an idea of the sequence?

[redacted] – In terms of operation, the ice road, one of the procedures that we do, is to start with snow cats on the trails. Let snow base sit, then tighten up. Start and continue packing the snow. The sequence is, that the base will be put on the Blackie road and then the Chance road. We will determine the sequence of the wells at a later point, considering factors such as where wildlife is observed. For example, if there are caribou then we will focus/move our work to another well.

Firelight – To confirm, there are no current plans to have these wells become disposal wells. But there is a possibility of that in the future. If that does happen, what does that entail?

[redacted] – From a technical perspective, injection well is the same as a production well. Just the fluid is going in the opposite direction. Tanks, pumps, equipment on site are generally the same.

Firelight - Fluids from other wells, that is not useable, that is what would be disposed?

[redacted] – For the most part. Maybe stimulation fluid.

[redacted] – Any activities along that line would be addressed in a later proposal.

[redacted] – Does VG or Firelight need any other info about Blackie Road?

VGG/Firelight – There are no additional roads being constructed, correct?

[redacted] – That is correct. Not additional road is being constructed, but the Blackie route is overgrown. The vegetation is thicker there. Will be doing some brushing. These winter roads were used decades ago, so there are some spruce trees now. But we will follow the exact route which is also located on the height of land.

VGG – We needed this clarity and information from this meeting in order to finish developing our comments and feedback. We will work with Firelight and hopefully get back to you by the end of the week. Maybe next week.

VGG – As for the open house, we hope to have a response to the questions and input we send you before the community meeting. Accommodation will be a limiting factor. Who would be coming?

[redacted]

[redacted] – Myself or someone on the DO application.

[redacted] – We will be sending the full application shortly. We hope to meet the community after VGG/NRC has had a chance to look at the details. We would like to explore employment opportunities during the open house. Some citizens in Old Crow seem interested in working on this program and future programs. Some opportunities for citizens to operate the equipment or environmental monitors.

VGG – We will get back to you about the availability of VGG/NRC. Full attendance may not be possible.

[redacted] – Can we schedule another brief call to sort out the logistics and the purpose and intent of the open house. Having a DO submission now as well as the ExCom, there could be confusion. How can we make sure we are clear but also not overwhelm people with detail?

VGG – That sounds good. We can arrange that by email later.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
VGG to provide feedback to Chance on the DO Project Description.	VGG	Sent to Chance/Hemmera July 10, 2020
Chance to provide a response to VGG's feedback in the document/template provided by VGG.	Chance/Hemmera	ASAP Prior to Old Crow Open House
[redacted] and [redacted] to connect via email or phone to discuss logistics and approach to Open House.	[redacted]	No Longer Applicable*
Share Open House communication materials with VGG (e.g., hand outs, project summaries, etc.).	Hemmera	COVID HASP shared July 10th. No Longer Applicable*

*Please Note: The Open House in Old Crow was cancelled the morning of July 20th.

APPENDIX 2-C-65. August 21, 2020, Meeting Summary - document not available at submission.

APPENDIX 2-C-66. September 3, 2020, Meeting Summary

VUNTUT GWITCHIN NATURAL RESOURCE COMMITTEE AND CHANCE OIL AND GAS MEETING

PROPOSED WELL MAINTENANCE AND WINTER ACTIVITIES

Date: September 3, 2020

Location: In-Person Meeting (Old Crow) and Conference Call

Attendees:

Vuntut Gwitchin:

[redacted], Director of Natural Resources, Vuntut Gwitchin Government
[redacted], Lands Manager, Vuntut Gwitchin Government
[redacted], Senior Researcher, Firelight
[redacted], Fish and Wildlife Manager, Vuntut Gwitchin Government
[redacted], Council, Vuntut Gwitchin Government
[redacted] Natural Resource Committee
[redacted], Admin Assistant, Natural Resources, Vuntut Gwitchin Government
[redacted], Natural Resource Committee
[redacted], Youth Representative, Natural Resource Committee
[redacted] Natural Resource Committee

Chance Oil and Gas Limited:

[redacted], President
[redacted], VP Government and Community Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator

Vertex/Hemmera:

[redacted], Vertex
[redacted], Human Environment Business Leader, Hemmera
[redacted], Senior Environmental Specialist, Hemmera
[redacted], Human Environment Specialist, Hemmera

Purpose and Objectives

The purpose of this meeting was for Chance to provide an overview of revisions to the proposed Eagle Plain Well Maintenance and Winter Activities (i.e., amendments from original project description shared) and to answer questions from the Vuntut Gwitchin (VG) Natural Resources Committee (NRC).

Meeting Discussion:

[redacted] – Welcomed everyone and opened the meeting.

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[redacted] – Reviewed the agenda.

[redacted] – Everybody has had a chance to review the original draft of the project description. However, it was revised in order to address a few issues. Even within those changes there remains some uncertainty. First, the need to abide by Yukon Government (YG) orders to either abandon or put the wells into service. The previous version of the project description considered having the suspension status continue, but YG has instructed differently. Two wells will be converted to deep well injection. One of those wells is at Chance Camp with rock formations (shale formations) that make it work well for injection (Well E78). Shale and permafrost are well known as fluid migration barriers. Well A25 is located in a dormant borrow pit. The remaining six wells will be abandoned after maintenance activities are completed. We do not want to put those six wells into service because they are further from the Dempster Highway. Second, the item up in the air, is whether or not Chance will open the camp. Mostly this uncertainty is with respect to COVID and addressing COVID management. Eagle Plains Hotel could accommodate us, but they also need to provide essential services to the public. Chance is working on this item. For the purpose of the YESAB submission we have to consider opening the camp and leaving that in as an option. The last item that was changed from the original Project Proposal is access to M59 and using Blackie winter road. When visiting the well sites last month to do inspections, Chance found that the final portion of the Blackie winter road access route was steep and would involve cutting a lot of trees. This portion of the route would be hazardous because it is so steep. Shifting access to the east would be safer and results in less vegetation disturbance.

[redacted] – We have hired Firelight to help with our assessment and evaluation of the project. Justin Page is up in Old Crow. VG has looked at some of the review, and it would be good at this point to use that as a basis for asking questions. Justin, do you want to take the lead?

[redacted] – Might be useful for people to ask high level questions. We've done a detailed review of the proposal. We also have some technical issues with respect to caribou, Vuntut Gwitchin rights, etc. With the conversion to injection, how does that affect timelines? How long would they (injection wells) be permitted for? Is it just to facilitate the abandonment of the other wells or for future activities associated with the Executive Committee Project?

[redacted] – These injection wells would be used to dispose fluids from the maintenance work. They could be useful for the Executive Committee Project also. In the meantime, there is a little water well at the Chance Camp that has some fairly salty water. We might use the disposal wells to dispose of salty water from that water well if we conduct pump tests. This would help us switch from using surface water to that well. But may get some salty water until we get good water.

[redacted] – For clarity, what else will be pumped down there Richard?

[redacted] – Water from drilling operations, sodium chloride or potassium chloride water from the maintenance project, or formation water.

[redacted] – What process are you going to use protect oral history? What about caribou analysis and back and forth with regional biologist? What is the timeline for collecting data on the wildlife, oral history, and interviewing people in the area? Research into the cultural component of the area.

[redacted] – As far as this well maintenance program, we are really relying on existing information. Data collected to date. Mostly because it is a relatively small program. We are also helping Chance with the

large Executive Committee Project. That program would be where we gather much more detailed information, including oral knowledge.

[redacted] – The elders who lived off the land, Dagoo elders, from the area provide all the information. Plants and animals and cultural information. I know it's a small project. I would still like to see a review of oral history. There are still people that use the area. Normally using existing information, I understand. I get the footprint is small and small amount of caribou use the area. But it's a fairly long and large road coming right off the highway. Even though the footprint is small, there could be larger impacts to the caribou and maybe the moose. Take those considerations into account.

[redacted] – Certainly, we can take the road into consideration. On top of the road and the wells themselves – we considered a 4km buffer around the disturbed area.

[redacted] – Can we use more recent information? This information must be outdated (referencing dates on the Caribou handout). Using something from the technical committee. It's referencing work from 1993 – that's 20 years ago. Is there more recent data?

[redacted] – We have used much more recent data in the assessment. In the handout, I just referenced the technical committee when referring to summer ecology of the caribou. When I reference the portion of caribou that are in the project footprint – I'm using much more recent information. Data from 2017 in a report by [redacted] and [redacted].

[redacted] – [redacted] can you update us on the status of the Technical Working Group (referring to the NYLUP technical working group?)

[redacted] – The work from [redacted] and [redacted] is the first of two reports, the second report is being finalized.

[redacted] – In the future, I'm going to want to see more than that (using recent data). Moving forward when we're dealing with bigger things/projects we need to incorporate more Traditional Knowledge.

[redacted] –We had an archaeology study of the whole area in 2014. In that work, they have polygons that flag areas (points of interest). The reports were drafted by Matrix which was bought by Stantec. A full assessment of the project area was completed. We understand where the high potential areas are.

[redacted]

[redacted] – What does "points of interest" mean?

[redacted] – Mostly for archaeology sites. They look at the creeks and streams or the south side of hills for potential human use as well as paleo resources. Those reports helped us build the access routes. In this case (for the DO assessment), the routes are already existing, and the well sites are existing.

[redacted]

[redacted] – The lack of assessment on impact on VG harvesting rights is a major gap, this area has been extensively used in the past by Dagoo people and used currently. Also of interest is getting people back on the land to maintain the culture and traditional knowledge. In light of COVID, people are wanting to go

into those areas. There is a wealth of information to draw upon. Also there was no real assessment on vegetation, for example Tamarack, this is the only place it grows in the region.

[redacted] – People have nice snow machines. Now the trail has been marked out, we're going to want to make use of it. Use in this area and getting back to the Dagoo area. We want our people to know our entire traditional territory as they did in the old days. Would like to preserve this area for future use. Important for us to have the area used properly, for our people and our culture.

[redacted] – Thank you [redacted] and [redacted] You've brought up a lot of information, but also a gap. Future land use and planning is a gap. There is some internal work that needs to be done. I don't really see that being reflected yet, and something changing all the time.

[redacted] – During land claims selection, we had a committee all elders. Those elders would pinpoint important areas. [redacted] There was a whole mountain. Whole purpose of it, I think, the traditional area is very important even if we're not using it very much. It's really important for us, for the future generation. Development of today, I always look towards the future of our young generation, these unborns are our investment and I respect that very much. How are we going to protect the land and work safely on the land? Head waters. If there's a disturbance around the head waters, we'll probably get hit with it. Salmon, every year we get different salmon migrating, and water birds. I just hope that we come to some good solution

[redacted]

[redacted] – From the Chance perspective, under the new Lands Act for VG. It would be nice if we can work with lands technical staff. To get interests in the area. Trapping, that type of thing. Ran into Norma two weeks ago and got to see their camp. There are four families up there utilizing the area. Chance is adaptive to working with the technical group to help work on the gaps that are being referred to. This work is a two-way street. Almost like land use planning. Land use plan has some guidance, but it is very generic. The Lands Act by VG is very current. And working with land technical group will help.

[redacted] – That new act only applies to VG settlement parcels, are you going to follow VG law on crown land?

[redacted] – We want to make sure we do things right. It's about the YESAB process. We want to work with VG Government, and follow all the rules and regulations

[redacted] – Have you talked to Norma? Or others who use the area? What do they think?

[redacted] – That information would better inform Chance and their work. Something like the effects the assessment. In looking at the effects assessment, it really isn't clear how VG's values are reflected in that approach. How has that been accounted for in that process?

[redacted] – We are talking about some pretty important issues. Issues that spill over into the Executive Committee project. That project is not something we want to get into detail today. Thinking about some of the overlaps between the projects and VGs concerns. Engagement with VG is important to identify the valued components (VCs) and issues and to look at things in a detailed and meaningful way. We want to move forward with that. In terms of the project in front of us, a lot of thought around the VCs associated with this project were identified based on past knowledge and past experience in the area. All

this needs to reflect the scale of the project which is 8 existing wells. The wells are already there and in a disturbed area. The majority of the routes, following the old routes. That's what influenced the VCs. Input from past meetings with VG did inform the VC selection.

[redacted] – There are some pieces of this project, with respect to issues, that we have raised before and that haven't been addressed. E.g., disturbance to caribou. Referencing the 600m, where did that value come from. I would like to learn more about how you came to that number. We never know what the caribou are going to do year from year. What if the caribou are congregating in the area next year, what will you do?

[redacted] – With respect to safe operating distance, as you noted there are lots of different numbers out there. If we think about the logistics you can only often see 100-150 meters. And the detection distance is often smaller. That is a challenge for operations. In terms of minimizing the spatial overlap between where the project is and where the caribou may be, when the operations start, ground monitors go out and assess the area to look for caribou and signs of caribou. Then Chance can use any signs of caribou to help schedule which well site Chance will go to first/next. Looking at available telemetry data, from monitoring, one thing that stands out is that the caribou are mobile throughout the winter. Its rare that they would remain on one site for too long. Caribou typically move 2-5 kms a day. However, the number of collars are few. For every 1 collar there are 200 caribou.

[redacted] – In 2014 or 2015 a significant number of caribou went into the project area. Considering adaptive management, when things are happening, such as a large group of caribou in the area, do you have any plans on how you'd engage with VG. In the past, we've asked to see your monitoring protocol. Or the monitoring data Chance may be collecting. The bigger question is engaging with VG when there are a lot of caribou in the area.

[redacted] – Of course, all our wildlife monitors will be hired from here, and typically have been. Of course we want to work with VG. In the past, we have shared lots of our reports and information. During the packing for the base of the winter road we would have wildlife monitors going out ahead of the snow machines, assessing the areas. Again we have certain windows of opportunity, such as limited daylight. We are prepared to do formal reports. For example, we have a person from VG who completed certain training (William Linklater, with a University Degree in Environmental Science) and he wants to be the environmental technician and wants to provide the technical reporting. We want local monitors. We are already thinking about how we'd provide reports and our monitoring plans.

[redacted] – Are there any plans to involve VG on the adaptive management thresholds? For example if caribou are observed in the area or a certain number of caribou, then a certain management reaction is triggered. It would be highly valuable to determine what the thresholds are. E.g., 10 caribou or more. What are those triggers for when you need to consider other mitigation measures?

[redacted] – Those thresholds are weakly defined. Based on limited science. There is certainly no magic number. There would absolutely be a benefit to getting VG input. Based on VG knowledge.

[redacted] – The road will be gated?

[redacted] – Yes. That's clear from past discussions. It is also key for safety, as there is potential for sour gas at the site.

[redacted] – When you're done, what happens with the road? Is YG responsible?

[redacted] We'll just let it melt. The permits will have certain conditions. There are three different permits required, a highway access permit, a land use permit, and a well license. When we are done building the winter road the Natural Resource Officer looks at things. We will be monitoring the winter roads to ensure there is 6 inches of snow. Once we are done and the rigs and supplies come out, then we take a backhoe to the area where the winter road meets the Dempster Highway in order to fill in the start of the road again. April 15th is the last day to have a land use permit for a winter road.

[redacted] – What about wolves and predation? I worry about the yearlings. What if the winter roads concentrate the caribou and make them more susceptible to wolves?

[redacted] – When we use the winter roads, we are there all the time using the roads. We don't see wolves. They're there, but they are not on the road because we are using it 24 hours a day.

[redacted] – Wildlife monitors could be looking out. We could be taking part in those adaptive measures.

[redacted] – They will report any wildlife that they see.

[redacted] – Once we are on top of a well and activities are underway it would be impossible to shut down the work. It would be too hazardous to shut down. There will be some latitude to investigate different locations in the beginning as we have all wells that need to be maintained as options at the start, but once the well site work begins, there is less latitude to stop and move to a new location.

[redacted] – It is difficult to stop or pause. Hours isn't unheard of to pause, we could pause for say 12 hours, but pausing for days would cause issues.

[redacted] – Could we come up with other possible mitigations? For if the road does impact the herd. Other than shutting down?

[redacted] – We will have very limited traffic. The most traffic will be the wildlife monitors. Or the YG inspectors or other inspectors. Would VG be interested in doing their own inspection? We could maybe accommodate that.

[redacted] – In the past, we've hosted tours of our operations. We could make arrangements for appropriate times to facilitate tours.

[redacted] – You had asked, what would we do if predation was happening on the winter road? There is a small chance of predation happening, but it is very difficult to manage without knowing the specific details. Their likelihood is so small that it's difficult to plan for. Might not be able to have plans in place for every eventuality, but have a mechanism in place for dealing with issues if they arise. For example, a team above the monitors that they can report to, such as wildlife biologists, VG staff etc. Based on information and what's going on, then that team can discuss and provide advice and put together an effective site-specific mitigation measure.

[redacted] – That is awesome.

[redacted] – Yes, we've been wanting that. That would be welcome.

[redacted] – We are not trying to handcuff you. We would just like to be involved.

[redacted] – The plan for reclamation is remove it all and plan for regeneration? It will be important to think about end land use objectives. This has been an area excluded from use for a while, and there is

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interest in bringing back use. Would natural regeneration bring us there? That should be taken into consideration.

[redacted] – Compared to a hard surface road. For these winter roads, the base layer (vegetation) is left intact. The trees and large shrubs are all that is removed. In terms of natural reclamation, the foundation is already there. Often there is not a lot that is done to reclaim those areas.

[redacted] You've been researching regeneration at EDI. Any findings worth sharing?

[redacted] – We looked at regeneration along types of linear feature specific to the larger exploration program, the Executive Committee Screening. This is building on work that YG already started. We are looking at successional pathways on different linear types of development. We used that as a base, understanding the year of disturbance and then tried to determine the stage of regeneration. We are in the final stages of writing that up and we can share that when it's done. What I said earlier about the base layer being maintained that's based on what we saw during this research. That's how we are getting a sense of how older linear features are regenerating.

[redacted] – Regeneration could go different ways. You could end up with difference species. It would be useful to look at other projects, and culturally important plants.

[redacted] – What we see more often in Alberta is that any resulting impact from linear features is due to snowpack that are the result of other uses such as snowmobile, and that results in additional packing and could result in a "highway" for wolves. If it stays unpacked, then it isn't used by wolves.

[redacted] – Why is the seismic line here near town with nothing growing on it?

[redacted] – This far north it tales a long time for things to regenerate.

[redacted] – Quick chat about process from here? What date do you want to submit? How much time do we have to engage?

[redacted] – That's up to Chance.

[redacted] - We would like to have our land use permits at the end of November and early December. In order to build the base and to commit the oil and gas equipment. We would like to be in YESAB soon. Very soon.

[redacted] – We need, at least, a logistical plan to get equipment into the area and get people under contract. We are cutting it close right now.

[redacted] – We look forward to getting VG's feedback and the input on the more technical pieces and work on integrating that into the proposal.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
VG to provide feedback to Chance on the revised DO Project Proposal.	VG	ASAP (estimated September 11, 2020)

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APPENDIX 2-C-67. October 31, 2020, Meeting Summary – document not available at time of submission.

APPENDIX 2-C68. November 3, 2020, Meeting Summary

VUNTUT GWITCHIN NATURAL RESOURCE COMMITTEE AND CHANCE OIL AND GAS MEETING

PROPOSED WELL MAINTENANCE AND WINTER ACTIVITIES

Date: November 03, 2020

Location: Conference Call

Attendees:

Vuntut Gwitchin:

[redacted], Director of Natural Resources, Vuntut Gwitchin Government
[redacted], Senior Researcher, Firelight
[redacted] Council, Vuntut Gwitchin Government
[redacted], Natural Resource Committee
[redacted], Natural Resource Committee
[redacted], Natural Resource Committee

Chance Oil and Gas Limited:

[redacted], President
[redacted], VP Government and Community Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator

Vertex/Hemmera:

[redacted], Vertex
[redacted], Human Environment Business Leader, Hemmera
[redacted], Senior Environmental Specialist, Hemmera
[redacted], Human Environment Specialist, Hemmera

Purpose and Objectives

The purpose of this meeting was for Chance to provide the Vuntut Gwitchin (VG) Natural Resources Committee (NRC) with additional information pertaining to the withdrawal of its Project Proposal from the Dawson Designated Office.

Meeting Discussion:

[redacted] – Opened with a round table and reviewed the agenda.

[redacted] – Referred to an email that went out yesterday providing VG with notice of Chance withdrawing its DO submission. This approach was informed by advice from YESAB. Withdrawal would allow Chance to incorporate changes to the project that they have decided are worth pursuing. The changes relate to Chance's interest in undertaking extended flow testing of natural gas in three of the wells. Chance is interested in testing one gas bearing zone in M59, one gas bearing zone in M08, and two

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gas bearing zones in J19. The same tests will be completed as described in the original project proposal. E.g., Pressure tests will be conducted to ascertain integrity of the well bore. Then Chance would proceed through the extended flow testing. Chance is unclear how long that test would take per gas bearing zone. However, estimates it to take 2 weeks. Extended flow testing at one site would be completed at the same time as the rest of the maintenance work. While conducting the flow test, a service rig would be elsewhere at another well site. Chance does not anticipate the duration of the project changing much. The zones of interest are the discovery intervals, or partial discovery intervals, that helped to define those sites as Significant Discovery Licences. The goal is to test the natural gas by measuring the pressure of the formation. A certain volume of natural gas would be produced over a two-week period. Information gathered at the outset would be compared against the end. Having measured what is withdrawn then it is possible to calculate an estimate of the resource in that accumulation. Chance has observed an obvious need in Yukon (e.g., by Yukon Energy). Yukon Energy is renting diesel generators and importing diesel generators. If Chance can demonstrate that a natural gas source is possible in the Yukon, then it could be an economic asset in northern Yukon. Assuming these wells go through flow testing, then they would be left in a suspended state pending an additional environmental assessment process that would be for the production and collection of the gas deposits. Rather than abandoning six wells, Chance is proposing to only abandon 3 wells and have 3 wells suspended as natural gas producing wells. The other 2 wells would be established wells for down hole disposal. Equipment on site for the extended flow testing would be similar to the equipment described in Chance's draft project proposal for its 30-well exploration project for Executive Committee Screening. Natural gas would be flared for the test period. If there are any liquids recovered, they could be trucked away for disposal in Alberta and/or down a disposal well. In M59, the natural gas is dry. In M08 and J19, the gas bearing intervals probably have more liquid. Perhaps some liquid propane and/or condensate. That would have to be trucked to Alberta or injected down hole. Tanks will be needed on site to contain what can't be flared. Chance will shortly be having engineering professional better defining/predicting what will occur. Chance's goal is to demonstrate to Yukon Government that there is a viable and locally available sources of energy. A resource that is more environmentally friendly being focused on natural gas and not diesel. Chance believes this will diversify the Yukon's economy, especially given the impacts of COVID on the Yukon's tourism industry. Chance also believes this resource could diversify the Yukon's supply train. Chance is revising its YESAB submission to include the changes mentioned regarding extended flow testing. Chance is hoping to get back in to YESAB as soon as possible, and hopefully still start this project this winter.

[redacted] – Expressed that these changes are quite a significant change from the previous project. VG will need some time, after having this in writing, in order for VG to formulate a response. In response to Chance's hopes of getting this new project into and through YESAB quickly, VG and Chance need to talk about timelines. First VG will need to talk internally to better understand what it will take for VG to review the new project proposal internally and provide comments to Chance.

[redacted] – At this time, only had one question pertaining to mechanics. Are there any anticipated changes in employment that would be associated with the additional changes?

[redacted] – Not for people hirable from the Yukon. It is a speciality service. Flow testing crew and equipment would have to come from Alberta. There may be some extra people involved in the flow testing maybe 2 per crew. Its possible we could have 6 more people depending on the flow testing.

[redacted] - No additional questions from the NRC members at this time.

[redacted] Indicated that Chance and Hemmera are updating the submission document. It can be shared when it is ready. Chance asked [redacted] and [redacted] to comment on timelines. Chance stated that they would be speaking with YG tomorrow. Though YG is aware of Chance's intention.

[redacted] Wanted to make it clear that changes will be incorporated into a new project proposal and those project changes will be tracked/carried throughout the document. Currently Chance and Hemmera are making those changes and adding in the new content. While we are fairly close, Hemmera hesitated to give a specific time for having the new project proposal (perhaps a week). Chance will have to review the draft. Then the draft will go to First Nations for review. The Dawson DO is pleased that Chance chose to revise the proposal and resubmit. Once the new project proposal is submitted, then the process restarts, i.e., proceed through the adequacy process again and forward as usual.

[redacted] Acknowledged that Hemmer and Chance are working on the specifics. However, broadly, inquired if Hemmera and Chance are systematically reviewing the interactions between the project components and the valued components, i.e., revising the effects assessment. Additionally, with respect to cumulative effects, if this project supports the development of a natural gas industry, has/will that be considered in the effects assessment.

[redacted]– Chance indicated that it needs the flow test to work that out and that it is not a certainty that the tests will go/be successful at this time. Looking at the future is too speculative

[redacted] – Responded that the new project components will be described/explained in the new project description and then be carried through the effects assessment to ensure that the whole document is updated. The effects assessment will include/consider the flow testing. Additionally, with respect to flow testing, if it is successful then those wells will be suspended for future use. Any future use is not being included in this proposal. The wells would simply remain suspended. Actually as they are now. Extended production will not take place on site. If Chance decides to do that in the future that would have to go through another assessment. At this times chance doesn't know what that looks like.

[redacted] – Understood, however questioned whether successful flow testing subsequent resource development can be seen as a reasonable in the foreseeable future.

[redacted] – Believed that the way the North Yukon Regional Plan, plan only looks at projects submitted/existing at that time. Chance did not think you can look at what might be foreseeable in the future. It will be difficult for Chance to consider / get into what would be there in the future.

[redacted] – Didn't have any additional content to add when asked by RW.

[redacted]– Stated that it sounded like Chance had had conversations with Yukon Government and inquired as to how long Chance has been talking with Yukon Government about this?

[redacted] – Only engagement with YG to date has been to notify Chioma (Izugbokwe) as to what Chance was looking to do. Chance has shared a draft program, but no comments from Chioma were received. Beyound that, no one else in YG is aware. Chance will be meeting with Yukon Government tomorrow.

[redacted] – A rough outline of the program was shared approximately 10 days ago, maybe 2 weeks. At that time Yukon Government was hesitant to provide any comments until the YESAB process had concluded. They did not want to be seen as influencing the process.

[redacted]– Stated that parties needed to map out the next steps. While NA was hesitant to give a date. I did hear him say a week to a week and half.

[redacted] – That depends on the back and forth with Chance in order to make sure we have all the details that we need.

[redacted] – What would the NRC like in terms of materials, in order to understand the changes. Do you just want the revised project proposal? An additional meeting? A summary of the changes?

[redacted] – VG would definitely expect the revised project proposal in full. And in terms of the committee's work, a summary of the changes would be helpful as well as a meeting. All three are likely needed. We should probably have another meeting before this gets submitted to YESAB. VG will have to revise its response.

[redacted] – Tentative date for 2 weeks from now for a meeting? With revised project description being provided in a week and a half.

[redacted] – Believes VG will need to talk internally as a committee. They have other files that they are working on. The NRC will discuss its schedule. Request that Hemmera/Chance provide an email so VG can follow-up once they have talked about their workload and timelines

[redacted] – For the next meeting scheduled between Chance and VG, Chance would like an agenda item to include discussing Section 68 benefits agreements.

[redacted] – Anything else the NRC would like a higher level of detail for?

[redacted] – Not at this time. Believed that the summary will be helpful for the NRC, then the draft when it is ready. It will be good to get that as soon as possible.

[redacted] – Responded that a one-pager could be put together and shared fairly quickly. Updated YESAB draft 12/13 of November, perhaps?

[redacted] – As Chance and Hemmera are progressing with the draft, they can give the NRC an update. To keep everyone in the loop.

[redacted] – Chance will share the summary before that week and half. That way VG has something to consider.

[redacted] – sign-off. Will follow-up with an email shortly.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Email with initial action items/reminders.	Hemmera	ASAP
Chance/Hemmera to provide project summary.	Chance/Hemmera	ASAP
Chance/Hemmera to provide project proposal.	Chance/Hemmera	Nov 12/13 (estimated)
Schedule a meeting to discuss project proposal	All Parties	

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APPENDIX 2-C-69. December 17, 2020, Meeting Summary

VUNTUT GWITCHIN GOVERNMENT AND CHANCE OIL AND GAS MEETING SUMMARY[DRAFT]

PROPOSED WELL MAINTENANCE AND WINTER ACTIVITIES

Date: December 17, 2020

Location: Conference Call

Attendees:

Vuntut Gwitchin Government:

[redacted], Director Intergovernmental Relations & Governance
[redacted], Director of Natural Resources
[redacted], Senior Researcher, Firelight

Chance Oil and Gas Limited:

[redacted], President
[redacted], VP Government and Community Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator

Chance Consultants:

[redacted], Vertex
[redacted], Environmental Dynamics Inc.
[redacted], Human Environment Business Leader, Hemmera
[redacted], Senior Environmental Specialist, Hemmera
[redacted], Human Environment Specialist, Hemmera

Purpose and Objectives

The purpose of this meeting was for Chance Oil and Gas Limited (Chance) and Vuntut Gwitchin Government (VGG) to discuss the proposed Eagle Plain Well Maintenance and Winter Activities Project and previous questions submitted to Chance from VGG.

Meeting Discussion:

[Meeting began with introductions and parties reviewing agenda.]

[redacted] – This is an opportunity to discuss changes made to the proposal after the last comments we received from VGG. Received the four main questions from Jordan and incorporated additional text into the revised draft. The main summary table in the email shows where those items were addressed. With respect to concerns about putting wells back into suspended status, we clarified in the introduction the Oil and Gas Drilling and Production Regulations. Clarified the language and we removed the "3 years language" that is not in regulations. Pertaining to the question around potential affects between Extended Flow Testing (EFT) and permafrost, air quality, and wildlife. Added additional text to those sections in the

proposal. The analysis determined there were not many additional interactions between EFT and wildlife. Part of that was the design of the flare. The length, physical time of EFT, and the prediction of wildlife in the area at the time. Text was added to show those considerations. That is also why a value like air quality did not need a full-scale effects assessment. We revised the COVID health and safety procedures. Made a few changes based on the current COVID conditions. Main take home, Chance would follow and monitor Yukon policy. COVID policy/precautions is changing quickly. Once the project is permitted, what the health procedures are at that time, Chance will follow them. Overall, the document is essentially ready to go for submission.

[redacted] – Related to the regulations, can you provide more context, what those regulations are and how they relate to Chance's project? Title of regulation provided Oil and Gas Drilling and Production Regulations.

[redacted] – We have 8 wells in suspended status. When in a suspended state – not able to produce or inject anything. What we are planning to do is convert two of those wells into deep well injectors, so we have a means of disposing fluids that are used or produced during the project. Three wells will go through EFT and are natural gas bearing rock formations. Objectives, to get a better sense of the resource. When these wells were first drilled and tested, it was for a short duration and that info does not say much about the resource. EFT will help show what the resource base is behind the well. Important info that feeds into development strategies. Then three remaining wells will be abandoned. At the end, left with five wells, three will ultimately be gas producers, but they will be returned to a suspended state after the EFT. The disposal wells will be shut in, but capable of being used for injectors in the future. We have a water well at our camp and we might want to do an extended flow test at that well and we could inject saline water from the water well to the disposal well.

[redacted] – If the wells don't turn out to be suitable for commercial development, will they still remain suspended or will they be abandoned?

[redacted] – If the results are discouraging. Then we would abandon the wells.

[redacted] – Is there a number that leads to/triggers that decision?

[redacted] – Can you give us some insight into how you plan on measuring or bringing those wells into a suspended or abandonment. Threshold for making that decision.

[redacted] – When you do the flow test. Flowing natural gas to the surface and flaring that gas. Flaring the gas because there is no market to sell. When you do the flow test, you start with measuring the initial pressure. Then you produce a volume of natural gas for about two weeks. Then you measure pressure again. That final pressure measure can take some time. Maybe two weeks. Then that information, the change in pressure between the start and the end, can be used to determine the resource mass. Would need confidence that the resource mass is large enough before talking about production and talking to people about investment, markets, etc. Maybe Yukon Energy or mines as potential markets. Or similar to how Inuvik has used natural gas. In order to go ahead with that strategy, we need to know what the resource mass is.

[redacted] – For clarity Richard, nothing about working with Yukon Energy, etc. pertains to this project.

[redacted] – Correct. What I was just talking about is hypothetical. We need the data. Then would submit another proposal in the future.

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[redacted] – What's that trigger? For it being marketable?

[redacted] – The flow test won't be the full/only defining measure. If we are going to get into contracts with Yukon Energy or a mine, we would be looking into an arrangement that would have to last up to 20 years in order to justify the investment of moving forward with development. Eagle Plains has zero infrastructure to deal with oil and gas development.

[redacted] – Is it fair to say that EFT for this project, the Designated Office project, will inform the Executive Committee multi-well exploration program.

[redacted] – No this project is not connected to the Executive Committee Project. It might have some benefits for it, for example, being able to use injector wells, that could provide value for the exploration program. What we get with respect to flow testing for the natural gas, may or may not be relevant to the Executive Committee. To get to a 20-year supply, we have to define 15 BCF of gas.

[redacted] – Any future work whether it's putting those wells into production would have to be a separate proposal.

[redacted] – Okay thank you, can we go back to my questions about regulations.

[redacted] – My interpretation of the regulations. Once we put these wells into EFT, they go into active status. Once that testing is complete and then they are returned to suspended status. If you have no additional activity for 3 years, then they have to be abandoned. As far as the injector wells. We plan on keeping them in an active status, by using them once or twice a year moving forward.

[redacted] – For how long?

[redacted] – Until the full Exploration Program [Executive Committee Project] begins.

[redacted] – Most of the wells are in a suspended state right now. Have been suspended for 60 years. Most "statuses" have certain time periods; however, regulators can extend timelines.

[redacted] – Are you speaking to the 2014 order?

[redacted] – In 2014, the regulator of the day, extended the suspended status for 5 years. Since then, have been in a back and forth with regulators to continue that status. We are still trying to do that. Regulators have the power to extend a suspended status. The status gets reviewed and that's where we are now.

[redacted] – In those regulations, it speaks to suspended wells in section 91. Speaks to the 3-year period as well as additional details.

[redacted] – The regulation provided was a federal regulation and not the territorial regulation. Are you aware of that? Make sure the right ones [regulations] are sent out to other parties.

[redacted] – That was an honest mistake. I pulled that table together. It should say the Yukon regulation. Yukon Oil and Gas Drilling Regulations OIC 2004/158.

[redacted] – Nathan can you describe how Chioma Izugbokwe (Yukon Government) would get involved?

[redacted] – I am expecting them to be full participants. I think they will feature prominently.

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[redacted] – The regulator is responsible for administration of legislation. If they felt that there were inaccuracies in how legislation was being interpreted, or if something was going against the legislation, they will bring that up. Beyond that, they are free to participate in any way they want. That's generally been the case with assessments in Yukon.

[redacted] – For the regulator, Chioma, they would also facilitate, on behalf of YG, comments from Environment, Highways and Public Works, other YG Departments. As well as submitting their own comments in the assessment process. Those opportunities would help clarify the regulations as well.

[[redacted] joined the call.]

[redacted] – Welcome [redacted] to the call. We've really just gotten into substance of the first question. Hand things off to Justin.

[redacted] – We appreciate the responses provided and the changes to the proposal. Some issues still need clarification. For example, birds. Still no response pertaining to EFT effects on birds. That content in the proposal remains the same as previous version. The rationale for not bringing birds in is that the project has low potential to interact with birds because the majority of birds are migratory and should be at their winter grounds. However, we know flaring can adversely affect birds. The Proposal should identify which bird species are likely to be resident/over wintering and whether those species be affected.

[redacted] – Certainly, that content would be straight forward to add. Species that are present: Ravens, Canada Jays, Boreal chickadees, and a couple species of wood peckers. Potential for interaction is quite low. The main difference between EFT and other well maintenance activities is the flaring stack. Potential interactions with birds are accidental collisions. That's the primary concern, but very limited potential of that happening.

[redacted] – Thanks, adding that information would be nice. With respect to Permafrost and flaring. Literature shows there is evidence that substantiates a relationship between flaring and increased surface temperature. It stands to reason flare stack height could mediate increases in surface temperature. The Proposal should provide information about the relationship between flare stack height and permafrost impacts. Flipping things around and thinking forward to other projects, have you given any thought to changes in permafrost and melting conditions over time and how that might affect the integrity of project infrastructure.

[redacted] – We retained Palmer Environmental to do some permafrost studies. They've been in the field over the past couple years. Focusing on the area of interest [i.e., area associated with the multi well exploration project]. Those studies have not quite concluded. Hoping to finish up the end of this year. Couple points to make. In the Eagle plain area, on the higher ground and to a lesser extent in the valleys, bedrock is quite close to the surface. Potential for degradation of ground stability for operations is less of a concern where there is bedrock. Where that is different in the valleys, we would want to avoid work in the valleys. However, it is hard to know where the resource is.

[redacted] – This in an important issue. Need to have more discussion and workshops on this. In order for us to get into those topics we need a cooperation agreement.

[redacted] – Our understanding, this project has nothing to do with Executive Committee project. Not sure how those comments relate.

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[redacted] – We are under Yukon orders to undertake maintenance on the wells. There is potential for wells to continue to exist after this program, they will have some application to the Exploration Program, but what that is, will be dependent on the outcomes of that program as it is carried out. Example, potential for disposal wells and fuel supply.

[redacted] – Pertaining to air quality, we appreciate the additional information. That was what we were looking for, previously there just wasn't enough info. Now, looking into caribou. We appreciate the response that the Project changes are accounted for by the conservative assessment that was already undertaken in the proposal. I.e., assuming 24 light and noise disturbance. However, that doesn't seem to account for increased intensity of disturbance. More people. More traffic. More machinery. In general. There may be no changes in frequency of disturbance, but there does seem to be changes in magnitude of disturbance.

[redacted] – I can speak to increased activity and flow tests. It is relatively low. There is a day shift and a night shift. One pick-up truck, back and forth twice a day with two testing personnel. Plus another pick-up truck for the supervisor. Other than that, there wouldn't be any other activity out there. Other than moving the test vessel in and out, that would be one tractor trailer load. A couple office trailers moved in and a little trailer for the 100-foot flare stack. The intensity of the activity is relatively low. It would be lower activity than what we would see on the abandonment and the disposal wells.

[redacted] – There would also be the wildlife monitor truck.

[redacted] – Your assessment is that this increase in disturbance is not sufficient to change the assessment valuation.

[redacted] – In the original assessment, we took precautionary large zones of influence. They would have accounted for louder and brighter disturbances than are really planned. They would have included the most extreme noises and activities levels. I'm confident that the zone of influence distances that we are using encompasses the potential effects of the extended flow testing.

[redacted] – What infrastructure would remain following closure of the project? In Section 2.5.8, it states reclamation activities will attempt to return the site to its previous conditions as much as possible. With several exceptions [listed the well sites]. However, no other info was included there. Curious to know what will remain at the sites. Will the flare stack remain?

[redacted] – As far as those sites, they would remain the same as they are now. A well will be at the site, but the flare stacks and the machinery would all be removed. They would go/return to the same physical status as they are now.

[redacted] – We know that flare stacks can leak. So there's potential for contamination, so wanted to know if they were going to be left behind. With respect to COVID and following YG guidelines, we would like to know if chance is developing its own policies in addition to those of YG?

[redacted] – Here at Vertex, we will be running the project for Chance. Vertex has developed a full comprehensive COVID 19 action plan that supplements or exceeds YG requirements.

[redacted] – Could that information make its way into the project proposal?

[redacted] – [redacted] and I can talk about that, and see what makes most sense.

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[redacted] – Given, this hasn't gone through YESAB screening yet, this project is highly unlikely to be done this winter. Likely winter 2021/2022 and vaccinations may be available.

[redacted] – That runs through the questions on the proposal.

[redacted] – I think that's everything with the few questions we have so far. Hope to have some time for a discussion, pertaining to Chances' perspective on addressing the concerns of the other parties or First Nations. What discussions have happened with chief operations officer, and Chance needing to get this proposal in by December 31?

[redacted] – We have been back and forth with YG for almost two years. Received orders in 2019 to do the maintenance work. We also have OICs to engage with First Nations and implement engagement plans. In the case of moving this forward, YG is aware of our engagement plans. Trying to live to the spirit of the engagement plans. There's been back and forth with your colleagues Jordan to get this document prepared. YG is aware we are moving this project forward. Living in a setting with COVID – that is causing more issues. YG knows where we are and that we are moving forward with the program. The pace is the pace.

[redacted] – Have they said get it in by December 31st?

[redacted] – They have strongly encouraged us to get it in.

[redacted] – North Yukon Gas Forum, YG told us they had a conversation there. About the clear mandate for us to get this application to YESAB.

[redacted] – I will have to look at my notes to see if YG actually raised that point. It's been 6 years, plenty of conversations going around. We're interested in how you've addressed meaningful participation of First Nations over the past year.

[redacted] – Not actually six years. Review period in 2014 on status of the wells. Regulator renewed/gave suspended status until 2019. Have since been engaging with YG to continue that suspension. The orders we are dealing with now are maybe 18 months old. In 2014, we got approval to continue the suspended status. Between 2014 and today, we have developed and been implementing engagement plans with the affected First Nations. We have been doing our best to implement those plans. The past year has been focusing this project.

[redacted] – That direction 18 months ago? Is that available?

[redacted] – I'm sure YG would be happy to share it.

[redacted] – We are talking with YG ADMs tomorrow and we will be sure to have that conversation with them.

[redacted] – From the perspective of YG, the four older wells need to go into operation or abandonment by December 31st of this year. Obviously, that is not going to happen. Moving forward, with YESAB process, is there any concern that the project or that Chance is out of compliance with the direction of the YG?

[redacted] – We haven't heard of anything yet, no. COVID has the most potential to impact timing. We would not be able to do this by December 31st. COVID is one issue, but also the snow pack. There are other factors that influence what you can do and when you can do it.

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[redacted] – The other thing to consider, we don't necessarily carry out many activities in December, except packing snow. We access well sites in Jan/Feb and when operating an under the land use permit. Operationally, the date/timeline that Chioma chose, it was/is a difficult time. Even without the hurdles we've had, the timeline still would have been hard to meet. The date we are going to focus on, get this into YESAB process, to get the clock ticking and get this in the public view phase. There is still an opportunity to work together. This is just the beginning. We can continue our conversation moving forward.

[redacted] – Nothing further from me.

[redacted] – Nothing further from me.

[redacted] – There might be some minor revisions to the proposal. However, for the most part, sounds like we are pretty much there.

[redacted] – I think that's accurate. Subject to the corrections/revisions mentioned today. Seems like we are there.

[redacted] – [redacted] and I will be a round to provide any additional information. Anyone on the Nature Resource Committee, if they need additional information, we are available to answer questions.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
None Identified	N/A	N/A

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APPENDIX 2-C-70. February 17, 2021, Meeting Summary - document not available at time of submission.

APPENDIX 2-C-71. October 13, 2021, Meeting Summary

OLD CROW OPEN HOUSE SUMMARY

Date: October 13, 2021

Location: Chief Zzeh Gitlitt School Gym, Old Crow

Attendees:

[See Sign-in Sheet for attendees.]

Chance Oil and Gas Limited (Chance):
[redacted], VP Government and Community Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator

Consultants:
[redacted], Hemmera:
[redacted], Hemmera
[redacted], Environmental Dynamics Inc. (EDI)
[redacted], EDI
[redacted], Peer Solutions
[redacted], Palmer

Purpose and Objectives:

The purpose of the open houses will be to share information about Chance's Eagle Plains Exploration Project (Project) and to collect feedback and concerns. More specifically, EDI, Peer Solutions, and Palmer presented information on baseline studies conducted for the Project.

Q&A Summary:

Note: The floor was open for questions throughout the presentation and afterwards.

[redacted] presented an overview of Project Components. Then [redacted] presented a high-level overview of the Yukon Environmental and Socio-economic Assessment Board (YESAB) process. Then EDI, Palmer, and Peer presented.]

Question/Comment: Clarify your role. You are from YESAB - what are you doing?

> [redacted]: We are not in YESAB and I'm not from YESAB. However, we are pulling together the application to YESAB and are in the early stages of developing the application.

Question/Comment: You've identified possible Valued Components (VC) based on past meetings. What has been heard from past meetings?

> [redacted]: Yes, we've shaped VCs from comments/concerns raised during past meetings, VCs from past assessments/projects, and using our professional expertise.

Question/Comment: When you did your baseline studies, what does that mean?

[redacted] The other consultants will provide those details in their presentations. The fieldwork for those studies was done in the project area on the map.

Question/Comment: Were those studies in that particular area [referenced outlined area on poster]?

[redacted]: Yes.

Question/Comment: In reference to the submission to YESAB, when is that due?

[redacted] Chance started this work [community engagement] a few years ago. We will be coming in November. Should be bringing Heritage in November. It is not “due”, but Chance is looking to submit at calendar year end.

Question/Comment: How could surface water be impacted. Are there going to be examples of things that will happen and what you will do?

[redacted] That is likely on our next trip, but there might be talk about that today because sometimes it’s about project design. Will touch on the project design portion today, but actual effects and mitigations will come at later meetings.

Question/Comment: My biggest concern is to let someone do what you are going to do [oil and gas development] while not protecting the area.

[redacted] We want to hear about your concerns. Discussion around that helps to frame the VCs and helps us to look at things.

Question/Comment: This is coming from an advocate for the protection of environment [land, animals, water] who was raised in the community and raised to protect lands [from oil and gas development, flaring]. People are scared and concerned, even more so today. They didn’t see the porcupine caribou herd this year. Water issues are important global issues too. There are issues with the salmon and vegetation. Land is eroding before our eyes. About our geology and terrain, how stable is that area, the project area? How stable are we today? We have people that come to our territory and do research and do research on our behalf. Informed decision making is critical for the Vuntut Gwitchin Government.

Question/Comment: Gwitchin people are fighting for calving grounds in Alaska, and your project is in the head waters and winter grounds. There is a trust issue that there could be fracking. But there is or was directional drilling? Or is it that only the moratorium on fracking that stopped Chance?

Question/Comment: Any updates on litigation?

[redacted] Not involved in legal matters. [redacted] Chance is focusing on conventional drilling, not fracking. Northern Cross wasn’t trying to hide anything, but describing all components of oil and gas. Northern Cross was owned by a Chinese company, but no longer.

Question/Comment: Does Vuntut Gwitchin Government (VGG) have veto powers? What you're saying is that, as a decision body, VGG has a final say?

[redacted]YESAB provides recommendations and YG makes decisions. However, YG consults with First Nations and that's when they can have their say and stop things.

Question/Comment: Concerns around oil in the area. There is oil in the Old Crow flats, it was always known that it is there, it has been identified.

Question/Comment: Historical context, with Northern Cross in particular. The blocks are in our traditional territory, but not R-blocks. You were under review by the Designated Office and were sent to Executive Committee because you did not have enough info. You are going to submit a new application. With respect to this, listen to elders, lots of work has been done already by Vuntut Gwitchin Government. You need to take this into account. That's why there is no trust. We have standards set in the community, standards that you are expected to meet. We need more analysis on what you found and your mitigations as well as the potential impacts to the environment. We know of the various boards that exist (caribou). This is not a standard application. There was a submission to the Designated Office, and it was sent back down to start from zero. The Yukon Oil and Gas Act requires benefits agreement which provides some decision-making power to the First Nation. There is a need to slow down because when you submit to YESAB the clock starts. There are 60-something days, and, at that time, the First Nation or community is reacting to what you've submitted or shared ahead of time. I'm concerned about the timeline. Request that you slow down and give us time to get info from you and then respond.

Question/Comment: Certainty and clarity about the future of the project. You say what your project is going to do and not do, but what certainty does the First Nation have for future events? Will there be a refinery in the Yukon? You say it will be small scale now, but nothing is holding you to that. That is where trust is an issue. What are the First Nation's tools?

Question/Comment: Who gave the permission to go there and do that work? I did not. Our elders said people would come and take things from us. We need to save the land and animals for our children.

Question/Comment: Concerning scale of the project. I've been to communities in Northern British Columbia that were told similar stories. They were smaller projects that were supposed to be small. Then they got bigger. Those areas also have seismic lines everywhere. They have no moose anymore. Old Crow is a small community, how does it/we stop this/that from happening?

Question/Comment: Is there salmon there in the area?

[redacted] salmon in the area.

Question/Comment: However, that the water flows all the way to where the salmon are.

Question/Comment: About the length of research, when did you do it and how much info was collected?

[redacted]Water was collected in summer and winters. We took a couple weeks long in both cases.

Question/Comment: About the presence of fish. Did you see fish in all the streams? Don't use 'probability' or 'predict the probability of fish', use language we understand.

[redacted] this [the language] should become clear as I walk through the slide, but this is good feedback.

Question/Comment: Do you know where the streams and rivers are? Could they be pointed out on the map?

[redacted] Yes, we have the project area and identified sample sites.

Question/Comment: Low temperatures and fish. Are there fish that can freeze and then re-animate in the spring or summer?

[redacted] No, but this is an interesting question, when you find slimy scalpin, you know there is overwintering areas nearby.

Question/Comment: Is the Chance Project Area in the caribou winter area?

[redacted] Yes, the 2016 winter area. There were years the caribou were not even in the Chance Project Area in the winter.

Question/Comment: Regarding the caribou: your caribou management plan was determined to be insufficient and impacts of the road on caribou was missing.

[redacted] Roads are an issue with any caribou. Project roads and their impacts to caribou.

Question/Comment: How will you show effects of roads on caribou and their migratory development? The communications and reporting about caribou are important.

[redacted] The environment work done is new. Understanding the effects of the road is the next step of analysis and we are working with the Porcupine Caribou Management Board. That way we can see where the road will be and effects on migrations. That will be key to the effects assessments. This has not been done yet.

Question/Comment: Will critical habitat be identified in the area? Are they are listed under Committee on the Status of Endangered Wildlife in Canada (COSEWIC)?

MS: They are not listed. Don't think that the critical habitat has been identified, or at least, nothing at this time. Calving grounds would definitely be considered critical habitat and, perhaps, some wintering grounds. If critical habitat was identified, it would be calving grounds.

Question/Comment: Are you seeing changes across the years with the caribou, water, fish, etc.?

[redacted] In the caribou over 30 years there has been some changes. Regarding fish, there is limited long-term data. Information on water goes back "a ways" with temperature - with an increase in temperature over time.

Question/Comment: It is going to take time to finish your studies. We rely on caribou as sole source of food. This is problematic with climate change and migratory changes. Hearing "little changes" form you for fish. I'm skeptical of you saying little or few changes when everything tells me there is more change. The caribou are not coming here, and we ate moose. I can't imagine 30 oil wells in the ground, and their impact on the

ground. The permafrost is melting. Concerned about the weight of the drills and wells, with the melting permafrost, causing them to sink into the ground. Glad people referenced the calving grounds in Arctic National Wildlife Refuge (ANWR), is a very real concern. We have to build a strong relationship to make good decisions. We have to build trust. We have to stand for all future generations. Caribou did not come to Old Crow this September. It scares me that there are caribou herds that are down to 3 animals. I do not want that to happen to my people or community.

Question/Comment: Question about how much wastewater would be produced by 30 wells. You're pumping wastewater underground?

> [redacted] In the reservoir, there is gas, oil, and water. That is what comes up and then that water mixture is what is put back down where it came from. Drilling chemicals are separated from the wastewater.

Question/Comment: You can fly over all the seismic sites and see the leftover damages from 50 years ago. It scarred the landscape. Predators. European Union just today have issued a banning oil and gas in the Arctic.

Question/Comment: The analysis and findings are not completed yet? So you will come back and educate us again?

> [redacted] The analysis and findings are not completed. If you have any information, it helps us. We don't want to come with complete reports.

Question/Comment: Every animal in this area we have a spiritual connection to, like a pet at home, and how much you grieve when it is gone. We live in untouched nature. We have committed to climate change (solar panels). It's not us impacting climate change versus India. Naturally connected to nature here. Those animals were who guided us, we are linked with them and had to speak to them. It's hard to articulate their importance. Talk to us and we'll tell you about that relationship.

Question/Comment: The Porcupine Caribou Technical Committee (PCTC) is made up of traditional users. It would be good to share the results of your work because the submission you are putting in will include information from all the communities.

> [redacted]We met with PCTC, and they want to see our methods section.

Question/Comment: Next, with respect to the submission process in advance of Yukon Environmental and Socio-economic Assessment Board (YESAB) submission and in advance of the clock starting. Give us time to review.

Question/Comment: Are there other ways that you are going to do consultation? There are people in the community that have traditional knowledge. How will you work with them? Mentioned a story of a family member talking about a river area, saying that what happens there, it will happen and come there, there is knowledge there to get from people.

> [redacted]COVID caused some hiccups. We had planned meetings all summer. Will share the reports. Had hoped to have a survey and go out to talk to people. We would like to do that. Chance would

like to bring people to the area/camp. We do want to do what the community wants. Everyone is on Facebook, so it is good for us to have a Facebook page or website. We want to start that.

Question/Comment: Specific question about wildlife, are you studying wolverines?

[redacted] No.

Question/Comment: Invasive species seen along the Dempster Highway are a concern. Thinking about seeds, fish, and animals, could that interfere with the food of these animals?

[redacted] Invasive species will be a component of this project, every project in the Yukon must have a plan for that. For example, vehicles get washed down. Actions like that can be done.

Question/Comment: About water sampling, is it possible to take people with you?

[redacted] Robin responded that in 2019, we did. But in 2021 it is not likely due to covid.

[redacted] We always reach out and let people know when we go.

Question/Comment: About the approach to water, how holistic is your approach, what other areas are you looking at? Caribou migrate across the landscape and water has movement, too.

[redacted] We definitely take a systems approach. For example, the designated office question about water movement, you need to look at the whole systems interaction with other disciplines.

Question/Comment: Developing oil and gas locally is better for climate change, but how is that reported and is the evidence for it quantified? Recommended that that argument be quantified with evidence and then present to the community.

Question/Comment: When you drill down into the permafrost, does it cause damage?

[redacted] The hole we drill is about 3 inches in diameter for seismic testing. Regarding wells we needed refrigerators around the well, there are aspects and ways to cool the ground around the well.

Question/Comment: Did/does the ground sink in around the drill?

[redacted] We visited older wells to look for slumping. Smaller drill holes can freeze up again. Larger well have more effects and impacts. Surface mitigation against this includes thick gravel layers under the well to provide insulation. Where we are proposing wells, very little soil on the bedrock, which reduces the subsidence. On rock, not soil and ice. Target environments are where bedrock is close to the surface.

[redacted]: Through Light Detection and Ranging (LiDAR) we are getting temperature readings which appeared consistent.

Question/Comment: Concerned about the permafrost melting. Stuff (items, animals, illnesses) previously caught and frozen in the permafrost comes to the surface.

Question/Comment: Concerned about forest fires. This is an isolated region, so forest fires are a major concern.

[redacted] Yukon Government doesn't stop fires. It monitors borders, but lets them burn. 40 to 60% of the landscape burned in that area.

Question/Comment: When drilling for the well, can shifts in the ground/permafrost break the pipe?

[redacted] The pipes are hundreds of meters in ground. Anything that happens in the surface environment is superficial and will not affect the pipe. The pipes are also supported by the gravel under the well. The pipes bend. We want to make sure that we are putting the wells where there isn't going to be movement.

Question/Comment: Suggests a two-day meeting.

[redacted] Suggested working groups.

Question/Comment: That approach doesn't work when everything is connected and if you want to or need to join all the groups.

APPENDIX 2-C-72. May 5, 2022, Meeting Summary

OLD CROW OPEN HOUSE SUMMARY

Date: May 5, 2022 – 10:00 AM - 7:00 PM

Location: New Community Hall, Old Crow

Attendees:

[See Sign-in Sheet for attendees.]

Chance Oil and Gas Limited (Chance):
Greg Charlie, VP Government and Community Relations
Cindy Dickson, Regulatory, Environmental and Community Relations Coordinator

Consultants:
Todd Mahon, Environmental Dynamics Inc.
Tim Bennett, Ecofor
Susan Eastman, Peer Solutions
Shirley McCuaig, Palmer
Jeffrey McLean, Hemmera

Purpose and Objectives:

The purpose of the open house was to share information about Chance's Eagle Plains Exploration Project (Project) and to collect feedback and concerns. More specifically, Greg Charlie opened the presentation session then Tim Bennett (TB) presented about heritage resources, Shirley McCuaig (SM) presented about permafrost, then Susan Eastman (SE) presented about seismic testing, and finally Todd Mahon (TM) presented about wildlife studies.

Q&A Summary:

The open house took place over the course of the day and posters were available for viewing and comment throughout. Below are questions from poster viewing and themes relating to those questions.

Question/Comment: How will some drilling affect the permafrost?

> SM: Drilling itself has a minimal impact on the permafrost because the drill components equilibrate to the temperature of the permafrost.

Question/Comment: Where is this project? Is the drilling on our traditional territory?

> JM: Referred the person asking the question to the poster on project location. The project area does overlap with Vuntut Gwitchin First Nation Traditional Territory.

Question/Comment: It is important to work the land and then break, then work again, and break. This is to let the land rest and keep it serene.

Question/Comment: Do you get both oil and gas?

GC: It depends on the composition of the deposit, but yes, there is potential for both oil and gas.

Question/Comment: Where and when are caribou around the project area?

TB: We have some data that I will present later in the day, and I'll go into more detail then. The short answer is that caribou ranges have a slight overlap with the project area in the late fall and winter.

Question/Comment: Concerns around outsiders interfering with caribou behaviour. Radio collaring, social media and technology in general are concerns because people are bothering the caribou.

Question/Comment: Opportunities and benefits like training and those sorts of things are important. The term of the jobs is important as well.

Question/Comment: Is this project on Vuntut Gwitchin land?

JM: Referred the person asking the question to the poster on project location. The project area does overlap with Vuntut Gwitchin First Nation Traditional Territory.

Question/Comment: Work opportunities are very important to the community, especially for the youth.

Question/Comment: Run-off water from the project operations is concerning.

Question/Comment: Air quality is important; it is important to know how the project will affect our air quality.

Question/Comment: A process flow chart that shows what stage in the process is this project at would be helpful.

Question/Comment: Would drilling cause the permafrost to thaw? A poster on the permafrost protection measures would be helpful. The casing is interesting to me too, a diagram would be helpful too.

SM: Drilling itself has a minimal impact on the permafrost because the drill components equilibrate to the temperature of the permafrost.

Beyond the questions and concerns captured above, other themes that arose during the poster session included the Project's progression through regulatory processes, training and job opportunities (location, duration of training, selection of employees), position of other affected First Nations, allocation and sale of products, and well closure.

Greg Charlie introduced the presentation sessions. The floor was open to questions during the presentation and afterwards. Tim Bennett presented about heritage resources

Question/Comment: Are the archaeology sites that have been found family sites?

TB: The sites are places where artefacts were found.

Question/Comment: What your job is to do is identify archaeology sites?

TB: Yes, that is right.

Question/Comment: Do you engage with First Nations? We have a heritage branch within the Vuntut Gwitchin Government (VGG).

TB: Yes, we submit to Yukon Heritage and they send this information along to First Nations. Then, there is a comment period. We try to bring First Nations crew along during fieldwork as well. There would be two Ecofor employees and a support role from the community as well.

Question/Comment: Have you worked with out heritage branch? Also, do you tell us when you find sites?

TB: Yes, I worked with Meghan, but we aren't at the point in the project where we are in the field scanning for heritage sites, not yet.

Question/Comment: Has the Natural Resource Committee been engaged?

Greg Charlie (GC): Last year we got a letter from Chief Dana saying to cease consultation and engagement with the VGG. But we are still needing to engage with the government, we have been sending letters with no response.

Question/Comment: Vuntut Gwitchin First Nation made it's own heritage department as we have our own regulations. Do you work under those regulations?

TB: I will try to work within that.

Question/Comment: When you identify an area, how strong is the ability to prevent disturbance?

TB: This is more difficult to follow up on, and it depends a lot on the proponent. In this case I think there is an understanding that heritage resources are important to the community and being respectful of that is important to my work.

Shirley McCuaig presented about permafrost

Question/Comment: The Dempster highway has some effects on permafrost. Will the roads that Chance uses damage permafrost?

SM: We are able to make roads that don't damage permafrost.

Question/Comment: Water is very important to the community. Keeping it safe and keeping it clean is important to the community. This area where you will do work is south of our areas. What effects are we looking at? What kind of aftermath could we expect?

SM: It is consistent heat that is damaging to permafrost. Vegetation and brush protect the permafrost by reducing some of the heat. If you remove vegetation, there is more of a chance to damage the permafrost. Mitigations are all about minimizing disturbance to the vegetation and revegetating. For example, we can re-seed damaged areas and this is very protective.

Susan Eastman presented about seismic testing

Question/Comment: Do you have the dates of the burns?

SE: Yes, we have the ones in the last fifteen years.

Question/Comment: What is in your seismic bags?

SE: Geophones that were placed by surveyors.

Question/Comment: You have the dates for seismic testing, do you have the dates for drilling?

SE: The seismic testing and drilling programs go hand in hand, but I do not have the dates for drilling. Drilling would typically happen a season after seismic testing.

Question/Comment: You mentioned something about 'hot rock.' What is that meaning?

SE: It detects multiple resources, hot rock is in reference to geothermal energy, energy within the earth.

Question/Comment: How much of the area has been seismic tested already?

SE: There is lots of 2-dimensional seismic testing data. Though I don't know exactly how much of the project area has seen seismic testing. 2-dimensional data isn't that representative in comparison the 3-dimensional data. 3D data gives you more information to work with. About 450km2 has been tested using 3D seismic.

Todd Mahon presented about wildlife

Question/Comment: How often do you see caribou in the permit area?

TM: It is difficult to tell because not many caribou in the porcupine herd have been radio collared. Of the caribou that are tagged, two out of 10 years they were tracked in the area. Incidental reports tell us that most years, if not all years, there are caribou in the area.

Question/Comment: There is project data here, and there is a porcupine caribou management plan. There is also lots of community knowledge. The correlation between the management board, the data that you have, and this community knowledge is very important.

TM: The information that I am presenting on is hot off the press. What is now important is how to use this information to maximize management of the herd. We have shared this information with the Porcupine Caribou Management Board and they are reviewing it now.

Question/Comment: How does this data relate to historical data?

TM: This data is new, although it shows similar findings to past studies.

Question/Comment: We are wondering about changing use in the last 10 years, in comparison to the previous 20 years. This caribou related data is very important to us.

Question/Comment: Thank you for the information today and please continue to keep us updated on this project and your studies.

Question/Comment: Has there been any interest in availability of jobs? And whose responsibility is it to decide who gets the jobs or which First Nations get the jobs?

> GC: Section 68 of the Yukon Oil and Gas Act requires a benefits agreements are discussed with First Nations and territorial government. In this case that includes Yukon Government, VGG and First Nation of Nacho Nyàk Dun. There has been no formal representation from VGG, since the Chief suspended communications with us. Last year we sent some letters, with no response. This open house doesn't count as consultation because VGG isn't here.

Question/Comment: Our members need work, and this work will take place for multiple years, but what will we have two years after this project is we don't become involved with the work?

Question/Comment: When our government doesn't take responsibility for showing up to meetings like this, the rules say that another government can fill in. Senior governments like the Yukon Government can fill in for Junior governments like VGG. You are on commissioners land. We agreed in our Final Agreement that there would be work on commissioners land and settlement land.

> GC: Yukon Government can sign off on some things, but we are trying to bring VGG back into discussions here.

Question/Comment: I would like to see information about how much oil and gas is down there.

Question/Comment: The project has been going for some time now, and I would like to know what the process is looking like from start to finish.

Question/Comment: All of us rely on fossil fuels in this community. We need it for the lifestyle we live and what we need is representation of members that want to work jobs.

Question/Comment: You need to share research on freshwater fish in the project areas.

Question/Comment: We have no investment; we have had no jobs either from Chance. We need to work with the opportunities that come across our territory when they do.

> GC: Chance will continue to advance with the project.

Question/Comment: Chance Oil and Gas proceeding means that caribou is critical. There has to be consultation and engagement about the caribou. It is critical that the community engage, not just VGG. It is critical because the VGG will decide on behalf of the people. It is critical that everyone is here, for example today we are missing some key knowledge keepers. This is a key part of the submission that Chance will make. Everyone has equal reason to share, if you don't share, the Minister of Environment will decide for us.

It is about co-management. We need to rally folks for the next meeting. We need to support democratic processes like this one.

Question/Comment: This project is very important for our livelihoods and our traditional territory. We can't forget that Chance will be there whether or not, so we should be there for consultation to get our voices heard. The agreement is a rolling plan and the socio-economic management plan needs lots of coordination. There could be a memorandum of understanding with the project as well, we need to see this as an opportunity.

Question/Comment: When John Eagle was chief, he followed the people. We need this now, no whispers behind closed doors. Everyone needs to be here so that we can get the shared benefits of projects on our traditional territory.

Question/Comment: This is a Yukon project, not just a Vuntut Gwitchin project. We will be competing for jobs with other First Nations, it is going to be hard. We need that training for the youth in our community and we need to be ready when the time comes.

APPENDIX 2-C-73. May 26, 2022, Meeting Summary

OLD CROW OPEN HOUSE SUMMARY

Date: May 26, 2022 – 10:00 AM - 8:00 PM

Location: New Community Hall, Old Crow

Attendees:

[See Sign-in Sheet for attendees.]

Chance Oil and Gas Limited (Chance):
[redacted], President
[redacted], Regulatory, Environmental and Community Relations Coordinator

Consultants:
[redacted], Environnemental Dynamics Inc.
[redacted], Environnemental Dynamics Inc.
[redacted], Vertex
[redacted], Hemmera
[redacted], Hemmera

Others:
[redacted] Yukon Government

Purpose and Objectives:

The purpose of the open house was to share information about Chance's Eagle Plains Exploration Project (Project) and to collect feedback and concerns. More specifically, Richard Wyman opened the session, Clive Mountford presented about drilling techniques and equipment, [redacted] (Hemmera) presented about YESAA and YESAB's new Pre-Submission Engagement Process, [redacted] (EDI) presented about linear features and disturbance, and finally [redacted] (EDI) presented about water bodies in the project area.

Q&A Summary:

The open house took place over the course of the day and posters were available for viewing and comment throughout. In the morning Chance and its consultants met with the Vuntut Gwitchin (VG) Renewable Resource Council (RRC). Below are questions from the RRC meeting, poster viewing, and evening presentations.

-----Start of RRC meeting----

RRC Attendees:
[redacted]

Question/Comment: Have you been consulting with the other First Nations like Tr'ondëk Hwëch'in (TH), Tetlit, Nacho Nyak Dun (NND) at a government level? Are they actively engaged with the company and what kind of engagement are they involved in?

[redacted] The TH and NND governments are mostly following VG's lead, meaning they are mostly unresponsive to engagement requests. There has been some communication with the TH Chief, although sporadic. There has been some limited communication with the Gwich'in Tribal Council (GTC), but ultimately limited due to Covid. The best chance of consultation seems to be with the GTC.

Question/Comment: Does the proposed project submission to YESAB include drilling in the summer?

[redacted] Yes, I believe so.

Question/Comment: As there are different concerns with drilling in the summer, I would like to know more. It would be nice to have posters up here in Old Crow, outlining where year-round access, drills, and where well locations will be so the community can look in their own time.

[redacted] We cannot say where these exact locations happen yet as it has not been determined, but we will be staying to higher land as much as possible to reduce permafrost troubles.

Question/Comment: How will the location of the first rig be determined?

[redacted] This will be determined using some historical data, but also information from seismic exploration.

Question/Comment: You mentioned high ground, but caribou go to high ground. Also, I am concerned about increased predation with increases in roads. How do mitigations work this through? I am also concerned about caribou at the headwaters and exploration activities.

Question/Comment: Will there be baseline water samples taken from all creeks before any exploration occurs to keep the company accountable in case any spills occur?

[redacted] I believe Yukon Government already holds this data.

[redacted] Yes, baseline data on water in the project area has been looked up and used while working on mitigations.

Question/Comment: A lot of concerns about this project are specifically about water and caribou. The community is concerned, and we are wondering who is going to manage everything? We don't feel that this has been outlined or shared enough with the community.

[redacted] We will work collaboratively to address these concerns.

Question/Comment: Can there be someone non-Chance to monitor. An independent non-Chance and non-government person. We would like someone completely separate to reduce any bias.

[redacted] We will have monitors on site throughout its entirety who will be contracted and paid by Chance but are a completely separate company. They will monitor wildlife sightings and would gather the data and information shared while on site with the affected First Nation(s).

Question/Comment: There is concern around companies not giving a full report on spills and concerns about projects in the area. Like what happened with the winter road. There is a high risk to water so the community concern is that all reports will be coming from Chance. It would be better to have some non-Chance reports about what is going on. There are big trust problems with the community and big companies. We need to know everything, not select information, but rather every little thing.

[redacted] We can make sure this will be done.

Question/Comment: How many spills has Chance had so far, on any project?

[redacted] If any, they have been very minor – less than one litre – none of consequence.

Question/Comment: Transparency is important, and it must be complete.

[redacted] The question you have, we don't have complete responses as it will require consultation with First Nations to create but it will come.

Question/Comment: There should already be reclamation plans outlining this (reclamation). We would like to see this in the plan. The more topics included in it, the better.

Question/Comment: This project must be worth the high cost of bringing all this equipment up here, there must be some sort of guarantee?

[redacted] There is no guarantee we will find anything; it is very high risk for us, and we are not certain of the outcome.

Question/Comment: What is the uncertainty of assessment, what kind of assessments will be done?

[redacted] Consultation with First Nations, YESAA (a federal Act), the Umbrella Final Agreement and land claims will guide the assessment. It will be Indigenous led. There might be a level of scrutiny through the Dawson Designated Office, or from Whitehorse with the Executive Committee.

Question/Comment: What happens if the consultation with VG doesn't or can't happen, will Chance bypass consultation and go ahead regardless of if the First Nation is happy and involved?

[redacted] Last March VG suspended consultation on this project. It is our duty to consult, but First Nations also have a duty to consult their citizens.

Question/Comment: Why did VG suspend consultation? I've been trying to get an answer from our Natural Resources Department, but they aren't responding to me.

[redacted] The Oil and Gas Policy initiated a VG led assessment process. The clock was ticking under Chance's exploration lands. We told VGFN this, but they said they wouldn't discuss with Chance anymore.

Question/Comment: You said you received a 10-year extension on the exploration lands, so why couldn't you finish within this timeline?

[redacted] The first bit expired in August 2021 and more will expire this August 2022. These extensions unfortunately still weren't sufficient.

Question/Comment: Policy, expiry, and dates? What happened?

Question/Comment: The NRC never came back after fully administering it, they didn't engage with the community and come back.

[redacted] It would have taken over four years to complete all of it (i.e., process under Oil and Gas Policy), so Chance asked to do it at the same time as everything else so it wouldn't expire, but VG said no.

[redacted] Explained some benefits of this project, specifically reducing dependence on imported diesel by using local natural gas.

Question/Comment: To use this oil and gas, don't you need to build a refinery for diesel before we could use it up here to reduce our carbon emissions?

[redacted] Diesel is pretty easy because you just need to heat it up and separate it.

Question/Comment: So how would we get it into that form? Something that would be a usable state for us?

[redacted] Something would need to be built, however it wouldn't be too difficult to build something to do this. A Yukon tailored refinery would not be that huge. Only creating about 12 truck loads a day or so.

Question/Comment: So fuel won't be exported anymore?

[redacted] Some might still be, but it depends on exploration and how much gas and oil is found.

Question/Comment: The main community concern is that they don't understand each process. Why is the location of the rigs not shared or not known yet. People want to be able to visualize and know how the risks will be mitigated.

Question/Comment: Last meeting someone brought up bringing community members out to site to see the project location. Where is this at, have you figured out when you will bring people? You need to engage more and get community members out on a plane to share concerns.

[redacted] With camp coming back into use, we could use this as a base camp for people and drive to 3 of the potential sites. It would be hard to see the location with a quick fly by as it would be missed in a blink of an eye.

Question/Comment: Will there be room in the chopper this summer to bring up some community members?

[redacted] Yes maybe, if someone wants to go work for a week slashing.

Question/Comment: Could you post it? It would be nice to make this available to community members.

[redacted] This information has already been shared with VG.

[redacted] Site visits are harder when the project location is not in operation and there are no trails yet.

Question/Comment: Why wouldn't the Executive Committee start in June as planned?

[redacted] The Pre-Submission Engagement Process is starting June 1st, which allows for more engagement and participation in developing the project proposal.

Question/Comment: How will VG communicate with YESAB if they shut down communication? How will it go ahead if not a lot of consultation?

[redacted] The Executive Committee will determine what happens, not Chance.

Question/Comment: Can Chance bypass First Nation consultation?

[redacted] Theoretically. In the past if the First Nations haven't been engaged, some projects have gone ahead. The Executive Committee may reach out to First Nations specifically, but this process includes locals and First Nation involvement.

Question/Comment: The community would like to see baseline data and to have this expertise on site. Would be nice to have a heritage person on site for the whole process. The biggest concerns with this project are water, reclamation, and heritage.

Question/Comment: It would be nice to have the full project description, not just the pre-description of the project.

[redacted] The pre-description is to be submitted in June

Question/Comment: It would be nice to have the full project description to have a meaningful conversation.

Question/Comment: What has Chance done for engagement so far? What sort of avenues have been pursued?

[redacted] We have mostly engaged with VG as the project has the biggest exposure to VG land. We have had Open House engagement with citizens, but the VG government decided not to engage. Also, important to note that the project description is only a draft because as comments are received, the project can be changed and edited.

[redacted] The project description is missing access roads information as they are still being explored right now. It is not complete yet.

Question/Comment: It would be nice to provide information at meetings as not everyone has internet or printers. It would be great if you could print off all the documents you are referring to. Bring it all for people.

[redacted] I will give you my card so that I can supply you with the studies. VG also was involved in these studies so they should have easy access to the information you are seeking.

Question/Comment: Will you engage the Yukon public, in Whitehorse with the YESAB process?

[redacted] Yes, we will specifically engage with Whitehorse, Dawson, Inuvik, and Fort McPherson.

Question/Comment: Tsiigehtchic?

[redacted] Yes, all over there we will engage.

Question/Comment: It would be nice to see exploration go way above industry standards for environmental concerns with oil and gas. Show how you are going above and beyond, and show the people because it will go a long way.

Question/Comment: Why is VG working with you for some departments like Heritage, but not all departments?

[redacted] I can't answer that I am not sure.

Question/Comment: Not everyone likes the public engagement forums. Over avenues of engagement and consultation would be good. Some ideas would be letting people know of online surveys, send a small package to mailboxes, allow for more private consultation, especially as it is hard for people to comment now with Covid issues and with leadership issues. Use local radio stations to involve people and do some interviews ([redacted] would be a good contact). Hire someone to interview people one on one in the community about this project. The youth could be hired to help with this.

[redacted] Thinks VG needs some approval to do this. Unclear, perhaps only if the interviews are being recorded. Regardless, the application is available online.

Question/Comment: [redacted] has a public computer and can send reports to her and help people access the site for comment submission. VG took away the public computer so there is only one at the RRC for the entire community now.

-----end of RRC meeting----

Beyond the questions and concerns captured above, other themes that arose during the poster session included the Project's progression through regulatory processes and consultation with VGFN, concerns about the project continuing without sufficient consultation, training and job opportunities, site visits for VGFN citizens), position of other affected First Nations, and specifics around rig location.

[redacted] *opened the presentation session describing the project at a very broad level while introducing the presentation sessions. Then* [redacted] *presented about drilling techniques and equipment,* [redacted] *(Hemmera) presented about YESAA and YESAB's new Pre-Submission Engagement Process, then* [redacted] *(EDI) presented about linear features and disturbance, and finally Mike Setterington (EDI) presented about water bodies in the project area. The floor was open to questions during the presentation and afterwards.* [redacted] *presented about heritage resources.*

Question/Comment: Has Chance run the numbers on how much this project will help reduce carbon emissions?

[redacted] No, however it will depend on many aspects. May lower the footprint more globally, but will reduce supply chain lines that are currently used for fuel and oil.

Question/Comment: Tapping gas is anticipated?

[redacted] Yes, we will capture any gas, fuel, oil, anything we possibly can.

Question/Comment: Should Old Crow comment submissions go through Chance or YESAB (*specifically asking for the comments with support for the project)*

[redacted] Chance is open to comments from residents of Old Crow and also a requirement to continue consultation and engagement with the First Nations and public. You can comment directly with Chance and/or through the YESAB public comment stage.

[redacted] We (Chance) need input from the community, so it (the Plan/Proposal) is developed with the local knowledge in the community. Feedback throughout all stages is important.

--[redacted] *presenting---*

Question/Comment: What type of training do I need to be a part of the emergency response team?

[redacted] There will be plenty of opportunities for employment, not necessarily emergency response stuff. Some of the key training areas are H2S Alive, WHMIS, First Aid, and some short Emergency Response course (like spill response/reclamation training).

[redacted] The Emergency Response Plan has many features to it and each area of activity would be responsible for addressing emergencies in their areas. Also, engagement and communication with other emergency personnel is involved. There will be a safety meeting on every shift, daily, or bi-daily with your crew.

[redacted] Blowout Preventer (BOP) drills are where we pretend there has been a release of gas or oil and act accordingly. Also, on my crews, I do a man down drill once a month. These types of drills and practice will likely be implemented.

[redacted] *presenting---*

Question/Comment: What's the density of proposed cut lines?

[redacted] I haven't calculated it yet, but likely twice the density that we see now.

Question/Comment: Will they be 2D lines or 3D?

[redacted] Both 3D and 2D will be used. It's a bit loose in the planning as we are still learning and figuring out stuff. It's a learning curve with each project going on and a lot of learning as we learn more about the geology in the area.

Question/Comment: If it goes into production, how would you monitor all impacts on the list and how often would these studies take place?

[redacted] Currently moving into creating monitoring plans. Hard to give specifics yet beyond these surveys in regards to environmental issues. Monitors will be on site to address the unknowns during project activities.

[redacted] This would be a good conversation to have with affected First Nations to determine the monitoring plans.

Question/Comment: It's important to have ongoing monitoring to determine if things need to stop or be changed.

Question/Comment: Monitoring of linear disturbance use was done in 2020 of March. Why wasn't it done at a different time, was there a reason for the March timing?

Question/Comment: This could have been a data gap if you only surveyed once. You didn't capture use during different times.

[redacted] We try to replicate exactly what's going on, but all studies are limited by logistics and budget. Every study is a snapshot in time.

[redacted] *presenting---*

Question/Comment: Is that [[redacted] *shared about how many little streams and pools there are in the study area.*] the same water you will be using for drilling operation?

[redacted]: No, the water for drilling needs to have flow. In the winter we will use the Eagle or Ogilvie Rivers because these other streams in the area will almost all freeze overwinter. Also drilling operations will have a very large setback from any waterbodies, flowing water as high ground is better from a permafrost point of view.

-----end of Presentations and Q&A----

APPENDIX 2-C-74. January 26, 2023, Meeting Summary

Eagle Plains Exploration Project – Reintroduction Meeting Minutes

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January 26, 2023

Project No.: 323

DRAFT

Prepared For

Chance Oil and Gas Limited
Vuntut Gwitchin First Nation
Gwitchin Tribal Council
First Nation Na-Cho Nyäk Dun

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Document details

Project Name	Eagle Plains Exploration Project
Document Title	Draft Reintroduction Meeting Minutes
Project No.	323
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1. Reintroduction Meeting Details

Table 1 below outlines details of the Reintroduction Meeting.

Table 1: Reintroduction Meeting Details

Topic	Action Description
Date	• January 26, 2023
Time	• 2:00 pm – 5:00 pm
Location	• Fairmont Waterfront, 900 Canada Pl, Vancouver, British Columbia V6C 3L5

Attendees	• Chance Oil and Gas Limited (Chance)
	  • [redacted] (Chairman and CEO)
	  • [redacted] (President)
	  • [redacted] (Regulatory, Environmental and Community Relations Coordinator)
	  • [redacted] (Vice President, joined by telephone)
	• First Nation Na-Cho Nyäk Dun (NND)
	  • Chief [redacted]
	  • [redacted] Implementation & Governance Manager
	• Gwitchin Tribal Council (GTC)
	  • Grand Chief [redacted]
	  • President [redacted], Tetlit Gwitchin Designated Gwitchin Organization
	  • [redacted], External Consultant, Lands and Resources Department, GTC
	  • [redacted]., Gwitchin Development Corporation Chief Executive Officer (CEO)
	  • [redacted], Executive Assistant, GTC
	• Two Worlds Consulting
	  • [redacted] (Facilitator Support)
	  • [redacted] (Facilitator)
	• Vuntut Gwitchin First Nation (VGFN)
	  • Chief [redacted]
	  • [redacted], Intergovernmental Relations Coordinator
	  • [redacted], Executive Director

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2. Reintroduction Meeting Discussion

Chief [redacted] led a welcome prayer.

[redacted] provided a safety share and initiated introductions. [redacted] shared that he is based out of Yellowknife and looks forward to learning and listening from everyone during the meeting. Grand Chief [redacted] said he has been in his role for 2.5 years and noted he has been involved in the mining industry for many years. Grand Chief [redacted] shared how his ancestors followed caribou in the Eagle Plains area. He noted the importance of this area to his people today. Grand Chief [redacted] added that he is interested in understanding more about the Eagle Plains Exploration Project (the Project) and Chance Oil and Gas Limited's (Chance) next steps [redacted] was born and raised in Inuvik and often drives through the Eagle Plains area. She noted interest in learning more about the objectives of today's meeting. Richard said he was born in Treaty Seven Territory and is the founding shareholder of Chance (previously known as Northern Cross (Yukon) Limited) [redacted] shared that the name Chance is taken from the Chance sandstone in the Eagle Plain sedimentary basin where oil was first discovered in Yukon in 1959 [redacted] thanked everyone for joining the meeting and said he looked forward to establishing a collaborative, constructive, and respectful relationship with all the participating First Nations. Willard noted he is a Gwitchin citizen born in Tetlit Territory. [redacted] is currently an Advisor for the Lands and Resources Department at Gwitchin Tribal Council (GTC). [redacted] expressed interest in learning more about the Project and shared he had been in his role for 13 months [redacted] said she is a Yukon Gwitchin member who was raised by her grandfather. She has been with Chance for 10 years and is based in Whitehorse, Yukon. [redacted] shared that he is Red River Métis and the Executive Director of the Vuntut Gwitchin First Nation (VGFN). Chief [redacted] was born and raised in Old Crow and noted a background in oil and gas, self-government agreements, land protection and management, and early negotiations. Chief [redacted] said she was previously the Minister of Environment and had extensive experience dealing with oil and gas licensing and permitting. Chief [redacted] also shared that her intention at today's meeting was to listen and create an open dialogue around intentions [redacted] introduced herself and noted she is the Intergovernmental Relations Coordinator for VGFN. Chief [redacted] introduced himself. [redacted] introduced himself and welcomed everyone to the meeting.

[redacted] reviewed the agenda and asked everyone to share proposed changes or suggestions.

[redacted] noted [redacted] from Chance had joined the meeting via speaker phone.

Chief [redacted] said the proposed agenda topics are not where they need to be. Chief [redacted] shared that the Indigenous Nation attendees had intricate technical knowledge of the Project area. Chief [redacted] noted the Indigenous leaders at today's meeting had an internal briefing prior to this meeting. Chief [redacted] asked [redacted] what her role was during the meeting and if Two Worlds Consulting (TWC) was participating in the Project's Impact Benefit Agreement (IBA) process. [redacted] said TWC is not supporting the Project's IBA process and was recently hired to support the Project's engagement scope of work including meeting facilitation and notetaking. [redacted] added that TWC staff were happy to step out at any time if discussions related to the IBA process

were going to take place. Chief [redacted] noted that Grand Chief [redacted] opening comments highlighted the importance of the Project area to all northern Indigenous Nations. She added that the Project's existing IBAs are maturing, and further discussions related to IBAs will be required.

Chief [redacted] shared community concerns for wells that exist on the Project site and the Yukon's definition of employment and income opportunities in the *Yukon Oil and Gas Act*. Other Project-related concerns shared by Chief [redacted] included impacts to the environment, Treaty and Aboriginal Rights, extent of engagement, how Chance plans to engage going forward, permits with First Nation Na-Cho Nyäk Dun (NND), the vision to push north, the removal of 5 northern permits with respect to hydraulic and conventional methodologies, land, water, fish, and caribou protections, and the Executive Committee stage. Chief [redacted] also noted there are outstanding engagement protocols to establish to sustainably build integrity and trust with Elders and communities. She expressed interest in understanding potential request for land use permits to potentially develop or maintain existing lands including and involvement in related discussions. Chief [redacted] noted the importance of re-establishing relationships with all northern Indigenous Nations and acknowledged the history that exists between meeting attendees. Added that the Project area is used by all northern Indigenous Nations and looks forward to having collective conversations going forward to establish new opportunities and protect their inherent rights. Chief Frost [redacted] Chance to clarify their engagement approach going forward (e.g., when do they want to meet, what information is needed etc.). Chief [redacted] said ethical and responsible partnerships that respect people, and the environment are the foundation to how the northern Indigenous Nations govern themselves. They have lived off the land for generations and Chance will need to communicate differently with their people going forward. Acknowledged that trust and integrity is currently lacking at the community-level. Chief [redacted] said her role as Chief is the voice of the people, to deliver messages on behalf of the people to Chance and advance how Chance can move forward in a respectful manner. Chief [redacted] noted Chance had not signed previous agreements with the northern Indigenous Nations. Stated they are not closed for business but are interested in sustainable opportunities rooted in the laws of the land and that is the laws of the people. Chief [redacted] looked forward to identifying priorities to move this process forward.

[redacted] thanked Chief [redacted] for her comments and said Chance is exploring for natural gas and oil resources in the Project area using permits that have already been awarded. He said Chance is looking to understand how each northern Indigenous Nation wishes to be engaged and the best way to share information. [redacted] said Chance is open to economic and environmental stewardship partnerships. He shared that Chance is proposing to conduct smaller-scale exploration activities over a longer period of time to minimize potential environmental impacts and maximize potential Project-related benefits. [redacted] shared that Yukon Government has mandated Chance to conduct further investigations of existing suspended wells dating back to the 1950s/1960s. He said hydrocarbons have been discovered in some suspended wells. Richard noted Chance hired consultants such as EDI, Palmer, and Ausenco (previously Hemmera) to assess potential Project-related effects to the Eagle Plains Basin and support Chance's Environmental Assessment Application to the Yukon Environmental Socio-economic Assessment Board (YESAB). Richard noted Chance has a lot of information to share with the northern Indigenous Nations and would like to further engage each Indigenous Nation to better understand issues that should be addressed through mitigation and/or prevention measures. He added there are up to 30 new exploration wells to be drilled, up to 1,500 square kilometres of

new 3-D seismic data acquisition and up to 2,000 kms of new 2-D seismic data acquisition. Drilling results will determine long-term natural gas/oil extraction within the existing exploration permit areas. [redacted] added that the exploration activities would take place during the winter seasons over an 8–10-year period depending on results as the program unfolds. The exact drilling locations have not yet been determined. [redacted] noted that no hydraulic fracking would take place because the anticipated drilling will evaluate resource potential in geological formations that are not expected to need hydraulic fracturing. He said the camp is located at KM 325 on Dempster Highway and can accommodate around 75 people [redacted] added that the drilling program will occur sequentially rather than all at once. He also shared that natural gas/oil resources from the Project would support local energy security, economic independence, economic diversification, and a reduction of cumulative greenhouse gas (GHG) emissions by transporting fuel over shorter distances.

[redacted] added he had been involved in the Eagle Plains since 1959 and noted the landscape is unique compared to other northern landscapes because there are no lakes, the terrain supports exploration/extraction equipment, and it will be easier to build roads without significantly damaging the environment.

Grand Chief [redacted] noted that he was recording the meeting for GTC's internal minute keeping and requested permission from all meeting attendees. All meeting attendees agreed to the recording. Grand Chief [redacted] said he struggled with the open-ended agenda and thought it was paternalistic. Expressed interest in more structured agendas to avoid wasting anyone's time and to supporting things moving forward. Grand Chief [redacted] said meetings were had with Chance during the COVID-19 pandemic. He suggested a certain level of transparency, respect, and integrity was required to move forward. Grand Chief [redacted] noted he expects transparency, respect, and integrity from anyone working within their Traditional Territory and said there is water under the bridge in terms of this Project.

[redacted] asked Grand Chief [redacted] if the agenda felt vague. Grand Chief [redacted] responded that the agenda felt a bit vague and shared that GTC agendas included an opening prayer, introduction, meeting content, action items, and next steps. Noted members will quickly share if too much was included in the meeting agenda. Grand Chief [redacted] said he had previously heard what [redacted] shared and preferred meetings with a presentation / opportunity to review maps/leases to understand what is being discussed. Grand Chief [redacted] noted GTC represents four Gwitchin councils, and Chance maps reference one of these councils. Grand Chief [redacted] added that the GTC expects Chance to engage all Gwitchin communities/Indian Band Act councils. Noted GTC will support bringing together the right group of people and expressed interest in visiting the Project's camp. Grand Chief [redacted] shared that the Project is in an area where Gwitchin people harvest caribou. Noted compensation should be the last topic of discussion, and instead discussions should be focused on the management of the land, water, resources, environment, and air. Grand Chief [redacted] suggested Chance simplify future meeting agendas and appreciated the effort to move forward together.

[redacted] said she heard there is an interest in building trust and integrity as well as understanding of historic use in and around the Project. She summarized that historic wells and current and future permitting, involving Elders, inherent rights, employment and economic opportunities, respectful and collaborative relationships, community level engagement timelines, and the

protection of land, water, and air resources are important topics to be discussed at future meetings. Erin asked meeting attendees if she heard them correctly. Grand Chief [redacted] added that the key values mentioned were respect, transparency, accountability, and integrity.

Chief [redacted] shared that it is unfortunate how things have gotten to this point and acknowledged the historical relationship between Chance and northern Indigenous Nations. He noted that he was one of four NND Chiefs to go through this process and felt like little had been accomplished to date. He suggested the northern Indigenous Nations wanted to get to work for their children and future generations. Noted the importance of getting right down to the basic facts. Chief [redacted] added that they need to keep a sharp eye on the issue from a political point of view and bring in politicians as needed and move quickly back to the technical folks. He said it is time to put the politics to the side. Shared the politicians are like the star at the top of a Christmas tree and will let information filter down. Chief [redacted] noted the discussions with Chance had been ongoing over the past 12 years. Emphasized the importance of straightening the politics and focusing on arrangements. Chief [redacted] suggested everyone move forward without going back over the past 12 years of deliberations. Noted NND has not had a large role in the Project to date and that the northern Indigenous Nations will charge hell with a snowball together. Thanked everyone for the opportunity to speak.

[redacted] asked if there was anything else that anyone wanted to add to the discussion. Chief [redacted] reflected on the process and the Project. Noted [redacted] had been involved in the region for a long time. Chief [redacted] said her people are fighting for refuge and noted pristine areas and it's significant to use as the refuges. Chief [redacted] said the previous Project application triggered an Executive Committee review and could not determine if there were any adverse effects to the Porcupine caribou herd because of proposed development in the region. She shared the importance of being more confident in numbers and determinations in the YESAB consultation and engagement process. Chief [redacted] expressed concern for the YESAB process. Specifically, caribou, environment, climate change, assessment planning, monitoring and evaluation, triggers for stopping and advancing work, inherent rights, and the full scope/development of the Project. Expressed interest in a broader agreement with Chance to set the bar higher than the *Yukon Oil and Gas Act* and influence Project triggers and remedies to consider environmental vulnerabilities (e.g., halting project operations). Chief [redacted] acknowledged how fragile the environment is currently, especially around climate change and the pressure of resource development. Added that the northern Indigenous Nations want to participate collaboratively in the Project to ensure it is well managed and not going to create long-term environmental degradation. Suggested this approach will create a degree of control for the Gwitchin people which is important for quantifying significant adverse impacts. Noted the significance of assessment, data, management, and planning work. Chief [redacted] said the northern Indigenous Nations will share their interests/concerns with Chance and will stop the process from advancing if it does consider local Indigenous Knowledge. Noted the importance of listening to Elders and their teachings to inform Project management, planning, and decision-making. Chief [redacted] added the importance of upholding sustainability objectives and expects Chance to work more responsibly.

[redacted] shared interest in having a full dialogue on issues, concerns, and values with the northern Indigenous Nations. Noted the Project's intention is to minimize impacts and hopefully create benefits too. Acknowledged that this exchange is required. [redacted] said he felt like Chance was previously delivering information in a one-way direction and hopes to have more of

[redacted] TWC kindly requests Chief [redacted] review and clarify this sentence to make sure it adequately captures what was being shared.

an exchange. Noted Chance is unable to react without feedback and looks forward to doing whatever it takes to address the concerns identified by the northern Indigenous Nations.

Grand Chief [redacted] acknowledged Gwitchin Treaty rights to harvest, including the rights to access to support their harvesting. Noted these rights come with the responsibility to legally and spiritually be stewards of their Traditional Territory. Shared a story about the late Elder [redacted], who travelled by dogsled in the 1960s in and around the Peel River area. Grand Chief [redacted] said the late Elder [redacted] saw smoke and assumed it was a camp. As he approached the smoke, he realized it was a drill rig. This was a troubling experience because late Elder [redacted] did not know who these people were or what they were doing on the land. This experience laid the groundwork for Gwitchin people to form the Gwitchin Comprehensive Land Claim Agreement (GCLCA) to prevent future incidents like this in their Traditional Territory. Grand Chief [redacted] explained the GCLCA was signed in 1991 and this agreement set a principle that non-Indigenous people, businesses, government, or elected agencies were not able to do anything in our Traditional Territory without speaking with the original inhabitants of the land. Noted this includes having the right to say no and share standards around what they are willing to allow. Grand Chief [redacted] shared porcupine caribou is the main concern for GTC as well as impacts to water, air, and the overall ecosystem (which is very fragile). Grand Chief [redacted] said he was not a fan of the term 'traditional knowledge' because it refers to the past, and Gwitchin Knowledge is current. He noted Gwitchin Knowledge Studies help Gwitchin people develop a record of their knowledge for community use purposes and stated the importance of respecting the intellectual property of such information. Expressed interest in advancing discussions around historic and current use of the land and impacts to Treaty rights and access. Grand Chief [redacted] shared that the Gwitchin standard is high for a good a reason.

[redacted] asked Chief [redacted] what collaboration looks like to her community. Chief [redacted] responded that she is at today's meeting to share the perspectives of her community and the standards they are trying to uphold. Noted these standards were established through their laws and agreements. Chief [redacted] said Chance had heard community feedback for over 20 years. Noted the northern Indigenous Nations are not interested in discussing only monetary compensation or relationships. They want to protect the land, water, air, and caribou. Chief [redacted] said there are outstanding questions to be answered around water, hydrology, and the assessment of oil and gas. These conversations will also include the Yukon Government. Chief [redacted] confirmed she had shared how her community would like to see this process move forward and preferred not to speak to her personal feelings. Chief [redacted] asked [redacted] to clarify what he meant by one-way conversation and lacking information. She said this comment was unclear because there is an established process through YESAB to obtain information. Requested further clarification from Chance. [redacted] said Chance has hired consultants to support their assessment and the Project has an interest from learning from the First Nations. [redacted] said he hears about Section 35 rights and mentioned he is looking to understand what those rights are and how the Project could potentially infringe on those rights. [redacted] added that the Chance had conducted baseline studies and offered to provide this information with the First Nations. Expressed interest in receiving First Nation feedback on what Chance has learned to help guide how they develop and manage the Project until conclusion. [redacted] said Chance is trying to develop a pathway to support conversations that will take place under a cooperation agreement including a terms-of-reference. He noted that previously this process did not go far and explained Chance is following this process because it was how mining companies in the Yukon

had moved forward their proposed projects. [redacted] asked the group to confirm if there is a different way of doing it.

Grand Chief [redacted] said he was surprised by the comment [redacted] made about not understanding legal rights. He said the courts look at collaborative agreements and IBAs to clarify the muddy waters. Grand Chief [redacted] said their rights have evolved over the last 30 years. Stated each Indigenous Nation has the inherent right to self-government in their Traditional Territories. Grand Chief [redacted] said if they seem sensitive it is because Chance is looking to occupy a part of their Traditional Territory and as a sovereign nation, they must review that. Noted it would take another 20 years to get an idea of rights. Grand Chief [redacted] expressed interest in clearly understanding timelines to convey this information back to the community level. Noted the Chiefs are spokespeople that have a responsibility to explain to their people what is being proposed. He said the support of Gwitchin will not be possible if he is unable to explain the Project to his people. Grand Chief [redacted] said he used to this type of back-and-forth dialogue. Noted there is often a desire to hold your cards close to your chest for fear of liability. He suggested Chance create frank and open discussions because that is what matters to the Gwitchin people. Shared that some people in the community may be upset around work being conducted in this area. Grand Chief [redacted] asked Chance if they will stop operations if the caribou migrate to the Project area. He explained that is the baseline of what Gwitchin people will expect and the community will also be interested in understanding what Chance is doing in the area to protect caribou and other species. Grand Chief [redacted] acknowledged some effort had been made to protect caribou. As a leader, Grand Chief [redacted] said he needs to be able to answer these questions from the community.

[redacted] said Chance loves feedback and had information to share. Noted Chance is looking to better understand how the northern Indigenous Nations would like to be engaged and how Chance should proceed after today.

Meeting attendees took a break between 3:50 pm – 4:05 pm.

[redacted] said Chief [redacted] wants the whole life cycle of Eagle Plains examined, and it is difficult for Chance because the Project is currently exploratory and does not go beyond that. Shared that the Project will determine if there is anything worth pursuing. If there something worth pursuing is found, then that is a better time to establish economic partnerships since the nature of the resource to be developed will be better understood [redacted] noted that Chief [redacted] understands this process because of the Victoria Gold project. [redacted] reiterated that the proposed Project is the first stage involving 30 wells to get an idea around what resources are available in the Eagle Plains for everyone. He added that pipelines and other works required after exploration will be considered later. [redacted] said Chance is willing to risk their money and assume that it might not work out, but they really hope that it will. Suggested the northern Indigenous Nations may regret getting into something now if it turns out differently because at this stage there is not enough information to move on. [redacted] said the northern Indigenous Nations can evaluate how the Project goes including how the terrain is treated and improvements needed to protect the environment better. [redacted] said Chance is focused on this first stage (exploration). He said that is hoping the northern Indigenous Nations will help Chance with that. Noted exploration is high risk in terms of very uncertain outcomes related to resource determination and they will not want to participate in that. Suggested involvement beyond exploration will be different, including a payoff for all the northern Indigenous Nations.

[redacted] said the exploration phase will create opportunities for businesses and these opportunities will continue even expand into development if the project proceeds beyond exploration.

Grand Chief [redacted] respectfully said they are not interested in any kind of payoff and said that [redacted] comment about payoff was offensive. [redacted] responded that he meant there would be an opportunity to be a full partner in the Project. Grand Chief [redacted] said they have different expectations and are interested in being full partners now. Expressed interest in understanding the nature of the operation and how and understood the long period of time between initial investment. Grand Chief [redacted] shared GTC experienced the false prospect of the Mackenzie Valley Pipeline. Shared that he felt the discussion was not getting anywhere productive and suggested Yukon Government attend the next meeting. Grand Chief [redacted] requested the meeting conclude. Chief [redacted] and Chief [redacted] agreed with Grand Chief [redacted] request to stop the meeting. Chief [redacted] added that they had addressed the major points and want further deliberation with Yukon Government present. Chief [redacted] added that the northern Indigenous Nations have an obligation to the Yukon Environmental and Socioeconomic Assessment Board (YESAB) as well and will take this time to reflect. Noted the importance of fully understanding what is involved in exploration, including the end product. Chief [redacted] said they want to know they did everything possible to protect the environment. Stated the Charter is intrinsic to everything they do. It is founded on Gwitchin ways. Chief [redacted] thanked everyone for making space for this conversation to happen and shared her appreciation.

[redacted] thanked everyone and said Chance would work on pulling together a summary of engagement topics and associated timelines. Noted the clock is ticking on land tenures. Chief [redacted] confirmed their awareness of the clock ticking and suggested the northern Indigenous Nations will get back to Chance with their perspectives [redacted] added that [redacted] booked accommodation in Old Crow in March at Porcupine Camp. Expressed that finding accommodation in Old Crow is a challenge.

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3. Reintroduction Meeting Action Items & Next Steps

Table 2 below details action items and next steps identified during the Reintroduction Meeting.

Table 2: Reintroduction Meeting Action Items & Next Steps

Topic	Action Description	Responsible	Estimated Date
Meeting Minutes	• Review and provide comment on Draft Reintroduction Meeting Minutes with Two Worlds Consulting.	All	February 20, 2023
Meeting Minutes	• Incorporate meeting attendees' feedback on the Draft Reintroduction Meeting Minutes and share a finalized version of the minutes with all attendees for their records.	Two Worlds Consulting	March 1, 2023 (or approximately 2 weeks after receiving feedback from meeting participants)
Meeting Agendas	• Create simplified agendas for future meetings.	Chance	Ongoing
Meeting Format	• Utilize visual aids such as presentation slides and maps during future meetings.	Chance	Ongoing
Next Steps	• Share perspectives with Chance.	GTC, NND, VGFN	TBC

APPENDIX 2-C-75. August 4, 2023, Meeting Summary

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Meeting Minutes

Subject	Project Overview Meeting
Prepared By	Two Worlds Consulting (TWC)
Groups Involved	Chance Oil and Gas Limited (Chance) Environmental Dynamics Inc. (EDI) TWC Vuntut Gwitchin First Nation (VGFN)
Participants	[redacted] Regulatory, Environmental and Community Relations Coordinator (Chance) [redacted], VP Government and Communication Relations (Chance) [redacted], Regulatory Lead (EDI) [redacted], Senior Fisheries Biologist (EDI) [redacted], Engagement Facilitator (TWC) [redacted], Technical Advisor (VGFN)
Date/Time	August 4, 2023 8:30 AM – 9:30 AM PST
Copies to	Chance and VGFN

Purpose of Meeting

- Chance provided an Eagle Plains Exploration Project (Project) overview to John.

Topics Discussed

- Chance overview
- Project overview including information on exploration, design changes, baseline studies, regulatory process, schedule, engagement, proposed next steps

Key Issues Raised / Chance Responses to Issues

- Interested in which consultants completed Chance's caribou work to support VGFN determine who they engage as a consultant to review Project information related to caribou.
    - [redacted] confirmed [redacted] at EDI led the caribou work.
- Expressed permafrost, caribou, and water are key issues.
    - Chance confirmed these topics would be included in the draft Project Proposal and Chance is open to discussing these topics with VGFN.
- Expressed interest in YESAB, Yukon Government, and Chance meeting to make sure that there is a common understanding of consultation next steps.
    - Chance confirmed interest in understanding YESAB and Yukon Government consultation next steps. Noted they would continue to try and meet YESAB and Yukon Government to confirm the common understanding of consultation next steps with First Nations.
- Inquired about the Eagle Plains Exploration Project's (Project) approach to cumulative effects.
    - [redacted] said they did a linear features assessment to assess regrowth of linear features. Staff walked seismic lines to assess line of sight and monitored wildlife. This

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information will feed into cumulative effects for the Project. Pat added there is no other development in the area except the Dempster Highway.

Actions and Responsible Party

- Chance to send meeting actions and requested information to [redacted] – complete.
- Chance to send a plain language definition of 2D and 3D seismic to [redacted] – complete.
- Chance to inquire about well abandonment service providers (i.e., future availability and anticipated service fees in the future) – in progress.
- EDI to forward August 23, 2023 virtual meeting invite with YESAB to [redacted] – complete.
- [redacted] to discuss information requests detailed in the email from [redacted] on September 5, 2023 with leadership and share feedback with Chance – in progress.

Details of Discussion

- [redacted] led a round of introductions.
- [redacted] said he is working for VGFN on energy files.
- [redacted] introduced the Project and reviewed background information. [redacted] said Chance wants to be part of the Yukon energy strategy by providing oil and natural gas to Yukoners and businesses in the territory. [redacted] said he spoke with [redacted] regarding royalty opportunities.
- [redacted] discussed the First Nation Traditional Territories that overlap with the Project area. He said Chance wants to make sure all potentially affected First Nations are informed of the proposed Project.
- [redacted] noted the Project overlaps with the North Yukon Planning Region (NYPR) and Peel Watershed Planning Region (PWPR). Specifically, land use management zone 4 (LMU 4).
- [redacted] shared Chance has been undergoing a Yukon Environmental Socio-economic Assessment Board (YESAB) assessment since 2014. He has been working with Chance for over nine years. Greg said the Dawson City Designated Office referred the Project to the Executive Committee of YESAB in 2016.
- [redacted] said some VGFN Citizens are very familiar with the Project and ask why Chance continues to keep talking about the Project. He added that these VGFN Citizens have said to [redacted] and [redacted] that a decision on the Project should be made. [redacted] said some VGFN Citizens have expressed interest in understanding the end-use products if the oil and gas resources from Eagle Plains are eventually extracted.
- [redacted] expressed Chance's interest in building a new path forward with First Nations. He noted the importance of reclamation and closure.
- Chance played the draft Project video.
- [redacted] shared that Chance is hoping to build a longer airstrip to accommodate crew change, movement of supplies, and medical evacuation (if required). He added that a smaller remote camp that can accommodate up to 25 people will be utilized for drilling and seismic activities.

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- [redacted] reviewed how the current Project is different than the previously proposed project. Specifically, how Chance is looking to rebuild relationships and collaborate with First Nations, use low impact seismic, complete drilling activities only during the winter season, utilize the existing Project footprint and networks, spread activities across 10 years to minimize annual impacts and support steady employment, and use winter ice roads versus all season roads.
- [redacted] asked if Chance is talking to the territorial government.
- [redacted] said Chance is talking to Yukon Energy. He said Yukon Energy recognizes that they are putting in more diesel generated electric power in the Faro area (approximately 24 megawatts of diesel this winter). [redacted] said Chance has also had meetings with proponents for the Casino and Coffee Gold projects. He said these projects will require more energy than what is available in the Yukon. [redacted] said Yukon has an isolated grid and potential end-use products from the Project could create royalties to support energy development.
- [redacted] asked [redacted] if Chance had retained Keith Halliday.
- [redacted] confirmed Chance had not retained [redacted]. He shared that [redacted] suggested Chance conduct economic analysis to understand mining royalties and how end-use products from the Project could penetrate the Yukon market. Greg said 70% of hydrocarbons in the Yukon are from the United States, mostly diesel for heating purposes.
- [redacted] said he is looking for folks to review Project documents on behalf of VGFN and wanted to know who Chance had engaged.
- [redacted] expressed interest in meeting with potentially affected First Nations on topics of most interested (e.g., porcupine caribou herd, fish, permafrost, etc.).
- [redacted] said that Chance hired consultants to do baseline studies in 2018/2019 and these studies were updated in 2022/2023. Jennifer shared that Chance had conducted baseline studies on terrain/surficial geology, permafrost, water quality and surface flows, fish and fish habitat, vegetation, porcupine caribou herd, moose, American marten, grizzly bear, birds, heritage resources, and linear features.
- [redacted] asked which consultants completed Chance's caribou work. [redacted] confirmed [redacted] at Environmental Dynamics Inc. led the caribou work and that it relied on existing data and habitat analysis.
- [redacted] shared Chance is aiming to submit their Project Proposal to the Executive Committee of YESAB in mid-December.
- [redacted] asked if Chance had progressed engagement with First Nation of the Na-Cho Nyäk Dun (NND) and Tr'ondëk Hwëch'in (TH).
- [redacted] confirmed Chance had met with [redacted], technical advisor on behalf of NND and TH, the day prior. He said [redacted] was going to discuss engagement preferences with each Nation's leadership. [redacted] said Chance was planning to go to Old Crow and Fort McPherson at the end of August to conduct open house events.
- [redacted] said he would follow up with VGFN leadership while he was in Old Crow with Chance at the end of August.

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- [redacted] said Chance is hoping to get feedback on the draft Table of Contents for the Project Proposal from YESAB and the First Nations.
- [redacted] asked if Chance is discussing the consultation process after the Project Proposal is submitted with the Yukon Government and YESAB. Greg said he did talk to [redacted] and [redacted] from Yukon Government about it.
- [redacted] said the Yukon Government and YESAB have to consult on their decision document. If the Project is approved, First Nations will be consulted on authorizations (i.e., the permits). He noted there are a lot of layers of consultation.
- [redacted] said he met with the former chair of YESAB. He added that YESAB is sorting out who is doing what. [redacted] suggested YESAB, Yukon Government, and Chance meet to make sure that there is a common understanding of steps.
- [redacted] asked if [redacted] was aware of any key areas of interest to VGFN. [redacted] said permafrost and water are key issues. Historically, caribou has been a huge issue for all northern First Nations.
- [redacted] provided an overview of the discussion on linear impact thresholds from a meeting with Yukon Government staff the day prior. [redacted] noted further discussions with YESAB on this topic are required.
- [redacted] asked about cumulative effects.
- [redacted] confirmed that cumulative effects is something that needs to be clarified with the Yukon Government and YESAB. Specifically, cumulative effects of seismic.
- [redacted] asked what approach Environmental Dynamics Inc. is using for cumulative effects. [redacted] said they did a linear features assessment to assess regrowth of linear features. Staff walked seismic lines to assess line of sight and monitored wildlife. This information will feed into cumulative effects for the Project. [redacted] added there is no other development in the area except the Dempster Highway.
- [redacted] asked when Chance will be in Old Crow later in August.
- [redacted] confirmed travel dates and noted the Project Team is interested in meeting with leadership at 2:00 pm in advance of the open house at 4:00 pm. [redacted] confirmed he would ask VGFN leadership if they were available to meet with Chance during their trip to Old Crow.
- [redacted] asked for the August 23, 2023 YESAB meeting details.
- [redacted] shared [redacted] is the Yukon Government point of contact for the Project.

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APPENDIX 2-C-76. September 13, 2023, Meeting Summary

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Meeting Minutes

Subject	Project Overview Meeting
Prepared By	Two Worlds Consulting (TWC)
Groups Involved	Bluescape Group of Companies (Bluescape) Chance Oil and Gas (Chance) Environmental Dynamics Inc. (EDI) Palmer Peer Solutions TWC Vuntut Gwitchin First Nation (VGFN)
Participants	[redacted], Senior Vice President Engineering and Operations (Bluescape) [redacted] Regulatory, Environmental and Community Relations Coordinator (Chance) [redacted], Deputy CEO and Senior Biologist (EDI) [redacted] Senior Geoscientist and Project Manager (Palmer) [redacted] VP Operations (Peer Solutions) [redacted] Engagement Support (TWC) [redacted] Socioeconomic Support (TWC) Deputy Chief [redacted] (VGFN) [redacted] Executive Director (VGFN) [redacted] Acting Executive Assistant (Virtual) (VGFN) [redacted] Technical Advisor (VGFN)
Date/Time	September 13, 2023 2:00 PM – 3:00 PM PST
Copies to	Chance and VGFN

Purpose of Meeting

- Chance provided an Eagle Plains Exploration Project (Project) update to VGFN.

Topics Discussed

- Chance overview
- Project overview including information on exploration, design changes, baseline studies, regulatory process, schedule, engagement, proposed next steps

Key Issues Raised / Chance Responses to Issues

- Expressed interest in understanding how community feedback shared to date has been used by Chance.
    - TWC confirmed a slide in the presentation documents how Chance has incorporated past feedback to the current Draft Project Description.
- Noted the importance of listening to the people that grew up and live in Old Crow.
- Suggested Chance consider additional engagement methods to reach a broader audience.
- Asked how Chance is in Phase 6: Submission of Project Proposal.
    - TWC committed to sharing the language from YESAB's User Guide: Pre-Submission Engagement for Executive Committee Screenings with meeting

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attendees which outlines that referred Projects move to Phase 6: Submission of Project Proposal. Noted where Chance stood in the Pre-Submission Engagement process was confirmed by Yukon Environmental Socioeconomic Assessment Board (YESAB) staff.

Actions and Responsible Party

- Chance to send meeting minutes including actions to VGFN – complete.
- Chance to share language from YESAB's User Guide: Pre-Submission Engagement for Executive Committee Screenings describing why the Project is in Phase 6: Submission of Project Proposal with meeting attendees – complete.
- Chance to consider conducting an open house event in Whitehorse with VGFN Citizens that do not live in Old Crow – in progress.
- Chance to consider conducting door-to-door engagement in Old Crow and a digital survey to engage a broader range of VGFN Citizens – in progress.
- Chance to contact [redacted] with requests to share information via the VGFN newsletter – as needed.
- Chance to provide Major Projects Yukon and Chance September meeting details with [redacted] – complete.
- Chance to contact [redacted] and cc [redacted] to confirm community-based research protocols and process – complete.
- VGFN to confirm if there are specific Citizens or businesses that should be invited to participate in socioeconomic interviews – in progress.
- VGFN to confirm if Chance can support coordination logistics for the meeting with all potentially affected First Nations – complete.
- VGFN to confirm if there are any existing documents containing VGFN socioeconomic data and/or Traditional Knowledge that Chance should review to inform the Project Proposal – in progress.

Discussion

- [redacted] led a round of introductions.
- Deputy Chief [redacted] asked what happens to the feedback shared at open house events and noted the importance of listening to the people that grew up and live in Old Crow. She expressed interest in understanding how the feedback shared to date has been used by Chance. [redacted] confirmed a slide in the presentation documents how Chance has incorporated past feedback in the current Draft Project Description.
- [redacted] reviewed the agenda and asked if anyone had any revisions. No revisions were shared.
- [redacted] provided a background on Chance. She shared that Chance is a small company with offices in Calgary and Whitehorse.
- [redacted] provided an overview of the proposed Project including information on the:

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- Project location (overlap with First Nation traditional territories, North Yukon Planning Region, and the Peel Watershed Planning Region).
- Proposed Project activities including seismic, drilling, extended flow testing, and progressive reclamation and closure.
- Proposed supporting Project activities including the use of the existing Chance camp and airstrip, construction of winter access roads, use of a remote fly-in camp, construction of a winter airstrip, mix-bury cover sumps, and a central processing facility.

- [redacted] shared how the Project approach and design had changed since it was last proposed. Daryl added a deeper explanation of the difference between past and current seismic technology (i.e., how seismic lines today have a relatively minimal impact to the land). Deputy Chief [redacted] said this information was a good point to share at the community open house event later that day.
- Deputy Chief [redacted] noted at previous open house events Chance proposed to drill 20 wells and then two years ago proposed 50 wells. She said she was surprised by that. [redacted] confirmed Chance is proposing up to 30 wells and did not recall previously proposing 50 wells.
- [redacted] added that the Project is also proposing to use winter access roads instead of all-weather roads. [redacted] confirmed what [redacted] shared and said the use of winter access roads only was in response to concerns shared by First Nations at past engagement events. She said winter access roads are expected to have less impact on permafrost. [redacted] added that this is one of the changes that they hope to share with the community at the open house later that day. She added that community members are likely not aware that the latest iteration of the Project is different, in some respects, than what they had previously heard.
- [redacted] reviewed baseline studies that were conducted in 2018/19 and updated in 2022/2023.
- [redacted] shared the Project would be assessed by the Executive Committee of YESAB. She explained the Project was referred by the Dawson City Designated Office of YESAB to the Executive Committee in 2014. She noted Chance received confirmation from YESAB that they were in Phase 6: Submission of Project Proposal of YESAB's Pre-Submission Engagement process since they were referred. Deputy Chief [redacted] asked how Chance was able to jump to Phase 6: Submission of Project Proposal. Eliza committed to sharing the language from YESAB's User Guide: Pre-Submission Engagement for Executive Committee Screenings with meeting attendees.
- [redacted] reviewed completed 2023 engagement activities with all potentially affected First Nations as well as proposed engagement and regulatory next steps for the Project.
- [redacted] shared that TWC, on behalf of Chance, is proposing to conduct socioeconomic interviews to understand Project-related socioeconomic effects to inform the Project Proposal (e.g., information on community health and wellbeing, infrastructure services, education, and employment). She noted information publicly available is often not specific or detailed enough to capture this information for northern communities. [redacted] asked VGFN to confirm if they have any community-based research protocols Chance should be aware of (e.g., forms to be completed in advance of fieldwork) and if there are specific VGFN Citizens or businesses

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that should be interviewed [redacted] added that she believed VGFN had a research approval process for Old Crow and said [redacted] in Whitehorse is responsible for reviewing research requests.

- Deputy Chief [redacted] said it is important to highlight Project changes. She noted northern communities have not been consulted on many things and it is important for the people to hear that Chance has heard and incorporated their feedback to their YESAB submission. She said this may encourage people to speak up more. She said some people may not say anything at open house events, but they have thoughts to share.
- [redacted] asked if VGFN has a suggestions board. Deputy Chief [redacted] said VGFN does not have a suggestions board. She said some folks will attend meetings and prefer to use sticky notes to share feedback rather than speaking aloud to the group.
- [redacted] asked Deputy Chief [redacted] if she was aware of any individuals that should be contacted about socioeconomic interviews. She noted they are hoping to interview a diverse group of individuals representing different genders, ages, people that live in community versus outside the community, land users, etc.
- Deputy Chief [redacted] recommend folks that live along the Dempster Highway are interviewed.
- [redacted] suggested a VGFN Citizen support with interview coordination. [redacted] responded and said VGFN will see how things roll out and requested he be included on communications to [redacted] (VGFN staff member responsible for managing community-based research requests). [redacted] said Chance is hoping VGFN will confirm if there are existing socioeconomic studies that should be relied on to inform the Socioeconomic Effects Assessment as well as leadership and community engagement preferences (virtual versus in person, frequency, topics of interest, preferred method for sharing information (e.g., verbal and/or written), etc.).
- [redacted] said Chance is also looking for feedback on the draft Valued Environmental Socioeconomic Components (VESECs).
- [redacted] asked VGFN to confirm if there are any sources of Traditional Knowledge that Chance should rely on for their Project Proposal. She confirmed that TWC, on behalf of Chance, is
- pulling together a list of publicly available secondary sources of Traditional Knowledge for VGFN's review and approval prior to being relied on in the Draft Project Proposal.
- Deputy Chief [redacted] shared that the same people attend the open houses and suggested Chance engage other subsets of the community. She asked if Chance is planning to conduct an open house in Whitehorse for VGFN Citizens that do not live in Old Crow and suggested they go door-to-door in Old Crow to share Project information and/or send out a digital survey.
- [redacted] confirmed Chance is hoping to conduct an open house in Whitehorse and asked if they should also direct the request for door-to-door engagement to [redacted]. [redacted] asked Chance to send this request to him and he can try and sort out logistics that take holidays and seasonal considerations into account.
- Deputy Chief [redacted] said people can make informed choice if they hear from Chance and VGFN leadership.

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- [redacted] asked if there is anywhere to post information. James confirmed community communications should be sent to him. He added survey and newsletter requests should also be sent to him.
- [redacted] asked if Chance is meeting with the Porcupine Caribou Herd Management Board (PCMB). [redacted] confirmed they had met with the PCMB committee a few times. He shared that EDI presented their analysis and plans for the Environmental Assessment (EA). [redacted] said they were planning to send the EA written analysis to the PCMB committee.
- [redacted] raised the proposed joint meeting with VGFN and Gwich'in Tribal Council (GTC). She asked if there was any update on this meeting. [redacted] said Greg had introduced him to the new GTC Acting Director and would introduce the GTC team at an already established meeting with VGFN, Tr'ondëk Hwëch'in, and First Nation of Nacho Nyäk Dun. [redacted] said this group would add the Project to the discussion list. [redacted] asked John to let Chance know if they needed any support coordinating logistics for that meeting.
- [redacted] shared Chance is looking to set up more meetings with YESAB.
- [redacted] asked if Chance is dealing with Major Projects Yukon.
- [redacted] said that she and [redacted] had met with them a few months ago. [redacted] shared Chance had a meeting scheduled with Major Projects Yukon mid-September and would confirm the meeting date and time with [redacted].
- Deputy Chief [redacted] thanked everyone and wished the Chance Project Team well at the community open house.
- [redacted] asked for community open house details.
- [redacted] shared the community open house was scheduled for 4:00 pm – 8:00 pm and noted dinner will start at 5:00 pm. She said the Chance Project Team will stay until needed. [redacted] added that the Chance Project Team would share a Project video during dinner and then provide a presentation including a question-and-answer period.
- [redacted] added that permafrost and jobs tend to be a main discussion point and that the Chance Project Team is looking for direction from leadership to have deeper discussions with community members on topics of interest.
- [redacted] thanked VGFN for their time.

APPENDIX 2-C-77. September 13, 2023, Open House Summary Report

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Meeting Minutes

Subject	Project Overview Meeting
Prepared By	Two Worlds Consulting (TWC)
Groups Involved	Bluescape Group of Companies (Bluescape) Chance Oil and Gas (Chance) Environmental Dynamics Inc. (EDI) Palmer Peer Solutions TWC Vuntut Gwitchin First Nation (VGFN)
Participants	[redacted], Senior Vice President Engineering and Operations (Bluescape) [redacted] Regulatory, Environmental and Community Relations Coordinator (Chance) [redacted], Deputy CEO and Senior Biologist (EDI) [redacted] Senior Geoscientist and Project Manager (Palmer) [redacted] VP Operations (Peer Solutions) [redacted] Engagement Support (TWC) [redacted] Socioeconomic Support (TWC) Deputy Chief [redacted] (VGFN) [redacted] Executive Director (VGFN) [redacted] Acting Executive Assistant (Virtual) (VGFN) [redacted] Technical Advisor (VGFN)
Date/Time	September 13, 2023 2:00 PM – 3:00 PM PST
Copies to	Chance and VGFN

Purpose of Meeting

- Chance provided an Eagle Plains Exploration Project (Project) update to VGFN.

Topics Discussed

- Chance overview
- Project overview including information on exploration, design changes, baseline studies, regulatory process, schedule, engagement, proposed next steps

Key Issues Raised / Chance Responses to Issues

- Expressed interest in understanding how community feedback shared to date has been used by Chance.
    - TWC confirmed a slide in the presentation documents how Chance has incorporated past feedback to the current Draft Project Description.
- Noted the importance of listening to the people that grew up and live in Old Crow.
- Suggested Chance consider additional engagement methods to reach a broader audience.
- Asked how Chance is in Phase 6: Submission of Project Proposal.
    - TWC committed to sharing the language from YESAB's User Guide: Pre-Submission Engagement for Executive Committee Screenings with meeting

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attendees which outlines that referred Projects move to Phase 6: Submission of Project Proposal. Noted where Chance stood in the Pre-Submission Engagement process was confirmed by Yukon Environmental Socioeconomic Assessment Board (YESAB) staff.

Actions and Responsible Party

- Chance to send meeting minutes including actions to VGFN – complete.
- Chance to share language from YESAB's User Guide: Pre-Submission Engagement for Executive Committee Screenings describing why the Project is in Phase 6: Submission of Project Proposal with meeting attendees – complete.
- Chance to consider conducting an open house event in Whitehorse with VGFN Citizens that do not live in Old Crow – in progress.
- Chance to consider conducting door-to-door engagement in Old Crow and a digital survey to engage a broader range of VGFN Citizens – in progress.
- Chance to contact [redacted] with requests to share information via the VGFN newsletter – as needed.
- Chance to provide Major Projects Yukon and Chance September meeting details with [redacted] – complete.
- Chance to contact [redacted] and cc [redacted] to confirm community-based research protocols and process – complete.
- VGFN to confirm if there are specific Citizens or businesses that should be invited to participate in socioeconomic interviews – in progress.
- VGFN to confirm if Chance can support coordination logistics for the meeting with all potentially affected First Nations – complete.
- VGFN to confirm if there are any existing documents containing VGFN socioeconomic data and/or Traditional Knowledge that Chance should review to inform the Project Proposal – in progress.

Discussion

- [redacted] led a round of introductions.
- Deputy Chief [redacted] asked what happens to the feedback shared at open house events and noted the importance of listening to the people that grew up and live in Old Crow. She expressed interest in understanding how the feedback shared to date has been used by Chance. [redacted] confirmed a slide in the presentation documents how Chance has incorporated past feedback in the current Draft Project Description.
- [redacted] reviewed the agenda and asked if anyone had any revisions. No revisions were shared.
- [redacted] provided a background on Chance. She shared that Chance is a small company with offices in Calgary and Whitehorse.
- [redacted] provided an overview of the proposed Project including information on the:

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- Project location (overlap with First Nation traditional territories, North Yukon Planning Region, and the Peel Watershed Planning Region).
- Proposed Project activities including seismic, drilling, extended flow testing, and progressive reclamation and closure.
- Proposed supporting Project activities including the use of the existing Chance camp and airstrip, construction of winter access roads, use of a remote fly-in camp, construction of a winter airstrip, mix-bury cover sumps, and a central processing facility.

- [redacted] shared how the Project approach and design had changed since it was last proposed. Daryl added a deeper explanation of the difference between past and current seismic technology (i.e., how seismic lines today have a relatively minimal impact to the land). Deputy Chief [redacted] said this information was a good point to share at the community open house event later that day.
- Deputy Chief [redacted] noted at previous open house events Chance proposed to drill 20 wells and then two years ago proposed 50 wells. She said she was surprised by that. [redacted] confirmed Chance is proposing up to 30 wells and did not recall previously proposing 50 wells.
- [redacted] added that the Project is also proposing to use winter access roads instead of all-weather roads. [redacted] confirmed what [redacted] shared and said the use of winter access roads only was in response to concerns shared by First Nations at past engagement events. She said winter access roads are expected to have less impact on permafrost. [redacted] added that this is one of the changes that they hope to share with the community at the open house later that day. She added that community members are likely not aware that the latest iteration of the Project is different, in some respects, than what they had previously heard.
- [redacted] reviewed baseline studies that were conducted in 2018/19 and updated in 2022/2023.
- [redacted] shared the Project would be assessed by the Executive Committee of YESAB. She explained the Project was referred by the Dawson City Designated Office of YESAB to the Executive Committee in 2014. She noted Chance received confirmation from YESAB that they were in Phase 6: Submission of Project Proposal of YESAB's Pre-Submission Engagement process since they were referred. Deputy Chief [redacted] asked how Chance was able to jump to Phase 6: Submission of Project Proposal. Eliza committed to sharing the language from YESAB's User Guide: Pre-Submission Engagement for Executive Committee Screenings with meeting attendees.
- [redacted] reviewed completed 2023 engagement activities with all potentially affected First Nations as well as proposed engagement and regulatory next steps for the Project.
- [redacted] shared that TWC, on behalf of Chance, is proposing to conduct socioeconomic interviews to understand Project-related socioeconomic effects to inform the Project Proposal (e.g., information on community health and wellbeing, infrastructure services, education, and employment). She noted information publicly available is often not specific or detailed enough to capture this information for northern communities. [redacted] asked VGFN to confirm if they have any community-based research protocols Chance should be aware of (e.g., forms to be completed in advance of fieldwork) and if there are specific VGFN Citizens or businesses

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that should be interviewed [redacted] added that she believed VGFN had a research approval process for Old Crow and said [redacted] in Whitehorse is responsible for reviewing research requests.

- Deputy Chief [redacted] said it is important to highlight Project changes. She noted northern communities have not been consulted on many things and it is important for the people to hear that Chance has heard and incorporated their feedback to their YESAB submission. She said this may encourage people to speak up more. She said some people may not say anything at open house events, but they have thoughts to share.
- [redacted] asked if VGFN has a suggestions board. Deputy Chief [redacted] said VGFN does not have a suggestions board. She said some folks will attend meetings and prefer to use sticky notes to share feedback rather than speaking aloud to the group.
- [redacted] asked Deputy Chief [redacted] if she was aware of any individuals that should be contacted about socioeconomic interviews. She noted they are hoping to interview a diverse group of individuals representing different genders, ages, people that live in community versus outside the community, land users, etc.
- Deputy Chief [redacted] recommend folks that live along the Dempster Highway are interviewed.
- [redacted] suggested a VGFN Citizen support with interview coordination. [redacted] responded and said VGFN will see how things roll out and requested he be included on communications to [redacted] (VGFN staff member responsible for managing community-based research requests). [redacted] said Chance is hoping VGFN will confirm if there are existing socioeconomic studies that should be relied on to inform the Socioeconomic Effects Assessment as well as leadership and community engagement preferences (virtual versus in person, frequency, topics of interest, preferred method for sharing information (e.g., verbal and/or written), etc.).
- [redacted] said Chance is also looking for feedback on the draft Valued Environmental Socioeconomic Components (VESECs).
- [redacted] asked VGFN to confirm if there are any sources of Traditional Knowledge that Chance should rely on for their Project Proposal. She confirmed that TWC, on behalf of Chance, is
- pulling together a list of publicly available secondary sources of Traditional Knowledge for VGFN's review and approval prior to being relied on in the Draft Project Proposal.
- Deputy Chief [redacted] shared that the same people attend the open houses and suggested Chance engage other subsets of the community. She asked if Chance is planning to conduct an open house in Whitehorse for VGFN Citizens that do not live in Old Crow and suggested they go door-to-door in Old Crow to share Project information and/or send out a digital survey.
- [redacted] confirmed Chance is hoping to conduct an open house in Whitehorse and asked if they should also direct the request for door-to-door engagement to [redacted]. [redacted] asked Chance to send this request to him and he can try and sort out logistics that take holidays and seasonal considerations into account.
- Deputy Chief [redacted] said people can make informed choice if they hear from Chance and VGFN leadership.

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- [redacted] asked if there is anywhere to post information. James confirmed community communications should be sent to him. He added survey and newsletter requests should also be sent to him.
- [redacted] asked if Chance is meeting with the Porcupine Caribou Herd Management Board (PCMB). [redacted] confirmed they had met with the PCMB committee a few times. He shared that EDI presented their analysis and plans for the Environmental Assessment (EA). [redacted] said they were planning to send the EA written analysis to the PCMB committee.
- [redacted] raised the proposed joint meeting with VGFN and Gwich'in Tribal Council (GTC). She asked if there was any update on this meeting. [redacted] said Greg had introduced him to the new GTC Acting Director and would introduce the GTC team at an already established meeting with VGFN, Tr'ondëk Hwëch'in, and First Nation of Nacho Nyäk Dun. [redacted] said this group would add the Project to the discussion list. [redacted] asked John to let Chance know if they needed any support coordinating logistics for that meeting.
- [redacted] shared Chance is looking to set up more meetings with YESAB.
- [redacted] asked if Chance is dealing with Major Projects Yukon.
- [redacted] said that she and [redacted] had met with them a few months ago. [redacted] shared Chance had a meeting scheduled with Major Projects Yukon mid-September and would confirm the meeting date and time with [redacted].
- Deputy Chief [redacted] thanked everyone and wished the Chance Project Team well at the community open house.
- [redacted] asked for community open house details.
- [redacted] shared the community open house was scheduled for 4:00 pm – 8:00 pm and noted dinner will start at 5:00 pm. She said the Chance Project Team will stay until needed. [redacted] added that the Chance Project Team would share a Project video during dinner and then provide a presentation including a question-and-answer period.
- [redacted] added that permafrost and jobs tend to be a main discussion point and that the Chance Project Team is looking for direction from leadership to have deeper discussions with community members on topics of interest.
- [redacted] thanked VGFN for their time.

APPENDIX 2-C-78. October 13, 2023, Meeting Summary

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Meeting Minutes

Subject	Consultation and Capacity
Prepared By	Two Worlds Consulting (TWC)
Groups Involved	Chance Oil & Gas (Chance) TWC The Yukon Government (YG) Canadian Northern Economic Development Agency (CanNor) Crown-Indigenous Relations and Northern Affairs Canada (CIRNAC) First Nation of Na-Cho Nyak Dun (FNNND) Tr'ondëk Hwëch'in First Nation (TH) Gwich'in Tribal Council (GTC) Vuntut Gwitchin Government (VGG) Yukon Environmental and Socio-economic Assessment Board (YESAB)
Participants	• [redacted] Executive Committee Manager (YESAB) • [redacted] Aboriginal Relations (YG) • [redacted] Major Projects Director (YG) • [redacted] Major Projects Manager (YG) • [redacted] Geothermal & Petroleum Resources Manager (YG) • [redacted] Regional Environment Manager (CIRNAC) • [redacted] Manager (CIRNAC) • [redacted] Project Officer (CanNor) • [redacted] Project Manager (CanNor) • [redacted], Resources & Governance Consultant (FNNND and TH) • [redacted], Lands & resources coordinator (GTC) • [redacted], Technical Advisor (VGG) • [redacted], Caribou Coordinator (VGG) • [redacted] (Chance) • [redacted] (Chance) • [redacted], Regulatory Lead (Chance) • [redacted], Transboundary Specialist (GTC) • [redacted], [redacted], and [redacted] (TWC)
Date/Time	October 13, 2023 from 10:30am – 12:00pm PST
Copies to	[redacted]

Purpose of Meeting

- Discuss Consultation and Capacity

Topics Discussed

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- YESAB Screening Process
- Consultation Plan
- Transboundary Territory

Key Issues Raised / Chance Responses to Issues

- Inquired about international transboundary lands and if there is a plan to address that.
    - Chance stated they are following the YESAB regulations and there is nothing explicitly about international transboundary consultation requirements.
- Noted the need for Nations to receive capacity funding prior to the submission of proposals.
    - CIRNAC stated that NPFP is flexible and can be arranged to support this

Actions and Responsible Party

- VGG to set up all Nations meeting.
- YG to set up meeting with VGG, TH, FNNND, GTC to discuss Consultation Plan after all Nations meeting.
- VGG, TH, FNNND, GTC to follow up with CIRNAC about capacity funding.
- CIRNAC to follow up about Transboundary with US consultation protocol

Details of Discussion

- [redacted] talked about Chance's project proposal. [redacted] discussed Engagement with Chance and the somewhat revised project description. He clarified that this meeting is about the process moving forward and not the project details, as well as to better understand the Nations feelings. John introduced the idea of making a joint consultation plan process to ultimately look at capacity funding for all Nations to meaningfully participate in further engagement. [redacted] clarified that this meeting is to hear the party's perspectives on consultation and capacity and not to talk about the project or project details.
- [redacted] reiterated that this meeting is for consultation discussions. [redacted] described the screening process for YESAB. He stated that YESAB through the screening process checks to see if the proponent has fulfilled consultation duties with communities and First Nations using the four-point test. He clarified YESAB doesn't need consultation records during the screening period, as this is separate from the records of past consultation leading up to the screening period. [redacted] said he is here to answer any further questions about the screening process as the meeting progresses.
- [redacted] asked for clarification about the project history and new regulatory screening process since the project went from Dawson City Designated Office to the Executive Committee. [redacted] continued that with the newer consultation under the Executive Committee how will this change the screening process since the project is referred from the DO?
- [redacted] clarified this is a referred project and now must update under new regulation. He stated Chance is not submitting a new project rather a revised proposal and consultation record to meet new standards.
- [redacted] asked whose regime Chance was under before compared to now and how that has changed the process.
- [redacted] added that Nations are dealing with a proposal that has not been submitted yet and the consultation record only covers what has happened during the DO days.

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- [redacted] stated that First Nations are providing comments but asked [redacted] if Nations should expect face to face discussions to provide input moving forward.
- [redacted] answered yes, this is a possibility. He said YESAB could include Nations in the screening process if needed and desired.
- [redacted] redirected the conversation onto Aboriginal Relations with Yukon Governments
- [redacted] proposed adding to the meeting agenda more discussions regarding the Yukon government. He stated the Yukon Government is a regulator on this project and decision maker on this project and will make recommendation based on the Department of Economic Developments input. [redacted] further explained that the Yukon will lead a consultation under major projects Yukon, with affected Nations and YG will be relying on the screening process which means Nations need to participate in the screening process to inform how treaty rights are affected and how YESAB are taking those impacts and converting to values ultimately to inform decision making. [redacted] continued that the YESAB approach is to engage early in addition to the ongoing screening. He said this meeting is a good time to understand what the consultation process looks like moving forward. He informed that YESAB will be leaning on the Aboriginal Relations to inform and set up that consultation approach. He clarified the assessment itself will be informed by regulators providing technical expertise.
- [redacted] agreed with [redacted] and explained the process further.
- [redacted] explained that YESAB has a less defined consultation process to let it be led more by participants. She explained that YG has been working on multiyear consultation efforts. She invited a discussion of the components that need to be improved in the engagement process. [redacted] stated that she looks forwards to using consultation tools to better inform a process moving forward.
- [redacted] asked if YG is aware of the transboundary areas and how consultation works with Alaskan transboundary lands. He also asked how YG feels about transboundary lands with America.
- [redacted] answered that YG takes transboundary issues seriously but can't confirm if there is a case to reference where an organized Indigenous group in America had transboundary lands with Canada. [redacted] explained that YG has dealt with transboundary within Canada and Provinces more frequently than National transboundary lands.
- [redacted] asked to hear from other Federal representatives on International transboundary protocol.
- [redacted] answered speaking to the federal approach to consultation and the federal participation in these major projects. [redacted] stated that this project may not require federal decision bodies. She clarified that Canada's engagement and duty to consult relies on what is determined through the YESAB screening process.
- [redacted] stated that the Northern Participant Funding Program (NPFP) is designed to assist First Nations in participating in big projects but is limited to 150,000 dollars per fiscal year. He further explained that NPFP is limited to projects that are for sure to go through the assessment process.
- [redacted] asked [redacted] if Nations can't trigger NPFP funding until the proposal is submitted how can Nations get ready for the assessment, as Nations don't want to be left behind. [redacted] asked, if there was a possibility for capacity funding about 2 months before the proposal is submitted.

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- [redacted] answered that CIRNAC tries to be very flexible with this and are open to discussions before submission if things are moving quickly. Shane continued that CIRNAC is looking to maximize participation and readiness.
- [redacted] asked [redacted] if he would be open to assisting in creating a consultation plan
- [redacted] answered that he would be very open to help with a consultation plan. He clarified that Provincial limiting doesn't limit federal funding.
- [redacted] asked If Canada is not a decision body how are transboundary lands addressed with the US for Federal consultation.
- [redacted] asked, for the federal money that is available, is there any documents on the responsibility of proponents to provide capacity funding or is there federal linkage to proponent obligation.
- [redacted] answered, no, federal funding is not linked to proponent responsibility, rather federal funding is supplementary.
- [redacted] asked what Transboundary lands are in question.
- [redacted] clarified that Gwich'in territory extends into Alaskan transboundary lands. [redacted] asked if there is a plan around addressing this.
- [redacted] asked if this is referencing Porcupine Caribou Herd. [redacted] continued that Chance follows YEASB regulations and is concerned over the international regulations being brought into the equation as Chance is following all required regulations that are known.
- [redacted] answered that there are international transboundary Porcupine Caribou Herd relations that he wants clarification on about if there is existing federal protocol for but he just wanted to raise question not to raise concern.
- [redacted] echoed [redacted] and thanked John for clarifying on importance of concern raised.
- [redacted] reiterated that there is no question about FNNND desire to be very involved but the form that will take on how that participation will look he is not sure on. He stated that FNNND is overlapping with TG and that both First Nations want to be involved but have to sort out the details.
- [redacted] stated that Chance has been working with FNNND for a while now and Chance needs to know what level of consultation is required as previous meetings have been postponed and there is not a clear understanding of what FNNND wants consultation wise. [redacted] wanted to get confirmation about level of consultation desired by FNNND. He stated porcupine caribou is common priority amongst all Nations involved and that is known. [redacted] said that Chance would like to schedule meetings with FNNND and asked if [redacted] could help Chance in a timely matter to get some direction on how and when to consult with FNNND as it has been hard in the past. [redacted] recognized that the type and degree of consultation needs to be sorted out on direction that further consultation will take.
- [redacted] answered that there has been some difficulty lately with new governments in both Nations and all new staff causing delays. [redacted] stated that he is working on trying to facilitate more understanding on needs.
- [redacted] stated that he had a few meetings with Chance regarding the proposal and GTC and Chance have a good working relationship, but this relationship doesn't replace the federal duty to consult, and GTC looks forward to discussing that further when the time comes.

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- [redacted] talked about the how the Old Crow meetings back in May discussing the revised project description were delayed due to floods but the but the Mid September meetings in Old Crow were very productive. [redacted] thought it was a good session. [redacted] shared that the VGG perspective is to get ahead of this and have regular meetings with Greg, to keep in touch. John shared that VGG are in support about the proposal being submitted. [redacted] shared that VGG would like to know what the consultation process looks like so VGG can prepare. [redacted] proposed that VGG works together with the other Nations to be more efficient and share resources and to be coordinated in the consultation process. John asked for a First Nations reps only meeting to get organized and so Nations can be active and not passive in the consultation process.
- [redacted] asked if the current project proposal is the final version of the proposal. [redacted] said that the last timeline heard was mid December for probable submission to YESAB. [redacted] asked if FNNND and TH are currently being consulted on the final or work in progress proposal.
- [redacted] answered that Chance has a description of the project in draft from. [redacted] said that the Nations consultation on the project so far has not just been about ticking off a box about rather what people think about the project. [redacted] said that all Nations are going to see the final proposal when it is submitted. [redacted] stated that Chance is looking at a submission in January and said [redacted] can talk to that more.
- [redacted] said that Nations are currently dealing with the draft proposal currently, but the final will be the one that is focused on moving forward.
- [redacted] asked if it can be confirmed that the proposal can be adjusted.
- [redacted] answered that the proposal can be adjusted until submission.
- [redacted] Presented Chance project updates: [redacted] showed slides. [redacted] thanked everyone for attending. He stated Chance is working to meet all four points under YESAB screening. [redacted] stated nothing has really changed from 2014 to the new project. He continued that minor changes were made to First Nations engagement, like seasonal road. [redacted] informed that between now and January 2024 the goal is to submit proposal early to mid February. He stated Chance is happy to do virtual meetings. [redacted] said Chance doesn't want to be throwing big packages at you, Chance wants to make sure that it can be a meaningful conversation. He stated Chance will be doing a document review and that Two Worlds Consulting was hired to support in this endeavour. He finished by saying the meeting held with YESAB about traditional knowledge was critical and Chance wants to capture that Knowledge and use it to influence the submission.
- [redacted] closed the meeting by discussing possible next steps like an all Nation only meeting and a consultation plan with help of YG. [redacted] stated that it was good to hear about support for consultation and about capacity funding as needs are there. He finished by sharing that it might be a good idea to collapse all nations together to save money.

APPENDIX 2-C-79. December 6, 2023, World Café Summary Report

VUNTUT GWITCHIN FIRST NATION AND CHANCE OIL AND GAS LIMITED: OLD CROW WORLD CAFÉ COMMUNITY EVENT SUMMARY REPORT DECEMBER 6, 2023



Figure 1: Old Crow (December 2023)

Introduction

Chance Oil and Gas Limited (Chance) is proposing the Eagle Plains Exploration Project (Project) to gain a better understanding of the commercial feasibility of oil and natural gas resources in the Eagle Plains Basin. Proposed Project activities are scheduled to occur over a period of up to 10 years, and include:

- Constructing approximately up to 1,500 square kilometers of new 3D seismic lines.
- Constructing approximately up to 2,000 square kilometers of 2D seismic lines.
- Drilling up to 30 wells (5 -8 wells per year) during the winter to evaluate the presence of oil and natural gas resources.

Chance is in the process of preparing a Project Proposal for submission to the Yukon Environmental Socio-economic Assessment Board (YESAB) Executive Committee in February 2024.

Chance invited Vuntut Gwitchin First Nation (VGFN) Citizens and residents of Old Crow to a World Café Community Event (World Café) in Old Crow on Wednesday, December 6, 2023. The objectives of the Community Event were to:

- Strengthen the relationship and enhance communications between VGFN Citizens, residents of Old Crow, and Chance.
- Share information on potential Project-related effects and proposed mitigation measures to support VGFN Citizens and residents of Old Crow to prepare views on the Project.
- Receive feedback from VGFN Citizens and residents of Old Crow on consultation and engagement, potential Project-related effects, general Project-related concerns, and proposed mitigation measures.

This report summarizes the World Café event including the location, invitation, details, and feedback received.

Event Location

The World Café event was hosted at the Darius Elias Community Centre in Old Crow.

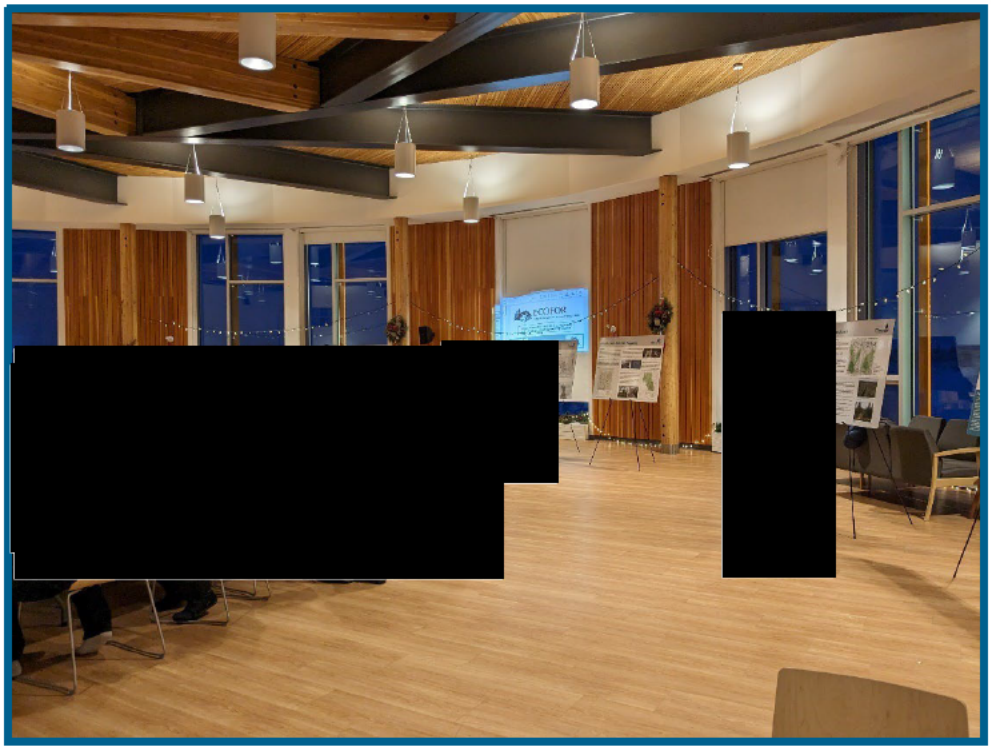


Figure 2: World Café attendees at the Darius Elias Community Centre.

World Café Event Invitation

On November 29, 2023, an invitation was provided to VGFN staff to print and display around Old Crow (Appendix A). The invitation was also shared virtually on Chance's Facebook page. The invitation provided key information such as purpose, location and time, and Chance contact information to share questions and/or feedback about the World Café event or Project.

World Café Event Participation

World Café event participants included:

- Chance Project Team[1]:
  - Chance.
  - Environmental Dynamics Inc. (EDI).
  - Ecofor.
  - Palmer.
  - Two Worlds Consulting.

[1] The Chance Project Team wore name tags to identify their names and the organization they represented.

- VGFN Citizens.
- VGFN Government and Staff; and
- Residents of Old Crow.

World Café Event Details

The World Café event was held on December 6, 2023, from 4:00 pm to 8:00 pm MDT. World Café event attendees[2] were asked to sign-in[3] upon arrival and were provided a Project handout (Appendix B). The Project handout included Project information, a description of the YESAB regulatory process, studies completed by Chance, Project regulatory process timeline, and key First Nation Project feedback and Chance's responses to shared feedback. World Café attendees were included in a raffle for a chance to win various door prizes (see page 6). Coloring sheets and medical masks were also provided for World Café attendees, if interested. In total, there were 42 World Café attendees.



Figure 3: Children's drawing from the World Café event.

[2] World Café event attendees refers to VGFN Citizens, VGFN Government and Staff, and residents of Old Crow.
[3] Completed sign-in sheets from the World Café event are available in Appendix C.

Chance placed Photo Permission Posters (Appendix D) around the Darius Elias Community Centre. These posters indicated that Chance would be taking photos at the World Café and that these images would be utilized by Chance in materials intended for the public. The posters encouraged attendees to advise facilitators from Two Worlds Consulting if they preferred that they and/or their children not be photographed. No World Café attendees requested not to be photographed.

Posterboards (Appendix E) were also placed around the Darius Elias Community Centre to share Project information with attendees. Representatives from the Chance Project Team were available to respond to comments and questions while World Café attendees reviewed the posterboards. Posterboards included:

- Eagle Plains Exploration Project
    - Including a high-level Project description, Project benefits to the Yukon, a Project map (depicting First Nation Traditional Territories and Settlement Lands, permit zones, Peel Watershed Planning Region, North Yukon Planning Region, and Dawson Planning Region), and a summary of the YESAB process.
- Heritage Resource Management Program
    - Including a description of the Project's Heritage Resource Overview Assessment, Heritage Resource Impact Assessment, Systematic Data Recovery Excavation, and current heritage resources management work within the Project area.
- Permafrost and Terrain Mapping
    - Including background information on permafrost in the Project area, how terrain and permafrost information informs the Project design, surficial geology mapping, and next steps for permafrost data gathering.
- Porcupine Caribou Herd
    - Including information on habitat mapping, seasonal ranges based on historic use of the area, caribou distribution and movement, key existing information, and the Project's *Linear Features Study*.
- Wildlife and Habitat Mapping
    - Included an ecological land classification plot location map, and information on wildlife such as birds, moose, and American Marten in the Project area.
- Fish and Water
    - Identified key findings from fish and aquatic studies, and information on fish sampling locations, water quality and hydrology.
- Information about Chance, Jobs, and Training.
    - Including a Chance company profile, examples of Project-related jobs, and related training requirements.

- Chance's Seismic Exploration Program
    - Including information on seismic technology, seismic programs, the difference between 2D and 3D seismic, and how Chance is planning to reduce potential seismic-related impacts.

Chance contracted a VGFN Citizen to prepare dinner for attendees. Dinner was served at 5:00 pm MDT. After dinner, attendees were divided into two focus groups. Technical experts from EDI, Ecofor, and Palmer were divided amongst the groups. Focus group #1 had a presentation from EDI on Wildlife and Fish and Fish Habitat. Focus group #2 had presentations from Ecofor and Palmer on Archaeology/Heritage Resources and Permafrost. Once presentations and comments/concerns were addressed, the technical experts switched tables and presented on their respective areas of expertise to the opposite focus group. The focus groups were designed to provide attendees with a forum for open conversation to learn about potential Project-related effects, offer feedback, express concerns, and propose mitigation measures in a more intimate setting. Attendees were encouraged to pose questions and share comments on the Project both during and after the presentations. Chance staff drew prize winners[4] periodically throughout the event. Door prizes included:

- Two Air North gift cards (eligible for freight and flight).
- Three Co-op grocery gift cards.
- One Bingo card.
- Five Ecofor packages (calendar, tote bag, hat).
- One mug from Indigo.

[4] World Café event prize winners had to be present at the time their name was drawn. If an individual was not present at the time their name was drawn, a new name was drawn.

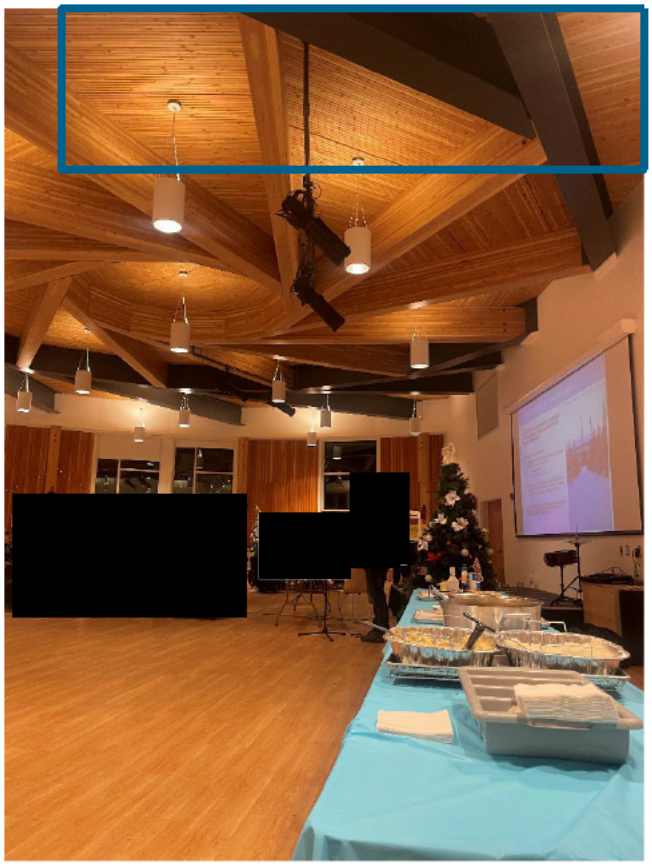


Figure 4: Community dinner provided by Chance.



Figure 5: Attendees split into two focus groups at the event.

Chance asked World Café attendees to complete a Project Feedback Form (Appendix F) prior to leaving the event. This form requested the following information from attendees:

- How they heard about the event.
- How they would rate the event.
- Whether they were able to share their thoughts, ideas, and knowledge during the event in a comfortable manner.
- Whether the event contributed to their understanding about Chance and the Project.
- Event highlights and areas for improvement for future events.
- Additional comments or questions about Chance, the Project, and/or the event.
- Whether they wished to receive Project updates including details on future engagement events.

World Café event Feedback Form results are summarized in the World Café Event Feedback Section. Four feedback forms were submitted at the World Café event.

World Café Event Feedback

Table 1 summarizes feedback shared at the World Café event by VGFN Citizens and residents of Old Crow.

Table 1: World Café Feedback

Feedback Topic	Feedback Shared	Chance's Response to Feedback Shared
Heritage Resources	Inquired if a heritage resource is the same as an unmarked grave.	The Chance Project Team stated that the two are distinct and impacts to burial sites are taken very seriously. If uncovered, work would stop and the RCMP and First Nations are contacted immediately. Once the area is cleared from Project activities, it is designated an archaeological site. Confirmed Chance would engage the First Nations and rely on and follow their guidance. The Chance Project Team added that burial sites can be marked off for avoidance and Drill sites are movable and would not impact known burial sites. The Chance Project Team does not anticipate encountering burial sites because of the acidic soil conditions in the Project area.
	Asked what Chance has found at known heritage resource sites and what is done with the artifacts. Asked what employees will do if they find a heritage and archaeological site.	The Chance Project Team has found stone tools and small stone chips that are the byproduct of their production. Discovered archeological and heritage resources are taken back to Ecofor's office in Whitehorse to examine and weigh them. These archeological and heritage resource materials are then turned over to Yukon Government Heritage Department. If an archaeological and heritage resource is discovered, Chance employees would be required to create a 30-meter buffer around the site(s) to protect and avoid the areas. The Project will implement measures to mitigate impacts to archaeological and heritage resources on site if they overlap with a planned drilling area. These mitigations will likely take the form if systematic data recovery excavations. Any removal of archaeological and heritage resources will be conducted in compliance with federal, provincial, First Nation, and industry best practices and standards.
	Encouraged Chance to work with the Vuntut Gwitchin Government Natural Resource department. VGFN noted that they have a lot of information that can inform Chance's work.	Chance thanked the attendee for their comment and noted they would continue to engage Vuntut Gwitchin Government on the Project including sharing heritage resources information. Chance planned a technical working group with government and technical advisor representatives from all potentially affected First Nations and Yukon Government to discuss the Project's

		archaeological and heritage resource studies on January 16, 2024.
	Stated they would like to see a copy of the Chance Find Procedure.	The Chance Project Team confirmed a *Chance Find Procedure* for the Project is being developed and stated potentially affected First Nations will be notified when the *Chance Find Procedure* is implemented. The Chance Project Team also shared that Chance is available to address any questions that VGFN Citizens may have about the Project via phone or email. The Chance Project Team committed to sharing Ecofor's contact information with VGFN Citizens who have questions related to archaeological and heritage resource studies completed for the Project, if requested.
Consultation and Engagement	Asked why Chance is consulting with Gwich'in Tribal Council (GTC).	The Chance Project Team responded that Chance is consulting Gwich'in Tribal Council because the Project overlaps with Gwich'in Tribal Council primary and secondary use areas.
	Expressed that Chance has provided clear and valuable information at the event. Added that the Project will be a significant project for Vuntut Gwitchin Government.	Chance appreciated the feedback.
	Expressed that having two focus groups made it conducive for open communication.	Chance appreciated the feedback.
	Expressed Chance explained the topics well.	Chance appreciated the feedback.
	Shared that they were satisfied or very satisfied with the World Café.	Chance appreciated the feedback.
Fish and Fish Habitat	Inquired as to how long water and fish studies had occurred.	The Chance Project Team shared that water quality and fish studies were conducted in 2019, 2020, and 2022. These studies were completed in the summer over a 3-month period.
	Inquired about Chance's fish guidelines for the Project and expressed interest in seeing clear guidelines to protect fish.	The Chance Project Team confirmed fish guidelines for the Project will follow guidelines set by the Department of Fisheries and Oceans (DFO) Canada. Measures will be outlined in the Project Proposal.

	Inquired about fish monitoring.	The Chance Project Team responded that water quality monitoring will take place during drilling. Added that Project activities occur in the winter and fish monitoring is not required at that time because fish overwinter outside of the Project area.
	Inquired about differences in monitoring outcomes between lake fish and river fish. Identified that different species are found in each.	The Chance Project Team said monitoring efforts have identified arctic grayling but did not detect any salmon species. Added that the Chance Project Team is only monitoring river systems and not lakes because lakes are not present in the Project area.
	Asked if the Chance Project Team has a best practice for protecting fish and fish habitat or where the answers go from their studies.	The Chance Project Team stated that Chance is required to follow fish guidelines set by DFO. Other guidelines for fish and fish habitat protection could come from YESAB or suggestions made by Vuntut Gwitchin First Nation and other potentially affected First Nations. Shared that there will be a public comment period once Chance submits the Project Proposal to YESAB in 2024. Added that anyone can download and submit comments on the Project Proposal directly to YESAB and/or Chance. The Chance Project Team noted that suggestions to protect fish and fish habitat shared today are helpful and could change the Project design. The Chance Project Team confirmed suggestions shared would be reflected in the Project Proposal. The Chance Project Team reminded attendees that the World Café event is one of multiple opportunities to ask questions about and shared feedback on the Project.
	Inquired about the Project's strategies for safeguarding riparian areas within the designated Project zone.	The Chance Project Team shared that studies completed for the Project identified high value riparian areas in the Project area and said these areas will be avoided as much as possible.
Drilling	Inquired about previous drilling activity in the Eagle Plains Area.	The Chance Project Team conducted drilling activities in 2012 and 2013. Added that drill holes were to up 3.4 kilometres deep. The Chance Project Team said the Project will utilize shallow drilling, involving drilling between 1,500 and 2,400 meters. The Chance Project Team confirmed that fracking will not be utilized for the Project and that Drill Stem Testing (DST) and flow tests to understand the amount and quality of natural gas reserves will be used.
	Asked who granted Chance the authority to drill in the Project area.	The Chance Project Team said the Project is located off First Nation settlement land, and the Yukon Government is the regulator that grants authority to drill.

	Asked why information around who has the authority to drill in the Project area is not known to the public.	The Chance Project Team responded that they want this information to get out. The Chance Project Team said there was a seven-year process to develop the *North Yukon Land Use Plan* including public meetings. The *North Yukon Land Use Plan* outlines designated high development areas. Chance shared that the *North Yukon Land Use Plan* was approved by Vuntut Gwitchin Government. The Chance Project Team also said that the YESAB process will dictate what the Project will be and stated YESAB is required to review all Project information and feedback from First Nations.
Monitoring	Shared that they had observed no progressive reclamation in the last three years and thought an environmental firm typically completes this work. Added there is an economic opportunity for Vuntut Gwitchin Government to be involved in progressive reclamation and expressed concern for Project-related waste after exploration concludes.	The Chance Project Team responded that monitoring programs will be in place during and after reclamation. Added Chance will conduct community meetings to share reclamation progress and status. The Chance Project Team also stated that money is put aside for reclamation and for any Project-related accidents that may occur.
Traditional Knowledge	Asked if traditional knowledge was considered in the Project design.	The Chance Project Team shared that Traditional Knowledge has been considered throughout the process and was provided information by citizens of Old Crow on the winter range of the PCH. The Chance Project Team noted that Porcupine Caribou Herd baseline studies captured both traditional knowledge and western science. The Chance Project Team engaged VGFN Heritage on Traditional Knowledge confidentiality and use protocols. The Chance Project Team also shared existing secondary sources of Traditional Knowledge for VGFN Heritage's review, comment, and permission for use. The Chance Project Team added that Traditional Knowledge is reflected in the Land and Resources section of the Project Proposal and has influenced the Project design (e.g., focusing on winter access roads versus all season access roads). The Chance Project Team added that a request was brought in for the Project Team to halt building an all-season road until resources have been identified. It was requested that hunters were not allowed on the access road.

	Expressed concerns about the Project impacting Vuntut Gwitchin lands and the Porcupine Caribou Herd. Added that Vuntut Gwitchin rely heavily on traditional food because of their remote location.	The Chance Project Team acknowledged the significance of Porcupine Caribou Herd to Vuntut Gwitchin people. Added that Project-related effects to the Porcupine Caribou Herd and land and resource use are described in the Project Proposal. Proposed mitigation measures for Project-related effects will also be described in the Project Proposal.
Accidents and Malfunctions	Asked how spills in rivers will be cleaned up.	The Chance Project Team shared that Chance has spill plans and an emergency response plan, which is required by law for all oil and gas companies in Canada. Added that as part of the regulations, the well location needs to be a minimum of 100 meters away from any water source. Added that the Chance Project Team must be aware of all spill incidents. Added that releases to the environment are expected to be highly unlikely.
Water Resources	Asked what measures the Project is taking to protect creeks.	The Chance Project Team said studies completed for the Project have helped to identify potential low impact drilling locations away from creeks and other water bodies. Added that the Project will avoid works near creeks as much as possible and that mitigation measures will be in place in case working near creeks becomes unavoidable.
	Asked how the Project will avoid creek crossings and erosion.	
	Encouraged Chance to conduct drilling away from water resources.	
Vegetation	Asked if Chance could give examples of lichen protection.	The Chance Project Team shared that conducting Project activities in the winter will reduce potential Project-related effects to lichen. The Chance Project Team added that lichen is also protected because newer seismic technology will not require that vegetation be cut all the way to the ground. Added that lichen is also protected when winter access roads are reused.
Wildlife	Inquired about a wildlife monitoring program.	The Chance Project Team said there will be a wildlife monitoring program throughout the Project that prioritizes hiring First Nation Citizens.
	Inquired about the decline of the northern caribou species.	The Chance Team acknowledge the concern about reported declines in caribou numbers, and that several herds are showing signs of recovery, and noted that the Porcupine Caribou Herd is at the largest numbers ever recorded.

	Requested that meat from a caribou killed by a predator be brought to Vuntut Gwitchin First Nation.	The Chance Project Team said typically the Yukon Government and Environment and Climate Change Canada want to inspect the carcass. The Chance Project Team confirmed looking into the viability of sharing caribou meat with Vuntut Gwitchin First Nation. Added that while drilling, employees are to let the caribou move through the Project site unimpeded. The Chance Project Team explained that caribou are expected to adapt to the drills if they are not seen as predators.
	Asked if proposed caribou mitigations to limit disturbance been successfully used elsewhere.	The Chance Project Team said Chance would need to implement and monitor the proposed mitigations to understand their effectiveness. Technically, effectiveness is impossible to determine unless we have an experimental design that allows effects to occur.
	Noted that a lot of caribou like to stay along the winter roads.	The Chance Project Team agreed and noted this behaviour may attract wolves and other predators. The Chance Project Team agreed based on observations from the 2013/2014 seismic work and noted this behaviour.
	Asked what information the Chance Project Team had received from the Porcupine Caribou Management Board (PCMB).	The Chance Project Team confirmed that a lot of information had been received from the PCMB. Added that the PCMB provided Chance/EDI with collared data and that Chance shared Project information and wildlife studies with the PCMB technical committee per the PCMB's direction. The Chance Project Team shared that Chance met with the PCMB on December 1st to discuss the Project and conducted a technical working group meeting with the PCBM on the Porcupine Caribou Herd on December 20th.
Land and Resource Use	Asked about subsistence hunting access in the Project area.	The Chance Project Team acknowledged land and resource use in the Project area will change during exploration. Added that no long-term effects to land and resource use are expected.
Employment and Economy	Inquired whether Vuntut Gwitchin First Nation employees have been involved in recent Project studies.	The Chance Project Team confirmed Project studies are shared with Vuntut Gwitchin First Nation and that VGFN Citizens will be involved in future monitoring work for the Project. In the past, consultants have contacted Vuntut Gwitchin Government to inquire about Citizen availability to participate in monitoring.
	Recommended wildlife monitors should be from Old Crow.	The Chance Project Team said wildlife monitoring opportunities will be prioritized for Vuntut Gwitchin First Nation Citizens.

Studies	Asked if other governments are involved in studies completed for the Project.	The Chance Project Team said Chance is responsible for conducting the studies and uses available government data to support their studies. Added that Chance is required to conduct specific studies to meet requirements under the *Yukon Environmental Socio-economic Assessment Act*.
	Inquired about EDI's involvement with other governments.	The Chance Project Team shared that EDI supports the sonar project on the Porcupine River and works with the Vuntut Gwitchin First Nation on the winter road which involves DFO.
Geology, Soils, and Permafrost	Asked if permafrost is under the whole Project area.	The Chance Project Team stated that the Project footprint is assumed to be continuous permafrost but are aiming to avoid ice-rich areas. Added that areas containing silts and clays will thaw the permafrost more quickly than areas without silts and clays. The Chance Project Team noted that Chance will utilize the suitability map prepared by Palmer to design winter access road and drilling locations.
	Asked if the temperature of the ground has been warmer due to climate change.	. The Chance Project Team stated that data has only been collected over the past few years and that changes in climate are measures over a longer time scale.
	Asked if the Project area has been hit by wildfires.	The Chance Project Team responded that wildfires have hit the Project area which can cause permafrost to reduce and increase the active layer. Added that wildfires damage permafrost, but vegetation helps to insulate in areas not damaged by wildfire.
	Asked how the Project will impact permafrost.	The Chance Project Team stated that a heat island (area with a higher temperature than surrounding areas) will have a thicker active layer of permafrost that is more susceptible to thawing. Explained that since the Project activities will occur in the winter, less impacts to permafrost are anticipated because snow helps to protect the permafrost active layer. Areas with more silts and clays are more susceptible to thawing the active layer of permafrost. These types of areas will be avoided for Project activities, where possible.
	Asked what was identified in the permafrost study.	The Chance Project Team said the studies identified areas and thickness of permafrost. Added that this data will help create a baseline to understand potential future impacts to permafrost in the area.

	Asked the depth of the permafrost.	The Chance Project Team said the depth of permafrost varies across the Project area. Palmer's drilling work shows that the active layer is 0.45 to 0.9 metres (m) thick in fine-grained soils, below wetlands, and in valley bottoms. In coarse-grained soils, it is more than 0.9 m thick. Areas recently burned by wildfire have active layers that are more than 1 m thick, possibly much more.
	Asked what the Project will do to avoid drilling in discontinuous permafrost areas.	The Chance Project Team noted that the Project will take action to prevent drilling in discontinuous permafrost areas.
	Noted that some people in Old Crow have noticed changes in soil/permafrost conditions.	The Chance Project Team said that happens when the permafrost starts to unfreeze.
	Inquired about mitigation measures to protect permafrost.	The Chance Project Team stated there are three approaches to protect permafrost (avoidance, monitoring, and protective approaches). Avoidance involves identifying and avoiding areas that are more susceptible to changes in permafrost conditions due to drilling or other Project-related activities. The Project is also anticipating implementing monitoring programs. Protective measures include using snowpack in the areas where the Project is anticipating conducting drilling and on winter roads. The Chance Project Team explained that stated the Project will use a solution/system to refrigerate the area around the drill to reduce heat from friction to protect the permafrost. This will ensure the integrity of the permafrost.
	Asked if the *Surficial Geology Mapping* and *Road and Wellpad Suitability for Exploration* maps shared on the permafrost posterboard were accurate.	The Chance Project Team clarified that the maps have been verified to a level consistent with professional standards and adjusted using data collected in field i.e. temperature sensors and surface drilling.
	Asked if Palmer was a private company or a government office.	The Chance Project Team confirmed that Palmer is a privately owned company. Shared that Palmer hires registered professional geologists and geo-scientists who are bound by ethical standards to present accurate terrain and permafrost information.
Other	Asked if Chance had mapped out traditional camps in the area.	The Chance Project Team stated that Ecofor and the VGG Heritage Department can assist if there is any traditional hunting camp. Added that to date, there are no specific camps in the area aside from a cabin from the 1960 to 1970s exploration. The Chance Project Team is assessing potential Project-related effects to land and resource use. This information will be

		described in the Project Proposal and will identify potential Project-related effects to known traditional camps.
	Asked if the Project is going to be conducted throughout the year.	The Chance Project Team confirmed exploration activities are planned for the winter months over a 10-year period.
	Inquired about who would lead the reclamation.	The Chance Project Team confirmed Chance is responsible for conducting reclamation work. Added that the Project will not require extensive reclamation. The Chance Project Team shared that reclamation activities will occur throughout exploration activities and natural regeneration is expected to occur. The Chance Project Team also said that the main reclamation activity is dismantling the camp.
	Inquired about Old Crow transitioning to cleaner energy sources.	The Chance Project Team said royalties from a future extraction project could be used by Vuntut Gwitchin Government to support the transition to more sustainable energy sources.

World Café Event Closing

Chance is grateful for the opportunity to conduct the World Café event. They valued discussing, Project-related interests, concerns, and feedback of VGFN Citizens and Old Crow residents.



Figure 6: Darius Elias Community Centre (December 2023).

Appendix A. Old Crow Event Invitation Poster

Chance
OIL AND GAS LIMITED

WE WANT TO HEAR FROM YOU

WEDNESDAY, DECEMBER 6, 2023

Come learn about potential Eagle Plains Exploration Project effects to the Porcupine Caribou Herd, heritage resources, wildlife, vegetation, and permafrost. Chance wants to hear your feedback on proposed mitigation measures to potential effects.

DARIUS ELIAS COMMUNITY CENTRE
DOORS OPEN FROM 4:00 PM - 8:00 PM
AIR NORTH DOOR PRIZES
CATERED DINNER

For more information, please contact:
Greg Charlie (e: gcharlie@chanceyukon.ca, p: 867.456.7805) or
Cindy Dickson (e: cdickson@chanceyukon.ca, p: 867.456.7805).

Appendix B. Project Handout

EAGLE PLAINS EXPLORATION PROJECT: NOVEMBER 2023 UPDATE

Contact Chance Oil and Gas Limited (Chance) with questions or comments about the Project:

[redacted]

[redacted]

Where is the Eagle Plains Exploration Project (Project)?

The Project is located in the Eagle Plains Basin area in the Yukon, centred approximately 605 km north of Whitehorse and 40 km south and west of the Eagle Plains Hotel, along the Dempster Highway.

What is the Project?

The Project proposes to use seismic and drilling techniques to better understand oil and natural gas resources in the Eagle Plains Basin. If sufficient oil and/or natural gas resources are discovered, Chance may propose to conduct a future extraction project. Any future extraction project would undergo an environmental assessment.

What is the regulatory process for the Project?

Chance is preparing a document called a Project Proposal for submission to the Yukon Environmental and Socio-economic Assessment Board (YESAB) in February 2024. This will begin the assessment process for the Project. The Project Proposal will summarize the Project, including potential Project-related environmental and socio-economic impacts to affected First Nations and residents of communities. Once submitted, the Project Proposal will be available for download on YESAB's website.

The Project is being assessed by the YESAB Executive Committee (EC). The EC will review the Project Proposal and recommend for the Project to proceed, proceed with terms and conditions, or be rejected. First Nations, the public, and Decision Bodies (i.e., Government of Yukon and Government of Canada) will review and provide feedback. The EC will consider feedback and post a final recommendation. Decision Bodies are responsible for issuing authorizations and permits for the Project to proceed to construction.

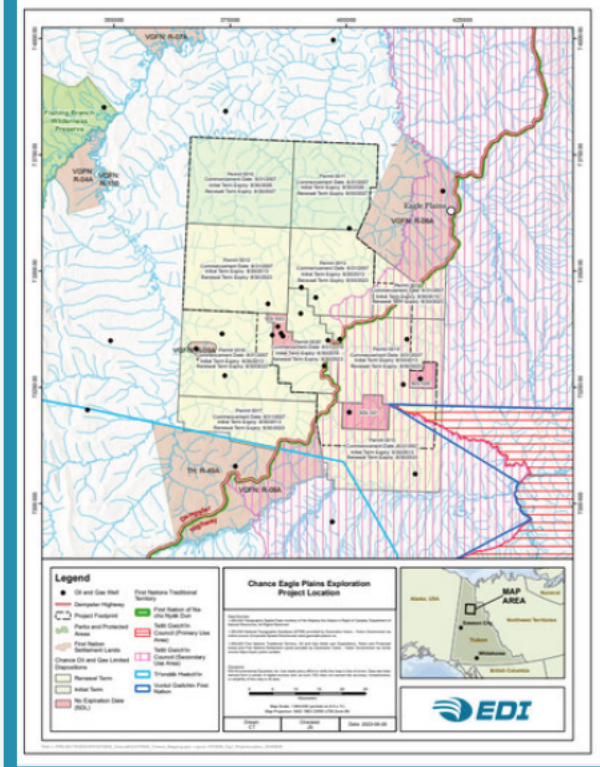


Figure: Project Location

Chance is committed to continued consultation and engagement with affected First Nations, residents of communities, and the Porcupine Caribou Management Board before and after submitting the Project Proposal.

What studies have been completed ?

- Permafrost Studies
- Fish and Fish Habitat Studies
- Vegetation Studies
- Water Quality and Surface Flow Studies
- Terrain and Surficial Geology
- Wildlife Studies
  - Porcupine Caribou Herd
  - Moose
  - American Marten
  - Grizzly Bear
  - Birds
- Linear Features Study
- Heritage Resources Studies

Chance OIL AND GAS LIMITED

Project Regulatory Process Timeline

2014
Chance started Project Planning

2016
YESAB Dawson City Designated Office referred the Project to be assessed by the YESAB EC

2018 - 2023
Chance conducted studies on permafrost, heritage resources, wildlife, water, vegetation etc.

June 2023
Chance developed the Draft Project Description

July 2023 - January 2024
Chance is currently developing the Project Proposal

February 2024
Chance will submit the Project Proposal to the YESAB EC to start the assessment process for the Project

Key First Nation and Residents of Communities' Project Feedback (2014 - Present)

- Shared the importance of land, water, and resources to First Nations culture and way of life
- Expressed concern for conventional seismic impacts to wildlife (e.g., predator-prey relationships), vegetation, and land and resource use (e.g., hunting)
- Expressed concern for year-round drilling impacts and increased Project footprint to the Porcupine Caribou Herd
- Shared interest in contributing to Project heritage studies and being notified of the discovery of any heritage resources
- Expressed concern for the use of temporary and all-season roads to permafrost and vegetation
- Had perceptions that the Project included fracking
- Expressed interest in developing mitigation measures for the Project (i.e., ways to reduce Project impacts to people and the environment)
- Shared interest in Project-related training, employment, and procurement opportunitites
- Noted concern for Project-related effects to wildlife such as the Porcupine Caribou Herd and land and resource use activities

How Chance Has Responded to Feedback Shared

- Spread activities across 10 years to reduce annual environmental impacts
- Focused on newer, low impact seismic technology
- Switched from year-round to winter-only drilling activities. Focused on using the existing Chance footprint and networks rather than increasing the Project footprint
- Shared heritage studies with affected First Nations and committed to notifying affected First Nations immediately if heritage resources are discovered
- Switched from year-round roads to winter ice roads
- Confirmed no fracking is anticipated, now or later
- Confirmed willingness to continue to have discussions on Project mitigation measures with affected First Nations and residents of communities
- Spread activities across 10 years to create longer/steady employment opportunities and hosted career fairs
- Completed constraints mapping to avoid sensitive or high-quality environmental and heritage areas, and focused on an area that allows the highest level of development based on the North Yukon Regional Land Use Plan and the Peer Watershed Regional Land Use Plan

Appendix C. Open House Sign-in Sheets

Old Crow

#	First Name	Last Name	First Nation (If applicable)	Please provide your contact information below if you would like to receive updates about the Eagle Plains Exploration Project and future engagement events (Phone # and/or email)
[redacted]				

Old Crow

#	First Name	Last Name	First Nation (If applicable)	Please provide your contact information below if you would like to receive updates about the Eagle Plains Exploration Project and future engagement events
[redacted]				

Old Crow

#	First Name	Last Name	First Nation (If applicable)	Please provide your contact information below if you would like to receive updates about the Eagle Plains Exploration Project and future engagement events
[redacted]				

Old Crow

#	First Name	Last Name	First Nation (If applicable)	Please provide your contact information below if you would like to receive updates about the Eagle Plains Exploration Project and future engagement events (Phone # and/or email)
[redacted]				

Old Crow

#	First Name	Last Name	First Nation (If applicable)	Please provide your contact information below if you would like to receive updates about the Eagle Plains Exploration Project and future engagement events (Phone # and/or email)
[redacted]				

old Crow

#	First Name	Last Name	First Nation (If applicable)	Please provide your contact information below if you would like to receive updates about the Eagle Plains Exploration Project and future engagement events (Phone # and/or email)
[redacted]				

old Crow

#	First Name	Last Name	First Nation (If applicable)	Please provide your contact information below if you would like to receive updates about the Eagle Plains Exploration Project and future engagement events (Phone # and/or email)
[redacted]				

Appendix D. Photo Permission Posters

Chance
OIL AND GAS LIMITED

Photo Consent



Photos will be taken at today's event. These images will be used by Chance Oil and Gas Limited in public-facing materials.

If you prefer for you or your child not to be photographed, please speak to the Open House facilitators from Two Worlds Consulting.

Appendix E. Project Information Posterboards

Eagle Plains Exploration Project

Chance Oil and Gas Limited Overview

Chance Oil and Gas Limited (Chance) is an exploration company focused on assessing oil and natural gas potential in Yukon. Chance was incorporated on September 19, 1994 and has offices in Whitehorse and Calgary.

What is the proposed Eagle Plains Exploration Project?

Chance is proposing a drilling and seismic exploration project ("Eagle Plains Exploration Project" or "Project") to better understand oil and natural gas resources in the Eagle Plain Basin. Chance will conduct the following activities over a period of up to 10 years:

- Construct 1,500 square kilometers (km²) of new 3D seismic lines (i.e., pathways created by removing vegetation to support Project activities)
  - Seismic lines will be constructed over multiple programs (i.e., not all at once)
- Construct 2,000 km² of 2D seismic lines
  - Seismic lines to be constructed during one or multiple of the 3D seismic programs
- Drill up to 30 wells to evaluate the presence of oil and natural and gas resources
  - Drilling to be conducted during the winter
  - Drilling approximately 5-8 wells per year
- Conduct extended flow testing on up to 20 wells to understand how much oil and/or natural gas each well can produce over time
  - This information will help Chance understand if it is economical to propose a new project focused on extracting available oil and natural gas resources in the Project area.

What are the benefits of oil and natural gas to the Yukon?

If the Project finds it is economical and feasible to extract, the proposed Project will:

- Provide less carbon intensive oil and natural gas supply to Yukon, parts of Canada, and other regions across the world
- Create employment and procurement opportunities for First Nations and local/regional businesses
- Reduce local and regional reliance on oil and natural gas resources from other areas in Canada and across the world
- Improve local and regional energy security
- Offset the use of carbon-intensive diesel in Yukon using natural gas for power generation.



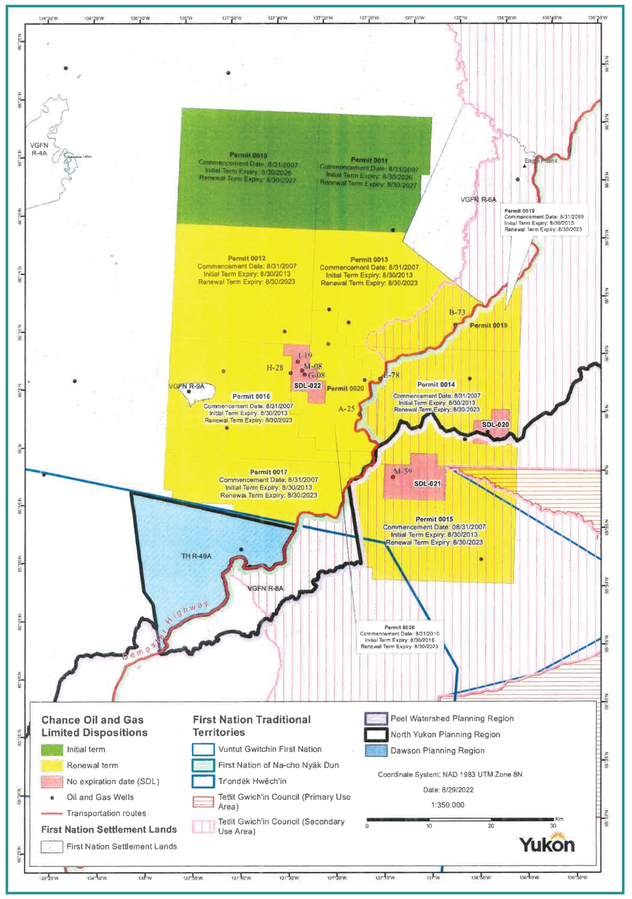
Chance Rig

Where is the Project?

The proposed Project is approximately 2,400 km² located in the territories of:

- First Nation of Na-Cho Nyäk Dun
- Tetlit Gwich'in Council Secondary Use Area
- Vuntut Gwitchin First Nation.

Chance Oil and Gas Limited Dispositions and Wells



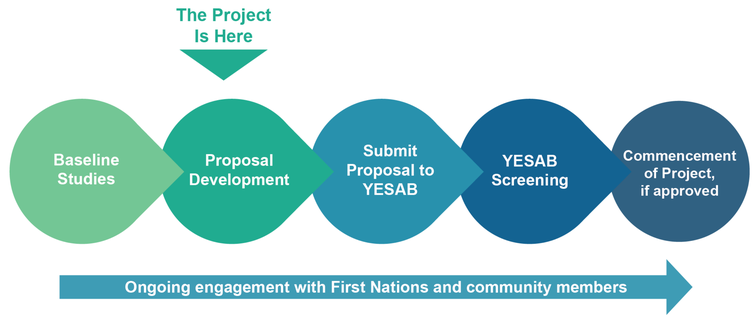


Chance Rig and Camp

What regulatory process does the Project fall under?

The proposed Project will be assessed by the Executive Committee of the Yukon Environmental and Socioeconomic Assessment Board (YESAB), under the *Yukon Environmental and Socioeconomic Assessment Act (YESAA)*. Chance is planning to submit a Project Proposal to YESAB in late 2023. The Project Proposal will reflect feedback from First Nations and community members as well as baseline research conducted by Chance between 2019 – 2023. First Nations and community members will have an opportunity to comment on the Project Proposal in engagement processes and during the YESAB assessment process. Chance will engage First Nations and community members during all stages of the YESAB assessment process.

YESAB Process



First Nation Engagement

Chance appreciates the opportunity to engage and learn from potentially affected First Nations. Chance will incorporate feedback shared during ongoing engagement with First Nations to the Project Proposal and other plans. Chance will provide ongoing Project updates with interested First Nations throughout the life of the Project.



Eagle Plain Basin

Heritage Resource Management Program

Introduction

On behalf of Chance Oil and Gas Ltd. (Chance), Ecofor Consulting Ltd. (Ecofor) has been developing a Heritage Resource Management Program for the Eagle Plains Exploration Project (Project) since 2021. The goals of the Heritage Resource Management Program are to assess the heritage resource potential and sensitivity within the Project Area and make recommendations for the ongoing management of heritage resources. The Heritage Resource Management Program includes three main types of assessments:

1. Heritage Resource Overview Assessment (HROA)

- An HROA involves a desktop review (no fieldwork) including reading through past documents, databases, and maps of the physical/environmental and cultural/historical setting within the Project Area. Information gathered during the desktop review is used to identify known heritage resource sites and predict areas of high potential for undocumented heritage resource sites. The HROA considers landscape features (e.g. mountains, hills, valleys), visible surroundings, closeness to natural resources (e.g. water and food gathering areas), and distance to previously recorded heritage resource sites to determine high potential for undocumented heritage resource sites. Indigenous Knowledge and Traditional Land Use data are also used to enhance the HROA, when available.

2. Heritage Resource Impact Assessment (HRIA)

- An HRIA is the first phase of field study within a Heritage Resource Management Program. It involves visits to any known heritage resource sites that may be affected by exploration activities and the areas of elevated potential identified in the HROA. Specific HRIA tasks include:
  - Pedestrian survey to identify surficial heritage resources and areas with potential for underground heritage resources
  - Shovel testing in areas with confirmed potential for underground heritage resources
  - Documentation of all shovel test locations and heritage resource sites encountered during the HRIA
  - Reporting of all documented heritage resource sites encountered during the HRIA to First Nations, Chance, and the Yukon Government Heritage Resource Unit.

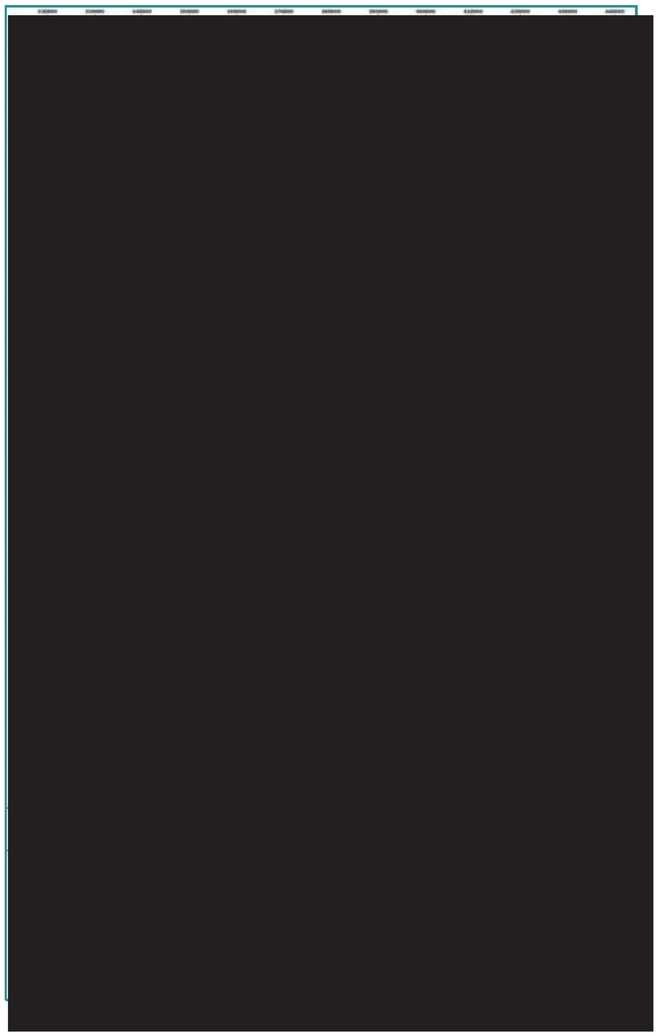
3. Systematic Data Recovery Excavation (SDR)

- An SDR program is used when the Project cannot avoid affecting a heritage resource site. The goal of the SDR program is to mitigate impacts to the site area by collecting detailed site data to develop a strong understanding of the site. Specific SDR tasks include:
  - Shovel testing within the known site area to determine the site boundaries and identify underground heritage resources
  - Excavation of 1 m x 1 m excavation units, arranged as blocks, trenches, or individual units, to recover heritage resource materials
  - Detailed documentation of all heritage resources encountered during the SDR program
  - Reporting of all documented heritage resource sites encountered during the SDR program to First Nations, Chance, and the Yukon Government Heritage Resource Unit.

Heritage Resource Management Program Details

Previous Heritage Resource Management Work Within the Project Area

The Project Area has not been extensively explored for heritage resources, but a few studies have assessed portions of the current footprint. These studies include three permitted HRIAs related to previous oil and gas exploration and one HRIA related to a fibre optic cable project along the Dempster Highway. Three non-permitted studies have also been completed in association with the fibre optic project along the Dempster Highway, including a HROA, an Indigenous Knowledge/Traditional Land Use study, and an update to the original HROA. These studies have identified seven archaeological sites and one Yukon Historic Sites Inventory site.



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The Project's Heritage Resource Management Program work began in 2021. An HROA was completed in early 2022. This review identified several thousand areas of high potential for surface and underground heritage resource sites within the 2,400 km^2 area Ecofor archaeologists studied.

In 2022, Ecofor conducted an HRIA program within a 625 km^2 subsection of the Project Area where a new seismic and drilling program has been proposed. A Vuntut Gwitchin First Nation member participated in this HRIA. Work included a helicopter survey throughout this area, a survey on foot, and shovel testing at 12 locations. In total, 228 shovel tests were completed. Shovel tests at location E10 led to the recording of archaeological site [redacted] This site has been flagged as a no-work area. If future phases of the Project are unable to avoid the site area, an SDR program may be considered. No heritage resources were discovered at the other shovel test locations.

Chance and Ecofor will continue to develop the Heritage Resource Management Program. Further HRIA studies are planned for summer 2023. This work will help inform heritage resources management needs of proposed Project activities.

Heritage Resource Management Program

Introduction

On behalf of Chance Oil and Gas Ltd. (Chance), Ecofor Consulting Ltd. (Ecofor) has been developing a Heritage Resource Management Program for the Eagle Plains Exploration Project (Project) since 2021. The goals of the Heritage Resource Management Program are to assess the heritage resource potential and sensitivity within the Project Area and make recommendations for the ongoing management of heritage resources. The Heritage Resource Management Program includes three main types of assessments:

1. Heritage Resource Overview Assessment (HROA)

- An HROA involves a desktop review (no fieldwork) including reading through past documents, databases, and maps of the physical/environmental and cultural/historical setting within the Project Area. Information gathered during the desktop review is used to identify known heritage resource sites and predict areas of high potential for undocumented heritage resource sites. The HROA considers landscape features (e.g. mountains, hills, valleys), visible surroundings, closeness to natural resources (e.g. water and food gathering areas), and distance to previously recorded heritage resource sites to determine high potential for undocumented heritage resource sites. Indigenous Knowledge and Traditional Land Use data are also used to enhance the HROA, when available.

2. Heritage Resource Impact Assessment (HRIA)

- An HRIA is the first phase of field study within a Heritage Resource Management Program. It involves visits to any known heritage resource sites that may be affected by exploration activities and the areas of elevated potential identified in the HROA. Specific HRIA tasks include:
  - Pedestrian survey to identify surficial heritage resources and areas with potential for underground heritage resources
  - Shovel testing in areas with confirmed potential for underground heritage resources
  - Documentation of all shovel test locations and heritage resource sites encountered during the HRIA
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[redacted]

Permafrost and Terrain Mapping

Chance OIL AND GAS LIMITED

Background Information on Permafrost

Continuous permafrost is frozen ground that remains below 0°C for more than 2 years. Chance Oil and Gas Ltd's (Chance) proposed Eagle Plains Exploration Project (Project) is entirely within a zone of continuous permafrost. The depth of permafrost below the ground surface varies across the Eagle Plains landscape and throughout the year. Permafrost can be more or less sensitive to disturbances (e.g., drilling), depending on a number of factors, such as ground temperature, ice content, and soil type. Permafrost warmer than -2°C is more likely to thaw as a result of local, minor disturbances to the ground surface, whereas cooler permafrost will likely not thaw from minor disturbances.

Chance needs to understand the terrain and permafrost conditions of the Project Area to design the Project. This information is key for identifying the best areas for the Project's access roads and well pads, for locating gravel for road construction, and for the in-ground placement of drill cuttings. Palmer has mapped the geology of the top layer of ground (what is above the bedrock, also called the surficial geology), determined the state of permafrost throughout the Project Area, and created maps identifying suitable locations for Chance's proposed oil and natural gas exploration activities.

Palmer installed sensors, using a drill that can be carried in a helicopter, to measure ground temperature and frozen/thawed state in the top 1 m of the ground in suitable locations.



Helicopter slinging drill



Drilling with lightweight Talon drill

How Terrain and Permafrost Information Informs the Project

The active layer is the part of the ground that thaws in the summer and refreezes in the winter. Palmer's drilling work shows that the active layer is 0.45 to 0.9 m thick in fine-grained soils, below wetlands, and in valley bottoms. In coarse-grained soils, it is more than 0.9 m thick. Areas recently burned by wildfire have active layers that are more than 1 m thick, possibly much more.



Field Testpit

Ice content information is important, as ground containing lots of ice is more sensitive to disturbances (e.g., drilling) and recovers less quickly than ground containing less ice. Areas with high to moderate amounts of ice were found within wetlands and fine-grained soils. The ice content in these areas makes up more than 20% of the soil, but ice amounts vary a lot and are not the same throughout the soil. Ground with low amounts of ice, (less than 10% of the soil) were found within weathered sandstone bedrock near the surface and within coarse-grained layers of material that can be found alongside fine-grained layers of material containing more ice. Palmer concludes that ground ice content in the Project Area is highly variable (i.e., the amount of ice underground is not the same everywhere). Palmer upgraded the oil and natural gas exploration suitability maps to account for different permafrost conditions.

Palmer first collected data from the ground temperature sensors in summer 2022. Cold, stable permafrost was identified in areas with lots of ice on the valley bottom and in a few other areas. One site on a northeast slope within the Project Area has a ground temperature of 3.8°C at 1 m depth, and temperatures are likely similar at locations on similar slopes. Palmer was unable to measure the ground temperatures at 1 m depths at two locations because the equipment malfunctioned.

In places where the shrubs and trees were burned by wildfire 18 years ago, the active layer is more than 1 m thick (and may have thawed down to bedrock) and the 1 m ground temperature is -0.2°C. Permafrost is unlikely to return to its former possible shallower depths due to the site conditions (a lack of vegetation), so permafrost is considered to be naturally disappearing at this site.

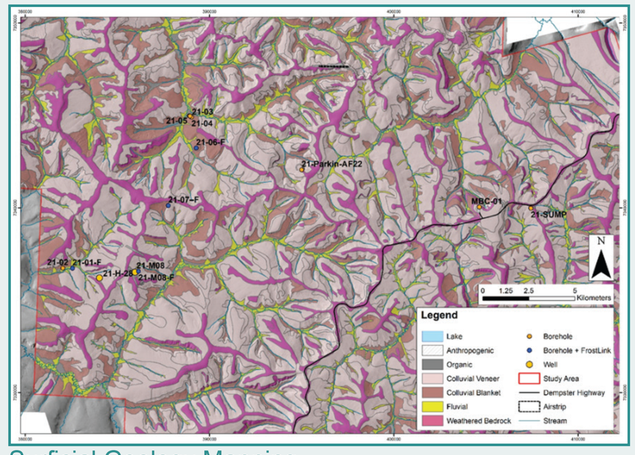
Cold, stable permafrost is preferred for proposed Project activities. Areas with large amounts of ice can either be avoided or protected through appropriate actions. Areas where permafrost is naturally becoming deeper because trees and brush were lost to wildfire should be left to naturally recover (i.e., allow permafrost to slowly re-establish itself) or actions can be taken to help keep the ground cold (e.g., adding an insulating cover to perform the same function as vegetation or installing a thermal management device). Such mitigation would likely result in faster permafrost recovery of these areas.



FrostLink Sensor with Plastic Housing



FrostLink Sensor with Steel Housing



Surficial Geology Mapping



Road and Wellpad Suitability for Exploration

Suitability is determined based on surficial geology, permafrost conditions, and drainage. Very high and high suitability are favourable for establishing access roads and wellpads, low and very low suitability are unfavourable for establishing access roads and wellpads. The exploration suitability map assumes no mitigation. Exploration activity that needs to cross less suitable areas can be done responsibly through appropriate mitigation.

Next Steps

Next steps include gathering data from two sensors installed in 2022, replacement of malfunctioning sensors, and installation of six new sensors in summer 2023. The new sensor design is more durable and waterproof and is expected to perform better in the harsh climate.

Porcupine Caribou Herd

Overview

The Porcupine Caribou Herd's annual range extends over large portions of northern Yukon and northeast Alaska. Environmental Dynamics Inc. (EDI) conducted habitat, movement, and linear features studies to:

- Better understand the Eagle Plains Exploration Project (Project) Area with regards to Porcupine Caribou
- Support the assessment of potential Project-related effects to Porcupine Caribou
- Identify ways for the Project to reduce potential Project-related effects to Porcupine Caribou.

Key Existing Information

- The Project overlaps a small proportion of the Porcupine Caribou Herd's late fall and winter ranges
- Based on the past 30 years of data collected from collars placed on caribou to track their movement using GPS, less than 3% of the Porcupine Caribou Herd typically occurs within the Project Area
- Late-fall and winter are less-sensitive periods for Porcupine Caribou
  - During these seasons, Porcupine Caribou are typically in good body condition and are free of insects and other stressors
  - Late-fall and winter are not associated with critical life stages, such as breeding or calving.



Example caribou habitat in Eagle Plains with lots of terrestrial lichen

Habitat Mapping

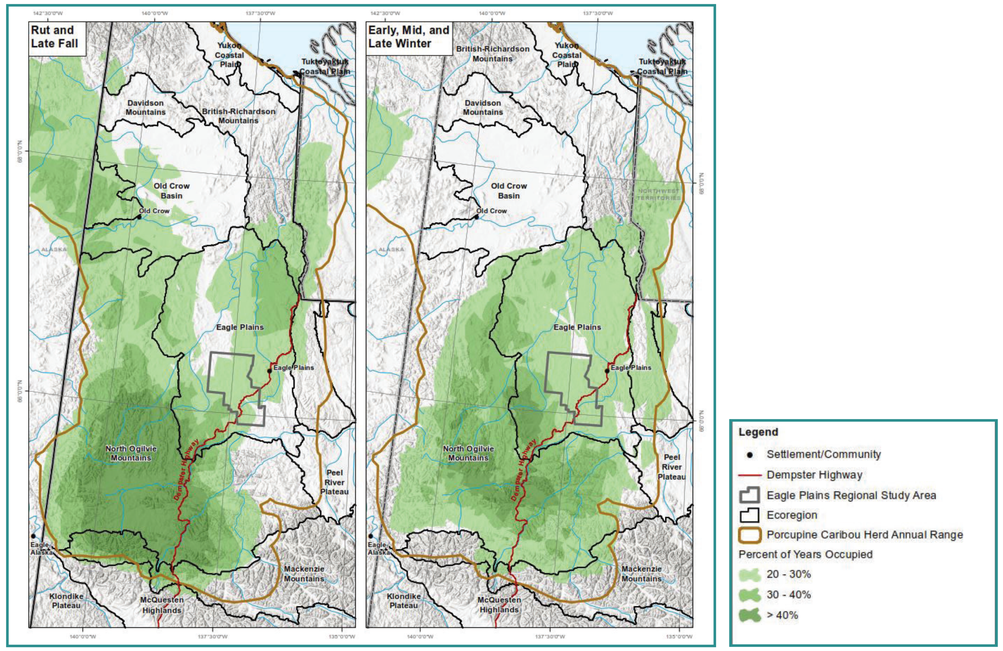
EDI modeled Porcupine Caribou habitat using collar data from the Porcupine Caribou Management Board and vegetation mapping. These models describe the amount, quality, and distribution of important late-fall and winter Porcupine Caribou habitat across the Project Area. Lichen cover was the primary driver of habitat selection by caribou.

Caribou Distribution and Movement

EDI used collar data and studies conducted by the Porcupine Caribou Technical Committee to better understand how much of the Project Area overlaps with the late-fall and winter ranges and movement routes of the Porcupine Caribou Herd.

- Caribou tend to move an average of 8.7 km per day in late-fall and 4.4 km per day in the winter.
- Porcupine Caribou spent half as much time in the Project Area during the late-fall and winter than other parts of their late-fall and winter ranges.

Seasonal Ranges Based on Historic Use



Linear Features Study

Linear features (e.g., roads, powerlines, and trails) can affect how people and wildlife move across the landscape as well as predator-prey relationships. EDI studied existing linear features in the Project Area to evaluate vegetation recovery on linear features and how those lines are used by people and wildlife.

- There are three main types of linear features associated with past oil and gas exploration activities in the Eagle Plains: winter roads, 2D seismic lines (i.e., pathways created by removing vegetation to support oil and gas exploration activities) (5-8 m wide), and 3D seismic lines (1.5-3 m wide)
- Most 2D seismic lines are from oil and gas exploration activities that took place between the 1950s to 1990s
  - 75% of these seismic lines have vegetation growing back with similar species and densities as the nearby vegetation that wasn't disturbed
  - 22% of these seismic lines have vegetation growing back at a faster rate, and are now larger than nearby vegetation that wasn't disturbed
- All 3D lines were created in the winter of 2014, and showed signs of normal regrowth
  - Line of sight down 3D lines was not expected to offer substantial advantage to hunters and/or predators compared to line of sight through areas that were undisturbed
- Signs of caribou or moose use were observed on all types of linear features
- Other than the Dempster Highway, no human use was observed on linear features in winter.



Line of sight down a seismic line in the Eagle Plains



Aerial view of a seismic line in the Eagle Plains

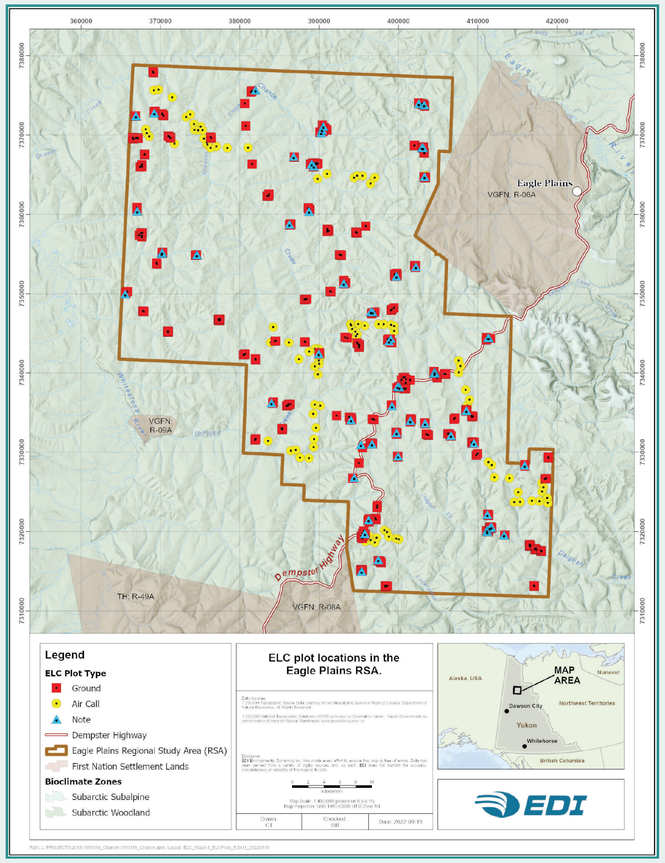
Wildlife and Habitat Mapping

Overview

Chance Oil and Gas Limited (Chance) is committed to protecting wildlife and habitat during the proposed Eagle Plains Exploration Project (Project). Many types of wildlife occur in the Project Area at different times of year. Environmental Dynamics Inc. (EDI) has been gathering information on a number of key species in the Project Area. Field studies, best management practices, working with Indigenous land users and Traditional Knowledge holders, and consultation with communities will help make informed decisions about protecting the environment and wildlife throughout the life of the Project.

Ecological Land Classification - Habitat Mapping

The Yukon Environmental Socio-economic Assessment Board requires that a project proposal have an area-wide ecosystem map. This mapping identifies any rare or sensitive ecosystems in the Project Area and can be used for wildlife habitat mapping. Both ecosystem and habitat mapping can be tools to measure potential Project-related impacts and disturbances to habitat types. They can also be used to reduce potential Project-related effects. EDI completed ecosystem mapping across the Project Area following Yukon standards for Ecological Landscape Classification.



Ecological Landscape Classification Plot Locations

Birds

Due to the remote location of the Project Area, existing knowledge on bird presence was limited. EDI conducted point count surveys and wetland bird surveys in the Project Area in June 2019. A total of 52 species of birds were detected, including four species at risk: Red-necked Phalarope, Common Nighthawk, Olive-sided Flycatcher, and Rusty Blackbird. The number of species and total bird abundance were both well-distributed across the habitats of the Project Area. Most birds are expected to be absent from the Project Area during winter months.


Lincolns Sparrow


Rock Ptarmigan


Spotted Sandpiper


Red-necked Phalarope

American Marten

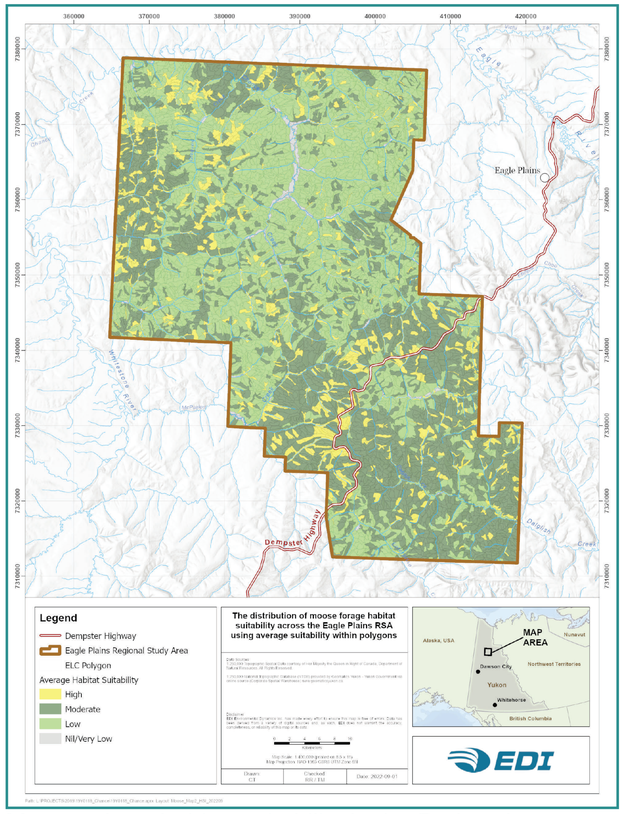
Marten is an indicator species for mature and old forest values and is important to local communities as a furbearer. EDI developed a habitat model to understand the amount, quality, and distribution of habitat for this species. The majority (60%) of the Project Area is made up of low-quality habitat. High-quality habitat, found in 16% of the Project Area, is associated with mesic, spruce-dominant ecosites in mature to old forests.

Moose

Formal population surveys of moose have not been conducted in the Project Area but local knowledge suggests that, while moose densities in Eagle Plains are relatively low compared to areas in southern Yukon, they are relatively high compared to other areas in northern Yukon. Winter is the most limiting season for moose due to reduced food availability and greater energy demands from cold temperatures and the extra effort to travel through snow. EDI developed a habitat model to understand winter moose habitat amount, quality, and distribution in the Project Area. The model identified widespread moderate- and low-quality habitat, with only a small amount of high-quality habitat present.



Willow shrubs browsed by moose in the Project Area



Moose winter habitat suitability in the Project Area

Fisheries and Water

Fish and Aquatic Studies

Overview

There is very little information available on fish populations in the Eagle Plains Area. In order to gain a better understanding of where and when fish are there, EDI conducted studies in 2019 and 2020. These studies included compiling historic info, assembling available spatial data on streams, conducting field studies in 2019-2020, and developing a model that could be used to tell the chances of fish being present in streams in the Project Area. Field studies occurred in July/August 2019, when the presence of fish was expected to be its highest, and again in March 2020, when the availability of overwintering fish habitat was expected to be at its lowest.

Key Findings

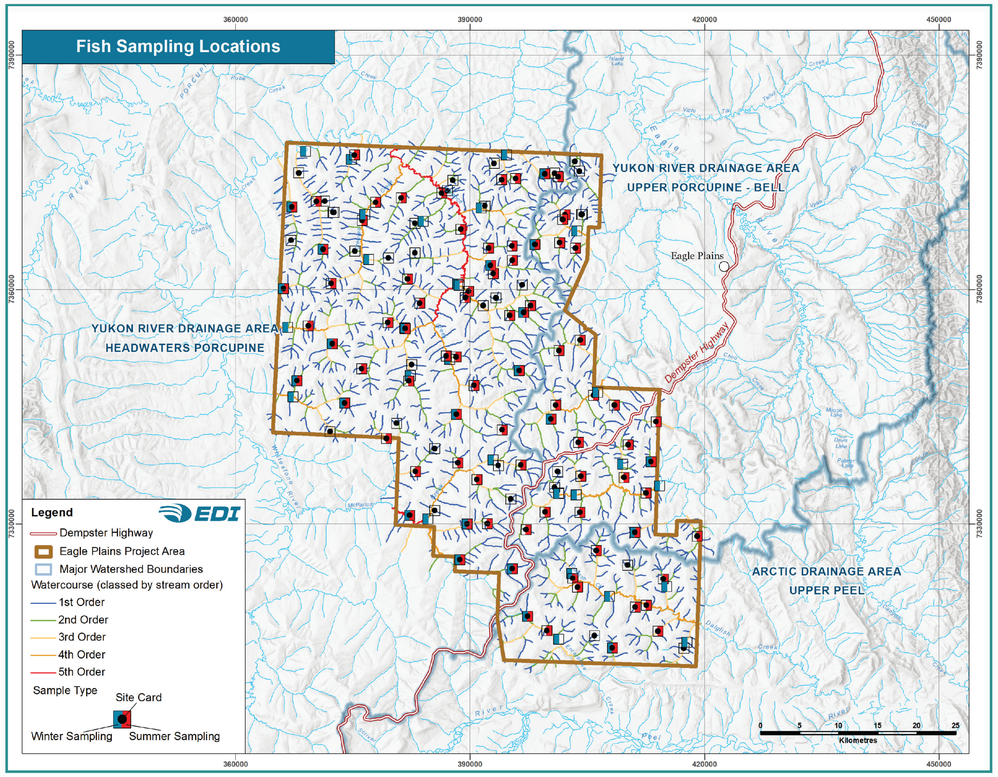
- Six species of fish were observed within or immediately next to the Project Area. This included Arctic grayling, slimy sculpin, longnose sucker, burbot, round whitefish, and lake whitefish. All of these species, with the exception of lake whitefish, were observed during the summer 2019 fish surveys.
  - During the summer, Arctic grayling were around the most. They were the only species found in all types of streams.
- Larger streams generally had better habitat for fish such as higher water volume and better water quality (e.g., dissolved oxygen levels). EDI found that the bigger the stream, the more likely the fish were there.
- During winter, fish habitat becomes very limited due to reduced water flow and reduced water quality. Smaller streams had no water in the winter. In bigger streams, water was limited to deeper pools and dissolved oxygen levels were too low to support overwintering fish.



Arctic Grayling caught during fish sampling



Electrofishing sampling during summer 2019



The 'order' is the type of stream, 1 is the smallest and 5 is the biggest. Clear sitecards mean that no sampling was done in 2019/2020, but there is historic information that was used in the study.

Water Quality and Hydrology

Overview

The project area contains 1,467 streams, many of which are smaller headwater streams. During summer 2019 and winter 2020, EDI collected water samples from five locations within the Project Area and five locations downstream. Eight of these sites match regional sites previously sampled by Yukon Government Water Resources Branch. EDI then combined the water quality data they collected with historic data available from Environment and Climate Change Canada, Yukon Government Water Resources Branch, and Water Survey of Canada.



Example of brown-stained water that is common in streams within the Project Area



Example of a stream in the Project Area

Key Information and Findings

- Surface water quality was similar across the Project Area. Surface water was generally neutral to slightly acidic, typical for boggy northern landscapes. Turbidity (concentration of suspended sediments) changed from stream to stream, likely as a result of melting permafrost causing slumping of stream banks.
- Some metal concentrations, including aluminum, cadmium, copper, iron, and manganese, were present throughout the Project Area at levels higher than Environment Guidelines. Select metals like arsenic and selenium also exceeded guidelines in isolated samples. Given the lack of development near sampling locations, these high levels of metals are likely naturally occurring.
- Dissolved oxygen is consistently low in all streams surveyed in the Project Area during the winter. It is suspected that most fish migrate out of the Project Area in the winter, to areas where the water conditions better support their survival.

Information about Chance, Jobs, and Training

Chance's Company Profile

Chance Oil and Gas Ltd. (Chance) is a Canadian-owned private company incorporated in the Yukon. Chance's head office is located in Calgary, but its team members are based in both Calgary and Whitehorse.

Key Members of Chance's Team:

- Mike Chernoff, Chairman and CEO
- Richard Wyman, President
- Greg Charlie, VP Government and Community Relations
- Cindy Dickson, Regulatory, Environmental and Community Relations Director
- Lynn O'Neil, Corporate Secretary

Chance's Exploration Objectives

The business plan of the company is to explore for, and in the future potentially develop, oil and natural gas resources in Eagle Plains to help meet the energy needs of the Yukon and/or other markets.

Chance's exploration objectives includes:

- Drill up to 30 wells to evaluate resource potential
- Undertake the exploration program on a small scale over a long period of time (i.e., up to 10 years) in order to minimize environmental and social impacts
- Operate as continuously as possible to provide steady employment, to become more efficient over time, and to reduce costs and disruptions associated with starting up and shutting down
- Involve local and regional businesses
- Discover sufficient oil and natural gas resources to support future development of oil and gas.


Worker at camp


Operator



Annual inspection of bottom suspended wells

Some Examples of Jobs

Drilling Program

- Wellsite Supervisor
- Service Rig
- Security
- Wireline Crew
- Slickline Crew
- Truck drivers/operators (Water Tank, Vacuum Truck, Picker / Bed Truck, Fuel Truck)
- Flow Test Crews
- Tool hand
- Cementing Crew
- Wildlife Monitor
- Heritage Monitor
- Road/Trail Construction and Maintenance

Seismic Program

- Line Preparation Supervisor
- Equipment Operators
- Survey Coordinator
- Surveyor
- Source Preparation Supervisor
- Equipment Helpers
- Cruisers
- Slashers
- Packers
- Water Truck Driver
- Line Crew
- Wildlife Monitor
- Heritage Monitor
- Road/Trail Construction and Maintenance

General Camp Operations

- Nurse Practitioner/Medic
- Camp Cooks
- Office Staff
- Camp attendants
- Maintenance and Cleaning Staff

Project Workforce

Chance's workforce is limited by the size of its camp. The Chance Camp can hold a maximum of 75 - 80 people. It's also possible that additional workers could stay at Eagle Plains Hotel.

Chance will work with First Nations to maximize their involvement. One of Chance's main objectives is to provide as much work and contracts to First Nation / Yukon partners as possible.

Training Requirements

Basic training required by all project workers:

- Workplace Hazardous Materials Information System (WHMIS)
- Hydrogen Sulphide Alive
- Wildlife Awareness
- Emergency First Aid/Wilderness First Aid Training
- Common Safety Orientation

Additional and advanced training (varies by job position):

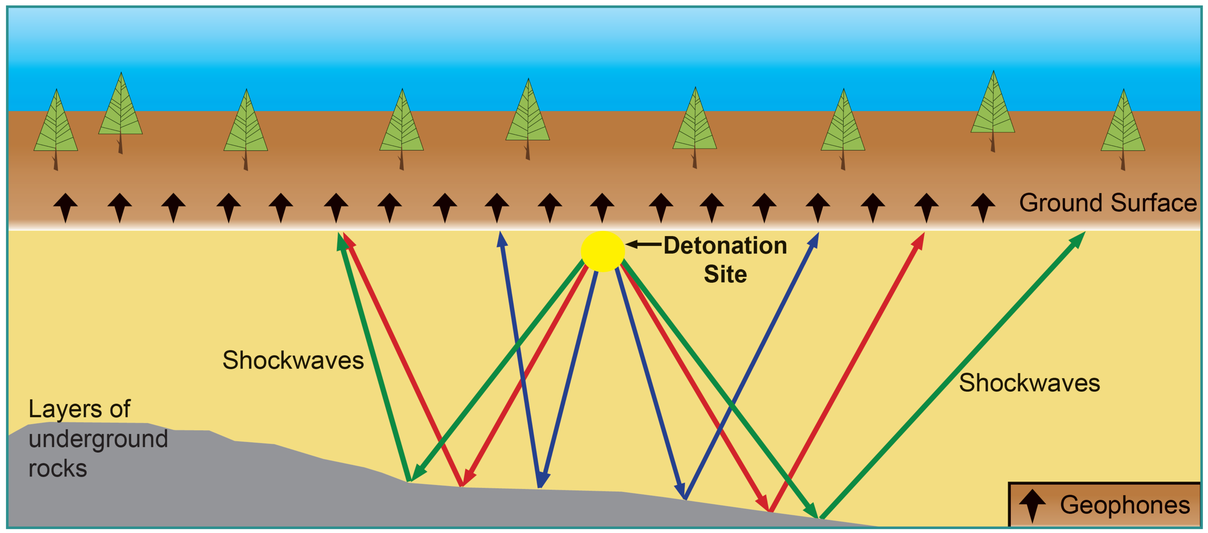
- Food Safe
- ATV
- Chainsaw (Level 1)
- Transportation of Dangerous Goods
- Wildlife/Environmental monitoring training
- Driving licenses (Class 1 and 3)
- Well Service Blowout Prevention
- Confined Space Entry and Monitor
- Fall Protection from Rig Work
- Oilfield Driver Awareness


Annual inspection of bottom suspended wells

Chance's Seismic Exploration Program

What is Seismic?

Seismic technology is used to record and study the earth's layers. Explosives are put in a hole underground (approximately 6m deep) and then that hole is sealed. When the explosives go off, the only sound heard above ground is a dull thud. That sound is similar to that of a passing diesel truck and only lasts about one second. The explosion sends shocks waves down into the ground. Those shock waves bounce back in a variety of different ways off the layers of underground rock. They are then recorded on the surface using equipment called geophones. Information recorded by geophones allows experts to create images of the layers of rock underground and find areas in the earth that may have oil or gas.



How seismic technology works. In this example it is 2D seismic because it is a single line.

Seismic Programs

Chance's seismic programs will help identify the general depths and locations of oil and gas reserves below the surface. Having this information will help decide the best locations for wells and help reduce the number of wells needed for exploration. The seismic programs propose up to 1500 km² of 3D seismic and 2000km of 2D seismic. The programs will take up to 5 to 10 years.

What is the difference between 2D and 3D?

2D seismic data is gathered by putting the geophones and shooting holes with dynamite in one line. 2D seismic is less expensive and needs less lines. They are measured by certain lengths (e.g., 2000 km of 2D seismic).

3D seismic data is gathered by spreading out the geophones in a grid pattern. The source lines (where dynamite is used) will run north/south direction while the receiver lines (geophones) will run east/west director. This is why 3D seismic is measured in area (e.g., 1500 km^2). 3D seismic provides a 3D understanding of the earth's layers. This provides better information on where the oil and gas are located.

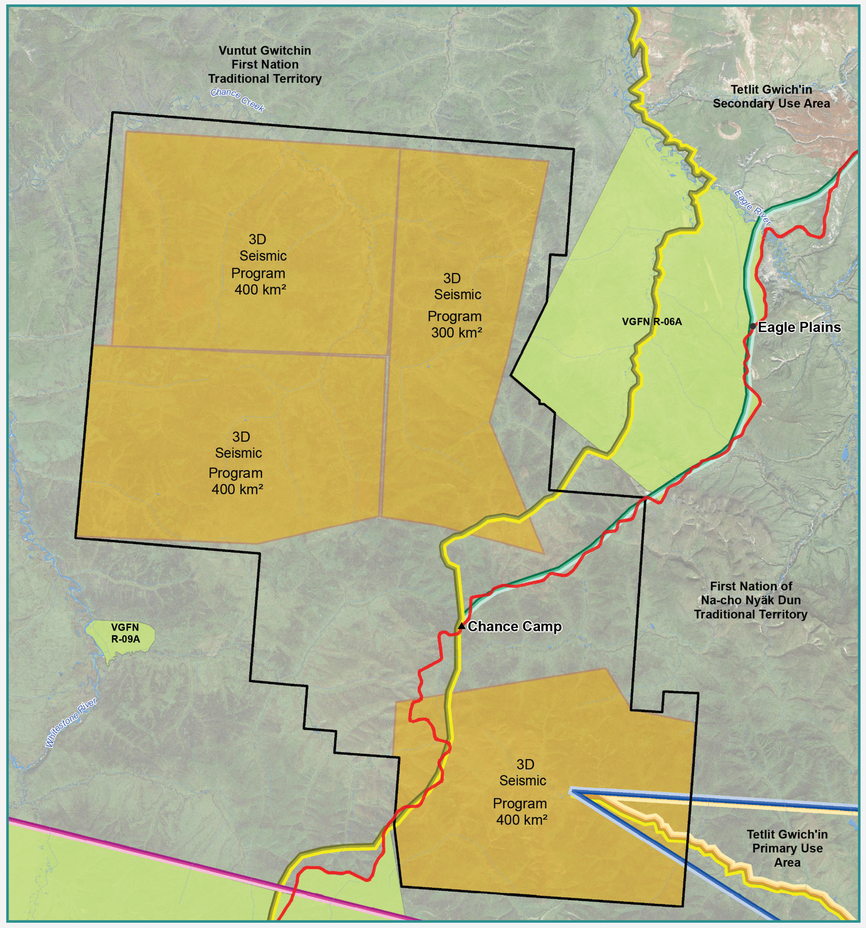
2D lines and 3D lines can overlap each other and take place in the same area.

Reducing Disturbances

In order to reduce the impact of the seismic lines on the environment, Chance will:

- Use old lines, previously burnt areas, and natural open areas, instead of clearing vegetation
- Prepare lines in winter to protect ground cover and vegetation.
- Use zigzags and curves in the lines to make them harder to see and reduce predator line-of-sight.
- Using rough mulching, which only takes off branches of trees. The trunk and roots are left intact to preserve the forest.
- Doglegs will be used where lines meet roads so they can't easily be seen by drivers.
- Remote detonate in summer to avoid times when caribou are present and to maximize hours worked.

Chance Project Area Yukon 3D Seismic Areas



Legend

- Chance Camp
- Chance Project Area
- 3D Seismic Program Area
- Dempster Highway
- Watercourse
- Waterbody
- Protected Area

First Nation Traditional Territories

- First Nation of Na-cho Nyäk Dun
- Tetlit Gwich'in Primary Use Area
- Tetlit Gwich'in Council Secondary Use Area
- Tr'ondëk Hwëch'in
- Vuntut Gwitchin First Nation

First Nation Settlement Lands

- Surface and Subsurface Rights

Appendix F. Open House Feedback Forms

Eagle Plains Exploration Project Feedback Form

Chance Oil and Gas Limited (Chance) would like to learn about your experience at today's event. Responses shared in this Feedback Form will be used by Chance to help inform Project decision-making, Project design, and the assessment of potential Project-related effects to community members. Responses will remain anonymous in any Project materials (e.g., reports to the Yukon Environmental Socio-economic Assessment Board). Thanks in advance for taking time to complete the Feedback Form!

1. How did you hear about the event? **Please check all that apply.**

Radio	Word of Mouth	Social Media	Signage/Poster	Other:
○	⊘	○	○	○

If you selected 'Other', please explain below.

2. Overall, how would you rate this event on a scale from 1 (Very Unsatisfied) to 5 (Very Satisfied)? **Please check one and explain your response below.**

Very Unsatisfied 1	Unsatisfied 2	Ok 3	Satisfied 4	Very Satisfied 5
○	○	○	⊘	○

3. Were you able to share your thoughts, ideas, and knowledge during the event in a comfortable manner? **Please check one and explain your response below.**

Yes	No	I don't know
⊘	○	○

Eagle Plains Exploration Project
Feedback Form

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1. How did you hear about the event? **Please check all that apply.**

Radio	Word of Mouth	Social Media	Signage/Poster	Other:
○	⊗	○	○	⊗

If you selected 'Other', please explain below.

2. Overall, how would you rate this event on a scale from 1 (Very Unsatisfied) to 5 (Very Satisfied)? 5
Please check one and explain your response below.

Very Unsatisfied 1	Unsatisfied 2	Ok 3	Satisfied 4	Very Satisfied 5
○	○	○	○	⊗

good info. given and understandable. People gave great ideas - I feel that this will be a great project for VGC.

3. Were you able to share your thoughts, ideas, and knowledge during the event in a comfortable manner? **Please check one and explain your response below.**

Yes	No	I don't know
⊗	○	○

The two groups with speakers on the project made it comfortable for me. (First time done in this manner.)

Eagle Plains Exploration Project
Feedback Form

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1. How did you hear about the event? **Please check all that apply.**

Radio	Word of Mouth	Social Media	Signage/Poster	Other:
○	○	○	⊘	○

If you selected 'Other', please explain below.

2. Overall, how would you rate this event on a scale from 1 (Very Unsatisfied) to 5 (Very Satisfied)? **Please check one and explain your response below**.

Very Unsatisfied 1	Unsatisfied 2	Ok 3	Satisfied 4	Very Satisfied 5
○	○	○	⊘	○

3. Were you able to share your thoughts, ideas, and knowledge during the event in a comfortable manner? **Please check one and explain your response below.**

Yes	No	I don't know
⊘	○	○

Eagle Plains Exploration Project
Feedback Form

Chance Oil and Gas Limited (Chance) would like to learn about your experience at today's event. Responses shared in this Feedback Form will be used by Chance to help inform Project decision-making, Project design, and the assessment of potential Project-related effects to community members. Responses will remain anonymous in any Project materials (e.g., reports to the Yukon Environmental Socio-economic Assessment Board). Thanks in advance for taking time to complete the Feedback Form!

1. How did you hear about the event? **Please check all that apply.**

Radio	Word of Mouth	Social Media	Signage/Poster	Other:
○	○	○	✓	○

If you selected 'Other', please explain below.

2. Overall, how would you rate this event on a scale from 1 (Very Unsatisfied) to 5 (Very Satisfied)? **Please check one and explain your response below**.

Very Unsatisfied 1	Unsatisfied 2	Ok 3	Satisfied 4	Very Satisfied 5
○	○	○	✓	○

Explained well about all of the Topics that were discussed in Circle

3. Were you able to share your thoughts, ideas, and knowledge during the event in a comfortable manner? **Please check one and explain your response below.**

Yes	No	I don't know
○	✓	○

Just listened.

APPENDIX 2-C-80. December 20, 2023, Meeting Summary

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Draft Meeting Minutes

Subject	Technical Working Group – Fish and Wildlife
Prepared By	Two Worlds Consulting
Groups Involved	Chance Oil and Gas (Chance) Environmental Dynamics Inc. (EDI) First Nation of Na-cho Nyäk Dun (NND) Porcupine Caribou Management Board (PCMB) Tr'ondëk Hwëch'in (TH) Two Worlds Consulting (TWC) Vuntut Gwitchin First Nation (VGFN) Yukon Government (YG)
Participants	**Chance Oil and Gas (Chance)** • [redacted], Community Engagement and Permitting • [redacted], Vice President Government and Community Relations **Environmental Dynamics Inc. (EDI)** • [redacted], Senior Biologist • [redacted], Senior Biologist • [redacted], Quantitative Ecologist **First Nation of Na-cho Nyäk Dun (NND)** • [redacted], Advisor **Porcupine Caribou Management Board (PCMB)** • [redacted], Executive Director • [redacted], Chair • [redacted], Minute Taker **Tr'ondëk Hwëch'in (TH)** • [redacted], Advisor **Two Worlds Consulting (TWC)** • [redacted], Engagement Facilitator • [redacted], Engagement Support **Vuntut Gwitchin First Nation (VGFN)** • [redacted] Technical Advisor **Yukon Government (YG)** • [redacted], Caribou Specialist
Date/Time	December 20, 2023, 8:00 to 12:00 am MST
Copies to	All groups involved

Purpose of Meeting

- To provide a Project summary and updates; and share results of Environmental Baseline Studies including preliminary potential effects and mitigation to Fish, Wildlife, Porcupine Caribou Herd, Linear Features, and North Yukon Land Use Planning Conformity.
- A question and answer period followed the information sharing.

Topics Discussed

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- Project summary and updates
- Baseline Studies
- Effects Assessments
- Fish and Fish Habitat
- Wildlife and Wildlife Habitat
- Porcupine Caribou Herd

Key Issues Raised / Chance Responses to Issues

- Participants would like more detail about the Project Proposal and requested Chance to include all activities in the Project proposal. / Chance to review.
- Participant inquired about meandering seismic lines and how operators are informed about the design. / Chance confirmed that there is a design in place and that scouting will occur prior to the work, to understand the density of the forest and to optimize line locations.
- Asked if the Project videos are online. / Chance is developing a webpage.
- Requested more information on Chance's interpretation of disturbance. / Chance responded that key disturbance factors include noise, smells, and human movement/presence, and consider how far away caribou are from the well sites. Chance stated that disturbance is dependent on how the caribou are responding. Studies on Zone of influence are mixed, with various analytical methods, and depending on interpretation can range from no avoidance up to 40 kilometres of avoidance. There are many issues with analytical approaches that are scale dependent, and not often considered by those authors.
- The priority is to not disturb the caribou, but further work is needed to determine what is too much disturbance. Participants inquired about mitigations and if there is anything other than seasonality. / Chance responded that there will be mitigations in place, and there will be direct and indirect effects.
- A participant cautioned about using a 1-kilometrer Zone of Influence (ZOI), and believes the literature will reflect larger zones. Shared that he thinks Chance will have a difficulty finding that in the literature. / Chance responded that the primary reason for the buffer was because of sensory disturbance and that in larger ZOI assessments there is not a clear mechanism that is associated with the level of disturbance. Chance is focused on addressing local scale sensory disturbance within the work area, and that linear avoidance is assumed within the literature on ZOI's. The assessment applies a uniform 75% reduction across the 1-kilometre zone, which is a conservative (i.e., likely over-estimate) of the effect throughout the zone.
- PCTC (Porcupine Caribou Technical Committee) advised against doing the ZOI analysis based on low sample size (few caribou interacting with 3D seismic across the range). / Chance said that they could not ignore existing data and conducted the analysis regardless, and in the end did not rely on a 3D ZOI analysis as it was not conclusive.
- Participants expressed concerns about the ability of the Land Use Planning Council to review the Project for a conformity check, compared to the capacity of the North Yukon Commission. / Chance said that there are knowledgeable people on the council who have been there for a while. Shared that the North Yukon Commission no longer exists.
- Inquired about how Chance will be able to privatize a road. / Chance responded that the Chief Operating Officer can make it a private road. Said that that it is more of a safety concern, and that people are not interested in hunting around the drilling area. The company could grant access to subsistence harvesters, but this may create a safety concern for staff on site.
- Expressed concerns about the lack of communication between Chance and the Executive Committee. These conversations are important.

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- A participant shared concerns that their experience on drill projects, drill sites needed a 24-hour supply of water, which was trucked into the site. Unless technology has changed, that is one example of essential road traffic even if there are caribou in the area. Participant asked if the reduction would be sufficient or not. / Chance does not have the details on what is considered essential road traffic right now, but will include that in the Project Description.
- Participant requested an end of season report, to understand if caribou mitigation efforts worked and is concerned that this is not being considered. / Chance is interested in learning how the caribou are impacted, and that Chance will learn over the project lifecycle (10-year program).
- Participants encouraged ongoing in-person discussion outside of the YESAB review, which, through written format, can become hostile.

Actions and Responsible Party

- No actions.

Details of Discussion

[redacted] (Chance) gave a brief Project summary and added that [redacted] (EDI) would lead the presentation. [redacted] emphasized that the Project is a proposed exploration program and reiterated that the proposed submission of their Project Proposal is February 2024. Chance has been conducting virtual and in person engagement meetings. He mentioned First Nation of Na-Cho Nyäk Dun leadership currently does not want to participate in community engagement. Chance will continue to provide Project information and that engagement will continue with the First Nations and residents of communities. Chance will also share technical reports with First Nations. Chance is proposing a 10-year program.

The group shared a round of introductions.

[redacted] (EDI) stated the exploration area is around 2400 square kilometres, with clearing occurring during the winter and that it will be approximately 1500 square kilometres total of 3D seismic spread over 10 years. He added that there will be 2000 square kilometres of 2D seismic. [redacted] (EDI) noted that the Project is looking at up to 5 wells per year, equivalent to 2 hectares, and a maximum of 30 wells total. He stated that winter operations will last about 1 to 3 years in each area. He added that there will be three Project work areas and winter access roads will be created. He noted that there will be spring and summer seismic activities with helicopter support and extended flow testing. He stated that the seismic work is different than what was done in the 1950s.

[redacted] (Chance) added that extended flow testing occurs during the winter months and a well of interest will be flowed for natural gas and oil to a service rig. He shared that Chance will be abandoning 3 or up to 5 wells next winter.

[redacted] (PCMB) asked if the seismic testing will include installing and retrieving geophones, which was done previously.

[redacted] (Chance) said that it is new to Chance and that they use the same equipment from the seismic program in 2013.

[redacted] (PCMB) mentioned that he knew Chance was working on site.

[redacted] (Chance) stated that the geophones will be flown out when the snow and wildlife are gone in the spring. He added that if the caribou are hanging out, they can employ mitigation measures and hold off detonation and data collection until the caribou migrate north.

[redacted] (NND/TH) asked if this includes surface drilling.

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[redacted] (Chance) said that it would involves drilling a 3-to-5-meter hole, and the charge will be put down and repacked.

[redacted] (NND/TH) inquired if it was helicopter access and if Chance would be setting up a portable drill.

[redacted] (Chance) mentioned that the site is accessible by vehicle and that Chance would transport the drilling equipment. He added that Chance can hold off until late spring to detonate and take samples.

[redacted] (NND/TH) inquired if it was restricted access.

[redacted] (Chance) confirmed that it will be restricted access.

[redacted] (PCMB) stated that in 2013 there were caribou around. If caribou are around when Chance conducts work, will they hold off on the seismic activity?

[redacted] Chance) said Chance would hold off on detonation activities, but this needs to be discussed further. Chance will make these decisions as they occur and depending on how many caribou are in the area. [redacted] does not understand what the criteria is for this. In the baseline data being gathered for the technical review, there is the understanding that the caribou will migrate. He noted that Chance will go back to that location after the caribou move through. He stated that it depends on the number of caribou that are migrating in the winter range. Chance won't know until they do the field work and determine caribou movement through wildlife monitoring.

[redacted] PCMB) said that if there are caribou moving through the area, it won't be just one hundred in the Eagle Plains Basin. It will be a lot more caribou than that. This is what the collared data suggests.

[redacted] (EDI) noted that the Project team wants to have a good understanding of caribou movement. He added that protecting the lichen protects the herd. He noted that this is why activities are occurring in the winter to minimize the impacts. Seismic lines don't have to be straight anymore, and it is not the Project that was proposed in the past. This is a different seismic operation and that the key thing is that it will be spread out over 10 years.

[redacted] (EDI) presented the Baseline Studies Completed slide.

[redacted] (EDI) shared that the Project was bumped up to Executive Committee screening, which required Chance to do several studies.

[redacted] (PCMB) inquired about information on the Executive Committee.

[redacted] (EDI) said that it is a higher level of consultation and requirements. The Executive Committee reviews the Project.

[redacted] (Chance) said that they require additional data and baseline studies. The original Project went to the Yukon Environmental and Socioeconomic Assessment Board (YESAB) Dawson office and four out of six concerns came from it. These concerns put the Chance Project into a higher level of screening.

[redacted] (EDI) stated that field studies from 2019 to 2021 included: ecological mapping, linear features, fish, water, birds, and desktop studies that includes Porcupine Caribou Herd (PCH), moose, and martens. Chance wanted to do a linear features study to feed into the Land Use Plan (LUP) conformity check. He noted that the PCH are in the desktop studies because there is so much information available on them. He added that there were concerns about grizzly bears, but Chance doesn't have information on them.

[redacted] (EDI) presented the Effects Assessment Approach slide.

[redacted] (EDI) said there will be an impact on caribou, and we are assessing the significance of the effects. He added that Chance put the Environmental Assessment in the context of the LUP. He noted that there is more disturbance which is included in the Linear Features Study. The constraint maps help to develop scenarios to figure out future impacts. He noted that the spatial

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scale is relevant to the species. He said that exploration programs typically do not trigger an Executive Committee review. He added that this Project is going through the same review as the Casino mine project. He said that there is enough concern that it triggered an Executive Committee screening. There are always questions about the Project. He stated that Chance can't do an impact assessment without confirmed sites, which is why the Project team is using scenarios.

[redacted] (Chance) stated that Chance is taking an ecological perspective. Chance is trying to do the Project in a sustainable way by using constraints mapping and studies. Chance knows where the Project would like to drill. Chance needs to design winter access that considers constraints and previous disturbances. The Project team has described this to the Executive Committee and to communities to understand that Chance is listening and modifying the Project Proposal. They are not drilling year-round, and Chance's approach is unique and hasn't been done in the Arctic.

[redacted] (PCMB) asked for clarification whether the Project team was talking about next steps in the permitting process and if they had stopped talking about drilling.

[redacted] (EDI) said seismic comes first to identify the drill targets.

[redacted] (PCMB) said drilling is part of the exploration program, but we are talking about seismic right now.

[redacted] (Chance) said that Chance will still have to drill but initially they must get the targets and do the seismic. He added that this is what will help us understand what kind of resources are out there.

[redacted] (PCMB) inquired as to whether seismic would give Chance that information.

[redacted] (Chance) responded that no, it won't. He added that once it is put in a controlled environment, seismic will be used to understand of the layers of rock formation, depth of it, and any anomalies. He noted that drill site locations will be determined in the seismic studies.

[redacted] (PCMB) questioned whether Greg believed seismic and drilling to be one and the same. [redacted] (Chance) stated they are indeed different, and that identifying drill targets requires the seismic work.

[redacted] (PCMB) said [redacted] (EDI) said the drill on the slide was unconventional.

[redacted] (VGFN) asked if the last step in the process is flow testing.

[redacted] (Chance) said that that is correct. Geologists have said there is a 10 to 20% success rate, which means that 3 of 30 wells or 6 of 30 wells may be successful. Currently they do not know how successful they will be, but that there is opportunity. He noted that the business plan is focused on local consumption and that the Yukon needs additional energy. He said that Chance needs to understand what kind of gas there is and flow it. He noted that the flow time is up to six weeks. Chance would like to understand what kind of gas there is.

[redacted]NND/TH) mentioned that even if heating oil is locally sourced, it would need to be refined down south and then shipped back up. To be a local supplier, Chance would still have to ship oil south.

[redacted] (Chance) said that oil would need to be shipped south during the flow tests, but that there is technology to be refined at the site, but that's not a part of this Project.

[redacted] (YG) said that natural gas flow testing would occur for 6 weeks to prove the resource and asked Greg how long it would be with oil.

[redacted] (Chance) said it would require two years for flow testing and that Chance would be awaiting recommendations from YESAB. He added that it is longer for oil than gas. He noted that when the pressure comes up, the oil is a heavier liquid. He said that it takes time to understand it.

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[redacted] (YG) inquired about how long it would need to flow for.

[redacted] (Chance) said that the Project is not able to flow test summer months as Chance does not have all season roads. If there are successful wells, then Chance will need to seek a permit for an all-season road.

[redacted]YG) said that he's trying to understand the level of disturbance and if Chance would have to turn off the tap and begin flow tests in the following year.

[redacted](EDI) stated that that is something that Chance will have to include in the Project description.

[redacted](Chance) said that winter activities will only be 4 to 5 months.

[redacted] (VGG) asked if flaring would occur during flow testing.

[redacted](Chance) said that yes that is why flow testing is shorter because it would include a minimum of 3 weeks of flaring.

[redacted] (YG) expressed concern about how the trucks would be staged up to get the oil.

[redacted](Chance) said that Chance could get him the information. There will be heated storage, and will include 400-barrel trucks to keep the crude oil in. He said that the oil will come into a station area and before it gets taken away, there will be separators. He stated that Chance will probably have to reinject produced water back down into the wells.

[redacted] (VGG) stated that there needs to be more details about the Project Proposal and what activities Chance is proposing. For example, what are the activities associated with flow testing so that it can be evaluated. He noted that if the detail is in the Project Proposal to start with it saves everyone time. Chance will review.

[redacted] (EDI) presented the Land Use Plan Context slide.

[redacted] (EDI) said there are differences between how it works. There is the Integrated Management Area Zone 4 and that this is where it is expected that development will occur in the area. This zone has a higher level of protection than other areas. Even though Chance is looking at development in this area, Chance is looking at a high level of environmental protection. He added that it is likely one of the highest levels of protection with protection covering 37% of late winter and 31% of the fall range.

[redacted] (EDI) presented the Low Impact Seismic slide.

[redacted] (EDI) said Chance will use meandering lines to avoid large trees and to make the lines of sight to be less than 70 meters. There will be small narrow mulchers used for the seismic lines (2.5 m), which will help to protect vegetation. There is low ground pressure equipment over at least 20 cm of packed snow/ice. The vegetation will be pushed over, not cut, which means a faster recovery.

[redacted] (YG) asked if that is 20 centimetres of snowpack.

[redacted] (EDI) confirmed that it is 20 centimetres of snowpack.

[redacted] (Chance) Chance wants 20 centimeters of snowpack for winter roads, and in Chance's mitigation section, it says Chance will strive to get 20 centimeters.

[redacted] (VGG) asked if there is a design in place for meandering seismic lines and how Chance will communicate this to the operator.

[redacted] (EDI) said that that is an excellent question and [redacted] is the expert.

[redacted](Chance) said that scouting will be done in advance to understand the density of the forest, determine the location, and design it based on that information. If there are dense trees on the south side, Chance will design it to go around.

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[redacted] (VGG) asked if Chance would design it.

[redacted] (Chance) responded yes, they go out and walk it before they design it. There was helicopter support in the past to scout areas, to avoid mulching and to decide where to mulch. He noted that Chance will get more information about the criteria.

[redacted]. (YG) said they are trying to avoid site lines from certain lengths.

[redacted](VGG) said that it is up to Chance to design meandering seismic lines.

[redacted] (EDI) said that is how it works operationally.

[redacted](YG) said aerial photos could be helpful.

[redacted] (EDI) noted that Chance does not have any high-definition photos.

[redacted] (YG) said that the Yukon Government has some photos.

[redacted] (EDI) presented the Linear Feature Disturbance slide.

[redacted] (EDI) said that there are indicator levels of linear disturbance. He added that cautionary is 0.75 kilometres/square kilometer and the Regional Study Area (RSA) is 1.79 kilometres/square kilometre (unadjusted), and 0.52 kilometres/square kilometres(adjusted). He said that if the 3D lines are removed, it could be down to 0.48 square kilometers. He added that the background isn't presented too much in the LUP. He noted that Chance is utilizing the cautionary level.

[redacted](YG) said this is all the discussion from the LUP process.

[redacted] (EDI) said that there is a lot of theory around it, and that is why Chance did a linear effects study.

[redacted](YG) said that the numbers came from the caribou work. He said that he was not at the table but talked to people, such as [redacted], after the plan was done.

[redacted] EDI) said that information came out of Alberta, for example, different land uses and species in the area such as wolves preying on moose rather than caribou.

[redacted] (YG) asked what Chance meant by vegetation recovery.

[redacted] (EDI) said that they used the tall shrub stage, which was 2 metres instead of 1.5 metres from the LUP.

[redacted] (EDI) added that the old seismic approach was to cut the vegetation down.

[redacted] (EDI) presented the Environmental Constraints Mapping slide.

[redacted] (EDI) said Chance intends to avoid heritage sites, permafrost/terrain sensitive areas, riparian management areas, priority ELC units, caribou habitat, and moose habitat. He added that directional drilling is good to avoid high quality habitat, another mitigation measure.

[redacted] (Chance) said that Chance needs to get surface distance between 1.5 to 2.0 kilometres. He said that the Project team could stay on top of the hill and still drill in the valley.

[redacted] (VGG) asked if the Project videos are online.

[redacted] (Chance) said that Chance is in the process of developing a webpage.

[redacted] (Chance) said that Chance wants to launch the website before the new year and the February 2024 submission.

[redacted] (EDI) presented the Well Site Scenarios slide.

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[redacted] (EDI) said that the well site locations are unknown. He added that Chance develops scenarios within constraints to the range of potential habitat effects. Chance develops scenarios based on Scenario 1 which is developed by the seismic team.

[redacted] EDI) presented the Project Interactions slide.

[redacted] (EDI) said that there will be direct and indirect habitat interactions. Direct being vegetation clearing and indirect such as sensory disturbance. He added that there are areas where the Project team will avoid human activity. He said that there will be an indirect and direct mortality risk, direct being vehicle collisions and indirect will be due to increased predator access. This is what YESAB brought up in the first review. Chance is trying to reach a balance in the assessment.

[redacted] (PCMB) inquired about Chance's interpretation of disturbance.

[redacted] (EDI) responded that key disturbing factors are noise, smells, and human movement/presence. He added that this depends how far away caribou are from the well sites. He noted, based on mixed results in literature using various analytical methods, some possibly erroneously, that disturbances could result in no avoidance and up to ~40 kilometres of avoidance. He said that it is dependent on how the caribou are responding to the disturbance.

[redacted] (NND/TH) asked if there would be something on the ground at whatever distance it is. He asked what mitigation is there. He added that the concern is not to disturb the caribou, but how much is too much disturbance. He asked if there were other mitigations other than seasonality.

[redacted] (EDI) responded that there is a mitigation. He added that Chance calls them direct and indirect effects.

[redacted] (EDI) presented the Porcupine Caribou slide.

[redacted] (EDI) said that the key resource in the LUP is the caribou. He added that the information that Chance presents on the caribou is far more descriptive than in 2013. He noted that it was important to characterize the caribou. He added that Chance must understand the caribou enough to understand interactions with the Project. He said that Chance can't avoid all locations, and that Chance has looked at potential effects on PCH habitat and movement. He said that when looking at mortality it is challenging to quantify. He added that Chance has looked at residual effects, which are effects that are left over after mitigation is applied and that cannot be addressed.

[redacted] (EDI) presented the Porcupine Caribou – Distribution slide.

[redacted] (EDI) identified the PCH-identified life cycle periods or seasons. He added that there are patterns of occurrence from 1970 to 2016, supplied by PCTC. He said that Chance is looking at rut and winter overlap. He added that there is no doubt that Chance will see the caribou and that they will likely show up some time during the 10 year operation, and when they do, they will show up in large numbers.

[redacted] (EDI) shared movement of the PCH after the 2013/2014 seismic program. He said that the PCH moved through the Project area in 2015. He added that there were 13,000 to 14,000 observations through the cameras. He said that it was evident that they had moved through there. He noted that this has not happened ever since. He said that he is unsure where the PCH are now in the winter.

[redacted] (YG) said that the time where it does split, they used winter ranges in Alaska recently. He added that the challenge is that the PCH may go to the same area for two decades and then never go there again. He noted that he has not seen them in the uplands for two decades but that is where they used to be. He said that it is common to see them overlap with the December range.

[redacted] (EDI) said that there could be richer detail to describe. He said that when the PCH do show up it will be a lot.

[redacted] (YG) said that they do not have detailed GPS data prior to 2015. He added that collared data did not start until 2012.

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[redacted] (EDI) added that before, there were different collars.

[redacted] (YG) confirmed that previously, the location was tracked every day versus now, where you can track every minute of their movement. He added that most survey work occurs during the summer periods. He said that they had late winter data to look at distribution.

[redacted] (EDI) presented the Porcupine Caribou – Movement slide.

[redacted] (EDI) stated that in 2015, caribou travelled through a network of 2D seismic lines, winter roads, and a large 3D seismic grid. He said that the PCH will probably show up in abundance based on the work Chance has done.

[redacted] (YG) said this is late winter data. He added that that is when distribution would be done.

[redacted] (EDI) said that this is why the Project went to the Executive Committee. He added that Chance doesn't know enough about the PCH in the winter. He said that in the baseline effects, the Project can compile that data. He shared that a lot of the information was not available to the Chance team. He noted that if Chance misses anything, that this is what Chance is looking for.

[redacted] (EDI) said that caribou occupy the RSA in less than 20% of previous years. He added that rut/late fall and winter seasons are considered the least biologically sensitive periods for the herd. He said that that doesn't mean that the Project team isn't treating them sensitively, caribou are just less sensitive during these times. Winter is the least sensitive period relative to all seasons. He said that protecting calving grounds is key. He added that this herd keeps going back and other caribou herds are quite different. He noted that, the PCH are in good health this time of year and less sensitive than other times of the year. He shared that this information came from the PCTC report.

[redacted] (EDI) said that they are looking at the movement rate of PCH and what will they be exposed to. He said that based on the PCH collared data, it is evident that they move through the area. He added that it is roughly 4 to 5 days in the rut and late fall or 15 to 16 days in the winter.

[redacted] (EDI) said that the analysis consisted of quantifying daily travel times. He added that Chance characterized the seasonal ranges by dividing the seasonal range into around 2500 square kilometres of cells. He said that after that, they compared the different travel rates and residency times. He noted that the Project can say that the RSA is around half in the late fall and there are about ten days less spent in the winter. He shared that overall, caribou are spending less time in the RSA when they are there.

[redacted] (EDI) said that this is why it is important to characterize what the caribou are doing in the area. He added that they seem to be moving through the area quickly.

[redacted] (YG) asked if Chance is characterizing that their residency will be half of when they are going into the area.

[redacted] (EDI) said that we calculated residency times as an average, and that we are making a relative comparison of residency in the RSA versus the broader seasonal ranges using the collar data. He said that when the Project team is making a comparison of residency times, they are seeing this much of a difference.

[redacted] (YG) said that he is unsure if he would base the data on the limited set of examples, but it does give a sense. He added he would be leaning more on to the seasonal range data (SRD). He shared that the residency of SRD is useful. He said that he would be careful saying that about collared data.

[redacted] (EDI) said that there will be a list of uncertainties in the Environmental Assessment.

[redacted] (EDI) said that the standard error is associated with the ranges. He shared that the seasonal range average is not directly comparable to the RSA and that he is not sure if the seasonal range residency time is the best average to use. He said

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that the composition of the eco ranges is different. He added that they wouldn't expect the same amount of residency time in the RSA.

[redacted] (YG) said that there is a lot of data, around 50 years of movement data for the herd. He added that there is only GPS data for a decade, which isn't that much.

[redacted] (EDI) said that the Project team must move through with some level of confidence. He said that the Project talks about reversibility of effects and if it is reversible.

[redacted] (EDI) presented the Porcupine Caribou – Habitat Selection slide.

[redacted] (EDI) shared a recap of the methods and results for PCH. He said that they used a standard approach to developing these models and used a generalized linear mixed model. He added that it was a 1:10 used-available design. He shared that they are looking at interactions with lichens, and plant functional type layers (e.g., light microlichens, conifer, forbs, deciduous shrubs, graminoids, and evergreen shrubs). He said that it included elevation, slops, aspect, and distance to waterbodies. He added that they did random effects on the caribou year and did a 5-fold cross variation of model predictions. He added that they mapped RSF predictions across seasonal ranges.

[redacted] (EDI) said that they used selection ratios to identify the RSF prediction threshold where the proportion of used locations is greater than available. He added that this corresponds to selected habitat by caribou; these predictions considers the partial effects of all habitat covariates (rather than single covariate coefficients). He shared that they were able to identify four habitat ratings: high, moderate, low, and very low. He said that the selection threshold identified the split between high/moderate and low/very low and that the split between high and moderate was based on midpoint value, the same for low and very low.

A participant asked if this is describing the quality of the habitat or the ratio of use.

[redacted] (EDI) said that it is quantifying selection. He added that when Chance maps that, it has been classified as a habitat with high or moderate rating. He shared that it is selection, not use.

[redacted] (EDI) said that the moderate and high ratings are the areas associated with selected habitat. He shared that that corresponds to caribou using the areas more frequently than what would be expected by random chance. He added that the Project team chose the term 'selected' habitat and didn't want to use 'suitable' habitat because all habitats can potentially be suitable and used by caribou. He said that the habitat ratings are associated with higher macrolichen cover.

[redacted] (YG) asked what the Y-axis on the top graph said.

[redacted] (EDI) responded that it is the proportion of locations. He said that both figures show the same information in a different type of way.

[redacted] (EDI) presented the Caribou / Project Interaction – Review slide.

[redacted] (EDI) shared that the RSA overlaps with the PCH seasonal ranges. He added that the caribou occupy the RSA in less than 20% of years (or approximately 1 in 5 years). He shared that rut/late fall and winter seasons are considered the least sensitive periods for the herd. He added that the exposure period of individual caribou is expected to be 1 to 2 weeks. He said that Chance is looking at the assessment of criteria of seasonal habitats and that they were built into the LUP.

[redacted] (EDI) presented the Potential Habitat Effects slide.

[redacted] (EDI) shared that direct habitat effects refers to areas cleared of vegetation. He said that this affects 2% of selected rut/late fall and winter habitats within the RSA. He added that it affects 0.2% of selected rut/late fall and winter habitats at the Eagle Plains ecoregion scale. He said that the 3D seismic may not create a functional loss if lichen persists. He shared that it should not affect the lichen.

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[redacted] (EDI) shared that the indirect habitat effects refer to sensory disturbance. He added that they did a ZOI study that was applied around all disturbances. He said that they assumed a 75% reduced habitat effectiveness within a 1-kilometer ZOI. He shared that it is hard to quantify the area. He said that it means that there is a 75% chance that caribou are less likely to select the area. He added that annually, about 32% of the RSA experiences sensory disturbance and affects 23% of the selected rut/late fall and winter habitats within the RSA. He said that it affects 5% of selected rut/late fall and winter habitats at the Eagle Plains ecoregion scale. He added that it is a temporary effect which is reversed once activity stops.

[redacted] (YG) asked where 1 kilometre came from.

[redacted] (EDI) said that it is based on the permanent disturbance, which was their own zone of disturbance. He added that they looked to find a balance of something that was reasonable. He said that 1 kilometer seemed like a reasonable measure.

[redacted] (YG) said that activities like helicopter work and safety checks, cause greater disturbance than the mulcher. He added that he cautions using the 1-kilometer buffer. He shared that he thinks Chance will have a hard time supporting that in the literature.

[redacted] (EDI) said that the primary reason was to associate the ZOI with sensory disturbance. He said that in assessments where ZOIs were found to be large, there hasn't been a test or link to a clear mechanism that could lead to such large areas of avoidance. He argues that studies with large ZOIs often capture broad changes in a herd's range distribution rather than local effects of a Project. He added that this assessment is focused on local-scale sensory disturbance which covers the work area. He said that, in the literature, ZOIs are most often quantified as linear avoidance up to the ZOI threshold. This causes the average avoidance effect to be about halfway up the sloped line. He shared that, for this assessment, they applied a uniform 75% reduction across the 1-kilometer buffer.

[redacted] (YG) said there is a potential effect for the whole area. He asked how they could get this into more detail. He said they will be looking at it very closely.

[redacted] (EDI) said that they identified a 2- or 4-kilometre ZOI associated with the 2D seismic lines (including winter roads and trails). However, he stated that they identified attraction (rather than avoidance) to the 3D seismic grid. He added that the 2–4-kilometre ZOIs for historical 2D seismic are small in magnitude. Habitat effectiveness is reduced by 20–40% on the footprint itself, but the average reduction across the ZOI is much smaller.

[redacted] (EDI) asked what the sample size for the 3D seismic sample size analysis was.

[redacted] (EDI) said that he will have to circle back.

[redacted] (YG) said that the PCTC advised against doing that analysis.

[redacted] (EDI) said that Chance did not rely on a 3D ZOI analysis.

[redacted] (YG) said that it was raised. He added that it may or may not be the case, but they don't have the data.

[redacted] (EDI) added that it is not conclusive.

[redacted] (YG) said that's perfect.

[redacted] (EDI) said that Chance expects those comments to come up too and that's why the analysis is there.

[redacted] said that when you talk about all this data, so next year when you are doing the seismic, there is no additional effects to the PCH at that location.

[redacted] (EDI) said that there will be a leftover footprint. He added that there is a linear disturbance that brings in predators.

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A participant said that it seems reasonable for seismic activity, but then there is a well being drilled. They said that the ZOI would be much bigger based on that. They said that there is going to be less of an impact.

[redacted]. (EDI) said that the impact could be up to 1 kilometer, but Chance could revisit that and rethink the details of that too.

[redacted] (EDI) shared that it was 1 kilometer impact for everything sticking to sensory disturbance.

[redacted] (NND/TH) said that if the caribou are discouraged from using the ZOI and activity stops, that they came back through. He added that he doesn't know if there is any information on prolonged activity. He said that they are talking about several winters. He said that if there is a prolonged period of disturbance, he hasn't come across the information. He asked if there is any information on permanent discouragement of using the area, even after the mulching disturbance stops.

[redacted] (EDI) said that he would look at caribou near mine sites and the Central Arctic Herd and how they responded. He said that they looked it on a herd basis, but he is unsure if they respond well. He shared that work has been done on caribou response to roads, and other development. He said he cannot think of whether they responded to any well site. He said thinking about the development in Prudhoe Bay, there was work on the caribou's response to the road and pipeline. He added that they had deemed a 300-meter zone. He said that if it is not fenced off, the caribou will move through.

[redacted] (YG) said Heather did the most recent analysis on that, and their role is to do objective PCTC science. He said it is the calving and post calving information that has not been developed in the last 30 years. He added that it was around 5 or 6 kilometers. He said that it was a tundra environment and oil field, in the summer. He shared that there were many differences.

[redacted] (EDI) said that it is hard to make that comparison of linear disturbance in Alberta to Eagle Plains. He shared that a caribou response to a single well site would need a wealth of data. He said that there are forty well sites out there.

[redacted] YG) said a camera on the well site would be good.

[redacted] (EDI) said that if you look at an oil rig and the caribou herd are going through, there is a clear answer to that.

[redacted] (VGG) asked if the linear thresholds Chance talks about, are based on the proposed linear disturbance.

[redacted] (EDI) said that that is why the planning commission did their own effects strategy.

[redacted](VGG) asked if Chance has talked to anyone at the Yukon Government about cumulative effects or linear features.

[redacted] (YG) said one of the linear things that was discussed was that the threshold is 1.5 meters of wooded vegetation. He added that they just don't know.

[redacted] (Chance) said that the last direction that Chance got was from [redacted] office when she was Deputy Minister and that the challenge is that the environmental groups are challenging the Yukon Government because the proponent is responsible to go to First Nations to work with them to get their permission on conformity checks. He asked if the proponents are responsible for making communities understand the effects.

[redacted] EDI) said that at the community level during our meetings, it has not been a topic of discussion.

[redacted] (VGG) said that it's coming up in another process around cumulative effects. He added that he is curious as it sounds like a lot of that work was based on studies from Alberta. He asked what the underpinning of the analysis is and if there is other information that is new to him.

[redacted] (EDI) said that Chance looked at the line of sight, travel speeds, visibility, and different levels of regeneration. He added that the Project team wanted to inform the planning commission.

[redacted](Chance) said that when Chance made the original submission, their understanding was that the Land Use Planning Council was working with them. He stated that they were told that Chance must figure that out and convince any other affected

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parties. He asked how Chance does that work. Chance completed what it was required to do based on what was agreed to. He said that it is basically an EMR (Energy, Mines, and Resources) office that is just trying to figure it out. He shared that Chance is confused on who will oversee the old studies and disturbance that didn't occur from Chance/Northern Cross.

[redacted] (EDI) added that Chance did their own studies of effects. He added that that is how Chance came up with adjusted numbers.

[redacted] (NND/TH) said that he's come across concerns about the Land Use Planning Council not having the background that the commission has. He added that this is a compounding factor. He said that the council doesn't have a knowledge of history that the commission developed under the treaty, and that the council doesn't have the background to consider a project. He said that there are concerns about the council being capable of having a reliable opinion.

[redacted] (Chance) said that Sam is at the council and has a lot of knowledge and has been there for a while. He shared that there is no North Yukon Commission now.

[redacted] (YG) said that he is interested in talking about mitigations. By focusing on if the herd is coming through, it minimizes the issue. What happens when they do come through. It may be important to get information from the PCTC or Mike Suitor from the Yukon Government. If you hear caribou are coming your way and will be there in 3 days, what will the response be to that data.

[redacted] (EDI) said that they will get into that. He added that the monitoring part is an important part of the assessment.

[redacted] (EDI) presented the Potential Movement Effects slide.

[redacted] (EDI) said that there will be local movement effects such as reduced crossing if there is traffic on roads and seismic lines. Effects to seasonal movements or migrations are unlikely. Long distance movements will mostly be in fall and do not overlap with the bulk of Project activities. Short residency times and fast movement rates through the RSA and caribou travel through network of linear features in the RSA.

[redacted] (YG) said that pertaining to the effect of harvesting activities, there are areas where similar work has been done. A similar migrating effect can be seen and that it is possible that it may change a migration pattern. He said that he doesn't want to discount it.

[redacted] (Chance) asked what the probability is of that occurring.

[redacted] (YG) said that he is unsure exactly. He added that in 2015 it almost happened.

[redacted] (Chance) said that it is easy to tell that they go along the Dempster Highway.

[redacted] (YG) said that humans are travelling the same way the PCH like to because it is the easier travel. He added that it is a scenario that could occur, and it shouldn't be discounted.

[redacted] (PCMB) said that if looking at the probability, what's going to be in place with the PCTC, the people, and what is the plan to respond.

[redacted] (EDI) said that Chance will note it. He asked if it is going to stop them from entering the work area. He stated that Chance is assuming a 75% probability. He said that he is not trying to downplay the potential effects, but it is only an exploration project.

[redacted] (YG) said that YG has programs that shut down for 2 to 3 weeks when the herd hits.

[redacted] (EDI) said that that will certainly happen. He said that the Project team can't operate with thousand caribou around us. He added that it will affect their localized movement.

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[redacted] (EDI) presented the Potential Mortality Effects slide.

[redacted] (EDI) said that direct effects are vehicle collisions, but this is low risk on access roads and seismic lines. He said that by restricting the road, it won't be public access. He stated that the indirect effects are predation and hunting. He added that linear features might give more access to humans.

[redacted] (NND/TH) said that the resource road regulation on the Territorial Roads Land Act should give Chance permission to make the road private. He asked how Chance can use it as a private road. He asked if under the Oil and Gas Act they would be able to say it is a private road. He asked if Chance has had that discussion.

[redacted] (Chance) said that the Chief Operating Officer (COO) can make it a private road. He said that it is more of a safety concern, and no one wants to hunt around the drilling area. He added that it is one thing to give the access to an Indigenous harvester, from a safety point of view there is an issue around the work area buffer.

[redacted] (NND/TH) asked if the COO has the capability to give Chance a private road.

[redacted] Chance) confirmed yes and that they have had a COO do it before.

[redacted] (EDI) said that any predator wants easier access. He shared that it would have a temporary effect, limited to annual work areas where activities pack the snow on linear feature. He added that there aren't resident caribou in the Project area compared to other herds. He said that it is hard to conceptualize.

[redacted] (YG) said that he has seen people using the seismic lines. He said that there is no real monitoring of it. He stated that on predation, it is a different scenario. He shared that it is complicated because there are migratory wolves. He added that the question is if the herd has a major decline. He said that it is being anticipated sooner or later but they don't know.

[redacted] (EDI) said that there is uncertainty around mortality effects. He shared that it is more around Indigenous access, but Chance doesn't know how to move around that.

[redacted] (YG) said that the affected harvest on ZOI basically has a double effect.

[redacted] (EDI) said that as soon as the Project increases predation risk, there will be an increased effect. He added that it is important to increase local awareness there.

[redacted] (YG) said that this can be dealt with in the Project Effects Assessment.

[redacted]. (EDI) said that there is no harvest policy other than the Indigenous Rights to Harvest.

[redacted]. (EDI) presented the General Protection Measures slide.

[redacted] (EDI) said there is environmental constraints mapping to reduce habitat loss. Chance will stay out of this area when caribou are coming. There will be a limited annual footprint, reducing sensory disturbance. There will be access management to reduce mortality risk. People will probably use the winter access. He shared that he doubts that individuals will use the 3D seismic access.

[redacted] (YG) agreed that people likely won't use it as well.

[redacted] (EDI) shared that low impact seismic will help to reduce habitat loss and has been developed over the years. He added that there will be a maximum width of 2.5 meters that will retain ground vegetation. There will be speed limits in place to reduce mortality risk. He emphasized the importance of worker awareness, including reporting any sightings. There will be a caribou interaction response plan. He asked if there is an information database that Chance can use to understand weekly migration patterns.

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[redacted] (YG) said that the YG is trying to get a database in place. He shared that the PCTC updates their website and YG does the updates as they can. He said that the YG has a regulatory meeting that often changes things.

[redacted] (EDI) asked if YG will tell them when the caribou are coming.

[redacted] (YG) said that some companies are required to contact YG on a schedule. The other more likely scenario is just paying attention to the herd. He said the Chief of Mine and Land Use provides emails and the YG provides weekly updates after that. He shared that YG has been doing it for 5 years and it is working well.

[redacted] (EDI) said that there is flexibility with the seismic operation and that it will be Chance's bad luck. He added that Chance can't move the seismic and once a drill is spinning, the Project team can't stop.

[redacted] (NND/TH) said that it is possible to stop the drill.

[redacted] Chance) said that when driving, risks of potential impacts are increased. He added that there are speed controls, traffic controls, and the only traffic would be wildlife monitors.

[redacted] (EDI) said anything that is necessary.

[redacted] (NND/TH) said there was a constant of bringing water in with big trucks when he worked at the mine sites.

[redacted] (EDI) said that once the drill is going, it is not stopping.

[redacted] (PCMB) said that a caribou action response plan has potential, and he knows PCMB would be interested. He said it would be great if Chance could get their caribou information from PCMB and PCTC. He added that it would be good to see something established. If Chance is responding to caribou interactions, it would be nice to have a plan established. It would make sense if there was official communication linkage to be notified. These communications could establish a cooperative protocol. He added that this could help PCMB study the herd.

[redacted] (EDI) said that he wouldn't be able to develop that independently.

[redacted] (Chance) said that he agrees with getting the real data.

[redacted] (YG) said there will always be redundancy on this, and YG is trying to figure that out. He added that there are ways to do it. He said that the challenge for using satellites to track is that there could be several thousand caribou that don't have collars.

[redacted] (EDI) said that he agrees that it is only a small portion.

[redacted] (YG) said that there are 110 collars on the caribou.

[redacted] (EDI) said there is a level of warning from local monitors. He added that there will be a balance of reported observations, onsite. He shared that Chance would have to do aerial surveys.

[redacted] (YG) said there is no need for aerial surveys. He added that it can give you a sense of what you are dealing with and that they did that in 2013.

[redacted] (PCMB) said that it makes her think about how PCMB could help. If there are wildlife monitors around, it would be great to get regular updates on what they are observing. She added that if there is a situation where several caribou are coming to the Project area, the PCMB has connections to the Porcupine Caribou communities to get the word out. PCMB can help communicate things to bring show that we are engaged and that communities can be confident that Chance and PMCB are working together and sharing accurate information. PCMB wants the communities to be comfortable with what is happening. She added that there is the opportunity to look at the PCMB and Chance engagement as a very positive thing.

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[redacted] (EDI) said that this could be something to work on. He said that he agrees on collaboration and that aerial surveys during operation will be good. He shared that he thinks that the project can operate safely. He said that a lot of this relies on the observers being there.

[redacted] (NND/TH) said that with an existing drill site, and caribou in the area, Chance won't be able to shut down the drill. He said that the idea being that traffic could be reduced. He doesn't know where the water is coming from for the drill. He said that in past projects, there was a 24-hour supply of water from the water source to the drill site. He said that unless technology has changed, that is one example of traffic that can't be stopped if there are caribou in the area. He asked if the reduction would be sufficient or not.

[redacted] (EDI) shared that Chance doesn't have the details on what is considered essential road traffic right now. He shared that 5 vehicles a day sounds manageable.

[redacted] (YG) said that his issue is that there are no communications occurring with the Executive Committee. He said that it is important to have these conversations. These conversations will greatly increase Indigenous relations.

[redacted] (PCMB) said that the PCMB represents PCMB from the PCMB Agreement parties. She said that the PCMB isn't a decision-making board, but they can provide input to regulatory processes and review processes. She added that the PCMB knows trust is important with communities and when working with groups that are willing to go over and above what is specified in regulatory decisions. When the PCMB knows that there is an interest in building that trust, if anyone is looking at building positive relationships, it must be a collaborative process. There needs to be transparency and a willingness to work together no matter what the information may be. It is important for PCMB to do that and that the PCMB wants to work together. It is reasonable to say Chance can't shut down a well in production if there is a conversation ahead of time. If they know about these concerns in advance, there could be something in place that incorporates Traditional Knowledge that would address the communities' concerns. She shared that when caribou come and you can't shut down the well, the PCMB knows that that is reasonable, and they can support that. The PCMB can help with mitigation around that. She said not to underestimate the trust with PCMB and that the PCMB wants to work with Chance to do a good job of this. She shared that what happens with the Project will last in people's minds.

[redacted] (NND/TH) said that even if the PCMB aren't a decision maker, they are important.

[redacted] (EDI) said that the next step is mitigation. He said that he has seen a change in the approach by Chance. It comes down to the communication aspect and the seismic program is flexible.

[redacted] (YG) said regarding the effects monitoring piece, that looking at developing a couple of well-focused designs would be helpful. He said that if the exploration project is successful, Chance will get towards a development stage and there won't be any data.

[redacted] (EDI) said that to determine if mitigation is successful, Chance will have to do an experimental approach.

[redacted] (NND/TH) said that they do a report at the end of the season, to understand if it worked. He is amazed that this is not being considered.

[redacted] (EDI) said that this is a 10-year program, and it is Chance's opportunity to learn. He added that Chance wants to understand what the caribou do.

[redacted] (YG) said that the collared data is one scale.

[redacted] (EDI) said that it makes sense to put in effects monitoring.

[redacted] (YG) said that he is happy to work with Chance and discuss with PCTC to provide input. It is going to have to be a collaborative approach somehow.

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APPENDIX 2-C-81. Vuntut Gwitchin First Nation Record of Contact

Vuntut Gwitchin First Nation Pre-Submission Record of Contact (January 1, 2014 - December 20, 2023)

Reference	Date	Communication Method	In / Out	First Nation	Author	Proponent Names	First Nation and/or Organization Names	Subject	Summary	Additional Comments	Attachments
Note: Reference ID formatting and ordering may not be consistent or sequential due to splitting out the Master Record of Contact into First Nation-specific Record of Contacts.											
Vuntut Gwitchin First Nation0248	30-Jan-12	Community Event	Not Applicable (N/A)	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Community Open House	Chance held a community open house and provided a presentation.	N/A	N/A
Vuntut Gwitchin First Nation0207	15-Jun-14	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Community Open House	Chance held a community open house event from 4:00PM - 7:00PM at Chief Zzeh Gittlit School Gym in Old Crow.	N/A	N/A
Vuntut Gwitchin First Nation0237	16-Jun-14	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Community Open House	Chance held a community open house event in Whitehorse at the Yukon Inn from 4:30PM - 6:00PM. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided an open house survey to get feedback to improve future engagement with the community.	N/A	20140616-Vuntut Gwitchin First Nation0246
Vuntut Gwitchin First Nation0247	16-Jun-14	Community Event Flyer	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Open House Advertisement	Chance shared a advertisement for open houses held in June of 2014 in the communities of Whitehorse, Mayo, Old Crow, and Dawson.	N/A	N/A
Vuntut Gwitchin First Nation0210	17-Jun-14	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Community Open House	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 3:30PM - 7:30PM. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided juice boxes and packaged sandwiches to Vuntut Gwitchin First Nation Citizens and residents of Old Crow.	N/A	N/A
Vuntut Gwitchin First Nation0238	03-Sep-14	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Community Open House	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 3:30PM - 7:30PM. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided juice boxes and packaged sandwiches to the residents of Old Crow.	N/A	20140903-Vuntut Gwitchin First Nation0238 200826_Chance_OldCrowOpenHouseFlyerRevised.pdf
Vuntut Gwitchin First Nation0208	13-Oct-14	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Community Open House	Chance held a community open house event from 4:30PM - 7:30PM at Chief Zzeh Gittlit School Gym in Old Crow. Topics for this event included: an overview of the proposed Project; information gathered by Chance's consultants on Wildlife, Fish, and Permafrost; and information on seismic programs.	N/A	N/A
Vuntut Gwitchin First Nation0256	26-Sep-16	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Bruce Charlie (Vuntut Gwitchin First Nation), Chief Mervyn (First Nation of Na-cho Nyäk Dun), Chief Roberta Joseph (Tr'ondëk Hwëch'in), Albert Peter (First Nation of Na-cho Nyäk Dun)	Draft Engagement and Communication Strategy	Chance sent a draft Engagement and Communication Strategy and requested they review and share comments. Richard (Chance) requested a meeting to go over the document and advance their relationship.	N/A	20160926-Vuntut Gwitchin First Nation0256A
Vuntut Gwitchin First Nation0257	13-Oct-16	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Chief Bruce Charlie (Vuntut Gwitchin First Nation), Esau Schafer (Vuntut Gwitchin First Nation), Paul Josie (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting request	Richard (Chance) requested to meet with Vuntut Gwitchin First Nation to provide an update and discuss topics of interest. Richard (Chance) stated they are prepared to travel to Old Crow when it is convenient to meet with them and the Elders council.	N/A	N/A
Vuntut Gwitchin First Nation0258	14-Oct-16	Email	Incoming	Vuntut Gwitchin First Nation	Esau Schafer (Vuntut Gwitchin First Nation)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Chief Bruce Charlie (Vuntut Gwitchin First Nation), Esau Schafer (Vuntut Gwitchin First Nation), Paul Josie (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting request	Stated they would be available the last week of November and will invite the Elders council.	N/A	N/A
Vuntut Gwitchin First Nation0259	03-Nov-16	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	Rebecca Shrubb (Vuntut Gwitchin First Nation), Esau Schafer (Vuntut Gwitchin First Nation)	Meeting request	Greg (Chance) stated they have heard from the community on many issues and that Caribou is the #1 concern, so they have been working with company called EDI (EDI) to assist with plans requested by Vuntut Gwitchin First Nation. Greg (Chance) requested a meeting and stated their confusion for why Vuntut Gwitchin First Nation did not seem interested in meeting.	N/A	N/A
Vuntut Gwitchin First Nation0260	03-Nov-16	Email	Incoming	Vuntut Gwitchin First Nation	Esau Schafer (Vuntut Gwitchin First Nation)	Greg Charlie (Chance), Cindy Dickson (Chance)	Esau Schafer (Vuntut Gwitchin First Nation), Rebecca Shrubb (Vuntut Gwitchin First Nation)	Meeting request	Esau stated they received an email on October 14, 2016 from Richard (Chance) for setting up a meeting and suggested that the last week in November would be a good time. Stated they waited for response and didn't recieve anything. Esau said they share Greg (Chance)'s concern and will work to make time to meet with them. Esau S. requested a draft agenda, and stated that they are free before December 17, 2016 but potentially on November 8, 2016.	N/A	N/A
Vuntut Gwitchin First Nation0261	04-Nov-16	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Esau Schafer (Vuntut Gwitchin First Nation), Rebecca Shrubb (Vuntut Gwitchin First Nation), Josie Josie William (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Meeting request	Greg (Chance) thanked Esau for the chat that morning. Greg (Chance) stated Richard (Chance) and them are prepared to fly to them on November 10, 2016 to meet with Esau S. and leadership. Greg (Chance) requested Josie W. be able to attend.	N/A	N/A
Vuntut Gwitchin First Nation0262	14-Nov-16	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Esau Schafer (Vuntut Gwitchin First Nation), Rebecca Shrubb (Vuntut Gwitchin First Nation), Josie Josie William (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Meeting request	Richard (Chance) thanked Vuntut Gwitchin First Nation for making arrangements and meeting.	N/A	N/A
Vuntut Gwitchin First Nation0255	27-Jan-17	Email	Incoming	Vuntut Gwitchin First Nation	Chief Bruce Charlie (Vuntut Gwitchin First Nation)	Richard Wyman (Chance)	Chief Bruce Charlie (Vuntut Gwitchin First Nation), Barbara Abel, Alex Novac, Rebecca Shrubb (Vuntut Gwitchin First Nation)	Pause on Engagement, due to Northern Cross (Yukon) Limited v. Canada (Attorney General)	Chief Bruce Charlie (Vuntut Gwitchin First Nation) emailed Richard (Chance) shared that Vuntut Gwitchin First Nation was to put substantive discussions with Northern Cross Yukon on hold until the resolution of Northern Cross Yukon's judicial review application in Northern Cross (Yukon) Limited v. Canada (Attorney General), Federal Court File No. T-418-16 (Vancouver Registry). Chief Bruce Charlie (Vuntut Gwitchin First Nation) requested Chance's patience as they finalize this protocol after which they will provide Northern Cross Yukon a copy and stated they will answer any questions.	N/A	N/A

Vuntut Gwitchin First Nation0269	14-Aug-17	Email	Incoming	Vuntut Gwitchin First Nation	Paul Doehle (Vuntut Gwitchin First Nation)	Greg Charlie (Chance)	Paul Doehle (Vuntut Gwitchin First Nation)	General Assembly Resolution 2017-2	Paul (Vuntut Gwitchin First Nation) emailed Greg (Chance) with a summary of Resolution No. 2017-2. It was entered by Sophia Flather and submitted by Cindy Dickson (Chance). The resolution covered topics such as settlement lands and potential effects caused by the proposed Project.	N/A	N/A
Vuntut Gwitchin First Nation0270	08-Sep-17	Letter	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Bruce Charlie (Vuntut Gwitchin First Nation)	Engagement and Communication Plan	Richard (Chance) sent a letter to Chief Bruce Charlie (Vuntut Gwitchin First Nation) stating their interest in achieving the Engagement and Communication Plan with Vuntut Gwitchin First Nation.	N/A	N/A
Vuntut Gwitchin First Nation0271	08-Sep-17	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance)	Esau Schafer (Vuntut Gwitchin First Nation), Josie Paul (Vuntut Gwitchin First Nation)	Engagement and Communication Plan	Richard (Chance) emailed a letter regarding the Engagement and Communication Plan, and a draft of the Engagement and Communication Plan.	N/A	N/A
Vuntut Gwitchin First Nation0272	12-Sep-17	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Cindy Dickson (Chance)	Josie Josie William (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement and Communication Plan	Richard (Chance) forwarded the email from September 8, 2017 (Vuntut Gwitchin First Nation0271) with the corresponding attachments (Vuntut Gwitchin First Nation0271A&B).	N/A	N/A
Vuntut Gwitchin First Nation0273	12-Sep-17	Letter	Incoming	Vuntut Gwitchin First Nation	Chief Bruce Charlie (Vuntut Gwitchin First Nation)	Richard Wyman (Chance)	Chief Bruce Charlie (Vuntut Gwitchin First Nation)	N/A	N/A	N/A	N/A
Vuntut Gwitchin First Nation0274	12-Sep-17	Email	Incoming	Vuntut Gwitchin First Nation	Rebecca Shrubb (Vuntut Gwitchin First Nation)	Richard Wyman (Chance)	Rebecca Shrubb (Vuntut Gwitchin First Nation)	Letter from Vuntut Gwitchin First Nation	Rebecca (Vuntut Gwitchin First Nation) emailed Richard (Chance) attaching a letter from Chief Bruce Charlie (Vuntut Gwitchin First Nation).	N/A	20170912-Vuntut Gwitchin First Nation0274A
Vuntut Gwitchin First Nation0001	01-Dec-17	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance)	Chief Bruce Charlie (Vuntut Gwitchin First Nation), Esau Schafer (Vuntut Gwitchin First Nation), Deputy Chief, Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Councillor, Paul Josie (Vuntut Gwitchin First Nation), Councillor, Marvin Frost Jr. (Vuntut Gwitchin First Nation), Councillor, Shena Shaw (Hemmera), Hon. Ranj Pillai, Rick Nielsen (Chance)	Engagement	Chance sent a letter to Vuntut Gwitchin First Nation about the *Communications and Engagement Plan* that Chance wishes to develop in partnership with Vuntut Gwitchin First Nation andp provided an introduction of Hemmera.	N/A	N/A
Vuntut Gwitchin First Nation0002	09-Jan-18	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	N/A	Chief Bruce Charlie (Vuntut Gwitchin First Nation)	Engagement	Chance left a voicemail Chief Bruce Charlie (Vuntut Gwitchin First Nation).	N/A	N/A
Vuntut Gwitchin First Nation0003	11-Jan-18	Email	Incoming	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	N/A	Chief Bruce Charlie (Vuntut Gwitchin First Nation), Rebecca Shrubb (Vuntut Gwitchin First Nation)	Engagement, *Vuntut Gwitchin First Nation Oil and Gas Engagement Policy*	The Vuntut Gwitchin First Nation Executive Specialist, Communications & Policy, sent an email to Chance on behalf of the Chief of Vuntut Gwitchin First Nation, with a letter and draft *Vuntut Gwitchin First Nation Oil and Gas Engagement Policy* attached. The letter invited Chance to provide comments on the draft policy by January 29, 2018. Vuntut Gwitchin First Nation attached the letter and draft En*gagement Policy* for Vuntut Gwitchin First Nation.	N/A	N/A
Vuntut Gwitchin First Nation0004	11-Jan-18	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	N/A	Chief Bruce Charlie (Vuntut Gwitchin First Nation)	Engagement, *Vuntut Gwitchin First Nation Oil and Gas Engagement Policy*	Chance tried calling Chief Bruce Charlie (Vuntut Gwitchin First Nation) regarding the December 1, 2017 letter.	N/A	N/A
Vuntut Gwitchin First Nation0005	16-Jan-18	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	N/A	Chief Bruce Charlie (Vuntut Gwitchin First Nation)	Engagement, *Vuntut Gwitchin First Nation Oil and Gas Engagement Policy*	Chance sent an email to Chief Bruce Charlie (Vuntut Gwitchin First Nation) regarding the draft Vuntut Gwitchin First Nation Oil and Gas Engagement Policy. Chance appreciated the opportunity to provide comments to the draft. Chance shared that they would be in Vancouver for the AME Roundup Conference and extended an invitation to the Chief to meet with Chance and Hemmera for lunch on the 22nd, or another date that works for Chief Charlie. Chief Charlie had lunch with Richard (Chance), Mike Chernoff and Greg (Chance), during Round Up on January 22, 2018.	N/A	N/A
Vuntut Gwitchin First Nation0006	24-Jan-18	Meeting	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Greg Charlie (Chance), Mike Chernoff	Chief Bruce Charlie (Vuntut Gwitchin First Nation)	Engagement, *Vuntut Gwitchin First Nation Oil and Gas Engagement Policy*	The purpose of the meeting was to introduce Chance's Chair of the Board of Directors to Chief Bruce Charlie (Vuntut Gwitchin First Nation). In addition, the key topics discussed were the draft Vuntut Gwitchin First Nation Oil and Gas Engagement Policy and arrangements to establish a Communications and Engagement Plan once the Policy is in place. A meeting with Vuntut Gwitchin First Nation was discussed for Old Crow in February or March.	N/A	N/A
Vuntut Gwitchin First Nation0007	06-Feb-18	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Cindy Dickson (Chance)	Barbara Abel, Dana Tramm, Darius Elias (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Engagement	Chance emailed Vuntut Gwitchin First Nation's Director of Natural Resources about the February 22, 2018 meeting that Chance would be having with Vuntut Gwitchin First Nation and wanted to introduce the Hemmera team to the Natural Resources Department.	N/A	N/A
Vuntut Gwitchin First Nation0008	09-Feb-18	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Cindy Dickson (Chance)	Joe Linklater (Vuntut Gwitchin First Nation), Rebecca Shrubb (Vuntut Gwitchin First Nation)	Engagement	Chance sent a draft agenda of the February 22, 2018 meeting in Old Crow between Chance and Vuntut Gwitchin First Nation for review and input.	N/A	N/A

Vuntut Gwitchin First Nation0009	22-Feb-18	Meeting	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	Greg Charlie (Chance), Mike Chernoff, Richard Wyman (Chance)	Chief Bruce Charlie (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Joe Linklater (Vuntut Gwitchin First Nation), Joe Peter, Martin Frost Jr., Paul Josie (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera)	Engagement	The purpose of this meeting was to re-set the relationship between Chance and Vuntut Gwitchin First Nation. In the meeting, it was discussed that Vuntut Gwitchin First Nation sees an opportunity with Chance. Vuntut Gwitchin First Nation is new to oil and gas and therefore Vuntut Gwitchin First Nation is taking slower steps and the process may be slower with Vuntut Gwitchin First Nation than elsewhere. Chance has a Community Relations Committee of the Board that focuses on identifying initiatives that Chance can pursue to promote collaborative community engagement. Vuntut Gwitchin First Nation leads for the Communications and Engagement Plan were discussed. Chance provided Vuntut Gwitchin First Nation with feedback on their draft Vuntut Gwitchin First Nation Oil and Gas Engagement Policy and the difference in purpose between this policy and the Communications and Engagement Plan. Vuntut Gwitchin First Nation described how the Vuntut Gwitchin First Nation Citizens will want to be part of engagement activities with Chance and will want to help set priorities for engagement.	Vuntut Gwitchin First Nation asked for Vuntut Gwitchin First Nation representation on the Community Relations Committee of the Chance Board of Directors.	N/A
Vuntut Gwitchin First Nation0010	20-Mar-18	Email	Outgoing	Vuntut Gwitchin First Nation	Shena Shaw (Hemmera)	N/A	Emily Mann (Hemmera), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement	Chance asked Vuntut Gwitchin First Nation to let them know when they have an alternate date for the September 28, 2018 meeting.	N/A	N/A
Vuntut Gwitchin First Nation0011	22-Mar-18	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Emily Mann (Hemmera), Kris Statnyk (Vuntut Gwitchin First Nation), Marvin Frost Jr. (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Rebecca Shrubb (Vuntut Gwitchin First Nation)	Engagement	The purpose of this meeting was to review the draft Schedule of Engagement, Chance Community Relations Committee Terms of Reference, Vuntut Gwitchin First Nation and Chance Engagement and Communication Plan, and the minutes of the February 22, 2018 meeting in Old Crow.	A Vuntut Gwitchin First Nation representative noted that the parties are in general agreement on the front heavy approach of the Oil and Gas Policy. They wondered if this commitment had been recorded in the meeting minutes. A Chance representative suggested that the topic be parked to a time when the Chance President was in attendance so that both parties can have a detailed discussion on the front-heavy approach. The Chance representative added that they had not received comments on the meeting minutes by either Chance or Vuntut Gwitchin and that the process for giving feedback on the minutes should be discussed in this current meeting.	N/A
Vuntut Gwitchin First Nation0012	27-Mar-18	Email	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Emily Mann (Hemmera), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Engagement	Hemmera sent the first of four updated documents to Vuntut Gwitchin First Nation - The February 22, 2018 Old Crow Meeting Minutes for Vuntut Gwitchin First Nation's review and input.	N/A	N/A
Vuntut Gwitchin First Nation0013	27-Mar-18	Email	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Emily Mann (Hemmera), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Engagement	Hemmera sent the second of four updated documents to Vuntut Gwitchin First Nation - the Community Relations Terms Of Reference.	N/A	N/A
Vuntut Gwitchin First Nation0014	28-Mar-18	Email	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Emily Mann (Hemmera), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Engagement	Hemmera sent the 3rd and 4th updated documents: the draft Communications and Engagement Plan, and the updated draft Schedule of Engagement. Hemmera noted that this draft incorporates some general feedback from Vuntut Gwitchin First Nation that was received during the March 22, 2018 teleconference and was aware both Vuntut Gwitchin First Nation and Chance were still reviewing and providing edits to these notes.	N/A	N/A
Vuntut Gwitchin First Nation0015	16-Apr-18	Email	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Emily Mann (Hemmera), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Engagement	Hemmera sent the draft meeting minutes from the March 22, 2018 teleconference for review and comment by Vuntut Gwitchin First Nation.	N/A	N/A

Vuntut Gwitchin First Nation0016	23-Apr-18	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	N/A	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement	Hemmera called Vuntut Gwitchin First Nation and spoke with a Councillor. The following items were discussed: Vuntut Gwitchin First Nation had completed their review of the draft documents provided to them (Engagement and Communication Plan, meeting minutes, draft TOR for the Community Relations Committee) and will email those to Hemmera today; Vuntut Gwitchin First Nation had requested a teleconference with Hemmera to review Vuntut Gwitchin First Nation's comments on the above-noted documents; Hemmera updated Vuntut Gwitchin First Nation on meetings had with other First Nations; Vuntut Gwitchin First Nation asked if the meetings went well; Vuntut Gwitchin First Nation asked if there are any obvious roadblocks to move forward with the Communications and Engagement Plans with all five First Nations, Hemmera said that there wasn't anything urgent at this moment and noted that having Vuntut Gwitchin First Nation so actively engaged is much appreciated and is important for generating buy-in when engaging the other First Nations. Vuntut Gwitchin First Nation thought that a meeting with other potentially affected First Nations was a good idea and suggested that this would be most successfully planned and executed if Vuntut Gwitchin First Nation were to lead the event with support from Chance and Hemmera. Vuntut Gwitchin First Nation agreed. Vuntut Gwitchin First Nation asked Hemmera if the multi-party meeting would be a full day. Discussed details around an all-party meeting. Vuntut Gwitchin First Nation has met multiple times internally about the Chance documents and that Vuntut Gwitchin First Nation as a whole has had really positive conversations, is very much looking forward to a new relationship with Chance, and there is noteworthy buy-in from Vuntut Gwitchin First Nation on Chance's plans and engagement efforts – Hemmera thanked Vuntut Gwitchin First Nation for this comment. Vuntut Gwitchin First Nation informed Hemmera that moving forward, should anything require their immediate attention, to text over cell phone and they would prioritize the matter.	N/A	N/A
Vuntut Gwitchin First Nation0017	27-Apr-18	Email	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Engagement	Hemmera sent to Vuntut Gwitchin First Nation and Chance the most recent version of the Vuntut Gwitchin and Chance Communication and Engagement Plan (Plan) as provided by Vuntut Gwitchin First Nation to Hemmera via email on April 25. Hemmera discussed this most recent version with Vuntut Gwitchin First Nation representatives that day a teleconference, and conveyed the following key points of Vuntut Gwitchin First Nation's revisions to the document: • This version discusses clearly the distinction between engagement and communication with Vuntut Gwitchin First Nation and engagement and communication with Vuntut Gwitchin First Nation Citizens; • The relationship between the Communications and Engagement Plan and Vuntut Gwitchin First Nation's Oil and Gas Engagement Policy (Policy) is more distinct; • The role of the Committee (as described in the Policy) in engagement and communication with Chance; and • Once Vuntut Gwitchin First Nation and Chance reach a point where the Plan is mostly agreed to by both parties, the Plan can likely be ratified by Vuntut Gwitchin Chief and Council in mid-May.	N/A	N/A
Vuntut Gwitchin First Nation0018	01-May-18	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Cindy Dickson (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Emily Mann (Hemmera), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Engagement	Chance sent revisions to the Communication and Engagement Plan provided to Hemmera by Vuntut Gwitchin via email on April 26. Chance provided the following suggestions and updates: Communication and Engagement Plan, Section 3: Chance had updated the Plan to reference the Policy and has removed the Policy as an attachment, noting that Chance would comply with this Policy and all other Vuntut Gwitchin First Nation policies applicable to Chance's activities. Chance was hesitant to sign off on the Policy as part of the Plan, as it did not seem appropriate for a proponent to be approving or signing off on a self-governing First Nation's internal Policy. However, Chance would like to strongly note that they were fully committed to complying with this, and all of Vuntut Gwitchin First Nations internal Policies and Procedures. Vuntut Gwitchin Oil and Gas Engagement Policy, "Conflict of Law and Policy": This section of the Policy describes conflict between the Policy and Vuntut Gwitchin First Nation Law; Vuntut Gwitchin First Nation may want to consider the instance of conflict between the Policy and the Yukon Oil and Gas Act as well. Policy, general comment: There are some legislated processes regarding engagement and oil and gas dispositions in the Yukon Oil and Gas Act that Vuntut Gwitchin First Nation may wish to engage Yukon Government about for consisteNorthern Cross Yukon with the Policy. Chance suggested a brief call to walk through all their edits in detail and discuss next steps; asks Vuntut Gwitchin First Nation for the best for time/date to set up a conference call.	N/A	N/A
Vuntut Gwitchin First Nation0019	03-May-18	Phone Call	Incoming	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Shena Shaw (Hemmera)	Engagement	Chance and Vuntut Gwitchin First Nation had a teleconference to discuss a round of revisions to the Communications and Engagement Plan.	N/A	N/A
Vuntut Gwitchin First Nation0020	10-May-18	Phone Call	Incoming	Vuntut Gwitchin First Nation	Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Greg Charlie (Chance)	Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Engagement	The Natural Resources Director for Vuntut Gwitchin First Nation called Chance to provide an update that the Vuntut Gwitchin First Nation team is meeting this week on the re-draft of the engagement plan and will provide the next draft by end of this week.	N/A	N/A
Vuntut Gwitchin First Nation0021	15-May-18	Email	Outgoing	Vuntut Gwitchin First Nation	Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance), Rick Nielsen (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Emily Mann (Hemmera), Kris Statnyk (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera)	Engagement	Vuntut Gwitchin First Nation thanked Hemmera for the email and said they would mention it again, to please include Vuntut Gwitchin First Nation, their Intergovernmental Affairs Coordinator in all emails. Vuntut Gwitchin First Nation also confirmed that Chance would receive the final version of the VVuntut Gwitchin First Nation/Chance Communication & Engagement Plan shortly. Hemmera sent back an email to Josie William (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), and thanked them for the note. Hemmera confirmed they would add Kris to the distribution list for Vuntut Gwitchin First Nation. Hemmera also sent apologies to a Vuntut Gwitchin First Nation representative for erroneously excluding him from the correspondence.	N/A	N/A

Vuntut Gwitchin First Nation0022	15-May-18	Email	Incoming	Vuntut Gwitchin First Nation	Kris Statnyk (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance), Rick Nielsen (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Emily Mann (Hemmera), Kris Statnyk (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera)	Engagement	Vuntut Gwitchin First Nation sent a revised copy of the Communication and Engagement Plan, dated May 7, 2018. This version of the Plan incorporated the changes most recently suggested by Chance with the only exception being Vuntut Gwitchin First Nation's desire to keep the Policy attached as an appendix. From the perspective of Vuntut Gwitchin First Nation, they considered this version of the Plan to be completed and final and subject to amendment by the parties over time as contemplated under Section 6 of the plan.	N/A	N/A
Vuntut Gwitchin First Nation0023	15-May-18	Email	Incoming	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Emily Mann (Hemmera), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Engagement	Hemmera sent Chance and Vuntut Gwitchin First Nation the attached meeting notes from the May 3, 2018 teleconference between Vuntut Gwitchin First Nation and Chance, to discuss the most recent version of the Engagement and Communication Plan. Hemmera requested that meeting participants please have a look and provide their review of the notes by June 14, 2018 if possible, by way of track changes.	N/A	N/A
Vuntut Gwitchin First Nation0024	15-May-18	Email	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rick Nielson, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Engagement	Hemmera sent an email with the attached meeting notes from May 3, 2018 teleconference between Vuntut Gwitchin and Chance to discuss the most recent version of the Engagement and Communication Plan. Hemmera asked everyone to please have a look and provide a review of the meeting by June 14, 2018 if possible, by way of track changes.	N/A	N/A
Vuntut Gwitchin First Nation0025	17-May-18	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Kris Statnyk (Vuntut Gwitchin First Nation)	Engagement	A representative from Chance sent Vuntut Gwitchin First Nation's representative an email thanking them for sending the final document. Chance said they were ready to work with Vuntut Gwitchin First Nation and Vuntut Gwitchin First Nation Citizens using the framework for this Communication and Engagement Plan. Chance then added there are two minor corrections. A representative from Vuntut Gwitchin First Nation emailed Chance back on May 17, 2018 with the minor corrections updated.	N/A	N/A
Vuntut Gwitchin First Nation0026	17-May-18	Email	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance), Rick Nielsen (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Emily Mann (Hemmera), Kris Statnyk (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Engagement	Hemmera sent a draft joint covering letter for the consideration of Vuntut Gwitchin First Nation and Chance to accompany the submission of the final Communications and Engagement plan to the Minister. Hemmera asked everyone to review the attached and provide feedback by way of track changes.	N/A	N/A
Vuntut Gwitchin First Nation0027	22-May-18	Email	Incoming	Vuntut Gwitchin First Nation	Kris Statnyk (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Emily Mann (Hemmera), Kelly Constable (Hemmera)	Engagement	A representative from Vuntut Gwitchin First Nation emailed Hemmera and said that they had been provided instructions to work with Hemmera to finalize the draft letter for signature. Vuntut Gwitchin First Nation indicated they had some suggested changes. Vuntut Gwitchin First Nation said if the changes were acceptable then the letter could be prepared for final signature by Vuntut Gwitchin First Nation and Chance accordingly.	N/A	N/A
Vuntut Gwitchin First Nation0028	23-May-18	Email	Incoming	Vuntut Gwitchin First Nation	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	N/A	Kelly Constable (Hemmera)	Engagement	A representative from Vuntut Gwitchin First Nation sent Hemmera an email to check in and update them after the Northern Chief's meeting over the long weekend. Vuntut Gwitchin First Nation stated they were currently working on a signing ceremony date, possibly June 2, in Old Crow but would keep Hemmera informed. Vuntut Gwitchin First Nation also said the other FN's (NND, TH) did not see a need for collective meetings together with Chance. They were fine with Vuntut Gwitchin First Nation engaging directly with Chance and keeping open lines of communication with them on discussions Vuntut Gwitchin First Nation was having with Chance in the areas where they may be affected. The Vuntut Gwitchin First Nation representative indicated that TH and NND would pursue engagement directly with Chance to the extent that each feels appropriate.	N/A	N/A
Vuntut Gwitchin First Nation0029	24-May-18	Email	Incoming	Vuntut Gwitchin First Nation	Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Brandon (no last name), Darius Elias (Vuntut Gwitchin First Nation), Mary Jane Moses, Maureen Charlie, Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Robert Kyikavichik, Sophia Flather	Engagement	Josie William (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) sent an email out to Chance and cc'd Vuntut Gwitchin First Nation employees, to inform them he would be moving to the Executive Director's office and would now answer to that email. Josie William (Vuntut Gwitchin First Nation) thanked everyone for their work and partnership over the years.	N/A	N/A
Vuntut Gwitchin First Nation0030	25-May-18	Email	Outgoing	Vuntut Gwitchin First Nation	Shena Shaw (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Kelly Constable (Hemmera), Emily Mann (Hemmera)	Engagement	Hemmera sent an email out with an attached memo that Hemmera had produced to discuss short term and long term activities to commence implementation of the approved Communications and Engagement Plan. Hemmera wanted to schedule a brief call to discuss several items and next steps. Hemmera asked about the Vuntut Gwitchin First Nation Oil and Gas Policy ratification, and wanted to know if they should hold off on a community celebration for the finalization of the Community and Engagement Plan until such time the policy has been ratified and rolled out to Vuntut Gwitchin First Nation Citizens.	N/A	N/A

Vuntut Gwitchin First Nation0031	31-May-18	Email	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Shena Shaw (Hemmera), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Emily Mann (Hemmera)	Engagement	A representative from Hemmera sent an email to Vuntut Gwitchin First Nation and Chance to follow up on the memo provided to them by Hemmera the week prior. Hemmera asked if there were any dates and times that worked for Vuntut Gwitchin First Nation to discuss the attached memo via teleconference in the coming week.	N/A	N/A
Vuntut Gwitchin First Nation0032	05-Jun-18	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	N/A	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement	A representative from Hemmera left Vuntut Gwitchin First Nation a voice message and asked if they would call Hemmera back to discuss the memo Hemmera sent, at a high level.	N/A	N/A
Vuntut Gwitchin First Nation0033	06-Jun-18	Email	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	N/A	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement	A representative from Hemmera sent an email to Vuntut Gwitchin First Nation saying that they were hoping to connect with them via telephone the previous day and left a voice mail regarding their note and memo provided on May 31, 2018. Hemmera asked Vuntut Gwitchin First Nation to call them back at their earliest convenience.	N/A	N/A
Vuntut Gwitchin First Nation0034	12-Jun-18	Email	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Emily Mann (Hemmera), Megan Williams (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera)	Engagement	A representative of Hemmera sent the newly appointed Acting Director for Lands and Resources an update about the newly completed Communications and Engagement Plan. Hemmera wanted to touch base with this representative about moving forward on implementing the finalized Plan (which was attached to the email). Hemmera also attached an outline with some suggested next steps for communications and engagement. Hemmera asked the representative if they could give them a call tomorrow or to have a touch-base chat. They asked if there was a time that worked best.	A representative from Vuntut Gwitchin First Nation answered the email that Hemmera sent to Vuntut Gwitchin First Nation on June 13th, 2018. Vuntut Gwitchin First Nation has prepared a response to the Hemmera memo and they expects it will be sent out today. Vuntut Gwitchin First Nation apologized for the delay but said with everyone's busy schedules they needed a bit more time. Vuntut Gwitchin First Nation also said that if Hemmera wanted to touch base they would be available the next day for a phone call.	N/A
Vuntut Gwitchin First Nation0035	19-Jun-18	Meeting	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	N/A	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement	A representative from Chance met with a representative from Vuntut Gwitchin First Nation in Whitehorse, Yukon, to discuss a meeting in Old Crow the week of July 9-13, 2018. The precise dates were not yet confirmed. Vuntut Gwitchin First Nation indicated they were also good with having Hemmera continue to participate as they moved into implementation of the Plan.	N/A	N/A
Vuntut Gwitchin First Nation0036	27-Jun-18	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Cindy Dickson (Chance), Richard Wyman (Chance)	Emily Mann (Hemmera)	Engagment	Chance sent Vuntut Gwitchin First Nation a draft agenda to assist with the discussion on July 10, 2018. Chance also said to add or make changes if they would like.	N/A	N/A
Vuntut Gwitchin First Nation0037	10-Jul-18	Meeting	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	N/A	Chief Bruce Charlie (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation), Esau Schafer (Vuntut Gwitchin First Nation), Marvin Frost Jr. (Vuntut Gwitchin First Nation), Paul Josie (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation)	Engagement	The purpose of this meeting was to establish a general understanding of Chance's project plans going forward and communication pathways for oil and gas related matters, as well as to collaboratively decide on next steps in engagement. Meeting Objectives: • Provide an overview of Chance's land tenure status and general exploration project plans • Learn the status of the standing committee Key outcomes for Chance: • Establish formal contact representatives for both Chance and Vuntut Gwitchin First Nation going forward • Decide on short term and medium term next steps.	N/A	N/A
Vuntut Gwitchin First Nation0038	23-Jul-18	Email	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	N/A	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement	Chance sent Vuntut Gwitchin First Nation an email about creating a 1-page information sheet of the Communications and Engagement Plan for a community celebration to be held in Old Crow on August 1, 2018. The email asked to have a call to discuss the contents of the 1-page summary.	N/A	N/A
Vuntut Gwitchin First Nation0039	23-Jul-18	Email	Incoming	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	N/A	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement	Vuntut Gwitchin First Nation responded saying they were able to talk about the contents of the 1-page summary of the Communications and Engagement Plan.	N/A	N/A
Vuntut Gwitchin First Nation0040	24-Jul-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	N/A	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Kelly Constable (Hemmera)	Engagement	Chance sent Vuntut Gwitchin First Nation a summary of the July 10, 2018, meeting for review and comment.	N/A	N/A
Vuntut Gwitchin First Nation0041	24-Jul-18	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	N/A	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement	Chance and Vuntut Gwitchin First Nation discussed the contents of the 1-page summary of the Communications and Engagement Plan. The priorities are to include background information on Vuntut Gwitchin First Nation and Chance's relationship, and a brief overview of the contents of the Plan, and Chance's exploration plans in Eagle Plain.	N/A	N/A
Vuntut Gwitchin First Nation0042	26-Jul-18	Email	Outgoing	Vuntut Gwitchin First Nation	Kelly Constable (Hemmera)	N/A	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Emily Mann (Hemmera)	Engagement	Chance sent Vuntut Gwitchin First Nation a draft Community Event one-pager for review and input. Chance noted that any feedback was welcome, and that feedback from both Chance and Vuntut Gwitchin First Nation went into the one-pager. Chance also attached a map of Chance's dispositions to the document.	N/A	N/A

Vuntut Gwitchin First Nation0043	26-Jul-18	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Kelly Constable (Hemmera), Shena Shaw (Hemmera), Emily Mann (Hemmera)	Engagement	Chance suggested the changes to the Draft One-Pager in an email sent to both Chance and Vuntut Gwitchin First Nation staff.	N/A	N/A
Vuntut Gwitchin First Nation0044	01-Aug-18	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Shena Shaw (Hemmera)	Engagement	Chance sent Vuntut Gwitchin First Nation a simple poster to post in the community for the community event on August 1, 2018.	N/A	N/A
Vuntut Gwitchin First Nation0045	14-Aug-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Shena Shaw (Hemmera)	Engagement	Following up on a phone call Chance as Vuntut Gwitchin First Nation when they would be available to have a call regarding the planning of an All-Party meeting.	N/A	N/A
Vuntut Gwitchin First Nation0046	14-Aug-18	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	N/A	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement	Chance called Vuntut Gwitchin First Nation to initiate the planning of an all-party meeting in October.	N/A	N/A
Vuntut Gwitchin First Nation0047	22-Aug-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Shena Shaw (Hemmera)	Engagement	Chance followed-up on their phone calls and emails regarding the planning of the All-Party meeting. Asking Vuntut Gwitchin First Nation to call Chance at anytime to discuss.	N/A	N/A
Vuntut Gwitchin First Nation0048	24-Aug-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	N/A	Kris Statnyk (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement	Chance responded to Vuntut Gwitchin First Nation saying that they had decided to wait until after the labour day weekend to start planning the All-Party meeting.	N/A	N/A
Vuntut Gwitchin First Nation0049	05-Sep-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Mike Chernoff, Rick Nielsen (Chance), Richard Wyman (Chance)	Kris Statnyk (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), George Meadows (Hemmera), Shena Shaw (Hemmera)	Engagement	Chance sent out two meeting invites for Days 1 and 2 of a Negotiation Planning Meeting.	N/A	N/A
Vuntut Gwitchin First Nation0050	06-Sep-18	Email	Incoming	Vuntut Gwitchin First Nation	Kris Statnyk (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance), Mike Chernoff, Richard Wyman (Chance)	Emily Mann (Hemmera), Kris Statnyk (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), George Meadows (Hemmera), Shena Shaw (Hemmera)	Engagement	At a meeting between Vuntut Gwitchin First Nation and Chance in Old Crow on July 10, 2018, Vuntut Gwitchin First Nation provided Chance with a draft Cooperation Agreement for review (attached). Vuntut Gwitchin First Nation asked if Chance had any written comments or suggested changes on the draft that they wished to provide to Vuntut Gwitchin First Nation for consideration in advance of the discussions on September 11 and 12, 2018.	N/A	N/A
Vuntut Gwitchin First Nation0051	07-Sep-18	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Richard Wyman (Chance), Cindy Dickson (Chance), Mike Chernoff	George Meadows (Hemmera), Shena Shaw (Hemmera), Kris Statnyk (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement	Chance responded to Vuntut Gwitchin First Nation's email regarding written feedback on the draft Cooperation Agreement. Chance explained that they were hoping to complete few steps in the process and have this working session next week to set the framework for negotiations. Greg (Chance) indicated they thought it was important for the parties to understand each other's objectives and have the ability to provide their thoughts on how we can achieve a workable Cooperation Agreement. Greg stated he was not saying Vuntut Gwitchin First Nation's document was not workable however thought it was important to get more information sharing between both parties. Greg stated that based on past experience this working session would allow all parties to provide more details to the agreement.	N/A	N/A
Vuntut Gwitchin First Nation0052	14-Sep-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Richard Wyman (Chance), Cindy Dickson (Chance), Mike Chernoff, Rick Nielsen (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation), George Meadows (Hemmera), Shena Shaw (Hemmera)	Engagement	Chance let Vuntut Gwitchin First Nation know that Chance was working on developing the exploration scenarios and draft Cooperation Agreement as action items discussed in the September 11 and 12, 2018, meeting. Chance was planning to have these documents ready to sent early next week.	N/A	N/A
Vuntut Gwitchin First Nation0053	17-Sep-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Richard Wyman (Chance), Cindy Dickson (Chance), Mike Chernoff, Rick Nielsen (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), George Meadows (Hemmera), Shena Shaw (Hemmera), Darius Elias (Vuntut Gwitchin First Nation)	Engagement	Chance sent Vuntut Gwitchin First Nation the meeting summary for the September 11 and 12, 2018, meeting. Chance asked Vuntut Gwitchin First Nation to make changes via tracked changes or to let a specific Chance representative know about a required change through email.	N/A	N/A
Vuntut Gwitchin First Nation0054	20-Sep-18	Email	Outgoing	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	N/A	Shena Shaw (Hemmera), Emily Mann (Hemmera)	Engagement	Vuntut Gwitchin First Nation let Chance know that they will need to re-schedule the September 28, 2018, meeting to allow for adequate time to review the documents. They do not have a alternate date to propose, but will be discussing one soon.	N/A	N/A

Vuntut Gwitchin First Nation0055	20-Sep-18	Email	Outgoing	Vuntut Gwitchin First Nation	Shena Shaw (Hemmera)	Cindy Dickson (Chance), Richard Wyman (Chance), Mike Chernoff, Rick Nielsen (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation), George Meadows (Hemmera), Emily Mann (Hemmera)	Engagement	Chance sent Vuntut Gwitchin First Nation two documents: Feedback on the draft Cooperation Agreement and Exploration Scenario's document as an action item from the September 11 and 12, 2018, meeting. These items were sent later than originally anticipated, and therefore Chance asked Vuntut Gwitchin First Nation if they would like to change the date of the next meeting (originally scheduled for September 28) and if Vuntut Gwitchin First Nation could advise on a date and time.	N/A	N/A
Vuntut Gwitchin First Nation0056	20-Sep-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation)	Engagement	Chance sent Vuntut Gwitchin First Nation the September 11 and 12, 2018, meeting summary with their tracked Changes so that Vuntut Gwitchin First Nation could add their changes to the same document.	N/A	N/A
Vuntut Gwitchin First Nation0057	24-Sep-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Cindy Dickson (Chance), Richard Wyman (Chance), Mike Chernoff, Rick Nielsen (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation), George Meadows (Hemmera), Shena Shaw (Hemmera)	Engagement	Chance asked if Vuntut Gwitchin First Nation had chosen an alternate date for the September 28, 2018, meeting and asked if the tentative meeting scheduled for October 4, 2018, could be confirmed for the next meeting date. Vuntut Gwitchin First Nation was asked to advise on their availability and time needed to review the documents.	N/A	N/A
Vuntut Gwitchin First Nation0058	24-Sep-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	N/A	Kris Statnyk (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement	Chance thanked Vuntut Gwitchin First Nation for an update on their availability. Chance also asked for feedback on the latest draft of the Cooperation Agreement and if there were any questions about the Exploration Project Description before October 4, 2018.	N/A	N/A
Vuntut Gwitchin First Nation0059	24-Sep-18	Email	Incoming	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	N/A	Kris Statnyk (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement	Vuntut Gwitchin First Nation proposed proceeding with the October 4, 2018, meeting that had previously been tentatively scheduled to continue discussion on the Cooperation Agreement. They proposed changing the time to the afternoon instead of the morning.	N/A	N/A
Vuntut Gwitchin First Nation0060	01-Oct-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance), Mike Chernoff	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation)	Engagement	Chance sent a draft meeting agenda for the October 4, 2018, for Vuntut Gwitchin First Nation to review.	N/A	N/A
Vuntut Gwitchin First Nation0061	02-Oct-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	N/A	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement	A representative from Chance that a representative from Vuntut Gwitchin First Nation and confirmed that it was ok that they were calling in from out of town.	N/A	N/A
Vuntut Gwitchin First Nation0062	03-Oct-18	Letter	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	N/A	Chief Bruce Charlie (Vuntut Gwitchin First Nation)	Engagement	Chance wrote to Vuntut Gwitchin First Nation to advise that Chance intends to relinquish its exploration rights to the entire Exploration Permit 0005 (EP). This EP partially overlaps with the Ch'ihilii Chik Habitat Protection Area (HPA). Chance recognizes the importance of protected areas and wishes to support the Vuntut Gwitchin First Nation by surrendering this EP to facilitate the creation of the HPA with no encumberance of outside oil and gas rights. As a courtesy, Chance was giving notice prior to informing the Yukon Government of the relinquishment.	Vuntut Gwitchin First Nation had previously mentioned that the Ch'ihilii Chik Habitat Protection Area (HPA) was of concern if oil and gas activity were to occur in permit 0005.	N/A
Vuntut Gwitchin First Nation0063	04-Oct-18	Email	Incoming	Vuntut Gwitchin First Nation	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance), Greg Charlie (Chance), Mike Chernoff, Richard Wyman (Chance)	Emily Mann (Hemmera), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), George Meadows (Hemmera), Shena Shaw (Hemmera), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation)	Engagement	A Vuntut Gwitchin First Nation representative let Chance know that they would be arriving in Vancouver on October 15, 2018, and in Whitehorse on October 16, 2018, at 6PM, and available to meet in Whitehorse on October 17 or 18, 2018.	N/A	N/A

Vuntut Gwitchin First Nation0064	04-Oct-18	Meeting	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	N/A	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation)	Engagement	Vuntut Gwitchin First Nation opened the meeting by discussing the timeline for finalizing the Agreement. Originally, Chance and Vuntut Gwitchin First Nation were striving for a timeline that would allow for the Agreement to be completed before October 19, when it is expected the Vuntut Gwitchin First Nation election will be called. However, this timeline would not afford time for community engagement. There were benefits to waiting for the incoming council in that they would be the ones to sign off on the Agreement and then be responsible for implementing the agreement. Vuntut Gwitchin First Nation suggested moving forward with the discussion of the Agreement keeping a new longer timeline in mind. Chance and Vuntut Gwitchin First Nation were looking at February 2019 as the earliest date on which an Agreement could be signed off. Chance responded that Chance did not have problems with this timeline as long as February 2019 remained the target end date for finalizing the Agreement, as this seemed to be a realistic deadline. Vuntut Gwitchin First Nation started the conversation by saying that Vuntut Gwitchin First Nation has issues with Chance's amendments and comments to Section 4.3, specifically Chance's reluctance to attach the Policy, and wish to have the freedom to submit a Yukon Environmental Socio-economic Assessment Board Proposal prior to the end of this Agreement and therefore prior to signing a Benefits Agreement. Chance asked if Chance and Vuntut Gwitchin First Nation could potentially complete some aspects of the Policy at the same time rather than sequentially. Due to the fact that Yukon Environmental Socio-economic Assessment Board had public components and Chance could not do anything without permits, they raised that it may be time inefficient to advance things sequentially. Vuntut Gwitchin First Nation asked for an example of items that Chance would want to develop in paralleled sequences. Chance elaborated that Chance and Vuntut Gwitchin First Nation could develop a YESAA application at the same time as a Benefits Agreement. Vuntut Gwitchin First Nation reminded the group that a fundamental aspect of the policy was to have a front-end process.	Timeline of Agreement - this should be extended from October 19, 2018 to February 2019. This allows for community engagement and for the newly elected officials to be in office.	N/A
Vuntut Gwitchin First Nation0065	05-Oct-18	Email	Outgoing	Vuntut Gwitchin First Nation	Shena Shaw (Hemmera)	N/A	Emily Mann (Hemmera), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement	Chance contacted Vuntut Gwitchin First Nation to discuss the agenda for the next meeting. Specifically, Chance wanted to discuss walking through the policy in more detail with the exploration development scenario document and also more detail on specific items in the NYRLUP.	N/A	N/A
Vuntut Gwitchin First Nation0066	05-Oct-18	Email	Incoming	Vuntut Gwitchin First Nation	Kris Statnyk (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance), Mike Chernoff	Emily Mann (Hemmera), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), George Meadows (Hemmera), Shena Shaw (Hemmera)	Engagement	Vuntut Gwitchin First Nation suggested they were available to meet for the next meeting from 9:00AM-12:00PM on October 17, 2018.	N/A	N/A
Vuntut Gwitchin First Nation0067	05-Oct-18	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Mike Chernoff, Cindy Dickson (Chance)	Emily Mann (Hemmera), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), George Meadows (Hemmera), Shena Shaw (Hemmera), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Engagement	A Chance representative let Vuntut Gwitchin First Nation know that they were unable to attend a meeting on October 17 or 18, 2018, as they would be in Old Crow.	N/A	N/A
Vuntut Gwitchin First Nation0068	10-Oct-18	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Emily Mann (Hemmera)	Engagement	Vuntut Gwitchin First Nation let Chance know that they would like to meet regarding the Agenda for the next meeting in the week of October 15, 2018.	N/A	N/A
Vuntut Gwitchin First Nation0069	15-Oct-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	George Meadows (Hemmera), Shena Shaw (Hemmera), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement	Chance sent Vuntut Gwitchin First Nation a draft Meeting Summary for the October 4, 2018, meeting for review and comment.	N/A	N/A
Vuntut Gwitchin First Nation0070	15-Oct-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	N/A	Kris Statnyk (Vuntut Gwitchin First Nation)	Engagement	A representative from Chance followed up on a October 4, 2018, meeting action item requesting written feedback from Vuntut Gwitchin First Nation on Chance's edits to the Cooperation Agreement.	N/A	N/A
Vuntut Gwitchin First Nation0071	16-Oct-18	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	N/A	Shena Shaw (Hemmera), Emily Mann (Hemmera)	Engagement	Vuntut Gwitchin First Nation notified Chance that they did not think there was a date set yet for the upcoming meeting and let Chance know that they were available to discuss an agenda for the next week.	N/A	N/A
Vuntut Gwitchin First Nation0072	17-Oct-18	Email	Outgoing	Vuntut Gwitchin First Nation	Shena Shaw (Hemmera)	N/A	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Emily Mann (Hemmera)	Engagement	A Chance representative confirmed that there was not a date set for the upcoming meeting and that next week would work on , or .	N/A	N/A
Vuntut Gwitchin First Nation0073	19-Oct-18	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	N/A	Shena Shaw (Hemmera), Emily Mann (Hemmera)	Engagement	A Vuntut Gwitchin First Nation representative informed a Chance representative that they now had a scheduling conflict with October 22, 2018, at 1:00pm and asked to reschedule to 11:00AM or 3:00PM.	N/A	N/A
Vuntut Gwitchin First Nation0074	19-Oct-18	Email	Outgoing	Vuntut Gwitchin First Nation	Shena Shaw (Hemmera)	N/A	Shena Shaw (Hemmera), Emily Mann (Hemmera)	Engagement	In response to a Vuntut Gwitchin First Nation representative's email, a Chance representative suggested meeting on October 24, 2018.	N/A	N/A
Vuntut Gwitchin First Nation0075	19-Oct-18	Email	Outgoing	Vuntut Gwitchin First Nation	Shena Shaw (Hemmera)	N/A	Shena Shaw (Hemmera), Emily Mann (Hemmera)	Engagement	A Vuntut Gwitchin First Nation representative said that their afternoon was open and suggested meeting at 1:00PM. A representative from Chance then sent a meeting scheduler.	N/A	N/A

Vuntut Gwitchin First Nation0076	31-Oct-18	Letter	Incoming	Vuntut Gwitchin First Nation	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	RE: Relinquishment of Exploration Permit 5	Dana T. sent a letter to Vuntut Gwitchin First Nation thanking Chance for surrendering their oil and gas Exploration Rights to their permit #0005 ("EP5") so that the Ch'ihilli Chik working group may submit a clean Ch'ihilli Chik Habitat Protection Area Management Plan without any third party land interests to YYukon Government and the Minister of Environment. Dana T. stated stated this was viewed as a 'good will gesture' of cooperation and respect.	N/A	20181031-Vuntut Gwitchin First Nation0076
Vuntut Gwitchin First Nation0077	19-Nov-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	N/A	Kris Statnyk (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Engagement	Hemmera sent out an email on behalf of Chance and stated that they hoped their email found all at Vuntut Gwitchin First Nation well. Hemmera explained that Chance acknowledged that there had been a small break since the last Vuntut Gwitchin First Nation-Chance meeting, Chance was proposing to meet again before the new year to maintain the positive momentum established with meetings. Chance and Vuntut Gwitchin First Nation had both expressed a need to meet regarding the Oil and Gas Policy and spend some time developing a further understanding of the Policy and its application to stages of the exploration project. Chance and GTC think this is an important step to be done before moving forward with the Cooperation Agreement. A common and improved understanding of the policy, and discussion of any issues with its implementation would aid in moving forward with the Cooperation Agreement and future engagement once the new Chief and Council was formed. Chance was proposing to spend half a day on this meeting and host it in Whitehorse on one of the following dates: • December 12 • December 13 • December 17 • December 18 Chance asked Vuntut Gwitchin First Nation representatives to please respond to Chance with tjtheir availability as soon as possible and Chance stated they would send out a scheduler by the end of that week.	N/A	N/A
Vuntut Gwitchin First Nation0078	21-Nov-18	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Cindy Dickson (Chance), Richard Wyman (Chance)	Kris Statnyk (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera)	Engagement	Greg (Chance) said they were available on meeting dates suggested by Hemmera.	N/A	N/A
Vuntut Gwitchin First Nation0079	21-Nov-18	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Cindy Dickson (Chance), Richard Wyman (Chance)	Shena Shaw (Hemmera), Kris Statnyk (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Engagement	Richard (Chance) informed the group that they would be unlikely to meet in person on the suggested dates, but could join by conference call. Richard agreed that there were some foundational conversations needed before the group gets back to crafting the Cooperation Agreement.	N/A	N/A
Vuntut Gwitchin First Nation0080	21-Nov-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	N/A	Kris Statnyk (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera)	Engagement	Hemmera sent a small update regarding the previous request for a meeting in December. Of the dates listed, December 17 and 18, 2018, are best for them. Hemmera asked if either of these days work for Vuntut Gwitchin First Nation to meet, and to please let them know.	N/A	N/A
Vuntut Gwitchin First Nation0082	27-Nov-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Calista Morrison (Hemmera)	Engagement	Hemmera sent some information about the All-Party Meeting that Chance was planning for February 1, 2019. Hemmera understood that Vuntut Gwitchin First Nation had been briefed about the meeting, but thought they would share what had been shared with the other First Nations. The All-Party Meeting was meant to bring together potentially affected First Nations and Yukon Government to discuss matters related to Chance's upcoming exploration project. Shared the proposed agenda. Hemmera stated that Chance would like to host the meeting in Vancouver on February 1, 2019, the day after AME Roundup Conference. They were hoping that scheduling this meeting immediately after this widely attended conference would allow for maximum participation. Details around capacity funding were discussed. Hemmera noted that they were happy to have further conversations regarding Vuntut Gwitchin First Nation's attendance and meeting logistics. Hemmera stated Vuntut Gwitchin First Nation could give them a call at any time if they have questions using the contact information provided below. Hemmera stated if Vuntut Gwitchin First Nation representatives knew the names of other Vuntut Gwitchin First Nation attendees who would attend to please let them know as well.	N/A	N/A
Vuntut Gwitchin First Nation0083	06-Dec-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Shena Shaw (Hemmera), Calista Morrison (Hemmera)	Engagement	Hemmera sent Vuntut Gwitchin First Nation the draft agenda for the December 12, 2018, meeting between Vuntut Gwitchin First Nation and Chance. If Vuntut Gwitchin First Nation had additions to the agenda, or changes, they were asked to let Hemmera know.	N/A	N/A

Vuntut Gwitchin First Nation0084	06-Dec-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	N/A	Darius Elias (Vuntut Gwitchin First Nation)	Engagement	Emily (Hemmera) tried to call Darius (Vuntut Gwitchin First Nation) about their attendance to the All-Party meeting in response to their voicemail. Emily apologized for the delayed reply as they were out of the office for a few days the week prior. Emily stated they were happy to hear that Darius could attend, and explained that Hemmera had secured the meeting room. Hemmera explained they were starting to confirm the attendance of representatives from each First Nation. Hemmera explained that Yukon Government was also looking into bringing the Minister or Deputy Minister to the event, but would have to confirm closer to the date. Emily explained that if Darius would like to arrive a few days before to attend AME Roundup, that would be fine with them. Emily said that logistically, they were thinking each person who would attend would book their travel and accommodation and submit receipts to Chance for reimbursement. Hemmera stated that Chance would cover their round-trip airfare and 2-nights accommodation, and that any other nights in Vancouver would not be covered. Emily stated to please let them know if they had any other questions, as they were generally in the office (with the exception of tomorrow, Dec. 7, afternoon).	N/A	N/A
Vuntut Gwitchin First Nation0085	11-Dec-18	Email	Incoming	Vuntut Gwitchin First Nation	Kris Statnyk (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Calista Morrison (Hemmera), Shena Shaw (Hemmera)	Engagement	Vuntut Gwitchin First Nation sent a presentation on the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy that they will be using in discussions in the December 12, 2018, meeting.	N/A	N/A
Vuntut Gwitchin First Nation0086	11-Dec-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation)	Engagement	Hemmera sent Vuntut Gwitchin First Nation meeting material in preparation for the December 12, 2018, meeting. Hemmera sent a copy of the Engagement and Communication Plan with the appended Vuntut Gwitchin First Nation Oil and Gas Engagement Policy and Chance's most recent permit map. Hemmera also included a copy of the meeting agenda.	N/A	N/A
Vuntut Gwitchin First Nation0087	11-Dec-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Shena Shaw (Hemmera), Calista Morrison (Hemmera), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Engagement	Hemmera thanked Vuntut Gwitchin First Nation for sending a PowerPoint presentation for the December 12, 2018, meeting. Hemmera said they would get this set-up before the meeting starts tomorrow. The presentation was added to the start of the meeting Agenda and discussion on the Policy would come after the presentation.	N/A	N/A
Vuntut Gwitchin First Nation0088	11-Dec-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	N/A	Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation)	Engagement	Emily (Hemmera) sent a note to Josie William (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) that they understood they may be joining Chance and Vuntut Gwitchin First Nation meeting tomorrow via teleconference. Emily wanted to pass along the meeting material that was sent to the group earlier today. The attachments included: • A Vuntut Gwitchin First Nation representative's Presentation on the Oil and Gas Engagement Policy • The Meeting Agenda (the Vuntut Gwitchin First Nation representative's presentation would be first, and then the rest of the meeting would proceed after that) • Chance's permit map which had been updated as of October 2018 Emily noted that to view the presentation the next day, the Vuntut Gwitchin First Nation representative would be indicating which slide they were on so Josie William (Vuntut Gwitchin First Nation) could follow along with the presentation on their own computer. The dial-in information was also included below, and Emily indicated they had just sent the meeting invite to Josie William (Vuntut Gwitchin First Nation) as well.	N/A	N/A
Vuntut Gwitchin First Nation0089	12-Dec-18	Meeting	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	N/A	Dana Tizya Tramm, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation)	Engagement	The purpose of this meeting was to have an in-depth discussion on the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy (Policy). This meeting sought to increase understanding of the stages of the Policy and the action required by each party to comply with each stage. This included pinpointing which stage of the Policy Chance and Vuntut Gwitchin First Nation are at currently and understanding how the stages of the Policy align with project design and environmental assessment in practice. Meeting objectives included: • Provide a forum in which discussion can be held around the Policy before beginning to move forward again with the Cooperation Agreement and other Policy action items • Increase understanding of the Policy, the reasons behind the Policy, and each stage of the Policy • Increase understanding of how the Policy will be executed in practice	N/A	N/A
Vuntut Gwitchin First Nation0090	13-Dec-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Shena Shaw (Hemmera), Calista Morrison (Hemmera), Kris Statnyk (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Engagement	Hemmera contacted a Vuntut Gwitchin First Nation representative explaining that Chance was considering going to Old Crow on January 17, 2019, and they wanted to let Vuntut Gwitchin First Nation know to see if Chance could align their meeting with anything the Natural Resources Committee has planned re: oil and gas activity and to follow protocol established in the Communications and Engagement Plan and the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy. Hemmera noted that Chance's objective with the trip was to meet with the new Chief and Council and the Natural Resources Committee to provide background information on Eagle Plains basin, the past year of engagement, and Chance's plans for 2019. Hemmera asked if this Vuntut Gwitchin First Nation representative was able to help arrange a meeting with the Natural Resources Committee or provide a contact.	N/A	N/A

Vuntut Gwitchin First Nation0091	14-Dec-18	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	N/A	Emily Mann (Hemmera)	Engagement	A Vuntut Gwitchin First Nation representative responsible for connecting Chance to the Natural Resources Committee through the Communications and Engagement Plan told Hemmera to arrange the proposed January 17, 2019, meeting in Old Crow with another Vuntut Gwitchin First Nation representative.	N/A	N/A
Vuntut Gwitchin First Nation0092	14-Dec-18	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Richard Wyman (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Shena Shaw (Hemmera), Calista Morrison (Hemmera)	Engagement	Greg (Chance) representative added to an email to a Vuntut Gwitchin First Nation representative that the Chief-elect said it is important that Chance and Vuntut Gwitchin First Nation meeting in Old Crow. This meeting will be an introduction going forward.	N/A	N/A
Vuntut Gwitchin First Nation0093	14-Dec-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance)	Megan Williams (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Shena Shaw (Hemmera), Calista Morrison (Hemmera)	Engagement	Hemmera sent an email after a Vuntut Gwitchin First Nation representative recommended that they got touch to arrange the January 17, 2019, meeting in Old Crow. Hemmera stated that some of Chance's objectives for the trip were to meet with the new Chief and Council and the Natural Resources Committee (Committee) to provide background information on the Eagle Plains basin, the past year of engagement, and Chance's plans for 2019. Hemmera explained that they would need to coordinate with the Committee to pick a time to meet and provide some background material for that conversation. Hemmera asked if they would be able to help coordinate with the Committee or provide a contact for them. Hemmera explained they realized that people's vacations might prohibit some of the planning in the next few weeks, but they were hoping to tentatively set a date before the holidays.	N/A	N/A
Vuntut Gwitchin First Nation0094	19-Dec-18	Email	Outgoing	Vuntut Gwitchin First Nation	Emily Mann (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Megan Williams (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Shena Shaw (Hemmera), Calista Morrison (Hemmera), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement	Chance thanks the Vuntut Gwitchin First Nation representative for being a liaison with the Natural Resource Committee and for communicating that the committee has not yet been formally formed. As soon as you can confirm the availability of the Committee members, even tentatively, it would be great to know. Chance understands that because of varying holiday schedules, it can be hard to schedule stuff at this time of year. Looking forward to hearing an update about the January 17, 2019, meeting when you can provide one.	N/A	N/A
Vuntut Gwitchin First Nation0095	20-Dec-18	Email	Outgoing	Vuntut Gwitchin First Nation	Kris Statnyk (Vuntut Gwitchin First Nation)	N/A	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Engagement	On behalf of the Vuntut Gwitchin First Nation, Vuntut Gwitchin First Nation sent out an attached revised draft of the Cooperation Agreement dated October 20, 2018. A blackline version showing changes was also attached for reference.	N/A	N/A
E00045	10-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Kris Statnyk (Vuntut Gwitchin First Nation)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	Vuntut Gwitchin First Nation provided revisions to meeting notes.	N/A	E00045_190208_RE_ Draft Meeting summary - Dec_ 12 Chance-Vuntut Gwitchin First Nation Meeting_1
E00046	10-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	Greg (Chance) asked for more time to review meeting notes.	N/A	E00046_190208_RE_ Draft Meeting summary - Dec_ 12 Chance-Vuntut Gwitchin First Nation Meeting_2
E00066	10-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera confirmed flight details, hotel details, and per diem for booking by Chance for Vancouver meeting.	N/A	E00066_190208_all party Meeting Logistics
E00118	10-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), George Meadows (Hemmera), Greg Charlie (Chance), Cindy Dickson (Chance)	Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	Hemmera asked for revisions/notes to meeting notes from December 12, 2018.	N/A	E00118_190212_RE_ Draft Meeting summary - Dec_ 12 Chance-Vuntut Gwitchin First Nation Meeting_1
E00119	10-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), George Meadows (Hemmera), Greg Charlie (Chance), Cindy Dickson (Chance)	Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	Hemmera stated they were giving more time to Greg (Chance) to review.	N/A	E00119_190212_RE_ Draft Meeting summary - Dec_ 12 Chance-Vuntut Gwitchin First Nation Meeting_2

E00028	11-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Leslie Blake (Gwich'in Tribal Council)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Dawna Hope, Catherine Mallon, Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender, Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), John Fox (Yukon Government), Derek Fraser	Meeting Coordination/Planning	Leslie confirming attendance in Vancouver.	N/A	E00028_190207_Re_ Chance Oil and Gas all party Meeting Draft Working Agenda_1
E00047	11-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	Richard (Chance) reviewed December 12, 2018 meeting notes.	N/A	E00047_190208_RE_ Draft Meeting summary - Dec_ 12 Chance-Vuntut Gwitchin First Nation Meeting_3
E00048	11-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Cindy Dickson (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	Cindy (Chance) reviewed December 12, 2018 meeting notes.	N/A	E00048_190208_RE_ Draft Meeting summary - Dec_ 12 Chance-Vuntut Gwitchin First Nation Meeting_4
E00049	11-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Greg (Chance) reviewed December 12, 2018 meeting notes with no additions.	N/A	E00049_190208_RE_ Draft Meeting summary - Dec_ 12 Chance-Vuntut Gwitchin First Nation Meeting_5
E00077	11-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Dawna Hope, Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender, Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), John Fox (Yukon Government), Derek Fraser	Engagement/Consultation Meeting Coordination/Planning	Hemmera sent out the attached Draft Working Agenda for All-Party meeting February 1, 2019, which remained to be finalized.	N/A	E00077_190211_Chance Oil and Gas all party Meeting Draft Working Agenda_1
E00120	11-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), George Meadows (Hemmera), Greg Charlie (Chance), Cindy Dickson (Chance)	Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	Hemmera sent out final meeting notes from December 12, 2018.	N/A	E00120_190212_RE_ Draft Meeting summary - Dec_ 12 Chance-Vuntut Gwitchin First Nation Meeting_3
E00136	14-Jan-19	Phone Call	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	Vuntut Gwitchin First Nation left a voicemail message for Hemmera regarding the material being brought to Old Crow for the meeting with Chief and Council and the Natural Resources Committee.	N/A	N/A
E00082	15-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera rescheduled the meeting and asked if there was anything to add to packages for meeting. Hemmer provided a list of plans for preparations for the meeting.	N/A	E00082_190212_Chance Old Crow Meeting
E00093	15-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera followed up to see who was attending All-Party meeting.	N/A	E00093_190212_RE_ all party Meeting Logistics_1
E00083	16-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance)	Darius Elias (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera attached Exploration Project description and discussed All- party meeting details.	N/A	E00083_190212_Chance's Project Description and all party Meeting
E00009	17-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) asked Hemmera to clarify travel cost details. Rosa also provided review of draft agenda, questions about Projects, and acknowledged reminder to provide information prior to meeting in Vancouver. Rosa indicated that she was the main point of contact for Chief Tizya-Tramm.	N/A	E00009_190206_RE_ all party Meeting Logistics_3
E00010	17-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) indicated they were unable to confirm Vuntut Gwitchin First Nation travel plans until next morning.	N/A	E00010_190206_RE_ all party Meeting Logistics_4
E00094	17-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera answered Rosa (Vuntut Gwitchin First Nation)'s questions about travel logistics, and about Chance's location in process. Hemmera explained that they were expecting clarification on policy and communication, and that they wanted to finalize travel details for All-Party meeting.	N/A	E00094_190212_RE_ all party Meeting Logistics_2
E00011	18-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) confirmed that Vuntut Gwitchin First Nation would be represented by Chief Tizya-Tramm, Kris Statnyk (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation), and Rosa Brown (Vuntut Gwitchin First Nation). Rosa could not confirm Darius' travel plans, stated that Kris was in Vancouver, and provided travel plans for Rosa and Chief Tizya-Tramm.	N/A	E00011_190206_RE_ all party Meeting Logistics_5

E00012	18-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Duplicate (minus attachments), of E00011.	N/A	E00012_190206_RE_ all party Meeting Logistics_6
E00054	21-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) explained that invoicing Chance would be difficult to do themselves. Rosa asked if Vuntut Gwitchin First Nation sent details, would Chance book the flights, and also asked about processes around paying for hotels.	N/A	E00054_190208_RE_ Travel for all party Meeting_1
E00055	21-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) shared final travel plans with Hemmera.	N/A	E00055_190208_RE_ Travel for all party Meeting_2
E00122	21-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera clarified that Chance would book flights, and Chance would prepare per diem cheques. Hemmera noted that Chance was covering 2 nights at the hotel.	N/A	E00122_190212_RE_ Travel for all party Meeting_1
E00130	21-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) forwarded Hemmera Lynn's (Vuntut Gwitchin First Nation) questions for Vuntut Gwitchin First Nation regarding travel, travel details by person, and per diem information.	N/A	E00130_190212_Travel for all party Meeting_1
E00145	21-Jan-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera called Vuntut Gwitchin First Nation to discuss the logistics of the All-Party meeting including flight and accommodation.	N/A	N/A
E00146	21-Jan-19	Phone Call	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Vuntut Gwitchin First Nation called Hemmera to discuss the All-Party meeting.	N/A	N/A
E00040	23-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	Hemmera contacted Vuntut Gwitchin First Nation about Shena's travel to Old Crow. Hemmera asked about confirming contents of information packets for attendees, and asked if they should include a presentation about Vuntut Gwitchin First Nation's Oil and Gas Engagement Policy.	N/A	E00040_190207_RE_ Chance Old Crow Meeting_1
E00001	24-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) responded to email from Hemmera and confirmed materials required for Chance's meeting with Chief and Council and Vuntut Gwitchin First Nation's Natural Resources Committee. Rosa confirmed there was no need to bring Communications and Engagement Plan and Vuntut Gwitchin First Nation's Oil and Gas Engagement Policy, as Chief and Council and Committee would be briefed on the oil and gas file. Rosa identified that Chance should bring Project and company-specific information.	N/A	E00001_190124_RE_ Chance Old Crow Meeting
E00031	24-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) proposing changes to agenda and sent to Hemmera.	N/A	E00031_190207_RE_ Chance Oil and Gas all party Meeting Draft Working Agenda_4
E00041	24-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) stated that Chief and Council would be briefed before meeting, and therefore did not need copies of Communication and Engagement Plan or Vuntut Gwitchin First Nation's Oil and Gas Engagement Policy. Rosa explained that they had planned for Chief and Council and Vuntut Gwitchin First Nation's Natural Resources Committee to meet with Chance at the same time, instead of at two separate meetings.	N/A	E00041_190207_RE_ Chance Old Crow Meeting_2
E00043	24-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) contacted Hemmera to discuss Darius' (Vuntut Gwitchin First Nation) hotel booking.	N/A	E00043_190207_RE_ Coast Hotel Reservation Codes_1
E00044	24-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) indicated to Hemmera that Darius would be returning a day later than originally planned.	N/A	E00044_190207_RE_ Coast Hotel Reservation Codes_2
E00056	24-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) contacted Hemmera about All-party meeting per diem, and logistics.	N/A	E00056_190208_RE_ Travel for all party Meeting_3
E00084	24-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera sent Rosa (Vuntut Gwitchin First Nation) Chief Tizyam-Tramm's hotel reservation details.	N/A	E00084_190212_Coast Hotel Reservation Codes
E00117	24-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera sent Rosa (Vuntut Gwitchin First Nation) an email about Darius' (Vuntut Gwitchin First Nation) hotel arrangements.	N/A	E00117_190212_RE_ Coast Hotel Reservation Codes
E00123	25-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera confirmed to Rosa (Vuntut Gwitchin First Nation) that Darius (Vuntut Gwitchin First Nation) was booked at a hotel in Vancouver.	N/A	E00123_190212_RE_ Travel for all party Meeting_2
E00042	28-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) asked Hemmera about the All-Party meeting agenda.	N/A	E00042_190207_Re_ Chance Old Crow Meeting_3
E00080	28-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera asked Rosa (Vuntut Gwitchin First Nation) if any materials needed to be printed for the All-party meeting.	N/A	E00110_190212_RE_ Chance Oil and Gas all party Meeting Draft Working Agenda_5
E00109	28-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Dawna Hope, Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), John Fox (Yukon Government), Derek Fraser, Sharon Peter, Millie Olson	Meeting Coordination/Planning Engagement/Consultation	Hemmera distributed the Final All-Party meeting agenda for February 1, 2019.	N/A	E00080_190211_Chance Oil and Gas Limited all party Meeting Agenda - Final version

E00110	28-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera sent an email to Rosa (Vuntut Gwitchin First Nation) to discuss final agenda for All-Party meeting, and any revisions	N/A	E00109_190212_RE_ Chance Oil and Gas all party Meeting Draft Working Agenda_4
E00148	28-Jan-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera called Vuntut Gwitchin First Nation regarding their proposed changes to the draft agenda for the All-Party meeting.	N/A	N/A
E00149	28-Jan-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Kris Statnyk (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera called Vuntut Gwitchin First Nation regarding their proposed changes to the draft agenda for the All-Party meeting.	N/A	N/A
E00057	29-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) thanked Hemmera for the information.	N/A	E00057_190208_RE_ Travel for all party Meeting_4
E00116	29-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera explained to Rosa (Vuntut Gwitchin First Nation) that they were planning for an informal meeting, and they would discuss roles and responsibilities and Chance's exploration Project plans.	N/A	E00116_190212_Re_ Chance Old Crow Meeting
E00124	29-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera contacted Rosa (Vuntut Gwitchin First Nation) about per diem rates, and plans for Chance to write a cheque.	N/A	E00124_190212_RE_ Travel for all party Meeting_3
E00200	29-Jan-19	Meeting	Outgoing	Vuntut Gwitchin First Nation	N/A	Mike Chernoff, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Rick Nielsen (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Brandy Tizya (Vuntut Gwitchin First Nation), Cheryl Charlie (Vuntut Gwitchin First Nation), Brandon Kyikavichik (Vuntut Gwitchin First Nation), Roger Kyikavichik (Vuntut Gwitchin First Nation), Sandra Charlie (Vuntut Gwitchin First Nation), George Meadows (Hemmera), Shena Shaw (Hemmera)	Engagement/Consultation Tenures/Dispositions/Permits Fracking Benefits/Capacity Agreement Project Description/Activities Caribou Education and Training Information Sharing Jobs/Contracts VESEC Selection Vegetation/Environment Regulatory Process Site Visit/Field Work	The purpose of this meeting was to introduce Chance to Vuntut Gwitchin First Nation's new Chief and Council and Natural Resources Committee (Committee). The meeting was an unstructured conversation in which Chance explained their permits and exploration intentions and provided the opportunity for Council and the Committee to share their thoughts on the Project and ask questions.	N/A	E00170_190402_Draft January 29 Vuntut Gwitchin First Nation-Chance Meeting summary_v.02
E00032	30-Jan-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera asked Vuntut Gwitchin First Nation about bringing laptops, and setting up for the presentation.	N/A	E00032_190207_RE_ Chance Oil and Gas all party Meeting Draft Working Agenda_5
E00033	31-Jan-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Vuntut Gwitchin First Nation stated they were able to bring the presentation on a USB drive.	N/A	E00033_190207_Re_ Chance Oil and Gas all party Meeting Draft Working Agenda_6
E00169	01-Feb-19	Meeting	Outgoing	Vuntut Gwitchin First Nation	N/A	Mike Chernoff, Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance); Hemmera	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Dawna Hope, Millie Olsen, Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Derek Fraser, John Fox (Yukon Government)	Project Description/Activities Engagement/Consultation Regulatory Process Tenures/Dispositions/Permits Confidentiality Agreement Information Sharing	See meeting summary.	N/A	E00169_190402__all party_Meeting_summary_Draft_v0.4 (002)
E00167	15-Feb-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance), Mike Chernoff	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Rose Brown, Kris Statnyk (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Dawna Hope, Millie Olsen, Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), Derek Fraser, John Fox (Yukon Government)	Engagement/Consultation	Hemmera sent a draft summary of February 1, 2019, All-party meeting for review. Hemmera indicated to participants to feel free to share with their teams.	N/A	E00167_190401_RE_ Chance all party Meeting - Thank You
E00151	19-Feb-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Lynn O'Neil	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera said to Vuntut Gwitchin First Nation that the invoice for the All-party meeting could be addressed to Richard (Chance) and sent via email to Richard and Lynn (Chance).	N/A	E00151_190401_RE_ Travel for all party Meeting_3
E00152	19-Feb-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) contacted Hemmera about where to send invoice for travel expenses.	N/A	E00152_190401_RE_ Travel for all party Meeting_2
E00153	19-Feb-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Rosa (Vuntut Gwitchin First Nation) apologized for the delay to Hemmera.	N/A	E00153_190401_RE_ Travel for all party Meeting_1
E00166	15-Mar-19	Letter	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Megan Williams (Vuntut Gwitchin First Nation)	Tenures/Dispositions/Permits	Greg (Chance) sent a notice of Chance's intention to apply with Yukon Government to extend tenure of select oil and gas dispositions held by Chance in the Eagle Plains Basin. This included the following components: • Introduction to Chance, • Company Profile, • Description of Oil and Gas Dispositions and Application, • Proponent Spokesperson, • Confidentiality Agreement, • Compliance Records, • Chance Dispositions and Wells.	N/A	E00166_190401_Notice to Vuntut Gwitchin First Nation of COGL intention to apply for tenure extension
E00239	08-May-19	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Cheryl Charlie	Meeting Coordination/Planning	Greg (Chance) asked to set up a meeting with Vuntut Gwitchin First Nation on or in Old Crow.	N/A	E00239_FW_ Meeting_
E00240	08-May-19	Email	Incoming	Vuntut Gwitchin First Nation	Cheryl Charlie	Greg Charlie (Chance)	Cheryl Charlie	Meeting Coordination/Planning	Vuntut Gwitchin First Nation replied that they had set up a meeting on June 6, 2019, and asked how long Chance would like the meeting to be.	N/A	E00239_FW_ Meeting_

E00241	08-May-19	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Cheryl Charlie	Meeting Coordination/Planning	Greg (Chance) said Chance would need a few hours. 1:15PM-3:30PM with the Committee and afterwards with the public which could be 5:00PM-8:00PM, or 7:00PM-9:00PM. Greg suggested that perhaps Rosalie (Vuntut Gwitchin First Nation) could make stew or bannock.	N/A	E00239_FW_ Meeting_
E00242	08-May-19	Email	Incoming	Vuntut Gwitchin First Nation	Cheryl Charlie	Greg Charlie (Chance)	Cheryl Charlie, Barbara Abel	Meeting Coordination/Planning	Cheryl (Vuntut Gwitchin First Nation) replied that they would book boardroom for that time as well as community call. Cheryl would be asking Barb (Vuntut Gwitchin First Nation) to work on bookings, and would ask Rosalie (Vuntut Gwitchin First Nation) about arranging dinner.	N/A	E00239_FW_ Meeting_
E00462	03-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	Hemmera sent Vuntut Gwitchin First Nation a meeting invitation and agenda. Hemmera asked if Rosa (Vuntut Gwitchin First Nation) could please forward the meeting invitation and the agenda to the Vuntut Gwitchin First Nation Natural Resources Committee members as well as any others from Vuntut Gwitchin First Nation who would be attending the meeting. Hemmera included call-in details below and in the agenda.	N/A	E00460_Chance and Vuntut Gwitchin First Nation NRC Meeting 190603_Vuntut Gwitchin First Nation_Chance_Meeting Agenda for June 6-DRAFT.docx
E00470	05-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Cindy Dickson (Chance), Richard Wyman (Chance), Greg Charlie (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning Project Description/Activities	Hemmera attached are the meeting materials that would be used during the community dinner tomorrow. These included posters to be displayed, a slide deck to be presented by Richard and Shena, and handouts for all attendees. Hemmera indicated that they would send out the Draft Project Description and slide deck for the presentation to the Committee by the end of the day.	N/A	E00470_Community Dinner Presentation Material 190605_Posters_Old Crow Community Dinner_June6.docx 190605_Chance_OldCrowCommunityHandout_FINAL.pdf 190604_Chance_Presentation_CommunityPresentation_OldCrow_v0.4.pdf
E00472	05-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning Project Description/Activities	Attached Draft Project Description and the presentation for tomorrow's meeting. Please distribute electronically among those who are attending the meeting. We will bring paper copies of the Draft Project Description and the presentation for all attending the meeting. It is not an expectation that meeting attendees will have time to read through the whole document.	N/A	E00472_Draft Project Description and Slide Deck for June 6 Meeting 190605_Chance Oil and Gas Eagle Plains Project Description.pdf 190604_Chance_Presentation_ProjectDescription+ExCom_Vuntut Gwitchin First Nation_NRSCommittee_v0.4.pdf
E01252	06-Jun-19	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Engagement/Consultation Information Sharing Caribou Road Access Project Description/Activities Site Visit/Field Work Wildlife Seismic	Chance held a community dinner in Old Crow at the Community Hall. Chance presented the draft Project Description, as well as the transition from Northern Cross to Chance Oil and Gas Limited, seismic techniques, Yukon Environmental Socio-economic Assessment Board process, Yukon Environmental Socio-economic Assessment Board's Executive Committee, consultation and engagement, and the Porcupine Caribou Herd.	N/A	E01252_190606_Chance_OldCrowCommunity_June6_SignInSheet.pdf E01252_190620_Draft_June6_Vuntut Gwitchin First NationCommunity-ChanceMeetingsummary_v.0.3.docx
E00283	10-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement/Consultation Information Sharing	Hemmera said it was nice to see everyone the week prior and to meet with Vuntut Gwitchin First Nation. Hemmera indicated that they were following up to ask for shape files for the new Vuntut Gwitchin First Nation and TH boundary. Hemmera also asked about the status of the boundary agreement and when the border would be made public.	N/A	E00283_New TH and Vuntut Gwitchin First Nation Boundary
E00250	14-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Site Visit/Field Work	Hemmera attached details for Vuntut Gwitchin First Nation to review about First Nations' participation in Chance's fieldwork this summer. Hemmera noted that they were still finalizing dates and logistics. Hemmera also noted that role profiles were in the attachment, and that they were aiming to have dates finalized by the following week. Hemmera asked that Vuntut Gwitchin First Nation give thought to potential participants in the fieldwork.	N/A	E00250_Vuntut Gwitchin First Nation Participation in Chance Fieldwork
E00262	17-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Todd Mahon	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Site Visit/Field Work Engagement/Consultation	Hemmera shared that Chance had set dates for participation in Field Surveys. Chance was proposing following logistics for First Nation participation: 1) Each First Nation with territory overlapping Project area could have up to two members participate 2) Important to note that the work would be physically demanding, requiring the ability to hike steep, rugged terrain and thick bush, and requiring average or above-average fitness to participate 3) There were limited spots for participants due to helicopter constraints and availability at Eagle Plains Hotel, and because of this it was important to respond as soon as possible to Emily or Calista (Hemmera) to confirm availability 4) Participants should arrive on start date, but not mandatory to stay for duration of field study 5) all travel, including flights, vehicle travel to Eagle Plains Hotel, ad stay in Hotel must be booked by the First Nation and billed to Chance. A Table of Opportunities by date was included in the correspondence. Hemmera noted that the purpose of participation would be to observe fieldwork and gain first hand understanding of the research. Hemmera noted that the deadline for Vegetation Survey # 1 was June 19.	N/A	E00262_Chance Field Surveys-Vuntut Gwitchin First Nation Chance FN Participant Information
E00251	19-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Project Description/Activities	Hemmera touched based with Vuntut Gwitchin First Nation before the holiday and asked if the Natural Resources Committee had a chance to review and provide comments on Draft Project Description. Hemmera also asked to schedule meeting to discuss next steps.	N/A	E00251_Touching base

E00275	19-Jun-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Engagement/Consultation	Rosa (Vuntut Gwitchin First Nation) said that the Natural Resources Committee was meeting late the following week and that they would have a response soon after.	N/A	E00275_FW_ Touching base
E00480	19-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Engagement	Hemmera thanked Rosa (Vuntut Gwitchin First Nation) and indicated that they looked forward to the Natural Resource Committee's response.	N/A	E00480_RE_ Touching base
E00268	20-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Information Sharing Engagement/Consultation	Hemmera distributed a draft meeting summary of the June 6, 2019 meeting in Old Crow between Chance and Vuntut Gwitchin First Nation.	N/A	E00268_Draft Meeting summary for Review 190620_Draft June 6 Vuntut Gwitchin First Nation-Chance Meeting summary_v0.4
E00282	20-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Information Sharing Engagement/Consultation	Hemmera shared the attached meeting summary of the Community Dinner held in Old Crow with Chance and Vuntut Gwitchin First Nation members on June 6, 2019.	N/A	E00282_Old Crow Community Dinner Meeting summary for Review 190620_Draft June 6 Vuntut Gwitchin First Nation Community-Chance Meeting summary_v.0.3
E00252	24-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Fish Information Sharing	Hemmera distributed the attached Notice Letter regarding DFO Licence Application for Environmental Dynamics Inc's Fish Studies.	N/A	E00252_RE_ Notice Letter_ DFO application for upcoming fish studies-Vuntut Gwitchin First Nation
E00258	24-Jun-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Fish Information Sharing	Rosa (Vuntut Gwitchin First Nation) thanked Hemmera.	N/A	E00258_RE_ Notice Letter_ DFO application for upcoming fish studies-Vuntut Gwitchin First Nation
E00316	27-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Fish Information Sharing	Hemmera distributed revisions from EDI for their DFO Application in an attachment.	N/A	190627_Stage 1 Notice Letter_DFO Permit_WithRevisions and peel_watershed_fish_habitat_assessment E00316_RE_ Notice Letter_ DFO application for upcoming fish studies (4)
E00284	28-Jun-19	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	Greg Charlie (Chance)	Megan Williams (Vuntut Gwitchin First Nation)	Site Visit/Field Work	Megan (Vuntut Gwitchin First Nation) said they would hire Dougie to go with Chance for field work. Megan noted that there were other research positions in the community at the same time, so they were stretched to find assistants. Megan asked Chance to confirm with Dougie to book travel.	N/A	E00284_FW_ COG fieldwork
E00285	28-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Megan Williams (Vuntut Gwitchin First Nation)	Site Visit/Field Work	Greg (Chance) asked Megan (Vuntut Gwitchin First Nation) for clarification, and stated that they would connect with Dougie to book their flight.	N/A	E00284_FW_ COG fieldwork
E00286	28-Jun-19	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	Greg Charlie (Chance)	Megan Williams (Vuntut Gwitchin First Nation)	Site Visit/Field Work	Megan (Vuntut Gwitchin First NationNF) stated that they had wanted to send a younger student assistant, but Chance's field work dates conflicted with Palaeontology dates, so it would be best that Dougie attends. Megan stated that timesheet deadlines would be July 19 and August 2, and asked Chance to please confirm dates with Dougie.	N/A	E00284_FW_ COG fieldwork
E00287	28-Jun-19	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Megan Williams (Vuntut Gwitchin First Nation)	Site Visit/Field Work	Greg (Chance) stated that they would contact Dougie. Chance asked Vuntut Gwitchin First Nation to confirm Dougie's rate, and number of days of travel (15 days) with flights to Dawson on July 10, and return on July 25.	N/A	E00284_FW_ COG fieldwork
E00288	28-Jun-19	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	Greg Charlie (Chance)	Megan Williams (Vuntut Gwitchin First Nation)	Site Visit/Field Work	Megan (Vuntut Gwitchin First Nation) said Gwiinzii to Greg (Chance).	N/A	E00284_FW_ COG fieldwork
E00339	05-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation), Cheryl Charlie (Vuntut Gwitchin First Nation)	Engagement/Consultation	Rosa (Vuntut Gwitchin First Nation) sent a note to Hemmera that they would be away for the remainder of the month, returning August 5. Rosa asked that Hemmera please send all correspondence to Cheryl J Charlie, Chair of Natural Resources Committee during this period, to please copy them for my records and catch up. Rosa noted that the Committee met yesterday and there would be correspondence to Chance forthcoming.	N/A	E00339_correspondence during July
E00482	05-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation), Cheryl Charlie (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera thanked Rosa for letting them know about their absence, and asked if they could expect correspondence before Rosa was back, or in August when Rosa returned.	N/A	E00482_RE_ correspondence during July
E00392	09-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Todd Mahon	Cheryl Charlie, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Site Visit/Field Work	Hemmera expressed that they understood someone from Vuntut Gwitchin First Nation had expressed interest in joining Chance's geological surveys, however, they wanted to ask if there was interest in any other surveys. Hemmera highlighted surveys where there would still be time to coordinate someone joining. Hemmera asked Vuntut Gwitchin First Nation to confirm if they had any potential participants or questions.	N/A	E00392_Chance Field Surveys_3
E00393	09-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Cheryl Charlie	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Todd Mahon	Cheryl Charlie, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Site Visit/Field Work	Cheryl (Vuntut Gwitchin First Nation) said they would get back to Hemmera about field survey participation.	N/A	E00392_Chance Field Surveys_3
E00394	09-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Cheryl Charlie (Vuntut Gwitchin First Nation)	N/A	Cheryl Charlie (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation), Tammy Josie	Site Visit/Field Work	Cheryl (Vuntut Gwitchin First Nation) indicated that Tyrel and Teryn Cassi of Old Crow were interested in this type of field work. Cheryl asked Tammy (Vuntut Gwitchin First Nation) to please provide their contact information to Emily (Hemmera).	N/A	E00394_RE_ Chance Field Surveys_2

E00391	10-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	N/A	Megan Williams (Vuntut Gwitchin First Nation)	Site Visit/Field Work Jobs/Contracts	Megan asked Hemmera questions about Chance Field Surveys. Megan indicated that Tyrel Cassi may be available and a good choice. Megan asked if they could hire 3 people for 5 days since the dates were the same for vegetation/seismic/fish and fish surveys, and also noticed that 2 of those people may also be able to work August 1-6. Megan asked if Chance was covering wages as well as travel, and also asked if there would be someone available to pick up the research assistant when they arrive/depart Dawson. Megan also asked if there were any other First Nations participants already signed up.	N/A	E00391_RE_ Chance Field Surveys_4
E00395	10-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Megan Williams (Vuntut Gwitchin First Nation)	Site Visit/Field Work Jobs/Contracts	Hemmera responded to Megan's (Vuntut Gwitchin First Nation) questions about field surveys. Hemmera said they would call Ty Cassi to ask about availability, and asked Megan to let them know if anyone else may be interested to attend as soon as possible. Answers to questions were included as follows: Yes, they could also hire 5 individuals for the 5 different time segments. Yes, Hemmera would talk to Chance about the daily rate. Picking up at Dawson would be logistically challenging as there was not room in the researcher's vehicles. Participants would have to rent a vehicle in Inuvik or Dawson and drive themselves to Eagle Plains. Spots were offered to Gwich'in Tribal Council and NND as well and they were taking people on field surveys on a first come first serve basis. Hemmera followed up with First Nations this week and did not hear back. For participants to be covered by Yukon Workers' Compensation Board, they would have to be contracted by Vuntut Gwitchin First Nation or by another other First Nation. Therefore, Hemmera stated that they needed lead up time to figure out contracts and payments.	N/A	N/A
E00436	10-Jul-19	Letter	Incoming	Vuntut Gwitchin First Nation	Cheryl Charlie	Greg Charlie (Chance)	Cheryl Charlie	Engagement/Consultation Meeting Coordination/Planning	Cheryl sent an email on behalf of Vuntut Gwitchin First Nation Natural Resources Committee, which included a letter in response to the following notices submitted by chance in accordance with the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy: 1. Notice of Chance's application to extend the term of oil and gas permits 0006-0011 and 0019 submitted March 15, 2019 pursuant to section 23 of the Policy; 2. Notice of Chance's proposed oil and gas activities in Eagle Plains basin submitted on June 6, 2019 pursuant to section 24 of the Policy. The Committee has reviewed both notices including Chance's confidential financial statements. The Committee had questions regarding the financial circumstances of the company and potential risks. The Committee determined by consensus that they were not in a position to recommend Vuntut Gwitchin First Nation proceed to any further stage of engagement with Chance unless the potential risks they were concerned about could be addressed. The Committee requested a meeting with Chance to discuss these matters further and proposed a meeting in Old Crow in August 2019 for this purpose.	N/A	E00435_Meeting acceptance letter to Cheryl Charlie dated July 15 2019.pdf
E00396	11-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	N/A	Megan Williams (Vuntut Gwitchin First Nation)	Site Visit/Field Work	Megan confirmed that the wage for field assistants is $250 per day. They also stated they would only be able to hire someone with a driver's license, and said they weren't sure if Ty had one. They would also have to get the driver's abstract in order to add the person to their insurance so they can use the Natural Resources truck in Dawson. Megan said they would keep in touch, and to please confirm the wage with Chance.	N/A	E00396_RE_Chance Field Surveys_1
E00341	12-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Todd Mahon, Lynn O'Neil, Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	Megan Williams (Vuntut Gwitchin First Nation), Ty Kassi	Site Visit/Field Work	Richard (Chance) spoke with Ty and confirmed their interest in participating in several environmental studies planned at Eagle Plains. The dates were a bit different than originally quoted, but they seemed to work ok for Ty. There were three studies happening between July 24 and August 8: fish and aquatics, seismic lines and broad area vegetation and habitat assessments. Richard stated that Ty would be welcome to join in for all of these studies. Richard noted that if Ty had chest waders, they should bring those, and if not to please advise so that they could make arrangements to get some. Richard said they would arrange for Ty to travel to Whitehorse on July 23, so they could join the EDI crew that is mobilizing to Eagle Plains on July 24. Ty would return with the crew on August 3, so he could get to Old Crow to participate in the GA activities starting August 8.	N/A	E00341_Ty Kassi
E00323	15-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Mike Chernoff	Cheryl Charlie, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Brandon Kyikavichik, Megan Williams (Vuntut Gwitchin First Nation), Sandra Charlie, Brandy Charlie	Engagement/Consultation	Richard (Chance) thanked the Vuntut Gwitchin First Nation Natural Resources Committee for their letter dated July 10. Richard stated to please file Chance's response accepting their invitation to meet and suggested it would be convenient to meet in Old Crow while there for the GA. Richard asked if Vuntut Gwitchin First Nation could arrange to get copies of this letter to the members of the Natural Resources Committee (Roger) since Richard did not have addresses for very many of them.	N/A	E00323_FW_ Meeting invitation NOTE ALL IN CHAIN OF EMAILS
E00325	15-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Hemmera sent draft reports on the Implementation of the Communications and Engagement Plan for both Vuntut Gwitchin First Nation and Chance to review. This report summarized the meetings the parties had since completing the plan. Hemmera asked recipients to please make any desired revisions to the document in tracked changes and send back once finalized. Once Hemmera has incorporated the changes, they indicated they would send final versions to both parties to sign. Hemmera asked parties to please have revisions in by July 26, after which Hemmera would finalize, get them signed and submit to Yukon Government for July 31.	N/A	E00325_Re_ Draft Plan Implementation Report to Review

E00435	15-Jul-19	Letter	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance)	Cheryl Charlie, Vuntut Gwitchin First Nation Natural Resources Committee	Engagement/Consultation	Richard (Chance) provided a response to July 10 letter from the Vuntut Gwitchin First Nation Natural Resources Committee. Chance would be pleased to meet with the Natural Resources Committee in August to discuss financial circumstances raised in letter and other matters related to ongoing engagement. Chance representatives including Greg (Chance), Cindy (Chance) and Richard (themself) would be in Old Crow during GA from August 8-10. Emily Mann (Hemmera) and Calista Morrison (Hemmera) of Hemmera would also be in Old Crow the entire week doing some engagement work with the community as part of the pre-submission consultation required by Yukon Environmental Socio-economic Assessment Board. In order for Chance and Hemmera to try to meet with Committee, Richard asked to please let them know what they were are able to arrange. A few points to consider 1. Chance has a 25 year corporate history in Yukon; 2. Chance has very supportive stakeholder base to finance Company's business plan; 3. Chance has successfully raised almost $150 million to undertake a variety of exploration Projects during past 25 years; 4. Fund the Company on "needs only basis" given unknown time frame and manage uncertainties inherent with oil and gas exploration; 5. The Eagle Plains area is under explored and understanding of oil and natural gas resources potential is relatively immature, but improving; 6. The knowledge gains Chance has made in the past 25 years, there is still uncertainty of outcomes from exploration activities, so there is not yet a basis for ay sustainable development in area; 7. Successful exploration work will attract future investment, but timeframe unpredictable; 8. Yukon Government policies and Yukon Environmental Socio-economic Assessment Board processes have shown to be unpredictable and variable. It is most convenient for Chance to meet with the Committee while in Old Crow for the GA, to the extent that this meeting relates to Chance's outstanding application to Yukon Government seeking extension in tenure to exploration permits 0006-0011 and 0019, prior to August 30 deadline for the permits to be continued or expire.	N/A	E00435_July 10 2019 fr NRC Chair regarding concerns about financial sustainability.pdf
E00342	16-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	N/A	Megan Williams (Vuntut Gwitchin First Nation)	Site Visit/Field Work	Megan (Vuntut Gwitchin First Nation) checked in with Hemmera to see if there was space for a second Vuntut Gwitchin First Nation field assistant and stated that Teryn Kassi was also very interested.	N/A	E00342_EDI Vuntut Gwitchin field assistant
E00418	16-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Megan Williams (Vuntut Gwitchin First Nation)	Jobs/Contracts Site Visit/Field Work	Hemmera sent correspondence that the Eagle Plains hotel was full and this was the only accommodation option. Hemmera said that EDI had also finalized their planning and cannot add another person at that time. Hemmera explained that they did not get participation from every First Nation for the field studies, so they would probably going to hold an additional site visit in the fall.	N/A	E00418_RE_ EDI Vuntut Gwitchin field assistant
E00427	16-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Megan Williams (Vuntut Gwitchin First Nation)	Jobs/Contracts Site Visit/Field Work	Hemmera indicated to Vuntut Gwitchin First Nation that they were going to be conducting interviews in Old Crow to inform the socio-economic study they were doing for Chance's Project Proposal . Hemmera stated that they had approached Laurie Reti (Vuntut Gwitchin First Nation) to help conduct the interviews. The day rate for field work that Chance was paying Ty is $250, and Hemmera asked if this was the same for work done in Old Crow and if there a standard half-day or hourly rate.	N/A	E00427_RE_ Old Crow Socio-Ec interviewer
E00428	16-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	N/A	Megan Williams (Vuntut Gwitchin First Nation)	Jobs/Contracts Site Visit/Field Work	Megan (Vuntut Gwitchin First Nation) stated to Hemmera that this kind of work would be $36 per hour.	N/A	E00427_RE_ Old Crow Socio-Ec interviewer
E00489	16-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Megan Williams (Vuntut Gwitchin First Nation)	Site Visit/Field Work	Hemmera thanked Vuntut Gwitchin First Nation for sharing hourly rate information.	N/A	E00489_RE_ Old Crow Socio-Ec interviewer
E00429	17-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Cindy Dickson (Chance), Richard Wyman (Chance), Greg Charlie (Chance)	Laurie Reti	Site Visit/Field Work Interviews Jobs/Contracts	Hemmera was confirming interest in helping with Chance surveys in Old Crow. Representatives from Hemmera indicated they would going to be in Old Crow from August 5-August 10 to conduct surveys by interviewing various community members. Hemmera asked what Laurie's availability was between August 6-8. Hemmera stated they would also likely need some assistance in planning interviews in the weeks from the present date until they arrived in Old Crow. Hemmera asked if Laurie was available should they have any questions. Hemmera stated that they had confirmed with Vuntut Gwitchin First Nation that the rate for helping out was $36 per hour. Hemmera explained that they didn't think there will be really long days of work, but maybe some hours outside of regular business hours (9-5) depending on people's availability.	N/A	E00429_Re_ Chance Oil and Gas Socio-economic Surveys_3
E00324	18-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Cheryl Charlie	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Mike Chernoff	Cheryl Charlie, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Brandon Kyikavichik, Megan Williams (Vuntut Gwitchin First Nation), Sandra Charlie, Brandy Charlie	Engagement/Consultation	Cheryl (Vuntut Gwitchin First Nation) said thank you, and explained that they wanted to let Chance know that the Vuntut Gwitchin First Nation Natural Resource Committee was committed to seeing our concerns through with Chance, and that communication was key in this endeavor. Cheryl stated that when they work together, they believed Chance and Vuntut Gwitchin First Nation could achieve the objective of sustainable development.	N/A	E00323_FW_ Meeting invitation NOTE ALL IN CHAIN OF EMAILS
E00419	18-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	N/A	Megan Williams (Vuntut Gwitchin First Nation)	Site Visit/Field Work Interviews Jobs/Contracts	Thank you. We'll keep in touch about possibilities in the fall.	N/A	E00418_RE_ EDI Vuntut Gwitchin field assistant
E00430	22-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Laurie Reti (Vuntut Gwitchin First Nation)	N/A	Laurie Reti (Vuntut Gwitchin First Nation)	Socio-economic Interview	I am working at the John Tizya Centre from 9:00AM-4:30PM weekdays. I think my only availability would be from the 8:00AM-10:00AM, but I have to check with my manager Megan Josie William (Vuntut Gwitchin First Nation)s. If that can't work then that's totally fine and I could help you recruit another surveyor.	N/A	E00429_Re_ Chance Oil and Gas Socio-economic Surveys_3
E00326	24-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Following up to see if Vuntut Gwitchin First Nation is planning to provide feedback on the draft reports on the Implementation of the Communication and Engagement Plan. Looking for feedback by . Please let me know if you are providing feedback or have any questions.	N/A	E00325_Re_ Draft Plan Implementation Report to Review

E00431	24-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Laurie Reti (Vuntut Gwitchin First Nation)	Socio-economic Interview	Thanks for letting me know you're availability. Are you free in the evenings to help with interviews of community members? It would also be great if you could also help find people to interview in advance of us arriving. I think we can do interviews with government and other workers in town during the day, and would like your help with interviewing community members in the evening if that works for you. I don't think you would have to take any time off work.	N/A	E00431_Re_ Chance Oil and Gas Socio-economic Surveys_2
E00432	24-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Laurie Reti (Vuntut Gwitchin First Nation)	N/A	Laurie Reti (Vuntut Gwitchin First Nation)	Socio-economic Interview	Evenings work fine. I'll start gathering some people to interview.	N/A	E00431_Re_ Chance Oil and Gas Socio-economic Surveys_2
E00433	24-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Laurie Reti (Vuntut Gwitchin First Nation)	Socio-economic Interview	I can send you a more specific list of the type of people we are interested in. But generally we are looking for people who are interested in talking about community effects of the Chance Project. I will get together a bit more information for you on the interviews and the Project. Perhaps we can talk on the phone next week. Are you currently employed by Vuntut Gwitchin First Nation? We will provide you with a short contract through Vuntut Gwitchin First Nation. You can create an invoice for Vuntut Gwitchin First Nation. Then Chance can pay Vuntut Gwitchin First Nation to pay you. A little complicating, but I think because of Vuntut Gwitchin First Nation and Chance's accounting and labour rules it has to go this way.	N/A	E00433_Chance Oil and gas Socio-economic Surveys_1
E00327	25-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Vuntut Gwitchin First Nation is planning to provide feedback on draft report, and will have comments submitted by end of day . We do not expect major revisions will be required.	N/A	E00325_Re_ Draft Plan Implementation Report to Review
E00434	25-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Laurie Reti (Vuntut Gwitchin First Nation)	N/A	Laurie Reti (Vuntut Gwitchin First Nation)	Socio-economic Interview	I would have to go through contract because I am employed by Vuntut Gwitchin First Nation. Next is good for a call, you can reach me at the John Tizya Centre.	N/A	E00433_Chance Oil and gas Socio-economic Surveys_1
E00493	25-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Thanks.	N/A	E00493_RE_ Draft Plan Implementation Report to Review_2
E00494	25-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Do you know if the Vuntut Gwitchin First Nation office in Old Crow has a portable Meeting speaker? I am not sure of the tech set up at the GA location, but Cindy said there was a cell phone connection. If we are able to, we would like to have 2 Hemmera staff call into the Meeting, but it would be nice to have a speaker to facilitate better audio. I can bring a speaker up with me if there isn't one available.	N/A	E00494_Potential Chance - NRC Meeting in Old Crow
E00495	25-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Please contact Information Systems Director Paul Doehle (Vuntut Gwitchin First Nation) to ask about the possibility of connecting by cell phone to the Chance Meeting at Tl'oo K'at. I think the connection is unlikely to be dependable enough to stay connected through a meeting, but could be wrong.	N/A	E00495_RE_ Potential Chance - NRC Meeting in Old Crow
E00496	25-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Megan Williams (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Thanks, I will give Paul a call.	N/A	E00495_RE_ Potential Chance - NRC Meeting in Old Crow
E00497	25-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	For reference, attached are Chance's edits to the Draft Plan Implementation report.	N/A	E00497_RE_ Draft Plan Implementation Report to Review_3 190715_DRAFT Plan Implementation Report_Vuntut Gwitchin First Nation to YTG.docx
E00514	25-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Lynn O'Neil	Lynn O'Neil, Richard Wyman (Chance)	Megan Williams (Vuntut Gwitchin First Nation)	Jobs/Contracts Interviews	Chance provided Vuntut Gwitchin First Nation/Vuntut Gwitchin First Nation a Purchase Order for both Tyrel and Dougie's time. We can do the same for Vuntut Gwitchin First Nation employee Laurie Reti, $36/hour for 20 hours. Does that work?	N/A	E00514_RE_ Flights and Contract for Laurie_1
E00515	25-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	Lynn O'Neil, Richard Wyman (Chance)	Megan Williams (Vuntut Gwitchin First Nation)	Jobs/Contracts Interviews	Yes we can do this via PO. Laurie will need to submit her hours on the payroll schedule. She is familiar with this process as she is currently working for Vuntut Gwitchin First Nation until August 1st. Please bear in mind that Finance adds a 9% payroll burden and a 15% admin to wage invoices.	N/A	E00514_RE_ Flights and Contract for Laurie_1
E00506	26-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Please see attached edits to the Draft Implementation report.	N/A	E00506_RE_ Draft Plan Implementation Report to Review_4
E00507	26-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Thanks. I'll incorporate all the changes from Vuntut Gwitchin First Nation and Chance on and send a final version for signing.	N/A	E00506_RE_ Draft Plan Implementation Report to Review_4
E00348	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Douglas Charlie (Vuntut Gwitchin First Nation) (Government Services)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Government Services Department about setting up an interview the following week (August 5th - 8th) to talk about the services they provide, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	E00348_190729_Chance Interview
E00349	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Brian Cameron Vuntut Gwitchin First Nation) (Government Services)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Government Services Department about setting up an interview the following week (August 5th - 8th) to talk about the services they provide, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	E00349_190729_Chance Interview
E00350	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Justine Benjamin Vuntut Gwitchin First Nation)(Government Services)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Government Services Department about setting up an interview the following week (August 5th - 8th) to talk about the services they provide, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	E00350_190729_Chance Interview
E00351	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Travis Frost Vuntut Gwitchin First Nation) (Government Services)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Government Services Department about setting up an interview the following week (August 5th - 8th) to talk about the services they provide, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	E00351_190729_Chance Interview

E00352	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Sandra Charlie (Vuntut Gwitchin First Nation) (Health and Social Services)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Health and Social Department about setting up an interview the following week (August 5th - 8th) to talk about the services the Health and Social Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	E00352_190729_Chance Interview
E00353	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Natasha Frost (Vuntut Gwitchin First Nation) (Health and Social Services)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Health and Social Department about setting up an interview the following week (August 5th - 8th) to talk about the services the Health and Social Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	E00353_190729_Chance Interview
E00354	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Adeline Charlie (Vuntut Gwitchin First Nation) (Health and Social Services)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Health and Social Department about setting up an interview the following week (August 5th - 8th) to talk about the services the Health and Social Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	E00354_190729_Chance Interview
E00355	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Kathie Nukon (Vuntut Gwitchin First Nation) (Health and Social Services)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Health and Social Department about setting up an interview the following week (August 5th - 8th) to talk about the services the Health and Social Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	E00355_190729_Chance Interview
E00356	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Candace Blake (Vuntut Gwitchin First Nation) (Health and Social Services)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Health and Social Department about setting up an interview the following week (August 5th - 8th) to talk about the services the Health and Social Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	E00356_190729_Chance Interview
E00357	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Loretta Itsi Vuntut Gwitchin First Nation) (Health and Social Services)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Health and Social Department about setting up an interview the following week (August 5th - 8th) to talk about the services the Health and Social Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	E00357_190729_Chance Interview
E00358	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Cheryl Charlie (Vuntut Gwitchin First Nation) (Director of Education)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Education Department about setting up an interview the following week (August 5th - 8th) to talk about the services the Education Department provides, the community of Old Crow, any ongoing issues, and how to Project could affect the community.	N/A	E00358_190729_Chance Interview
E00359	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Marion Blake Vuntut Gwitchin First Nation) (Education)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Education Department about setting up an interview the following week (August 5th - 8th) to talk about the services the Education Department provides, the community of Old Crow, any ongoing issues, and how to Project could affect the community.	N/A	E00359_190729_Chance Interview
E00360	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Glenna Tetlichi Vuntut Gwitchin First Nation) (Education)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Education Department about setting up an interview the following week (August 5th - 8th) to talk about the services the Education Department provides, the community of Old Crow, any ongoing issues, and how to Project could affect the community.	N/A	E00360_190729_Chance Interview
E00361	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Kecia Kassi Vuntut Gwitchin First Nation) (Education)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Education Department about setting up an interview the following week (August 5th - 8th) to talk about the services the Education Department provides, the community of Old Crow, any ongoing issues, and how to Project could affect the community.	N/A	E00361_190729_Chance Interview
E00362	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Paige Tizya-Tramm Vuntut Gwitchin First Nation) (Education)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Education Department about setting up an interview the following week (August 5th - 8th) to talk about the services the Education Department provides, the community of Old Crow, any ongoing issues, and how to Project could affect the community.	N/A	E00362_190729_Chance Interview
E00510	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	I have accepted all of Vuntut Gwitchin First Nation and Chance's tracked changes. Attached is the final version for signing to which I have added you as the signee. If this is incorrect, please add the correct person. Can you facilitate the signing of the report and return it to me? I will have Chance sign the report and CC you on the submission to Yukon Government.	N/A	190729_Plan Implementation Report_Vuntut Gwitchin First Nation to YTG-rb_Hemmera.docx E00510_RE_ Draft Plan Implementation Report to Review_5
E00511	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Laurie Reti (Vuntut Gwitchin First Nation)	Socio-economic Interview	Does tomorrow work for a phone call? If not, I will try to make today work.	N/A	E00511_RE_ Chance Oil and Gas Socio-economic Surveys_3
E00512	29-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Laurie Reti (Vuntut Gwitchin First Nation)	N/A	Laurie Reti (Vuntut Gwitchin First Nation)	Socio-economic Interview	Yes, tomorrow works for me. Anytime after 1.	N/A	E00512_RE_ Chance Oil and Gas Socio-economic Surveys_4
E00513	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Laurie Reti (Vuntut Gwitchin First Nation)	Socio-economic Interview	Thanks.	N/A	E00512_RE_ Chance Oil and Gas Socio-economic Surveys_4
E00516	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Lynn O'Neil	Megan Williams (Vuntut Gwitchin First Nation)	Jobs/Contracts Interviews	Lynn, can you facilitate the Purchase Order for Laurie?	N/A	E00514_RE_ Flights and Contract for Laurie_1
E00520	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Lynn O'Neil	Lynn O'Neil, Richard Wyman (Chance)	Megan Williams (Vuntut Gwitchin First Nation)	Jobs/Contracts Interviews	The PO was sent to Megan this morning.	N/A	E00520_RE_ Flights and Contract for Laurie_2
E00521	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Lynn O'Neil, Richard Wyman (Chance)	Megan Williams (Vuntut Gwitchin First Nation)	Jobs/Contracts Interviews	Thanks for completing the PO. Megan, we are going to talk to Laurie about her role ad responsibilities tomorrow afternoon. Will she have everything she needs to submit her hours to Vuntut Gwitchin First Nation one the PO is complete?	N/A	E00520_RE_ Flights and Contract for Laurie_2
E00522	29-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	N/A	Megan Williams (Vuntut Gwitchin First Nation)	Jobs/Contracts Interviews	Yes, Laurie just needs to submit her hours to me on the regular timesheet dates. The next timesheet deadline is August. 2 and every 2 weeks after. Do you want to review her hours before the payment is done?	N/A	E00520_RE_ Flights and Contract for Laurie_2

E00523	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Megan Williams (Vuntut Gwitchin First Nation)	Jobs/Contracts Interviews	Yes, I'll review the hours.	N/A	E00520_RE_ Flights and Contract for Laurie_2
E00524	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Information Sharing	We are in the final stages of creating foam core posters. We have a map created of Chance's Project area that has the old TH/Vuntut Gwitchin First Nation boundary, and would like to show the updated boundary. Are you able to send the shape file?	N/A	E00524_Vuntut Gwitchin First Nation_TH Border Shapefile
E00525	29-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	N/A	Megan Williams (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	I can sign off on the report. Please re-send for my signature.	N/A	E00525_RE_ Draft Plan Implementation Report to Review_6
E00526	29-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Megan Williams (Vuntut Gwitchin First Nation) Rosa Brown (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Attached is the report prepared for your signature.	N/A	E00525_RE_ Draft Plan Implementation Report to Review_6 190729_Plan Implementation Report_Vuntut Gwitchin First Nation to YTG-rb_Hemmera.docx
E00369	30-Jul-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Douglas Charlie (Vuntut Gwitchin First Nation) (Government Services)	Socio-economic Interview	Chance called the Vuntut Gwitchin First Nation Government Services Department about setting up an interview the following week (August 5th - 8th) to talk about the services they provide, the community of Old Crow, any ongoing issues, and how the Project could affect the community. Government Services said they received my email and would let me know if they would be in Old Crow next week.	N/A	N/A
E00370	30-Jul-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Sandra Charlie (Vuntut Gwitchin First Nation) (Health and Social Services)	Socio-economic Interview	Chance called Vuntut Gwitchin First Nation Health and Social Department and left a message about setting up an interview the following week (August 5th - 8th) to talk about the services the Health and Social Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	N/A
E00371	30-Jul-19	Phone Call	Incoming	Vuntut Gwitchin First Nation	Sandra Charlie (Vuntut Gwitchin First Nation)	N/A	Sandra Charlie (Vuntut Gwitchin First Nation) (Health and Social Services)	Socio-economic Interview	Vuntut Gwitchin First Nation Health and Social Department called Chance and said they received Chance's message about doing interviews in Old Crow. The individual said they would be at the General Assembly during the week and would be willing to meet for an interview at the General Assembly	N/A	N/A
E00372	30-Jul-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Natasha Frost (Vuntut Gwitchin First Nation) (Health and Social Services)	Socio-economic Interview	Chance called Vuntut Gwitchin First Nation Health and Social Department and left a message about setting up an interview the following week (August 5th - 8th) to talk about the services the Health and Social Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	N/A
E00373	30-Jul-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Adeline Charlie (Vuntut Gwitchin First Nation) (Health and Social Services)	Socio-economic Interview	Chance called Vuntut Gwitchin First Nation Health and Social Department and left a message about setting up an interview the following week (August 5th - 8th) to talk about the services the Health and Social Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	N/A
E00374	30-Jul-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Kathie Nukon (Vuntut Gwitchin First Nation) (Health and Social Services)	Socio-economic Interview	Chance called Vuntut Gwitchin First Nation Health and Social Department and left a message about setting up an interview the following week (August 5th - 8th) to talk about the services the Health and Social Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	N/A
E00375	30-Jul-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Candace Blake (Vuntut Gwitchin First Nation) (Health and Social Services)	Socio-economic Interview	Chance called Vuntut Gwitchin First Nation Health and Social Department and left a message about setting up an interview the following week (August 5th - 8th) to talk about the services the Health and Social Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	N/A
E00376	30-Jul-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Cheryl Charlie (Vuntut Gwitchin First Nation) (Director of Education)	Socio-economic Interview	Chance called Vuntut Gwitchin First Nation Education Department and left a message about setting up an interview the following week (August 5th - 8th) to talk about the services the Education Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	N/A
E00377	30-Jul-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Paige Tizya-Tramm (Education)	Socio-economic Interview	Chance called Vuntut Gwitchin First Nation Education Department about setting up an interview the following week (August 5th - 8th) to talk about the services the Education Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community. The Education representative contacted expressed they would be willing to do an interview, but recommended the Director of Education for the interview.	N/A	N/A
E00378	30-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Robert Kaye (Natural Resources)	Socio-economic Interview	Chance emailed Vuntut Gwitchin First Nation Natural Resources Department about setting up an interview the following week (August 5th - 8th) to talk about the services the Natural Resources Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	E00378_190730_Chance Interview
E00379	30-Jul-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Robert Kaye (Natural Resources)	Socio-economic Interview	Chance called Vuntut Gwitchin First Nation Natural Resources Department and left a message about setting up an interview the following week (August 5th - 8th) to talk about the services the Natural Resources Department provides, the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	N/A
E00527	30-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Information Sharing	I'll be in the office tomorrow and will send you the file.	N/A	E00527_RE_ Vuntut Gwitchin First Nation_TH Border Shapefile
E00528	30-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Information Sharing	Thanks.	N/A	E00527_RE_ Vuntut Gwitchin First Nation_TH Border Shapefile

E00531	30-Jul-19	Email	Incoming	Vuntut Gwitchin First Nation	Megan Josie William (Vuntut Gwitchin First Nation)s	N/A	Megan Williams (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Signed and attached.	N/A	E00531_RE_ Draft Plan Implementation Report to Review_7 Signed Plan Implementation Report
E00532	30-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Megan Williams (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Thanks.	N/A	E00531_RE_ Draft Plan Implementation Report to Review_7
E00533	30-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Laurie Reti (Vuntut Gwitchin First Nation)	Socio-economic Interview	Myself and my colleague Maegan will call around 3PM. I'll give you an introduction to the Project, explain what the interviews are for and what your role will be.	N/A	E00533_RE_ Chance Oil and Gas Socio-economic Surveys
E00545	31-Jul-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Derek Fraser, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Attached Annual Report on the Implementation of the Vuntut Gwitchin First Nation and Chance Communication and Engagement Plan.	N/A	E00545_Plan Implementation Report - Vuntut Gwitchin First Nation and Chance 190731_Vuntut Gwitchin First Nation and Chance Plan Implementation Report
E00380	01-Aug-19	Email	Outgoing	Vuntut Gwitchin First Nation	Maegan McCaw	N/A	Elizabeth Staples (Vuntut Gwitchin First Nation) (Caribou Coordinator)	Socio-economic Interview	Chance called Vuntut Gwitchin First Nation Caribou Coordinator about setting up an interview the following week (August 5th - 8th) to understand the community of Old Crow, any ongoing issues, and how the Project could affect the community.	N/A	E00380_190801_Chance Interview
E00548	01-Aug-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Laurie Reti (Vuntut Gwitchin First Nation)	Socio-economic Interview	Find some Project information attached. Dates of interviews, August 5-10, would like your help when you are free in the evenings. Your role and responsibility is to book interviews with community members the nights of August 6 & 7 and potentially another time if the person is comfortable Meeting with Maegan and I when you are not there. Interviews with Youth, Elders, People who spend a lot of time on the land. We will talk to anyone and everyone. Are you free tomorrow to talk about booking interviews?	N/A	E00548_Chance Interview Information 190730_Chance_InterviewGuideExternal_v0.6, 190730_Chance_InformedConsent_v0.3, 190731_Handout_Vuntut Gwitchin First Nation GA
E00385	06-Aug-19	Email	Incoming	Vuntut Gwitchin First Nation	Elizabeth Staples (Vuntut Gwitchin First Nation)	N/A	Elizabeth Staples (Vuntut Gwitchin First Nation)	Socio-economic Interview	Vuntut Gwitchin First Nation Caribou Coordinator responded to Chance's email requesting an interview and expressed they would be willing to do an interview during the week of August 6th - 8th.	N/A	E00385_190806_Chance Interview
E00437	06-Aug-19	Phone Call	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Socio-economic Interview	Rosa called Shena and left voice mail. (11:27 am)	N/A	E00437_FW Voice Message attached from 8676332950 - name unavailable
E00438	06-Aug-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Socio-economic Interview	Shena returned Rosa's call, and left voicemail at 12:01 PM.	N/A	E00437_FW Voice Message attached from 8676332950 - name unavailable
E00439	06-Aug-19	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Socio-economic Interview	Shena called Rosa and left a voicemail requesting a call to discuss Hemmera's work in Old Crow this week. (10:45 am)	N/A	E00438_for Chance consultation log
E00440	06-Aug-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Socio-economic Interview	I just left you a voicemail. Greg mentioned to me that you had some concerns with the work we are doing in Old Crow this week so I just wanted to chat with you about it today. Can you please give me a call when you have a chance?	N/A	E00438_for Chance consultation log
E00549	06-Aug-19	Email	Incoming	Vuntut Gwitchin First Nation	Laurie Reti (Vuntut Gwitchin First Nation)	N/A	Laurie Reti (Vuntut Gwitchin First Nation)	Socio-economic Interview	Have you made it to Old Crow? I am just wondering what the plan is.	N/A	E00549_RE_ Chance Interview Information
E00550	06-Aug-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Laurie Reti (Vuntut Gwitchin First Nation)	Socio-economic Interview	We made it to Old Crow. We are actually not going to be conducting community interviews on this trip. We are going to be interviewing service providers during the day, but doing community conversations at a later date. Sorry for the late notice, it was just decided today. Thank you for being interested in the Socio-economic research. We will let you know when we are doing community interviews, as we would like your help when we do these at a later date.	N/A	E00549_RE_ Chance Interview Information
E00387	07-Aug-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Elizabeth Staples (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation)	Socio-economic Interview	Chance responded to Vuntut Gwitchin First Nation Caribou Coordinator's email, suggesting that the requested interview be postponed for a later time to discuss how to address caribou in the Project Proposal when other members of the Chance team (e.g. EDI) can also be present for the conversation.	N/A	E00387_190807_Chance Interview
E00553	08-Aug-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement Information Sharing	Hemmera has prepared the attached memo on the services we are providing Chance. We are hoping this can be shared with the Natural Resources Committee in the Meeting tonight to clarify our role. The memo includes Shena's contact information.	N/A	E00553_Memo re_ Hemmera's role in Chance's Project 190808_Hemmera Memo for NRC_Final_v2
E00444	26-Aug-19	Letter	Incoming	Vuntut Gwitchin First Nation	Cheryl Charlie	Greg Charlie (Chance)	Cheryl Charlie	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00445	26-Aug-19	Email	Incoming	Vuntut Gwitchin First Nation	Cheryl Charlie	Greg Charlie (Chance)	Cheryl Charlie, Sandra Charlie, Katherine Peter, Brandon Kyikavichik, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00446	26-Aug-19	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Cheryl Charlie, Sandra Charlie, Katherine Peter, Brandon Kyikavichik, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00595	24-Sep-19	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Marvin Frost, Cheryl Charlie, Katherine Peter, Megan Williams (Vuntut Gwitchin First Nation), Brandon Kyikavichik, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	I am back from my vacation and am following up the letter that Cheryl sent to Greg at the end of August to request a face to face meeting, please see the attached letter that proposes a number of meeting dates based on the availability of representatives of Chance. I don't have an email address for Roger so kindly provide a copy of this email to him. Also I have sent this to Megan Williams (Vuntut Gwitchin First Nation), but if Megan is no longer the acting director of Natural Resources, kindly ensure her replacement obtains a copy of this letter.	N/A	E00595_FW_ Meeting request(1) Cooperation Agreement Meeting request to Vuntut Gwitchin First Nation and NRC Sept 24, 2019

E00596	24-Sep-19	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	I am back from my vacation and am following up the letter that Cheryl sent to Greg at the end of August to request a face to face meeting, please see the attached letter that proposes a number of meeting dates based on the availability of representatives of Chance. I don't have an email address for Roger so kindly provide a copy of this email to him. Also I have sent this to Megan Williams (Vuntut Gwitchin First Nation), but if Megan is no longer the acting director of Natural Resources, kindly ensure her replacement obtains a copy of this letter.	N/A	E00596_FW_ Meeting request(2) Cooperation Agreement Meeting request to Vuntut Gwitchin First Nation and NRC Sept 24, 2019
E00568	01-Oct-19	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Thanks for the chat. We are still 100% committed to proceed in our collaboration, however meeting with you and council essential. Need to have understanding of Vuntut Gwitchin First Nation objectives and talk about shared objective to develop understanding for a Cooperation Agreement. We can discuss funding numbers to make sure there is adequate resources available for Vuntut Gwitchin First Nation going forward. October 16th to meet?	N/A	E00568_FW CC and Chance Meeting
E00569	08-Oct-19	Email	Incoming	Vuntut Gwitchin First Nation	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Greg Charlie (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	I appreciate your patience. Trying to find a time next week to accommodate everyone's schedule for this important meeting. We foresee a quick sit down meeting with council followed by a longer meeting with the NR committee to iron out the details. Resolution No. 2017-02 - passed by Consensus: Engagement with the Oil & Gas Industry. This has full support of council and will get back to you with a solid date by the end of today.	N/A	E00568_FW CC and Chance Meeting
E00571	21-Oct-19	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Brandy Tizya, Cheryl Charlie, Darius Elias (Vuntut Gwitchin First Nation), Marvin Frost	Engagement/Consultation	Draft minutes of meeting here in Old Crow. Please review and advise if the draft is accurate and covers the topics highlighted in the agenda to your satisfaction.	N/A	E00571_FW_ Draft Minutes of the October 17 (See chain) October 17,2019 Meeting Minutes with Vuntut Gwitchin First Nation Chief and Council and COG in Old Crow
E00570	29-Oct-19	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Cheryl Charlie, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Brandon Kyikavichik, Katherine Peter	Project Description/Activities Engagement/Consultation	I am providing an update to summary description of the Exploration Project. Since this was presented to Chief and Council in 2018, there have been changes to both the Chief and Council and Vuntut Gwitchin First Nation staff. The Natural Resource Committee contemplated under the Oil and Gas Engagement Policy has formed since the original Project summary was shared. The latest Ministerial Order 2019/27 dated August 28, 2019, the number of exploration permits held by Chance have been reduced by two and tenure extended for 5 exploration permits that would have expired August 30, 2019. Attachment provides context about the Project and includes a summary of the objectives that Chance has. It is fundamental to Chance to build relationships with affected First Nations in this process.	N/A	E00570_FW Conference call Items for consideration(email to Vuntut Gwitchin First Nation in chain) Exploration Project description updated October 29 2019
E00572	29-Oct-19	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Chance let Natural Resources Committee know about your participation and the Committee welcomes your involvement.	N/A	E00572_NRC conference call
E00573	29-Oct-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Thank you for welcoming us to the meeting. Shena, Calista and I will be joining the call from Whitehorse.	N/A	E00573_RE_ NRC conference call
E00574	29-Oct-19	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	Erika Tizya, Cheryl Charlie, Brandon Kyikavichik, Katherine Peter, Sandra Charlie, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Engagement/Consultation Information Sharing	Thank you for these updates and suggested agenda items. Committee looks forward to discussing these points and Committees proposed items attached this email. Please forward any revisions for finalization of the agenda in advance of our meeting. It is fundamental to our Committee that we also receive feedback and support in this process as we work towards fulfilling the direction and guidance set out in Vuntut Gwitchin First Nation policies, resolutions, plans and agreements as they relate to proposed oil and gas work in Vuntut Gwitchin First Nation Traditional Territory.	N/A	E00574_RE_ Conference call items for consideration 10-31-2019 NRC-COGL Meeting agenda DRAFT_
E00631	18-Nov-19	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Lynn O'Neil	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Cheryl Charlie	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00630	19-Nov-19	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Mike Chernoff, David Savage	Erika Tizya, Cheryl Charlie, Brandon Kyikavichik, Katherine Peter, Sandra Charlie, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00703	26-Nov-19	Meeting	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00592	28-Nov-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00593	02-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Hemmera presented the attached workplan to the Natural Resources Committee at the June meeting. It would be helpful to see a updated version of this chart. Did Chance share the Vuntut Gwitchin First Nation Proposal for Capacity Funding with you?	N/A	E00592_RE_ Hemmera and Vuntut Gwitchin First Nation Next Steps Meeting(1) Hemmera workplan (June 2019)
E00594	02-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	For this call we want to discuss next steps with Vuntut Gwitchin First Nation before we propose an updated chart. We have not seen a recent Proposal for Capacity Funding, is this something you are able to share?	N/A	E00594_RE_ Hemmera and Vuntut Gwitchin First Nation Next Steps Meeting(2)
E00577	04-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Want to set a time to test Zoom.	N/A	E00577_RE_ Zoom Meeting Test
E00578	04-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	I am available tomorrow morning. 10 am. I'll chat with IT guys and send you a meeting invite.	N/A	E00577_RE_ Zoom Meeting Test

E00579	04-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	I got the lowdown on setting up a zoom meeting. The invitation will be sent shortly before the meeting is scheduled. I expect a bit of chaos on my end.	N/A	E00577_RE_ Zoom Meeting Test
E00580	04-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Sounds like a plan.	N/A	E00577_RE_ Zoom Meeting Test
E00614	04-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00575	05-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	We are working on the agenda for . Rosa and Calista haven't been bale to test run the zoom application yet, but sounds similar to skype. Given the productivity of these discussions in person, I am wondering if there is any interest in you two coming down to Whitehorse for this meeting, even if it meant pushing it to the week of the 16th. Let me know if this might be doable.	N/A	E00575_Meeting next week
E00581	05-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	I'm sorry, we need to reschedule. The boardroom was scooped by Chief and Council this morning. Are you available this afternoon?	N/A	E00577_RE_ Zoom Meeting Test
E00582	05-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	No problem! I can do anytime this afternoon.	N/A	E00577_RE_ Zoom Meeting Test
E00583	05-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Headed to the boardroom to hook up. Stay tuned for a meeting invite shortly.	N/A	E00577_RE_ Zoom Meeting Test
E00584	05-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	I just got bumped from the boardroom again. There might ne another opportunity later this afternoon, I'll let you know.	N/A	E00577_RE_ Zoom Meeting Test
E00626	05-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00576	06-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Thank you. I agree we need to plan a whiteboard session to ensure it is as productive as possible. Our understanding is the whiteboard session is for both parties to reach a stronger understanding of opportunities to alight our work toward a benefits and stewardship agreement under the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy with Chance's consultation requirements under Yukon Environmental Socio-economic Assessment Board. We are currently looking at how we can prepare for this meeting so that Vuntut Gwitchin First Nation moves forward in the most informed and effective manner possible. Look forward to draft agenda, and suggest holding off on deciding meeting logistics until we have common understanding of our work ahead.	N/A	E00576_RE_ Meeting next week(1)
E00597	09-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning Engagement/Consultation	Attached is a draft agenda for discussion. Please let me know of any questions or changes you'd like me to make. I'm also attaching Hemmera's August 8th memo that's referenced within.	N/A	E00597_RE_ Meeting next week(2) 191209_Vuntut Gwitchin First Nation=Hemmera_Meeting Agenda_DecX_v0.2, 190808_HemmeraMemo_Vuntut Gwitchin First Nation_NRC_Hemmera'sROle_Final_v2
E00627	09-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00628	10-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00629	10-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00598	11-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Did you have any thoughts on the agenda or a potential date to have the meeting?	N/A	E00597_RE_ Meeting next week(2)
E00599	11-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation)	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00623	18-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00624	18-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00625	18-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00616	20-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Katrijn Thys, Robert Froehlich, Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00617	20-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Katrijn Thys, Robert Froehlich, Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya Josie William (Vuntut Gwitchin First Nation) Josie (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00618	23-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Kris Statnyk (Vuntut Gwitchin First Nation)	Katrijn Thys (Norton Rose Fulbright), Robert Froehlich (Norton Rose Fulbright), Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Kris Statnyk (Vuntut Gwitchin First Nation), Erika Tizya-Tramm (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A

E00619	24-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Robert Froehlich (Norton Rose Fulbright)	Katrijn Thys (Norton Rose Fulbright), Robert Froehlich (Norton Rose Fulbright), Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Kris Statnyk (Vuntut Gwitchin First Nation), Erika Tizya-Tramm (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00620	27-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Kris Statnyk (Vuntut Gwitchin First Nation)	Katrijn Thys (Norton Rose Fulbright), Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance), Robert Froehlich (Norton Rose Fulbright)	Kris Statnyk (Vuntut Gwitchin First Nation), Erika Tizya-Tramm (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00621	27-Dec-19	Email	Outgoing	Vuntut Gwitchin First Nation	Katrijn Thys (Norton Rose Fulbright)	Katrijn Thys (Norton Rose Fulbright), Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance), Robert Froehlich (Norton Rose Fulbright)	Kris Statnyk (Vuntut Gwitchin First Nation), Erika Tizya-Tramm (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00622	27-Dec-19	Email	Incoming	Vuntut Gwitchin First Nation	Kris Statnyk (Vuntut Gwitchin First Nation)	Katrijn Thys (Norton Rose Fulbright), Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance), Robert Froehlich (Norton Rose Fulbright)	Kris Statnyk (Vuntut Gwitchin First Nation), Erika Tizya-Tramm (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00615	08-Jan-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00605	10-Jan-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Cheryl Charlie, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Brandon Kyikavichik, Katherine Peter, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E01008	14-Jan-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Justin Page, Clive Mountford, Todd Mahon	DO Project Meeting Coordination/Planning	Thank you for the Meeting minutes from our Dec. 17 discussion regarding the Yukon Environmental Socio-economic Assessment Board Project Proposal for Chance's Well Maintenance work. attached you will find Vuntut Gwitchin First Nation's revisions to the minutes.	N/A	E01008_Re_ Chance and Vuntut Gwitchin First Nation Dec 17 Meeting summary - Discussion of Yukon Environmental Socio-economic Assessment Board DOProject Proposal for Well Maintenance and Winter Activities - DRAFT for review (7).msg
E00606	16-Jan-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00607	16-Jan-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00604	17-Jan-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Traditional Knowledge and Use Information Sharing Meeting Coordination/Planning	Following up on Richard's correspondence, and look forward to learning more about the work completed by Hemmera, EDI, Palmer and Peer Solutions and discussing it thoroughly, along with the results of our own gap analysis, at the proposed state of knowledge workshop.	N/A	E00604_FW_ Cooperation Agreement update and other matters
E00608	17-Jan-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00609	17-Jan-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00939	20-Jan-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Derek Fraser	DO Project	We have a planning Meeting on January 25 at 10:00am and we're looking forward to the Meeting. Before the Christmas holidays there were a number of emails dealing with Chance revised Project Proposal and your commitment to helping all parties come to a "common understanding" before submitting the Chance revised Project Proposal to Yukon Environmental Socio-economic Assessment Board, which is why we found it unfortunate that during the holidays we had seen that Chance had submitted the Proposal on December 24, 2020 and the Vuntut Gwitchin First Nation was not notified by Chance. To help inform the discussions around planning for negotiations can Chance provide us with a deeper understanding of all details related to what the cost of the Project will be, potential employment, training and contracting opportunities there will be in relation to the Project?	N/A	E00939_FW_ Dawson DO Project Proposal
E00610	22-Jan-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00613	22-Jan-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00611	27-Jan-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A

E00600	28-Jan-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Cheryl Charlie, Katherine Peter, Brandon Kyikavichik, Brandy Tizya, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Tenures/Dispositions/Permits DO Project Engagement/Consultation	Chance will be applying to the Yukon Government very shortly to extend the tenure of Exploration Permit 20. Application will be for maximum allowable under the Oil and Gas Act of 5 years. This permit has one suspended well at McPartlon A-25 which we hope to use for fluid disposal of any produced water associated with the proposed exploration Project. We are at an intermediate stage of discussions with the Manager of Oil and Gas Operations with Yukon to extend the suspended well status on the suspended wells at Eagle Plain. Manager has indicated hat Chance will need to do some physical assessments of the legacy wells to confirm the integrity of the wells before granting an extension. Assessments will require access to 3 suspended wells at SDL M-08, G-08, and J-19 and well as M-59 in order to do the work. A service rig, cement pumping equipment, and wireline services are expected to be used to conduct the assessments. Anticipate taking temperature measurements in wells to evaluate permafrost depth. The program is expended to take 1-2 months. This is a winter operation and will be done during the winter of 2020-2021 and may require Designated Office screening by Yukon Environmental Socio-economic Assessment Board. We will provide more information as soon as we can.	N/A	E00600_FW_ Suspended wells and Exploration Permit 20_1
E00612	28-Jan-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00640	10-Feb-20	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00632	12-Feb-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Brandon Kyikavichik, Katherine Peter, Cheryl Charlie	Information Sharing	Please see attached Gap Analysis that was completed by Hemmera team. This will help assist the phase 1 Project with Firelight Group to complete their analysis on behalf of Natural Resources Committee. Please let us know if you have any questions or need additional information. Please pass a copy along to the other members that we don't have email address for.	N/A	E00632_FW_Gap Analysis
E00655	12-Feb-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Brandon Kyikavichik, Katherine Peter, Cheryl Charlie	Information Sharing	Please see attached Gap Analysis that was completed by Hemmera team. This will help assist the phase 1 Project with Firelight Group to complete their analysis on behalf of Natural Resources Committee. Please let us know if you have any questions or need additional information. Please pass a copy to other members that we don't have email addresses for.	N/A	E00632_Gap Analysis 20200124 Gap Analysis v1.2
E00633	13-Feb-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Robert Froehlich, Katrijn Thys	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Cheryl Charlie, Brandon Kyikavichik, Katherine Peter, Sandra Charlie, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Marvin Frost	Project Description/Activities Cooperation Agreement	Explained Chance's need to submit to the Yukon Environmental Socio-economic Assessment Board the multi-well exploration drilling and seismic data acquisition Project ("Activities") in June, 2020, whether or not a Benefits and Stewardship Agreement ("BSA") is in place despite provisions in the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy ("Policy").The intention here is driven by external factors that affect our future. We fully intend to negotiate a BSA prior to undertaking the Activities in parallel to the Yukon Environmental Socio-economic Assessment Board prices. I have obtained Board Approval for the first phase of Capacity Funding as described in recent discussions of the Cooperation Agreement. The 2 fundamental reasons for Chance to move forward on a June submission: 1. The land tenure clock is ticking down 2. The Yukon Environmental Socio-economic Assessment Board process will involve external bodies which could significantly influence the character of the proposed Activities and the various management plans in ways that my render any prior BSA obsolete or unworkable. Discusses Permits and Significant Discovery Licenses, their numbers, expirations, and applications for tenure extensions. Remaining tenure is very short to be able to get through ExComm, coincidently negotiate and execute a BSA, complete any training, negotiate contracts for services, obtain necessary permissions, plan and ultimately start to execute the proposed Activities. We cannot rely on past success related to tenure extensions going forward. Submitting to ExComm a comprehensive Project Description will be an important step to change that mindset and we are hopeful that the Vuntut Gwitchin First Nation will collaborate in a constructive way in the development of this submission. ExComm has significant consultation requirements of proponents and First Nations in the development of these submissions. I would like to request a Meeting with the Natural Resources Committee and arrange a public Meeting to update the community with progress being made on either March 5 or March 10 in Old Crow. We can continue the Cooperation Agreement discussions as needed, or if we can resolve the outstanding issues before then, have a signing ceremony of the Cooperation Agreement.	N/A	E00633_FW_ Scheduling considerations for a June 2020 submission to Yukon Environmental Socio-economic Assessment Board-1
E00634	25-Feb-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance), Robert Froehlich, Katrijn Thys	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Cheryl Charlie, Brandon Kyikavichik, Katherine Peter, Sandra Charlie, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Marvin Frost	Meeting Coordination/Planning	Chance has prepared two draft agendas for events next week. One agenda is for a community dinner evening (March 5th), and the second is for a Meeting with Vuntut Gwitchin First Nation Chief and Council and the members of the Natural Resources Committee. For the latter Meeting, dates of March 5th and March 10th were proposed and so far responses have indicated that March 5th is preferable. Please confirm the afternoon of March 5, then confirm attendees.	N/A	E00634_RE_ Scheduling considerations for a June 2020 submission to Yukon Environmental Socio-economic Assessment Board(1) Chance_OldCrowCommunity March5Meeting Chance-OC_Comm_Mar5Agenda Chance-Vuntut Gwitchin First Nation+NRC_Mar5Agenda

E00641	25-Feb-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Robert Froehlich, Katrijn Thys	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Cheryl Charlie, Brandon Kyikavichik, Katherine Peter, Sandra Charlie, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Marvin Frost	Meeting Coordination/Planning	Keep me posted on any response. Did you request delivery and read receipts?	N/A	E00641_Re_ Scheduling considerations for a June 2020 submission to Yukon Environmental Socio-economic Assessment Board(2)
E00635	27-Feb-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Further to our discussion yesterday, you indicated that the Natural Resources Committee and Chief and Council had not yet aligned on a date for the Meeting with Chance. Chance is still available either the 5th or the 10th, please let us know which date works best on your end. Or alternate date in first half of March that would work with an appropriate evening for a community Meeting, let us know and we can look to see if we are available. Confirmation of date by end of the week would be necessary in order to plan logistics and ensure adequate notice of the community Meeting. Look forward to advancing the Cooperation Agreement and community consultation for the Multi-Well Program. If Natural Resources Committee and Chief and Council are not available in the first half of March we will continue to provide updates to the public for our applications to YESAA in Old Crow.	N/A	E00635_FW_ Chance and Vuntut Gwitchin First Nation Meeting
E00636	27-Feb-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Mike Chernoff	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Darius Elias (Vuntut Gwitchin First Nation), Marvin Frost, Cheryl Charlie, Brandon Kylkavichik, Katherine Peter, Sandra Charlie	Engagement/Consultation	attached is formal response of the Vuntut Gwitchin First Nation Natural Resources Committee regarding Chance's intention to submit a Project Proposal to Yukon Environmental Socio-economic Assessment Board.	N/A	E00636_FW_ Letter to COGL re Intention to Submit Proposal Letter to R.Wyman re COGL Intention to Submit Proposal signed
E00637	27-Feb-20	Letter	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Richard Wyman (Chance), Mike Chernoff	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation	Letter in response to discussions with Chance on February 10, 2020 and subsequent correspondence received from Chance regarding the intention to submit a Proposal in June 2020. The Committee considered Chance's request for a waiver of the requirement under the Vuntut Gwitchin First Nation's Oil and Gas Engagement Policy for the negotiation and ratification of a Benefits and Stewardship Agreement with the Vuntut Gwitchin First Nation prior to submission of the Proposal to Yukon Environmental Socio-economic Assessment Board. Based on feedback and input received by the Committee, Chance's request for a waiver cannot be granted. The engagement process set out under the Policy must be respected and adhered to by Chance. Chance has been aware of the Policy since its development in fall 2017, and that the Policy would be the framework for engagement with Vuntut Gwitchin First Nation. In May 2018, following approval of Policy, Chance agreed in the Communication and Engagement Plan that it would comply with the Policy in relation to any oil and gas activities within the Vuntut Gwitchin First Nation Traditional Territory. On numerous occasions Vuntut Gwitchin First Nation met with Chance to discuss in good faith the Policy, including the staged requirements for a Cooperation Agreement and a Benefits and Stewardship Agreement. After two years of good faith engagement with Chance, the notice that it is prepared to submit the Proposal to Yukon Environmental Socio-economic Assessment Board in less than three months and in non-compliance with the Policy is deeply disappointing to the Committee. It is contrary to the guiding purposes of the Policy which we are mandated to fulfill. We acknowledge receipt of the Cooperation Agreement delivered by Chance on February 22, 2020, however, in absence of terms that ensure compliance with the Policy in relation to the Proposal, the Committee cannot recommend it to Council for approval under section 27 of the Policy. In the event that Chance chooses to proceed with its intention to submit the Proposal in non-compliance with the Policy, Vuntut Gwitchin First Nation will not be in a position to support the Proposal. To advance the Proposal contrary to the Policy undermines the fundamental objective of sustainable development enshrined under the Final Agreement and North Yukon Regional Land Use Plan. A lack of support for the Proposal will arise in the event of non-compliance with the Policy, the Committee will continue to fulfill its mandate to inform and seek the views of Citizens in relation to the Proposal. Nothing in the Policy prevents Chance from carrying out consultation activities with Citizens in relation to the Proposal; however, it is expected Chance will adhere to the notice requirement under section 21 of the Policy.The Committee has considered Chance's notice to meet in Old Crow on March 5, 2020, to consult with Citizens.The Elders Council recommended that Chance schedule its consultation after the community meeting with the Yukon Environmental Socio-economic Assessment Board Executive Committee on March 24, 2020 in Old Crow. The Committee supports this recommendation. Asked that further communication be directed to Erika.	N/A	E00636_FW_ Letter to COGL re Intention to Submit Proposal
E00638	10-Mar-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Rick Nielson	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Cheryl Charlie, Brandon Kyikavichik, Katherine Peter, Sandra Charlie, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Information Sharing	Please find attached our response to your letter of February 27, which includes a request for a Meeting or a series of Meetings as needed to continue the dialogue regarding the Cooperation Agreement and other topics of importance. A community presentation is also requested. The request for a Meeting complies with your request to defer getting together until after you have met with Yukon Environmental Socio-economic Assessment Board Executive Committee on March 24.	N/A	E00638_Meeting request March 10 Letter to Vuntut Gwitchin First Nation NRC

E00639	10-Mar-20	Letter	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Rick Nielsen (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Cheryl Charlie, Brandon Kyikavichik, Katherine Peter, Sandra Charlie, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning Engagement Reports/OIC Requirements Cooperation Agreement	I am responding to your correspondence dated February 27, 2020. Chance is disappointed that the Natural Resources Committee was not able to provide the waiver requested by Chance to accommodate a parallel process of the undertaking the Yukon Environmental Socio-economic Assessment Board process and negotiating the Benefits and Stewardship Agreement in place of the sequence processes described in the Oil and Gas Engagement policy. Chance is interested in continuing discussions related to the Cooperation Agreement and wishes to meet the Natural Resources Committee, possibly the Chief and Council and the community at large. Chance requests a Meeting or series of Meetings between April 1 and April 8 in Old Crow. Meeting topic suggestions: 1. Continuation of Cooperation Agreement negotiations 2. Tenure management and application to extend the tenure of Exploration Permit 0020 beyond August 30, 2020 expiry 3. Upcoming Yukon Environmental Socio-economic Assessment Board Designated Office application for well maintenance work 4. Discussions related to information gathering processes needed to support a submission to Yukon Environmental Socio-economic Assessment Board Executive Committee 5. Other consultation related to anticipated Yukon Environmental Socio-economic Assessment Board Exec. Committee assessment of proposed exploration drilling and seismic data gathering Project 6. Initiating discussions related to the Benefits and Stewardship Agreement connected to the Project including discussions about timeline needed to reach agreement. Chance interested in hosting a community dinner to provide an update about the Project while in Old Crow for Meetings with Natural Resources Committee. Depending on topic, Chance would like representatives of Hemmera to attend some of the discussions given its expertise in Yukon Environmental Socio-economic Assessment Board submissions for both Executive Committee and the Designated Office in Dawson. Chance is interested in working in a constructive, cooperative and collaborative way with the Natural Resources Committee, the Chief and Council and the Citizens of Vuntut Gwitchin First Nation.	N/A	E00639_Meeting request
E00642	13-Mar-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Did you check with your group about the Meeting in Old Crow in the first week of April? It is always hard to get things organized on short notice so we would like to get travel and people committed. Please advise if we can start organizing a date in April. As you are well aware while working at Gwich'in Tribal Council, we had also coordinate other SGFN Meeting in NWT and Yukon.	N/A	E00642_FW_April Meeting in YOC
E00643	13-Mar-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	As I'm sure you understand with the current health advisories and decision from Council, all current Meetings are cancelled and no new Meetings are being scheduled. We'll keep in touch once officials announce otherwise. Stay healthy.	N/A	E00642_FW_April Meeting in YOC
E00644	16-Mar-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Cheryl Charlie	Meeting Coordination/Planning	Thanks for the update, so are you guys still working in Old Crow? Maybe we can resort to conference call and we can easily can set that up next week. Please let me know if this work and I included Cheryl as the co chair and leader of Vuntut Gwitchin First Nation as well, so we can decide on next steps.	N/A	E00642_FW_April Meeting in YOC
E01185	18-Mar-20	Letter	Incoming	Vuntut Gwitchin First Nation	Cheryl Charlie	Richard Wyman (Chance)	Cheryl Charlie, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Kathleen Peter, Brandon Kyikavichik, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Regulatory Process Cooperation Agreement Project Description/Activities Engagement/Consultation	attached is the Natural Resources Committee's response to your March 10/20 letter. I am sending the letter in the absence of Erika, as she is on vacation.	N/A	E01185_Mar 18 2020 letter COGL.pdf
E00705	30-Mar-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00706	31-Mar-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E01197	09-Apr-20	Letter	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Cheryl Charlie, Sandra Charlie, Brandon Kyikavichik, Katherine Peter, Roger Kyikavichik, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation),	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00650	16-Apr-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	I hope all is well with family and home in Old Crow! I want to follow up from our last correspondence to see if we can continue our conversation on the Cooperation Agreement. Please let me know if I can help organize a conference call or virtual Meeting over the internet, like Microsoft Team Meeting program or Zoom? However I heard Zoom is not that secure.	N/A	E00650_FW_Follow up_1
E00651	16-Apr-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Thank you for Chance's letter. I have had time to review the letter and I am glad to see a shift back to due process under Vuntut Gwitchin First Nation's Oil and Gas Engagement Policy, albeit now under these new and unprecedented times. NR is in discussions and given Vuntut Gwitchin First Nation Council's implementation of EmergeNorthern Cross Yukon Response Measures for COVID-19 and these unprecedented times, my superiors are requiring Council engagement on this matter, hopefully early next week. After then Vuntut Gwitchin First Nation will be better able to respond about next steps.	N/A	E00650_FW_Follow up_1

E00654	20-Apr-20	Letter	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Brandon Kyikavichik, Roger Kyikavichik, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Katherine Peter, Cheryl Charlie, Sandra Charlie	Project Description/Activities Engagement/Consultation	As previewed in my letter of April 9, 2020, this letter confirms what had already been mentioned in emails, correspondence and conversations of the past several months regarding tenure extension of Exploration Permit 0020 ("Permit"). On March 12, 2020, Chance ("Chance") applied to the Yukon Government to extend tenure of the Permit that will otherwise expire on August 30, 2020, unless extended. Chance requested the maximum permissible tenure extension of five years to allow sufficient time to continue engagement with affected First Nation Governments and communities, undergo Yukon Environmental and Socio-Economic Assessment Board Executive Committee impact assessment of proposed exploration activities as described in the Project description ("Project Description") delivered to the Vuntut Gwitchin First Nation ("Vuntut Gwitchin First Nation") on June 5, 2019, and ultimately to undertake exploration activities. In the interest of transpareNorthern Cross Yukon, this letter highlights the importance of this Permit to Chance and the reasons for the tenure extension request. The application sets tin motion a consultation process between the Vuntut Gwitchin First Nation, other affected First Nation Governments, and the Yukon Government in accordance with the *Yukon Oil and Gas Act* and associated disposition regulations. This letter is simply a courtesy to both alert you to the pending consultation and also share with you the rationale for the tenure extension request. It is important to Chance that this Permit be continued for several reasons. First of all, there is a suspended well, McParlon A-25, that has significant value either as a potential producing well, a potential disposal well for water and other by products that may be produced in association with oil or natural gas, or as an observation well to periodically monitor permafrost changes. Secondly, part of a significant shale oil discovery made in 2012 is located throughout this Permit. Under the moratorium preventing hydraulic fracturing, this resource is stranded, and forms part of the claim made by Chance against Yukon for compensation for the damages caused by the moratorium. Thirdly, the Permit has significant conventional oil and natural gas resource potential (i.e. hydraulic fracturing is NOT required to produce any discovered resources) that could be evaluated as part of the program described in the Project Description. Fourthly, Chance has good 3D seismic data covering most of the permit to support future exploration work to define prospects to drill. In closing, Chance would like the support of the Vuntut Gwitchin First Nation so Chance can get the requested tenure extension and continue exploring. If you have any questions or comments about this letter, please feel free to contact any of Greg (Chance), Cindy (Chance) or me. Please forward this letter and the attachments to Roger Kyikavichik for review.	N/A	E00654_April 20 Letter concerning EP 0020
E00660	20-Apr-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Sandra Charlie, Katherine Peter, Cheryl Charlie, Brandon Kyikavichik, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Project Description/Activities Engagement/Consultation	Please see attach letter from Richard (Chance). Please provide a copy to Roger Kyikaivchik for us as well.	N/A	E00660_FW_Permit 20 April 20 Letter concerning EP 0020 Related to entry E00654.
E00652	22-Apr-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Could you please provide me with an update with regards to Council direction on moving the engagement/negotiation forward on the following; Cooperation Agreement, Phase 1 (Gap analysis - Firelight), Benefit and Stewardship negotiations as part of the Executive Committee submission in Yukon Environmental Socio-economic Assessment Board? We look forward making progress on these implementation obligation in Vuntut Gwitchin First Nation Oil and Gas policy. Of course, the Covid pandemic is still a significant matter, so we will be happy to facilitate virtual Meeting or conference calls to move this forward.	N/A	E00652_FW_Follow up_(2)
E00653	29-Apr-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	I wanted to follow up again, hoping we can proceed forward on our process under Vuntut Gwitchin First Nation oil and gas policy with Natural Resources Committee members. With redrafting the cooperation agreement to reflect the policy and with the hopes we get things back on track, we feel we can get the agreement completed soon with conference calls or virtual Meetings. I had a lot of these type of Meetings in the last few weeks due to Covid pandemic and it has so far been successful. So I am hoping we can do the same with Vuntut Gwitchin First Nation team. Please let me know if we can continue this negotiations soon.	N/A	E00653_FW_Next Steps_1
E00659	04-May-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00700	04-May-20	Letter	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00656	13-May-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Information Sharing	May I get a copy of the word version of Hemmera's gap analysis so we can make our comments directly within the document?	N/A	E00632_FW_Gap Analysis
E00657	14-May-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00658	15-May-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00754	15-May-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00661	25-May-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tram	Project Description/Activities DO Project Engagement/Consultation	I am sending you the formal stage 1 Project description for our workover of well that will be submitted to Dawson DO. I will stop by and give you quick update on payment $1000 and audit financials.	N/A	E00661_FW_Stage 1 Project Description - NRC(0) 200522_appendix11_Chance_DO _ProjectDescription_DRAFT 20522_WellMaintenance_Stage1p24Notice_Final-Signed
E00663	26-May-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tram	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Thank you for the notification and Project description. When are you available to meet for the update?	N/A	E00663_ FW_Stage 1 Project Description - NRC
E00664	26-May-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	I am available this afternoon before 3:00PM because I am going hunting on the river or I am available tomorrow anytime?	N/A	E00663_ FW_Stage 1 Project Description - NRC
E00665	26-May-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	OK we can meet tomorrow at 1:30 regarding the audit financials and payment	N/A	E00663_ FW_Stage 1 Project Description - NRC
E00666	26-May-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Sounds good and could we discuss any progress on moving forward on Cooperation Agreement and next steps with Natural Resources Committee? I think it is very important we understand the timeframe and focus on some scheduling. Chance has been working on all of our ecological components for pass few months and we would like to eventually move forward on Benefit and Stewardship Agreement. See you tomorrow afternoon.	N/A	E00663_ FW_Stage 1 Project Description - NRC

E00662	27-May-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project	I am forwarding additional material to complete the Stage 1 process as described under Section 24 of the Vuntut Gwitchin First Nation Engagement Policy. This letter, the cheque and the recently released Audited Financial Statements for 2019 are being mailed to your attention today. We look forward to discussing this Project with you as soon as it can be arranged	N/A	E00662_FW_Well Maintenance Project follow up 1516_001
E00667	27-May-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Due to new Vuntut Gwitchin First Nation building restrictions regarding children, I will not be able to meet at 1:30 as I have no childcare. Are you available to discuss over the phone? Mahsi and sorry for this last minute change.	N/A	E00663_ FW_Stage 1 Project Description - NRC
E00701	27-May-20	Letter	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Project Description/Activities DO Project Engagement/Consultation Benefits/Capacity Agreement	This letter follows up the letter dated May 22, 2020 from Greg (Chance) to provide additional information and payment in accordance with the Policy in order to complete the requirements of Section 24. Enclosed with this letter is a copy of the Audited Financial Statements of Chance for the year ended December 31, 2019. This information is marked "Confidential". Also enclosed with this letter is a cheque in the amount of $1000.00 as payment for the administration fee. We look forward to collaborating with you on this Yukon Government mandated Project as soon as possible. In order to be able to ensure that the necessary oil field services are contracted to be able to do the work during the winter of 2020-2021, a submission to the Yukon Environmental Socio-economic Assessment Board Designated Office in Dawson will need to be submitted in the first part of June. A benefits agreement will be needed since the Project is likely going to exceed $1 million in expenditures. Please contact Greg (Chance) to set up a virtual Meeting to address any questions or comments you may have regarding the Project. I hope you and your family are well and looking forward to summer in Old Crow.	N/A	E00662_FW_Well Maintenance Project follow up Email with Letter attached
E00668	01-Jun-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project Meeting Coordination/Planning	I left you voice message this morning and trying to follow up with you from last week. Sorry it didn't work out to meet in person and was hoping to meet in person. I hope we can continue on with our work and because we have sensitive timeframe, we need to understand what is our schedule. I spoke to Dana and Darius at Council office separately about moving forward with negotiation and engagement and they both informed me that they gave you direction already and it was to proceed. I didn't see Cheryl in the office during my time up there so I couldn't follow up with her. We would like to know where we are going with NR and Natural Resources Committee with this file. Thanks and please give me a call soon.	N/A	E00668_ FW_Stage 1 Project Description - NRC (14)
E00698	09-Jun-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	Due to new Vuntut Gwitchin First Nation COVID policies at Vuntut Gwitchin First Nation and the community's day care closure, I have had to work from home full-time and manage my time as such, so I apologize I could not meet with you directly as was planned. Being the direct contact on this file, I was not aware you had Meetings planned with Vuntut Gwitchin First Nation Council during your recent visit to Old Crow. It sounds like those Meetings reaffirmed my email to you May 26 notifying you of the direction from Council to recommence negotiations of a cooperation agreement. The NR committee is scheduled to discuss this direction at their next Meeting. Since officially notifying the Natural Resources Committee of Chance's multi-year, multi-well Project under Vuntut Gwitchin First Nation's Engagement Policy in July 2019, which was subsequently deemed adequate in August 2019, the Natural Resources Committee has worked with Chance regarding their various issues with the process. Vuntut Gwitchin First Nation and the NR committee have a demonstrated commitment to our work on this file and will continue to do so under the current COVID circumstances, Vuntut Gwitchin First Nation's Policy, and Yukon Environmental Socio-economic Assessment Board. We look forward to the recommencement and timely conclusion of a cooperation agreement. We will have our revisions to Chance's version as soon as practicable after our committee meets this week.	N/A	E00668_ FW_Stage 1 Project Description - NRC (3)
E00669	10-Jun-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	Please see attach letter and we look forward to hearing back from the Natural Resources Committee.	N/A	E00669_200210_FW_ DO Workover Letter - Vuntut Gwitchin First Nation NR Vuntut Gwitchin First Nation NR Director Letter - June 10, 2020
E00670	10-Jun-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	The Natural Resources Committee is Meeting tomorrow and will follow up thereafter.	N/A	E00669_FW_DO Workover Letter - Vuntut Gwitchin First Nation NR (9)
E00671	24-Jun-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Information Sharing	Did the Natural Resources Committee manage to meet June 11th? Did they have any feedback for Chance on the DO application (well maintenance)? Any sort of update would be appreciated.	N/A	E00671_200610_FW_DO Workover Letter - Vuntut Gwitchin First Nation NR

E00799	30-Jun-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance)	Erika Tizya Tramm	DO Project Engagement/Consultation Meeting Coordination/Planning	I just wanted to reach out because I will be off on holidays for the remainder of the week and out of cell phone range. We are hoping to hear back from you regarding the Well Maintenance program. I understand that Chance has made some arrangements for a community Meeting in Old Crow the week of July 13th and it would be great if I could get some feedback from the Natural Resources Committee to see if this is amendable to them or not. And if not, if there is a future date that would be better for such a Meeting. As I will be away, if you could kindly cc Calista Morrison (Hemmera) in your response that would be most appreciated to we can action any of your requests in my absence.	N/A	E00799_RE_ DO Workover Letter - Vuntut Gwitchin First Nation NR (15)
E00804	07-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Chance	Erika Tizya Tramm	Engagement/Consultation DO Project Meeting Coordination/Planning	Our technical staff completed their review and comments on the well maintenance Project and presented it to myself and the Committee. Before the Committee responds formally, there are some outstanding questions that would benefit from a brief Meeting. How do schedules look on your end for a one-hour discussion July 9 with Natural Resources staff and Firelight? Once a Meeting is confirmed, I will send out a Meeting invite and agenda	N/A	E00804_Re_ DO Workover Letter - Vuntut Gwitchin First Nation NR (19)
E00805	07-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project Meeting Coordination/Planning	Who do you need to be in this Meeting from Chance and Hemmera? We can check with our side and make ourselves available for , July 9th. We have a call tomorrow at 1:00PM with the group.	N/A	E00805_RE_ DO Workover Letter - Vuntut Gwitchin First Nation NR (22)
E00806	07-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project Meeting Coordination/Planning	Sorry my email was a bit vague. We need someone who can speak to the technical aspects of the proposed work of each well, so I leave it to you to determine who best from your team can address this.	N/A	E00806_Re_ DO Workover Letter - Vuntut Gwitchin First Nation NR (21)
E00807	07-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project Meeting Coordination/Planning	We will make ourselves available for 1:00PM on the 9th. The agenda will help us narrow down which technical expertise would be most appropriate.	N/A	E00807_RE_ DO Workover Letter - Vuntut Gwitchin First Nation NR (20)
E00808	07-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project Meeting Coordination/Planning	Great, we will send the Meeting invite and agenda tomorrow morning.	N/A	E00804_Re_ DO Workover Letter - Vuntut Gwitchin First Nation NR (19)
E00800	08-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation Meeting Coordination/Planning	In regards to your proposed Chance community Meeting date in your email below, unfortunately all of the Vuntut Gwitchin First Nation reps on this file are unavailable the week of July 13. We did discuss the next best dates and we'd like to propose the week of July 20. July 20 and July 24 would be travel days, which leaves the other days free for our full participation at your community Meeting. If agreeable, we can raise this with the Natural Resources Committee at our Meeting next week. I would also recommend Chance provide the NR committee with an agenda, a description of how this Meeting will be conducted given COVID restrictions, and any other information that needs to be shared in preparation for this event. We would be happy to share any feedback to make your Meeting successful. I suggested to Greg that our Heritage centre, the John Tizya Centre, would be a better venue as it is right by the river, it has a great indoor and outdoor space, and it is very central in our community. We are looking forward to some deep and meaningful engagement on your Project.	N/A	E00800_Re_ DO Workover Letter - Vuntut Gwitchin First Nation NR (18)
E00801	08-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation Meeting Coordination/Planning	Thanks very much for the feedback Erika. That is helpful. I will loop back with Chance to see if they are available those dates. Do you happen to know if the John Tizya Centre is available to book those dates? The other materials will be along shortly, including a draft agenda, outline of the Meeting materials and a COVID Health and safety plan. In anticipation of developing the COVID plan any ideas you have for the communities expectations from us with respect to items such as mask wearing, etc. would be helpful. We have a draft template that we have started developing but it is for work we are doing in more urban centres in other parts of the country and it would be good to get a sense of what would be considered appropriate from Vuntut Gwitchin First Nation perspective.	N/A	E00801_RE_ DO Workover Letter - Vuntut Gwitchin First Nation NR (17)
E00802	08-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation Meeting Coordination/Planning	I will call Megan who oversees John Tizya Centre about its availability for that week. The main practices exercised in the community at this point have been to keep to outdoor gatherings as much as possible, social distancing, and any food should be handled with gloves, pre-plated and handed out individually. Vuntut Gwitchin First Nation has a mic and speaker system they can set up if need be, but would need a heads up for our tech people to set up. Any other equipment needed such as Projector, screens, etc would also need advanced notice	N/A	E0802_Re_ DO Workover Letter - Vuntut Gwitchin First Nation NR (16)
E00803	08-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project	Okay that all sounds great. And thanks for checking on the Centre's availability.	N/A	E00799_RE_ DO Workover Letter - Vuntut Gwitchin First Nation NR (15)

E00810	08-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Justin Page, Tania Salerno	Engagement/Consultation Meeting Coordination/Planning DO Project	Meeting Invitation Vuntut Gwitchin First Nation has requested this Meeting to get clarity on a few outstanding questions regarding Chance's well maintenance program. I realize the short notice, but it would be really helpful to our group if we had a brief power point presentation to follow along with Chance's walk through of their program and well-by-well plans. Below are some questions to assist Chance in preparing this material: Is the well being prepared to maintain suspended status or abandonment? If it is being prepared for suspended status, what is the new timeframe before the well will be brought into production or abandoned? If abandoned, are the plans for downhole abandonment or surface abandonment? If plans are for downhole abandonment, could the well be brought into production at a later date? Describe the different activities pertaining to maintaining suspended status, downhole abandonment, and surface abandonment. What is the deadline for the 4 newer wells to be brought into production or abandoned (the deadline for the four older wells is Dec 31 2020)? Are any of the wells being prepared for deep well injection? We are also seeking additional information about Blackie Road and if any new construction is planned or the re-establishing of previously used winter roads. Based on this, our agenda looks like: 1.Introductions 2.Walk though of Chance well maintenance program 3.Plans for each well (with map) 4.Plans for Blackie Road 5.Next steps	N/A	E00810_RE_ Vuntut Gwitchin First Nation questions re COGL well maintenance program (10)
E00812	08-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project Meeting Coordination/Planning	I just wanted to let you know that I will be forwarding the invite to Calista and Nathan at Hemmera, and a fellow by the name of Clive who is the well engineer from Vertex designing the program. Also to Richard and Cindy for their participation.	N/A	E00812_RE_ Vuntut Gwitchin First Nation questions re COGL well maintenance program (14)
E00811	09-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Justin Page, Tania Salerno	Engagement/Consultation DO Project Meeting Coordination/Planning	We were able to quickly pull together a ppt for presentation at our 1:00PM Meeting today. Clive from Vertex will be on the phone to speak to the specific technical aspects of well suspension and abandonment. Erika if there is time it would also be helpful if we could take five min to discuss logistics for the Old Crow Meeting the week of July 20th so we can confirm date etc.	N/A	E00810_RE_ Vuntut Gwitchin First Nation questions re COGL well maintenance program (10) 200709_Chance_DO_Project_Vuntut Gwitchin First NationMeeting_July2020_v0.1.pptx
E00813	09-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Justin Page, Tania Salerno, Clive Mountford	Engagement/Consultation DO Project Meeting Coordination/Planning	Hemmera apologized for sending the wrong version and asked recipients to please use the newly attached version for review. There were a few small corrections to some of the details around the wells. There may be further technical clarifications during the Meeting and we will send out a correct and accurate ppt after the Meeting along with a Meeting summary and record of action items for your review.	N/A	E00813_RE_ Vuntut Gwitchin First Nation questions re COGL well maintenance program 200709_Chance_DO_Project_Vuntut Gwitchin First NationMeeting_July2020_v0.2.pptx
E01186	09-Jul-20	Meeting	N/A	Vuntut Gwitchin First Nation	N/A	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Justin Page, Tania Salerno, Clive Mountford	DO Project Engagement/Consultation	The purpose of this Meeting was for Chance to provide an overview of the proposed Eagle Plain Well Maintenance Project and to answer initial questions provided by Vuntut Gwitchin First Nation. Additional clarity around the Project would allow Vuntut Gwitchin First Nation to provide more official feedback on the Project description at a later date.	N/A	E01186_200709_Vuntut Gwitchin First Nation-Chance_Meetingsummary_July09_v0.3_DRAFT.docx
E00774	10-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Derek Fraser	Engagement/Consultation DO Project	As was discussed in our July 9th Meeting, I am following up with Vuntut Gwitchin First Nation's information requirements related to Chance's proposed well maintenance program. The attached word file allows for Chance to respond directly within the document.	N/A	E00774_Fwd_COGL Well Maintenance Program - Vuntut Gwitchin First Nation information requirements.msg 2020-07-10 Vuntut Gwitchin First Nation COGL Well Maintenance.pdf 20200710 Information Requirements for COGL Well Maintenance Program.docx
E00809	10-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project Meeting Coordination/Planning	Please find attached our COVID health and safety policy for community Meetings. This template was created at the height of COVID in April so some of the information related to whether or not the virus is airborne may be a bit dated, but as of this week the guidance from the BC CDC had not yet been changed so we are proceeding as is. This has been vetted by our HS Director and our external HS consultants. If there are any additional considerations you would like us to include for Old Crow please let me know as we do have the ability to be flexible to accommodate local conditions. If you have some time today or lets connect to discuss logistics and agenda for the Meeting. I am mostly clear but having to leave work early (3:00PM) most days to accommodate shortened summer camp hours for the kids this year.	N/A	E00809_RE_ DO Workover Letter - Vuntut Gwitchin First Nation NR COVID-19 Community Meeting Procedure_ss.docx
E00707	13-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Hemmera has prepared a draft report on implementation of Vuntut Gwitchin First Nation and Chance Engagement and Communication Plan for Vuntut Gwitchin First Nation and Chance to review. This report summarizes Meetings/correspondence that have occurred between Vuntut Gwitchin First Nation and Chance since completing the 2019 Annual Report. I have attached the draft as a Word Document, if both Vuntut Gwitchin First Nation and Chance could make revisions to that document in tracked changes, that would assist me in creating a final version. If there are any issues that arise between parties' revision, we can address them via email or a quick call. Once revisions have been incorporated and the document is considered final by Vuntut Gwitchin First Nation and Chance, I will send the final version to both parties to sign. I have also attached, as a pdf, a draft of Vuntut Gwitchin First Nation and Chance's Engagement Log which functions as Appendix D for the report. Please complete reviews by , July 24th. Reminder that reports need to be signed and submitted to Yukon Government on July 31st.	N/A	E00707_DRAFT 2020 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - For Review(0) 200713_Plan Implementation Report_Vuntut Gwitchin First Nation_DRAFTv0.3.docx 200713_AppendixD_Vuntut Gwitchin First Nation_EngagementLog_DRAFT.pdf

E00798	13-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Derek Fraser	Engagement Reports/OIC Requirements	Thank you very much for your feedback. We will gather up the information to respond to you as soon as possible. Would we be able to connect this week to discuss the community Meeting in Old Crow, understanding that it won't go ahead until your questions have been responded to (as per your letter). In the event that the responses are able to be provided it would be helpful to discuss logistics as well as your thoughts on the agenda, either for the 23rd or a later date. I am relatively clear and will do my best to accommodate your availability.	N/A	E00798_RE_ COGL Well Maintenance Program - Vuntut Gwitchin First Nation information requirements
E00712	14-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	No additions besides the dates for the workshop were November 26 & 27, 2019	N/A	E00712_RE_ DRAFT 2020 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - For Review
E00779	16-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project	NR staff have been working to find accommodations for our reps to attend Chance's proposed community Meeting July 23 in Old Crow, but there is absolutely nothing available for those dates.Vuntut Gwitchin First Nation requested at our phone call regarding the well maintenance work that Vuntut Gwitchin First Nation's questions addressed prior to a community Meeting. With the Meeting only a week away, would you be able to provide a response on the community Meeting date and the timeline for Chance's response to Vuntut Gwitchin First Nation's questions on the well maintenance program by the end of today so Vuntut Gwitchin First Nation can plan accordingly?	N/A	E00779_Fwd_ Well Maintenance questions and community Meeting
E00768	17-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation Meeting Coordination	Thanks for your efforts to find accommodation for your reps to attend the planned community Meeting in Old Crow on July 23. We are eager to be able to come to the community and share information about the Well Maintenance Project planned for the winter of 2020-2021. To that end, Chance has been able to make adjustments to its accommodation needs which has freed up accommodation space for your representatives. Greg or Cindy have the details about the accommodation so please contact them to firm up the arrangements. From what I have been told, there are now two beds available to your committee representatives. Either later today or early next week, Hemmera will send copies of the communication materials that we plan on using. Greg and Cindy have booked the John Tizya Centre for an outdoor Meeting, but as contingeNorthern Cross Yukon if the weather is poor, the Community Hall is also booked. It is an open house which hopefully meets the protocols of COVID gatherings and the time is from 2:00PM to 6:00PM PDT. With respect to your request on July 10 to have the responses to your questions submitted prior to the open house - yes those answers are in development and we will send them for your review early next week. we definitely fully intend on complying with your request that the Natural Resources Committee has Chance's response prior to the Open House. Importantly, we do need to submit the application for the well maintenance program to the Dawson Yukon Environmental Socio-economic Assessment Board DO as soon as possible in order to have sufficient time to negotiate a Benefits Agreement, obtain a variety of permits and operating licenses, and contract the services and suppliers needed to do the required work. As such we will need to submit the application to the Dawson DO very shortly after you receive our responses. I have copied Shena and Calista at Hemmera so they are aware of this communication. Shena is likely travelling to Old Crow for the Open House with Greg and Cindy. We are also expecting that a biologist working on this file with EDI will be attending as well since we expect interest and questions to several valued components, notably caribou, from the community members. Please let me know if this approach works for you and I hope you have a good weekend.	N/A	E00768_Community Meeting in Old Crow July 23.msg
E00769	20-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning Engagement/Consultation	We are going to postpone our community engagement due to respect of our lost in our community. I will be sending you final response to Vuntut Gwitchin First Nation questions and Final draft of the application to Dawson DO shortly.	N/A	E00814_YOC Open House
E00814	20-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Nathan Aasman	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Tania Salerno, Clive Mountford, Shena Shaw (Hemmera)	Engagement/Consultation DO Project	attached is a draft summary of the call we had on July 9th. I retained the original action items from the call. However, I adjusted due dates for some seeing that the Open House in Old Crow was cancelled this morning.	N/A	E00769_Draft summary of Vuntut Gwitchin First Nation_Chance July 9 Meeting.msg 200709_Vuntut Gwitchin First Nation-Chance_Meetingsummary_July09_v0.3_DRAFT.docx
E00815	21-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning Engagement/Consultation	Thank you for postponing Chance's Meeting out of respect for the community's time of mourning. Please keep me updated on next available dates when Chance has had a chance to discuss. I look forward to reviewing Chance's final Project draft and the response to Vuntut Gwitchin First Nation's questions.	N/A	E00815_Re_ YOC Open House
E00711	22-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00771	22-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project	Please see attach for your review, please let us know if you have any questions or Natural Resources Committee want to set up a call to discuss any details. We have few Environmental Consultants involved developing the application, so if you need to speak directly, please don't hesitate to reach out. Chance is expected to submit this into Dawson DO by end of this week or early next week.	N/A	E00771_FW_Dawson Do Application.msg 200721_Chance_Yukon Environmental Socio-economic Assessment Board_PP_Draft.docx Fig2_1_104709_01_Overview_200522.pdf
E00778	22-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project	See attached Chance Response to Vuntut Gwitchin First Nation Information Request	N/A	E00778_FW_ Vuntut Gwitchin First Nation IR Response_ 200721_Response to Vuntut Gwitchin First Nation Questions July 21
E00714	24-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A

E00725	24-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation Meeting Coordination	As part of the Engagement and Communication plan, Vuntut Gwitchin First Nation Oil and Gas Policy, and Yesaa process, we would like propose a open house , August 5th in community of Old Crow. With anticipating going into Stage 3 of Covid rules, it will allow us to provide indoor open house on the workover Project with our consultants. This would be great opportunity to inform the Citizens on what is happening in Eagle Plains area prior to GA on August 6,7 & 8. If not, we would be happy to provide a presentation at the GA as well. With the partnership with Natural Resources Committee, it will be really important for both parties to provide an update and details to Chance's application to Dawson DO. As you are aware, I was in Old Crow and had a few questions on what we are doing in Eagle Plains. It also resulted to meet NYRRC on Dempster Highway next if everything goes as plan. Please let me know what your thoughts are and we do look forward engaging everyone.	N/A	E00725_Fwd_ Open House in Old Crow
E00713	27-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	My apologies for not sending this reminder earlier in the week, but I wanted to check-in and see how the review of the draft engagement report was fairing? I also want to acknowledge my typo below. These reports are due to Yukon Government July 31, 2020. Not 2019. There is no time travel involved.	N/A	E00713_DRAFT 2020 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - For Review
E00726	27-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination	I have put this Proposal forward to Vuntut Gwitchin First Nation Executive as they are responsible for overseeing the GA. I will let you know right away. Will all Chance representatives (including consultants) be coming from Whitehorse? Will materials be advanced to Vuntut Gwitchin First Nation ahead of the proposed Meeting?	N/A	E00725_Fwd_ Open House in Old Crow
E00772	27-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project Meeting Coordination	We will have people from Whitehorse coming to the GA or prior to GA, which ever we decide on doing public engagement. Vuntut Gwitchin First Nation has everything already as per materials. We don't have any other documentation.	N/A	E00772_Open House in Old Crow.msg
E00773	27-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project Meeting Coordination	I have put this Proposal forward to Vuntut Gwitchin First Nation Executive as they are responsible for overseeing the GA. I will let you know right away. Will all Chance representatives (including consultants) be coming from Whitehorse? Will materials be advanced to Vuntut Gwitchin First Nation ahead of the proposed Meeting?	N/A	E00772_Open House in Old Crow.msg
E00770	28-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Calista Morrison (Hemmera), Calista Morrison (Hemmera)	Engagement/Consultation DO Project	Please see attach appendices for our application on the workover.	N/A	E00770_FW_Appendices for Workover Application.msg Northern Cross Yukon 2014 Well Site and Road Heritage Review.pdf Spill Response Plan.docx MATRIX_HROA_Abridged_for_Yukon Environmental Socio-economic Assessment Board.pdf; Appendix A-Yukon Government Letter To Chance.pdf
E00715	29-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project	Vuntut Gwitchin First Nation has reviewed Hemmera's detailed report of Engagement Activities. We have edits but this won't be finalized in time for the July 31 deadline. I am not sure what the alternative is under the circumstances, but we hope to have this work complete next week.	N/A	E00715_Re_ DRAFT 2020 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - For Review (2)
E00716	29-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project	In the past we've submitted these reports to Derek Fraser, Director of Oil, Gas and Mineral Resources at Yukon Government. I will send an email to him right after this, seeking his advice. I'll cc yourself and the Chance team.	N/A	E00716_RE_ DRAFT 2020 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - For Review (3)
E00717	29-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Derek Fraser, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project	Hemmera is currently working with Vuntut Gwitchin (Vuntut Gwitchin First Nation) and Chance to finalize their annual report of engagement activities under the Vuntut Gwitchin First Nation and Chance Communication and Engagement Plan. Vuntut Gwitchin First Nation reached out to us this morning indicating that they have reviewed Hemmera's report. However, they have edits and suspect the report will not be finalized in time for the July 31st deadline. Once Vuntut Gwitchin First Nation has finished their review, Vuntut Gwitchin First Nation and Chance will have to review revisions by either party and finalize the report. We hope to have this work complete by next week. Are there any alternatives under these circumstances?	N/A	E00717_DRAFT 2020 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - Submission Date
E00718	29-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project	Yes, my thought was that Vuntut Gwitchin First Nation could submit our edits directly to Derek once they are finalized.	N/A	E00718_Re_ DRAFT 2020 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - For Review (4)
E00719	30-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Derek Fraser	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Derek Fraser, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	I can grant an additional week – please submit the annual report by end of business day on , August 7.	N/A	E00719_RE_ DRAFT 2020 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - Submission Date
E00720	30-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Derek Fraser, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Thank you very much – we greatly appreciate this flexibility.	N/A	E00720_RE_ DRAFT 2020 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - Submission Date (5)

E00721	30-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	You'll see I just an email to Derek thanking them for the one week extension. So now we have until end of day August 7th. Do you know when you'll be able to send the Vuntut Gwitchin First Nation edits? I know everyone is busy right now, but could you also send several date/time options for next week. Just in case we need a call to help us all finalize the report.	N/A	E00721_RE_ DRAFT 2020 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - For Review (6)
E00722	30-Jul-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Thank you for taking the lead on looking into this matter. After further consideration of the task at hand and in the interest of time, it would be best if Chance remove the Vuntut Gwitchin First Nation signature block from the report and submit it without edits from Vuntut Gwitchin First Nation. While there are no significant concerns with the body of the report or consultation record, our choice of language to describe activities over the past year would be different.	N/A	E00722_RE_ DRAFT 2020 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - For Review (7)
E00723	31-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Thanks for letting us know Vuntut Gwitchin First Nation's wishes. I will actually remove both signature blocks and submit the report to Derek as a Draft. I'm just tidying up the formatting now and will be sending it to Derek shortly. Vuntut Gwitchin First Nation and Chance will be cc'ed.	N/A	E00723_RE_ DRAFT 2020 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - For Review (8)
E00724	31-Jul-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Derek Fraser, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Thank you again for your offer to extend the deadline for us to incorporate Vuntut Gwitchin First Nation's (Vuntut Gwitchin First Nation) revisions in Hemmera's draft report. Unfortunately one week would not suffice as they are dealing with a number of other competing priorities. Please see the attached email from Erika Tizya-Tramm that describes this. Please accept this draft without signature blocks as the submission for 2020 Annual Report on the Implementation of the Vuntut Gwitchin First Nation and Chance Engagement and Communication Plan. Should Vuntut Gwitchin First Nation wish to provide edits at a later date we would be happy to incorporate those and prepare a final report, including signatures, for submission to Yukon Government.	N/A	E00724_2020 Annual Report - Vuntut Gwitchin First Nation and Chance Oil and Gas Engagement and Communication Plan 200721_Plan Implantation Report_Vuntut Gwitchin First Nation_DRAFTv0.4wAppendixD.pdf RE:DRAFT 2020 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - For Review
E00727	03-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project Meeting Coordination	Vuntut Gwitchin First Nation Executive advised me that any engagement activity with the community around the time of Vuntut Gwitchin First Nation's General Assembly is not a good time. Executive also advised me that while presentations by external entities and partners were supported in the past, this year and going forward the General Assembly will be focused to Vuntut Gwitchin First Nation business only. This is good to know for future reference. Please let me know what Chance's thoughts are for next best dates. If our August 5 Cooperation Agreement Meeting date goes ahead, we can discuss community engagement dates at that time too.	N/A	E00725_Fwd_ Open House in Old Crow
E00828	05-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00816	07-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation Meeting Coordination/Planning	This email is intended to give you early notice that Chance has not yet submitted our Well Maintenance Program Project Proposal to Yukon Environmental Socio-economic Assessment Board due to evolving discussions with the regulator. The amendments are being incorporated into the Project Description and effects assessment over the next week or two as we manage vacation absences. Once updated, we will share the updated Yukon Environmental Socio-economic Assessment Board submission with you to review. I suggest that a follow up conference call or Microsoft Teams Meeting be arranged to address your questions or respond to your comments to the amendments.	N/A	E00816_Well Maintenance Program amendments (2)
E01005	11-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Project Description/Activities	Email read receipt	N/A	E01005_Fwd_ Read_ Well Maintenance Program amendments.msg
E00829	17-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	I have confirmation from the Natural Resources Committee and legal that they are available August 20 1:30-4:00PM PST. Does this still work for Chance and your legal?	N/A	E00828_FW_ Cooperation Agreement discussions
E00830	17-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Robert Froehlich	DO Project Meeting Coordination/Planning	It does work for us. I will set up a Microsoft Teams Meeting. Please let me know who will be participating from the Vuntut Gwitchin First Nation so I can send out a meeting invitation.	N/A	E00828_FW_ Cooperation Agreement discussions
E00833	17-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Robert Froehlich	DO Project Meeting Coordination/Planning	Apologies, Vuntut Gwitchin First Nation's legal updated me just now that he is available the morning of August 19, morning of August 20 or anytime August 21. What is your team's preference?	N/A	E00828_FW_ Cooperation Agreement discussions
E00926	17-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	Old Crow continues to be a busy little place, especially now with Fall here. We also had a productive GA last weekend. Thank you for the update regarding the Well Maintenance Program Project. I will keep an eye out for the new draft. Once Vuntut Gwitchin First Nation has had a chance to review, we can discuss how best to address any new questions/comments Vuntut Gwitchin First Nation may have.	N/A	E00926_Re_ Well Maintenance Program amendments
E00831	18-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Robert Froehlich, Katrijn Thys	DO Project Meeting Coordination/Planning	Based on feedback, I suggest that we have the Cooperation Agreement discussion of morning. Can I ask you to set up the Microsoft Teams Meeting please since you know who needs to be included from the Vuntut Gwitchin First Nation perspective. I have copied everyone on my side so they are in the loop and aware of the suggested timing for .	N/A	E00828_FW_ Cooperation Agreement discussions

E00832	18-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Robert Froehlich, Katrijn Thys	DO Project Meeting Coordination/Planning	I will look into how to set up the Microsoft Teams Meeting with all included.	N/A	E00828_FW_ Cooperation Agreement discussions
E00962	18-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance)	DO Project Engagement/Consultation	We would like to provide an overview with an open house in Old Crow on August 27th on the Workover Project that will be submitted to Dawson DO. Our plan is to have full day of open house at the community Centre for everyone with poster and materials that explains the Project this winter. We plan to have EDI rep for environment/wildlife information, Hemerra reps x 2 for communication, Cindy and myself. Chance is hoping we can do this jointly with Natural Resources Committee.	N/A	E00962_FW_ Public Consultation.msg
E00827	21-Aug-20	Meeting	N/A	Vuntut Gwitchin First Nation	N/A	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Esau Schaeffer, Roger Kiykavitchik, Kathering Peters, Kris Statnyk (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00963	24-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance)	DO Project Engagement/Consultation	Thank you for notifying us of Chance's plans to hold a community engagement session in Old Crow. Unfortunately the last two proposed dates did not transpire due to conflicting community priorities – the first being multiple community funerals and the second being Vuntut Gwitchin First Nation's annual General Assembly. The Committee is waiting to receive a copy of the revised Project Proposal in time for them to adequately review and address any new issues with the amendments prior to a community engagement session. Unfortunately some of our key representatives have prior commitments that prevent them from attending this engagement session.	N/A	E00962_FW_ Public Consultation.msg
E00964	24-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance)	DO Project Engagement/Consultation	We have push back the engagement session to September 3rd in Old Crow in order to get update Proposal , plus to complete our community posters and information for the Project. Hope this new date works better for representatives. We will be providing the Project Proposal soon.	N/A	E00962_FW_ Public Consultation.msg
E00965	26-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance)	DO Project Engagement/Consultation	Would you please send me the details of Chance's open house? Will your representatives be flying up on September 3 and holding an open house in the late afternoon/evening or will they be coming up September 2 and holding an open house for the full day of September 3? This would help us with coordinating Vuntut Gwitchin First Nation representatives travel.	N/A	E00962_FW_ Public Consultation.msg
E00966	27-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance)	DO Project Engagement/Consultation	We have now confirm our plans and the following is our travel and open house plans; YXY – YOC , September 2nd Open House , September 3rd – 3:30 – 7:30 (package food/drinks) YOC – YXY , September 4th. The following will be attending the Open House, Todd Mohan EDI, Shena Shaw (Hemmera) Hemmera, Cindy and myself. We are expecting to have the revised draft Project submission sent to Vuntut Gwitchin First Nation/Natural Resources Committee today or tomorrow morning. We will be bring posters, 1 pager fact sheet and maps for Vuntut Gwitchin First Nation Citizens to review. We look forward engaging folks in Old Crow. All procedures for Covid will be followed during this visit to Old Crow.	N/A	E00962_FW_ Public Consultation.msg
E00967	27-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation	This looks good, thank you very much for providing me with the details. We will start coordinating on our end.	N/A	E00962_FW_ Public Consultation.msg
E00968	27-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), Todd Mahon	DO Project Engagement/Consultation	Thank you for sharing Chance's open house plans, much appreciated. Just looking at what you are proposing here, do you think we could take the opportunity to meet as a group prior to your 3:30 open house? Maybe we could meet at 1:30? This would be with the Natural Resources Committee and NR technical reps along with your reps to discuss any questions Vuntut Gwitchin First Nation may have with respect to the revised Project Proposal .	N/A	E00968_Re_ Public Consultation.msg
E00980	27-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), Todd Mahon	DO Project Engagement/Consultation	Yes we should have a Meeting, let me confirm with you soon. Just waiting for confirmation with NYRRC on a time on September 3rd	N/A	E00980_RE_ Public Consultation (77).msg
E00870	28-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation	Email read receipt	N/A	E00870_Read_ Chance Eagle Plains Well Maintenance - Draft Yukon Environmental Socio-economic Assessment Board Project Proposal REVISED (72)

E00911	28-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Project Description/Activities	Further to Richard's email dated August 7th (attached), Chance (Chance) has made a few revisions to their Project Description for the Designated Office Evaluation of their proposed Well Maintenance Program. As a result of those changes, Hemmera has also revised the effects assessment sections of the Project Proposal . Below are the reasons for the revision that have been provided to us by Chance and a brief summary of the amendment itself: 1. Ongoing conversations between Chance and Yukon Government, Oil and Gas Branch (Yukon Government) have necessitated changes. While Chance was previously of the impression wells could continue to be suspended, Yukon Government is now directing Chance to conduct inspection and maintenance activities for all eight suspended wells and then abandon those wells or bring them into active status (i.e., end the period of well suspension). Chance is now proposing to abandon six wells (i.e., M-59, M-08, J-19, G-08, B-73, and H, 28) and to bring the remaining two wells (i.e., A-25 and E-78) into active status as deep-injection wells. Waste fluid produced during the abandonment of the six wells can then be disposed of via injection into the deep-injection wells. No oil or gas is expected to be produced from the two wells proposed to be activated; they would specifically be used for disposal of waste fluid from activities associated with these maintenance activities. (See sections 2.1.4 and 2.1.5 for further description) 2. At this time, Chance cannot confirm whether it will use the Eagle Plains Hotel or the existing Chance Camp for housing workers over the duration of the Project. The decision to utilize the Eagle Plains Hotel or the Chance Camp will be made when the Project schedule is finalized. It will also have to take into consideration the Hotel's ability to accommodate Chance workers over the full duration of the Project as well as COVID-19 related self-isolation requirements at that time. As a result both options are considered in the effects assessment for the housing of the Project workforce. (See sections 2.2 and 2.3 for further description) 3. When the Chance field team were at Eagle Plain early August, they observed that the route used to access M-59 would require realignment of the final portion of Blackie Winter Road. The section of the original route that proceeds north for the final kilometer is not ideal for traffic due to steeper terrain. The steeper route would result in a significant risk to the trucks bearing heavy loads, fuel supply, and other fluid handling shipments. Chance is proposing shifting the final portion of Blackie Winter Road east of the original route in order to attain a much gentler gradient.	N/A	E00911_Chance Eagle Plains Well Maintenance - Draft Yukon Environmental Socio-economic Assessment Board Project Proposal REVISED (75) Fwd: Well Maintenance Program amendments.msg 200828_Chance_Yukon Environmental Socio-economic Assessment Board-DO_ProjectProposal _REVISED.pdf
E00956	28-Aug-20	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Cooperation Agreement	No official record.	N/A	E00956_Communications Log entry
E00969	28-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), Todd Mahon, Clive Mountford	DO Project Engagement/Consultation	We can confirm 1:30 pm Meeting with Vuntut Gwitchin First Nation/Natural Resources Committee in Old Crow. Could we use the Vuntut Gwitchin First Nation boardroom? We also need a speaker phone so we can have Clive and Richard on line for any technical information. We look forward seeing everyone up in Old Crow!! I will have Shena or Calista send a draft agenda.	N/A	E00968_Re_ Public Consultation.msg
E00854	31-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	I was asked to send call-in details for this Meeting. I've also included below a brief agenda for the call. Let me know if there are any changes you'd like me to make, and feel free to forward this invite to other potential attendees.	N/A	E00854_Vuntut Gwitchin First Nation_NRC and Chance Meeting_ proposed Well Maintenance and Winter Activities Chance Eagle Plains Well Maintenance - Draft Yukon Environmental Socio-economic Assessment Board Project Proposal REVISED.msg
E00888	31-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation	attached is a word document with screen shots of the posters that Chance will have at the open house on . In order for the posters to be produced in time, we actually had to send files to the printers before the revised Project Proposal was completed. As a result, the posters are very high-level. They only show maps and pictures of Project equipment. I've also attached the flyer developed for Chance. With the revised Project Proposal now complete (i.e., finished and sent to you last), we plan on drafting a 1 to 2-page handout summarizing the Project. Once that's been drafted, I'll send you a copy.	N/A	E00888_Chance Communication Materials - Old Crow Sept 3 Open House 200826_Chance_OldCrow_ Sept3OpenHouseFlyer_Revised.pdf, 200831_ChanceDO_OldCrowSept3OpenHouse_Posters.docx
E00970	31-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), Todd Mahon, Clive Mountford	DO Project Engagement/Consultation	The Vuntut Gwitchin First Nation boardroom is not available for our Meeting on and the need for a speaker phone limits the options. I'll keep you update as I wait to hear back from the Youth Centre. Has Chance posted anything for the September 3 open house? I am getting feedback that there are no posts in the community advertising this Meeting and we are days away from community engagement. Does Chance require any support to do this? Maybe you can get something posted to Vuntut Gwitchin First Nation's Facebook page?	N/A	E00968_Re_ Public Consultation.msg
E00977	31-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Cindy Dickson (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), Todd Mahon	DO Project Engagement/Consultation	I spoke with Maylinda and she will post on the Vuntut Gwitchin First Nation bulletin board outside VVuntut Gwitchin First Nation's administration building. Can we ask you to take care of adding a post to Vuntut Gwitchin First Nation website or should I contact someone else? If someone can also do a post at the store that would be very helpful.	N/A	E00977_RE_ Public Consultation (63).msg
E00978	31-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), Todd Mahon	DO Project Engagement/Consultation	I will send this to Vuntut Gwitchin First Nation Information systems with you cc'd to get on the Vuntut Gwitchin First Nation Facebook page right away. If the flyers have been sent to Malinda just recently, then maybe they are working on this now. I will ask if our admin assistant can send a post to all our usual posting areas.	N/A	E00977_RE_ Public Consultation (63).msg
E00979	31-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Cindy Dickson (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), Todd Mahon	DO Project Engagement/Consultation	Thank you very much Erika	N/A	E00977_RE_ Public Consultation (63).msg
E01017	31-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Project Description/Activities	Thank you for sending these materials. We will work with what we have and when we get them. I'm sure the Meeting will be informative for the community.	N/A	E01017_Re_ Chance Communication Materials - Old Crow Sept 3 Open House (67).msg
Vuntut Gwitchin First Nation0266	31-Aug-20	Email	Outgoing	Vuntut Gwitchin First Nation	Calista Morrison (Hemmera)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Calista Morrison (Hemmera), Erika Tizya, Shena Shaw (Hemmera), Nathan Aasman	Chance Communication Materials - Old Crow Sept 3 Open House	Calista M. emailed Erika T., cc'd Shena S., Nathan A., Richard (Chance), Greg (Chance), and Cindy D. attaching a document with screen shots of the posters that Chance will have at the open house on , September 3, 2020. Calista M. also attached the flyer developed for Chance and stated they would send the revised Project Proposal soon.	N/A	N/A

Vuntut Gwitchin First Nation0267	31-Aug-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Calista Morrison (Hemmera), Erika Tizya, Shena Shaw (Hemmera), Nathan Aasman	Chance Communication Materials - Old Crow Sept 3 Open House	Erika T. emailed Calista M. and cc'd Shena S., Nathan A., Richard (Chance), Greg (Chance), Cindy (Chance) thanking them for the materials.	N/A	N/A
E00882	01-Sep-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation Meeting Coordination/Planning	Accepted Meeting for September 3 - Vuntut Gwitchin First Nation/Natural Resources Committee and Chance Meeting: proposed Well Maintenance and Winter Activities	N/A	E00882_Accepted_ Vuntut Gwitchin First Nation_NRC and Chance Meeting_ proposed Well Maintenance and Winter Activities
E00971	01-Sep-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), Todd Mahon, Clive Mountford	DO Project Engagement/Consultation	We have confirmed the John Tizya Centre for our Meeting venue. Realizing you have an open house at 3:30, how long are you available to meet? We will have the Natural Resources Committee, Vuntut Gwitchin First Nation technical, NR Standing Committee member, and our Firelight consultant in attendance. I can send an agenda once the details of this email are confirmed, but the main purpose of our Meeting is to hear from Chance the changes made from the old Project Proposal to the new Project and discuss the questions and comments Vuntut Gwitchin First Nation has from their review. I wanted to float a suggestion for your consideration: I was noticing in the Project Proposal that TH and Gwich'in Tribal Council are quite engaged with Chance on this Project. Would you be open to me extending an invite our neighboring First Nation reps to join this information session? I think there are benefits to us Meeting collaboratively on the Project Proposal . Please let me know your thoughts and I'll organize accordingly.	N/A	E00968_Re_ Public Consultation.msg
E00972	01-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), Todd Mahon, Clive Mountford	DO Project Meeting Coordination/Planning	I can suggest we can start 10 am Yukon time and with the option to reconvene at 1:15 if more time is needed. That would work for us, however we can stick to 1:30 pm Yukon Time and finish by 3 pm. Also we are happy to include other First Nation partners in this discussion. However I think NND should be invited if they are available as well.	N/A	E00968_Re_ Public Consultation.msg
E00973	01-Sep-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), Todd Mahon, Clive Mountford	DO Project Meeting Coordination/Planning	I didn't mean to suggest we wouldn't invite NND, but yes the idea is to have all parties meet collaboratively on this Project Proposal info session. Glad to hear this support. I'll extend the invite to those interested. Unfortunately we are pressed for time and 1:30 is the only time that works for us. We'll see you then at the John Tizya Centre.	N/A	E00968_Re_ Public Consultation.msg
E00974	01-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance),	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), Todd Mahon, Clive Mountford	DO Project Meeting Coordination/Planning	Just a quick note that Calista sent a Meeting invite and call in details for at 1:30 already but we are happy to delete invite that if you have other conferencing lines you would prefer. Alternatively, please feel free to forward that on to whomever you wish to be in attendance.	N/A	E00974_RE_ Public Consultation (59).msg
E00975	01-Sep-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), Todd Mahon, Clive Mountford	DO Project Meeting Coordination/Planning	Apologies for any confusion! Let's stick with Calista's previous invite. I will dig through my emails to respond and forward on to others.	N/A	E00974_RE_ Public Consultation (59).msg
E00976	01-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rick Nielsen (Chance), Todd Mahon, Clive Mountford	DO Project Meeting Coordination/Planning	No apologies necessary! There's been lots of emails flying around. Let us know if there are any adjustments to the invite or working agenda needed.	N/A	E00974_RE_ Public Consultation (59).msg
E01018	01-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	attached are some handouts that we are going to have available for the open house. They focus on describing the Project and explaining what some of the tests are. We may have another handout from Todd Mahon (EDI) that focuses on the Porcupine Caribou Herd. I'll also send that along once it's finished.	N/A	E01018_RE_ Chance Communication Materials - Old Crow Sept 3 Open House.msg 200901_ChanceDO_Project summaryHandout_v0.2.pdf
Vuntut Gwitchin First Nation0268	01-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Calista Morrison (Hemmera)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Calista Morrison (Hemmera), Erika Tizya, Shena Shaw (Hemmera), Nathan Aasman	Chance Communication Materials - Old Crow Sept 3 Open House	Calista M. emailed Erika T., cc'd Shena S., Nathan A., Richard (Chance), Greg (Chance), and Cindy D. attaching handouts that Chance will have at the open house on , September 3, 2020.	N/A	20200901-Vuntut Gwitchin First Nation0268A
E00884	03-Sep-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Clive Mountford	DO Project Meeting Coordination/Planning	N/A	N/A	E00884_Call in details
E00927	03-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Clive Mountford, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	I just wanted to send out the agenda and call-in details for the Meeting/conference call this afternoon. So it's fresh in everyone's minds! The call is this afternoon at 1:30 PM (PST) and expected to last an hour and a half. Call in details. So far the only participants that I am aware of are included in this email. If there are others please let me know, so that I can include them. This will also help me ahead of time for the Meeting summary.	N/A	E00927_RE_ Vuntut Gwitchin First Nation_NRC and Chance Meeting_ proposed Well Maintenance and Winter Activities
E00953	03-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance)	Geordan Clark	DO Project	It was nice to see you last night at the OCDC Meeting. As discussed, I am attaching the draft Project Proposal for the Well Maintenance Program. This is in the final stages of engagement and is anticipated to be submitted to the Dawson DO soon. Please let me know if you have any questions or comments.	N/A	E00953_Chance Oil and Gas - Draft Project Proposal Well Maintenance Program (54) 200828_Chance_Yukon Environmental Socio-economic Assessment Board-DO_ProjectProposal _REVISED.pdf
E01046	03-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	Thank you so much for helping with the phone troubles today! Much appreciated!	N/A	E01046_RE_ Call in details.msg
Vuntut Gwitchin First Nation0244	03-Sep-20	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Community Open House	Chance held an open house in Old Crow on September 3, 2020.	N/A	N/A
Vuntut Gwitchin First Nation0251	03-Sep-20	Community Event Flyer	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Open House Handout - Caribou	Chance provided a handout at the open house on September 3, 2020 in Old Crow. This hand out outlines the mitigation measures and potential effects on Caribou.	N/A	N/A

Vuntut Gwitchin First Nation0252	03-Sep-20	Meeting	N/A	Vuntut Gwitchin First Nation	N/A	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) Jeremy Brammer Esau Schaeffer Katherine Peter Jenna Lord Brandon Kyikavichik Caleb Charlie Roger Kaye Justin Page	Meeting on proposed Well Maintenance and Winter Activities	The purpose of this meeting was for Chance to provide an overview of revisions to the proposed Eagle Plain Well Maintenance and Winter Activities (i.e., amendments from original project description shared) and to answer questions from the Vuntut Gwitchin (Vuntut Gwitchin First Nation) Natural Resources Committee (NRC). This meeting was also held via conference call for remote attendees.	N/A	N/A
Vuntut Gwitchin First Nation0263	05-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Shena Shaw (Hemmera)	Greg Charile, Cindy Dickson (Chance)	Calista Morrison (Hemmera), Shena Shaw (Hemmera), nyrrc@northwestel.net (Jason)	Draft Project Proposal for the Well Maintenance Program	Shena S. emailed Jason and cc'd Greg (Chance), Cindy (Chance) and Calista M. attaching the draft Project Proposal for the Well Maintenance Program.	N/A	20200905-Vuntut Gwitchin First Nation0263A
Vuntut Gwitchin First Nation0254	07-Sep-20	Email	Incoming	Vuntut Gwitchin First Nation	Todd Mahon	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Shena Shaw (Hemmera), Nathan Aasman, Todd Mahon	Wildlife Issues regarding Well Maintenance Project	Todd M. emailed Greg (Chance), Cindy (Chance) Richard (Chance), Shena S., Nathan A., and provided notes on wildlife issues raised by Vuntut Gwitchin First Nation regarding the Well Maintenance Project. Todd M. provided recommendations on how to respond to these issues.	N/A	N/A
E01045	11-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Rosa Brown (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning Information Sharing Traditional Knowledge and Use	Sorry for the delay, here are the handouts from the open house last week. Also Rosa, if you wouldn't mind sending on that publicly available TK study on the Caribou you mentioned at the open house that would be most appreciated.	N/A	E01045_Handouts from Chance Meeting last week.msg 100920_ChanceDO_OldCrowSept3OpenHouse_AllHandouts.pdf
E00904	15-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation Project Description/Activities	We appreciated the time and feedback of the Natural Resources Committee while in Old Crow on September 3rd and did our best to incorporate what we heard during that trip. As you know, Chance's timeline for completing this work was tied to compliance with regulations, so in an effort to ensure that the maintenance activities could occur this winter Chance needed to submit the application last week. It was submitted late evening and today Hemmera received confirmation that the Project was on the Yukon Environmental Socio-economic Assessment Board registry. We acknowledge that you will have future comments on the Project as it progresses through the Yukon Environmental Socio-economic Assessment Board process. We continue to look forward to hearing your views and are happy to hold additional Meetings to discuss and answer any questions you may have. Please see the link to the registry here: Project 2020-0151 Eagle Plains Well Maintenance and Winter Activities	N/A	E00904_Chance DO Project (Well Maintenance) - Yukon Environmental Socio-economic Assessment Board Registry Information
E00857	16-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Derek Fraser, John Fox (Yukon Government), Josee Tremblay	Engagement/Consultation DO Project Cooperation Agreement	attached is the most recent agreement we have with signatures from all parties to section 68 of Yukon Oil and Gas Act. Hope this helps with the start of our discussion on the Workover Project. Please feel free to let us know what would be the next steps to begin our discussion.	N/A	E00857_Section 68 Agreement 2013 BA - Northern Cross-4 party.pdf
E00866	16-Sep-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation	Email read receipt.	N/A	E00866_Read_ Chance DO Project (Well Maintenance) - Yukon Environmental Socio-economic Assessment Board Registry Information
E01024	16-Sep-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Project Description/Activities	Thank you for the notification. Vuntut Gwitchin First Nation will be sending our list of questions/information request by end of week.	N/A	N/A
E00915	17-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Justin Page	DO Project Engagement/Consultation	Attached is a draft summary of the Meeting/conference call held on September 3rd. Please forward to others as you see fit and let me know if you see any corrections that need to be made.	N/A	E00915_Draft summary of Vuntut Gwitchin First Nation NRC and Chance Sept 3 Meeting 200917_Vuntut Gwitchin First NationNRC-Chance_Meetingsummary_Sept3_v0.2_DRAFT.docx
Vuntut Gwitchin First Nation0253	17-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Calista Morrison (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) Justin Page Shena Shaw (Hemmera) Nathan Aasman Calista Morrison (Hemmera)	Meeting on proposed Well Maintenance and Winter Activities	Calista M. emailed Erika T., Rosa B., Justin P., Richard (Chance), Greg (Chance), Cindy (Chance) cc'd Shena S. and Nathan A. attaching a summary from the meeting/conference call on September 3, 2020.	N/A	20200917-Vuntut Gwitchin First Nation0253A
E00883	18-Sep-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Derek Fraser, Josee Tremblay	DO Project Engagement/Consultation Meeting Coordination/Planning	I just wanted to follow up and hope everyone had a chance to review the last BA agreement. I would suggest that we set up a call sometime soon to discuss on how we want to proceed with section 68 negotiations. As I am away all next week, however I have include Richard and Cindy so they can be available if the parties do agree to discuss next steps. We look forward to your response.	N/A	E00883_BA Discussion
E00+A496:A594958	06-Oct-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00959	09-Oct-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project	I called your office and left a voicemail on your cell. For these initial discussions I am the contact person. Our questions are finalized and will form our submission into Yukon Environmental Socio-economic Assessment Board.	N/A	E00958_Fwd_ Benefit Agreement.msg
E00856	14-Oct-20	Phone Call	N/A	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project	No official record.	N/A	E00856_Update Vuntut Gwitchin First Nation Next Steps
E00855	15-Oct-20	Phone Call	N/A	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation DO Project	No official record.	N/A	E00855_Vuntut Gwitchin First Nation update

E00916	21-Oct-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation Information Sharing	I committed to following up with you about Vuntut Gwitchin First Nation's lead for the section 68 negotiations triggered by COGL's well abandonment program. I will continue as your point of contact, but the negotiating team is as such: Jordan Peterson, Vuntut Gwitchin First Nation Director of Intergovernmental Relations and Governance (IGR) as negotiations oversight and team lead; Rebecca Shrubb (Vuntut Gwitchin First Nation), Vuntut Gwitchin First Nation Associate Director of IGR assisting the team; Kris Statnyk (Vuntut Gwitchin First Nation), Vuntut Gwitchin First Nation legal representative; Erika Tizya, Vuntut Gwitchin First Nation Director of Natural Resources, responsible for Oil and Gas file.	N/A	E00916_FW_ Benefits Agreement - follow up (24)
E00929	22-Oct-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Benefits, Jobs, Contracts	Thank you for our phone call last. You had indicated in that call that Chance is looking to set a date for our first Meeting with the Parties to begin the section 68 discussions. Before setting this date and to help this initial discussion, the Vuntut Gwitchin First Nation team have a few questions: 1.What is the total cost of the Well Abandonment Project? 2.List the permit area in which each well is located, how many wells in each area and which wells? 3.Where are the wells in relation to NND and Vuntut Gwitchin First Nation's Traditional Territories and which of those wells are being abandoned versus prepared for deep injection? 4.Please send a list of potential job opportunities and training needs.	N/A	E00929_FW_ Benefits Agreement discussions - Vuntut Gwitchin First Nation questions (42)
E00930	23-Oct-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Derek Fraser	Meeting Coordination/Planning Jobs/Contracts DO Project Benefits/Capacity Agreement	Please see our response below in RED, if you have any questions please don't hesitate to call or email. The following are purpose dates for negotiation session with parties and I will include Yukon Director of Oil & Gas Derek Fraser in this email so we can start coordinating; October 28 9:00 am PST October 30 9:00 am PST November 2, 4, and 6 9:00 am PST Please let me know what will work for your team and I will send a formal invite and I would think we will do a zoom Meeting. Responses to questions: 1. Preliminary cost estimate is about $5mm. 2. (H-28 Permit 16), (J-19,M-08,G-08 SDL-022), (M-59 SDL-021), (B-73 Permit 19), (A-25 Permit 20), (E-78 Permit 14). 3. M-59 in NND and Vuntut Gwitchin First Nation overlap, other wells in Vuntut Gwitchin First NationTT only and Tetlit Gwich'in Council Secondary Use Area. 4. List of Personnel required.	N/A	N/A
E00940	28-Oct-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	We have some changes with proposed Project description with the workover application to Dawson DO. After more review of regulation and some internal company discussion, Chance needed to amend the application. It was recommend by Yukon Environmental Socio-economic Assessment Board Dawson DO to withdraw our current application and resubmit with the changes after having discussion with the affected First Nation partners. Chance would like to have follow up with a Meeting with Natural Resources Committee on this Project description changes next week. Please let us know when Natural Resources Committee is available? The only times Richard is not available next week is and 2 pm onward. I am not available on form 1-3 pm. Keep in mind next week we share same time zone with Northwest Territories/Alberta.	N/A	E00943_FW_ NRC Meeting (41)
E00941	28-Oct-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	The Committee has time on , November 3 in the morning, anytime from 9:30-11:30. Does this work for you?	N/A	E00943_FW_ NRC Meeting (41)
E00942	28-Oct-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	Thanks for the quick response. Yes we can start at 9:30 am on for an hour. I will send the invite out via email and call in number.	N/A	E00943_FW_ NRC Meeting (41)
E00943	28-Oct-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	Thank you for the invite. I will be extending the invite to our Firelight consultants for any adjustments needed to the IR report.	N/A	E00943_FW_ NRC Meeting (41)
E00944	28-Oct-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	Sounds good Erika! Chance whole team and our consultants will be in the call so if Firelight have any question(s) to address, it would be great time as well. Thanks and chat next . Are you sending the redraft of the ratification process from Natural Resources Committee by ?	N/A	E00945_FW_ NRC Meeting (39)
E00945	28-Oct-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00699	31-Oct-20	Meeting	N/A	Vuntut Gwitchin First Nation	N/A	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Cheryl Charlie, Brandon Kyikavichik, Katherine Peter, Sandra Charlie, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Emily Mann (Hemmera)	Engagement/Consultation Meeting Coordination/Planning	Vuntut Gwitchin First Nation Natural Resources Committee and Chance Meeting October 31, 2019 10:30AM-12:00 PM DRAFT AGENDA Chair: Minutes: 1. Chance Project Update 2. Review workplan and Vuntut Gwitchin First Nation Engagement Policy process (flowchart) 3. Project Proposal and Natural Resources Committee feedback 4. Process to reach Cooperation Agreement a. Draft Cooperation Agreement – issues b. Objectives setting c. Capacity Funding d. Third party support 5. Yukon Environmental Socio-economic Assessment Board Submission a. Yukon Environmental Socio-economic Assessment Board pre-submission b. Community engagement Role of Hemmera 6. Next steps	N/A	E00699_10-31-2019 NRC-COGL Meeting agenda DRAFT_

E00908	02-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation	After further consideration of the proposed Project (Eagle Plains Well Maintenance and Winter Activities) activities and the requirements of the Yukon Oil and Gas Act, Chance (Chance) has determined that changes are required to the Project submitted to the Dawson Designated Office on September 11, 2020 (Project #2020-0151). As such, Chance has decided to withdraw its Project Proposal and will be informing the Yukon Environment and Socio-Economic Assessment Board today, November 2, 2020. Chance intends to incorporate changes into a revised Project Proposal . Once the revised Proposal has been drafted, Chance will notify you by sharing a draft and requesting a Meeting to discuss the changes further. After Chance has discussed those changes with the Vuntut Gwitchin, the Project Proposal will be finalized and resubmitted to the Dawson Designated Office. Chance understands and appreciates that making changes to this Project a second time is requesting additional effort and capacity of the Vuntut Gwitchin. Chance looks forward to continuing to work with the Vuntut Gwitchin and will do its best to ease this process.	N/A	E00908_Chance DO Proposal Withdrawal - Vuntut Gwitchin Notification
E00913	02-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Katherine Peter, Brandon Kyikavichik, Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Esau Schafer (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation Meeting Coordination/Planning	Agenda for call tomorrow. Let me know if there are any changes you'd like me to make, and feel free to forward this agenda to other potential attendees. Call in details.	N/A	E00913_Chance_NRC Conference Call - Draft Agenda
E01190	03-Nov-20	Meeting	N/A	Vuntut Gwitchin First Nation	N/A	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance),	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Justin Page, Esau Schaeffer, Katherine Peter, Cheryl Charlie, Roger Kaye, Clive Mountford	DO Project Engagement/Consultation	The purpose of this Meeting was for Chance to provide the Vuntut Gwitchin First Nation Natural Resources Committee (Natural Resources Committee) with additional information pertaining to the withdrawal of its Project Proposal from the Dawson Designated Office.	N/A	E01190_201103_Vuntut Gwitchin First NationNRC-Chance_Meetingsummary_Nov03_v0.2.docx
E00914	09-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Justin Page	DO Project Engagement/Consultation	Attached is a draft summary of our Meeting last November 3rd. Please review and let me know if you have any corrections/revisions. Also, please feel free to forward this to other members of your teams. Hemmera and Chance staff are still working on drafting the new Project Proposal . When that is ready, perhaps at the end of this week, Hemmera will share the draft with Vuntut Gwitchin First Nation, and we can work on scheduling a time for a follow-up Meeting.	N/A	E00914_Draft Chance_Vuntut Gwitchin First Nation Nov 3 Meeting summary - for Review 201103_Vuntut Gwitchin First NationNRC-Chance_Meeting summary_Nov-3_v0.2.docx
E00960	10-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00961	10-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Cooperation Agreement	Yes, the Committee was scheduled to finalize our version of the Cooperation Agreement on , but due to tragic circumstances in the community, priorities quickly shifted in the interim and we will have to revisit our work on the Cooperation Agreement next week. Thank you for your understanding during this sensitive time for the community.	N/A	E00960_FW_ NRC Meeting
E01047	11-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya Justin Page	DO Project Engagement/Consultation Project Description/Activities	Thank you for providing a Meeting summary. Vuntut Gwitchin First Nation has reviewed the document and we don't have any revisions.	N/A	E01047_Re_ Draft Chance_Vuntut Gwitchin First Nation Nov 3 Meeting summary - for Review .msg
E00981	17-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Project Description/Activities Information Sharing	I am writing to follow up on Chance's revised well maintenance Project Proposal . I have it in my notes that Hemmera would have a draft for Vuntut Gwitchin First Nation's review Nov. 13. Any updates on when this might be ready?	N/A	E00981_RE_ Revised Well Maintenance Project Proposal
E00982	17-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Hemmera	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Project Description/Activities Information Sharing	The revisions are being finalized now. I expect that Hemmera will be in a position to share the revised document either later tomorrow or on morning. I have copied them so they can offer any correction to this view. The revisions relate to the Extended Flow Tests and will look a lot like the information in the Multi-year Exploration Project Description as it relates to extended flow testing.	N/A	E00981_RE_ Revised Well Maintenance Project Proposal
E00820	18-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Cooperation Agreement Meeting Coordination/Planning	While Greg is away from the office, I am following up an email from you sent to Greg last month regarding the Cooperation Agreement. Based on that email we were expecting something from the Natural Resources Committee on November 6. Please let us know what the current timing is for you to send this agreement.	N/A	E00820_FW_ Cooperation Agreement Status_
E00821	18-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Cooperation Agreement Meeting Coordination/Planning	Please refer to my November 10th email update to yourself and Greg.	N/A	E00820_FW_ Cooperation Agreement Status_
E00822	19-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	Thanks for the reminder. Based on your November 10 email, this week the Natural Resources Committee was planning to meet this week to deal with the Cooperation Agreement. Can you update me on the timing for some feedback please?	N/A	E00820_FW_ Cooperation Agreement Status_
E00823	19-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00862	19-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation	Email read receipt	N/A	E00862_Read_ Chance Designated Office Project Proposal - Revised Draft for Sharing with Vuntut Gwitchin

E00900	19-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation Project Description/Activities	Further to my email dated November 2nd (attached) and our Meeting November 3rd, Chance (Chance) has revised its Project Proposal (including updated Project Description and Effects Assessment) for Designated Office Evaluation. Below is the key Project component that has changed: •Extended Flow Testing: After maintenance activities are complete and depending on wellbore integrity (as confirmed through maintenance activities), Chance proposes to conduct Extended Flow Testing (EFT) on up to three of the wells which have the highest potential for natural gas reserve. The reason for this change is to allow Chance to gather important information about the nature of the natural gas resource accumulation and its productive capability. a.Wells proposed for EFT are M-59, M-08, and J-19 (see PDF attached for Figure 2-1). Please note, Figure 2-1 is currently being updated to reflect this change. b.Revert up to three wells to suspended status (if the EFT results prove to have sufficient resource). c.Abandon three to six wells (the three remaining wells (G-08, B-73, and H-28) will be abandoned and up to additional three wells may be abandoned if wellbore integrity is not confirmed or if EFT results prove insufficient resources). •Timelines: If work cannot be completed this winter season (due to low snow pack, COVID considerations, or permitting delays), Chance will complete the Project during the winter of December 2021 to March 2022. Additional detail is within the attached revised Draft Project Proposal . While revisions were made throughout the document, Section 2.1.3 is the substantive addition with respect to EFT. We've attached both a clean version and a version with tracked changes to facilitate your review. Given the very short time frame for winter work, Chance will be submitting the application to Yukon Environmental Socio-economic Assessment Board on , November 20th. Hemmera anticipates the Vuntut Gwitchin Natural Resource Committee requiring additional discussions with Chance to review these changes and look forward to scheduling a Meeting where we can discuss these matters further to support your future submissions to the YESAA process.	N/A	E00900_Chance Designated Office Project Proposal - Revised Draft for Sharing with Vuntut Gwitchin Chance DO Proposal Withdrawal -Vuntut Gwitchin Notification.msg 102229_Chance_Yukon Environmental Socio-economic Assessment Board_PP_Revised_v2.0.docx 201119_Chance_Yukon Environmental Socio-economic Assessment Board_PPRevised_v2.0_redline.docx Fig2_1_104709_01_Overview_200828.pdf
E00824	20-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00825	20-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00826	20-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E01025	20-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	N/A	DO Project Project Description/Activities	I completely understand your concerns regarding the very tight timeline. While Chance would like to submit as soon as possible, the submission will be delayed until mid next week. If Vuntut Gwitchin First Nation has any immediate concerns, please contact us and we'll make scheduling a Meeting a priority.	N/A	E01025_RE_ Chance Designated Office Project Proposal - Revised Draft for Sharing with Vuntut Gwitchin.msg
E00917	24-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Derek Frase	DO Project Engagement/Consultation	Could you please connect us with Jordan Peterson in order to set some dates for future discussion with next steps to negotiate section 68 of the workover Project. You also sent an another email wanting more details, however we can provide more details once the group gets together with a zoom/Microsoft team Meeting. I have included Derek Fraser in this email as Yukon is part of this negotiation process.	N/A	E00916_FW_ Benefits Agreement - follow up (24)
E00889	25-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Justin Page, Kris Statnyk (Vuntut Gwitchin First Nation), Rebecca Shrubb (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation DO Project Engagement/Consultation Project Description/Activities	Vuntut Gwitchin First Nation ("Vuntut Gwitchin First Nation") acknowledges receipt of Chance's ("Chance") revised Project Proposal on November 19, 2020 (the "Revised Proposal ") and notice of Chance's intention to submit the Revised Proposal to Yukon Environmental Socio-economic Assessment Board's designated office (the "DO") by "mid-week" of this week of November 23, 2020. In the current circumstances, Vuntut Gwitchin First Nation is not able to provide any detailed comments or views to Chance on the Revised Proposal within the very short timeline Chance has provided us for preliminary review before it submits to the DO. From our initial and limited review of the Revised Proposal , Vuntut Gwitchin First Nation has identified the following questions for clarification from Chance while reserving our ability to provide further and more detailed comments and views in the future once we have an opportunity to more fully understand the Revised Proposal : 1.What specific regulations does Chance rely for its assertion in the Revised Proposal that "wells which are converted to deep-injection wells are considered active" and that "if EFT is conducted on wells their status is considered active at which point they can be put into a suspended status for three additional years"? 2.Has Chance considered the potential interactions between EFT activities and birds, permafrost and air quality? The Revised Proposal continues to reject these candidate valued components for assessment despite the potential for interaction with EFT activities, particularly with respect to gas flaring. 3.Has Chance considered the potential impacts of EFT activities on caribou? The Revised Proposal identifies potential disturbance and localized effects on wildlife movement and distribution, but does not identify any effects on caribou. 4.Has Chance considered revising the COVID health and safety procedures due to increased number of personnel travelling to the Project site from out of territory and the changing context of the pandemic? Please be advised that these questions are in addition to outstanding questions and information requests previously sought by Vuntut Gwitchin First Nation on Chance's original Proposal to the extent they remain relevant to the Revised Proposal . Please also be advised by notice of this email message that I have been designated by Vuntut Gwitchin First Nation as the primary contact person in relation to all communications and engagement with Chance on a go forward basis. Until further notice, Chance is requested to direct all future correspondence and communications to me.	N/A	E00889_Chance Designated Office - Nov 19_ 2020 Revised Project Proposal
E00918	25-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson, Derek Fraser	DO Project Engagement/Consultation	As requested, I have included Jordan Peterson into this email to begin discussions towards section 68 negotiations. As you've stated, Vuntut Gwitchin First Nation's previous questions under the former well abandonment Project will need to be revisited after Vuntut Gwitchin First Nation has fully reviewed the new Project Proposal .	N/A	E00916_FW_ Benefits Agreement - follow up (24)

E00919	25-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson, Derek Fraser	DO Project Engagement/Consultation	Thank you for connecting me with Chance, really appreciate it. Greg, as Erika has stated through email and on your call in October I will be the lead for the Vuntut Gwitchin First Nation on the section 68 negotiations. As also communicated this morning I will be Vuntut Gwitchin First Nation's point of contact on all Chance communications and engagement on a go forward basis. Mahsi for also including Derek in the email Greg, we look forward to moving forward on discussions and planning some future dates that make sense. Derek, we should begin a new thread and include NND point person Skeeter Wright (First Nation of Na-cho Nyäk Dun) to begin assessing when we will need to meet to begin any discussions related to Chance Projects.	N/A	E00916_FW_ Benefits Agreement - follow up (24)
E00920	25-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Derek Fraser	Greg Charlie (Chance), Richard Wyman (Chance)	Derek Fraser, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Jordan Peterson	DO Project Engagement/Consultation Benefits/Capacity Agreement	Thanks, Jordan. I've brought Skeeter into the discussion by copying him on this response. My understanding as communicated in Erika's email earlier is that Vuntut Gwitchin First Nation is seeking a more comprehensive understanding of the details around the recent amendments to the well program following the withdrawal of the previous Project Proposal from the YESAA process earlier this month. I am prepared to enter Benefits Agreement discussions when the other parties are ready to do so.	N/A	E00916_FW_ Benefits Agreement - follow up (24)
E00921	25-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Derek Fraser, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Jordan Peterson	DO Project Engagement/Consultation Project Description/Activities	We are open and prepared to discuss any details of our proposed Project description that will be submitted to Dawson DO. We have indicated many times we need to work together as all parties to provide a common understanding with the right folks explaining the Project i.e. Engineers, Biologist etc. We have done a lot of work and prepared to address any items including the ecological values with our team. Again, we need to meet if we are going get a better understanding. For example, we had Todd Mohan from EDI at our public engagement in Old Crow (September 3rd) and he was a popular guy because his office (EDI) worked on Caribou, Fish, and Vegetation in the Project area. There was a lot of interest from the public on his work.	N/A	E00916_FW_ Benefits Agreement - follow up (24)
E00922	25-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Derek Fraser, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson, Skeeter Wright (First Nation of Na-cho Nyäk Dun)	DO Project Engagement/Consultation	It sounds like your looking to provide a common understanding to the parties before submitting your revised Proposal to the Dawson DO?	N/A	E00916_FW_ Benefits Agreement - follow up (24)
E00938	25-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance)	Jordan Peterson	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00923	26-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Derek Fraser, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	DO Project Engagement/Consultation	Yes, that would certainly benefit Chance and all parties if we can come up with common understanding. As you can appreciate we are pressured with time on many other fronts under the regulations and commitments with Yukon. However we have to manage to get it right for all parties and that has been Chance objective all along. We will get back to you very soon to address your concerns and I think it is important we address collectively with Yukon and First Nation partners prior to submission.	N/A	E00916_FW_ Benefits Agreement - follow up (24)
E00924	26-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Derek Fraser	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Derek Fraser, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson, Skeeter Wright (First Nation of Na-cho Nyäk Dun)	DO Project Meeting Coordination/Planning	My team would certainly welcome the opportunity to meet as a group on this matter.	N/A	E00924_FW_ Benefits Agreement - follow up
E00925	26-Nov-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Derek Fraser, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson, Skeeter Wright (First Nation of Na-cho Nyäk Dun)	DO Project Engagement/Consultation Project Description/Activities	It's great to hear Chance won't be submitting its new Proposal until any issues are dealt with, I'd also like to say mahsi for your considerate approach with Yukon First Nations regarding Chance's revised Project Proposal . Greg, given the objectives you've outlined below, when can the Natural Resources Committee expect Chance to organize a Meeting to bring a common understanding? Please ensure the organizing of such a meeting is in a different thread and communicated to me. It's important to ensure that we keep the threads of work separate and we look forward to setting up some of the logistics around the section 68 negotiations while we await a more comprehensive understanding of the Chance Proposal. Derek, is it a bad idea to have Yukon Government develop some of the processes involved in the negotiations?	N/A	E00924_FW_ Benefits Agreement - follow up
E01006	27-Nov-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Richard Wyman (Chance), Cindy Dickson (Chance), Hemmera	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Derek Fraser	DO Project Benefits/Capacity Agreement	Thank you Jordan, we are happy to continue to address any concerns in timely way. The following is our view of timelines in order to move forward. We would like to respond to Vuntut Gwitchin First Nation questions and concerns in our redraft submission and have our team work on that, with the hope to send another redraft to Yukon, Vuntut Gwitchin First Nation, NND, THFN and Gwich'in Tribal Council by end of next week. So that would take us into week December 7th ,this week we can have a group Zoom/Microsoft Team Meeting which Hemmera will assist in setting up. This will give everyone time to review our latest draft submission. I have included Hemmera folks in our email so they are in the loop with timelines. As stated we hope to address as much as we can prior to submission. We will certainly add more technical folks to our group Meeting in December 7th week to address any other concerns and questions. Also again, we are still sensitive to time, so we will do our best to get this done with reasonable timeframe for official submission.	N/A	E01006_RE_ Benefits Agreement - follow up.msg
E01016	01-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Justin Page	DO Project Engagement/Consultation Project Description/Activities	There are a number of conversations going on that include Chance and Vuntut Gwitchin First Nation, in an attempt to ensure we don't cross the different threads I wanted to respond to this email specifically to communicate what we have heard regarding the Chance revised Proposal . Greg, you've communicated in the last week that Chance and Hemmera will be hosting a Zoom/Microsoft Meeting with the affected Indigenous Governments and Yukon Government the week of Dec 7 to provide a common understanding of the Chance Nov 19, 2020 Revised Project Proposal ? Calista, are you against providing Vuntut Gwitchin First Nation feedback to our questions below by end of the week?	N/A	E01016_Re_ Chance Designated Office - Nov 19_ 2020 Revised Project Proposal (22).msg

E01019	02-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Cindy Dickson (Chance), Richard Wyman (Chance)	Jordan Peterson, Justin Page, Rebecca Shrubb (Vuntut Gwitchin First Nation)	DO Project Project Description/Activities	If I understand your email, you want to know if we will address Vuntut Gwitchin First Nation concerns and questions in our review of the revised draft submission. So the answer is yes, we are having our team of technical folks working on that as we email back and forth. It will be incorporated into the redraft for review and hopefully it will be done by end of this week. Nathan Aasman from Hemmera is facilitating the redraft and he can provide an update soon. Please refer to the email I sent November 27th as I was trying to layout the timeline. If it didn't come across that way I apologize.	N/A	E01019_RE_ Chance Designated Office - Nov 19_ 2020 Revised Project Proposal .msg
E00931	03-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson	Meeting Coordination/Planning DO Project Information Sharing	I believe Greg has separately addressed your questions, but I can add a little more information. My colleagues Nathan Aasman and Chris Lovatt are working on addressing the four questions in your previous email (dated November 25th). At this time, it likely won't be ready for tomorrow, but we will send it to you as soon as we can. While the responses are being integrated into the Project Proposal , when I send that draft, I will include a cover letter to highlight where the changes are (i.e., to facilitate your review). Our hope is to arrange a Meeting with Vuntut Gwitchin First Nation after that response is shared. It's possible that Meeting could take place late next week or perhaps the week after (week of December 14th–18th). Are there any items in your schedule and that of the Natural Resource Committee that we need to work around? You had mentioned that the questions in your November 25th email were in addition to others previously submitted by Vuntut Gwitchin First Nation. Would it be possible for you to compile Vuntut Gwitchin First Nation's comments into an updated document? I've attached a document that Chance and Vuntut Gwitchin First Nation had exchanged over the summer. However, in early October, Erika communicated to Greg that Vuntut Gwitchin First Nation's questions/comments at that time were finalized but would form Vuntut Gwitchin First Nation's submission to Yukon Environmental Socio-economic Assessment Board. If there were any new concerns/issues raised at that time, we might not have seen them yet. Moving forward, I'll make sure to address all communications with Vuntut Gwitchin First Nation to you. If you have a specific CC list you'd like me to follow, just let me know. In hopes of keeping the emails streams separate as you requested, I've confirmed with Chance the main contacts for the following items: •Cooperation Agreement (in relation to the "Eagle Plains Exploration Project for Executive Committee": Greg (Chance) •Benefits Agreement (in relation to the "Well Maintenance and Winter Activities Project for Designated Office"): Greg (Chance) •Engagement with respect to Chance Yukon Environmental Socio-economic Assessment Board applications: Calista Morrison (Hemmera)	N/A	E00931_Engagement - Chance Well Maintenance and Winter Activities Project for Designated Office .msg 200721_Response to Vuntut Gwitchin First Nation Questions July 21.docx
E01039	07-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project	It remains Vuntut Gwitchin First Nation's objective to find a common understanding in all Chance proposed Project activities in Vuntut Gwitchin First Nation Traditional Territory before submitting to Yukon Environmental Socio-economic Assessment Board. It's great to see Chance committed to addressing the questions and concerns that Vuntut Gwitchin First Nation has on the original and revised Proposal . Am I correct that if Vuntut Gwitchin First Nation provides our compiled comments into an updated document that Chance will not submit to Yukon Environmental Socio-economic Assessment Board until they are fully addressed?	N/A	E01039_RE_ Engagement - Chance Well Maintenance and Winter Activities Project for Designated Office (18).msg
E01040	09-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project	At this time, Chance is working on it's response to the questions issued in your November 25th email. Those issues/topics will be integrated into Chance's Project Proposal . We should be able to send the document to you tomorrow. Our apologies for the delay. It is our understanding that Yukon Government's expectations are for Chance to submit the Project Proposal to Yukon Environmental Socio-economic Assessment Board before December 31st. This is in order for Chance to demonstrate to Yukon Government that it is actioning Yukon Government's instructions. Chance does however look forward to working with the Vuntut Gwitchin First Nation in a collaborative and cooperative way in order to respond to Vuntut Gwitchin First Nation's comments. Parties can discuss these timelines and how best to achieve both Chance's and Vuntut Gwitchin First Nation's goals at our upcoming Meeting. Perhaps we can work on scheduling that Meeting? Would late next week work? Chance and Hemmera can be flexible to whatever time works best for you.	N/A	E01039_RE_ Engagement - Chance Well Maintenance and Winter Activities Project for Designated Office (18).msg
E00933	11-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Clive Mountford	Meeting Coordination/Planning DO Project	Meeting invitation for December 17, 2020 9-11 am.	N/A	E00933_FW_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities
E01038	11-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project	Vuntut Gwitchin First Nation looks forward to a response on our initial questions from our Nov. 25 email on the revised Project Proposal . I am glad to hear Vuntut Gwitchin First Nation's questions led to improvements in the revised Proposal . Regarding your request for Vuntut Gwitchin First Nation to compile and share our full, updated suite of questions/comments, is that with the understanding that these will all be addressed and incorporated into a final submission? Or, considering the tight timelines Chance is under with the Dec. 31 Yukon Environmental Socio-economic Assessment Board submission deadline, would it be more realistic to share those questions/comments related to the revised Project Proposal to be fully addressed and incorporated.	N/A	E01038_Re_ Engagement - Chance Well Maintenance and Winter Activities Project for Designated Office (17).msg
E01041	11-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project	If Chance will be sending the revised Proposal today we should set up the Meeting for some time next week, preferably morning from 9-11.	N/A	E01039_RE_ Engagement - Chance Well Maintenance and Winter Activities Project for Designated Office (18).msg

E01042	11-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project	My team members are incorporating some final comments from Richard and Clive Mountford from Vertex. Sorry, but it looks like we won't be able to get it to you today. We'll send the document along first thing morning. Apologies for this moving target and we really appreciate your patience. I've put a placeholder in Hemmera and Chance's calendars for next , December 17th. We can confirm meeting details once Vuntut Gwitchin First Nation has received the revised Proposal .	N/A	E01039_RE_ Engagement - Chance Well Maintenance and Winter Activities Project for Designated Office (18).msg
E01043	14-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Project Description/Activities DO Project	attached is the revised Proposal that Chance drafted in response to your November 25th questions. Below is a table which can direct you to where those changes are in the document. It's tough for me to answer your question below though. Perhaps that is an item better suited for an "in-person" conversation/discussion with Chance and my EPE colleagues (Environmental Planning and Ecology staff leading Proposal development)? It could be an agenda item for the proposed Meeting this ?	N/A	E01043_RE_ Engagement - Chance Well Maintenance and Winter Activities Project for Designated Office.msg 201211_Chance_Yukon Environmental Socio-economic Assessment Board_PP_Revised_v2.0_clean.docx
E00885	15-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Clive Mountford, Todd Mahon	DO Project Engagement/Consultation Meeting Coordination/Planning	attached is a draft agenda for the Meeting this December 17th. Please review and provide any revisions you would like me to make. I can them combine all changes into a final agenda. Jordan, please forward this email and attachment those from your team that you would like to attend. We can also update the attendees list for Vuntut Gwitchin First Nation with your feedback.	N/A	E00885_Chance and Vuntut Gwitchin First Nation Dec 17 Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities 201215_Vuntut Gwitchin First Nation-Chance_MeetingAgenda_Dec17_DRAFT_v0.1.docx
E00887	15-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Clive Mountford, Todd Mahon	DO Project Engagement/Consultation Meeting Coordination/Planning	Meeting Invitation for December 17, 2020 9-11 am. Draft agenda to follow in a separate email. Jordan, please feel free to forward this invite to anyone else on your team	N/A	E00887_Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities
E00895	15-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance)	Jordan Peterson, Skeeter Wright (First Nation of Na-cho Nyäk Dun), Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Justin Page, Derek Fraser	DO Project Engagement/Consultation Meeting Coordination/Planning	As was communicated in numerous emails over the last month from Chance, I wanted to send a follow up email to see if Chance still plans to host a Meeting to discuss the revised Proposal this ?	N/A	E00895_COGL Meeting - Dec 17
E00873	16-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation Meeting Coordination/Planning	Accepted Meeting for December 17- Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Proposal for Well Maintenance and Winter Activities	N/A	E00873_Accepted_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities (15)
E00874	16-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	N/A	Jordan Peterson	DO Project Engagement/Consultation Meeting Coordination/Planning	Accepted Meeting for December 17- Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Proposal for Well Maintenance and Winter Activities	N/A	E00874_Accepted_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities
E00893	16-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Kris Statnyk (Vuntut Gwitchin First Nation)	N/A	Kris Statnyk (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning Engagement/Consultation	Declined Meeting for December 17 - Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities	N/A	E00893_Declined_ FW_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities
E00934	16-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Kris Statnyk (Vuntut Gwitchin First Nation), Justin Page, Jordan Peterson, Todd Mahon, Clive Mountford	DO Project Meeting Coordination/Planning	Forwarding Meeting invitation for: December 17, 2020 9-11 am.	N/A	E00933_FW_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities

E01009	16-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Justin Page, Todd Mahon	DO Project Meeting Coordination/Planning	Hemmera said it was very strange that the invitation could not be forwarded. They said they would take a look at it and see if there's anything that could be changed with respect to its Meeting properties/settings. In the mean time, if you want provide your list to me, I can send the invite along! Greg's previous comments were related to conversations around the benefits agreements, however they may have pulled in the DO Project Proposal . Previous emails frequently mixed topics like the DO Project Proposal development, the benefits agreements, and the cooperation agreements. At this time, Chance would like to have a Meeting with Vuntut Gwitchin First Nation to discuss and focus on Vuntut Gwitchin First Nation's comments, Chance's responses, and the revised draft of the DO Project Proposal that was shared on , December 14th. This will help Chance prepare for its upcoming submission to Yukon Environmental Socio-economic Assessment Board (i.e., that will happen before the end of the year). If Chance were to arrange a Meeting with all parties, that Meeting would also have to include representatives from TH and GTC (and Tetlit Gwich'in Council) in addition to NND and Yukon Government. If there was/is interest in an all parties meeting, that could be arranged in the new year but would take much more coordination. Chance has Engagement Plans with NND, TH, and GTC (and Tetlit Gwich'in Council) that has guided its engagement and communications. If Vuntut Gwitchin First Nation, and/or other parties, is interested in coordinating more joint Meetings moving forward (e.g., does Vuntut Gwitchin First Nation want all Meetings with Chance to include NND and Yukon Government?), perhaps that could also be discussed in the new year?	N/A	E01009_RE_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities (10).msg RE: Benefits Agreement - follow up
E01010	16-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Justin Page, Todd Mahon, Clive Mountford	DO Project Meeting Coordination/Planning	The invites should go to: Erika Tizya-Tramm - nrd@Vuntut Gwitchin First Nation.net Justin Page - justin.page@thefirelightgroup.com Kris Statnyk (Vuntut Gwitchin First Nation) - kris@mandellpinder.com	N/A	E01009_RE_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities (10).msg
E01011	16-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	I just want to double check, does the invite in your calendar have a link for the Teams Meeting as well as call-in details?	N/A	E01011_RE_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities (12).msg
E01012	16-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Meeting Coordination/Planning	Yes it does. I had to scroll all the way down the page to find them, but they are there.	N/A	E01011_RE_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities (12).msg
E01013	16-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Tizya, Kris Statnyk (Vuntut Gwitchin First Nation), Justin Page, Todd Mahon, Clive Mountford	DO Project Meeting Coordination/Planning	For further clarification to my emails, attached is the email from Chance initial statements about Chance and all parties needing to come to a "common understanding". Vuntut Gwitchin First Nation understands the pressures you are under, and that its Chance objective to get it right for all parties, especially given the changes Chance is proposing to its Project and the increased pressure you are under from the order from 6 years ago. Vuntut Gwitchin First Nation continues to look forward to the importance of addressing concerns with Yukon First Nation partners prior to submission as described in the attached email.	N/A	E01013_Re_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities.msg
E01048	16-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Justin Page	N/A	Justin Page	Meeting Coordination/Planning	Meeting invite accepted	N/A	E01048_Re_ Event accepted_ FW_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities (9).msg
E01049	16-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Justin Page	Meeting Coordination/Planning	I just want to double check that the invite in your calendar has a Teams link as well as call-in details?	N/A	E01048_Re_ Event accepted_ FW_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities (9).msg
E01050	16-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Justin Page	N/A	Justin Page	Meeting Coordination/Planning	Yes, the invite has the Teams link and call-in details.	N/A	E01048_Re_ Event accepted_ FW_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities (9).msg

E01051	16-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Justin Page	Meeting Coordination/Planning	Okay, good! Thanks for letting me know.	N/A	E01051_RE_ Event accepted_ FW_ Chance and Vuntut Gwitchin First Nation Meeting - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities.msg
E00935	17-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Mike Chernoff	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Esau Schafer (Vuntut Gwitchin First Nation), Katherine Peter, Brandon Kyikavichik, Cheryl Charlie, Kris Statnyk (Vuntut Gwitchin First Nation), Robert Froehlich	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00957	17-Dec-20	Letter	Outgoing	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E01191	17-Dec-20	Meeting	N/A	Vuntut Gwitchin First Nation	N/A	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Justin Page, Clive Mountford, Todd Mahon	DO Project Engagement/Consultation	The purpose of this Meeting was for Chance and Vuntut Gwitchin First Nation to discuss the proposed Eagle Plain Well Maintenance and Winter Activities Project and previous questions submitted to Chance from Vuntut Gwitchin First Nation.	N/A	E01191_201223_Vuntut Gwitchin First Nation-Chance_Meetingsummary_Dec17_v0.3.docx
E00936	19-Dec-20	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Mike Chernoff	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Esau Schafer (Vuntut Gwitchin First Nation), Katherine Peter, Brandon Kyikavichik, Cheryl Charlie, Kris Statnyk (Vuntut Gwitchin First Nation), Robert Froehlich	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00886	23-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Justin Page, Clive Mountford, Todd Mahon	DO Project Engagement/Consultation	Attached is a draft summary of our meeting last , December 17th. Please review and let me know if you have any revisions I need to make. Also, I have one comment in the document which is actually a question for Richard. Lastly, as some people may already be out of the office, I will send a reminder about this draft summary in the new year. So that it doesn't get buried in inboxes.	N/A	E00886_Chance and Vuntut Gwitchin First Nation Dec 17 Meeting summary - Discussion of Yukon Environmental Socio-economic Assessment Board DO Project Proposal for Well Maintenance and Winter Activities - DRAFT for 201223_Vuntut Gwitchin First Nation-Chance_Meetingsummary_Dec17_v0.1_DRAFT.docx
E01007	23-Dec-20	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya, Justin Page, Clive Mountford, Todd Mahon	DO Project Meeting Coordination/Planning	Attached is a draft summary of our Meeting last , December 17th. Please review and let me know if you have any revisions I need to make. Also, I have one comment in the document which is actually a question for Richard.	N/A	E01008_Re_ Chance and Vuntut Gwitchin First Nation Dec 17 Meeting summary - Discussion of Yukon Environmental Socio-economic Assessment Board DOProject Proposal for Well Maintenance and Winter Activities - DRAFT for review (7).msg 201223_Vuntut Gwitchin First Nation-Chance_Meetingsummary_Dec17_v0.1_DRAFT_JP_ETT.docx
E00986	01-Jan-21	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Richard Wyman (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Jordan Peterson, Josee Tremblay	DO Project	Please call anytime on my cell or phone if need any information or an update. If you are in Whitehorse please stop by my office and I can provide you with more details and photos of the area we are talking about. Look forward working with you on this Project.	N/A	E00986_FW_ Section 68 Discussion (11
E00983	06-Jan-21	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Richard Wyman (Chance), Cindy Dickson (Chance)	Derek Fraser, Jordan Peterson	DO Project	Hope everyone had a relaxing holidays with family. Back to work and would like to request some dates for discussion on benefits agreement related to our workover Project currently in the Dawson DO process. We are mostly open for our first Meeting in then next 2 weeks, so if we can suggest a date that works, we will be happy to set up Meeting. We will get started by suggesting , January 14th at 10:00 am?	N/A	E00986_FW_ Section 68 Discussion (8
E00995	11-Jan-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance)	Jordan Peterson, Skeeter Wright (First Nation of Na-cho Nyäk Dun)	DO Project	That doesn't work for us either, we'll be in touch tomorrow with a more formal response and suggested path forward.	N/A	E00995_FW_ Section 68 Discussion.msg
E00996	11-Jan-21	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Richard Wyman (Chance)	Jordan Peterson, Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay, Derek Fraser	DO Project	Thanks for getting back and we will wait for your dates. We look forward getting this started soon.	N/A	E00995_FW_ Section 68 Discussion.msg
E00937	12-Jan-21	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance), Mike Chernoff	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Esau Schafer (Vuntut Gwitchin First Nation), Katherine Peter, Brandon Kyikavichik, Cheryl Charlie, Kris Statnyk (Vuntut Gwitchin First Nation), Robert Froehlich	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E01014	14-Jan-21	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Justin Page, Clive Mountford, Todd Mahon	DO Project Engagement/Consultation Project Description/Activities Meeting Coordination/Planning	Thank you for the Meeting minutes from our Dec. 17 discussion regarding the Yukon Environmental Socio-economic Assessment Board Project Proposal for Chance's Well Maintenance work. attached you will find Vuntut Gwitchin First Nation's revisions to the minutes.	N/A	E01014_RE_ Chance and Vuntut Gwitchin First Nation Dec 17 Meeting summary - DRAFT for review.msg 201223_Vuntut Gwitchin First Nation-Chance_Meetingsummary_Dec17_v0.1_DRAFT_JP_ETT.docx

E01015	15-Jan-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Erika Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Justin Page, Todd Mahon, Clive Mountford	DO Project Engagement/Consultation Project Description/Activities Meeting Coordination/Planning	Thanks for the revisions Erika! Richard, are you able to answer the question I've flagged for you? Then I can send folks a final/clean version.	N/A	E01014_RE_ Chance and Vuntut Gwitchin First Nation Dec 17 Meeting summary - DRAFT for review.msg
E00899	19-Jan-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	DO Project Engagement/Consultation	A brief update on Chance's proposed Eagle Plains Well Maintenance and Extended Flow Testing Project is provided below: • Project was submitted to the Dawson District Office (DO) December 24, 2020. • Adequacy Review started December 29, 2020 and was extended January 11, 2021. o The Adequacy Review period was extended for 21 days due to the complexity of the Project. • Dawson DO issued an Information Request on January 15, 2021 Chance is currently working on its response to Information Request 1 which you can find here. Additionally, here is the link to the Project's page on the Yukon Environmental Socio-economic Assessment Board registry: 2020-0197.	N/A	E00899_Chance DO Project_ Eagle Plains Well Maintenance and Extended Flow Testing (Vuntut Gwitchin First Nation Update)
E00988	20-Jan-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Derek Fraser	DO Project	We have a planning meeting on January 25 at 10:00am and we're looking forward to the meeting. Before the Christmas holidays there were a number of emails dealing with Chance revised Project Proposal and your commitment to helping all parties come to a "common understanding" before submitting the Chance revised Project Proposal to Yukon Environmental Socio-economic Assessment Board, which is why we found it unfortunate that during the holidays we had seen that Chance had submitted the Proposal on December 24, 2020 and the Vuntut Gwitchin First Nation was not notified by Chance. To help inform the discussions around planning for negotiations can Chance provide us with a deeper understanding of all details related to what the cost of the Project will be, potential employment, training and contracting opportunities there will be in relation to the Project? A detailed list would be beneficial for all parties.	N/A	E00989_RE_ Dawson DO Project Proposal (1).msg
E00989	20-Jan-21	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Derek Fraser	DO Project	We will provide as much details regarding the opportunities on morning. As pre "Common Understanding" we have been very clear on the information provided with Meetings over the past year. Chance have to work within the limited timeframe, so hope you appreciate the position we are in and hoping to follow through on the Order from Yukon Government in timely way. As stated to you and other FN partners we are always available to continue conversation about this Project. Please feel free to reach out to us via phone call or email if you have any questions. We are happy to set up another discussion as group if required.	N/A	E00989_RE_ Dawson DO Project Proposal (1).msg
E00990	20-Jan-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Derek Fraser	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E01029	21-Jan-21	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	DO Project Project Description/Activities	Vuntut Gwitchin First Nation appreciates these updates, thank you. Our team has remained engaged on Chance's Well Maintenance Project Proposal through the YOR since first learning of the Proposal submission through YOR notifications. Vuntut Gwitchin First Nation looks forward to submitting our response to the Project during the public comment period.	N/A	E01029_Re_ Chance DO Project_ Eagle Plains Well Maintenance and Extended Flow Testing (Vuntut Gwitchin First Nation Update).msg
E00932	29-Jan-21	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Jordan Peterson	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00991	29-Jan-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Derek Fraser	DO Project Benefits/Capacity Agreement Meeting Coordination/Planning	My apologies once again that we couldn't participate in the call on . Looking forward to the Meeting on February 16. As you suggested in your email below on January 20th that if we have any questions to call or email you, which I did in my email of January 20th and we've received no response. When can we expect an answer to the questions?	N/A	E00989_RE_ Dawson DO Project Proposal (1).msg
E00992	29-Jan-21	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance), Hemmera	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Derek Fraser	DO Project Benefits/Capacity Agreement Meeting Coordination/Planning	We can discuss in more detail on February 16th to address your questions. We have to meet in order to address this situation. That's part of the negotiations process.	N/A	E00989_RE_ Dawson DO Project Proposal (1).msg
E01000	29-Jan-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance)	Jordan Peterson	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00993	02-Feb-21	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Derek Fraser	DO Project Benefits/Capacity Agreement Meeting Coordination/Planning	Is it possible you can send a Zoom Meeting invite out to the group for this Meeting?	N/A	E00989_RE_ Dawson DO Project Proposal (1).msg
E00994	02-Feb-21	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Derek Fraser, Todd Mahon, Clive Mountford	DO Project Benefits/Capacity Agreement Meeting Coordination/Planning	I believe Derek Fraser has done that already for the 16th.	N/A	E00989_RE_ Dawson DO Project Proposal (1).msg
E01036	02-Feb-21	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson, Skeeter Wright (First Nation of Na-cho Nyäk Dun), Derek Fraser	DO Project Engagement/Consultation Project Description/Activities	I believe Derek Fraser has done that already for the 16th.	N/A	E01036_Re_ Dawson DO Project Proposal .msg
E01037	02-Feb-21	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya, Jordan Peterson, Skeeter Wright (First Nation of Na-cho Nyäk Dun), Derek Fraser	DO Project Engagement/Consultation Project Description/Activities	There is nothing in my calendar nor my emails. If I've been overlooked, can someone please extend the invite to me? Also, can a summary of the last Meeting's discussion be sent?	N/A	E01036_Re_ Dawson DO Project Proposal .msg
E00948	15-Feb-21	Letter	Incoming	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A

E00946	16-Feb-21	Meeting	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00947	17-Feb-21	Meeting	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
Vuntut Gwitchin First Nation0265	17-Feb-21	Email	Outgoing	Vuntut Gwitchin First Nation	Kris Statnyk (Vuntut Gwitchin First Nation)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Jordan Peterson, Cheryl Charlie, Brandon Kyikavichik, Robert Froehlich, Erika Tizya, Katherine Peter, Kris Statnyk (Vuntut Gwitchin First Nation)	Draft Agenda for Meeting	Kris S. emailed Jordan P., Cindy (Chance) Greg (Chance), Cheryl C., Brandon K., Robert F., Erika T., and Katherine P., attaching a proposed draft agenda for the meeting being held that day.	N/A	20210217-Vuntut Gwitchin First Nation0265A
E00949	01-Mar-21	Letter	Outgoing	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Cooperation Agreement	Details around capacity funding were discussed.	No record available due to confidentiality.	N/A
E00950	04-Mar-21	Email	Incoming	Vuntut Gwitchin First Nation	N/A	N/A	Jordan Peterson	Meeting Coordination/Planning	Confidential - No official record - email exchange with Jordan Peterson to learn of Stadnik's position changes.	N/A	N/A
E00951	05-Mar-21	Email	Incoming	Vuntut Gwitchin First Nation	N/A	N/A	Jordan Peterson	Meeting Coordination/Planning	Confidential - No official record - email exchange with Jordan Peterson to learn of Statnyk's position changes.	N/A	N/A
E00952	05-Mar-21	Email	Incoming	Vuntut Gwitchin First Nation	N/A	N/A	Kris Statnyk (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Confidential - No official record - email exchange with Kris Statnyk (Vuntut Gwitchin First Nation) regarding his departure from Mandell Pinder and ongoing status as counsel for Vuntut Gwitchin First Nation.	N/A	N/A
E01074	15-Mar-21	Email	Incoming	Vuntut Gwitchin First Nation	Erika TIzya-Tramm	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Kris Statnyk (Vuntut Gwitchin First Nation), Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	I'm sorry to do this at the end of the day before our Meeting tomorrow morning, but Vuntut Gwitchin First Nation is requesting we postpone this Meeting. In the absence of developing a terms sheet for our negotiations, we'd like to see this move forward prior to a next Meeting. We will follow up in the coming days on this.	N/A	E01073_FW_ Benefits Agreement Discussions - S_68 Agreement for COGL Well Program.msg
E01076	16-Mar-21	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	I am checking with my colleagues and our counsel and will advise as to everyone's availability. As it stands right now, I am not available on morning, but good for the other times that Derek has offered.	N/A	E01073_FW_ Benefits Agreement Discussions - S_68 Agreement for COGL Well Program.msg
E01077	16-Mar-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	All of Council, Senior Management and other staff are in training all next week except for . Can we schedule for March 26 at 9:30am to 12:00pm for Sec. 68? We then are planning for another Oil and Gas Meeting in the afternoon.	N/A	E01073_FW_ Benefits Agreement Discussions - S_68 Agreement for COGL Well Program.msg
E01069	22-Mar-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	As you may have previously discussed with Chance, Hemmera is currently resuming work on developing the Project Proposal for Chance's Eagle Plains Exploration Program and, at this time, planning for a late fall submission to Yukon Environmental Socio-economic Assessment Board for an Executive Committee level screening. As we have discussed in the past, critical to Chance's work will be engagement with both the Vuntut Gwitchin First Nation, in accordance with the Communication and Engagement Plan (the Plan) (and appended Vuntut Gwitchin First Nation Oil and Gas Engagement Policy (the Policy)) from 2018, as well as Vuntut Gwitchin Citizens. To that end, Chance has developed a schedule for internal planning purposes and discussion with Vuntut Gwitchin First Nation and the Natural Resources Committee. It coordinates engagement events over the coming months with the logistical/administrative items needed in order to deliver each event. attached is an overview of that schedule which shares the weeks that Chance anticipates being in Old Crow and the topics to be presented/discussed at each community event. Chance is also in the process of creating a Community Engagement Committee to assist in the delivery and effectiveness of its engagement activities over the coming months. Chance is finalizing the Terms of Reference for this committee and anticipates finalizing its membership over the coming weeks. Please note, Chance was careful to ensure that the Terms of Reference for the committee are in accordance with the Plan (and appended Policy) and that nothing about the committee is meant to replace or change Chance's commitments/responsibilities under the Plan. For your information, we have attached a copy of the Terms of Reference that's been drafted for the committee. We feel that both the schedule and the Community Engagement Committee will foster an environment for productive discussion regarding the environmental and socio-economic values of concern related to the multi-well exploration program. To answer any questions that the Natural Resources Committee or Vuntut Gwitchin First Nation may have pertaining to either item, Chance wanted to request a Meeting perhaps the week of March 29th – April 1st or April 5th – 9th.	N/A	E01069_Chance Eagle Plains Exploration Project (Executive Committee) - Schedule Memo and Community Engagement Committee TOR .msg 210315_Chance_Schedule Memo_for_Vuntut Gwitchin First Nation_v0.3.docx 210317_Chance_CommunityEngagementCommitteeTORdraft_v0.4.docx
E01078	22-Mar-21	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	Sorry for the delayed response, it took a bit of time to determine the availability of everyone from Chance. Both Bob Froehlich and I are available to meet on morning to continue the well maintenance program benefits agreement. Greg and Cindy are not available.	N/A	E01073_FW_ Benefits Agreement Discussions - S_68 Agreement for COGL Well Program.msg
E01085	23-Mar-21	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Jordan Peterson	Project Description/Activities Engagement/Consultation Meeting Coordination/Planning Cooperation Agreement	Meeting	N/A	E01085_FW_ Vuntut Gwitchin First Nation Special GA(1).msg
E01086	23-Mar-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance)	Jordan Peterson	Project Description/Activities Engagement/Consultation Meeting Coordination/Planning Cooperation Agreement	We've just communicated with Richard that we support Chance as a business to utilize your own avenues of engagement with Vuntut Gwitchin First Nation Citizens. The Special GA is a Governance process for internal matters of the Vuntut Gwitchin. If you are receiving calls from Citizens we encourage you to direct them to the government to get a better understanding of the items being discussed at the Special GA.	N/A	E01086_FW_ Vuntut Gwitchin First Nation Special GA(2).msg
E01087	23-Mar-21	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Jordan Peterson	Project Description/Activities Engagement/Consultation Meeting Coordination/Planning Cooperation Agreement	When Vuntut Gwitchin First Nation Citizens call me about our Project in Eagle Plains or for an update we always provide info regardless and also request they speak to Natural Resources Committee as well because of their responsibility to report. We are always following Vuntut Gwitchin First Nation and Chance Engagement and Communication Plan when it relates to Vuntut Gwitchin First Nation, Natural Resources Committee and Vuntut Gwitchin First Nation Citizens. We will also take your advise and start preparing to engage with Vuntut Gwitchin First Nation Citizens soon.	N/A	E01086_FW_ Vuntut Gwitchin First Nation Special GA(2).msg

E01079	24-Mar-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	We had bilateral meeting with Chance regarding the Vuntut Gwitchin First Nation and Chance Cooperation Agreement on afternoon, unfortunately Greg and Cindy aren't available to participate in the bilateral, Chance has had to reschedule. Given this we'd suggest that we also cancel the Sec. 68 Negotiations as well until a rescheduled date can be found.	N/A	E01073_FW_ Benefits Agreement Discussions - S_68 Agreement for COGL Well Program.msg
E01080	24-Mar-21	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Project Description/Activities Engagement/Consultation Meeting Coordination/Planning Cooperation Agreement	The Cooperation Agreement is more advanced and is better suited to having the two parties fully represented. As I understand it, we are awaiting either a draft term sheet or a draft Benefits Agreement from Vuntut Gwitchin First Nation as offered at the February 16 Zoom meeting, perhaps based on a template that has worked will in the past that was shared in previous correspondence. Whether we are able to restore the Meeting originally planned for morning or do indeed reschedule, if the Vuntut Gwitchin First Nation has something to share in this regard, it is appreciated if the Vuntut Gwitchin First Nation can provide whatever material it has crafted to all parties to prepare for the next Section 68 meeting.	N/A	E01073_FW_ Benefits Agreement Discussions - S_68 Agreement for COGL Well Program.msg
E01082	24-Mar-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Meeting Coordination/Planning	Due to emerging priorities, we will not be able to participate in the meeting. We thank you for your understanding and hope that we can reschedule to ensure all are apart of these discussions.	N/A	E01073_FW_ Benefits Agreement Discussions - S_68 Agreement for COGL Well Program.msg
E01119	30-Mar-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Meeting Coordination/Planning	I wanted to follow-up on the email sent last week and see if you've had a chance to review the documents that were sent (attached again) and/or if you had any questions? A conference call could be scheduled for next week, or the week after, whichever would work better for you!	N/A	E01119_RE_ Chance Eagle Plains Exploration Project (Executive Committee) - Schedule Memo and Community Engagement Committee TOR .msg 210315_Chance_Schedule Memo_for_Vuntut Gwitchin First Nation_v0.3.docx 210317_Chance_CommunityEngagementCommitteeTORdraft_v0.4.docx
E01179	31-Mar-21	Letter	Incoming	Vuntut Gwitchin First Nation	Chief Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Mike Chernoff	Chief Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation	Chief Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) and the Vuntut Gwitchin First Nation Chief Executive Officer of Vuntut Gwitchin First Nation addressed a letter to Michael N. Chernoff of Chance. The topic of the letter was on communication and engagement with the Vuntut Gwitchin First Nation. Chief Dana Tizya Tramm stated that Chance has consistently failed to adhere to the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy in relation to the exploration Project.	N/A	E01179_2021 03 31 Vuntut Gwitchin First Nation Letter to COGL_.pdf
E01068	05-Apr-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Meeting Coordination/Planning	The timing for these events will end up falling within the dates shared in Chance's Schedule Memo (sent March 22nd and 30th). Chance and Hemmera staff are currently scheduled to fly up to Old Crow on April 20th. We hope to hold an open house that evening from 3:30 – 6:00 and another open house the following evening (April 21st) from 5:00 – 7:00. We are currently in the process of booking the venues and reviewing guidance to ensure the events follow all COVID-19 restrictions. Once those details are finalized, we'll be able to share a copy of the flyer for the events. We are also in the process of preparing our communication materials and should be able to share copies at the end of this week or early next week.	N/A	E01068_Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Events in Old Crow April 20th_21st.msg
E01130	07-Apr-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	N/A	Jordan Peterson	Engagement/Consultation	Email read receipt	N/A	E01130_Read_ Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Events in Old Crow April 20th_21st (1).msg
E01083	08-Apr-21	Email	Outgoing	Vuntut Gwitchin First Nation	Mike Chernoff	Mike Chernoff	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Project Description/Activities Engagement/Consultation Meeting Coordination/Planning Cooperation Agreement	I am writing to follow up our telephone conversation this morning. You asked that Chance delay having Meetings with Vuntut Gwitchin First Nation Citizens because of a lack of readiness on your part. I suggested that Chance could delay Meeting Vuntut Gwitchin First Nation Citizens by a month, but I made that offer without knowing that arrangements have already been made for Chance and Hemmera staff to travel to Old Crow later this month. Accommodation and meeting rooms have been booked too. We are now committed to be in Old Crow later in April. The Meetings later this month are meant to be introductory in the sense that there will be a refresher presentation on the Multi-well and seismic acquisition exploration Project since it has been nearly two years since Chance last presented to the community at the GA in August 2019. There will also be information about the process Chance has to follow for an Executive Committee Assessment of this Project and discussion about the plans Chance and its expert consultants have to meet in Old Crow with the community over the next several months. As such, there are going to be several occasions for the Natural Resources Committee to participate in these Meetings. A high level schedule was provided to the Natural Resources Committee a couple of weeks ago for its consideration.	N/A	E01083_FW_ Chance Community Meetings.msg
E01131	09-Apr-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	N/A	Jordan Peterson	Project Description/Activities Meeting Coordination/Planning	Email read receipt	N/A	E01131_Read_ Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Events in Old Crow April 20th_21st.msg

E01180	12-Apr-21	Letter	Outgoing	Vuntut Gwitchin First Nation	Mike Chernoff	Mike Chernoff	Chief Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation	Mike Chernoff wrote this letter in response to Vuntut Gwitchin First Nation's letter (dated March 31, 2021).	N/A	E01179_GOGL response to Vuntut Gwitchin First Nation letter of March 31, 2021.pdf
E01257	20-Apr-21	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Community Open House	Open house - no summary available.	N/A	E01257_210430_Chance_OldCrowOpenHouse_April20_SignInSheet.pdf
E01258	21-Apr-21	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Engagement/Consultation, Community Open House	In accordance with Vuntut Gwitchin First Nation's March 31st letter to Chance and the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy, Chance wanted to provide notice of an upcoming community engagement event that is being planned in Old Crow. Chance, Hemmera, and EDI staff are currently scheduled to fly up to Old Crow on June 15th and are hoping to hold an open house that evening from 4:00 pm to 7:00 pm. We are currently in the process of booking a venue. Additionally, the North Yukon Renewable Resource Council invited Chance to present a few slides on the topics of fish and wildlife (i.e., any work that has been done (baseline studies) and work that Chance is prepared to do) as part of a larger event they are organizing. That will be taking place the evening of June 16th starting at 5:00pm in the school gym.	N/A	E01258_210430_Chance_OldCrowOpenHouse_April21_SignInSheet.pdf
E01067	06-May-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Engagement/Consultation Meeting Coordination/Planning	In accordance with Vuntut Gwitchin First Nation's March 31st letter to Chance and the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy, Chance wanted to provide notice of an upcoming community engagement event that is being planned in Old Crow. Chance, Hemmera, and EDI staff are currently scheduled to fly up to Old Crow on May 18th and are scheduled to hold an open house that evening from 4:00 pm to 7:00 pm.	N/A	E01067_Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow May 18th .msg
E01259	18-May-21	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Community Open House	Open house - no summary available.	N/A	E01259_210521_Chance_OldCrowOpenHouse_May18_SignInSheet.pdf
E01206	02-Jun-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	In accordance with Vuntut Gwitchin First Nation's March 31st letter to Chance and the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy, Chance wanted to provide notice of an upcoming community engagement event that is being planned in Old Crow. Chance, Hemmera, and EDI staff are currently scheduled to fly up to Old Crow on June 15th and are hoping to hold an open house that evening from 4:00 pm to 7:00 pm. We are currently in the process of booking a venue. Additionally, the North Yukon Renewable Resource Council invited Chance to present a few slides on the topics of fish and wildlife (i.e., any work that has been done (baseline studies) and work that Chance is prepared to do) as part of a larger event they are organizing. That will be taking place the evening of June 16th starting at 5:00pm in the school gym.	N/A	E01206_Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow June 15th .msg
E01241	07-Jun-21	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Engagement/Consultation	Thank you Calista for this notice. As set out under section 21 of the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy, notice of any materials to be relied on by Chance (Chance) for the purposes of consultations with Vuntut Gwitchin Citizens should also be provided in advance of the scheduled Meetings. We continue to seek upholding these policy requirements which Chance agreed to comply with under our joint Communication and Engagement Plan. Please also note that the Natural Resources Committee has received feedback from Vuntut Gwitchin Citizens that the "Open House" format of consultation has not been effective in meaningfully informing them and has not allowed for an open question and answer period. It is also important to note pursuant to section 22 of the Oil and Gas Engagement Policy that any consultations with Vuntut Gwitchin Citizens that are organized and carried out by Chance are not considered consultation with the Vuntut Gwitchin First Nation (Vuntut Gwitchin First Nation). The status of engagement between Vuntut Gwitchin First Nation and Chance remains as set out in Chief Tizya-Tramm's March 31 letter to Mr. Chernoff	N/A	E01241_RE_ Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow June 15th (2).msg
E01207	09-Jun-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Project Description/Activities Information Sharing Engagement/Consultation	You have received access to a Hemmera File Share from calista.morrison@hemmera.com. The link to transfer your file(s) will expire on , June 16, 2021 12:00 AM. https://fd-hemmera.ausenco.com/?ShareToken=7970DFDDC2332E7447EF1C63310F90943E4EDD14	N/A	E01207_Chance Engagement Materials - Poster Package 1.msg
E01208	09-Jun-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Project Description/Activities Information Sharing Engagement/Consultation	You have received access to a Hemmera File Share from calista.morrison@hemmera.com. The link to transfer your file(s) will expire on , June 16, 2021 12:00 AM. https://fd-hemmera.ausenco.com/?ShareToken=BF2077B6D3A695F01F37E48BD3D54C29F8D1E205	N/A	E01208_Chance Engagement Materials - Poster Package 2.msg

E01242	09-Jun-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Engagement/Consultation	I will send you a separate file sharing link that will provide copies of the posters that were used at the open houses April 20th, April 21st, and May 18th. The poster titled "Regulatory Context" was first used at the May 18th open house. Chance/Hemmera will be bringing these same posters to the open house next week, June 15th. I've attached a PDF that has our collection of handouts and a PDF of the presentation we had Projected and automatically playing during the previous open houses. Please note, no presentations were actually delivered during the open houses April 20th, April 21st, and May 18th.We are currently in the process of designing additional posters to describe the work (studies conducted and baseline findings) of Chance's subconsultants (EDI, Peer Solutions, and Palmer) as well as a poster that describes Chance's exploration objectives, possible job opportunities, and training. However, we haven't finished designing these posters yet. We should complete the last posters for that package later today. I'll send them via the file sharing link. If we develop any additional handouts, I can commit to sending you copies next . Given the nature of the work load prior to an open house, we prioritize posters, then handouts, and finally any presentations. At the open house June 15th, we will likely present some slides providing an overview of the Chance's Project, however EDI will actually be providing the presentation. They will be presenting their work to date and seeking any comments, questions or concerns from the audience. We can share a copy of their presentation as soon as they have created it and it is finalized. That likely won't be until next week. Chance has also been asked to attend and provide a brief presentation to the NYRRC Meeting on June 16th next week. The content of this will be specific to fish and wildlife, as well as time for Q&A. Just yesterday we were finally able to confirm our venue. The June 15th open house will be held at the school gym from 4:00 – 7:00 pm. We plan on having the presentation at 5:30. The purpose of the previous open houses was to share information about Chance's Eagle Plains Exploration Project and to collect any feedback and concerns. That remains to be the purpose for the upcoming open house, as well as beginning to share information about studies conducted and baseline findings of Chance's subconsultants. Regarding your comment below with respect to the status of consultation with Vuntut Gwitchin First Nation, yes that is also our understanding of the status of consultation with Vuntut Gwitchin First Nation. All community open houses and presentations are intended to be aspects of consultation with residents of Old Crow and not consultation with the Vuntut Gwitchin First Nation. Thank you for sharing the feedback regarding the consultation format below. We're are hoping that by setting aside some time for a specific presentation and Q&A that we'll be able to address those concerns moving forward.	N/A	E01241_RE_ Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow June 15th (2).msg 210608_Chance_Handout_Package.pdf 210414_Chance_ProjectDescription_April2021.pdf
E01243	14-Jun-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Engagement/Consultation	I wanted to let you know that, due to the recent COVID outbreak in Whitehorse, Chance is cancelling the trip to Old Crow this week. Chance and Hemmera are currently doing their best to communicate the cancellation of the open house (i.e., originally schedule for tomorrow evening).	N/A	E01241_RE_ Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow June 15th (2).msg
E01244	14-Jun-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation	Thank you for the notice, we will communicate internally.	N/A	E01244_Re_ Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow June 15th.msg
E01222	13-Jul-21	Email	Incoming	Vuntut Gwitchin First Nation	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Greg Charlie (Chance)	Rosa Brown (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Heritage/Archaeology Information Sharing	I read on the Yukon Environmental Socio-economic Assessment Board registry today that Chance does not have a copy of the Vuntut Gwitchin First Nation Heritage Act. Please see attached.	N/A	E01222_FW_ Vuntut Gwitchin First Nation Heritage Act.msg 2016-10-17VuntutGwichtinHERITAGEACT.pdf
E01198	18-Jul-21	Community Event Flyer	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Vuntut Gwitchin First Nation PO mail boxes	Project Description/Activities Engagement/Consultation Education and Training Well Location Seismic Fish Caribou	Project description booklets mailed to the community PO boxes in Old Crow, Yukon. Covered Project location, description, training, job opportunities, consultant information, Chance contact information.	N/A	E01198_210716 Chance_July_Booklet_v0.3.pdf
E01220	19-Jul-21	Email	Outgoing	Vuntut Gwitchin First Nation	Mike Chernoff	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	I am sending you a draft annual report of the Engagement and Communications Plan Implementation for your officials to review and comment. The report was prepared by Hemmera on behalf of Chance. The report is to be submitted by July 31 in accordance with the Order in Council. I have copied my colleagues and Calista Morrison (Hemmera) with Hemmera to facilitate future correspondence.	N/A	E01220_FW_ DRAFT 2021 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - For Review (1).msg 210716_EngagementPlan_2021ImplementationReport_Vuntut Gwitchin First Nation_v0.5.docx
E01221	20-Jul-21	Email	Outgoing	Vuntut Gwitchin First Nation	Mike Chernoff	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement Reports/OIC Requirements	Dear Chief Tizya-Tramm, Richard (Chance) has reviewed the draft annual report of the Engagement and Communications Plan and attached is a version with his edits. Hemmera has also prepared a draft of Appendix D (Chance/Vuntut Gwitchin First Nation engagement log) which I am sending to you.	N/A	E01221_Fw_ DRAFT 2021 Annual Report of Vuntut Gwitchin and Chance Engagement Activities - For Review.msg 210714_ChanceCommunicationLog_v7Vuntut Gwitchin First Nation.pdf 210716_EngagementPLan_2021ImplementationReport_Vuntut Gwitchin First Nation_v0.5_RMW.docx
E01295	08-Sep-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Meeting Coordination/Planning Engagement/Consultation	In accordance with Vuntut Gwitchin First Nation's March 31st letter to Chance and the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy, Chance wanted to provide notice of upcoming community engagement events that are being planned in Old Crow. Chance, Hemmera, as well as additional consultants are currently scheduled to fly up to Old Crow on Sept 21st. We are hoping to hold open houses the evenings of Sept 21st and Sept 22nd from 4:00 pm to 7:00 pm. We are currently in the process of booking a venue. Once that is confirmed I'll send you an update. The purpose of the open houses will be to share information about Chance's Eagle Plains Exploration Project and to collect feedback and concerns. More specifically, EDI, Peer Solutions, and Palmer will be sharing information about studies they've conducted and their baseline findings. I will send you a separate file sharing link that will provide copies of the posters we'll have. However, we are currently in the process of developing the presentation and handouts. Once those communication materials have been finalized I will send you copies. Thank you for your time,	N/A	E01295_Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow Sept 21 and Sept 22.msg

E01296	08-Sep-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Information Sharing	Calista shared files (engagement materials for September 2021 old crow open house) using Hemmera File Share.	N/A	E01296_Chance Engagement Materials - Posters.msg
E01301	08-Sep-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordon Peterson	Richard Wyman (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning Engagement/Consultation	Richard, The annual Meeting of the Vuntut Gwitchin First Nation (Vuntut Gwitchin First Nation) General Assembly (GA) is scheduled for September 22-24, 2021 which was posted and made public on multiple platforms. The timing of the community engagement Meetings Chance is proposing for September 21-22 would overlap with the GA's scheduled business. We therefore kindly ask you to reschedule your engagement Meetings to a future date so as to avoid any undue interference in the Meeting of the GA and the important internal governance processes of Vuntut Gwitchin First Nation, and to allow for greater participation of Vuntut Gwitchin First Nation Citizens in your planned engagement activities. We remind you that our March 31, 2021 letter to you arose out of our unresolved concerns regarding Chance's communication and engagement practices with the community, including events that occurred earlier that month which interfered with internal Vuntut Gwitchin First Nation discussions and deliberations at a special Meeting of the GA. As we also set out in the March 31st letter, the participation of individuals in their professional capacity as Chance Directors, officers, employees, consultants, professional advisors, and representatives in internal governance processes such as Meetings of the Vuntut Gwitchin First Nation GA are by invitation only. No such invitation has been extended to Chance to participate in the upcoming Meeting of the Vuntut Gwitchin First Nation GA therefore any Vuntut Gwitchin First Nation Citizens who are also Chance representatives will be understood to be participating in the discussions of the Vuntut Gwitchin First Nation GA as entitled to under Vuntut Gwitchin First Nation law in their personal capacity as Vuntut Gwitchin First Nation Citizens.	N/A	E01301_FW_ Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow Sept 21 and Sept 22.msg
E01298	14-Sep-21	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Lynn O'Neil	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning Engagement/Consultation	Thank you for reaching out and sorry for the delay responding. I was off grid attending a family gathering last week. It did come to our attention on Sept 7 that the Vuntut Gwitchin First Nation (Vuntut Gwitchin First Nation) General Assembly (GA) has been re-scheduled to now occur September 22-24 and that GA events would overlap with one of our planned open houses. When we made our plans to host community meetings to share information about our proposed exploration Project, it was prior to our knowing the confirmed timing of the annual Vuntut Gwitchin First Nation GA. To avoid any meeting conflicts, we have cancelled our plans to have an open house during the evening of Sept 22nd . We are however hosting a dinner and open house presentations during the evening of Sept 21. Travel and accommodation arrangements for our party have been adjusted so our technical consultants will be departing YOC on Sept 22. As presentation materials are available, Calista Morrison (Hemmera) will forward them to you so you know what topics are being discussed. Otherwise, if you are in Old Crow while we are there, you are welcome to attend the Sept 21 open house.	N/A	E01298_Community Meetings and Vuntut Gwitchin First Nation GA.msg
E01303	14-Sep-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Richard Wyman (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning Engagement/Consultation	Thank you for your consideration and change of your Sept 22 date, we were hoping that you would consider moving the date to after the General Assembly as a respectful consideration. Can you please confirm that none of your employees will be participating in any Vuntut Gwitchin First Nation governing processes as a representative for Chance as outlined in my previous email and the letter sent to Chance on March 31st?	N/A	E01303_FW_ Community Meetings and Vuntut Gwitchin First Nation GA.msg
E01357	17-Sep-21	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson	Meeting Coordination/Planning	We understand that a well respected Vuntut Gwitchin First Nation Citizen is in rapidly failing health and that the community is supporting the family. Out of respect for the ailing person, the family and the community, Chance has decided to delay the planned community Meeting scheduled for Sept 21 to a later date which has not yet been confirmed. The timing for this decision is too late for all the advertising for the community meeting to be cancelled or amended such as the newspapers. Other means are being used to give notice of next week's Meeting cancellation. We will advise you when the rescheduled Meeting is planned to happen.	N/A	E01357_Re_ Community Meetings and Vuntut Gwitchin First Nation GA.msg
E01262	27-Sep-21	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	I am letting you know that our plan to host a community information and dinner event on October 13 was established well before we learned that the Vuntut Gwitchin First Nation Annual General Assembly was rescheduled to Oct 14-16. In order to manage the lead times required to book accommodation, travel, Meeting venues and catering for representatives of Chance and its consultants to participate in community presentations and discussions, Chance had to make commitments several months ago. The material intended to be shared with the community at the Meeting originally scheduled for last week will be used at the October meeting. Some materials intended to be used at the October meeting have already been sent to you and more presentation material will be sent as it is available.	N/A	E01262_Oct 13 community Meeting.msg
E01263	27-Sep-21	Email	Incoming	Vuntut Gwitchin First Nation	Jordan Peterson	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Jordan asked that Chance not use personal emails for communicating with Vuntut Gwitchin First Nation and Erika confirmed she is back and on email.	N/A	E01263_RE_ Oct 13 community Meeting.msg

E01264	05-Oct-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Jordan Peterson, Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation	Related to Richard's Sept 27th email (below), I'll be sending you copies of the presentations that will be shared at the October 13th Open House. Due to file size, I'll have to use Hemmera's file sharing site. We might make small editorial changes to the presentations between now and the open house, but for the most part they are completed. No changes have been made to the posters that were shared with you September 8th. If you would like me to send them again, please let me know.	N/A	E01263_RE_ Oct 13 community Meeting.msg
E01297	05-Oct-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Information Sharing	Calista shared files (presentations) for Chance's upcoming open house on Oct 13th.	N/A	E01297_Chance Oct 13 Old Crow Open House - Presentations
E01300	05-Oct-21	Email	Incoming	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Information Sharing	A file was downloaded (engagement materials) by Vuntut Gwitchin First Nation for the Old Crow open house.	N/A	E01300_File downloaded from share_ Chance Oct 13 Old Crow Open House - Presentations.msg
E01260	13-Oct-21	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Open House	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 4:30 pm - 7:30 pm. Chance shared Project information by presentation. Chance provided a dinner and door prizes.	N/A	E01260_211101_Chance_OldCrowOpenHouse_Oct13_SignInSheet.pdf E01260_211123_Vuntut Gwitchin First NationCommunity-Chance_Oct13OpenHouse_Meetingsummary_v.0.4.docx
Vuntut Gwitchin First Nation0264	13-Oct-21	Community Event Flyer	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Open House	Chance created a flyer for an open house at the Chief Zzeh Gittlitt School Gym in Old Crow on October 13, 2021 from 4:30 - 7:30 PM.	N/A	N/A
E01266	27-Oct-21	Letter	Outgoing	Vuntut Gwitchin First Nation	Mike Chernoff	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Engagement/Consultation Cooperation Agreement Meeting Coordination/Planning	Michael Chernoff sent Vuntut Gwitchin First Nation a letter regarding: • Chance holding events again in the fall • Chance reviving negotiations under the Vuntut • Gwitchin Oil and Gas Engagement Policy • Planning a meeting and re-engaging in consultation	N/A	E01266_Vuntut Gwitchin First Nation LETTER OCT, 27, 2021.pdf
E01352	31-Oct-21	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Mike Chernoff	Mike Chernoff	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation	Mike Chernoff called Chief Dana and left a message.	N/A	E01302_FW_ Chief Dana.msg
E01353	01-Nov-21	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Mike Chernoff	Mike Chernoff	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation	Mike Chernoff called Chief Dana and left a message.	N/A	E01302_FW_ Chief Dana.msg
E01294	04-Nov-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Engagement/Consultation	In accordance with Vuntut Gwitchin First Nation's March 31st letter to Chance and the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy, Chance wanted to provide notice of upcoming community engagement events that are being planned in Old Crow. Chance, Hemmera, as well as additional consultants will be flying up to Old Crow on November 17th. We are planning on holding open houses the evenings of Nov 17th and Nov 18th. Both open houses will be held at the School Gym and will take place from 4:30 pm to 7:00 pm. The purpose of the open houses will be to share information about Chance's Eagle Plains Exploration Project and to collect feedback and concerns. More specifically, Peer Solutions and Vertex will be sharing information about seismic programs and well construction and design. We will be re-using posters already made and previously shared with you. Please let me know if you would like me to send a copy of them again. I am currently working with Peer and Vertex to develop their presentations. As soon as they're finalized, I will send you copies.	N/A	E01294_Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow Nov 17 and Nov 18.msg
E01358	11-Nov-21	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Engagement/Consultation	Given recent developments in the Yukon with respect to COVID, Chance has decided to cancel the open houses planned for next week. Sorry for the confusion and I hope you're well.	N/A	E01358_RE_ Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow Nov 17 and Nov 18.msg
E01362	01-Dec-21	Email	Outgoing	Vuntut Gwitchin First Nation	Mike Chernoff	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Chief Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Engagement/Consultation	See attached Chance Letter to Vuntut Gwitchin First Nation.	N/A	E01362_FW_ Meeting Request.msg E01362_Vuntut Gwitchin First Nation_LETTER DEC 1_2021.pdf
E01365	14-Dec-21	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation	Thank you for the Meeting in Old Crow on December 9th. As discussed I will provide you with our thoughts on moving forward with Chance 1. We would like to retain professional services from Mehaffey Consulting to assist the parties in facilitating the Cooperation Agreement and eventually the Benefit and Stewardship Agreement in Vuntut Gwitchin Oil and Gas policy as soon as possible. 2. Chance is prepared to hold off submission again and submit into the new Pre-submission Process in Spring of 2022. This will give parties more time get engaged in the new year. This position allows all parties, affected FN, Yukon and others to be involved with facilitation from Yukon Environmental Socio-economic Assessment Board. Chance is looking forward meeting with the Vuntut Gwitchin First Nation representatives again and including Natural Resources Committee members in Old Crow. I really appreciate our conservation and our willingness to move on and provide path forward to get information out to Citizens in Old Crow. Please don't hesitate to contact me if you have any questions or want to meet. Also as discussed in Old Crow, please feel free to contact Matt Mehaffey to discuss his role.	N/A	E01365_FW_ Chance Oil and Gas Proposal .msg
E01364	17-Dec-21	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Mike Chernoff, Richard Wyman (Chance), Cindy Dickson (Chance)	Chief Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation) Grand Chief Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), Chief Roberta Joseph (Tr'ondëk Hwëch'in)	Engagement/Consultation	Please see attach a formal letter to Minister Streicker and if you guys have any questions, please don't hesitate to contact myself via email or call my cell.	N/A	E01364_FW_ Land Tenure Request (2).msg E01363_Yukon Government Land Tenure Extension Request.pdf

E01366	21-Dec-21	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation	Thank you for your message following up on our December 9 Meeting in Old Crow and setting out Chance's thoughts and Proposal s. As I have previously communicated, the NR committee will be seeking a decision from the Council on next steps with respect to Vuntut Gwitchin First Nation engagement on Chance's exploration Proposal following the previous decision to discontinue engagement communicated March 31, 2021. The details of our discussion on December 9, and your Proposal s below, including Chance's intentions to proceed to the Yukon Environmental Socio-economic Assessment Board process as early as Spring 2022, will help to inform that decision. With the holiday season, current emergeNorthern Cross Yukon circumstances in the community and Vuntut Gwitchin First Nation priorities at this time, we will likely be looking at sometime in January 2022 to be meeting with Council. We will ensure to keep Chance informed of the outcomes.	N/A	E01366_FW_ Chance Oil and Gas Proposal (6).msg
E01367	04-Jan-22	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation	Thanks for your email and look forward to resume process with Vuntut Gwitchin First Nation! Please let me know as soon as you can! I will also update Marvin and Roger about this email.	N/A	E01366_FW_ Chance Oil and Gas Proposal (6).msg
E01368	20-Jan-22	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation	I wanted to follow up via email on any progress on our progress to move forward on engagement and Chance Proposal . FYI, we are currently working on all documents and will be sending it to all affected FN and Yukon within weeks, so I just wanted to see where your at? It has been over month since the meeting took place in Old Crow (December 7, 2021) and as stated in our discussion at that time with the elders Marvin Frost and Roger Kyikavichik present, time is important to Chance	N/A	E01366_FW_ Chance Oil and Gas Proposal (6).msg
E01369	20-Jan-22	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation	As formerly communicated to Chance, there is January meeting set with Vuntut Gwitchin First Nation Council, after which Chance will be informed of the outcomes.	N/A	E01366_FW_ Chance Oil and Gas Proposal (6).msg
Vuntut Gwitchin First Nation0096	20-Jan-22	Email	Outgoing	Vuntut Gwitchin First Nation	Tim Bennett	Richard Wyman (Chance), Greg Charlie (Chance)	Ty Heffner, Megan Williams (Vuntut Gwitchin First Nation), Sharon Snowshoe, heritagemgr@nndfn.com, James Mooney	Eagle Plains Basin Exploration Project HROA	Tim B. emailed Ty H., Megan (Vuntut Gwitchin First Nation), Sharon S., Heritage Manager of NND, and cc'd James M., Richard (Chance), Greg (Chance), and Calista M., attaching a link to the Eagle Plains Basin Exploration Project Heritage Resource Overview Assessment (HROA).	N/A	N/A
E01370	21-Feb-22	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation)	Engagement/Consultation	I am just following up with you on the status of moving forward with Chance Proposal we discuss few months ago (December 9,2021) . We are still committed to move forward with Vuntut Gwitchin First Nation if you guys are still interested. As you may or may not know, Yukon Environmental Socio-economic Assessment Board as pushed back the new regulated Pre Submission start date for June 1, 2022. So we agree to move back our multi well submission as well to June 1, 2022. This will give us more time to work out solution for engagement with Vuntut Gwitchin First Nation and it's Citizens.	N/A	E01366_FW_ Chance Oil and Gas Proposal (6).msg
E01371	04-Apr-22	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Engagement/Consultation	In accordance with Vuntut Gwitchin First Nation's March 3, 2021 letter to Chance and the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy, Chance wanted to provide notice of upcoming community engagement events that are being planned in Old Crow. Chance, Hemmera, as well as additional consultants will be flying up to Old Crow the evening of May 4th. We are planning on holding one open house the following evening (May 5th) at the new community hall between 4:30 pm to 7:00 pm. The purpose of the open house will be to share information about Chance's Eagle Plains Exploration Project and to collect feedback and concerns. More specifically, Peer Solutions will be sharing information about the proposed seismic program and EDI (EDI) will be presenting findings of their baseline studies. We will be re-using posters already made and previously shared with you. Please let me know if you would like me to send a copy of them again. I can send copies of the presentations as soon as they're finalized.	N/A	E01371_Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow May 5th.msg
E01391	22-Apr-22	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Engagement/Consultation	In accordance with Vuntut Gwitchin First Nation's March 3, 2021 letter to Chance and the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy, Chance wanted to provide notice of upcoming community engagement events that are being planned in Old Crow. Chance, Hemmera, as well as additional consultants will be flying up to Old Crow the evening of May 4th. We are planning on holding one open house the following evening (May 5th) at the new community hall between 4:30 pm to 7:00 pm. The purpose of the open house will be to share information about Chance's Eagle Plains Exploration Project and to collect feedback and concerns. More specifically, Peer Solutions will be sharing information about the proposed seismic program and EDI (EDI) will be presenting findings of their baseline studies. We will be re-using posters already made and previously shared with you. Please let me know if you would like me to send a copy of them again. I can send copies of the presentations as soon as they're finalized.	N/A	E01391_RE_ Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow May 5th (1).msg
E01392	05-May-22	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Engagement/Consultation Information Sharing	Apologies for the delay in getting this to you. Presentations are usually a last-minute item, but especially so this time. I'll be sending you copies of the presentations that will be shared later today at the Open House. Due to file size, I'll have to use Hemmera's file sharing site. The presenters might make small editorial changes to the presentations, but for the most part they are completed. I've also attached here an additional handout that EDI prepared. It is a collection of the draft executive summaries from their baseline studies.	N/A	E01392_RE_ Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow May 5th.msg E01392_Chance_summary of Environmental Baseline Studies_v1.1_220504.docx

E01393	05-May-22	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erin Light, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Engagement/Consultation Information Sharing	On the off chance you do not receive the automated email from the sharefile – please use the link in the email attached!	N/A	E01391_RE_ Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow May 5th (1).msg E01391_Chance Eagle Plains Exploration Project (ExCom) - Community Event in Old Crow May 5th.msg
E01398	05-May-22	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	Greg Charlie (Chance), Cindy Dickson (Chance)	Todd Mahon, Tim Bennett, Susan Eastman, Shirley McCuaig	Wildlife Permafrost Project Description/Activities Seismic Heritage/Archaeology Caribou Engagement/Consultation	Chance held a community open house event in Old Crow at the Darius Elias (Vuntut Gwitchin First Nation) Community Centre from 11:00 am – 7:00 pm MST. Chance shared information regarding the Project, heritage resources, permafrost, seismic testing, and wildlife studies.	N/A	E01397_220526_Vuntut Gwitchin First NationCommunity-Chance_May5OpenHouse_Meetingsummary_v.0.3.docx E01397_220505_Vuntut Gwitchin First NationCommunity-Chance_May5OpenHouse_Sign-inSheet.pd
E01385	16-May-22	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Engagement/Consultation	In accordance with Vuntut Gwitchin First Nation's March 3, 2021 letter to Chance and the Vuntut Gwitchin First Nation Oil and Gas Engagement Policy, Chance wanted to provide notice of an upcoming community engagement event that is being planned in Old Crow. Chance, Hemmera, as well as additional consultants will be flying up to Old Crow the evening of May 25th. We are planning on holding one open house the following day (May 26th) at the new community hall between 11:00 am to 7:00 pm (dinner and presentations to start at 4:30pm). The purpose of the open house will be to share information about Chance's Eagle Plains Exploration Project and to collect feedback and concerns. More specifically, Vertex will be sharing information about the proposed drilling program and EDI (EDI) will be focusing on caribou mitigation and monitoring actions. We will be re-using posters already made and previously shared with you. Please let me know if you would like me to send a copy of them again. I can send copies of the presentations as soon as they're finalized.	N/A	E01385_Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow May 26th.msg
E01394	17-May-22	Email	Incoming	Vuntut Gwitchin First Nation	Erin Light	N/A	Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Information Sharing	I am reaching out to let you know that on May 26, there is also a Vuntut Gwitchin First Nation All-Staff mandatory meeting happening from 9-3.	N/A	E01394_RE_ Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow May 26th (4).msg
E01395	18-May-22	Email	Outgoing	Vuntut Gwitchin First Nation	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erin Light, Erika Tizya-Tramm (Vuntut Gwitchin First Nation), Jordan Peterson	Information Sharing	Thanks for the information!	N/A	E01394_RE_ Chance Eagle Plains Exploration Project (ExCom) - Upcoming Community Event in Old Crow May 26th (4).msg
E01384	26-May-22	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	Richard Wyman (Chance), Cindy Dickson (Chance)	Derek Fraser, Todd Mahon, Michael Setterington, Clive Mountford	Wildlife Engagement/Consultation Water - Surface Regulatory Process Mitigation Measure	Chance held a community open house event in Old Crow at the Darius Elias (Vuntut Gwitchin First Nation) Community Centre from 10:00 am – 8:00 pm MST. Chance shared information regarding the Project, drilling techniques and equipment, YESAA and Yukon Environmental Socio-economic Assessment Board's Pre-Submission Engagement Process, linear features and disturbance, and water bodies in the Project area.	N/A	E01384_220606_Vuntut Gwitchin First NationCommunity-Chance_May26OpenHouse_Meetingsummary_v.0.5.docx E01384_220525_Vuntut Gwitchin First NationCommunity-Chance_May25OpenHouse_sign-inSheet.pdf
Vuntut Gwitchin First Nation0245	26-May-22	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	N/A	N/A	Open House	Chance held an open house in Old Crow at the New Community Hall on May 26, 2022 from 1:00 PM until 8:00 PM.	N/A	N/A
E01405	09-Jun-22	Email	Incoming	Vuntut Gwitchin First Nation	Erika Tizya-Tramm	Greg Charlie (Chance)	Erin Light, Jordon Peterson	Engagement	Erika (Vuntut Gwitchin First Nation) emailed Greg (Chance) to let him know that as lead for the Vuntut Gwitchin First Nation's Stewardship and Sustainablity Portfolio and Natural Resources Committee Co-Chair, she would provide an update to the General Assembly (GA) at the GA Resolution directing Erika and Greg to work together.	N/A	N/A
E01425	05-Aug-22	Email	Incoming	Vuntut Gwitchin First Nation	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation)	Mike Chernoff	N/A	Engagement	Richard forwarded a letter that Mike received from Dana. It was a 7-page letter on re-engaging on its commitments to Vuntut Gwitchin First Nation.	N/A	E01421 - Vuntut Gwitchin First Nation LTR COGL re communication and engagement letter
Vuntut Gwitchin First Nation0097	29-Nov-22	Email	Outgoing	Vuntut Gwitchin First Nation	Tim Bennett	N/A	Ty Heffner, Megan Williams (Vuntut Gwitchin First Nation), Sharon Snowshoe, heritagemgr@nndfn.com, James Mooney	Eagle Plains Exploration Project 2022 HRIA Interim Report (22-22ASR)	Tim B. emailed Ty H., Megan (Vuntut Gwitchin First Nation), Sharon S., Heritage Manager of NND, and cc'd James M. attaching a pdf of the Eagle Plains Exploration Project 2022 Heritage Resource Impact Assessment (HRIA) Interim Report (22-22ASR).	N/A	N/A
E014786	09-Dec-22	Email	Incoming	Vuntut Gwitchin First Nation	Loretta Itsi	Cindy Dickson (Chance)	N/A	Engagement	Loretta (Vuntut Gwitchin First Nation) emailed Cindy (Chance) and let her know the Chance Logo would go in the hall where the party is being held and would recognize Chance during speeches.	N/A	E01472 - RE logo for sponsorship of heating fuel and gas tickets
VGFN0098	10-Jan-23	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	Cindy Dickson (Chance)	N/A	Engagement	Cindy D. went to Old Crow to witness the Swearing In Ceremony of the newly elected Chief Pauline Frost (Vuntut Gwitchin First Nation) and two acclaimed Councilors, Deputy Chief Debra-Leigh Reti (Vuntut Gwitchin First Nation) and Jeneen Frei-Njootli.	N/A	E01485 - Air North Yukon's Airline-Confirmation 23163751
VGFN0103	16-Jan-23	Email	Outgoing	Vuntut Gwitchin First Nation	Cindy Dickson (Chance)	N/A	Chief Pauline Frost (Vuntut Gwitchin First Nation)	Engagement	Cindy D. sent Chief Pauline Frost (Vuntut Gwitchin First Nation) a meeting invitation for January 26, 2023 from 2:00 pm - 5:00 pm in Vancouver, right after the conclusion of AME Roundup Conference.	N/A	E01490 - FW January 26th 2023 Vancouver Meeting with Chance Oil and Gas Limited

E014808	24-Jan-23	Email	Incoming	Vuntut Gwitchin First Nation	Elizabeth Staples (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance)	Vuntut Gwitchin First Nation	Engagement	Elizabeth (Vuntut Gwitchin First Nation) sent Cindy D. an email to confirm if the January 26, 2023 meeting was still going ahead and noted that Chief Pauline Frost (Vuntut Gwitchin First Nation) would be accompanied by James Smith (Vuntut Gwitchin First Nation), Executive Director and herself.	N/A	E01496 - RE January 26th 2023 Vancouver Meeting with Chance Oil and Gas Limited
E01498	26-Jan-23	Email	Incoming	Vuntut Gwitchin First Nation	Elizabeth Staples (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance)	Elizabeth Staples (Vuntut Gwitchin First Nation)	Meeting Coordination/Planning	Elizabeth (Vuntut Gwitchin First Nation) asked if its possible to change the location of the meeting that afternoon to the Fairmont Waterfront. They have access to a meeting room there so it would be better for the potentially affected First Nations.	N/A	E01498 - Re January 26th 2023 Vancouver Meeting with Chance Oil and Gas Limited
VGFN0114	30-Jan-23	Email	Outgoing	Vuntut Gwitchin First Nation	Cindy Dickson (Chance)	Greg Charlie (Chance)	James Smith (Vuntut Gwitchin First Nation)	Engagement	Cindy D. sent James (Vuntut Gwitchin First Nation) an email thanking him, Chief Pauline Frost (Vuntut Gwitchin First Nation) and Elizabeth (Vuntut Gwitchin First Nation) for joining the meeting in Vancouver. Cindy said that Chance would like to suggest a new date to meet with leadership and community members in Old Crow. Chance suggested presenting on the draft Project Description on March 7, 2023 as well as presentations on caribou, permafrost, other ecological values, heritage, and Indigenous Knowledge work.	N/A	E01501 - Thank you
VGFN0115	30-Jan-23	Email	Outgoing	Vuntut Gwitchin First Nation	Cindy Dickson (Chance)	Greg Charlie (Chance)	James Smith (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	Cindy (Chance) sent James (Vuntut Gwitchin First Nation) an email thanking him, Chief Pauline Frost (Vuntut Gwitchin First Nation) and Elizabeth (Vuntut Gwitchin First Nation) for joining the Meeting in Vancouver. Cindy said that Chance would like to suggest a new date to meet with leaders and Citizens in Old Crow. A meeting date of March 7, 2023 was suggested for a Project description presentation as well as presentations on caribou, permafrost, other ecological values and heritage/traditional knowleddge work.	N/A	E01501 - Thank you
VGFN0116	01-Feb-23	Email, Letter	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance), Mike Chernoff (Chance)	Chief Pauline Frost (Vuntut Gwitchin First Nation), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Tara Kyikavichik, Willard Hagen (Gwich'in Tribal Council), Roy Erasmus (Gwich'in Tribal Council), James Smith (Vuntut Gwitchin First Nation), Elizabeth Staples (Vuntut Gwitchin First Nation), Adrienne Hill (First Nation of Na-cho Nyäk Dun), Erin Prelypchan (Two Worlds Consulting)	Engagement	Richard (Chance) sent Chief Frost (Vuntut Gwitchin First Nation), Grand Chief Kyikavichik (Gwich'in Tribal Council), and Chief Mervyn (First Nation of Na-cho Nyäk Dun) (First Nation of Na-Cho Nyäk Dun) emailed a thank you letter for a constructive meeting. Noted Chance would wait for direction on next steps and laying out the process for future engagement. Richard also informed that Chance had commissioned several studies to gather and evaluate baseline environmental data using experts at Environmental Dynamics, Palmer Environmental, ECOFOR, Mountford Consulting, Peer Solution, Tetratech, Ausenco and Two Worlds Consulting.	N/A	E01502 - FW email to chiefs of Vuntut Gwitchin First Nation Gwich'in Tribal Council and First Nation of Na-cho Nyäk Dun
VGFN0123	22-Feb-23	Email	Outgoing	Vuntut Gwitchin First Nation	Cindy Dickson (Chance)	N/A	Chief Pauline Frost (Vuntut Gwitchin First Nation)	Engagement	Cindy D. sent Chief Pauline Frost (Vuntut Gwitchin First Nation) an email as a follow up to the January 26th, 2023 meeting. Cindy asked how Chance should engage with Vuntut Gwitchin First Nation and noted they had set aside potential engagement dates in Old Crow in April 2023.	N/A	E01510 - Follow-Up from January 6th Meeting in Vancouver
VGFN0125	07-Mar-23	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Cindy Dickson (Chance), Richard Wyman (Chance)	Aparna Verma (Yukon Government), Chief Pauline Frost (Vuntut Gwitchin First Nation), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Derek Fraser (Yukon Government), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), Honourable John Streicker (Yukon Government), Mike Chernoff (Chance)	Engagement	Greg (Chance) emailed Honorable John Streicker, (Minister of Energy, Mines and Resources) and cc'd Derek (Yukon Government), Aparna (Yukon Government), representatives from Chance, Chief Frost (Vuntut Gwitchin First Nation), Grand Chief Kyikavichik (GTC), Chief Mervyn (First Nation of Na-cho Nyäk Dun) (NND), and Chief Roberta Joseph (Tr'ondëk Hwëch'in) (TH) providing the Land Tenure extension request. Chance stated to contact Chance if there are any questions.	N/A	E0141860 - Land Tenure Extension Request
VGFN0129	15-Mar-23	Email	Outgoing	Vuntut Gwitchin First Nation	Tim Bennett (Ecofor)	N/A	Ty Heffner (Yukon Government), Megan Williams (Vuntut Gwitchin First Nation)Sharon Snowshoe (Gwich'in Tribal Council), heritagemgr@nndfn.com, James Mooney (Ecofor)	Eagle Plains Exploration Project 2022 HRIA FINAL Report (22-22ASR)	Tim B. emailed Ty H., Megan (Vuntut Gwitchin First Nation), Sharon S., Heritage Manager of NND, and cc'd James M. attaching a link to the Eagle Plains Oil and Gas 2022 Heritage Resource Impact Assessment (HRIA) Final Report (22-22ASR).	N/A	N/A
VGFN0130	22-Mar-23	Email	Incoming	Vuntut Gwitchin First Nation	Moira Lassen (Yukon Government)	Greg Charlie (Chance), Mike Chrenoff, Richard Wyman (Chance), Cindy Dickson (Chance)	Derek Fraser (Yukon Government), Aparna Verna, Patricia Randall (Unknown), Chief Pauline Frost (Vuntut Gwitchin First Nation), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), John Streicker	Tenures/Dispositions/Permits	Moira (Ausenco) sent Greg (Chance) a thank you letter for reaching out to Minister Streicker with the land tenure extension request.	N/A	E01520 - RE EXT Land Tenure Extension Request
VGFN0131	03-Apr-23	Email	Incoming	Vuntut Gwitchin First Nation	Sabrin-Jean Fred	Greg Charlie (Chance), Mike Chernoff (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Moira Lassen (Yukon Government), Chief Pauline Frost (Vuntut Gwitchin First Nation), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), Aparna Verma (Yukon Government), Patricia Randall (Unknown), Derek Fraser (Yukon Government)	Tenures/Dispositions/Permits	Sabrina-Jean (Yukon Government) sent Greg (Chance) an email with an attached letter from Minister Streiker regarding Land Tenure Extension Request, Oil and Gas Permits 0012-0017, 0019 and 0020.	N/A	E01521 - Letter from Minister Streicker E01522 - 23.03.30_LTR_Greg Charlie (Chance) (002)

VGFN0132	04-Apr-23	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Cindy Dickson (Chance), Greg Charlie (Chance)	Chief Pauline Frost (Vuntut Gwitchin First Nation), Deputy Chief Debra-Leigh Reti (Vuntut Gwitchin First Nation), Jeneen Frei-Njootli (Vuntut Gwitchin First Nation), James Smith (Vuntut Gwitchin First Nation), Elizabeth Staples (Vuntut Gwitchin First Nation)	Engagement	Richard sent Chief Frost, Deputy Chief Debra-Leigh Reti (Vuntut Gwitchin First Nation), and Councilor Jeneen Frei-Njootli letter requesting in-person meetings in Old Crow on May 15, 2023 and June 11, 2023.	N/A	E01523 - Meeting request E01524 - April 5 Letter to Vuntut Gwitchin First Nation Chief and Council
E0141840	28-Apr-23	Email	Incoming	Vuntut Gwitchin First Nation	John Bailey (Vuntut Gwitchin First Nation)	Greg Charlie (Chance)	James Smith (Vuntut Gwitchin First Nation)	Engagement	John (Vuntut Gwitchin First Nation) sent Greg (Chance) an email indicating he was now the contact for Vuntut Gwitchin First Nation on all matters respecting Chance.	N/A	N/A
E0141840	28-Apr-23	Email	Outgoing	Vuntut Gwitchin First Nation	Cindy Dickson (Chance)	N/A	James Smith (Vuntut Gwitchin First Nation)	Engagement	Cindy (Chance) sent James (Vuntut Gwitchin First Nation) the May 15, 2023 Community Open House Advertisement.		
VGFN0139	01-May-23	Email	Outgoing	Vuntut Gwitchin First Nation	Cindy Dickson (Chance)	N/A	John Bailey (Vuntut Gwitchin First Nation)	Engagement	Cindy D. sent John (Vuntut Gwitchin First Nation) the May 15, 2023 Community Open House Advertisement. Noted the advertisement was previously sent to James Smith (Vuntut Gwitchin First Nation), Executive Director for Vuntut Gwitchin First Nation on April 28, 2023.	N/A	E01530 - May 15 Community Open House Advertisement
E0141844	08-May-23	Email	Incoming	Vuntut Gwitchin First Nation	John Bailey (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance)	N/A	Engagement/Consultation	John (Vuntut Gwitchin First Nation) responded to Cindy's (Chance) email of May 1, 2023, letting her know that he will be in Old Crow on the 15th and he will see the Chance team there.	N/A	E01532 - Re May 15 Community Engagement Notice in Old Crow
VGFN0172	11-May-23	Community Event Flyer and Radio Advertisement	Incoming	Vuntut Gwitchin First Nation	Chance	Cindy Dickson (Chance)	Vuntut Gwitchin First Nation	Information Sharing	Chance sent an event invitation poster to Vuntut Gwitchin First Nation staff to post in Old Crow facilities. This invitation was targeted to Vuntut Gwitchin First Nation Citizens and residents of Old Crow. Chance shared the Open House invitation via a rolling advertisement with a local radio station. The invitation provided key information such as event purpose, event location and time, and Chance contact information to share questions and/or feedback about the Open House or the Project.	N/A	Vuntut Gwitchin First Nation0172A
VGFN0142	15-May-23	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	Cindy Dickson (Chance), Greg Charlie (Chance)	Eliza Bethune (Two Worlds Consulting), Mike Setterington (Environmental Dynamics Inc.), Rebecca DeLorey (Two Worlds Consulting), Shirley McCuaig (Palmer), Tim Bennett (Ecofor), Vuntut Gwitchin First Nation Citizens and residents of Old Crow	Engagement	The Project Team travelled to Old Crow and planned to conduct an in-person community open house event. This event was cancelled due to a potential flash flood. Chance, with approval from Chief Pauline Frost (Vuntut Gwitchin First Nation), provided a catered dinner for leadership and community members at the Old Crow Community Centre.	N/A	N/A
VGFN0147	04-Jul-23	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	John Bailey (Vuntut Gwitchin First Nation)	Engagement/Consultation	Greg (Chance) emailed John (Vuntut Gwitchin First Nation) following up on the status of the Benefit Agreement. Greg stated Chance will be getting the Project description out and then can set up an introduction meeting with Jennifer the following week.	N/A	N/A
VGFN0148	07-Jul-23	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Richard Wyman (Chance)	John Bailey (Vuntut Gwitchin First Nation)	Engagement	Greg (Chance) emailed John (Vuntut Gwitchin First Nation) stating Jennifer and Greg (Chance) would like to meet with John as an introduction. Chance stated Jenn is new and will lead the Environmental Assessment process. Chance noted they are expecting to submit the Environmental Assessment to the Executive Committee around December 14, 2023. Greg stated Chance will forward a copy of the draft Project Description early next week. Chance noted the only dates available to meet are August 2-4, 2023. Chance stated to contact Greg if there are any questions.	N/A	N/A
VGFN0151	10-Jul-23	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	N/A	John Bailey (Vuntut Gwitchin First Nation), Jennifer Shalagan (Environmental Dynamics Inc.)	Engagement	Greg (Chance) sent a August 3, 2023 meeting agenda and calendar placeholder.	N/A	N/A
VGFN0152	10-Jul-23	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	N/A	John Bailey (Vuntut Gwitchin First Nation), Skeeter Wright (First Nation of Na-cho Nyak Dun), Jennifer Shalagan (Environmental Dynamics Inc.)	Engagement	Greg (Chance) invited John (Vuntut Gwitchin First Nation) to the August 3, 2023 meeting.	N/A	N/A
VGFN0153	10-Jul-23	Email	Incoming	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	John Bailey (Vuntut Gwitchin First Nation)	Engagement/Consultation	John (Vuntut Gwitchin First Nation) emailed Greg (Chance) to ask if August 3, 2023 works to meet. John stated to send an invite with a preferred time and location if that date works.	N/A	N/A
VGFN0154	10-Jul-23	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	N/A	John Bailey (Vuntut Gwitchin First Nation), Jennifer Shalagan (Environmental Dynamics Inc.)	Engagement/Consultation	Greg (Chance) emailed John (Vuntut Gwitchin First Nation) stating to meet at Greg's office at 9:00AM on August 3, 2023. Chance stated they will be setting up a meeting to introduce Jennifer to the Yukon Government and Yukon Environmental Socio-economic Assessment Board. Chance asked John to recommend anyone else that should be included in that meeting.	N/A	N/A
VGFN0155	10-Jul-23	Email	Incoming	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	N/A	John Bailey (Vuntut Gwitchin First Nation), Jennifer Shalagan (Environmental Dynamics Inc.)	Engagement/Consultation	John (Vuntut Gwitchin First Nation) emailed Greg (Chance) shared that the Yukon Environmental Socio-economic Assessment Board confirmed Laura Melvin (Yukon Environmental Socio-economic Assessment Board) laura.melvin@yesab.ca who manages Executive Committee and/or Bryony Mcintyre (Yukon Government) Bryony.McIntyre@yesab.ca a member of the Executive Committee were the key contacts for the Project.	N/A	N/A
VGFN0156	13-Jul-23	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	N/A	John Bailey (Vuntut Gwitchin First Nation), Jennifer Shalagan (Environmental Dynamics Inc.)	Engagement	Greg (Chance) emailed John (Vuntut Gwitchin First Nation) and Jennifer S. and provided a draft Project Description. Chance requested that John (Vuntut Gwitchin First Nation) share with the Vuntut Gwitchin First Nation team. Chance stated they can discuss next steps at the August 3, 2023 meeting. Chance noted that they are preparing community engagement meetings in Old Crow, Inuvik, Tsiigehtchic, and Teetl'it Zheh (Fort McPherson) during the August 22, 2023 week. Chance said to not hesitate to contact Greg or Jennifer if there are any questions.	N/A	N/A
VGFN0158	28-Jul-23	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	N/A	Eliza Bethune (Two Worlds Consulting), John Bailey (Vuntut Gwitchin First Nation)	Engagement	Greg (Chance) emailed John (Vuntut Gwitchin First Nation) and cc'd Eliza (Two Worlds Consulting) providing a presentation Chance is planning to share on August 3, 2023 at 9:00AM. Chance stated they will meet in the EDI office and there will be refreshments during the meeting. Asked John to confirm if any edits to the meeting agenda.	N/A	323-Chance EaglePlainsExplPresentation_August 3 2023_20230728_FINAL.pptx

VGFN0159	04-Aug-23	Meeting	N/A	Vuntut Gwitchin First Nation	Eliza Bethune (Two Worlds Consulting)	N/A	John Bailey (Vuntut Gwitchin First Nation), Eliza Bethune (Two Worlds Consulting), Jennifer Shalagan (Environmental Dynamics Inc.), and Pat Tobler (Environmental Dynamics Inc.)	Engagement	Chance, EDI, and TWC met with a technical advisor on behalf of Vuntut Gwitchin First Nation in Whitehorse, YT to provide a Project overview and discuss proposed engagement activities with Vuntut Gwitchin First Nation leadership.	https://twoworldsconsulting.sharepoint.com/sites/323ChanceOilandGasYukon_engagement/Shared%20Documents/02_Engagement%20Scope/02_Leadership%20and%20Technical%20Advisor%20Engagement/August%203%20and%204%2023%20Meetings%20with%20Vuntut Gwitchin First Nation,%20TH,%20NND,%20and%20Yukon Government%20Reps/2023-08-03-413-Chance-EaglePlainsProject-Draft-Vuntut Gwitchin First Nation-August%204,%202023-Meeting%20Minutes.docx?d=w714623c378c04d41b47c40313bdcdb3d&csf=1&web=1&e=9cQDCB	N/A
VGFN0161	10-Aug-23	Text Message	Incoming	Vuntut Gwitchin First Nation	John Bailey (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Eliza Bethune (Two Worlds Consulting)	Engagement	John (Vuntut Gwitchin First Nation) texted Greg (Chance) and stated Vuntut Gwitchin First Nation will check on the possibility of early September and will get back to Chance when there is more information.	N/A	N/A
VGFN0162	10-Aug-23	Text Message	Incoming	Vuntut Gwitchin First Nation	John Bailey (Vuntut Gwitchin First Nation)	Greg Charlie (Chance)	N/A	Engagement	John (Vuntut Gwitchin First Nation) texted Greg (Chance) and stated the first week in September will work. Vuntut Gwitchin First Nation stated if Chance can aim for September 5 or 6, it would be appreciated. John (Vuntut Gwitchin First Nation) stated they will set up an appearance with Chief and Council for Chance in advance to the meeting. John (Vuntut Gwitchin First Nation) noted he would let Chance know if he would like to grab a coffee and chat on August 14, 2023.	N/A	N/A
VGFN0164	10-Aug-23	Text Message	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Cindy Dickson (Chance), Richard Wyman (Chance)	Eliza Bethune (Two Worlds Consulting), John Bailey (Vuntut Gwitchin First Nation)	Engagement	Greg (Chance) texted John (Vuntut Gwitchin First Nation) and stated Chance is debating pushing back the Old Crow visit on August 23, 2023 due to wildfires. Greg asked what John's thoughts are on this and said maybe the first week of September instead.	N/A	N/A
VGFN0165	10-Aug-23	Text Message	Incoming	Vuntut Gwitchin First Nation	John Bailey (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Eliza Bethune (Two Worlds Consulting)	Engagement	John (Vuntut Gwitchin First Nation) texted Greg (Chance) and stated Vuntut Gwitchin First Nation will check on the possibility of early September and will get back to Chance when there is more information.	N/A	N/A
VGFN0166	10-Aug-23	Text Message	Incoming	Vuntut Gwitchin First Nation	John Bailey (Vuntut Gwitchin First Nation)	Greg Charlie (Chance)	N/A	Engagement	John (Vuntut Gwitchin First Nation) texted Greg (Chance) and stated the first week in September will work. Vuntut Gwitchin First Nation stated if Chance can aim for September 5 or 6, it would be appreciated. John stated they would set up an appearance with Chief and Council for Chance in advance to the meeting. John noted to let them know if Chance would like to grab a coffee and chat on August 14, 2023.	N/A	N/A
VGFN0168	25-Aug-23	Meeting	Incoming	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	N/A	John Bailey (Vuntut Gwitchin First Nation)	Engagement	Greg (Chance) met with John (Vuntut Gwitchin First Nation) to discuss the upcoming engagement meeting in Old Crow on September 13, 2023 with Vuntut Gwitchin First Nation leadership about the Land Tenure extension and resources for participation in the Executive Committee process for the Project.	N/A	N/A
VGFN0276	31-Aug-23	Community Event Flyer and Radio Advertisement	Incoming	Vuntut Gwitchin First Nation	Chance	Cindy Dickson (Chance)	Vuntut Gwitchin First Nation	Information Sharing	Chance provided an invitation on August 31, 2023 to Vuntut Gwitchin First Nation staff to print and post around Old Crow, as well as post virtually on social-media platforms accessible to Vuntut Gwitchin First Nation Citizens and residents of Old Crow. The invitation provided key information such as event purpose, event location and time, and Chance contact information to share questions and/or feedback about the Open House or Project.	N/A	N/A
VGFN0169	11-Sep-23	Text Message	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	John Bailey (Vuntut Gwitchin First Nation)	Meeting with Council	Greg (Chance) texted John (Vuntut Gwitchin First Nation) asking if they are able to meet with council at 2:00 PM . Greg (Chance) noted that Cindy could contact the office in Old Crow if needed.	N/A	N/A
VGFN0170	12-Sep-23	Text Message	Incoming	Vuntut Gwitchin First Nation	John Bailey (Vuntut Gwitchin First Nation)	Greg Charlie (Chance)	John Bailey (Vuntut Gwitchin First Nation)	Meeting with Council	John (Vuntut Gwitchin First Nation) texted Greg (Chance) and stated they have set up the meeting Vuntut Gwitchin First Nation leadership for 2:00PM on September 13, 2023.	N/A	N/A
VGFN0171	13-Sep-23	Text Message	Outgoing	Vuntut Gwitchin First Nation	Eliza Bethune (Two Worlds Consulting)	N/A	Eliza Bethune (Two Worlds Consulting), John Bailey (Vuntut Gwitchin First Nation)	Meeting with Council	Greg (Chance) texted John (Vuntut Gwitchin First Nation) stating thanks for setting up a meeting with Vuntut Gwitchin First Nation leadership for 2:00PM on September 13, 2023.	N/A	N/A
VGFN0173	18-Sep-23	Email	Incoming	Vuntut Gwitchin First Nation	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Kevin Simpson (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), John Bailey (Vuntut Gwitchin First Nation)	Leadership Meeting Follow-up	Eliza (Two Worlds Consulting) emailed John (Vuntut Gwitchin First Nation) and cc'd Greg (Chance), Cindy (Chance) Kevin (Two Worlds Consulting), and Richard (Chance) stating their thanks for supporting the coordination of the last week's meeting between Vuntut Gwitchin First Nation leadership and staff representatives and Chance Oil and Gas' Project Team. Eliza (Two Worlds Consulting) requested feedback on the joint discussions being organized by and held between the Nations. Eliza (Two Worlds Consulting) confirmed Chance was meeting with Andrea Wilson (Yukon Government) (Yukon Government) from Yukon Government on September 20th and invited John (Vuntut Gwitchin First Nation) to join that meeting, if interested.	N/A	N/A

VGFN0174	19-Sep-23	Email	Incoming	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Jennifer Shalagan (Environmental Dynamics Inc.), Cindy Dickson (Chance)	Eliza Bethune (Two Worlds Consulting), John Bailey (Vuntut Gwitchin First Nation)	Chance Submission to Yukon Environmental Socio-economic Assessment Board	Greg (Chance) phoned John (Vuntut Gwitchin First Nation) to discuss a regular meeting for sharing information starting mid-October with potentially affected First Nations. Greg said he would set up presentations on caribou and other wildlife. He agreed to have the Porcupine Caribou Management Board invited to future sessions on the Porcupine Caribou Herd. John agreed to try to attend the meeting with Yukon Government and Greg forwarded the invite to him. John said Vuntut Gwitchin First Nation was discussing details around capacity funding with the Yukon Government to support their involvement in the Project.	N/A	N/A
VGFN0175	19-Sep-23	Email	Incoming	Vuntut Gwitchin First Nation	John Bailey (Vuntut Gwitchin First Nation)	Greg Charlie (Chance) Cindy Dickson (Chance)	John Bailey (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) Bailey, Andrea Wilson (Yukon Government), Brian Macdonald (Yukon Government), Keith Maguire (Yukon Government), Katie Fraser (Tr'ondëk Hwëch'in), executivedirector@First Nation of Na-Cho Nyäk Dunfn.com, lands.director@First Nation of Na-Cho Nyäk Dunfn.com, Jim Taggart (Unknown), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Bryony Mcintyre (Yukon Government), Laura Melvin (Yukon Environmental Socio-economic Assessment Board), Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council), Brandon Roebuck (Government of Canada), Elizabeth Staples (Vuntut Gwitchin First Nation), McGarry Selbee (First Nation of Na-cho Nyäk Dun), Jennifer Shalagan (Environmental Dynamics Inc.), Eliza Bethune (Two Worlds Consulting)	Executive Committee Screening	John (Vuntut Gwitchin First Nation) invited Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, and Gwich'in Tribal Council to a meeting with the Yukon Government, Chance, and Yukon Environmental Socio-economic Assessment Board regarding the Yukon Environmental Socio-economic Assessment Board Executive Committee screening for the Project. John (Vuntut Gwitchin First Nation) requested individuals RSVP if they were available for a virtual meeting at 10:30AM on , October 13th.	N/A	N/A
VGFN0176	21-Sep-23	Email	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance) Cindy Dickson (Chance)	John Bailey (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) Bailey, Andrea Wilson (Yukon Government), Brian Macdonald (Yukon Government), Keith Maguire (Yukon Government), Katie Fraser (Tr'ondëk Hwëch'in), executivedirector@First Nation of Na-Cho Nyäk Dunfn.com; lands.director@First Nation of Na-Cho Nyäk Dunfn.com; Jim Taggart (Unknown), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Bryony Mcintyre (Yukon Government), Laura Melvin (Yukon Environmental Socio-economic Assessment Board), Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council), Brandon Roebuck (Government of Canada), Elizabeth Staples (Vuntut Gwitchin First Nation), McGarry Selbee (First Nation of Na-cho Nyäk Dun), Jennifer Shalagan (Environmental Dynamics Inc.), Eliza Bethune (Two Worlds Consulting)	Executive Committee Screening	Greg (Chance) emailed and stated thanks for organizing a meeting with the parties. Chance stated their team will be available for this meeting and will send out a presentation ahead of time.	N/A	N/A
VGFN0278	04-Oct-23	Email	Outgoing	Vuntut Gwitchin First Nation	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance) Cindy Dickson (Chance) Richard Wyman (Chance)	Kevin Simpson (Two Worlds Consulting) Jennifer Shalagan (Environmental Dynamics Inc.) Eliza Bethune (Two Worlds Consulting)	Meeting	Eliza (Two Worlds Consulting) emailed John and cc'd Chance representatives asking if Nations were still interested in an all-Nation meeting on October 13, 2023. Eliza asked John to answer the following: 1. Should Chance send a meeting invite to everyone included on the email you sent a few weeks ago? If yes, do the Nations prefer to meet via Zoom, Microsoft Teams, or another platform? What time would work best to meet and how long are the Nations interested in meeting for? 2. Should Chance prepare a draft agenda for the meeting to share with the Nations for review and confirmation? Potential agenda items could include Chance reviewing at a high-level the draft Table of Contents for the Project Proposal , Chance to review a high-level Project Proposal schedule, and First Nations and Chance to discuss future all-party meeting frequency, topics, format etc. This information will help Chance determine who from the Project Team should attend the meeting. 3. Should Chance prepare and send materials to the Nations prior to the meeting? Chance will try their best to accommodate material requests. If not possible, materials can be prepared and shared after the meeting.	N/A	N/A
VGFN0178	05-Oct-23	Email	Incoming	Vuntut Gwitchin First Nation	John Bailey (Vuntut Gwitchin First Nation)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Eliza Bethune (Two Worlds Consulting), John Bailey (Vuntut Gwitchin First Nation), Jennifer Shalagan (Environmental Dynamics Inc.), Kevin Simpson (Two Worlds Consulting), Elizabeth Staples (Vuntut Gwitchin First Nation)	All-Party Meeting	John (Vuntut Gwitchin First Nation) emailed Eliza (Two Worlds Consulting) and said they are setting up the October 13, 2023 virtual meeting. John (Vuntut Gwitchin First Nation) stated that the main purpose of the meeting is to discuss process and consultations relating to the Yukon Environmental Socio-economic Assessment Board Executive Committee screening.	N/A	20231005-Vuntut Gwitchin First Nation

VGFN0179	05-Oct-23	Email	Outgoing	Vuntut Gwitchin First Nation	John Bailey (Vuntut Gwitchin First Nation)	N/A	Eliza Bethune (Two Worlds Consulting), John Bailey (Vuntut Gwitchin First Nation)	All-Party Meeting	Eliza (Two Worlds Consulting) emailed John (Vuntut Gwitchin First Nation) thanking John (Vuntut Gwitchin First Nation) for this quick reply. Eliza (Two Worlds Consulting) stated that Chance will be prepared to speak to proposed consultation steps and a timing update on the Project Proposal submission to Yukon Environmental Socio-economic Assessment Board to support the Nations' resourcing and capacity planning.	N/A	20231005-Vuntut Gwitchin First Nation.2
VGFN0180	10-Oct-23	Email	Incoming	Vuntut Gwitchin First Nation	Elizabeth Staples (Vuntut Gwitchin First Nation)	Greg Charlie (Chance) Cindy Dickson (Chance)	Shane Kilpatrick (Government of Canada), Kim Pawley (Government of Canada), Carey Sibbald (Government of Canada), Krista Magee (Government of Canada), Jennifer Walsh (Government of Canada), Alicia McKae (Gwich'in Tribal Council), Maggie Crump, Kanda Gnama (Gwich'in Tribal Council), Brian MacDonald, Keith Maguire (Yukon Government) (Yukon Government), Andrea Wilson (Yukon Government), Tiffani Fraser (Yukon Government), Jim Taggart (Unknown) (Yukon Government), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), and John Bailey (Vuntut Gwitchin First Nation).	Meeting	Elizabeth Staples (Vuntut Gwitchin First Nation)emailed Vuntut Gwitchin First Nation, Gwich'in Tribal Council, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Chance, and Two Worlds Consulting forwarding them a meeting invite for October 13, 2023. Elizabeth attached an agenda.	N/A	20231010-ALLNATIONS
VGFN0181	10-Oct-23	Email	Outgoing	Vuntut Gwitchin First Nation	Rebecca DeLorey (Two Worlds Consulting)	N/A	Megan Williams (Vuntut Gwitchin First Nation)Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), James Smith (Vuntut Gwitchin First Nation)	Researcher's Application Form Submission	Rebecca (Two Worlds Consulting) emailed Vuntut Gwitchin First Nation and attached the Researcher's Application Form, draft Information Sheet and Informed Consent Form, and Oral History Access Form for the Eagle Plains Exploration Project Socio-economic Interview Program. These applications were in follow-up to discussions that Chance had with Vuntut Gwitchin First Nation regarding the Eagle Plains Exploration Project proposed by Chance.	N/A	20231010-Vuntut Gwitchin First Nation-Vuntut Gwitchin First Nation Researcher's Application Form 20231010-Vuntut Gwitchin First Nation-Vuntut Gwitchin First Nation Access to Oral History Materials Application 20231010-Vuntut Gwitchin First Nation-Information Sheet and Informed Consent Form Draft 20231010-Vuntut Gwitchin First Nation
VGFN0182	13-Oct-23	Meeting	N/A	Vuntut Gwitchin First Nation	Elizabeth Staples (Vuntut Gwitchin First Nation)	Greg Charlie (Chance) Cindy Dickson (Chance)	Shane Staples (Government of Canada), Kim Pawley (Government of Canada), Carey Sibbald (Government of Canada), Krista Magee (Government of Canada), Jennifer Walsh (Government of Canada), Alicia McKae (Gwich'in Tribal Council), Maggie Crump, Kanda Gnama (Gwich'in Tribal Council) (Gwich'in Tribal Council), Brian Macdonald (Yukon Government), Keith Maguire (Yukon Government) (Yukon Government), Andrea Wilson (Yukon Government) (Yukon Government), Tiffani Fraser (Yukon Government), Jim Taggart (Unknown) (Yukon Government), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), and John Bailey (Vuntut Gwitchin First Nation).	October 13 Meeting	A meeting was had between Chance, Vuntut Gwitchin First Nation, Gwich'in Tribal Council, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, the Yukon Government, Crown-Indigenous Relations and Northern Affairs Canada, Environmental Dynamics Inc., and Two Worlds Consulting. They discussed consultation activities for the Project and capacity funding opportunities to support First Nations' involvement in the Project's regulatory process.	N/A	20231010-ALLNATIONS
VGFN0183	17-Oct-23	Email	Outgoing	Vuntut Gwitchin First Nation	John Bailey (Vuntut Gwitchin First Nation)	Cindy Dickson (Chance), Richard Wyman (Chance), Greg Charlie (Chance)	Kevin Simpson (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)James Smith (Vuntut Gwitchin First Nation), Elizabeth Staples (Vuntut Gwitchin First Nation)	Traditional Knowledge Sources for Vuntut Gwitchin First Nation's Review, Comment, and Permission for Use	Eliza (Two Worlds Consulting) emailed John (Vuntut Gwitchin First Nation) and cc'd Kevin (Two Worlds Consulting), Cindy (Chance) Greg (Chance), Jennifer Shalagan (Environmental Dynamics Inc.), Richard (Chance), Elizabeth (Vuntut Gwitchin First Nation), James (Vuntut Gwitchin First Nation), and Megan (Vuntut Gwitchin First Nation) and stated Two Worlds Consulting on behalf of Chance has identified some existing secondary sources of Traditional Knowledge for Vuntut Gwitchin First Nation's review, comment, and permission for use. The table provided listed secondary sources related to Vuntut Gwitchin First Nation that, based on Two World's understanding, may contain Traditional Knowledge related to the Project area. Chance requested Vuntut Gwitchin First Nation's feedback including any protocols or guidance for the use of Traditional Knowledge and permission to use the listed secondary sources by , October 27, 2023. Chance also invited Vuntut Gwitchin First Nation to share any additional Traditional Knowledge sources that may not be listed to help inform the development of the socio-economic assessment and Project Proposal. Eliza stated that if Vuntut Gwitchin First Nation wanted to use alternative submission options for certain Traditional Knowledge sources, Chance would be happy to meet and discuss further.	N/A	N/A

VGFN0184	18-Oct-23	Email	Outgoing	Vuntut Gwitchin First Nation	Eliza Bethune (Two Worlds Consulting)	Cindy Dickson (Chance), Richard Wyman (Chance), Greg Charlie (Chance)	Kevin Simpson (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Elizabeth Staples (Vuntut Gwitchin First Nation), Jennifer Shalagan (Environmental Dynamics Inc.), John Bailey (Vuntut Gwitchin First Nation)	Meeting Minutes and File Sharing Information	Eliza (Two Worlds Consulting) emailed John (Vuntut Gwitchin First Nation) and cc'd Kevin (Two Worlds Consulting), Cindy (Chance) Greg (Chance), Jennifer Shalagan (Environmental Dynamics Inc.), Richard (Chance), Elizabeth (Vuntut Gwitchin First Nation), and attached meeting minutes for August 4, 2023 and September 13, 2023; letter that Yukon Environmental Socio-economic Assessment Board sent Chance on September 5, 2023 confirming Chance is expected to submit an updated Project Proposal to the Executive Committee of Yukon Environmental Socio-economic Assessment Board. Eliza (Two Worlds Consulting) confirmed that TWC will share the Open House Summary Report September 13, 2023 and October 13, 2023 Meeting Minutes. Eliza (Two Worlds Consulting) stated that a link to the First Nation-specific restricted access file sharing sites will be shared soon.	N/A	N/A
VGFN0185	20-Oct-23	Phone Call	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Richard Wyman (Chance), Cindy Dickson (Chance)	Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting), Jennifer Shalagan (Environmental Dynamics Inc.), John Bailey (Vuntut Gwitchin First Nation)	Phone Call	John (Vuntut Gwitchin First Nation) requested Chance prepare a Collaboration Plan similar to one that Greg described and was prepared for Gwich'in Tribal Council. John said the potentially affected First Nations and Yukon Government had a technical oil and gas meeting planned for the following week. Noted Vuntut Gwitchin First Nation's interest in a joint review approach of the Project Proposal.	N/A	N/A
VGFN0186	23-Oct-23	Email	Outgoing	Vuntut Gwitchin First Nation	Eliza Bethune (Two Worlds Consulting)	Richard Wyman (Chance), Cindy Dickson (Chance), Richard Wyman (Chance), Rick Nielsen (Chance)	Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting), Jennifer Shalagan (Environmental Dynamics Inc.), Elizabeth Staples (Vuntut Gwitchin First Nation), John Bailey (Vuntut Gwitchin First Nation), James Smith (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)	File Sharing Site Information and Access Instructions	Eliza (Two Worlds Consulting) emailed John (Vuntut Gwitchin First Nation), Debra-leigh R., James (Vuntut Gwitchin First Nation), Megan (Vuntut Gwitchin First Nation), Elizabeth (Vuntut Gwitchin First Nation), and cc'd Jennifer Shalagan (Environmental Dynamics Inc.), Kevin (Two Worlds Consulting), Greg (Chance), Cindy (Chance) Richard (Chance) and provided the steps to access the Vuntut Gwitchin First Nation file sharing site.	N/A	N/A
VGFN0187	23-Oct-23	Email	Incoming	Vuntut Gwitchin First Nation	Megan Williams (Vuntut Gwitchin First Nation)	Richard Wyman (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Richard Wyman (Chance), Cindy Dickson (Chance), Richard Wyman (Chance), Elizabeth Staples (Vuntut Gwitchin First Nation), John Bailey (Vuntut Gwitchin First Nation), James Smith (Vuntut Gwitchin First Nation)	Traditional Knowledge Sources for Vuntut Gwitchin First Nation's Review, Comment, and Permission for Use	Megan (Vuntut Gwitchin First Nation) emailed Eliza (Two Worlds Consulting), John (Vuntut Gwitchin First Nation) and cc'd Kevin (Two Worlds Consulting), Cindy (Chance) Greg (Chance), Jennifer Shalagan (Environmental Dynamics Inc.), Richard (Chance), Elizabeth (Vuntut Gwitchin First Nation), James (Vuntut Gwitchin First Nation) stating that Vuntut Gwitchin First Nation Research Application is on the agenda for review at the next Heritage Committee meeting. Megan (Vuntut Gwitchin First Nation) stated that the secondary sources listed below are fine to use and there are additional materials that are available, and attached the catalogue of Vuntut Gwitchin First Nation materials and also have a database of published and unpublished reports/articles.	N/A	N/A
VGFN0188	01-Nov-23	Email	Incoming	Vuntut Gwitchin First Nation	Eliza Bethune (Two Worlds Consulting)	Richard Wyman (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	John Bailey (Vuntut Gwitchin First Nation), James Smith (Vuntut Gwitchin First Nation)	Draft Collaboration Plan	Eliza (Two Worlds Consulting) emailed John (Vuntut Gwitchin First Nation) and cc'd James (Vuntut Gwitchin First Nation), Greg (Chance), Cindy (Chance) Richard (Chance), and Kevin (Two Worlds Consulting) providing a draft Collaboration Plan and a link to the document sharing site. Eliza (Two Worlds Consulting) requested confirmation of if the Plan should be shared with others and if John (Vuntut Gwitchin First Nation) or others would like to meet to discuss the Plan.	N/A	N/A
VGFN0189	10-Nov-23	Email	Incoming	Vuntut Gwitchin First Nation	Megan Williams (Vuntut Gwitchin First Nation)	N/A	Rebecca DeLorey (Two Worlds Consulting)	Researcher's Application Form Submission	Megan (Vuntut Gwitchin First Nation) emailed Rebecca (Two Worlds Consulting) stating the Vuntut Gwitchin Heritage Committee met on November 10, 2023 to review the research and assess applications. Vuntut Gwitchin First Nation stated they will send the agreements for review soon. Vuntut Gwitchin First Nation asked if TWC can send a list of the interview questions for the one-on-one and group sessions.	N/A	20231110-Vuntut Gwitchin First Nation
VGFN0190	20-Nov-23	Email	Outgoing	Vuntut Gwitchin First Nation	Rebecca DeLorey (Two Worlds Consulting)	N/A	Megan Williams (Vuntut Gwitchin First Nation)Daryl Harrison (Two Worlds Consulting)	Researcher's Application Form Submission	Rebecca (TWC) emailed Vuntut Gwitchin First Nation stating Chance is interested in speaking with representatives from Heritage, Health and Social, and Lands Departments on population and demographics data, community infrastructure, traditional economy, planning initiatives, traditional and current land and resource use, and issues/concerns/benefits of the Project.	N/A	20231120-Vuntut Gwitchin First Nation
VGFN0191	27-Nov-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Megan Williams (Vuntut Gwitchin First Nation), Daryl Harrison (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting)	Researcher's Application Form Submission	Jorge (Two Worlds Consulting) emailed Vuntut Gwitchin First Nation providing the Information Sheet and Informed Consent Form and the draft list of the interview questions for the upcoming socio-economic interviews. TWC added that a list of people that they would like to interview and requested that Vuntut Gwitchin First Nation let TWC know if they are available to participate. TWC stated that if there are any other suggestions for Vuntut Gwitchin First Nation interviewees to let TWC know.	N/A	Information Sheet and Informed Consent Form Vuntut Gwitchin First Nation 20232311 Chance's Eagle Plains Project Interview Question by Topic 20232711 20231127-Vuntut Gwitchin First Nation
VGFN0204	27-Nov-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Jorge Soler-Cruz (Two Worlds Consulting), Daryl (Two Worlds Consulting), Rebecca (Two Worlds Consulting), Janelle Pascal (Vuntut Gwitchin First Nation)	Socio-economic Interview	Jorge (Two Worlds Consulting) emailed Janelle P. and cc'd Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), requesting an interview regarding health and wellness in your community.	N/A	N/A

VGFN0192	28-Nov-23	Email	Incoming	Vuntut Gwitchin First Nation	Megan Williams (Vuntut Gwitchin First Nation)	N/A	Daryl Harrison (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation),Jorge Soler-Cruz (Two Worlds Consulting)	Researcher's Application Form Submission	Megan (Vuntut Gwitchin First Nation) emailed Jorge (Two Worlds Consulting) and cc'd Eliza (Two Worlds Consulting), Daryl (Two Worlds Consulting), Rebecca (Two Worlds Consulting) attaching the Vuntut Gwitchin First Nation Research Agreement for Vuntut Gwitchin First Nation's review. Megan (Vuntut Gwitchin First Nation) requested that the final product will need to be reviewed by Vuntut Gwitchin First Nation prior to release to the EC and to allow adequate time for the review. Megan (Vuntut Gwitchin First Nation) stated that John Bailey (Vuntut Gwitchin First Nation) could be interviewed as he is handling Lands files for Vuntut Gwitchin First Nation. Megan (Vuntut Gwitchin First Nation) asked if TWC has reviewed the North Yukon Land use Plan for historical and current land use information. Megan (Vuntut Gwitchin First Nation) provided the contact information for Rebecca Hanson, Brandon Kyikavichik, Briana Tetlichi (Vuntut Gwitchin First Nation), Elder Mary Jane Moses, Energy Manager David Frost, and Fish and Wildlife Manager Jeremy Brammer (Vuntut Gwitchin First Nation). Megan (Vuntut Gwitchin First Nation) stated that community members and Elders need to be paid an honorarium for interviews.	N/A	N/A
VGFN0193	29-Nov-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation),Jeremy Brammer (Vuntut Gwitchin First Nation), Jorge Soler-Cruz (Two Worlds Consulting)	Socio-economic Interview	Jorge (Two Worlds Consulting) emailed Jeremy (Vuntut Gwitchin First Nation) and cc'd Rebecca (Two Worlds Consulting), Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), Megan (Vuntut Gwitchin First Nation) requesting an interview to discuss fish and wildlife conditions in the Eagle Plains area. The interview can be conducted in person or virtually. The TWC team will be in Old Crow on December 5 and 6, 2023, and wants to conduct in-person interviews during those days.	N/A	N/A
VGFN0194	29-Nov-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Daryl Harrison (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)Jorge Soler-Cruz (Two Worlds Consulting), Brandon Kyikavichik (Vuntut Gwitchin First Nation), Rebecca Hanson (Vuntut Gwitchin First Nation), Briana Tetlichi (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation)	Socio-economic Interview	Jorge (Two Worlds Consulting) emailed Rebecca H., Brandon K., Briana T., and cc'd Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), Megan (Vuntut Gwitchin First Nation), and requested an interview to discuss cultural and heritage activities conducted in the Eagle Plains area.	N/A	N/A
VGFN0195	29-Nov-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Daryl Harrison (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation),Jorge Soler-Cruz (Two Worlds Consulting)	Researcher's Application Form Submission	Jorge (Two Worlds Consulting) emailed Megan (Vuntut Gwitchin First Nation) and cc'd Eliza (Two Worlds Consulting), Daryl (Two Worlds Consulting), and Rebecca (Two Worlds Consulting) stating TWC will reach out soon regarding the Research Agreement. Jorge (Two Worlds Consulting) stated that during TWC's desktop research, they identified some information gaps related to current socio-economic conditions related to the Chance Eagle Plains Project, as well as land and resource usage in the Eagle Plains. To fill these gaps, TWC is trying to meet with Vuntut Gwitchin First Nation staff. Jorge (Two Worlds Consulting) asked what Vuntut Gwitchin First Nation's preferred review period for the interview information would be.	N/A	N/A
VGFN0196	29-Nov-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Daryl Harrison (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation),Jorge Soler-Cruz (Two Worlds Consulting), John Bailey (Vuntut Gwitchin First Nation)	Socio-economic Interview	Jorge (Two Worlds Consulting) emailed John (Vuntut Gwitchin First Nation) and cc'd Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), Megan (Vuntut Gwitchin First Nation), requesting an interview with them to discuss current and historic land and resource use in the Eagle Plains area. The interview can be conducted in person or virtually, and the TWC team would be in Old Crow on December 5th and 6th, and Jorge (Two Worlds Consulting) stated they hoped to conduct in-person interviews during those days.	N/A	N/A
VGFN0197	29-Nov-23	Email	Incoming	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Brandon Kyikavichik (Vuntut Gwitchin First Nation)	Socio-economic Interview	Brandon K. emailed Jorge (Two Worlds Consulting) stating they were willing to participate in a virtual socio-economic interview.	N/A	N/A
VGFN0198	29-Nov-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Brandon Kyikavichik (Vuntut Gwitchin First Nation), Eliza Bethune (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting)	Socio-economic Interview	Jorge (Two Worlds Consulting) emailed Brandon K. and cc's Eliza (Two Worlds Consulting), Daryl (Two Worlds Consulting), Rebecca (Two Worlds Consulting) requesting a best time and date to meet for a socio-economic interview.	N/A	N/A
VGFN0277	29-Nov-23	Community Event Flyer and Radio Advertisement	Incoming	Vuntut Gwitchin First Nation	Chance	Cindy Dickson (Chance)	Vuntut Gwitchin First Nation	Information Sharing	Chance provided an invitation on November 29, 2023 to Vuntut Gwitchin First Nation staff to print and display around Old Crow. The invitation was also shared virtually on Chance's Facebook page. The invitation provided key information such as purpose, location and time, and Chance contact information to share questions and/or feedback about the World Café event or Project.	N/A	323-Chance-OldCrowDec6Advertisement-20231127

VGFN0201	30-Nov-23	Email	Outgoing	Vuntut Gwitchin First Nation	Rebecca DeLorey (Two Worlds Consulting)	N/A	Eliza Bethune (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)	Signed Research Agreement and Interview Request	Rebecca (Two Worlds Consulting) emailed Megan (Vuntut Gwitchin First Nation) and cc'd Eliza (Two Worlds Consulting), Daryl (Two Worlds Consulting), Jorge (Two Worlds Consulting), Kevin (Two Worlds Consulting), attaching TWC's signed version of the Research Agreement. Rebecca (Two Worlds Consulting) stated they wanted to confirm that the Project Proposal will be submitted to the Yukon Environmental and Socio-economic Assessment Board (Yukon Environmental Socio-economic Assessment Board) and will be publicly available through the Yukon Environmental Socio-economic Assessment Board Registry. Rebecca (Two Worlds Consulting) stated that information about individuals being interviewed will not be disclosed. Rebecca (Two Worlds Consulting) stated that not being a Citizen doesn't exclude them.	N/A	N/A
VGFN0202	01-Dec-23	Email	Incoming	Vuntut Gwitchin First Nation	Megan Williams (Vuntut Gwitchin First Nation)	N/A	Eliza Bethune (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)	Researcher's Application Form Submission	Megan (Vuntut Gwitchin First Nation) emailed Rebecca (Two Worlds Consulting) and cc'd Eliza (Two Worlds Consulting), Daryl (Two Worlds Consulting), Jorge (Two Worlds Consulting), Kevin (Two Worlds Consulting), thanking Rebecca (Two Worlds Consulting) for the signed Research Agreement. Megan (Vuntut Gwitchin First Nation) stated they need to review the submission prior to it going to Yukon Environmental Socio-economic Assessment Board, for a period of two weeks.	N/A	N/A
VGFN0203	01-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Rebecca DeLorey (Two Worlds Consulting)	N/A	Eliza Bethune (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)	Researcher's Application Form Submission	Rebecca (Two Worlds Consulting) emailed Megan (Vuntut Gwitchin First Nation) and cc'd Eliza (Two Worlds Consulting), Daryl (Two Worlds Consulting), Jorge (Two Worlds Consulting), Kevin (Two Worlds Consulting), stated they are looking forward to visiting Old Crow next week.	N/A	N/A
VGFN0205	01-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Jorge Soler-Cruz (Two Worlds Consulting), Daryl (Two Worlds Consulting), Rebecca (Two Worlds Consulting), Janelle Pascal (Vuntut Gwitchin First Nation)	Socio-economic Interview	Jorge (Two Worlds Consulting) emailed Janelle P. and cc'd Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), Rebecca (Two Worlds Consulting), stating they are still interested in meeting in an interview.	N/A	N/A
VGFN0206	01-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Eliza Bethune (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)	Socio-economic Interview	Jorge (Two Worlds Consulting) emailed Jeremy (Vuntut Gwitchin First Nation) and cc'd Rebecca (Two Worlds Consulting), Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), Megan (Vuntut Gwitchin First Nation) stating they are still interested in meeting for an interview.	N/A	N/A
VGFN0211	01-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	David Frost (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)Jorge Soler-Cruz (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Socio-economic Interview	Jorge (Two Worlds Consulting) emailed David F. and cc'd Rebecca (Two Worlds Consulting), Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), and Megan (Vuntut Gwitchin First Nation) providing a reminder of the interview request from November 29, 2023, and requested a meeting in Old Crow on December 5 or 6, 2023.	N/A	N/A
VGFN0212	01-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Rebecca Hanson (Vuntut Gwitchin First Nation), Briana Tetlichi (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)Jorge Soler-Cruz (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Socio-economic Interview	Jorge (Two Worlds Consulting) emailed Rebecca H. and Briana T. and cc'd Rebecca (Two Worlds Consulting), Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), and Megan (Vuntut Gwitchin First Nation) providing a reminder of the interview request from November 29, 2023, and requested a meeting in Old Crow on December 5 or 6, 2023.	N/A	N/A
VGFN0213	01-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	John Bailey (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)Jorge Soler-Cruz (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Socio-economic Interview	Jorge (Two Worlds Consulting) emailed John (Vuntut Gwitchin First Nation) and cc'd Rebecca (Two Worlds Consulting), Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), and Megan (Vuntut Gwitchin First Nation) providing a reminder of the interview request from November 29, 2023, and requested a meeting in Old Crow on December 5 or 6, 2023.	N/A	N/A
VGFN0214	01-Dec-23	Email	Incoming	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	John Bailey (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)Jorge Soler-Cruz (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Socio-economic Interview	John (Vuntut Gwitchin First Nation) emailed Jorge (Two Worlds Consulting) and cc'd Rebecca (Two Worlds Consulting), Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), and Megan (Vuntut Gwitchin First Nation), stating that John (Vuntut Gwitchin First Nation) should not be on the interview list because of John (Vuntut Gwitchin First Nation)'s role in the upcoming Project assessment, and John (Vuntut Gwitchin First Nation) was not a Vuntut Gwitchin First Nation Citizen.	N/A	N/A
VGFN0215	01-Dec-23	Email	Incoming	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Briana Tetlichi (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Jorge Soler-Cruz (Two Worlds Consulting)	Project and Interview Information Request	Briana T. emailed Jorge (Two Worlds Consulting) requesting more information on the Project, what would be done with the collected information, and whether the interview would be recorded.	N/A	N/A

VGFN0216	01-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Briana Tetlichi (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)Jorge Soler-Cruz (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Project and Interview Information Request	Jorge (Two Worlds Consulting) emailed Briana T. providing background information on the Project, and information on the socio-economic purposes of the interview. Jorge (Two Worlds Consulting) confirmed the interview would be recorded with Briana T.'s consent.	N/A	N/A
VGFN0217	02-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Briana Tetlichi (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)Jorge Soler-Cruz (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Project and Interview Information Request	Jorge (Two Worlds Consulting) emailed Briana T. stating that TWC was working with Vuntut Gwitchin First Nation Heritage Department to comply with their research application process.	N/A	N/A
VGFN0218	04-Dec-23	Email	Incoming	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Briana Tetlichi (Vuntut Gwitchin First Nation), Megan Williams (Vuntut Gwitchin First Nation)Jorge Soler-Cruz (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Socio-economic Interview	Briana T. emailed Jorge (Two Worlds Consulting) declining the socio-economic interview, and thanked Jorge (Two Worlds Consulting) for reaching out.	N/A	N/A
VGFN0199	05-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Rebecca DeLorey (Two Worlds Consulting)	N/A	Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Socio-economic Interview	Rebecca (Two Worlds Consulting) emailed Jeremy (Vuntut Gwitchin First Nation) and cc'd Jorge (Two Worlds Consulting), Eliza (Two Worlds Consulting), Daryl (Two Worlds Consulting), requesting participation in a socio-economic interview.	N/A	N/A
VGFN0200	05-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Rebecca DeLorey (Two Worlds Consulting)	N/A	Eliza Bethune (Two Worlds Consulting)	Socio-economic Interview	Rebecca (Two Worlds Consulting) emailed Clifton N. and cc'd Eliza (Two Worlds Consulting) requesting a socio-economic interview.	N/A	N/A
VGFN0219	05-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Rebecca DeLorey (Two Worlds Consulting)	N/A	E. Clifton (Vuntut Gwitchin First Nation), Rebecca DeLorey (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Socio-economic Interview	Rebecca (Two Worlds Consulting) emailed Clifton and cc'd Eliza (Two Worlds Consulting) requesting participation in a socio-economic interview.	N/A	N/A
VGFN0220	05-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Rebecca DeLorey (Two Worlds Consulting)	N/A	Rebecca Hansen (Vuntut Gwitchin First Nation), Rebecca DeLorey (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Socio-economic Interview	Rebecca (Two Worlds Consulting) emailed Rebecca H. and cc'd Eliza (Two Worlds Consulting) requesting participation in a socio-economic interview.	N/A	N/A
VGFN0221	05-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Rebecca DeLorey (Two Worlds Consulting)	N/A	Jeremy Brammer (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Rebecca DeLorey (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Socio-economic Interview	Rebecca (Two Worlds Consulting) emailed Jeremy (Vuntut Gwitchin First Nation) and cc'd Eliza (Two Worlds Consulting) requesting participation in a socio-economic interview.	N/A	N/A
VGFN0222	05-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Rebecca DeLorey (Two Worlds Consulting)	N/A	Katherine Peter (Vuntut Gwitchin First Nation), Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting)	Socio-economic Interview	Rebecca (Two Worlds Consulting) emailed Katherine P. and cc'd Eliza (Two Worlds Consulting) requesting participation in a socio-economic interview.	N/A	N/A
VGFN0223	05-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Rebecca DeLorey (Two Worlds Consulting)	N/A	Robert Kyikavichik (Vuntut Gwitchin First Nation), Eliza Bethune (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting)	Socio-economic Interview	Rebecca (Two Worlds Consulting) emailed Robert K. and cc'd Eliza (Two Worlds Consulting) requesting participation in a socio-economic interview.	N/A	N/A
VGFN0224	05-Dec-23	Email	Incoming	Vuntut Gwitchin First Nation	Jeremy Brammer (Vuntut Gwitchin First Nation)	N/A	Jeremy Brammer (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Rebecca DeLorey (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting)	Interview Availability	Jeremy (Vuntut Gwitchin First Nation) emailed Jorge (Two Worlds Consulting) and cc'd Rebecca (Two Worlds Consulting), Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), and Megan (Vuntut Gwitchin First Nation), stating they were available on December 12, 2023 for a virtual socio-economic interview.	N/A	N/A
VGFN0225	05-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Rebecca DeLorey (Two Worlds Consulting)	N/A	Loretta Itsi (Vuntut Gwitchin First Nation), Rebecca DeLorey (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Socio-economic Interview	Rebecca (Two Worlds Consulting) emailed Loretta I. and cc' d Eliza (Two Worlds Consulting) requesting participation in a socio-economic interview.	N/A	N/A
VGFN0226	05-Dec-23	Email	Incoming	Vuntut Gwitchin First Nation	Rebecca Hansen	N/A	Rebecca Hansen (Vuntut Gwitchin First Nation), Rebecca DeLorey (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Interview Availability	Rebecca H. emailed Rebecca (Two Worlds Consulting) and cc'd Eliza (Two Worlds Consulting), stating they were available that evening or December 6, 2023. Rebecca H. requested confirmation of preferred time/date for a socio-economic interview.	N/A	N/A
VGFN0227	06-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Eliza Bethune (Two Worlds Consulting)	N/A	Deputy Chief Debra-Leigh Reti (Vuntut Gwitchin First Nation)	Open House Feedback	Eliza (Two Worlds Consulting) emailed Debra-Leigh R. providing feedback received during the September 13, 2023 Open House that related to Vuntut Gwitchin First Nation. Feedback included a suggestion for the Vuntut Gwitchin First Nation government to conduct research on water impacts, and a suggested involvement of Vuntut Gwitchin First Nation in the proposed Project.	N/A	N/A
VGFN0227	06-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Deputy Chief Debra-Leigh Reti (Vuntut Gwitchin First Nation)	N/A	Eliza Bethune (Two Worlds Consulting)	Open House Feedback	Eliza (Two Worlds Consulting) emailed Debra-Leigh R. providing feedback received during the September 13, 2023 Open House that related to Vuntut Gwitchin First Nation. Feedback included a suggestion for the Vuntut Gwitchin First Nation government to conduct research on water impacts, and a suggested involvement of Vuntut Gwitchin First Nation in the proposed Project.	N/A	N/A

VGFN0228	06-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Jeremy Brammer (Vuntut Gwitchin First Nation), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)	Interview Availability	Jorge (Two Worlds Consulting) emailed Jeremy (Vuntut Gwitchin First Nation) and cc'd Rebecca (Two Worlds Consulting), Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), and Megan (Vuntut Gwitchin First Nation) confirming that Jorge (Two Worlds Consulting) would send a calendar invite to Jeremy (Vuntut Gwitchin First Nation) for an interview on December 12, 2023.	N/A	N/A
VGFN0236	06-Dec-23	Community Event	N/A	Vuntut Gwitchin First Nation	N/A	Greg Charlie (Chance), Cindy Dickson (Chance)	N/A	World Café Event	Chance held a World Café event in Old Crow at the Darius Elias (Vuntut Gwitchin First Nation) Community Centre from 4:00 PM - 8:00 PM MST. World Café attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to World Café attendees. After dinner, technical experts from EDI, Ecofor, and Palmer were divided amongst the groups. Focus group #1 had a presentation from EDI on Wildlife and Fish and Fish Habitat. Focus group #2 had presentations from Ecofor and Palmer on Archaeology/Heritage Resources and Permafrost. Once presentations and comments/concerns were addressed, the technical experts switched tables and presented to the rest of the attendees. The World Café event had door prizes that were drawn throughout the event which included 2 Air North gift cards, 3 Co-op grocery gift cards, Ecofor packages, and a mug from Indigo.	N/A	N/A
VGFN0229	12-Dec-23	Email	Incoming	Vuntut Gwitchin First Nation	Jeremy Brammer (Vuntut Gwitchin First Nation)	N/A	Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)	Socio-economic Interview	Jeremy (Vuntut Gwitchin First Nation) emailed Jorge (Two Worlds Consulting) and cc'd Rebecca (Two Worlds Consulting), Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), and Megan (Vuntut Gwitchin First Nation), asking to reschedule the interview to December 13, 2023 at 3:00PM due to an unscheduled all-staff meeting.	N/A	N/A
VGFN0229	12-Dec-23	Email	Outbound	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Jeremy Brammer (Vuntut Gwitchin First Nation), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)	Socio-economic Interview	Jorge (Two Worlds Consulting) emailed Jeremy (Vuntut Gwitchin First Nation) confirming that Jorge (Two Worlds Consulting) would update the calendar invite and asked if Jeremy (Vuntut Gwitchin First Nation) was available at 3:45PM on December 13, 2023.	N/A	N/A
VGFN0230	12-Dec-23	Email	Incoming	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Jeremy Brammer (Vuntut Gwitchin First Nation), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)	Socio-economic Interview	Jeremy (Vuntut Gwitchin First Nation) emailed Jorge (Two Worlds Consulting) and cc'd Rebecca (Two Worlds Consulting), Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), and Megan (Vuntut Gwitchin First Nation), confirming availability for 3:45PM on December 13, 2023.	N/A	N/A
VGFN0231	13-Dec-23	Email	Incoming	Vuntut Gwitchin First Nation	Megan Williams	N/A	Megan Williams (Vuntut Gwitchin First Nation)Rebecca DeLorey (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting)	Signed Research Agreement	Megan (Vuntut Gwitchin First Nation) emailed Rebecca (Two Worlds Consulting) and cc'd Eliza (Two Worlds Consulting), Daryl (Two Worlds Consulting), Jorge (Two Worlds Consulting), and Kevin (Two Worlds Consulting), providing the fully signed Research Agreement.	N/A	20231213-Vuntut Gwitchin First Nation0231A
VGFN0232	13-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz (Two Worlds Consulting)	N/A	Jeremy Brammer (Vuntut Gwitchin First Nation), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)	Consent Form	Jorge (Two Worlds Consulting) emailed Jeremy (Vuntut Gwitchin First Nation) and Rebecca (Two Worlds Consulting) and cc'd Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), and Megan (Vuntut Gwitchin First Nation) providing the Information Sheet, Informed Consent Form, and a copy of the map discussed in the meeting, and asked Jeremy (Vuntut Gwitchin First Nation) to review and sign the consent form.	N/A	20231213-Vuntut Gwitchin First Nation0232A 20231213-Vuntut Gwitchin First Nation0232B
VGFN0233	14-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Rebecca DeLorey (Two Worlds Consulting)	N/A	Megan Williams (Vuntut Gwitchin First Nation)Rebecca DeLorey (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting)	Signed Research Agreement	Rebecca (Two Worlds Consulting) emailed Megan (Vuntut Gwitchin First Nation) and cc'd Eliza (Two Worlds Consulting), Daryl (Two Worlds Consulting), Jorge (Two Worlds Consulting), and Kevin (Two Worlds Consulting), thanking Megan (Vuntut Gwitchin First Nation) for sending the signed Vuntut Gwitchin First Nation Research Agreement, and stated Rebecca (Two Worlds Consulting) would contact Megan (Vuntut Gwitchin First Nation) in the new year regarding transcripts.	N/A	N/A
VGFN0234	14-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz	N/A	David Frost, Megan Williams (Vuntut Gwitchin First Nation)Jorge Soler-Cruz (Two Worlds Consulting), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting)	Consent Form	Jorge (Two Worlds Consulting) emailed David F. and cc'd Rebecca (Two Worlds Consulting), Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), and Megan (Vuntut Gwitchin First Nation) providing the Information Sheet and Informed Consent Form, and asked David F. to review and sign the consent form.	N/A	20231214-Vuntut Gwitchin First Nation0234A
VGFN0235	15-Dec-23	Email	Outgoing	Vuntut Gwitchin First Nation	Daryl Harrison (Two Worlds Consulting)	N/A	Jeremy Brammer (Vuntut Gwitchin First Nation), Rebecca DeLorey (Two Worlds Consulting), Jorge Soler-Cruz (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)	Updated Map	Daryl (Two Worlds Consulting) emailed Jeremy (Vuntut Gwitchin First Nation), Jorge (Two Worlds Consulting), and Rebecca (Two Worlds Consulting) and cc'd Eliza (Two Worlds Consulting) and Megan (Vuntut Gwitchin First Nation) providing an updated copy of the map discussed during the meeting.	N/A	N/A

VGFN0240	20-Dec-23	Meeting	N/A	Vuntut Gwitchin First Nation	N/A	Cindy Dickson (Chance), Greg Charlie (Chance)	Chris Albrecht (Environmental Dynamics Inc.) (Environmental Dynamics Inc.), Mike Setterington (Environmental Dynamics Inc.), Kerman Bajina (Environmental Dynamics Inc.), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Deana Lemke (Porcupine Caribou Management Board), Joe Tetlichi (Porcupine Caribou Management Board), Matt Clarke, Eliza Bethune (Two Worlds Consulting), Haylee Dlouhy (Two Worlds Consulting), John Bailey (Vuntut Gwitchin First Nation), Mike Suitor (Yukon Government)	Technical Working Group	Chance met with Environmental Dynamics Inc., a technical advisor on behalf of First Nation of Na-Cho Nyäk Dun and Tr'ondëk Hwëch'in, a technical advisor on behalf of Vuntut Gwitchin First Nation, the Porcupine Caribou Management Board, and Yukon Government to have a hybrid technical working group session. The purpose of this meeting was to discuss Project updates and Environmental Baseline Studies including potential effects and mitigation to Fish, Wildlife, Porcupine Caribou Herd, Linear Features, North Yukon Land Use Planning Conformity. The working group session also included and a question-and-answer period.	N/A	323-Chance_PCMB_Technical_Working_Group-December 20 2023_20240104
VGFN0243	21-Dec-23	Meeting	Outgoing	Vuntut Gwitchin First Nation	Greg Charlie (Chance)	Greg Charlie (Chance)	John Bailey (Vuntut Gwitchin First Nation)	Meeting	Greg (Chance) met with John (Vuntut Gwitchin First Nation) at 9:30 AM. John (Vuntut Gwitchin First Nation) requested more virtual/in person meeting prior and after submission in 2024. John (Vuntut Gwitchin First Nation) requested Chance attend the PCMB meeting in Inuvik on February 13 and 14, 2024. John (Vuntut Gwitchin First Nation) stated they have enough funding from Federal Government and the Yukon Government, and they are looking for a new consultant to assist them.	N/A	N/A
E014813	30-Jan-23	Email	Outgoing	Vuntut Gwitchin First Nation	Cindy Dickson (Chance)	Greg Charlie (Chance)	James Smith (Vuntut Gwitchin First Nation)	Engagement/Consultation Meeting Coordination/Planning	Cindy (Chance) sent James (Vuntut Gwitchin First Nation) an email thanking him, Chief Pauline Frost (Vuntut Gwitchin First Nation) and Elizabeth (Vuntut Gwitchin First Nation) for joining the meeting in Vancouver. Cindy said that Chance would like to suggest a new date to meet with leaders and Vuntut Gwitchin First Nation Citizens in Old Crow. A meeting date of March 7, 2023 was suggested for a Project description presentation as well as presentations on caribou, permafrost, other ecological values and heritage/traditional knowledge work.	N/A	N/A
E014814	1-Feb-23	Email	Outgoing	Vuntut Gwitchin First Nation	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance)	President Abe Wilson (Gwich'in Tribal Council), Adrienne Hill (First Nation of Na-cho Nyäk Dun), Chief Pauline Frost (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Elizabeth Staples (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Erin Prelypchan (Two Worlds Consulting), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), James Smith (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation), Mike Chernoff (Chance), Roy Erasmus (Gwich'in Tribal Council), Tara Kyikavichik (Gwich'in Tribal Council)	Engagement	Richard W. emailed Chief Pauline Frost (Vuntut Gwitchin First Nation), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), and Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun) and stated Chance had commissioned Environmental Dynamics Inc. and Palmer Environmental to cover several studies to gather and evaluate baseline environmental data. Chance stated heritage resource studies have begun by Ecofor. Chance noted Chance has retained supervision of drilling and completions, well maintenance, and follow testing activities help from Mountford Consulting; Peer Solutions for seismic program design and project management; TetraTech for civil engineering advice; Ausenco for preparing YESAB submission documents and project management; and Two Worlds Consulting for engagement and communication processes and gathering socio-economic data to complete YESAB submissions. Chance stated that all information that is gathered can be shared with the Nations and their feedback is welcome. Chance noted that Chance intended to extend the Land Tenure of Exploration Permits that are due to expire August 30, 2023. Chance stated a Benefits Agreement needs to be completed by First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Vuntut Gwitchin First Nation. Chance said that accommodation in Old Crow is difficult to arrange and Chance had tentatively arrange accommodation on March 7, 2023 in Old Crow and March 8 to 9, 2023 in Inuvik and Fort McPherson for consideration. Chance noted no meetings in Mayo or other communities in the Yukon have been committed to.	N/A	N/A

Gwich'in Tribal	29-Nov-23	Email	Outgoing	Vuntut Gwitchin First Nation	Jorge Soler-Cruz	N/A	David Frost (Vuntut Gwitchin First Nation), Rebecca DeLorey (Two Worlds Consulting), Daryl Harrison (Two Worlds Consulting), Eliza Bethune (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)	Socio-economic Interview	Jorge (Two Worlds Consulting) emailed David (Vuntut Gwitchin First Nation) and cc'd Rebecca (Two Worlds Consulting), Daryl (Two Worlds Consulting), Eliza (Two Worlds Consulting), Megan Williams (Vuntut Gwitchin First Nation)(Vuntut Gwitchin First Nation) requested an interview with David (Vuntut Gwitchin First Nation) to discuss community services available and energy use in Old Crow. Jorge (Two Worlds Consulting) stated that the Two Worlds Consulting team will be in Old Crow on December 5 and 6, 2023, and they stated that they hope to conduct in-person interviews during those days.	N/A	N/A
E014810	26-Jan-23	Meeting - In Person	N/A	First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, Two Worlds Consulting, Vuntut Gwitchin First Nation	N/A	Cindy Dickson (Chance), Greg Charlie (Chance), (joined by telephone), Mike Chernoff (Chance), Richard Wyman (Chance)	Adrienne Hill (First Nation of Na-cho Nyäk Dun), Chief Pauline Frost (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Elizabeth Staples (Vuntut Gwitchin First Nation), Erin Prelypchan (Two Worlds Consulting), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), James Smith (Vuntut Gwitchin First Nation) President Abe Wilson (Gwich'in Tribal Council) (Gwich'in Tribal Council), Roy Erasmus (Gwich'in Tribal Council) Jr. (Gwich'in Tribal Council), Tara Kyikavichik, Willard Hagen (Gwich'in Tribal Council)	Engagement	Chance hosted an in-person meeting with leadership and technical advisors from First Nation of Na-Cho Nyäk Dun Gwich'in Tribal Council, and Vuntut Gwitchin First Nation in Vancouver. The purpose of the meeting was to re-establish collaborative working relationships, discuss engagement preferences going forward, and provide a Project update.	N/A	January 26, 2023 Meeting Minutes

APPENDIX 2-C-82. Residents of Communities Record of Contact

Residents of Communities Record of Contact (January 1, 2014 - January 1, 2024)

Reference	Date	Communication Method	Location	Community Open House Attendees	Subject	Summary	Additional Comments	Attachments
VG0207	15-Jun-14	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 4:00 pm - 7:00 pm. Chance shared Project information by presentation. Chance provided dinner and door prizes.	N/A	210607_Chance_OldCrow_June15OpenHouseFlyer
VG0237	16-Jun-14	Community Event	Whitehorse	Residents of Whitehorse	Community Event	Chance held a community open house event in Whitehorse at the Yukon Inn from 4:30 pm - 6:00 pm. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided an open house survey to get feedback to improve future engagement with the community.	N/A	Open House Advertisement June 2014.pdf
VG0209	16-Jun-14	Community Event	Whitehorse	Residents of Whitehorse	Community Event	Chance held a community open house event from 1:00 PM to 2:00PM MST at the Vuntut Gwitchin First Nation Whitehorse Office at 3A-508 Hansen Street.	N/A	20140616-VG0209
NND0128	17-Jun-14	Community Event	Mayo	Residents of Mayo	Community Event	Chance held a community open house event in Mayo at the First Nation of Na cho Nyäk Dun Multi-Purpose Room from 10:00 am - 12:00 pm. Chance shared Project information by presentation and held a question-and-answer period after. Chance provided lunch to the residents of Mayo.	N/A	Mayo Open House Notice for June 17 2014.pdf Open House Advertisement June 2014.pdf
VG0210	17-Jun-14	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Old Crow Community Hall from 4:00 pm - 6:00 pm. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided dinner to the residents of Old Crow.	N/A	Old Crow Notice for June 17 2014.pdf Open House Advertisement June 2014.pdf
TH0099	18-Jun-14	Community Event	Dawson City	Residents of Dawson City	Community Event	Chance held a community open house event in Dawson City at the YOOP Hall from 4:00 pm - 6:00 pm. Chance shared Project information by presentation and had a question-and-answer period after.	N/A	Dawson City Open House Notice for June 18 2014
VG0238	03-Sep-14	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 3:30 pm - 7:30 pm. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided juice boxes and packaged sandwiches to the residents of Old Crow.	N/A	200826_Chance_OldCrowOpenHouseFlyerRevised.pdf
E01252	06-Jun-19	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community dinner in Old Crow at the Community Hall. Chance presented the draft Project Description, as well as the transition from Northern Cross to Chance Oil and Gas Limited, seismic techniques, YESAB process, YESAB's Executive Committee, consultation and engagement, and the Porcupine Caribou Herd.	N/A	E01252_190606_Chance_OldCrowCommunity_June6_SignInSheet.pdf E01252_190620_Draft_June6_VGCommunity-ChanceMeetingsummary_v.0.3.docx
E01254	19-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01255	20-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01253	21-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01256	22-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01257	20-Apr-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Meeting summary not available at time of submission.	N/A	E01257_210430_Chance_OldCrowOpenHouse_April20_SignInSheet.pdf
E01258	21-Apr-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Meeting summary not available at time of submission.	N/A	E01258_210430_Chance_OldCrowOpenHouse_April21_SignInSheet.pdf
E01259	18-May-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Meeting summary not available at time of submission.	N/A	E01259_210521_Chance_OldCrowOpenHouse_May18_SignInSheet.pdf
E01260	13-Oct-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 4:30 pm - 7:30 pm. Chance shared Project information by presentation. Chance provided a dinner and door prizes.	N/A	E01260_211101_Chance_OldCrowOpenHouse_Oct13_SignInSheet.pdf E01260_211123_VGCommunity-Chance_Oct13OpenHouse_Meetingsummary_v.0.4.docx

E01398	05-May-22	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Darius Elias Community Centre from 11:00 am – 7:00 pm MST. Chance shared information regarding the Project, heritage resources, permafrost, seismic testing, and wildlife studies.	N/A	E01397_220526_VGCommunity-Chance_May5OpenHouse_Meetingsummary_v.0.3.docx E01397_220505_VGCommunity-Chance_May5OpenHouse_Sign-inSheet.pd
E01384	26-May-22	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Darius Elias Community Centre from 10:00 am – 8:00 pm MST. Chance shared information regarding the Project, drilling techniques and equipment, YESAA and YESAB's Pre-Submission Engagement Process, linear features and disturbance, and water bodies in the Project area.	N/A	E01384_220606_VGCommunity-Chance_May26OpenHouse_Meetingsummary_v.0.5.docx E01384_220525_VGCommunity-Chance_May25OpenHouse_sign-inSheet.pdf
VG0098	10-Jan-23	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance went to Old Crow to witness the Swearing In Ceremony of the newly elected Vuntut Gwitchin First Nation leadership.	N/A	E01485 - Air North Yukon's Airline-Confirmation 23163751
VG0142	15-May-23	Community Event	Old Crow	N/A	Community Event	The Project Team travelled to Old Crow and planned to conduct an in-person community open house event. This event was cancelled due to a potential flash flood. Chance, with approval from Chief Frost, provided a catered dinner for leadership and community members at the Old Crow Community Centre.	N/A	N/A
VG0143	15-May-23	Community Event	Old Crow	N/A	Community Event	The Chance team travelled to Old Crow and the meeting ended up being postponed due to potential flooding of the community.	N/A	N/A
E0141852	16-May-23	Community Event	Inuvik	Residents of Inuvik	Community Event	Chance held a community open house event in Inuvik at the Nihtat Gwich'in Council Board Room from 4:00 pm – 8:00 pm MST. Six community members attended this event. Open house attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to open house attendees. This presentation included a question-and-answer period as well as a draw for two Air North tickets.	N/A	Summary Report
E0141852	17-May-23	Community Event	Fort McPherson	N/A	Community Event	Chance planned to conduct an in-person community open house event in Teetł'it Zheh (Fort McPherson). This event was cancelled due to flash flooding in the Teetł'it Zheh (Fort McPherson) area.	N/A	N/A
E0141852	17-May-23	Community Event	Fort McPherson	N/A	Community Event	Chance planned to conduct an in-person community open house event in Teetł'it Zheh (Fort McPherson). This event was cancelled due to flash flooding in the Teetł'it Zheh (Fort McPherson) area.	N/A	N/A
VG0236	06-Dec-23	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a World Cafe event in Old Crow at the Darius Elias Community Centre from 4:00 pm – 8:00 pm MST. World Cafe attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to World Cafe attendees. After dinner, technical experts from EDI, Ecofor, and Palmer were divided amongst the groups. Focus group #1 had a presentation from EDI on Wildlife and Fish and Fish Habitat. Focus group #2 had presentations from Ecofor and Palmer on Archaeology / Heritage Resources and Permafrost. Once presentations and comments/concerns were addressed, the technical experts switched tables and presented to the rest of the attendees. The World Cafe event had door prizes that were drawn throughout the event which included 2 Air North gift cards, 3 Co-op grocery gift cards, Ecofor packages, and a mug from Indigo.	N/A	Summary Report

GTC0220	07-Dec-23	Community Event	Fort McPherson	Residents of Fort McPherson	Community Event	Chance held a community open house event in Fort McPherson at the Tetlit' Zheh Fort McPherson Hamlet Chamber from 4:00 to 8:00 pm MST. Open house attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to the Open House attendees. The Open House event had door prizes that were drawn throughout the event which included 2 Air North gift cards, 2 Co-op grocery gift cards, and Ecofor packages.	N/A	Summary Report

APPENDIX 2-D. Tr'ondëk Hwëch'in and Residents of Dawson City Consultation and Engagement Records

APPENDIX 2-D-01. June 18, 2014 Meeting Summary - document not available at time of submission.

APPENDIX 2-D-02. March 15, 2018, Phone Call Summary - document not available at time of submission.

APPENDIX 2-D-03. April 10, 2018, Meeting Summary - document not available at time of submission.

APPENDIX 2-D-04. October 23, 2018, Meeting Summary

Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Meeting Notes

Date: November 23, 2018

Location: Teleconference

Attendees:

Tr'ondëk Hwëch'in:

[redacted], Senior Advisor, Mining and Strategic Initiatives
[redacted], Legal Counsel

Chance Oil and Gas Limited:

[redacted], President
[redacted], Vice President of Community and Government Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator

Hemmera:

[redacted], Community Engagement and Consultation Specialist
[redacted], Human Environment Specialist

Introduction: Purpose and Objectives

Meeting Objectives:

The purpose of this meeting was to discuss the implementation of the TH and Chance Engagement and Communications Plan. Items also on the agenda were discussing the Confidentiality Agreement, and Letter of Agreement for Capacity Funding sent from TH to Chance on November 5, 2018. Chance also wished to discuss their proposal for an All-Party Meeting where the Five First Nations, Yukon Government, and Chance would meet to discuss key project items and areas for collaboration.

Meeting Objectives:

- Finalize Confidentiality Agreement;
- Discuss itemized budget for Capacity Funding; and
- Discuss All-Party Meeting.

Discussion of Key Topics:

[redacted] began the meeting by introducing meeting attendees and reviewing the agenda.

DRAFT

TH [redacted] informed attendees that [redacted] was no longer working for TH.

[redacted] initiated discussion of the Confidentiality Agreement.

[redacted] expressed that the Confidentiality Agreement was good to go, and that he would clean up the document and send it to TH for signing.

TH [redacted] stated that because of the staffing change an Acting-Executive Director would likely have to sign the agreement. However, it's possible that someone else would be responsible for signing. He stated that he would get direction from Council and that the process might take a couple weeks. TH asked Chance to provide a clean version of the agreement to both [redacted] and [redacted].

[redacted]

[redacted] moved on to discussing the VG election and that the transition to the new government might delay engaging with that First Nation. Transition to the new Chief and Council is expected to take place Jan 2019 and that there would likely be a series of information sessions over the coming months to bring them up to speed with respect to Chance. [redacted] mentioned that there appears to be interest in the other First Nations for an All-Party Meeting in the new year. They are tentatively scheduling this for February 1, 2019. Because of the change with VG, it's possible the Northern Chiefs would want to meet ahead of time.

TH [redacted] confirmed that a private meeting of the Northern Chiefs is desired.

[redacted] stated that could be arranged either before the All-Party Meeting or during it.

TH [redacted] will have to seek internal instructions and confirm schedules and availability for the date proposed.

[redacted] mentioned that the new Chief for VG had proposed an idea similar to the All-Party Meeting in the past. From that, Chance is assuming that VG would still be interested in the idea. [redacted] expressed that at this time, all Parties have generally been supportive.

TH [redacted] stated that Roundup is very busy for TH. [redacted] mentioned that he would work internally to check availability and will try to confirm dates and availability over email by December 13th.

[redacted] informed TH that Chance/Hemmera were hoping to include an In-Camera session in the agenda for the All-Party Meeting. It was also mentioned that Yukon Government is assisting with booking a room for the meeting. [redacted] offered to send a brief summary of the All-Party meeting to TH to aid in their internal discussions and planning.

[redacted] asked who the Letter of Agreement for the Capacity Funding should be addressed to.

[redacted]

TH [redacted] said to send the clean draft to himself and that he would follow up internally as to next steps and signatures. Similar to the direction required for the Confidentiality Agreement. [redacted] will also check in with the TH Finance Department on payment instructions (i.e., who to send the letter to and who it should be addressed to). TH did ask about extra costs that might in incurred by attending an All-Party Meeting.

[redacted] mentioned that Chance would provide funding for the additional costs incurred by TH representatives attending the All-Party meeting after Round Up.

Attachments:

No attachments.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Create clean version of Confidentiality Agreement and provide to TH	Chance	Sent from Chance to TH on November 23, 2018
Create clean version of the Letter of Agreement for Capacity Funding and provide to TH	Chance – this task was completed by TH when payment information was sent	Sent from TH to Chance on December 4
Send payment instructions for capacity funding	TH	Sent from TH to Chance on December 4
Provide memo summarizing All-Party meeting to TH	Hemmera	Sent on November 23, 2018
TH to confirm attendance for All-Party Meeting (Feb. 1, 2019) and payment instructions	TH	Dec. 13, 2018 (confirming attendance for All-Party Meeting)

Key Meeting Outcomes

Outcome	Responsible Party	Notes
Confidentiality Agreement finalized	Chance and TH	
Itemized budget accepted by Parties and the Letter of Agreement for Capacity Funding finalized.	Chance and TH	

DRAFT

APPENDIX 2-D-05. November 23, 2018, Meeting Summary

Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Meeting Notes

Date: November 23, 2018

Location: Teleconference

Attendees:

Tr'ondëk Hwëch'in:

[redacted], Senior Advisor, Mining and Strategic Initiatives
[redacted], Legal Counsel

Chance Oil and Gas Limited:

[redacted], President
[redacted], Vice President of Community and Government Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator

Hemmera:

[redacted], Community Engagement and Consultation Specialist
[redacted], Human Environment Specialist

Introduction: Purpose and Objectives

Meeting Objectives:

The purpose of this meeting was to discuss the implementation of the TH and Chance Engagement and Communications Plan. Items also on the agenda were discussing the Confidentiality Agreement, and Letter of Agreement for Capacity Funding sent from TH to Chance on November 5, 2018. Chance also wished to discuss their proposal for an All-Party Meeting where the Five First Nations, Yukon Government, and Chance would meet to discuss key project items and areas for collaboration.

Meeting Objectives:

- Finalize Confidentiality Agreement;
- Discuss itemized budget for Capacity Funding; and
- Discuss All-Party Meeting.

Discussion of Key Topics:

[redacted] began the meeting by introducing meeting attendees and reviewing the agenda.

DRAFT

TH [redacted] informed attendees that [redacted] was no longer working for TH.

[redacted] initiated discussion of the Confidentiality Agreement.

[redacted] expressed that the Confidentiality Agreement was good to go, and that he would clean up the document and send it to TH for signing.

TH [redacted] stated that because of the staffing change an Acting-Executive Director would likely have to sign the agreement. However, it's possible that someone else would be responsible for signing. He stated that he would get direction from Council and that the process might take a couple weeks. TH asked Chance to provide a clean version of the agreement to both [redacted] and [redacted].

[redacted]

[redacted] moved on to discussing the VG election and that the transition to the new government might delay engaging with that First Nation. Transition to the new Chief and Council is expected to take place Jan 2019 and that there would likely be a series of information sessions over the coming months to bring them up to speed with respect to Chance. [redacted] mentioned that there appears to be interest in the other First Nations for an All-Party Meeting in the new year. They are tentatively scheduling this for February 1, 2019. Because of the change with VG, it's possible the Northern Chiefs would want to meet ahead of time.

TH [redacted] confirmed that a private meeting of the Northern Chiefs is desired.

[redacted] stated that could be arranged either before the All-Party Meeting or during it.

TH [redacted] will have to seek internal instructions and confirm schedules and availability for the date proposed.

[redacted] mentioned that the new Chief for VG had proposed an idea similar to the All-Party Meeting in the past. From that, Chance is assuming that VG would still be interested in the idea. [redacted] expressed that at this time, all Parties have generally been supportive.

TH [redacted] stated that Roundup is very busy for TH. [redacted] mentioned that he would work internally to check availability and will try to confirm dates and availability over email by December 13th.

[redacted] informed TH that Chance/Hemmera were hoping to include an In-Camera session in the agenda for the All-Party Meeting. It was also mentioned that Yukon Government is assisting with booking a room for the meeting. [redacted] offered to send a brief summary of the All-Party meeting to TH to aid in their internal discussions and planning.

[redacted] asked who the Letter of Agreement for the Capacity Funding should be addressed to.

[redacted]

TH [redacted] said to send the clean draft to himself and that he would follow up internally as to next steps and signatures. Similar to the direction required for the Confidentiality Agreement. [redacted] will also check in with the TH Finance Department on payment instructions (i.e., who to send the letter to and who it should be addressed to). TH did ask about extra costs that might in incurred by attending an All-Party Meeting.

[redacted] mentioned that Chance would provide funding for the additional costs incurred by TH representatives attending the All-Party meeting after Round Up.

Attachments:

No attachments.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Create clean version of Confidentiality Agreement and provide to TH	Chance	Sent from Chance to TH on November 23, 2018
Create clean version of the Letter of Agreement for Capacity Funding and provide to TH	Chance – this task was completed by TH when payment information was sent	Sent from TH to Chance on December 4
Send payment instructions for capacity funding	TH	Sent from TH to Chance on December 4
Provide memo summarizing All-Party meeting to TH	Hemmera	Sent on November 23, 2018
TH to confirm attendance for All-Party Meeting (Feb. 1, 2019) and payment instructions	TH	Dec. 13, 2018 (confirming attendance for All-Party Meeting)

Key Meeting Outcomes

Outcome	Responsible Party	Notes
Confidentiality Agreement finalized	Chance and TH	
Itemized budget accepted by Parties and the Letter of Agreement for Capacity Funding finalized.	Chance and TH	

DRAFT

APPENDIX 2-D-06. Letter Request to Extend Tenure on Exploration Permits 0006-0011 and 0019 at Eagle Plains

Chance
OIL AND GAS LIMITED

March 27, 2019.

Tr'ondek Hwech'in First Nation
P.O. Box 599
Dawson City, YT
Y0B 1G0

sent by email: [redacted]

Attention: [redacted], Senior Advisor, Mining and Strategic Initiatives

Dear [redacted]:

Re: Request to extend tenure on Exploration Permits 0006-0011 and 0019 at Eagle Plains

As you know, the Chance Oil and Gas Limited ("Chance", the "Company") currently has fourteen exploration permits located in the Eagle Plains area of northern Yukon. The permits are numbered 0006 to 0017 and 0019 to 0020. Of these, exploration permits 0006-0011 and 0019 will expire on August 30, 2019 unless extended in accordance with some combination of Sections 27, 28 and 31.01 of the Yukon *Oil and Gas Act* (the "Act"). For convenience, I have attached a map showing all the existing exploration permits held by the Company.

Pursuant to the Engagement and Communication Plan that was approved in August, 2018, I am writing to advise you that Chance wishes to extend the tenure of the expiring permits for a period of five years in order to continue exploring for crude oil and natural gas in the area of these Expiring Permits.

With the expiry deadline for the permits fast approaching and knowing that Yukon Government consultation needs to occur in relation to any tenure extension request of existing exploration permits, I wish to inform you that Chance will be submitting the tenure extension application this week to the Oil and Gas Branch of the Department of Energy, Mines and Resources.

CHANCE OIL AND GAS LIMITED

☐ **Whitehorse Office:**
Suite 202, 208 Main Street
Whitehorse, YT Y1A 2A9
Telephone (867) 456-7805

☐ **Calgary Office:**
Suite 1000, 340 - 12th Ave S.W.
Calgary, AB T2R 1L5
Telephone (403) 699-0055
Fax (403) 699-0044

We would be pleased to discuss the tenure extension request at your convenience. We look forward to working together on this and other matters in the future.

Please contact either [redacted] or me if you require additional information and to share your views on this course of action.

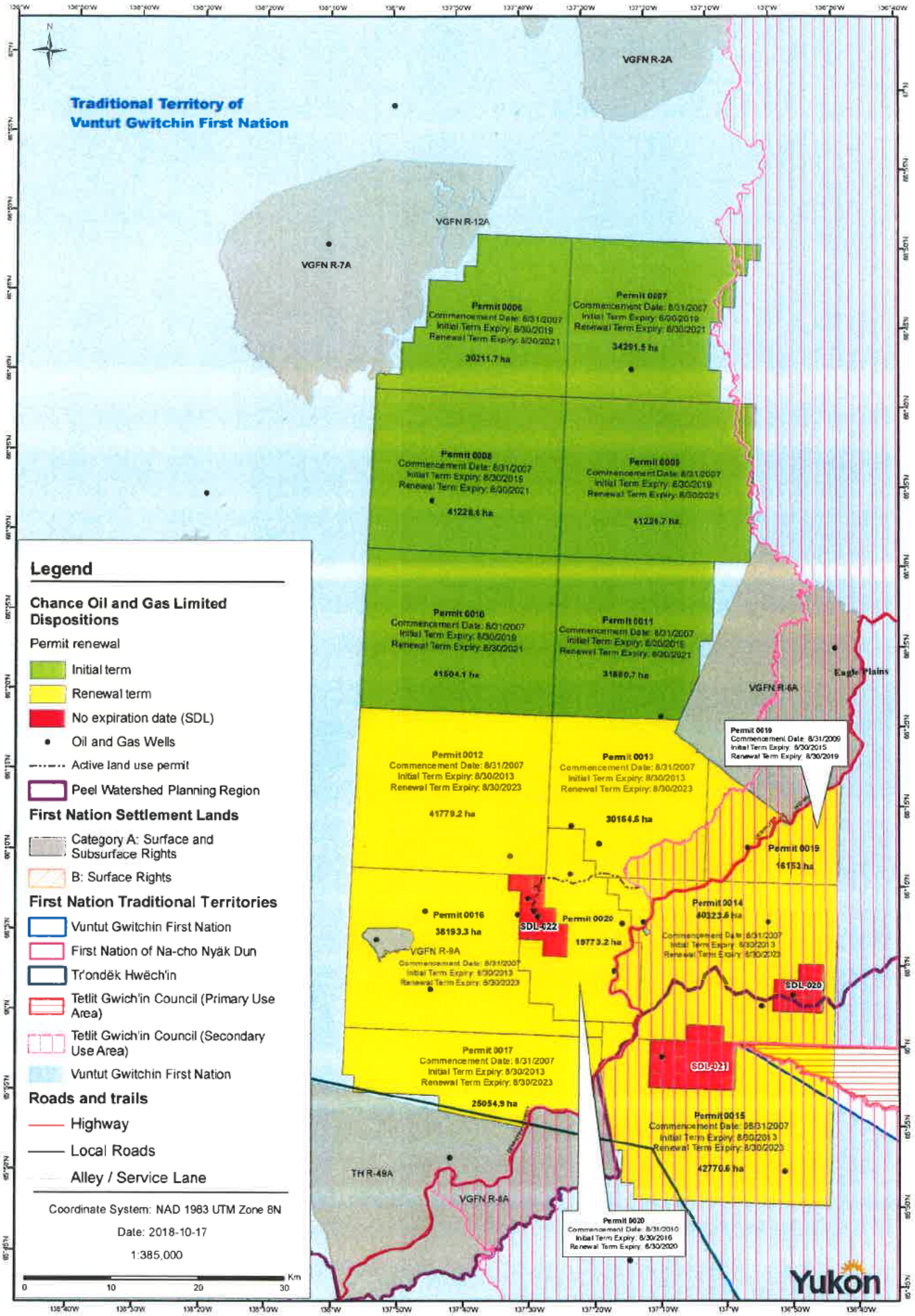
Yours truly,
Chance Oil and Gas Limited

[redacted]
President

Encl.

Cc: [redacted]
[redacted] Oil and Gas and Minerals, EMR, Government of Yukon
[redacted] Director, Oil and Gas Branch, Government of Yukon

Chance Oil and Gas Limited Dispositions and Wells



APPENDIX 2-D-07. June 11, 2019, Meeting Summary – document not available at time of submission.

APPENDIX 2-D-08. August 12, 2019, Meeting Summary

TR'ONDËK HWËCH'IN AND CHANCE OIL AND GAS MEETING ON THE DRAFT EXPLORATION PROJECT DESCRIPTION

Date: August 12, 2019

Location: Downtown Hotel Boardroom, Dawson City

Attendees:

Tr'ondëk Hwëch'in:

[redacted], Senior Advisor, Mining and Strategic Initiatives
[redacted], Natural Resources Director
[redacted], Legal Counsel (conference call)
[redacted] Development Assessment Coordinator
[redacted], Development Assessment Coordinator

Chance Oil and Gas Limited:

[redacted], President
[redacted], VP Government and Community Relations
[redacted] Regulatory, Environmental and Community Relations Coordinator

Hemmera:

[redacted], Human Environment Specialist
[redacted], Human Environment Specialist
[redacted], Human Environment Specialist (conference call)

Introduction: Purpose and Objectives

The purpose of this meeting was for Chance Oil and Gas Limited (Chance) to provide Tr'ondëk Hwëch'in (TH) with project updates and to answer questions TH might have with respect to exploration activities proposed in the Eagle Plains Exploration Project Description. Items also discussed were long-term capacity funding and a Cooperation Agreement.

Meeting Objectives

- Provide project updates and answer questions on project description
- Provide an update on the initial capacity funding budget and discuss additional capacity funding
- Discuss a Cooperation Agreement template and steps to complete an agreement

Meeting Discussion:

The meeting opened with introductions and a welcome.

[redacted] stated the purpose of this meeting was to provide updates on the project and answer questions on the project description provided in June 2019 as well as to discuss the capacity funding budget and a Cooperation Agreement.

[redacted] provided updates on 2019 summer field work and Chance's project proposal preparation activities. Baseline studies have been ongoing throughout the summer. EDI has been in the field twice to conduct surveys. They did a one-week program in June and a second program that was about two weeks long at the end of July/early August. They completed a bird survey, vegetation and ecosystem assessments, and fish surveys. Palmer also completed permafrost field surveys. Peer Solutions scouted the area to design the seismic program. Chance did a geologic sampling study at the end of July. At this point all activities have been focused on gathering data and no reporting has been done. It will likely be one to two months until reporting from this field season is done. Chance will share that information once it is available.

[redacted] explained that Chance and Hemmera were in Old Crow from August 5th to 8th, 2019 to meet with the Natural Resource Committee and present at the Vuntut Gwitchin First Nation (VGFN) General Assembly (GA). Chance may meet with Chief and Council of the First Nation of Na-cho Nyäk Dun (FNNND) on August 13, 2019. Chance is planning on visiting communities in the Northwest Territories in the coming weeks to present the Project Description and to provide an update on project activities and receive feedback on the project description from the Gwich'in Tribal Council. Those meetings and today's meeting are part of the community and First Nation consultation process.

[redacted] asked how Chance will handle Heritage Resource Assessments to address culture and heritage concerns.

[redacted] explained that Hemmera is currently working on completing a Gap Analysis. The Analysis is based on the 2014 Designated Office (DO) submission to see what heritage work was done at that time, and what needs to be done for an Executive Committee Screening. Once Hemmera completes the Gap Analysis, the next steps in heritage work will be assessed with each First Nation.

[redacted] acknowledged that Chance is expecting to do more heritage work because the scope of the project has expanded. Hemmera is doing community interviews as part of this process, in order to better understand heritage values and traditional use and knowledge in the area. [redacted] explained that Vuntut Gwitchin (VG) heritage research is informing the application to update the heritage assessment.

[redacted] added that Hemmera also expects information from users of the area to help create and assess the project's valued components (VCs). There is a need to understand how the project could affect communities such as Fort McPherson and Old Crow. Hemmera started their socio-economic research last week by interviewing service providers in Old Crow. That type of research will continue.

[redacted] asked what factors are affecting the socio-economic study at this time.

[redacted]xplained feedback from communities is the main source of information guiding the socio-economic research. Chance has received very little feedback on the Project Description from communities so far, and Chance needs to flesh out the project more based on feedback from the different First Nations. This feedback will be received through interviews, community meetings, and workshops that are focused on VCs. Consultants such as EDI and Palmer can present information from their field work at these workshops. They will be sharing that information in the next few months.

[redacted] acknowledged the North Yukon Regional Land Use Plan and the Peel Watershed Regional Land Use Plan [*signed August 22, 2019*] have been completed. Information in the Land Use Plans from each of the First Nations could be used for the Gap Analysis, instead of re-doing all that work. Chance could then supplement the information from the Land Use Plans with Hemmera's socio-economic research to complete the Gap Analysis.

[redacted] noted Chance has been working with [redacted], Senior Planner of the Yukon Land Use Planning Council. Chance has also been working with the North Yukon Regional Land Use Plan Working Group, with an emphasis on the permit area. The focus has been on identifying cumulative effects in the area, and they are hoping to finish that research this fall.

[redacted] asked if the project area is associated with the Peel district.

[redacted] presented the project area map and explained that approximately 90% of the project area is within the North Yukon Regional Land Use Plan area. A small section in the southeast is in the Peel drainage. However, project activity will start away from that drainage area, in the Northern part of the project area. The approximate timing for project activities to reach the Peel region is unknown at this point. Since this is exploration, the plan will change according to what information is gained as work continues.

[redacted] inquired as to where Chance expects to drill the first five wells. [redacted] explained that Chance will start work in the northern part of the project area, working southward. The geology is shallower to the northeast and slopes down to the southwest. [redacted] asked for clarification on what depth the term shallow refers to for this project. [redacted] stated that shallow means approximately 1000m or 800m deep.

[redacted] questioned how much of the hydrogeology in the project area is known. [redacted] explained the whole area is underlain with permafrost at 90m – 230m. There is no flowing potable water in the near surface. A well drilled near the Chance camp wasn't potable water. There were too many dissolved solids present and this made the water brackish (salty). The condition of the water is similar in the southern portion of the project area.

TH asked if there is natural seismic activity in the area. [redacted] explained there is some natural seismic activity, but that Chance hasn't been tracking it.

[redacted] added that the Yukon Government (YG) has been doing studies and tracking permafrost in the area. YG has been doing these surveys from around Blackstone creek to the border. [redacted] asked if YG's permafrost work has been focused on the Dempster corridor, or over the broader region. [redacted] explained climate change may have an impact on permafrost in the area, so YG has been monitoring it extensively over the broader region.

[redacted] explained that Palmer does permafrost work as well as geology and hydrogeology. Chance doesn't want to do exploration work in areas where loss of permafrost causes problems. Chance will stay on high ground where there is less permafrost and will avoid crossing creeks or working in valleys, where there is more permafrost, as much as possible. Horizontal Direction Drilling will be used from points of high ground to reach subsurface targets to reduce the surface impacts. [redacted] asked if that detail will be included in the project description. [redacted] responded that yes, those details will be provided, but that Chance must be careful with the language used. Chance has defined that they will stick to heights of land - not that they will stay on defined ridge tops - due to the geographic layout of the area.

[redacted] went on to say that Chance will limit the number of connection points to the Dempster Highway to control access for activities like hunting. Many of these details will be designed based on the feedback Chance receives. There could be road or trail networks developed in the back country to avoid sensitive areas and to reach geologic points. The trade off will be having more points of access along the Dempster Highway or more road/trail disturbance in the backcountry. [redacted] recommended that Chance ensure those types of details are recorded in the YESAB application.

[redacted] noted that further seismic work will help define some details and it is hard to be definitive with exploration work. The footprint in the early stages of the exploration program will consist of a winter trail, which might be turned into a road if the well is successful.

[redacted] asked if Chance has a definition of what makes a successful flow test.

[redacted] explained that extended flow tests assess how a well will perform. They allow Chance to determine the flow rate of the well and what the long-term recovery of the well will be like. Chance wants to be sure of the long-term recovery to understand the subsurface situation.

[redacted] commented that Chance's YESAB assessment is for exploration work, but flow tests would technically be production. [redacted] asked if that production would affect the scope of the assessment. [redacted] explained the flow tests are a testing method; they are not considered production.

[redacted] elaborated that if Chance goes into production there would be another assessment. Testing is part of the data set needed under the Yukon Oil and Gas regulations to justify the work. Facilities are needed to process the oil and production is a completely different process from the flow tests.

[redacted] added Chance needs data to understand how the reservoir will perform, which is derived from the flow tests.

[redacted] asked what kind of problems Chance foresees with the YESAB application and process, and noted that TH needs to plan their next steps so that they can provide feedback on the project.

[redacted] responded that Chance wants to minimize the amount of time spent going through YESAB, but that oil and gas discoveries may mean multiple YESAB submissions in the future.

[redacted] recognized that feedback is needed from YESAB to help scope the work. Chance has been putting together a list of things they want to do as part of the project, which includes the airport. [redacted] added that the airport and all associated development is hypothetical at this point.

Regarding the YESAB process, [redacted] noted that the Executive Committee has more resources for assessing a project like the one in question. Designated Offices have limited resources. YESAB has been clear the project will be more scrutinized during this assessment, there will be multiple steps throughout the process, and there will be plenty of information sharing and discussions.

[redacted] commented on the draft project proposal. In the proposal Chance referenced other jurisdictions to demonstrate the exploration process. [redacted] asked if those jurisdictions were referenced due to a lack of Yukon Oil and Gas regulations, or if Chance was just following the industry's best practices. [redacted] explained those jurisdictions were referenced to follow the best available practices. There is very little oil and gas work in the Yukon, so Chance has had to look to other regions like BC for appropriate examples.

[redacted] asked how First Nations and other organizations are dealing with wildlife and caribou concerns related to the project.

[redacted] responded that baseline data collection is ongoing. EDI has been doing wildlife surveys to collect baseline data on multiple species. Chance will be engaging First Nations, individuals, and the Porcupine Caribou Management Board to discuss wildlife and caribou. Project planning and assessment is at a very high level at this point, and the Porcupine Caribou Herd is considered a VC. [redacted] elaborated that most of the concerns Chance has heard about the caribou are focused on concerns related to increased access for hunting (i.e., increased hunting pressure). However, more information and feedback is needed to inform the VC assessment. G. Charlie added that Chance will be doing multiple workshops in Old Crow to gain that information from VGFN.

[redacted] explained that Hemmera and EDI will work together on community engagement focused on wildlife and the Porcupine Caribou Herd. EDI will finalize the data, and then together Hemmera and EDI will use the data for community meetings.

[redacted] mentioned that in the project proposal Chance mentioned 23 quarries and asked where those will be located.

[redacted] explained that Chance calculated the number of quarries by examining the project under the scenario of maximum infrastructure extent. In that setting, Chance looked at where and how many quarries would be needed, and that analysis gave the number 23. The actual number and location of the quarries would all depend on how the exploration program goes. Currently there aren't any points on the map for the quarries.

[redacted] noted there will be a high demand for construction materials for the project, on top of the YG's demand for gravel resources for the Dempster Highway. The Eagle Plains area is a high permafrost area so there is probably not a lot of gravel available. He wondered if Chance plans on collaborating with YG to avoid competing for gravel reserves. It would probably be in YG's interests to work with Chance to identify more gravel reserves in the area.

[redacted] and [redacted] explained Chance's demand for gravel will be unique to the project depending on the success of the exploration program. The gravel for the Dempster Highway was taken from along the highway right-of-way. For this project, Chance will have single lane roads with pullouts at certain intervals. The roads will be radio controlled and will have low traffic. The roads for the project will be about 1m thick and about 5m wide.

TH asked if Chance expects to have difficulties finding enough gravel for the project. [redacted] responded that Chance must ensure they are working with the right kind of material (for road construction) when sampling, however, there is adequate gravel in the area.

[redacted] inquired regarding the timeline for completing Chance's heritage work and Hemmera's Gap Analysis study and contacting the associated communities.

[redacted] explained Hemmera will have to get back to TH at a later date about the timeline for finishing the Gap Analysis. Nathan Aasman of Hemmera is working on completing the Gap Analysis so follow-up with him will be required. Hemmera might try to finish the Gap Analysis by the end of August. By that point, the data from EDI and Palmer should also be available. Hemmera and Chance can then initiate the next steps of the process.

[redacted] asked if engagement includes all VCs being considered as one package.

[redacted] explained Caribou will be one topic or VC, and Land Use and Heritage will be other VCs. Determining further VCs will depend on peoples' interests and the conversations Hemmera and Chance have with community members and First Nations. Hemmera will contact [redacted] about those VCs and about initiating the next step.

[redacted] commented that, informally, VG wants caribou to be its own VC, and there will be community visits specifically focused on the Porcupine Caribou Herd.

[redacted] asked how far TH Settlement Land is from the project area.

[redacted] presented the project area map and indicated that 10 km is the closest distance between the project area and TH Settlement Land. Chance will begin exploration work in the North, further away from TH Settlement Land. There won't be any overlap while the TH Settlement Land boundary is being finalized.

TH discussed the location of the TH boundary. TH mentioned Kris Statnyk, VGG's Intergovernmental Coordinator, may have more information on the boundary line, and that TH needs to identify specific landmarks along the boundary.

[redacted] noted she was told the TH Settlement Land border could change and asked if the border is in flux. [redacted] asked when Hemmera should expect to be able to update the project location map with the TH Settlement Land border.

[redacted] explained TH needs to verify the description of the boundary line, such as by land marks, but the line itself shouldn't move significantly. [redacted] is working on that file and is the person to refer to. [redacted] added that TH and VGFN want to get the border line finalized and the boundary shouldn't be very different from the 2015 agreement. It will just be a technical exercise of describing the border.

[redacted] asked how much of the historic data Chance can use for the exploration program, and wondered if the reservoir is mostly intact or if it is in patches.

[redacted] mentioned that data from the 1960's has a limited ability to support modern exploration work. Structurally the reservoir is fragmented, but hopefully not stratigraphically fragmented.

[redacted] commented that Settlement Land Parcels R-6A and R-8A were selected for economic development under the VGFN Final Agreement, and asked what the description is for R-49A. [redacted] initially R-49A was selected for Oil and Gas economic development. However, it is also an area used by the Porcupine Caribou Herd and impacts to the herd must be minimized.

[redacted] noted the scale of this project has similarities to work that was done from 1955 – 1973, when there were 25 or so wells in the project area, and the seismic work was split into two basins. There are about 38 or 39 wells in total, and four are Chance's. The current project has some similarities to that intensity, but it will take less time to drill wells using modern techniques and Chance won't be using sumps. [redacted] added that Chance's CEO [redacted] worked in Eagle Plains during the 1960's and 1970's so he is familiar with how things were done at that time.

[redacted] asked if Chance will be dealing with formation water during exploration work.

[redacted] explained that formation water should stay in the formation. If water is produced during the flow tests, it will be separated at the surface and then re-injected into suspended wells. [redacted] asked if there are regulations in the Yukon for that type of work, to which [redacted] responded there are, but

its unclear who the regulatory body is for deep subsurface water. It's uncertain if the Water Board will be involved yet. The Oil and Gas Committee and the Water Board still have to sort out who regulates the deep subsurface.

[redacted] asked if there is any part of the project that crosses into the NWT, and if the Mackenzie Valley Land and Water Board is involved at all.

Chance explained that the project is entirely in the Yukon so the Mackenzie Valley Land and Water Board is not involved. However, there is a NWT connection to the project via the Tetlit Gwich'in (TGC) Primary Use Area and Secondary Use Area with which the project overlaps.

[redacted] clarified that the TGC Secondary Use Area is a traditional use harvesting area, so TGC land rights are different from that of the Yukon First Nations. It is important to consider everyone's interests, but also important to make sure all involved parties are aware of who has authority.

[redacted] inquired regarding the roads and asked what Chance's plan is for assessing roads and conducting a basic survey. How will Chance deal with road impacts?

[redacted] explained Chance will be sourcing the building material and establishing the road design. Additional data is needed - after discoveries are made, Chance will know where roads are needed. Some information is available on the central portion of the area. Findings from Palmer will be available on permafrost and areas of risk. Geotechnical work will be done for sourcing material for road construction. Regarding road design, roads will be single lane roads with pullouts at certain intervals. The road will be 1 m thick and about 5 to 6 m wide, tapering to the base. Those dimensions multiplied by the length of the road will reveal the amount of material that is required. Access points will need to be determined based on feedback from the First Nations. Chance has an idea of the sensitivities, and the feedback received so far indicates that First Nations want fewer touchpoints to the Dempster Highway and a larger network in the back country. Having fewer connections to the Dempster Highway will allow Chance to better manage access and minimize the potential for increased harvest pressure.

[redacted]tated that road location and level of development would be dependant on the exploration program. Access control and successful decommissioning is the main concern associated with the roads. The Roads to Resources regulations are being made, which would help with planning this aspect of the project. However, those regulations may not be done in a timely manner regarding this project, so working with the communities is the best plan to follow at this point.

[redacted] mentioned that in the early stages of the project the roads will just be winter trails. The trails will need to be upgraded for extended flow tests if a discovery is made. Chance has successfully controlled access historically. One option to improve access control is to possibly use the Old Crow winter road. Crossing First Nation land adds a layer of control versus just going through public lands. In addition, depending how far away a well is from camp, an emergency shelter may be needed.

[redacted] noted VGFN land may be more appropriate to control access through Settlement Lands. Free infrastructure, such as roads, in Settlement Land has a cost-savings benefit to the First Nation.

[redacted] stated he hoped the Roads to Resources regulations are finished soon, and that it resolves the discussion about whether access is public or not. It will be late 2021 or 2022 before Chance can start work if things go smoothly, and it would be helpful if they have those regulations done by then. It would make Chance's role and responsibilities clearer in terms of controlling access.

[redacted] hoped that the Roads to Resources regulations are done soon as well. It is an issue that needs to be addressed. No legislation is holding yet, but he explained legislation and laws for Roads to Resources is needed to keep people accountable.

[redacted] asked if Chance has additional options for controlling access.

[redacted] explained Chance has had gates at entry points from the Dempster Highway that were effective. In the past Chance has only had winter trails, so has never had permanent access. Chance has never had someone get off the Dempster Highway and onto one of Chance's trails. The camp is also fenced and no one has ever accessed it.

[redacted] asked about the level of traffic on the Dempster Highway and how Chance calculates the volume of material or traffic that will be travelling on the Dempster for the project.

[redacted] explained that Chance will be bringing in food and fuel, so that provides the subsequent volume. Chance has operated the camp at capacity and has operated a deep well that required fuel runs. On a heavy day, that rig would use 15,000 L, which requires one fuel truck every three days. For the proposed project, the wells won't be as deep and smaller equipment will be used, so 15,000 L would be a maximum volume. A food truck comes to the camp once a week. Most staff members flew into Eagle Plains, but some of the locals drove to the camp. Therefor, the amount of traffic on the Dempster Highway for the project would be small.

[redacted] explained Chance supplies the camp with water from Glacier Creek and uses water from Eagle River for drilling. The project would require approximately one to two truck loads a day for water.

[redacted] asked if Chance will be using other materials such as hydrochloric acid (HCl) for the project. R. Wyman responded that yes HCl will be used, but very few truck loads will be required. Approximately one truck load a month would be needed to supply HCl.

[redacted] asked if Chance is operating on the water license of the Eagle Plains Hotel, and what volume the water license permits. [redacted] explained that Chance is secondary on the Eagle Plains Hotel water license. Chance uses Glacier Creek, Eagle River, and Ogilvie River. Chance will probably have their own water license under the land use permit. R. Wyman added Chance uses about 200 m^3 of water a day when the camp is at maximum capacity. Otherwise Chance uses 15-20 m^3 of water a day. [redacted] elaborated that Chance recycles the drilling water and uses water to make snow at the drill location, and the roads need to be iced in winter.

[redacted] stated that if Chance is using 300 m^3 of water for making snow and 300 m^3 for supplying camp, the maximum is 600 m^3 of water being used per day. Even at a maximum, the water usage won't be very high.

Chance discussed that they might have to go through the water board and will have to see what the water board decides is necessary. Chance has two years left on the water license so will need to renew it for the exploration program. The current water license goes to 2022. Chance will receive an update at the end of August 2019.

[redacted] asked what the duration of the updated water license is expected to be; if it isn't for a 10-year term, [redacted] asked if Chance will have to re-evaluate the exploration program. [redacted] explained the water license is already a five-year maximum, so Chance doesn't anticipate having to re-evaluate the program due to the duration of the water license.

[redacted] asked if Chance has baselines for air quality, emissions, and noise in the project area. [redacted] explained Chance has limited data on emissions. Chance uses natural gas to provide heat and fuel for mechanical requirements, and that extra gas is flared. Chance has discussed putting in monitoring equipment but hasn't developed a plan yet. [redacted] added that for the air emissions permit, the YESAB DO recommended monitoring a truck. However, this was expensive and was not required. There are no people living there to be affected and Chance will do air quality tests occasionally.

[redacted] noted that emissions monitoring could be part of Chance's climate change action plan by directly monitoring affecting emissions. [redacted] commented that there won't be a huge volume of emissions from the project, and that Chance is open to feedback on how to manage the emissions monitoring program.

[redacted] noted Chance's emissions will be below that of the gas plant in Whitehorse, where people live, so this project should be ok. Chance could compare this program to the Whitehorse gas plant as an example, as Chance's emissions would be much lower and are insignificant right now. A monitoring program would be valuable for tracking the level of emissions. Chance could design a monitoring program in the context of fish and wildlife since no one is living in the area. Factoring in the prevailing winds will also be a consideration.

[redacted] mentioned that there are shale outcroppings on the Eagle River. Organics in the shale are burning naturally and have been for about 20 years. There is lots of acid, such as Sulphur Dioxide (SO_2), being emitted from that burn. [redacted] used to go fishing in that area in the 1960s and 1970s, but there are no fish in that water now. The water is very acidic and its probably from that continued burning and releasing of acid. [redacted] noted that Palmer and Davis Lake also have a pH that is much lower than it was in the 60s.

[redacted] asked if there are any naturally high compounds in the water baseline data, or if some areas of the water shed have naturally higher (or lower) concentrations of certain compounds. [redacted] noted that sulphate is the most common naturally occurring element throughout the project area.

[redacted] asked if Chance has concerns about acid rock drainage and metal leaching (ARDML.)

[redacted] explained that the area's geology is composed of sedimentary rock, which does not pose concerns for ARDML. Chance will not be going into rocks with hydrothermic events. Chance doesn't know of any thermal events that will be present, but there are some data gaps and the answers depend on the exploration work.

[redacted] commented that a permit within a permit may be how the assessment goes with YESAB for this project. At the Executive Committee level, if mining projects were compared with oil and gas projects, the areas and regions are more defined in mining projects before this stage of assessment. There is lots of variability with this project and it is hard to nail down specifics. Chance might need permits for some aspects of data collection, which is why YESAB might want to take the approach of having a permit within a permit for this project.

[redacted] explained Chance began with a DO assessment and it got bumped to the Executive Committee level. Lot of questions about the project can only be answered by continued field work.

[redacted] noted the process is similar to placer and quartz mining. Exploration must always happen, and further details are a result of exploration work.

[redacted] commented that people are usually given longer permits for non-invasive exploration. Given that, [redacted] inquired as to why this project isn't being assessed at the DO level.

[redacted] explained that Chance tried submitting the project proposal at the DO level. Exploration for oil and gas is received differently from mining in the Yukon, so the DO approach wasn't suitable. [redacted] added that YESAB wanted to immediately jump to cumulative effects when discussing oil and gas exploration.

[redacted] noted that Chance met with the Executive Committee before writing the first draft of the Project Proposal to get some advice on how to proceed. The Designated Office's referral to the Executive Committee also provided six recommendations on further research that needed to be done on the project area and three of them were directly related to the North Yukon Regional Land Use Plan.

[redacted] suggested YESAB could be testing for a pre-screening process.

[redacted] commented that YESAB provided hardly any guidance on the project proposal. Chance is relying on Hemmera's experience to guide this process.

[redacted] asked if Chance has a timeline to receive additional feedback, such as feedback from heritage representatives. [redacted] responded that Chance will receive feedback up until the project proposal is submitted to YESAB. Chance has had little feedback so far but expects to receive a lot more feedback when the baseline environmental data is available.

[redacted] asked if there is any potential for some coordination with other First Nations. [redacted] noted it would be more efficient if the First Nations could coordinate and work together for giving feedback on the project. [redacted] explained TH can reference coordinating with the other First Nations when briefing council, but that it is up to them whether they take a collective or individual approach. The accord may provide guidance. It is typically in everyone's best interest to collectively work on larger projects.

[redacted] commented that YG recently held an Oil and Gas 101 course in Old Crow, and they expressed it was very helpful for VGFN's understanding of the process. [redacted] asked if TH has had that course offered yet. [redacted] noted that TH has not had the course offered yet. TH tried to organize the course for the summer but couldn't because of individual schedules. Now they are aiming to host the course in September 2019.

[redacted] mentioned VGFN has moved to discussing capacity funding and their benefits agreement, and Chance is looking at scheduling activities leading up to an expected proposal submission date at the end of January 2020. [redacted] asked if Chance should draft a schedule for their activities over the next few months to share with TH. [redacted] noted that an anticipated schedule of activities would be a good start. TH must discuss the capacity funding letter and framework further internally. Their discussion of capacity funding would be assisted with a detailed schedule.

[redacted] noted YESAB may require that Chance meet with TH Chief and Council and have public meetings. [redacted] asked that, if Chance gives TH a schedule, could TH let Chance know when those meetings could be done. S. Schafrik asked where in YESAB did they say Chance needs to meet with Chief and Council. [redacted] explained that it was verbally communicated to Chance. [redacted] asked if the meeting with Chief and Council is for Chance to present the project description, or for Chance to receive feedback on the project description. [redacted] replied both (i.e., presenting the project description and receiving feedback) would be appreciated, if possible. Chance wouldn't expect to receive immediate feedback from TH Chief and Council, but Chance wants to make sure all the steps are followed.

[redacted] mentioned that VGFN's Chief and Council want to be informed and FNNND's Chief [redacted] wants to participate.

[redacted] noted the timing will need to be discussed further to determine when to involve TH Chief and Council.

[redacted] noted that right now Chance and Hemmera are at a high level of scheduling and that the schedule will need to be narrowed down. [redacted] commented that once TH has the schedule delivered, TH can come up with a program of what activities need to be done internally.

[redacted] mentioned that engagement and consultation requirements in Legislation may not correspond well with internal processes. TH and Chance need to define what consultation entails for their relationship in their agreements and future documents. The two parties can come up with their own definition for how Chance and TH will engage as a part of the capacity funding plan. This may help avoid delays in consultation and would be more efficient.

[redacted] asked if there are any events in the TH community over the next five months that Chance should be aware of when developing the schedule. [redacted] stated that there are no events that are anticipated to conflict with the schedule. Chance should start with providing the schedule and further planning will proceed from there. The TH election in spring 2020 is the only major event, but that shouldn't affect engagement on this project. [redacted] commented that the schedule will assist with scoping TH's work, and TH will follow up once they have the schedule in hand. [redacted] mentioned that Hemmera and Chance should be able to have a defined schedule early September 2019. [redacted] stated TH can review the schedule after Hemmera delivers it, and then TH and Chance can meet again to discuss the next steps. [redacted] noted there will be strict protocols for engagement, and TH will follow-up about those protocols. Chance stated that Hemmera is responsible for the engagement program and will follow TH's guide.

[redacted] asked if Hemmera has a list of people they want to speak with. TH will also need to know the types of discussions Hemmera will be having and what Hemmera wants to learn. [redacted] replied that yes there are certain people that Hemmera wants to engage with. Hemmera can share that information via email. [redacted] added that Hemmera will share the interview guide that was developed for interviewing citizens and service providers in Old Crow. Some of the details would be different for TH, but it should give a good idea of what Hemmera plans on doing (at this point in time). [redacted] noted that the more detail the better so TH can understand what will be done. [redacted] stated that all of the interviews will be done anonymously through Hemmera.

[redacted] explained that consultation is built into the assessment process, but TH is more interested in time frames outlining what TH does at each step of engagement. A timeframe and a work plan will need to be developed to guide how TH and Chance will exchange information. YESAB has their own consultation process and TH and Chance should make their own consultation plan. TH just needs to be able to tell YESAB that they are satisfied with the consultation process.

[redacted] commented that he will be out of the office until mid September. Therefore, TH and Chance will be looking at mid to late September to meet again.

[redacted] noted that discussion is easier in person. It would work well if, for the next meeting, TH, Chance, and Hemmera could meet in Whitehorse. It would also be beneficial to have [redacted] at the meeting

in person instead of over the phone. Chance and Hemmera agreed that having the next meeting in Whitehorse was a good plan.

[redacted] mentioned she sent TH an outline of the Cooperation Agreement, and suggested they could fill out the sections together at the next meeting in Whitehorse. [redacted] agreed with annotating the Cooperation Agreement together at the next meeting and stated that the meeting should be focussed on discussing the capacity funding agreement and Cooperation Agreement.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Hemmera and Chance will develop and share the schedule of activities leading up the YESAB project proposal submission	Chance/Hemmera	September 2019

Key Meeting Outcomes

Outcome	Responsible Party	Notes
Chance and Hemmera answered TH's detailed questions on the Draft Project Description and project proposal process going forward.	All	
Next steps for Capacity Funding and the Cooperation Agreement were discussed.	All	This will be a key agenda item for the next meeting between Chance and TH.

APPENDIX 2-D-09. June 17, 2020, Meeting Summary

TR'ONDËK HWËCH'IN AND CHANCE OIL AND GAS MEETING

PROPOSED WELL MAINTENANCE PROGRAM

Date: June 17, 2020

Location: Conference Call

Attendees:

Tr'ondëk Hwëch'in:

[redacted], Senior Advisor, Mining and Strategic Initiatives
[redacted], Land and Resources Manager

Chance Oil and Gas Limited:

[redacted] President
[redacted], VP Government and Community Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator

Hemmera/EDI:

[redacted] Senior Environmental Specialist, Hemmera
[redacted], Human Environment Specialist, Hemmera
[redacted], Senior Wildlife Ecologist, Environmental Dynamics Inc.

Purpose and Objectives

The purpose of this meeting is for Chance to provide an overview of the proposed Eagle Plain Well Maintenance Project and to provide an opportunity for Tr'ondëk Hwëch'in to ask questions and/or provide any feedback with respect to the proposed project.

Meeting Discussion:

The meeting opened with identifying participants on the call.

TH added an additional agenda item for the end of the meeting: Capacity Funding.

TH provided a brief update on governance issues. Due to COVID-19 TH was unable to hold their election. A byelection for Chief is scheduled for end of July. Chance and Hemmera were instructed to include in-coming Deputy Chief [redacted] ([redacted]) in communications.

Chance applied to renew (for a period of 5 years) Permit 20 in March. Yukon Government should be in the process of consulting with First Nations at this time. If not renewed the permit will expire at the end of August. Permit 20 has a suspended well on it.

TH asked about well A-25 and what Chance intends to do with that well.

Chance explained that A-25 was never completed for production and is 1 of 4 suspended wells. This particular well may be a candidate for disposing of waste from other wells in the event of future potential Chance activities. Chance inspects all suspended wells every year as a part of their regular maintenance activities. However, this year, to continue the "suspended" status of these wells, Yukon Government has issued additional measures.

TH asked is Chance inspects wells every year, what additional information is Yukon Government asking for that is not already done by Chance.

Chance clarified that their annual activities look at surface infrastructure. The proposed maintenance project is looking at subsurface components. Yukon Government is requiring Chance to update some of the wells to meet current standards (i.e., cement full casing for wells that have been perforated). Chance clarified that, with respect to surface components, their annual maintenance activities have indicated that there are no issues. Chance then provided details on the proposed well maintenance project and timelines (see Project Description).

Chance and TH discussed the proposed project. Feedback from TH included:

- What problems could Chance expect during project activities?
    - With respect to potential problems sub-surface, Chance will forward that question to their engineering consultants and provide a response to TH. TH indicated that it would be beneficial to include potential risks and mitigation measures in Chance's Project Proposal. Hemmera confirmed that risks are being considered. Chance provided an example where project activities could be disrupted before maintenance activities even begin. For example, if winter 2020/2021 happens to be a low snow year. This will require alterations in project activities related to winter road construction. TH indicated that Management Plans will help Chance outline possible scenarios and help First Nations' review project activities and pre-empt questions from First Nations.
- Clarify in section 1.2.1 of Draft Project Description (affected First Nations) that even though project activities do not occur in TH Traditional Territory, TH are indirectly affected by project activities (e.g., increased traffic, impacts to wildlife in the region).
    - Chance and Hemmera indicated that the language in that section can be adjusted.
- Will there be a wildlife management plan? How will project activities be affected if wildlife, Porcupine Caribou, are in the area?
    - Hemmera indicated that Chance, Hemmera, and other consultants (e.g., Environmental Dynamics Inc.) are working on developing the rest of the project proposal. Including effects assessment sections and management plans. Environmental Dynamics Inc. indicated that they are working through the wildlife values now and their activities include mitigation measures and management plans. These components will be in the proposal and believe they can be shared with TH. TH stated that seeing drafts, especially prior to submission, would be ideal.
- Suggesting that Chance mention and consider potential impacts to 40 Mile Caribou Herd and Hart River Caribou Herd, in addition to the Porcupine Caribou Herd. While project activities may

not directly overlap the ranges of the 40 Mile and Hart herds, the ranges do come up to the Dempster Highway. As such, traffic through those ranges may impact the animals. E.g., particularly in a scenario when Chance may have to acquire water from different sources. TH highlighted that depending on the timeline for project activities, some areas in the region may have little to no traffic (i.e., even minimal vehicle activity may have effects). TH highlighted that it is good for Chance to explore these values and initiate these conversations now. Keeping in mind that communication now lays groundwork for future project proposals by Chance.

- Have traffic studies been done in the region?
    - Chance and Hemmera will dig into this topic. Recent Dempster Fibre Project may provide data on traffic in the region. Presence or absence of traffic data in the region could inform what baseline studies are conducted for Chance's future Executive Committee project proposal.

TH indicated that once Chance has additional materials (e.g., draft project proposal, management plans), TH can draft a workplan for their review which will outline potential need for capacity funding. TH will be in communication with other First Nations. When TH is aware of where and when there can be joint operations between First Nations, they will inform Chance.

Action Items/Next Steps:

Action Item	Responsible Party	Date Required
Provide TH an update on timelines for draft Project Proposal and additional project materials, in anticipation of sharing drafts with TH.	Chance/Hemmera	Week of June 23rd
Incorporate TH feedback (outlined above) into project proposal.	Chance/Hemmera	Ongoing

APPENDIX 2-D-10. Draft *2020 Annual Report Implementation of the Tr'ondëk Hwëch'in and Chance Oil and Gas Engagement and Communication Plan*

DRAFT 2020 ANNUAL REPORT

Implementation of the Tr'ondëk Hwëch'in and Chance Oil and Gas Engagement and Communication Plan

DRAFT

Prepared for:

Yukon Energy, Mines and Resources
Oil and Gas Resources (K-11)
Box 2703
Whitehorse, YT Y1A 2C6

Prepared by:

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Whitehorse, YT Y1A 0K7
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F: 604.669.0430
hemmera.com

July 31, 2020

1.0 INTRODUCTION

This report demonstrates implementation of the *Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan* (Plan) (see **Appendix A**) finalized on August 28, 2018. It summarizes discussions held between Tr'ondëk Hwëch'in (TH) and Chance Oil and Gas Limited (Chance) since the *2019 Annual Report: Implementation of the Tr'ondëk Hwëch'in and Chance Oil and Gas Engagement and Communication Plan* was submitted July 31, 2019. The purpose, objectives, and outcomes of each discussion are described below in order to fulfill the requirements of Ministerial Order (MO) 2018/42 (see **Appendix B**) issued to Chance on August 30, 2018.

2.0 BACKGROUND

The development of communications and engagement plans began with Order in Council (OIC) 2016/169. OIC 2016/169 required Chance to file a First Nations communication and engagement plan with the Minister of Energy, Mines and Resources in order to extend tenure on their northern permits: 0005, 0006, 0007, 0008, 0009, 0010, and 0011. Chance complied with OIC 2016/169 and received their tenure extension.

Chance subsequently received MO 2017/37 when applying for tenure extension on six of eight southern permits: 0012, 0013, 0014, 0015, 0016, and 0017. MO 2017/37 required Chance to revise, in consultation with affected First Nations, the consultation and engagement plan filed under OIC 2016/169. The affected First Nations listed in MO 2017/37 were Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Tetlit Gwich'in Council.

TH and Chance collaboratively developed their Plan through a series of in-person meetings and conference calls. Hemmera was retained by Chance in November 2017 to facilitate the development and completion of the communications and engagement plans with the affected First Nations and facilitated all discussions between TH and Chance.

TH and Chance submitted their finalized Plan to Minister Ranj Pillai on August 28, 2018. To satisfy its obligations under MO 2017/37, Chance filed a total of four communications and engagement plans. All four plans were approved by the Minister and Chance received a five-year tenure extension on the six southern permits.

A condition of the five-year tenure extension, issued via MO 2018/42, required that Chance submit annual reports summarizing actions taken to implement each communications and engagement plan.

See **Appendix C** for a map of Chance's current permits.

3.0 ENGAGEMENT AND COMMUNICATION PLAN IMPLEMENTATION SUMMARY

3.1 Summary

In the past year, TH and Chance have continued to build their relationship. Parties have advanced discussion in Chance's proposed Eagle Plains Exploration Project, Chance's proposed Eagle Plain Well Maintenance Project (see **Table 1**), and items outlined in Section 7.0 of the Plan (i.e., Adaptive Management of the Engagement and Communications Plan).

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Table 1 Chance proposed projects

Project Name	Date Draft Project Description was Shared with VGG	YESAB Assessment Process	Anticipated Submission to YESAB
Eagle Plains Exploration Project	June 2019	Executive Committee Screening	Spring 2021
Eagle Plain Well Maintenance Project	May 2020	Designated Office Evaluation	July/August 2020

Between August 1, 2019 and June 30, 2020, Chance and TH have had one in-person meeting and exchanged informal phone calls and emails. The main themes of discussions between Chance and TH have been:

- Draft Project Description and scope of activities for Chance's proposed Eagle Plains Exploration Project
- Draft Project Description for Chance's proposed Eagle Plain well Maintenance Project
- Capacity Funding and Cooperation Agreement
- Proposal submission processes to Yukon Environmental and Socio-economic Assessment Board (YESAB)
- Tr'ondëk Hwëch'in Final Agreement
- Annual reporting requirements for the Plan

The correspondence between Chance and TH documented in the Engagement Log (see **Appendix D**).

3.2 August 12, 2019 – TH and Chance (In-Person Meeting)

Location: Dawson City, Downtown Hotel Boardroom

Attendees: TH Technical Staff, Chance Management, Hemmera

The purpose of this meeting was for Chance to provide TH with project updates and to answer questions TH might have with respect to the draft Project Description for Chance's proposed the Eagle Plains Exploration Project. Items also discussed were long-term capacity funding and a Cooperation Agreement.

Chance shared project updates including fieldwork that had been completed and/or planned for summer 2019. TH asked questions regarding road construction; required materials and construction activities (including quarries); site mapping; water use and licensing; air quality and emissions; and strategies for addressing wildlife concerns such as the Porcupine Caribou Herd. Chance and TH discussed these topics and Chance stated that they would provide more detailed responses once data was collected and analyzed from the summer field studies.

There was discussion regarding a Gap Analysis and a potential TH Heritage Resource Assessment. TH also asked about the factors affecting the socio-economic study. Chance stated that they were looking for more feedback from communities to inform this study and will seek community involvement from all affected First Nations through interviews, community meetings, and workshops. TH asked that when Hemmera was ready to conduct its socio-economic research that they provide a list of people they wish to speak with and what they wish to learn.

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Topics also discussed were the Regional Land Use Plan, flow test logistics, access control to the site area, natural seismic activity in the region, and TH Traditional Territory boundary. A general timeline for project feedback, consultation, and YESAB proposal preparation was considered. TH stated that there were no events that are anticipated to conflict with the general timeline over the ensuing five months.

Both parties agreed that hosting the next meeting in Whitehorse would allow for more attendees to meet in person. Follow up agenda items for the next meeting were suggested to include collaborative annotating of a Cooperation Agreement and further discussion of a capacity funding agreement.

3.3 June 17, 2020 – TH and Chance Meeting (Conference Call)

Attendees: TH Technical Staff, Chance Management, Hemmera

The purpose of this meeting was for Chance to provide an overview of the proposed Eagle Plain Well Maintenance Project and to provide an opportunity for TH to ask questions and/or provide any feedback with respect to the proposed project..

Chance and TH discussed the proposed project. Feedback from TH included:

- Requesting additional information on what problems Chance could expect during project activities.
- Clarifying that TH are indirectly affected by project activities (e.g., increased traffic, impacts to wildlife in the region).
- Inquiring if there be a wildlife management plan, and clarity on how project activities will be affected if wildlife, Porcupine Caribou, are in the area?
- Suggesting that Chance mention and consider potential impacts to 40 Mile Caribou Herd and Hart River Caribou Herd, in addition to the Porcupine Caribou Herd.
- Inquiring if traffic studies had been done in the region

Chance and TH are currently reviewing the summary of this meeting to ensure it reflects both party's understanding. Additionally, Chance and Hemmera are working on follow-up activities in order to respond to TH's comments and continue discussions.

4.0 PLANS FOR ONGOING ENGAGEMENT AND NEXT STEPS

TH and Chance will continue to hold discussions at regular intervals as Chance develops its project proposals for YESAB. Upcoming engagement activities are expected to involve the following:

- Share data collected during 2019 Summer/Fall field season
- Proposed meeting with TH Chief and Council to present the Draft Project Description for proposed Eagle Plains Exploration Project
- Meetings between TH technical staff and technical consultants preparing the Project Proposal for proposed Eagle Plains Exploration Project
- Discussion on Capacity Funding to enable TH to engage on Chance's Project Proposals for the Eagle Plains Exploration Project and the Eagle Plain Well Maintenance Project
- Community consultation events in Dawson City for proposed Eagle Plains Exploration Project

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5.0 APPROVAL OF IMPLEMENTATION SUMMARY

TH and Chance have reviewed this report and agree to its contents as an accurate summary of the engagement activities carried out between August 1, 2019 and June 30, 2020.

Per: Tr'ondëk Hwëch'in

Dated: _____

Sidney Schafrik, Senior Advisor, Mining and Strategic Initiatives

Per: Chance Oil and Gas Limited

Dated: _____

Greg Charlie, VP Government and Community Relations

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APPENDIX A

Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan

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Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan

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1.0 Introduction

Chance Oil and Gas Limited (Chance) is an oil and gas exploration company that holds permits to perform oil and gas exploration activities in the Eagle Plain basin of Yukon Territory, Canada. As part of Chance's exploration program, Chance seeks to develop engagement and communication plans with all the First Nations that are potentially affected by Chance's exploration program activities. Permits 15 and 17 fall partially within Tr'ondëk Hwëch'in Traditional Territory and Chance is seeking to engage Tr'ondëk Hwëch'in (TH) on its activities within these permits.

2.0 Purpose

This document serves as an Engagement and Communication Plan (Plan) to provide a mutually agreed upon framework to support collaborative and effective engagement and communication between Chance and TH now and into the future.

3.0 Relationship

Chance and TH will execute this Plan according to the following principles:

- Transparency and openness;
- Timeliness;
- Integrity;
- Adaptive Management;
- Mutual respect; and
- Working towards trust and understanding of one another.

4.0 Key Tr'ondëk Hwëch'in and Chance Connections

Engagement and communication between Chance and TH will be generally associated with the proposed work and potential effects associated with Chance's oil and gas exploration program and potential opportunities (via training, employment, contracting, and other community investments), as well as any topics or issues identified through engagement and communication associated with Chance's proposed activities. This section of the Plan identifies the key contacts related to these overarching engagement and communication themes. Key representatives involved in engagement and communication are expected to be as follows:

- Chief and Council;
- TH Government department officials and advisors;
- TH Business Development agencies;
- TH Citizens and communities at large; and
- Proponent Management and designated staff and advisors.

The table in the Schedule to this Plan lays out the key engagement and communication topics, in no particular order, and associated key contacts for both Chance and TH.

5.0 Engagement and Communication Methods

Chance and TH will employ the following engagement and communication methods for specific correspondence:

- In person meetings;
- Email;
- Letters;
- Sharing Power Point Presentations (to support in person meetings);
- Sharing reports and other documents (as requested and as required); and
- Telephone (teleconferences and less formal phone calls).

Engagement and communication methods that support general communication of Chance's activities are as follows:

- Chance newsletters; and
- The website for Chance Oil and Gas Limited.

Engagement and communication meetings will be executed in the following manner:

1. Chance or TH will request a meeting in writing to the other party according to the connections iterated in Table 1;
2. The parties to meet will develop the agenda collaboratively;
3. The party requesting the meeting will develop supporting materials (collaboratively, where possible), and share those in advance of the meeting; and
4. The meeting will take place in a mutually agreeable location.

The above general process applies to meetings with subject matter leads (Table 1) as well as meetings with Citizens and communities at large.

Through engagement with North Yukon First Nations, Chance understands that there are existing agreements between Tr'ondëk Hwëch'in, the First Nation of Na-Cho Nyak Dun, and Vuntut Gwitchin First Nation. In keeping with the relationship principle of mutual respect, Chance will work within any communications protocols or provisions existing or developed pursuant to these agreements, where applicable and as directed by TH.

The following documentation sharing and review protocols support the methods described above:

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- Chance and TH will discuss and establish the confidentiality of meeting minutes in advance of each meeting; i.e. if a meeting is to not be included in the record that will be submitted to regulators and assessors, it is the responsibility of both parties to discuss and agree to this prior to the meeting beginning;
- Chance will take meeting minutes and send these to TH within two weeks via email. Within 30 days of receiving the minutes TH will review and make changes through tracked changes or another method agreed to by both parties. Should TH require more time to review the meeting minutes, TH will notify Chance by email within two weeks of receiving the minutes. The parties will agree on meeting minutes before such minutes become part of the record. No response by TH to Chance's email providing meeting minutes within the 30 days will be interpreted as general acceptance of the meeting minutes by TH, and no response by Chance to TH's email providing amended meeting minutes within 30 days will be interpreted as general acceptance of the amended meeting minutes by Chance;
- Action items and meeting outcomes will be logged during meetings and reviewed by both parties at the end of the meeting to ensure that there is general agreement on the list of actions and parties responsible for those actions. Chance will include the list of action items and meeting outcomes with the meeting minutes;
- Chance and TH will agree upon and use a password-protected file sharing platform to facilitate sharing of large files, such as Power Point presentations and reports; and,
- Should Chance or TH employ a third party for records development and management, the third party will follow the process iterated above for recording and providing meeting minutes.

6.0 Records Management

All information exchanged by Chance and TH is subject to a confidentiality agreement to be agreed upon in the future by Chance and TH.

Subject to collaborative review and the written agreement of both parties, Chance and TH consent to the disclosure of the following information to regulators and assessors for review if and when a potential project is assessed in the future:

- Meeting agendas;
- Non-confidential meeting minutes (finalized versions as described in section **5.0 Engagement and Communication Methods);**
- Invitee/Attendees lists and/or meeting sign-in sheets;
- Records log, which will include summaries of the following:
    - In person meetings;
    - Phone calls and teleconferences;
    - Incoming and outgoing emails between Chance and Chance's representatives and TH representatives;
    - Attachments to the above noted incoming and outgoing emails;

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- Reports provided to TH by Chance and reports provided to Chance by TH for review and consideration for engagement and communication purposes; and
- Copies of Power Point presentations delivered by Chance to TH for engagement and communication purposes.

7.0 Adaptive Management of the Engagement and Communication Plan

Chance and TH will review and assess the effectiveness and success of this Plan on at least a 6-month basis.

Within 3 months of the Plan first being agreed to and implemented, Chance and TH will:

- as a first step, sign a confidentiality agreement as contemplated by Section 6.0 above;
- meet to check in on the progress made by both parties in implementing the Plan;
- develop a schedule for review of the Plan; and
- discuss the need for a long-term budget and a comprehensive formal capacity funding agreement to enable TH to participate in future engagement.

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Schedule

Key Engagement and Communication Topics and Leads

Role or Subject Matter	TH Key Contact	Chance Key Contact
Project Lead	Sidney Schafrik, Senior Advisor, Mining and Strategic Initiatives (Sidney.schafrik@trondek.ca)	Greg Charlie, VP of Government and Community Relations (gcharlie@chanceyukon.ca)
Culture and Community (includes Indigenous Knowledge and Indigenous Land Use, heritage resources, social, health, and other "human environment" subjects)	Debbie Nagano, Director of Heritage (Debbie.nagano@trondek.ca)	Cindy Dickson Regulatory, Environmental and Community Relations Coordinator (cdickson@chanceyukon.ca)
Engineering and Geology	Sidney Schafrik, Senior Advisor, Mining and Strategic Initiatives (Sidney.schafrik@trondek.ca)	Richard Wyman, President (rwyman@chanceyukon.ca)
Environmental (includes water, aquatic environment, fish, wildlife, forest resources and other plants, and other environmental subjects)	Darren Taylor, Director of Natural Resources (Darren.taylor@trondek.ca)	Greg Charlie VP of Government and Community Relations (gcharlie@chanceyukon.ca) Cindy Dickson Regulatory, Environmental and Community Relations Coordinator (cdickson@chanceyukon.ca)
Opportunities (includes community investment, training, education, contracting, employment, and other business opportunities)	Sidney Schafrik, Senior Advisor, Mining and Strategic Initiatives (Sidney.schafrik@trondek.ca)	Mike Chernoff, Chairman/CEO (mchernoff@caribouca p.com); Richard Wyman, President (rwyman@chanceyukon.ca); Greg Charlie, VP of Government and Community Relations (gcharlie@chanceyukon.ca)
Agreements and Capacity Funding	Pat Titus, Executive Director (Pat.titus@trondek.ca)	Richard Wyman President (rwyman@chanceyukon.ca) Mike Chernoff CEO/Chairman (mchernoff@caribouca p.com)

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APPENDIX B

Ministerial Order 2018/42

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YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,

(d) oil and gas permit No. 0015,

(e) oil and gas permit No. 0016,

(f) oil and gas permit No. 0017. « *permis visé* »

2 The renewal term of each subject permit is extended by five years (so that it ends on August 30, 2023).

3 The resulting total length of the initial term and the renewal term of a subject permit is 16 years.

YUKON

CANADA

ARRÊTÉ MINISTÉRIEL 2018/42

LOI SUR LE PÉTROLE ET LE GAZ

Le ministre de l'Énergie, des Mines et des Ressources, conformément à la *Loi sur le pétrole et le gaz*, arrête :

1 La définition suivante s'applique au présent arrêté.

« permis visé » Les permis suivants de pétrole et de gaz détenus par Chance Oil and Gas Limited :

a) permis de pétrole et de gaz nº 0012;

b) permis de pétrole et de gaz nº 0013;

c) permis de pétrole et de gaz nº 0014;

d) permis de pétrole et de gaz nº 0015;

e) permis de pétrole et de gaz nº 0016;

f) permis de pétrole et de gaz nº 0017. "*subject permit*"

2 La durée du renouvellement de chaque permis visé est prolongée de cinq ans, de façon à ce qu'elle se termine le 30 août 2023.

3 La durée totale d'un permis visé, y compris la durée initiale et la durée du renouvellement, est de 16 ans.

4(1) In this section

"first nations communications and engagement plan" means the plan filed under O.I.C. 2016/169 and revised in accordance with M.O. 2017/37. *« plan de participation et de communication avec les premières nations »*

(2) It is a condition of this Order that Chance Oil and Gas Limited must file annual reports with the Division Head, in accordance with subsection (3) and to the satisfaction of the Division Head, about the implementation of the first nations communications and engagement plan.

(3) For the purposes of subsection (2), Chance Oil and Gas Limited must file

(a) the first annual report on or before July 31, 2019, in respect of the period beginning on September 1, 2018, and ending on May 31, 2019; and

(b) each subsequent annual report on or before July 31 of each year in respect of the period beginning on June 1 of the preceding year and ending on May 31 of the year in which the report is to be filed.

4(1) La définition suivante s'applique au présent article.

« plan de participation et de communication avec les premières nations » Le plan déposé en vertu du Décret 2016/169 et révisé en conformité avec l'Arrêté 2017/37. *"first nations communications and engagement plan"*

(2) À titre de condition du présent arrêté, Chance Oil and Gas Limited dépose des rapports annuels auprès du chef de division, en conformité avec le paragraphe (3) et à la satisfaction du chef de division, concernant la mise en œuvre du plan de participation et de communication avec les premières nations.

(3) Pour l'application du paragraphe (2), Chance Oil and Gas Limited dépose :

a) le premier rapport annuel au plus tard le 31 juillet 2019, pour la période débutant le 1er septembre 2018 et se terminant le 31 mai 2019;

b) chaque rapport annuel subséquent, au plus tard le 31 juillet de chaque année pour la période débutant le 1er juin de l'année précédente et se terminant le 31 mai de l'année au cours de laquelle le rapport doit être déposé.

Dated at Whitehorse, Yukon,
~~Dc~~ August 30th 2018.

Fait à Whitehorse, au Yukon,
le August 30th 2018.

Minister of Energy, Mines and Resources/Ministre de l'Énergie, des Mines et des Ressources

APPENDIX C

Map of Chance Dispositions and Wells

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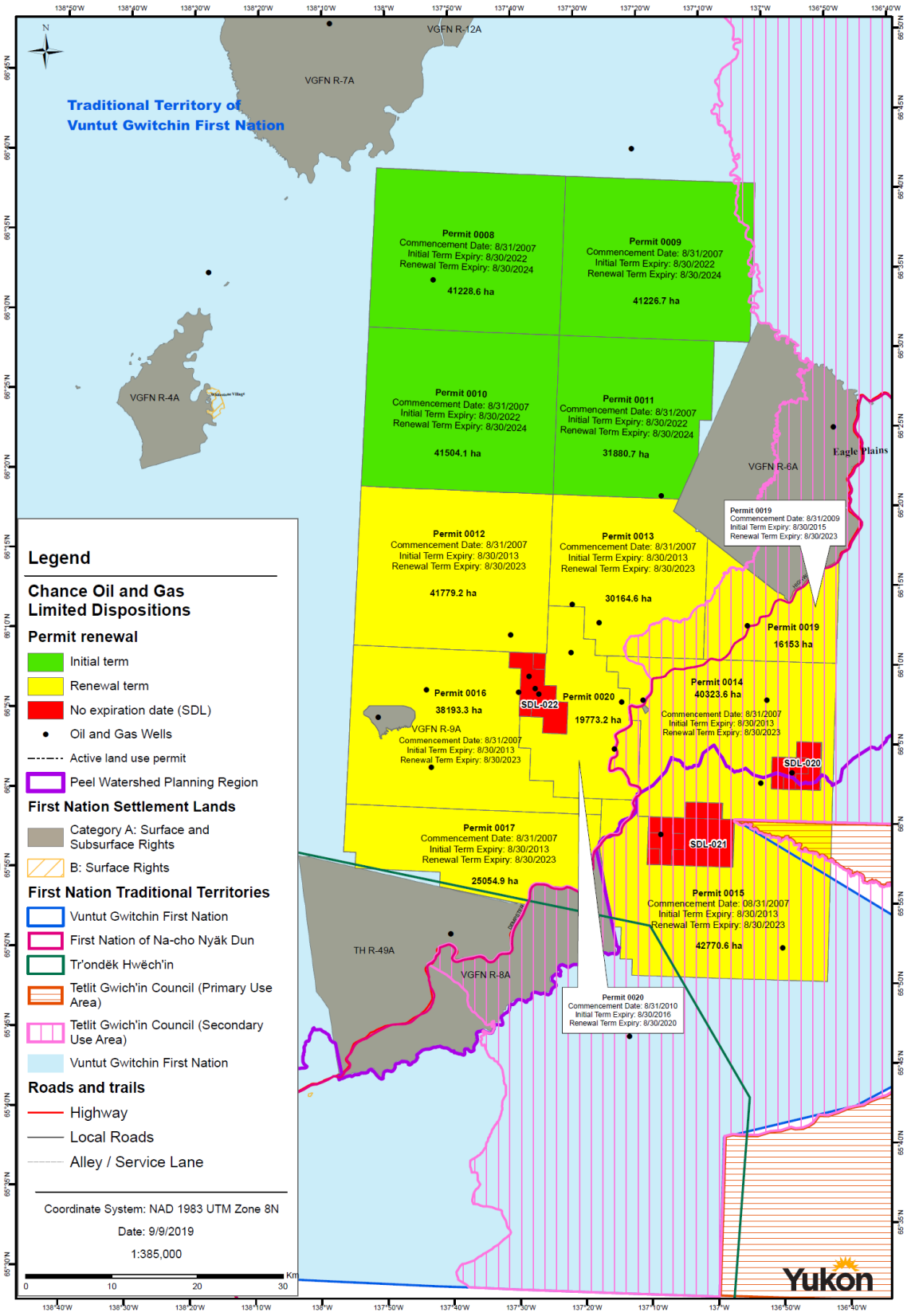
Chance Oil and Gas Limited Dispositions and Wells



APPENDIX D
Engagement Log

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APPENDIX 2-D-11. April 27, 2021, Meeting Summary

TR'ONDËK HWËCH'IN AND CHANCE OIL AND GAS MEETING

Date: April 27, 2021

Location: Microsoft Teams

Attendees:

Tr'ondëk Hwëch'in:

[redacted], Senior Advisor, Mining & Strategic Initiatives

Chance Oil and Gas Limited:

Richard Wyman, President
[redacted], VP Government and Community Relations
[redacted], Regulatory, Environmental and Community Relations Coordinator

Hemmera:

[redacted], Human Environment Specialist (conference call)
[redacted], Business Leader
[redacted], Human Environment Specialist

Purpose and Objectives

The purpose of this meeting was for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin. Chance provided recent information and updates regarding baseline information gathered by consultants (Environmental Dynamics Inc (EDI), Peer Solutions, Palmer) and Parties discussed next steps with community engagement and consultation schedules for Tr'ondëk Hwëch'in (TH).

Meeting Discussion:

The meeting opened with introductions and a welcome.

[redacted]: Updates on the Eagles Plains Exploration Project, almost the same project as back in 2019, this presentation will highlight any changes that have happened since. Then we will go over next steps on developing the project proposal and community consultation and engagement schedules and preferences of the Tr'ondëk Hwëch'in Government.

[redacted]: This presentation will cover what has changed since sharing the 2019 project description. We have also undertaken a number of field studies, work on ecosystems characteristics, performed by EDI, permafrost processes by Palmer Environmental, and technical design by Peer Solutions. They worked on seismic activity, difficult terrain etc.

EDI had several teams go into the field in 2019 and 2020. They were looking at bird studies, seismic lines During the 50s to mid 80s there was 2D seismic activity. Then we did 3D seismic. Now, the footprint for seismic lines is much smaller today than 60 years ago. EDI looked at old seismic lines. If those lines get any sort of use from animals, if they are regenerating, if humans use them, etc. They have a good summary of this. EDI also did fish and aquatic studies. They are trying to find the types of fish and patterns. They obtained porcupine caribou information/data from the board. They have not finished their interpretation. EDI also visited quite a few spots and used lidar, which is a laser beam that is reflected off the surface, for land and ecosystem classification. Which is useful for determining access to sites. When you calibrate those images you get a pretty good snapshot of the area.

Palmer did a study to see where permafrost is active and visited those spots along with visiting spots that would make it difficult for access. They are going back to get geotechnical data. Palmer's work is substantially done. Aside from what would need to be done following regulation processes. All this information will be available to share with everybody.

Well maintenance work on suspended wells, this is now in the Designated Office (DO) undergoing assessment.

[redacted]: What has been done on the water side of things? With respect to baseline data collection.

[redacted]: Department of water resources is undertaking water samples over Eagle Plains. Other water stuff is more to gauge different orders of drainage. Where are we going to encounter fish? Where are fish over wintering? Are streams freezing solid? EDI has been investigating these items. They can share this when they give their presentation.

[redacted]: In general, easiest/best to just send this information through beforehand and then we set up meeting with consultants. I have no difficulties receiving this information without an initial presentation. Please feel free to send this along first.

[redacted]: Thank you, that's great feedback.

[redacted]: Is Chance still in legal litigation?

[redacted]: Still in litigation. Yukon Government (YG) is dragging it out.

[redacted]: What is the YG's definition of hydraulic fracking? What is your approach/definition? This will come up. There are many different forms. Clarification will be helpful to understand what the definition is – who is deciding this?

[redacted]: I do not think the litigation is going to decide this, or the threshold, or the technique – none of that is going to get decided by the courts. Our litigation is solely for compensation for approval of fracking before they set the moratorium.

[redacted]: If there are some references or standardized language that you would suggest, that would provide clarity throughout the YESAB process, please let us know. Any additional descriptions would be great if you have them handy.

[redacted]: I'm wondering how/of this could be boosted up to Panel. [S. Schafrik read an example] This is the definition from the European Union, who looked into this a few years ago, it's a good scientific definition. It implies all fluids are hydraulic fracking. Only jurisdiction that seems to have really defined it well. Yukon is very unclear, no one is happy with definitions so far. I would recommend that you put a lot of effort into what has been defined so far and how you are defining it – that is the difference between Executive Committee and Panel right there.

[redacted]: Huge difference between minor and large levels of the project up to the certain fluid.

[redacted]: The report, by the Joint Research Centre, titled an overview of hydraulic fracturing and other information stimulation technologies for shale gas production, the European Commission are the ones who defined it.

[redacted]: If it were shale, it would be permeability to flow to the well. We are hoping to get the focus off shale and to rocks that do not require hydraulic fluid. But you are right, there can be some chemistry in the rock system that still requires some fluid flow. Do they talk about a broad spectrum of techniques?

[redacted]: They do, it's water based, oil based, alcohol based. Pneumatic fracturing, mechanic cutting, and heating of the rock mass.

[redacted]: Moving on. Any updates from TH perspective?

[redacted]: In general, TH is still meeting with the Northern Chiefs Accord. They will be discussing these topics around mid-May. This is the only update that I can provide.

[redacted]: Ok, moving on to outline the project description:

Subset of exploration lands held by Chance, drilling up to 30 wells, 3D and 2D drilling. The footprint would be smaller based on modern techniques, narrow trails etc. Network of winter trails to seismic data. Alternate drilling systems use water-based, we can do something that is environmentally friendly enough to be disposed in the study area. If oil is discovered, longer testing needs to be done which would turn into longer development plans. The other part is to construct airstrip along the Chance winter trails. This could be elsewhere as well. Vuntut Gwitchin (VG) is interested in developing one nearby. Map overview hasn't changed since last time you saw this.

[redacted]: Do you have anymore idea about the chosen drill sites? Locating your targets more? This concern will continue to come up.

[redacted] The only data that we have on this is from 1960s data. We cannot put 30 spots on the map. We can only figure out approx. 2-3. Taking a phased approach. We need more seismic data, this would also happen upon discovery. There are different opportunities north to the south geologically. More rock as you move to the south west.

[redacted]: Permits 17 and 15 are going to be TH's particular interest. Water drainage systems are a concern to us. Both underground and above.

[redacted] Permit 17 is out of interest no to us.

[redacted]: Permit 15 goes into the Peel.

[redacted]: SDL 021 is in that area. Permit 15 has a natural gas discovery, dry gas. No liquids associated with it. Further south is more gassy and less liquid. Gas tends not to stay in liquid very long. Gas is also hard to commercialize due to little demand. We are preferential to oil.

[redacted]: One of the things we want to do for the project proposal, it's a big area, so we are hoping to develop a constraints map with Palmer, EDI, and the First Nations. We might not be able to put 30 X's on a map, but we might be able to narrow things down and create constrains. Like avoiding sensitive vegetation areas. Not working in valleys. Keeping to heights of land. Or using directional drilling. Our intention is to narrow it down to "best places" for well pads. Do you think that would be helpful?

[redacted]: That would help define exactly what is happening, having this generalized area makes it appear much more than it is. It would help visually. How is this project description area created? Particularly VG will want this information

[redacted]: We will be avoiding valleys, due to permafrost. The other component is horizontal directional drilling. We can reach/cover an area as much as 4-5 squared miles. You would not see much of a change in the surface operations.

[redacted]: What is the range for directional drilling?

[redacted]: Focused on depth, 1000 meters deep, you can get 2000-3000 meters horizontal reach.

[redacted]: Heritage resource studies?

[redacted]: This has been centered around 20km from the camp. Southern area has had more heritage work. May need more heritage work/projects in the northern project area.

[redacted]: Stantec, originally Matrix, did an archaeology study. We worked with VG citizens to do the archaeological assessments. We had consultants reach out to First Nations to add more Traditional Knowledge. We got our permits from Old Crow and the YG Heritage Department. There is going to be more updates on this going forward. We would love to have more feedback on this topic. To add into the project proposal. We got little from First Nation of Na-cho Nyäk Dun (FNNND), mostly from VG.

[redacted]: Sidney, you mentioned that TH would be interested in specific permits? Just 17 and 15? Was there a third?

[redacted]: More specifically, we are interested in the water systems in the area, affects to the dempster highway, and the caribou herds. The other stuff is up to VG since it is in their Traditional Territory.

[redacted]: A difference in the presentation today, is that is says up to 5 wells per year, that is the main change since the 2019 presentation. Which said 8 wells per year.

[redacted]: Does this change the manpower?

[redacted]: In this situation, where you could drill a 2500 m well, it would take more time. If we have 1 drilling rig and had a discovery, then we'd have to take more rigs in. This is hypothetical, will manage results as they come in. It could happen that we find something completely different than what drew us into the area. Allowing for flexibility in that reaction is not going to change what happens to the surface area.

[redacted]: Clarification on the number of rigs is important. The actual number of rigs you have is important. Will there be 30 1000m wells or 2500m wells versus 30 drilling rigs? That is a huge difference. Clarification will help.

[redacted]: Nothing much has changed here [R. Wyman referred to the presentation], sitting on higher ground is better for drainage and permafrost issues. Warmer weather up on the hill tops.

These are diagrams to give you an idea of the sub-surface. Our zones of interest are not any deeper than 2000-2500m. A 4000-5000m horizontal reach is quite significant the deeper you get. Extended flow testing cartoon on the right is not to scale. Both natural gas and oil is lighter than water, so they float. Chance wells back in the 1960s are similar to this.

[redacted]: There have been no changes to max numbers of wells.

[redacted]: Number of 20 is a wild guess based on if we have success.

[redacted]: What is the difference between exploratory and production? Thinking about the mining industry. When it comes to Extended Flow Testing, what is your categorization of success? What is the threshold on your decisions?

[redacted]: There is a number of factors on this, the deeper you go the more expansive. What is the discovery; is it liquid rich natural gas or is it dry gas or is it oil? This would make a difference. Also, a preliminary test to put packers on the zone of interest and conduct a flow and see what you get. This is what would make the decision. Bit of decision tree depends on what is the estimated cost of recovery, what is the discovery.

[redacted]: Decision tree on this would be helpful. Define the methodology on this and it will help people evaluate this project. When it's unknown then we assume the worst case on this. If I were with VG, I would really want to know.

[redacted]: One other influence that could affect this, is if we have a vertical well and encounter oil but have a slow flow. If the oil covers a larger area, it might be better if we drill horizontally to it. To get better flow.

[redacted]: Did you want to move on to the seismic exploration program?

[redacted]: Seismic program would be a maximum of / up to 1500km^2 of 3D and 2000km^2 of 2D. 3D will be helpful for the exploration expensive. Too shallow will mean seismic lines spaced too close to each other. We are probably not going to be able to do this all in 1 season. 2D could be done in 1 winter season. Only way to extend season is to push recording side into the summer. Bulk of it needs to be done in the winter. Helicopter flying the line, recording in the summer when caribou are unlikely found in the area.

Workforce in the camp. Drilling is 24 hours, seismic would be 10-12 hours a day. Any overflow in camp would be going to the hotel.

[redacted]: Look at Kudz Ze Kyah. The report on the social implications of the camp. Or the Coffee project. Taking a look at those reports can help you refine project descriptions, specifically for the camp A lot of work has been done lately on the sexual assault implications of a project; workforce wellbeing; vulnerable persons. This is something that can provide challenges related to the outcome of the conditions from YESAB.

[redacted]: We have policies for this.

[redacted]: It might be something you put additional work into. You see this stuff in a lot of the ExCom stuff coming out. Something to keep in mind.

[redacted]: There is not that much that has changed [R. Wyman referred to presentation.] Let's flip to timelines and next steps:

[redacted]: Chance has drafted internal engagement strategies. We were wondering if you were offering any guidance for TH – virtual or in-person meetings?

[redacted]: We are getting back into real engagement meetings. Timeline wise, we are not up to date on this. I need to get guidance/approval from Chief and Council first. Then we can come up with an engagement plan. Anything technical though that you have, send it through.

[redacted]: Our first package of information will be the revised project description. Following that will be the baseline studies. We'll send you those. Following that, there will be other thematic trips to talk to about wildlife and Traditional Knowledge and then water and permafrost. We have frontloaded EDI in the community engagement sessions. Palmer has been backloaded for the time being due to border restrictions. We can send you a tentative schedule of what we are thinking. You can take this to Chief and Council. Together, we can specify how we should be engaging with citizens vs NND government staff?

[redacted]: Direct engagement will be primarily required with community on caribou. Primary topic will be caribou. The Porcupine and Klaza herds. I'm working now with Chief and Council, but we naturally respect VG and Northern Chiefs Accord and they will discuss certain topics at the leadership level. This moves into capacity funding. For Wildlife, we do have technical teams available. I believe that this is going to become a joint item with northern Chiefs.

[redacted]: Existing agreement with Chance stands until Chance receives direct information from you?

[redacted]: Yes, moving forward that is the agreement. I am working on a budget and workplan. Once capacity agreement runs out, we can talk more.

[redacted]: Mentioned you would be seeking guidance from Chief and Council and northern Chiefs regarding engagement, do you have a timeline?

[redacted]: Aiming for end of May. When would you submit?

[redacted]: Late 2021 to submit

[redacted] I will still try to shoot for end of May, covid permitting. I'll be on vacation near end of May. Let's say 2nd week of June we have a catchup.

Action Items/Next Steps:

1. Hemmera to send Memo with tentative engagement schedule to TH.
2. Hemmera/Chance to send revised project description to TH.
3. Hemmera/Chance to send baseline information (EDI, Palmer, and Peer Solutions) to TH as it becomes available.
4. Hemmera to schedule meeting for 2nd week of June.

APPENDIX 2-D-12. Draft *2021 Annual Report Implementation of the Tr'ondëk Hwëch'in and Chance Oil and Gas Engagement and Communication Plan*

DRAFT 2021 ANNUAL REPORT

Implementation of the Tr'ondëk Hwëch'in and Chance Oil and Gas Engagement and Communication Plan

Prepared for:

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Department of Energy, Mines and Resources
Oil and Gas Resources
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July 30, 2021

1.0 INTRODUCTION

This report demonstrates implementation of the *Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan* (Plan) (see **Appendix A**) finalized on August 28, 2018. It summarizes discussions held between Tr'ondëk Hwëch'in (TH) and Chance Oil and Gas Limited (Chance) between June 1, 2020 and May 31, 2021. The purpose, objectives, and outcomes of each discussion are described below in order to fulfill the requirements of Ministerial Order (MO) 2018/42 (see **Appendix B**) issued to Chance on August 30, 2018.

2.0 BACKGROUND

The development of communications and engagement plans began with Order in Council (OIC) 2016/169. OIC 2016/169 required Chance to file a First Nations communication and engagement plan with the Minister of Energy, Mines and Resources in order to extend tenure on their northern permits: 0005, 0006, 0007, 0008, 0009, 0010, and 0011. Chance complied with OIC 2016/169 and received their tenure extension.

Chance subsequently received MO 2017/37 when applying for tenure extension on six of eight southern permits: 0012, 0013, 0014, 0015, 0016, and 0017. MO 2017/37 required Chance to revise, in consultation with affected First Nations, the consultation and engagement plan filed under OIC 2016/169. The affected First Nations listed in MO 2017/37 were Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Tetlit Gwich'in Council.

TH and Chance collaboratively developed their Plan through a series of in-person meetings and conference calls. Hemmera was retained by Chance in November 2017 to facilitate the development and completion of the communications and engagement plans with the affected First Nations and facilitated all discussions between TH and Chance.

TH and Chance submitted their finalized Plan to Minister Ranj Pillai on August 28, 2018. To satisfy its obligations under MO 2017/37, Chance filed a total of four communications and engagement plans. All four plans were approved by the Minister and Chance received a five-year tenure extension on the six southern permits.

A condition of the five-year tenure extension, issued via MO 2018/42, required that Chance submit annual reports summarizing actions taken to implement each communications and engagement plan.

See **Appendix C** for a map of Chance's current permits.

3.0 ENGAGEMENT AND COMMUNICATION PLAN IMPLEMENTATION SUMMARY

3.1 Overview

In the past year, TH and Chance have continued to build their relationship. Parties have advanced discussion on Chance's proposed Eagle Plains Exploration Project and Chance's proposed project for Well Maintenance and Extended Flow Testing. The following sections provide separate summaries of engagement activities that occurred for Chance's projects between June 1, 2020 and May 31, 2021.

3.2 Summary of Engagement – Well Maintenance and Extended Flow Testing Project

Initial notification was sent to TH on May 25, 2020. That package included a high-level overview of the project (e.g., project activities, components, goals, outcomes), the regulatory submissions Chance would be making, a brief introduction to Hemmera and its role, as well as a request to discuss any concerns the affected party may have and an offer to arrange a conference call should they so desire. Also included was a 4-page project summary and map of the project location.

A conference call was organized between Chance and TH for June 17, 2020. The purpose of that meeting was for Chance to provide an overview of the project and an opportunity for TH to ask questions and provide feedback on the project. During the conference call, TH requested to be identified as a potentially affected First Nation. While project activities will not occur in TH Traditional Territory, TH will be indirectly affected by activities (e.g., increased traffic, impacts to wildlife in the region). TH also requested additional information on the following themes:

- Potential risks associated with the project and identified mitigation measures
- The Project's Wildlife Management Plan and how project activities would be affected if Porcupine Caribou are in the area (possibly the 40 Mile Caribou Herd and Hart River Caribou Herd).

TH also recommended that Chance research the availability of traffic data in the project area and surrounding region. Knowledge of the available traffic data in the region would inform Chance on any additional baseline studies Chance may need to conduct for future project proposals.

At the time of the initial call between Chance and TH, no other materials were available (e.g., effects assessments, summaries of mitigation measures, management plans); however, Chance shared the draft project proposal with TH when it was completed on July 24, 2020.

Following additional conversations with the regulator (Government of Yukon), Chance was required to make changes to its project design. On August 7, 2020, TH was provided notice that revisions were being made to the project and that additional information would be forthcoming. A revised project proposal was provided, via email, to TH on August 28, 2020, along with a cover letter summarizing the revisions and providing a rationale for each.

Chance submitted an initial project proposal to Yukon Environmental and Socio-economic Assessment Board (YESAB) on September 11, 2020. However, after further consideration, Chance determined that additional changes were required. On November 2, 2020, via email, Chance notified TH that it had decided to withdraw its project proposal from YESAB and submit a revised version. In that email Chance stated that once a revised proposal had been drafted, Chance would notify TH by sharing a draft and requesting a meeting to discuss the changes further, and Chance stated at that time that after it had the opportunity to discuss those changes with TH, the project proposal would be finalized and resubmitted to the Dawson Designated Office.

The revised draft project proposal was provided via email to TH on November 19, 2020, and in that email Hemmera indicated that Chance would be submitting the proposal to YESAB the following day. On November 20, 2020, Hemmera informed TH that Chance would delay submission until the following week. However, to allow for additional revisions, the submission was delayed until December 24, 2020.

3.3 Summary of Engagement – Eagle Plains Exploration Project

Between June 1, 2020 and May 31, 2021, Chance and TH had only one meeting pertaining to the Eagles Plains Exploration Project.

3.3.1 Meeting Summaries

Date: April 27, 2021
Location: Microsoft Teams
Attendees: TH Mining & Strategic Initiatives Staff, Chance Management, Hemmera

Chance last engaged TH on the Eagle Plains Exploration Project in 2019 and the purpose of this meeting was for Chance to re-initiate engagement. Chance presented a high-level overview of exploration activities proposed for the Eagle Plain Basin. The presentation also highlighted any changes in project design that occurred since it had last been shared with TH in 2019. The presentation went over the layout of well sites, drilling methods, seismic program, and workforce. Chance also provided recent information and updates regarding baseline information gathered by Chance's consultants (Environmental Dynamics Inc (EDI), Peer Solutions, Palmer), and Parties discussed next steps regarding TH's preferences for community engagement and consultation (e.g., schedule, format).

TH asked about whether or not baseline information on water (surface and ground) was collected and that this topic would be of specific concern/interest to TH moving forward. TH raised that Territorial legislation is vague on the definition of fracking and suggested that Chance make efforts to address this in its project proposal. TH inquired as to whether or not Chance was able to identify the location of proposed well sites. Stating that this ambiguity in the project design is likely to raise concern. Chance stated that they likely cannot put more than 2-3 well sites on a map before additional seismic is completed. There was a discussion regarding the constraints map that Chance is developing with Palmer/EDI and the input of First Nations. Chance clarified the difference between exploration and production, and TH stated/recommended that Chance consider including a decision tree in its project proposal.

TH asked about heritage studies. Chance stated that they had previously completed heritage work and had worked with VG Citizens to do an archaeology assessment with permits from Old Crow and the YG Heritage Department. TH requested that Chance look into the social implications of a camp on the people and communities that may be involved or affected.

Chance and TH discussed community engagement strategies. TH stated that they are getting back into in-person engagement, but would require specific guidance from Chief and Council. Chance was to send the revised project description and baseline studies as they become available, as well as a tentative schedule for community engagement.

3.3.2 Communication Log

The correspondence between Chance and TH is documented in the Engagement Log (see **Appendix D**).

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4.0 PLANS FOR ONGOING ENGAGEMENT AND NEXT STEPS

No additional engagement activities are expected for the Well Maintenance and Extended Flow Testing Project while it is undergoing YESAB's review.

TH and Chance will continue to hold discussions at regular intervals as Chance develops its project proposal for the Eagle Plains Exploration Project.

Upcoming engagement activities for the Eagle Plains Exploration Project are expected to involve the following:

- Sharing baseline data
- Meetings between TH technical staff and Chance's technical consultants preparing the project proposal for proposed Eagle Plains Exploration Project
- Community engagement events for TH citizens

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5.0 APPROVAL OF IMPLEMENTATION SUMMARY

TH and Chance have reviewed this report and agree to its contents as an accurate summary of the engagement activities carried out between June 1, 2020 and May 31, 2021.

Per: Tr'ondëk Hwëch'in

Dated: _____

Sidney Schafrik, Senior Advisor, Mining and Strategic Initiatives

Per: Chance Oil and Gas Limited

Dated: _____

Greg Charlie, VP Government and Community Relations

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APPENDIX A

Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan

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Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan

1.0 Introduction

Chance Oil and Gas Limited (Chance) is an oil and gas exploration company that holds permits to perform oil and gas exploration activities in the Eagle Plain basin of Yukon Territory, Canada. As part of Chance's exploration program, Chance seeks to develop engagement and communication plans with all the First Nations that are potentially affected by Chance's exploration program activities. Permits 15 and 17 fall partially within Tr'ondëk Hwëch'in Traditional Territory and Chance is seeking to engage Tr'ondëk Hwëch'in (TH) on its activities within these permits.

2.0 Purpose

This document serves as an Engagement and Communication Plan (Plan) to provide a mutually agreed upon framework to support collaborative and effective engagement and communication between Chance and TH now and into the future.

3.0 Relationship

Chance and TH will execute this Plan according to the following principles:

- Transparency and openness;
- Timeliness;
- Integrity;
- Adaptive Management;
- Mutual respect; and
- Working towards trust and understanding of one another.

4.0 Key Tr'ondëk Hwëch'in and Chance Connections

Engagement and communication between Chance and TH will be generally associated with the proposed work and potential effects associated with Chance's oil and gas exploration program and potential opportunities (via training, employment, contracting, and other community investments), as well as any topics or issues identified through engagement and communication associated with Chance's proposed activities. This section of the Plan identifies the key contacts related to these overarching engagement and communication themes. Key representatives involved in engagement and communication are expected to be as follows:

- Chief and Council;
- TH Government department officials and advisors;
- TH Business Development agencies;
- TH Citizens and communities at large; and
- Proponent Management and designated staff and advisors.

The table in the Schedule to this Plan lays out the key engagement and communication topics, in no particular order, and associated key contacts for both Chance and TH.

5.0 Engagement and Communication Methods

Chance and TH will employ the following engagement and communication methods for specific correspondence:

- In person meetings;
- Email;
- Letters;
- Sharing Power Point Presentations (to support in person meetings);
- Sharing reports and other documents (as requested and as required); and
- Telephone (teleconferences and less formal phone calls).

Engagement and communication methods that support general communication of Chance's activities are as follows:

- Chance newsletters; and
- The website for Chance Oil and Gas Limited.

Engagement and communication meetings will be executed in the following manner:

1. Chance or TH will request a meeting in writing to the other party according to the connections iterated in Table 1;
2. The parties to meet will develop the agenda collaboratively;
3. The party requesting the meeting will develop supporting materials (collaboratively, where possible), and share those in advance of the meeting; and
4. The meeting will take place in a mutually agreeable location.

The above general process applies to meetings with subject matter leads (Table 1) as well as meetings with Citizens and communities at large.

Through engagement with North Yukon First Nations, Chance understands that there are existing agreements between Tr'ondëk Hwëch'in, the First Nation of Na-Cho Nyäk Dun, and Vuntut Gwitchin First Nation. In keeping with the relationship principle of mutual respect, Chance will work within any communications protocols or provisions existing or developed pursuant to these agreements, where applicable and as directed by TH.

The following documentation sharing and review protocols support the methods described above:

- Chance and TH will discuss and establish the confidentiality of meeting minutes in advance of each meeting; i.e. if a meeting is to not be included in the record that will be submitted to regulators and assessors, it is the responsibility of both parties to discuss and agree to this prior to the meeting beginning;
- Chance will take meeting minutes and send these to TH within two weeks via email. Within 30 days of receiving the minutes TH will review and make changes through tracked changes or another method agreed to by both parties. Should TH require more time to review the meeting minutes, TH will notify Chance by email within two weeks of receiving the minutes. The parties will agree on meeting minutes before such minutes become part of the record. No response by TH to Chance's email providing meeting minutes within the 30 days will be interpreted as general acceptance of the meeting minutes by TH, and no response by Chance to TH's email providing amended meeting minutes within 30 days will be interpreted as general acceptance of the amended meeting minutes by Chance;
- Action items and meeting outcomes will be logged during meetings and reviewed by both parties at the end of the meeting to ensure that there is general agreement on the list of actions and parties responsible for those actions. Chance will include the list of action items and meeting outcomes with the meeting minutes;
- Chance and TH will agree upon and use a password-protected file sharing platform to facilitate sharing of large files, such as Power Point presentations and reports; and,
- Should Chance or TH employ a third party for records development and management, the third party will follow the process iterated above for recording and providing meeting minutes.

6.0 Records Management

All information exchanged by Chance and TH is subject to a confidentiality agreement to be agreed upon in the future by Chance and TH.

Subject to collaborative review and the written agreement of both parties, Chance and TH consent to the disclosure of the following information to regulators and assessors for review if and when a potential project is assessed in the future:

- Meeting agendas;
- Non-confidential meeting minutes (finalized versions as described in section **5.0 Engagement and Communication Methods);**
- Invitee/Attendees lists and/or meeting sign-in sheets;
- Records log, which will include summaries of the following:
    - In person meetings;
    - Phone calls and teleconferences;
    - Incoming and outgoing emails between Chance and Chance's representatives and TH representatives;
    - Attachments to the above noted incoming and outgoing emails;

- Reports provided to TH by Chance and reports provided to Chance by TH for review and consideration for engagement and communication purposes; and
- Copies of Power Point presentations delivered by Chance to TH for engagement and communication purposes.

7.0 Adaptive Management of the Engagement and Communication Plan

Chance and TH will review and assess the effectiveness and success of this Plan on at least a 6-month basis.

Within 3 months of the Plan first being agreed to and implemented, Chance and TH will:

- as a first step, sign a confidentiality agreement as contemplated by Section 6.0 above;
- meet to check in on the progress made by both parties in implementing the Plan;
- develop a schedule for review of the Plan; and
- discuss the need for a long-term budget and a comprehensive formal capacity funding agreement to enable TH to participate in future engagement.

Schedule

Key Engagement and Communication Topics and Leads

Role or Subject Matter	TH Key Contact	Chance Key Contact
Project Lead	Sidney Schafrik, Senior Advisor, Mining and Strategic Initiatives (Sidney.schafrik@trondek.ca)	Greg Charlie, VP of Government and Community Relations (gcharlie@chanceyukon.ca)
Culture and Community (includes Indigenous Knowledge and Indigenous Land Use, heritage resources, social, health, and other "human environment" subjects)	Debbie Nagano, Director of Heritage (Debbie.nagano@trondek.ca)	Cindy Dickson Regulatory, Environmental and Community Relations Coordinator (cdickson@chanceyukon.ca)
Engineering and Geology	Sidney Schafrik, Senior Advisor, Mining and Strategic Initiatives (Sidney.schafrik@trondek.ca)	Richard Wyman, President (rwyman@chanceyukon.ca)
Environmental (includes water, aquatic environment, fish, wildlife, forest resources and other plants, and other environmental subjects)	Darren Taylor, Director of Natural Resources (Darren.taylor@trondek.ca)	Greg Charlie VP of Government and Community Relations (gcharlie@chanceyukon.ca) Cindy Dickson Regulatory, Environmental and Community Relations Coordinator (cdickson@chanceyukon.ca)
Opportunities (includes community investment, training, education, contracting, employment, and other business opportunities)	Sidney Schafrik, Senior Advisor, Mining and Strategic Initiatives (Sidney.schafrik@trondek.ca)	Mike Chernoff, Chairman/CEO (mchernoff@caribouca p.com); Richard Wyman, President (rwyman@chanceyukon.ca); Greg Charlie, VP of Government and Community Relations (gcharlie@chanceyukon.ca)
Agreements and Capacity Funding	Charles Pugh, Executive Director (Charles.Pugh@trondek.ca)	Richard Wyman President (rwyman@chanceyukon.ca) Mike Chernoff CEO/Chairman (mchernoff@caribouca p.com)

APPENDIX B

Ministerial Order 2018/42

YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,

(d) oil and gas permit No. 0015,

(e) oil and gas permit No. 0016,

(f) oil and gas permit No. 0017. « *permis visé* »

2 The renewal term of each subject permit is extended by five years (so that it ends on August 30, 2023).

3 The resulting total length of the initial term and the renewal term of a subject permit is 16 years.

YUKON

CANADA

ARRÊTÉ MINISTÉRIEL 2018/42

LOI SUR LE PÉTROLE ET LE GAZ

Le ministre de l'Énergie, des Mines et des Ressources, conformément à la *Loi sur le pétrole et le gaz*, arrête :

1 La définition suivante s'applique au présent arrêté.

« permis visé » Les permis suivants de pétrole et de gaz détenus par Chance Oil and Gas Limited :

a) permis de pétrole et de gaz nº 0012;

b) permis de pétrole et de gaz nº 0013;

c) permis de pétrole et de gaz nº 0014;

d) permis de pétrole et de gaz nº 0015;

e) permis de pétrole et de gaz nº 0016;

f) permis de pétrole et de gaz nº 0017. "*subject permit*"

2 La durée du renouvellement de chaque permis visé est prolongée de cinq ans, de façon à ce qu'elle se termine le 30 août 2023.

3 La durée totale d'un permis visé, y compris la durée initiale et la durée du renouvellement, est de 16 ans.

4(1) In this section

"first nations communications and engagement plan" means the plan filed under O.I.C. 2016/169 and revised in accordance with M.O. 2017/37. *« plan de participation et de communication avec les premières nations »*

(2) It is a condition of this Order that Chance Oil and Gas Limited must file annual reports with the Division Head, in accordance with subsection (3) and to the satisfaction of the Division Head, about the implementation of the first nations communications and engagement plan.

(3) For the purposes of subsection (2), Chance Oil and Gas Limited must file

(a) the first annual report on or before July 31, 2019, in respect of the period beginning on September 1, 2018, and ending on May 31, 2019; and

(b) each subsequent annual report on or before July 31 of each year in respect of the period beginning on June 1 of the preceding year and ending on May 31 of the year in which the report is to be filed.

4(1) La définition suivante s'applique au présent article.

« plan de participation et de communication avec les premières nations » Le plan déposé en vertu du Décret 2016/169 et révisé en conformité avec l'Arrêté 2017/37. *"first nations communications and engagement plan"*

(2) À titre de condition du présent arrêté, Chance Oil and Gas Limited dépose des rapports annuels auprès du chef de division, en conformité avec le paragraphe (3) et à la satisfaction du chef de division, concernant la mise en œuvre du plan de participation et de communication avec les premières nations.

(3) Pour l'application du paragraphe (2), Chance Oil and Gas Limited dépose :

a) le premier rapport annuel au plus tard le 31 juillet 2019, pour la période débutant le 1er septembre 2018 et se terminant le 31 mai 2019;

b) chaque rapport annuel subséquent, au plus tard le 31 juillet de chaque année pour la période débutant le 1er juin de l'année précédente et se terminant le 31 mai de l'année au cours de laquelle le rapport doit être déposé.

Dated at Whitehorse, Yukon,
~~Dc~~ August 30th 2018.

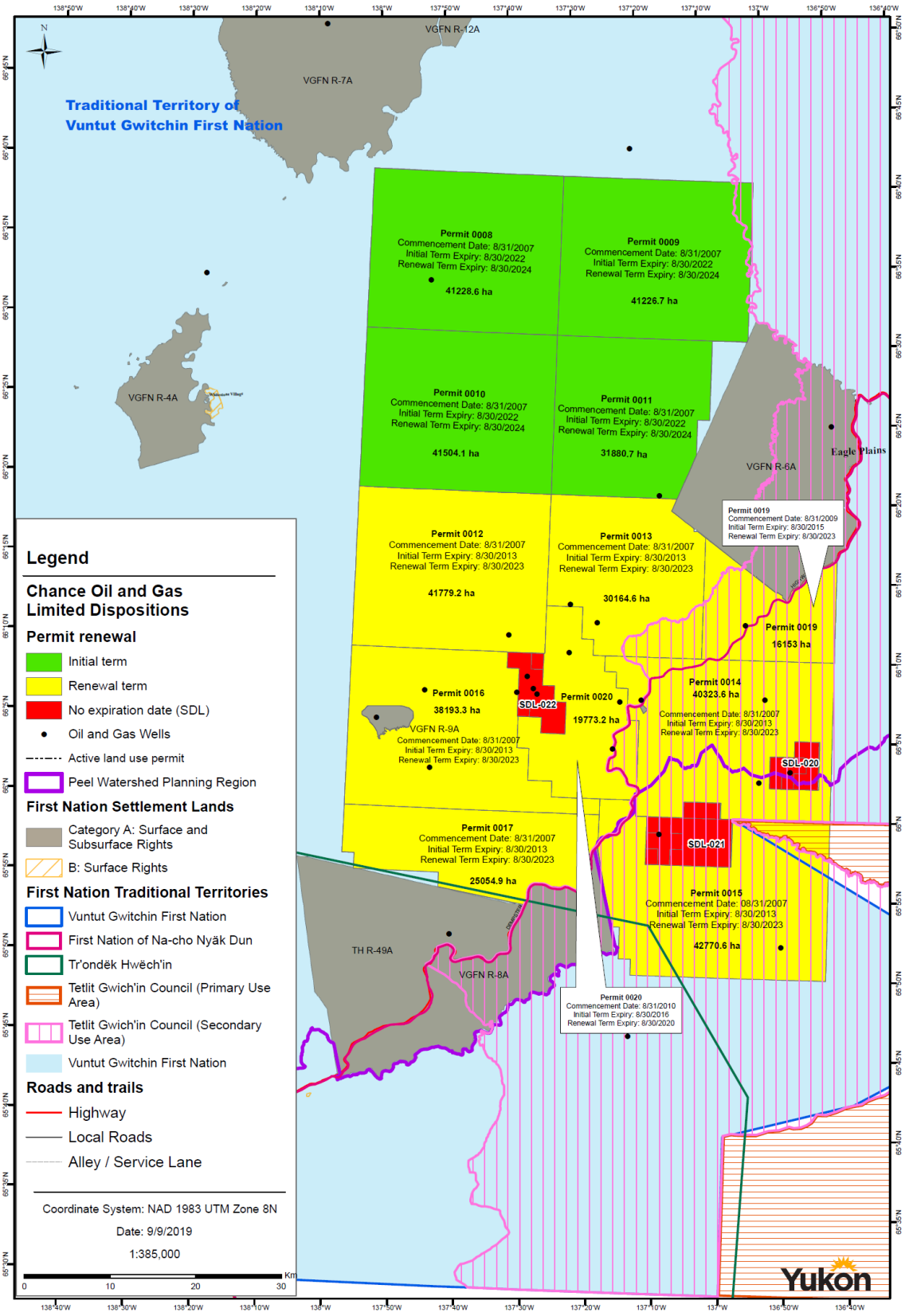
Fait à Whitehorse, au Yukon,
le August 30th 2018.

Minister of Energy, Mines and Resources/Ministre de l'Énergie, des Mines et des Ressources

APPENDIX C

Map of Chance Dispositions and Wells

Chance Oil and Gas Limited Dispositions and Wells



APPENDIX D
Engagement Log

APPENDIX 2-D-13. August 3, 2023, Meeting Summary

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Meeting Minutes

Subject	Draft Project Description Meeting
Prepared By	Two Worlds Consulting (TWC)
Groups Involved	Chance Oil and Gas Limited (Chance) First Nation Na-Cho Nyäk Dun (NND) Tr'ondëk Hwëch'in (TH) Environmental Dynamics Inc. (EDI) TWC
Participants	[redacted], Regulatory, Environmental and Community Relations Coordinator (Chance) [redacted], VP Government and Communication Relations (Chance) [redacted], Technical Advisor (TH and NND) [redacted], Regulatory Lead (EDI) [redacted], Senior Fisheries Biologist (EDI) [redacted], Engagement Facilitator (TWC)
Date/Time	August 3, 2023 8:30 AM – 9:30 AM
Copies to	Chance, NND, and TH

Purpose of Meeting

- Chance provided an Eagle Plains Exploration Project (Project) overview to Skeeter.

Topics Discussed

- Chance overview
- Project overview including information on exploration, design changes, baseline studies, regulatory process, schedule, engagement, proposed next steps

Key Issues Raised / Chance Responses to Issues

- Asked about availability of well abandonment service providers (i.e., future availability and anticipated service fees in the future).
    - Chance to inquire about well abandonment service providers (i.e., future availability and anticipated service fees in the future).
- Noted seismic impacts to predator-prey relationships had been a major objection from communities in the past.
- Inquired about outstanding Yukon Government directives.
    - Chance to follow up with Yukon Government about directives and confirm if anything is outstanding and then confirm with Nations when and how directives were or will be addressed.

Actions and Responsible Party

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- Chance to inquire about well abandonment service providers (i.e., future availability and anticipated service fees in the future) – in progress.
- Chance to resend presentation to [redacted] – complete.
- Chance to send [redacted] 2D versus 3D seismic definition – complete.
- Chance to send [redacted] copies of primary socioeconomic baseline data and caribou baseline data – complete; Chance confirmed no socioeconomic baseline data was available to share at this time and that TWC has been engaged to draft the socioeconomic inputs of the draft Project Proposal.
- Chance to share linear features study with [redacted] – complete.
- Chance to check internal records to confirm receipt of [redacted] response to the 2022 Communication and Engagement Plan – in progress.
- Chance to follow up with Yukon Government about directives and confirm if anything is outstanding and then confirm with Nations when and how directives were or will be addressed – in progress.
- Chance to send meeting minutes to [redacted] – complete.
- Chance to send updated Project video to [redacted] – in progress.
- [redacted] to discuss information requests with leaderships from NND and TH and share feedback with Chance – in progress.

Details of Discussion

- [redacted] led a round of introductions.
- [redacted] introduced themselves.
- [redacted] shared he was attending the meeting on behalf of NND and TH. He previously worked as a land claims negotiator for the Yukon Government (YG) and other First Nations. He also worked on the drill floor for an exploration project.
- [redacted] said he is a senior fisheries biologist for the Project.
- [redacted] said she is supporting Chance in navigating regulatory requirements for the Project. This includes working with the Yukon Environmental and Socio-economic Assessment Board (YESAB) and the Project's consultants to submit a Project Proposal.
- [redacted] said the Project is the first oil and gas project going through YESAB. He shared that he was involved in writing the *Yukon Environmental and Socio-economic Assessment Act* (YESAA).
- [redacted] explained that [redacted] (Chance President) and [redacted] (Chance CEO) have been working together in the Eagle Plains area on oil and gas exploration for decades. He said 30 wells were drilled in the Eagle Plains area between 1959-1973. [redacted] shared that Chance has offices in Whitehorse and Calgary, and is a small company of approximately 5 people. [redacted] said oil and natural gas reserves were first discovered in the Eagle Plains area in 1958. Chance has focused on exploration activities to assess oil and gas potential in the Eagle Plains. More seismic and drilling is required to support this work. [redacted] said Chance wants to

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be part of the Yukon energy strategy by providing oil and natural gas to Yukoners and businesses in the territory.

- [redacted] presented the Project's currently permitted area. He noted the Project falls within Gwich'in Tribal Council's (GTC) primary and secondary areas and Vuntut Gwitchin First Nation's primary area. He noted the Project area overlaps with the North Yukon Planning Region and Peel Watershed Planning Region (PWPR). Specifically, land use management zone 4. [redacted] acknowledged that the part of the Project area that overlaps with the PWPR is mostly in NND territory.
- [redacted] presented the proposed Project activities. He noted that Chance originally submitted an application to the Dawson City YESAB Designated Office (DO). The Project was referred by the DO to YESAB's Executive Committee in 2016. The referral was made after the DO determined that it was unable to assess whether the Project will have, or is likely to have, significant adverse environmental and socio-economic effects. Chance has been working on their Project Proposal for 9 years.
- [redacted] shared that Chance has completed seismic exploration across a 2500 sq km area and is proposing to drill up to 30 wells. This does not mean that Chance will necessarily drill 30 wells. The number of wells depends on the results from initial wells drilled. Drilling would be conducted during the winter, using a focused approach of approximately 5 to 7 wells per year. Good results will lead to extended flow testing of successful wells for 2 years.
- [redacted] shared the Project Proposal will include information on progressive reclamation.
- [redacted] presented the seismic program. He noted seismic will sometimes be done in the same location as the drilling.
- [redacted] asked what the difference is between 2D and 3D seismic.
- [redacted] responded that 3D is very dense and provides more detailed data.
- [redacted] asked if Chance would put the blasts closer together.
- [redacted] said the 3D seismic allows Chance to have a more detailed picture of the natural gas and oil reserves underground; similar to cutting a cake open.
- [redacted] followed up to ask if it's more how Chance is using the data that's different rather than the how Chance is obtaining it.
- [redacted] confirmed [redacted] understanding was correct. He noted the same method for 2D and 3D at the ground level. For example, there is a downhill target and both options support directional drilling.
- [redacted] asked if the data was being collected differently.
- [redacted] suggested Chance prepare and send [redacted] a plain language definition of 2D versus 3D seismic to support his discussions with leadership.
- [redacted] reviewed the use of the existing camp and proposed a remote camp. He noted the remote camp will have medical staff on site. He added that Chance is looking to build a winter airstrip to accommodate bigger aircraft to support crew changes, transportation of supplies, and emergency medivac if needed.
- [redacted] asked if Chance has received their water license yet.

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- [redacted] confirmed Chance had not yet received their water licence. He shared the Project will also include a mix-bury-cover sumps and central processing facility. He noted the oil and gas will be sent to an approved site like Taylor, British Columbia for refinement.
- [redacted] said processing on site will create pure crude oil and that used water will be reinjected back to a regulator-approved zone. He added that oil gets trucked offsite. He said Chance will complete extended flow testing of the wells to understand the pressure, flow, and how many barrels per day the wells could yield as well as a reservoir analysis. [redacted] noted this data is just as important as seismic data [redacted] explained this part of the process will help Chance to understand the economic and production value of the oil and gas in the Project area.
- [redacted] said Chance's YESAB 2014 submission indicated that they wanted to build all season roads to the proposed drilling locations. Communities indicated they preferred not to see all season roads. In response, Chance's 2023 Project Proposal is focused on ice roads and 100% winter drilling. He noted camp operations would typically start in November/December and drilling would generally occur between December - March/April.
- [redacted] noted there are a lot of seismic lines in the Eagle Plains.
- [redacted] said the geophone data collection will be in spring and summer when the Porcupine Caribou Herd heads north.
- [redacted] added that seismic technology has changed over time, and noted the widths of rights-of-way are smaller than in the past.
- [redacted] reviewed how the current Project is different than the previously proposed Project, specifically, how Chance is looking to rebuild relationships and collaborate with First Nations, use low impact seismic, complete drilling activities only during the winter season, utilize the existing Project footprint and networks, spread activities across 10 years to minimize annual impacts and support steady employment, and use winter ice roads versus all season roads.
- Jennifer shared that many studies had been conducted since 2018 and are continuing this year, and noted Chance is trying to learn from past engagement and incorporate concerns. Jennifer presented completed baseline studies for terrain/surficial geology, permafrost, water quality and surface flows, fish and fish habitat, vegetation, wildlife (porcupine caribou, moose, American marten, grizzly bear, and birds), and heritage resources.
- [redacted] requested more recent caribou baseline information and primary socioeconomic baseline information.
- [redacted] said mapping has been completed across the whole Project area. That has been really helpful for the effects assessment. He also explained that Environmental Dynamics Inc. had completed a linear features study. They walked old seismic trails to get a feel for walking speed, how far you could see, etc.
- [redacted] said that is good because seismic impacts to predator-prey relationships had been a major objection from communities.
- [redacted] reviewed the regulatory process, and noted the Project was referred to the YESAB Executive Committee in 2016 and Chance is working on their Draft Project Proposal [redacted] said Chance was waiting for regulatory direction from YESAB on the Draft Project Proposal Table of Contents (TOC).

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- [redacted] asked Chance to confirm that they had not gotten the TOC yet from YESAB.
- [redacted] confirmed Chance had not received a TOC from YESAB.
- [redacted] said they had all the information lined up and the First Nations told them not to come and do socioeconomic studies.
- [redacted] said he was not aware of that.
- [redacted] said the First Nations said no to meeting in 2019 and then the pandemic happened.
- [redacted] shared that Chance is hoping to submit an updated Draft Project Proposal on December 15th to YESAB.
- [redacted] said Chance is hoping to build trust in the communities and support their understanding of the Project. He noted the Project no longer includes fracking.
- [redacted] reviewed completed and proposed 2023 engagement activities.
- [redacted] asked [redacted] what NND's engagement preferences are. He asked if NND wants Chance to come to the community to conduct open houses and socioeconomic primary data collection. [redacted] said if NND prefers to defer engagement to Vuntut Gwitchin First Nation, Chance respectfully requests that deferral is made in writing to share with YESAB.
- [redacted] asked what level of involvement TH will have in the Project.
- [redacted] said Chance is legally required to consult all potentially impacted First Nations.
- [redacted] asked if Gwich'in Tribal Council has an interest in the Project and if the Project will impact their secondary use area.
- [redacted] confirmed the Project will impact Gwich'in Tribal Council's secondary use area.
- [redacted] suggested Chance follow the Yukon Oil and Gas Act, land claims, and North Yukon Regional Land Use Plan guidelines.
- [redacted] forwarded Chance's virtual meeting invite with YESAB on August 23, 2023 to [redacted]
- [redacted] asked what happens after the submission of the Project Proposal. He also asked what the referral process means and what are the milestones to accomplish to have an adequate submission.
- [redacted] said Chance is looking to get feedback from YESAB on the regulatory process for the Project. She added that Chance is trying to hit on the requirements and wants to submit a complete Project Proposal. [redacted] said Chance will append the baseline reports to the Project Proposal.
- [redacted] acknowledged YESAB is going through their own changes.
- [redacted] said Chance is open to meeting virtually as needed. Noted the logistical challenges of engaging in-person (e.g., lack of accommodation in Mayo).
- [redacted] asked Chance about three outstanding directives issued by Yukon Government to address old wells. He said the work has not been done and he had heard from the Yukon Government that Chance had yet to respond to the directives.

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- [redacted] said one directive was to complete the consultation reports for the land disposition, and noted this year's reports were being submitted to Yukon Government that day. [redacted] said Chance did not receive responses on those reports for the last 3 years.
- [redacted] said he did respond to a previous consultation report for the land disposition.
- [redacted] confirmed they were meeting with Yukon Government that afternoon.
- [redacted] confirmed the Impact Benefits Agreement had been sent to leadership for signature. He also shared that NND is supporting the well maintenance work getting done as soon as possible.
- [redacted] explained that Chance's camp has a water system that treats water for cooking, bathing, etc. He said First Nations and Yukon Government want Chance to reassess the camp's wastewater management.

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APPENDIX 2-D-14. December 20, 2023, Meeting Summary

Chance Oil and Gas Ltd.
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Draft Meeting Minutes

Subject	Technical Working Group – Fish and Wildlife
Prepared By	Two Worlds Consulting
Groups Involved	Chance Oil and Gas (Chance) Environmental Dynamics Inc. (EDI) First Nation of Na-cho Nyäk Dun (NND) Porcupine Caribou Management Board (PCMB) Tr'ondëk Hwëch'in (TH) Two Worlds Consulting (TWC) Vuntut Gwitchin First Nation (VGFN) Yukon Government (YG)
Participants	**Chance Oil and Gas (Chance)** • [redacted], Community Engagement and Permitting • [redacted], Vice President Government and Community Relations **Environmental Dynamics Inc. (EDI)** • [redacted], Senior Biologist • [redacted], Senior Biologist • [redacted], Quantitative Ecologist **First Nation of Na-cho Nyäk Dun (NND)** • [redacted], Advisor **Porcupine Caribou Management Board (PCMB)** • [redacted], Executive Director • [redacted], Chair • [redacted], Minute Taker **Tr'ondëk Hwëch'in (TH)** • [redacted], Advisor **Two Worlds Consulting (TWC)** • [redacted], Engagement Facilitator • [redacted], Engagement Support **Vuntut Gwitchin First Nation (VGFN)** • [redacted] Technical Advisor **Yukon Government (YG)** • [redacted], Caribou Specialist
Date/Time	December 20, 2023, 8:00 to 12:00 am MST
Copies to	All groups involved

Purpose of Meeting

- To provide a Project summary and updates; and share results of Environmental Baseline Studies including preliminary potential effects and mitigation to Fish, Wildlife, Porcupine Caribou Herd, Linear Features, and North Yukon Land Use Planning Conformity.
- A question and answer period followed the information sharing.

Topics Discussed

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- Project summary and updates
- Baseline Studies
- Effects Assessments
- Fish and Fish Habitat
- Wildlife and Wildlife Habitat
- Porcupine Caribou Herd

Key Issues Raised / Chance Responses to Issues

- Participants would like more detail about the Project Proposal and requested Chance to include all activities in the Project proposal. / Chance to review.
- Participant inquired about meandering seismic lines and how operators are informed about the design. / Chance confirmed that there is a design in place and that scouting will occur prior to the work, to understand the density of the forest and to optimize line locations.
- Asked if the Project videos are online. / Chance is developing a webpage.
- Requested more information on Chance's interpretation of disturbance. / Chance responded that key disturbance factors include noise, smells, and human movement/presence, and consider how far away caribou are from the well sites. Chance stated that disturbance is dependent on how the caribou are responding. Studies on Zone of influence are mixed, with various analytical methods, and depending on interpretation can range from no avoidance up to 40 kilometres of avoidance. There are many issues with analytical approaches that are scale dependent, and not often considered by those authors.
- The priority is to not disturb the caribou, but further work is needed to determine what is too much disturbance. Participants inquired about mitigations and if there is anything other than seasonality. / Chance responded that there will be mitigations in place, and there will be direct and indirect effects.
- A participant cautioned about using a 1-kilometrer Zone of Influence (ZOI), and believes the literature will reflect larger zones. Shared that he thinks Chance will have a difficulty finding that in the literature. / Chance responded that the primary reason for the buffer was because of sensory disturbance and that in larger ZOI assessments there is not a clear mechanism that is associated with the level of disturbance. Chance is focused on addressing local scale sensory disturbance within the work area, and that linear avoidance is assumed within the literature on ZOI's. The assessment applies a uniform 75% reduction across the 1-kilometre zone, which is a conservative (i.e., likely over-estimate) of the effect throughout the zone.
- PCTC (Porcupine Caribou Technical Committee) advised against doing the ZOI analysis based on low sample size (few caribou interacting with 3D seismic across the range). / Chance said that they could not ignore existing data and conducted the analysis regardless, and in the end did not rely on a 3D ZOI analysis as it was not conclusive.
- Participants expressed concerns about the ability of the Land Use Planning Council to review the Project for a conformity check, compared to the capacity of the North Yukon Commission. / Chance said that there are knowledgeable people on the council who have been there for a while. Shared that the North Yukon Commission no longer exists.
- Inquired about how Chance will be able to privatize a road. / Chance responded that the Chief Operating Officer can make it a private road. Said that that it is more of a safety concern, and that people are not interested in hunting around the drilling area. The company could grant access to subsistence harvesters, but this may create a safety concern for staff on site.
- Expressed concerns about the lack of communication between Chance and the Executive Committee. These conversations are important.

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- A participant shared concerns that their experience on drill projects, drill sites needed a 24-hour supply of water, which was trucked into the site. Unless technology has changed, that is one example of essential road traffic even if there are caribou in the area. Participant asked if the reduction would be sufficient or not. / Chance does not have the details on what is considered essential road traffic right now, but will include that in the Project Description.
- Participant requested an end of season report, to understand if caribou mitigation efforts worked and is concerned that this is not being considered. / Chance is interested in learning how the caribou are impacted, and that Chance will learn over the project lifecycle (10-year program).
- Participants encouraged ongoing in-person discussion outside of the YESAB review, which, through written format, can become hostile.

Actions and Responsible Party

- No actions.

Details of Discussion

[redacted] (Chance) gave a brief Project summary and added that [redacted] (EDI) would lead the presentation. [redacted] emphasized that the Project is a proposed exploration program and reiterated that the proposed submission of their Project Proposal is February 2024. Chance has been conducting virtual and in person engagement meetings. He mentioned First Nation of Na-Cho Nyäk Dun leadership currently does not want to participate in community engagement. Chance will continue to provide Project information and that engagement will continue with the First Nations and residents of communities. Chance will also share technical reports with First Nations. Chance is proposing a 10-year program.

The group shared a round of introductions.

[redacted] (EDI) stated the exploration area is around 2400 square kilometres, with clearing occurring during the winter and that it will be approximately 1500 square kilometres total of 3D seismic spread over 10 years. He added that there will be 2000 square kilometres of 2D seismic. [redacted] (EDI) noted that the Project is looking at up to 5 wells per year, equivalent to 2 hectares, and a maximum of 30 wells total. He stated that winter operations will last about 1 to 3 years in each area. He added that there will be three Project work areas and winter access roads will be created. He noted that there will be spring and summer seismic activities with helicopter support and extended flow testing. He stated that the seismic work is different than what was done in the 1950s.

[redacted] (Chance) added that extended flow testing occurs during the winter months and a well of interest will be flowed for natural gas and oil to a service rig. He shared that Chance will be abandoning 3 or up to 5 wells next winter.

[redacted] (PCMB) asked if the seismic testing will include installing and retrieving geophones, which was done previously.

[redacted] (Chance) said that it is new to Chance and that they use the same equipment from the seismic program in 2013.

[redacted] (PCMB) mentioned that he knew Chance was working on site.

[redacted] (Chance) stated that the geophones will be flown out when the snow and wildlife are gone in the spring. He added that if the caribou are hanging out, they can employ mitigation measures and hold off detonation and data collection until the caribou migrate north.

[redacted] (NND/TH) asked if this includes surface drilling.

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[redacted] (Chance) said that it would involves drilling a 3-to-5-meter hole, and the charge will be put down and repacked.

[redacted] (NND/TH) inquired if it was helicopter access and if Chance would be setting up a portable drill.

[redacted] (Chance) mentioned that the site is accessible by vehicle and that Chance would transport the drilling equipment. He added that Chance can hold off until late spring to detonate and take samples.

[redacted] (NND/TH) inquired if it was restricted access.

[redacted] (Chance) confirmed that it will be restricted access.

[redacted] (PCMB) stated that in 2013 there were caribou around. If caribou are around when Chance conducts work, will they hold off on the seismic activity?

[redacted] Chance) said Chance would hold off on detonation activities, but this needs to be discussed further. Chance will make these decisions as they occur and depending on how many caribou are in the area. [redacted] does not understand what the criteria is for this. In the baseline data being gathered for the technical review, there is the understanding that the caribou will migrate. He noted that Chance will go back to that location after the caribou move through. He stated that it depends on the number of caribou that are migrating in the winter range. Chance won't know until they do the field work and determine caribou movement through wildlife monitoring.

[redacted] PCMB) said that if there are caribou moving through the area, it won't be just one hundred in the Eagle Plains Basin. It will be a lot more caribou than that. This is what the collared data suggests.

[redacted] (EDI) noted that the Project team wants to have a good understanding of caribou movement. He added that protecting the lichen protects the herd. He noted that this is why activities are occurring in the winter to minimize the impacts. Seismic lines don't have to be straight anymore, and it is not the Project that was proposed in the past. This is a different seismic operation and that the key thing is that it will be spread out over 10 years.

[redacted] (EDI) presented the Baseline Studies Completed slide.

[redacted] (EDI) shared that the Project was bumped up to Executive Committee screening, which required Chance to do several studies.

[redacted] (PCMB) inquired about information on the Executive Committee.

[redacted] (EDI) said that it is a higher level of consultation and requirements. The Executive Committee reviews the Project.

[redacted] (Chance) said that they require additional data and baseline studies. The original Project went to the Yukon Environmental and Socioeconomic Assessment Board (YESAB) Dawson office and four out of six concerns came from it. These concerns put the Chance Project into a higher level of screening.

[redacted] (EDI) stated that field studies from 2019 to 2021 included: ecological mapping, linear features, fish, water, birds, and desktop studies that includes Porcupine Caribou Herd (PCH), moose, and martens. Chance wanted to do a linear features study to feed into the Land Use Plan (LUP) conformity check. He noted that the PCH are in the desktop studies because there is so much information available on them. He added that there were concerns about grizzly bears, but Chance doesn't have information on them.

[redacted] (EDI) presented the Effects Assessment Approach slide.

[redacted] (EDI) said there will be an impact on caribou, and we are assessing the significance of the effects. He added that Chance put the Environmental Assessment in the context of the LUP. He noted that there is more disturbance which is included in the Linear Features Study. The constraint maps help to develop scenarios to figure out future impacts. He noted that the spatial

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scale is relevant to the species. He said that exploration programs typically do not trigger an Executive Committee review. He added that this Project is going through the same review as the Casino mine project. He said that there is enough concern that it triggered an Executive Committee screening. There are always questions about the Project. He stated that Chance can't do an impact assessment without confirmed sites, which is why the Project team is using scenarios.

[redacted] (Chance) stated that Chance is taking an ecological perspective. Chance is trying to do the Project in a sustainable way by using constraints mapping and studies. Chance knows where the Project would like to drill. Chance needs to design winter access that considers constraints and previous disturbances. The Project team has described this to the Executive Committee and to communities to understand that Chance is listening and modifying the Project Proposal. They are not drilling year-round, and Chance's approach is unique and hasn't been done in the Arctic.

[redacted] (PCMB) asked for clarification whether the Project team was talking about next steps in the permitting process and if they had stopped talking about drilling.

[redacted] (EDI) said seismic comes first to identify the drill targets.

[redacted] (PCMB) said drilling is part of the exploration program, but we are talking about seismic right now.

[redacted] (Chance) said that Chance will still have to drill but initially they must get the targets and do the seismic. He added that this is what will help us understand what kind of resources are out there.

[redacted] (PCMB) inquired as to whether seismic would give Chance that information.

[redacted] (Chance) responded that no, it won't. He added that once it is put in a controlled environment, seismic will be used to understand of the layers of rock formation, depth of it, and any anomalies. He noted that drill site locations will be determined in the seismic studies.

[redacted] (PCMB) questioned whether Greg believed seismic and drilling to be one and the same. [redacted] (Chance) stated they are indeed different, and that identifying drill targets requires the seismic work.

[redacted] (PCMB) said [redacted] (EDI) said the drill on the slide was unconventional.

[redacted] (VGFN) asked if the last step in the process is flow testing.

[redacted] (Chance) said that that is correct. Geologists have said there is a 10 to 20% success rate, which means that 3 of 30 wells or 6 of 30 wells may be successful. Currently they do not know how successful they will be, but that there is opportunity. He noted that the business plan is focused on local consumption and that the Yukon needs additional energy. He said that Chance needs to understand what kind of gas there is and flow it. He noted that the flow time is up to six weeks. Chance would like to understand what kind of gas there is.

[redacted]NND/TH) mentioned that even if heating oil is locally sourced, it would need to be refined down south and then shipped back up. To be a local supplier, Chance would still have to ship oil south.

[redacted] (Chance) said that oil would need to be shipped south during the flow tests, but that there is technology to be refined at the site, but that's not a part of this Project.

[redacted] (YG) said that natural gas flow testing would occur for 6 weeks to prove the resource and asked Greg how long it would be with oil.

[redacted] (Chance) said it would require two years for flow testing and that Chance would be awaiting recommendations from YESAB. He added that it is longer for oil than gas. He noted that when the pressure comes up, the oil is a heavier liquid. He said that it takes time to understand it.

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[redacted] (YG) inquired about how long it would need to flow for.

[redacted] (Chance) said that the Project is not able to flow test summer months as Chance does not have all season roads. If there are successful wells, then Chance will need to seek a permit for an all-season road.

[redacted]YG) said that he's trying to understand the level of disturbance and if Chance would have to turn off the tap and begin flow tests in the following year.

[redacted](EDI) stated that that is something that Chance will have to include in the Project description.

[redacted](Chance) said that winter activities will only be 4 to 5 months.

[redacted] (VGG) asked if flaring would occur during flow testing.

[redacted](Chance) said that yes that is why flow testing is shorter because it would include a minimum of 3 weeks of flaring.

[redacted] (YG) expressed concern about how the trucks would be staged up to get the oil.

[redacted](Chance) said that Chance could get him the information. There will be heated storage, and will include 400-barrel trucks to keep the crude oil in. He said that the oil will come into a station area and before it gets taken away, there will be separators. He stated that Chance will probably have to reinject produced water back down into the wells.

[redacted] (VGG) stated that there needs to be more details about the Project Proposal and what activities Chance is proposing. For example, what are the activities associated with flow testing so that it can be evaluated. He noted that if the detail is in the Project Proposal to start with it saves everyone time. Chance will review.

[redacted] (EDI) presented the Land Use Plan Context slide.

[redacted] (EDI) said there are differences between how it works. There is the Integrated Management Area Zone 4 and that this is where it is expected that development will occur in the area. This zone has a higher level of protection than other areas. Even though Chance is looking at development in this area, Chance is looking at a high level of environmental protection. He added that it is likely one of the highest levels of protection with protection covering 37% of late winter and 31% of the fall range.

[redacted] (EDI) presented the Low Impact Seismic slide.

[redacted] (EDI) said Chance will use meandering lines to avoid large trees and to make the lines of sight to be less than 70 meters. There will be small narrow mulchers used for the seismic lines (2.5 m), which will help to protect vegetation. There is low ground pressure equipment over at least 20 cm of packed snow/ice. The vegetation will be pushed over, not cut, which means a faster recovery.

[redacted] (YG) asked if that is 20 centimetres of snowpack.

[redacted] (EDI) confirmed that it is 20 centimetres of snowpack.

[redacted] (Chance) Chance wants 20 centimeters of snowpack for winter roads, and in Chance's mitigation section, it says Chance will strive to get 20 centimeters.

[redacted] (VGG) asked if there is a design in place for meandering seismic lines and how Chance will communicate this to the operator.

[redacted] (EDI) said that that is an excellent question and [redacted] is the expert.

[redacted](Chance) said that scouting will be done in advance to understand the density of the forest, determine the location, and design it based on that information. If there are dense trees on the south side, Chance will design it to go around.

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[redacted] (VGG) asked if Chance would design it.

[redacted] (Chance) responded yes, they go out and walk it before they design it. There was helicopter support in the past to scout areas, to avoid mulching and to decide where to mulch. He noted that Chance will get more information about the criteria.

[redacted]. (YG) said they are trying to avoid site lines from certain lengths.

[redacted](VGG) said that it is up to Chance to design meandering seismic lines.

[redacted] (EDI) said that is how it works operationally.

[redacted](YG) said aerial photos could be helpful.

[redacted] (EDI) noted that Chance does not have any high-definition photos.

[redacted] (YG) said that the Yukon Government has some photos.

[redacted] (EDI) presented the Linear Feature Disturbance slide.

[redacted] (EDI) said that there are indicator levels of linear disturbance. He added that cautionary is 0.75 kilometres/square kilometer and the Regional Study Area (RSA) is 1.79 kilometres/square kilometre (unadjusted), and 0.52 kilometres/square kilometres(adjusted). He said that if the 3D lines are removed, it could be down to 0.48 square kilometers. He added that the background isn't presented too much in the LUP. He noted that Chance is utilizing the cautionary level.

[redacted](YG) said this is all the discussion from the LUP process.

[redacted] (EDI) said that there is a lot of theory around it, and that is why Chance did a linear effects study.

[redacted](YG) said that the numbers came from the caribou work. He said that he was not at the table but talked to people, such as [redacted], after the plan was done.

[redacted] EDI) said that information came out of Alberta, for example, different land uses and species in the area such as wolves preying on moose rather than caribou.

[redacted] (YG) asked what Chance meant by vegetation recovery.

[redacted] (EDI) said that they used the tall shrub stage, which was 2 metres instead of 1.5 metres from the LUP.

[redacted] (EDI) added that the old seismic approach was to cut the vegetation down.

[redacted] (EDI) presented the Environmental Constraints Mapping slide.

[redacted] (EDI) said Chance intends to avoid heritage sites, permafrost/terrain sensitive areas, riparian management areas, priority ELC units, caribou habitat, and moose habitat. He added that directional drilling is good to avoid high quality habitat, another mitigation measure.

[redacted] (Chance) said that Chance needs to get surface distance between 1.5 to 2.0 kilometres. He said that the Project team could stay on top of the hill and still drill in the valley.

[redacted] (VGG) asked if the Project videos are online.

[redacted] (Chance) said that Chance is in the process of developing a webpage.

[redacted] (Chance) said that Chance wants to launch the website before the new year and the February 2024 submission.

[redacted] (EDI) presented the Well Site Scenarios slide.

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[redacted] (EDI) said that the well site locations are unknown. He added that Chance develops scenarios within constraints to the range of potential habitat effects. Chance develops scenarios based on Scenario 1 which is developed by the seismic team.

[redacted] EDI) presented the Project Interactions slide.

[redacted] (EDI) said that there will be direct and indirect habitat interactions. Direct being vegetation clearing and indirect such as sensory disturbance. He added that there are areas where the Project team will avoid human activity. He said that there will be an indirect and direct mortality risk, direct being vehicle collisions and indirect will be due to increased predator access. This is what YESAB brought up in the first review. Chance is trying to reach a balance in the assessment.

[redacted] (PCMB) inquired about Chance's interpretation of disturbance.

[redacted] (EDI) responded that key disturbing factors are noise, smells, and human movement/presence. He added that this depends how far away caribou are from the well sites. He noted, based on mixed results in literature using various analytical methods, some possibly erroneously, that disturbances could result in no avoidance and up to ~40 kilometres of avoidance. He said that it is dependent on how the caribou are responding to the disturbance.

[redacted] (NND/TH) asked if there would be something on the ground at whatever distance it is. He asked what mitigation is there. He added that the concern is not to disturb the caribou, but how much is too much disturbance. He asked if there were other mitigations other than seasonality.

[redacted] (EDI) responded that there is a mitigation. He added that Chance calls them direct and indirect effects.

[redacted] (EDI) presented the Porcupine Caribou slide.

[redacted] (EDI) said that the key resource in the LUP is the caribou. He added that the information that Chance presents on the caribou is far more descriptive than in 2013. He noted that it was important to characterize the caribou. He added that Chance must understand the caribou enough to understand interactions with the Project. He said that Chance can't avoid all locations, and that Chance has looked at potential effects on PCH habitat and movement. He said that when looking at mortality it is challenging to quantify. He added that Chance has looked at residual effects, which are effects that are left over after mitigation is applied and that cannot be addressed.

[redacted] (EDI) presented the Porcupine Caribou – Distribution slide.

[redacted] (EDI) identified the PCH-identified life cycle periods or seasons. He added that there are patterns of occurrence from 1970 to 2016, supplied by PCTC. He said that Chance is looking at rut and winter overlap. He added that there is no doubt that Chance will see the caribou and that they will likely show up some time during the 10 year operation, and when they do, they will show up in large numbers.

[redacted] (EDI) shared movement of the PCH after the 2013/2014 seismic program. He said that the PCH moved through the Project area in 2015. He added that there were 13,000 to 14,000 observations through the cameras. He said that it was evident that they had moved through there. He noted that this has not happened ever since. He said that he is unsure where the PCH are now in the winter.

[redacted] (YG) said that the time where it does split, they used winter ranges in Alaska recently. He added that the challenge is that the PCH may go to the same area for two decades and then never go there again. He noted that he has not seen them in the uplands for two decades but that is where they used to be. He said that it is common to see them overlap with the December range.

[redacted] (EDI) said that there could be richer detail to describe. He said that when the PCH do show up it will be a lot.

[redacted] (YG) said that they do not have detailed GPS data prior to 2015. He added that collared data did not start until 2012.

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[redacted] (EDI) added that before, there were different collars.

[redacted] (YG) confirmed that previously, the location was tracked every day versus now, where you can track every minute of their movement. He added that most survey work occurs during the summer periods. He said that they had late winter data to look at distribution.

[redacted] (EDI) presented the Porcupine Caribou – Movement slide.

[redacted] (EDI) stated that in 2015, caribou travelled through a network of 2D seismic lines, winter roads, and a large 3D seismic grid. He said that the PCH will probably show up in abundance based on the work Chance has done.

[redacted] (YG) said this is late winter data. He added that that is when distribution would be done.

[redacted] (EDI) said that this is why the Project went to the Executive Committee. He added that Chance doesn't know enough about the PCH in the winter. He said that in the baseline effects, the Project can compile that data. He shared that a lot of the information was not available to the Chance team. He noted that if Chance misses anything, that this is what Chance is looking for.

[redacted] (EDI) said that caribou occupy the RSA in less than 20% of previous years. He added that rut/late fall and winter seasons are considered the least biologically sensitive periods for the herd. He said that that doesn't mean that the Project team isn't treating them sensitively, caribou are just less sensitive during these times. Winter is the least sensitive period relative to all seasons. He said that protecting calving grounds is key. He added that this herd keeps going back and other caribou herds are quite different. He noted that, the PCH are in good health this time of year and less sensitive than other times of the year. He shared that this information came from the PCTC report.

[redacted] (EDI) said that they are looking at the movement rate of PCH and what will they be exposed to. He said that based on the PCH collared data, it is evident that they move through the area. He added that it is roughly 4 to 5 days in the rut and late fall or 15 to 16 days in the winter.

[redacted] (EDI) said that the analysis consisted of quantifying daily travel times. He added that Chance characterized the seasonal ranges by dividing the seasonal range into around 2500 square kilometres of cells. He said that after that, they compared the different travel rates and residency times. He noted that the Project can say that the RSA is around half in the late fall and there are about ten days less spent in the winter. He shared that overall, caribou are spending less time in the RSA when they are there.

[redacted] (EDI) said that this is why it is important to characterize what the caribou are doing in the area. He added that they seem to be moving through the area quickly.

[redacted] (YG) asked if Chance is characterizing that their residency will be half of when they are going into the area.

[redacted] (EDI) said that we calculated residency times as an average, and that we are making a relative comparison of residency in the RSA versus the broader seasonal ranges using the collar data. He said that when the Project team is making a comparison of residency times, they are seeing this much of a difference.

[redacted] (YG) said that he is unsure if he would base the data on the limited set of examples, but it does give a sense. He added he would be leaning more on to the seasonal range data (SRD). He shared that the residency of SRD is useful. He said that he would be careful saying that about collared data.

[redacted] (EDI) said that there will be a list of uncertainties in the Environmental Assessment.

[redacted] (EDI) said that the standard error is associated with the ranges. He shared that the seasonal range average is not directly comparable to the RSA and that he is not sure if the seasonal range residency time is the best average to use. He said

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that the composition of the eco ranges is different. He added that they wouldn't expect the same amount of residency time in the RSA.

[redacted] (YG) said that there is a lot of data, around 50 years of movement data for the herd. He added that there is only GPS data for a decade, which isn't that much.

[redacted] (EDI) said that the Project team must move through with some level of confidence. He said that the Project talks about reversibility of effects and if it is reversible.

[redacted] (EDI) presented the Porcupine Caribou – Habitat Selection slide.

[redacted] (EDI) shared a recap of the methods and results for PCH. He said that they used a standard approach to developing these models and used a generalized linear mixed model. He added that it was a 1:10 used-available design. He shared that they are looking at interactions with lichens, and plant functional type layers (e.g., light microlichens, conifer, forbs, deciduous shrubs, graminoids, and evergreen shrubs). He said that it included elevation, slops, aspect, and distance to waterbodies. He added that they did random effects on the caribou year and did a 5-fold cross variation of model predictions. He added that they mapped RSF predictions across seasonal ranges.

[redacted] (EDI) said that they used selection ratios to identify the RSF prediction threshold where the proportion of used locations is greater than available. He added that this corresponds to selected habitat by caribou; these predictions considers the partial effects of all habitat covariates (rather than single covariate coefficients). He shared that they were able to identify four habitat ratings: high, moderate, low, and very low. He said that the selection threshold identified the split between high/moderate and low/very low and that the split between high and moderate was based on midpoint value, the same for low and very low.

A participant asked if this is describing the quality of the habitat or the ratio of use.

[redacted] (EDI) said that it is quantifying selection. He added that when Chance maps that, it has been classified as a habitat with high or moderate rating. He shared that it is selection, not use.

[redacted] (EDI) said that the moderate and high ratings are the areas associated with selected habitat. He shared that that corresponds to caribou using the areas more frequently than what would be expected by random chance. He added that the Project team chose the term 'selected' habitat and didn't want to use 'suitable' habitat because all habitats can potentially be suitable and used by caribou. He said that the habitat ratings are associated with higher macrolichen cover.

[redacted] (YG) asked what the Y-axis on the top graph said.

[redacted] (EDI) responded that it is the proportion of locations. He said that both figures show the same information in a different type of way.

[redacted] (EDI) presented the Caribou / Project Interaction – Review slide.

[redacted] (EDI) shared that the RSA overlaps with the PCH seasonal ranges. He added that the caribou occupy the RSA in less than 20% of years (or approximately 1 in 5 years). He shared that rut/late fall and winter seasons are considered the least sensitive periods for the herd. He added that the exposure period of individual caribou is expected to be 1 to 2 weeks. He said that Chance is looking at the assessment of criteria of seasonal habitats and that they were built into the LUP.

[redacted] (EDI) presented the Potential Habitat Effects slide.

[redacted] (EDI) shared that direct habitat effects refers to areas cleared of vegetation. He said that this affects 2% of selected rut/late fall and winter habitats within the RSA. He added that it affects 0.2% of selected rut/late fall and winter habitats at the Eagle Plains ecoregion scale. He said that the 3D seismic may not create a functional loss if lichen persists. He shared that it should not affect the lichen.

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[redacted] (EDI) shared that the indirect habitat effects refer to sensory disturbance. He added that they did a ZOI study that was applied around all disturbances. He said that they assumed a 75% reduced habitat effectiveness within a 1-kilometer ZOI. He shared that it is hard to quantify the area. He said that it means that there is a 75% chance that caribou are less likely to select the area. He added that annually, about 32% of the RSA experiences sensory disturbance and affects 23% of the selected rut/late fall and winter habitats within the RSA. He said that it affects 5% of selected rut/late fall and winter habitats at the Eagle Plains ecoregion scale. He added that it is a temporary effect which is reversed once activity stops.

[redacted] (YG) asked where 1 kilometre came from.

[redacted] (EDI) said that it is based on the permanent disturbance, which was their own zone of disturbance. He added that they looked to find a balance of something that was reasonable. He said that 1 kilometer seemed like a reasonable measure.

[redacted] (YG) said that activities like helicopter work and safety checks, cause greater disturbance than the mulcher. He added that he cautions using the 1-kilometer buffer. He shared that he thinks Chance will have a hard time supporting that in the literature.

[redacted] (EDI) said that the primary reason was to associate the ZOI with sensory disturbance. He said that in assessments where ZOIs were found to be large, there hasn't been a test or link to a clear mechanism that could lead to such large areas of avoidance. He argues that studies with large ZOIs often capture broad changes in a herd's range distribution rather than local effects of a Project. He added that this assessment is focused on local-scale sensory disturbance which covers the work area. He said that, in the literature, ZOIs are most often quantified as linear avoidance up to the ZOI threshold. This causes the average avoidance effect to be about halfway up the sloped line. He shared that, for this assessment, they applied a uniform 75% reduction across the 1-kilometer buffer.

[redacted] (YG) said there is a potential effect for the whole area. He asked how they could get this into more detail. He said they will be looking at it very closely.

[redacted] (EDI) said that they identified a 2- or 4-kilometre ZOI associated with the 2D seismic lines (including winter roads and trails). However, he stated that they identified attraction (rather than avoidance) to the 3D seismic grid. He added that the 2–4-kilometre ZOIs for historical 2D seismic are small in magnitude. Habitat effectiveness is reduced by 20–40% on the footprint itself, but the average reduction across the ZOI is much smaller.

[redacted] (EDI) asked what the sample size for the 3D seismic sample size analysis was.

[redacted] (EDI) said that he will have to circle back.

[redacted] (YG) said that the PCTC advised against doing that analysis.

[redacted] (EDI) said that Chance did not rely on a 3D ZOI analysis.

[redacted] (YG) said that it was raised. He added that it may or may not be the case, but they don't have the data.

[redacted] (EDI) added that it is not conclusive.

[redacted] (YG) said that's perfect.

[redacted] (EDI) said that Chance expects those comments to come up too and that's why the analysis is there.

[redacted] said that when you talk about all this data, so next year when you are doing the seismic, there is no additional effects to the PCH at that location.

[redacted] (EDI) said that there will be a leftover footprint. He added that there is a linear disturbance that brings in predators.

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A participant said that it seems reasonable for seismic activity, but then there is a well being drilled. They said that the ZOI would be much bigger based on that. They said that there is going to be less of an impact.

[redacted]. (EDI) said that the impact could be up to 1 kilometer, but Chance could revisit that and rethink the details of that too.

[redacted] (EDI) shared that it was 1 kilometer impact for everything sticking to sensory disturbance.

[redacted] (NND/TH) said that if the caribou are discouraged from using the ZOI and activity stops, that they came back through. He added that he doesn't know if there is any information on prolonged activity. He said that they are talking about several winters. He said that if there is a prolonged period of disturbance, he hasn't come across the information. He asked if there is any information on permanent discouragement of using the area, even after the mulching disturbance stops.

[redacted] (EDI) said that he would look at caribou near mine sites and the Central Arctic Herd and how they responded. He said that they looked it on a herd basis, but he is unsure if they respond well. He shared that work has been done on caribou response to roads, and other development. He said he cannot think of whether they responded to any well site. He said thinking about the development in Prudhoe Bay, there was work on the caribou's response to the road and pipeline. He added that they had deemed a 300-meter zone. He said that if it is not fenced off, the caribou will move through.

[redacted] (YG) said Heather did the most recent analysis on that, and their role is to do objective PCTC science. He said it is the calving and post calving information that has not been developed in the last 30 years. He added that it was around 5 or 6 kilometers. He said that it was a tundra environment and oil field, in the summer. He shared that there were many differences.

[redacted] (EDI) said that it is hard to make that comparison of linear disturbance in Alberta to Eagle Plains. He shared that a caribou response to a single well site would need a wealth of data. He said that there are forty well sites out there.

[redacted] YG) said a camera on the well site would be good.

[redacted] (EDI) said that if you look at an oil rig and the caribou herd are going through, there is a clear answer to that.

[redacted] (VGG) asked if the linear thresholds Chance talks about, are based on the proposed linear disturbance.

[redacted] (EDI) said that that is why the planning commission did their own effects strategy.

[redacted](VGG) asked if Chance has talked to anyone at the Yukon Government about cumulative effects or linear features.

[redacted] (YG) said one of the linear things that was discussed was that the threshold is 1.5 meters of wooded vegetation. He added that they just don't know.

[redacted] (Chance) said that the last direction that Chance got was from [redacted] office when she was Deputy Minister and that the challenge is that the environmental groups are challenging the Yukon Government because the proponent is responsible to go to First Nations to work with them to get their permission on conformity checks. He asked if the proponents are responsible for making communities understand the effects.

[redacted] EDI) said that at the community level during our meetings, it has not been a topic of discussion.

[redacted] (VGG) said that it's coming up in another process around cumulative effects. He added that he is curious as it sounds like a lot of that work was based on studies from Alberta. He asked what the underpinning of the analysis is and if there is other information that is new to him.

[redacted] (EDI) said that Chance looked at the line of sight, travel speeds, visibility, and different levels of regeneration. He added that the Project team wanted to inform the planning commission.

[redacted](Chance) said that when Chance made the original submission, their understanding was that the Land Use Planning Council was working with them. He stated that they were told that Chance must figure that out and convince any other affected

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parties. He asked how Chance does that work. Chance completed what it was required to do based on what was agreed to. He said that it is basically an EMR (Energy, Mines, and Resources) office that is just trying to figure it out. He shared that Chance is confused on who will oversee the old studies and disturbance that didn't occur from Chance/Northern Cross.

[redacted] (EDI) added that Chance did their own studies of effects. He added that that is how Chance came up with adjusted numbers.

[redacted] (NND/TH) said that he's come across concerns about the Land Use Planning Council not having the background that the commission has. He added that this is a compounding factor. He said that the council doesn't have a knowledge of history that the commission developed under the treaty, and that the council doesn't have the background to consider a project. He said that there are concerns about the council being capable of having a reliable opinion.

[redacted] (Chance) said that Sam is at the council and has a lot of knowledge and has been there for a while. He shared that there is no North Yukon Commission now.

[redacted] (YG) said that he is interested in talking about mitigations. By focusing on if the herd is coming through, it minimizes the issue. What happens when they do come through. It may be important to get information from the PCTC or Mike Suitor from the Yukon Government. If you hear caribou are coming your way and will be there in 3 days, what will the response be to that data.

[redacted] (EDI) said that they will get into that. He added that the monitoring part is an important part of the assessment.

[redacted] (EDI) presented the Potential Movement Effects slide.

[redacted] (EDI) said that there will be local movement effects such as reduced crossing if there is traffic on roads and seismic lines. Effects to seasonal movements or migrations are unlikely. Long distance movements will mostly be in fall and do not overlap with the bulk of Project activities. Short residency times and fast movement rates through the RSA and caribou travel through network of linear features in the RSA.

[redacted] (YG) said that pertaining to the effect of harvesting activities, there are areas where similar work has been done. A similar migrating effect can be seen and that it is possible that it may change a migration pattern. He said that he doesn't want to discount it.

[redacted] (Chance) asked what the probability is of that occurring.

[redacted] (YG) said that he is unsure exactly. He added that in 2015 it almost happened.

[redacted] (Chance) said that it is easy to tell that they go along the Dempster Highway.

[redacted] (YG) said that humans are travelling the same way the PCH like to because it is the easier travel. He added that it is a scenario that could occur, and it shouldn't be discounted.

[redacted] (PCMB) said that if looking at the probability, what's going to be in place with the PCTC, the people, and what is the plan to respond.

[redacted] (EDI) said that Chance will note it. He asked if it is going to stop them from entering the work area. He stated that Chance is assuming a 75% probability. He said that he is not trying to downplay the potential effects, but it is only an exploration project.

[redacted] (YG) said that YG has programs that shut down for 2 to 3 weeks when the herd hits.

[redacted] (EDI) said that that will certainly happen. He said that the Project team can't operate with thousand caribou around us. He added that it will affect their localized movement.

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[redacted] (EDI) presented the Potential Mortality Effects slide.

[redacted] (EDI) said that direct effects are vehicle collisions, but this is low risk on access roads and seismic lines. He said that by restricting the road, it won't be public access. He stated that the indirect effects are predation and hunting. He added that linear features might give more access to humans.

[redacted] (NND/TH) said that the resource road regulation on the Territorial Roads Land Act should give Chance permission to make the road private. He asked how Chance can use it as a private road. He asked if under the Oil and Gas Act they would be able to say it is a private road. He asked if Chance has had that discussion.

[redacted] (Chance) said that the Chief Operating Officer (COO) can make it a private road. He said that it is more of a safety concern, and no one wants to hunt around the drilling area. He added that it is one thing to give the access to an Indigenous harvester, from a safety point of view there is an issue around the work area buffer.

[redacted] (NND/TH) asked if the COO has the capability to give Chance a private road.

[redacted] Chance) confirmed yes and that they have had a COO do it before.

[redacted] (EDI) said that any predator wants easier access. He shared that it would have a temporary effect, limited to annual work areas where activities pack the snow on linear feature. He added that there aren't resident caribou in the Project area compared to other herds. He said that it is hard to conceptualize.

[redacted] (YG) said that he has seen people using the seismic lines. He said that there is no real monitoring of it. He stated that on predation, it is a different scenario. He shared that it is complicated because there are migratory wolves. He added that the question is if the herd has a major decline. He said that it is being anticipated sooner or later but they don't know.

[redacted] (EDI) said that there is uncertainty around mortality effects. He shared that it is more around Indigenous access, but Chance doesn't know how to move around that.

[redacted] (YG) said that the affected harvest on ZOI basically has a double effect.

[redacted] (EDI) said that as soon as the Project increases predation risk, there will be an increased effect. He added that it is important to increase local awareness there.

[redacted] (YG) said that this can be dealt with in the Project Effects Assessment.

[redacted]. (EDI) said that there is no harvest policy other than the Indigenous Rights to Harvest.

[redacted]. (EDI) presented the General Protection Measures slide.

[redacted] (EDI) said there is environmental constraints mapping to reduce habitat loss. Chance will stay out of this area when caribou are coming. There will be a limited annual footprint, reducing sensory disturbance. There will be access management to reduce mortality risk. People will probably use the winter access. He shared that he doubts that individuals will use the 3D seismic access.

[redacted] (YG) agreed that people likely won't use it as well.

[redacted] (EDI) shared that low impact seismic will help to reduce habitat loss and has been developed over the years. He added that there will be a maximum width of 2.5 meters that will retain ground vegetation. There will be speed limits in place to reduce mortality risk. He emphasized the importance of worker awareness, including reporting any sightings. There will be a caribou interaction response plan. He asked if there is an information database that Chance can use to understand weekly migration patterns.

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[redacted] (YG) said that the YG is trying to get a database in place. He shared that the PCTC updates their website and YG does the updates as they can. He said that the YG has a regulatory meeting that often changes things.

[redacted] (EDI) asked if YG will tell them when the caribou are coming.

[redacted] (YG) said that some companies are required to contact YG on a schedule. The other more likely scenario is just paying attention to the herd. He said the Chief of Mine and Land Use provides emails and the YG provides weekly updates after that. He shared that YG has been doing it for 5 years and it is working well.

[redacted] (EDI) said that there is flexibility with the seismic operation and that it will be Chance's bad luck. He added that Chance can't move the seismic and once a drill is spinning, the Project team can't stop.

[redacted] (NND/TH) said that it is possible to stop the drill.

[redacted] Chance) said that when driving, risks of potential impacts are increased. He added that there are speed controls, traffic controls, and the only traffic would be wildlife monitors.

[redacted] (EDI) said anything that is necessary.

[redacted] (NND/TH) said there was a constant of bringing water in with big trucks when he worked at the mine sites.

[redacted] (EDI) said that once the drill is going, it is not stopping.

[redacted] (PCMB) said that a caribou action response plan has potential, and he knows PCMB would be interested. He said it would be great if Chance could get their caribou information from PCMB and PCTC. He added that it would be good to see something established. If Chance is responding to caribou interactions, it would be nice to have a plan established. It would make sense if there was official communication linkage to be notified. These communications could establish a cooperative protocol. He added that this could help PCMB study the herd.

[redacted] (EDI) said that he wouldn't be able to develop that independently.

[redacted] (Chance) said that he agrees with getting the real data.

[redacted] (YG) said there will always be redundancy on this, and YG is trying to figure that out. He added that there are ways to do it. He said that the challenge for using satellites to track is that there could be several thousand caribou that don't have collars.

[redacted] (EDI) said that he agrees that it is only a small portion.

[redacted] (YG) said that there are 110 collars on the caribou.

[redacted] (EDI) said there is a level of warning from local monitors. He added that there will be a balance of reported observations, onsite. He shared that Chance would have to do aerial surveys.

[redacted] (YG) said there is no need for aerial surveys. He added that it can give you a sense of what you are dealing with and that they did that in 2013.

[redacted] (PCMB) said that it makes her think about how PCMB could help. If there are wildlife monitors around, it would be great to get regular updates on what they are observing. She added that if there is a situation where several caribou are coming to the Project area, the PCMB has connections to the Porcupine Caribou communities to get the word out. PCMB can help communicate things to bring show that we are engaged and that communities can be confident that Chance and PMCB are working together and sharing accurate information. PCMB wants the communities to be comfortable with what is happening. She added that there is the opportunity to look at the PCMB and Chance engagement as a very positive thing.

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[redacted] (EDI) said that this could be something to work on. He said that he agrees on collaboration and that aerial surveys during operation will be good. He shared that he thinks that the project can operate safely. He said that a lot of this relies on the observers being there.

[redacted] (NND/TH) said that with an existing drill site, and caribou in the area, Chance won't be able to shut down the drill. He said that the idea being that traffic could be reduced. He doesn't know where the water is coming from for the drill. He said that in past projects, there was a 24-hour supply of water from the water source to the drill site. He said that unless technology has changed, that is one example of traffic that can't be stopped if there are caribou in the area. He asked if the reduction would be sufficient or not.

[redacted] (EDI) shared that Chance doesn't have the details on what is considered essential road traffic right now. He shared that 5 vehicles a day sounds manageable.

[redacted] (YG) said that his issue is that there are no communications occurring with the Executive Committee. He said that it is important to have these conversations. These conversations will greatly increase Indigenous relations.

[redacted] (PCMB) said that the PCMB represents PCMB from the PCMB Agreement parties. She said that the PCMB isn't a decision-making board, but they can provide input to regulatory processes and review processes. She added that the PCMB knows trust is important with communities and when working with groups that are willing to go over and above what is specified in regulatory decisions. When the PCMB knows that there is an interest in building that trust, if anyone is looking at building positive relationships, it must be a collaborative process. There needs to be transparency and a willingness to work together no matter what the information may be. It is important for PCMB to do that and that the PCMB wants to work together. It is reasonable to say Chance can't shut down a well in production if there is a conversation ahead of time. If they know about these concerns in advance, there could be something in place that incorporates Traditional Knowledge that would address the communities' concerns. She shared that when caribou come and you can't shut down the well, the PCMB knows that that is reasonable, and they can support that. The PCMB can help with mitigation around that. She said not to underestimate the trust with PCMB and that the PCMB wants to work with Chance to do a good job of this. She shared that what happens with the Project will last in people's minds.

[redacted] (NND/TH) said that even if the PCMB aren't a decision maker, they are important.

[redacted] (EDI) said that the next step is mitigation. He said that he has seen a change in the approach by Chance. It comes down to the communication aspect and the seismic program is flexible.

[redacted] (YG) said regarding the effects monitoring piece, that looking at developing a couple of well-focused designs would be helpful. He said that if the exploration project is successful, Chance will get towards a development stage and there won't be any data.

[redacted] (EDI) said that to determine if mitigation is successful, Chance will have to do an experimental approach.

[redacted] (NND/TH) said that they do a report at the end of the season, to understand if it worked. He is amazed that this is not being considered.

[redacted] (EDI) said that this is a 10-year program, and it is Chance's opportunity to learn. He added that Chance wants to understand what the caribou do.

[redacted] (YG) said that the collared data is one scale.

[redacted] (EDI) said that it makes sense to put in effects monitoring.

[redacted] (YG) said that he is happy to work with Chance and discuss with PCTC to provide input. It is going to have to be a collaborative approach somehow.

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APPENDIX 2-D-15. Open House Flyer



OPEN HOUSE

June 18, 2014

4PM - 6PM YOOP Hall

SNACKS WILL BE SERVED

Northern Cross (Yukon) Limited is hosting a series of information sessions across Yukon to present its plans for the next phase of exploration activities at Eagle Plains. These information sessions are open to the public to attend.

Using information obtained from the recently concluded 3D seismic program, the next phase of exploration activity is planned to be a targeted exploration drilling program. The format of the Open House will be a formal presentation by representatives of Northern Cross followed by a period of questions and answers. The entire management team at Northern Cross will be participating at the Open House in Dawson City.

APPENDIX 2-D-16. Letter – document not available at time of submission.

APPENDIX 2-D-17. Letter - document not available at time of submission.

APPENDIX 2-D-18. Letter - document not available at time of submission.

APPENDIX 2-D-19. Draft *Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan* – document not available at time of submission.

APPENDIX 2-D-20. Tr'ondëk Hwëch'in Traditional Territory shapefiles – document not available at time of submission.

APPENDIX 2-D-21. Letter on the *Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan* – document not available at time of submission.

APPENDIX 2-D-22. DFO License Application Notice Letter

Chance Oil and Gas Limited
Suite 1000, 340 – 12th Avenue SW
Calgary, AB T2R 1L5
T: 587.390.4136

June 14, 2019

Tr'ondek Hwech'in
PO Box 599
Dawson City, Yukon Y0B 1G0

Attention: [redacted] **Senior Advisor – Mining and strategic Initiatives**

Dear [redacted],

Re: DFO License Application Notice

The purpose of this letter is to provide notice to Tr'ondëk Hwëch'in (TH) of the intention of Environmental Dynamics Inc. (EDI) to submit an Application for a *License to Fish for Scientific, Experimental, Education, or Public Display Purposes, Under Section 52 of the Fishery (General) Regulations.* Chance Oil and Gas Limited (Chance) has contracted EDI to perform fish studies, among other environmental studies, within the project area described in the Draft Project Description delivered to TH on June 11, 2019.

The fish studies are scheduled to take place from July 1, 2019 to July 10, 2019 pending approval of the DFO license. Please see attached for EDI's application and list of watersheds and species for the permit.

If any questions should arise regarding the license application or EDI's field work, please contact [redacted] at Hemmera and she will coordinate a reply.

Sincerely,

[redacted]

Vice President Government and Community Relations
867.456.7805
gcharlie@chanceyukon.com

Fisheries and Oceans Canada | Pêches et Océans Canada

APPLICATION FOR A LICENCE TO FISH FOR SCIENTIFIC, EXPERIMENTAL, EDUCATIONAL or PUBLIC DISPLAY PURPOSES, UNDER SECTION 52 OF THE FISHERY (GENERAL) REGULATIONS *(Yukon /Transboundary Rivers Area)*

(Check one)
- ☐ SCIENTIFIC PURPOSES *
- ☐ EXPERIMENTAL PURPOSES**
- ☐ EDUCATIONAL PURPOSES***
- ☐ PUBLIC DISPLAY PURPOSES****

(see footnote for descriptions)

(Check one, and provide the additional info if required)
- ☒ New Application
- ☐ Renewal of previous year's licence — Previous Licence #:
- ☐ Amendment to a current licence — Current Licence #:

Yes ☐ No ☒ **Do you have an Animal-Use protocol approved by a CCAC-accredited animal care committee?** *(http://www.ccac.ca/en_/standards/guidelines)*

1. Please briefly describe the purpose of your application request. If this is an amendment to a previous license, briefly describe the requested changes to the original license.

The Chance Oil and Gas Project Area covers approximately 2,500 km^2 and includes 1,467 streams. Very little fisheries data exists for the proposed Project Area, with the most recent (limited) sampling occurring in 2001. EDI Environmental Dynamics Inc. proposes to conduct fish sampling on streams from each order throughout the Project Area. Fish sampling will mostly be conducted using electrofishing methods, with beach seining where necessary on 4th or 5th order streams. Electrofishing effort will be approximately 100-300 meters and for a minimum of 400 seconds in order to adequately sample each site. The length of stream sampled will be proportional to the stream width (i.e., narrow creeks will be sampled for longer distance than wide creeks). Sites will be sampled a minimum of 100 m upstream from the nearest confluence. The planned target of sites is 50, with an allowance up to 100.

2. Indicate the desired start and end date for the requested licence/permit. (Licence/permits may only be issued for up to one year.)

Start Date: 2019-07-01 End Date: 2019-10-01

Details (Specify sampling periods, if applicable): *Sampling is intended to begin in mid-July, but may require subsequent sampling.*

3. Applicant Information:

Legal Name of Applicant: [redacted] Date of Birth: 1990-07-24

Organization or School: EDI Environmental Dynamics Inc.

Street Address/Unit#: 2195 Second Avenue City: Whitehorse

Province/Territory: Yukon Postal Code: Y1A 3T8

Phone: [redacted] Fax: Email: [redacted]

Cell:

List individuals that will be assisting with the activity, DOB is required. *(Attach additional page if needed)*

[redacted]

4. SAMPLING PROGRAM - METHODS/LOCATION/SPECIES/DETAILS/OBJECTIVE etc..

Details of where the sampling is to occur, and the gear being used (*Provide detailed information including when, where, and how much sampling will occur)*

Name of River/Stream/Lake/Creek *(use a separate line for each waterbody)* **Watershed codes:** *search http://cmnmaps.ca/fiss_yukon/*	Detail of each sampling method *(ie. #trap nights, electrofishing seconds, # and duration of net sets, mesh size, etc. per sampling site etc. Also specify details of multiple sampling periods if applicable)*
See attached.	

Include species and life stage. Specify planned upper limit of sample size, maximum number and species of specimens that will be retained (if any). (Details not provided in specified fields, to be completed in "Additional Details" below.)

Species *(attach additional page if needed)*	Life stage	# of Fish Sampled	# of Fish Retained	# Estimates of Mortalities	Specify location of all mortalities and/or # retained
Arctic grayling	subadult/adult	200	0	5	
Arctic grayling	juvenile	200	0	10	
Slimy sculpin	subadult/adult	200	15	25	5 Peel w/s, 5 Bell w/s, 5 Whitestone w/s
Round whitefish	subadult/adult	100	0	10	
Lake whitefish	subadult/adult	100	0	10	
Longnose sucker	subadult/adult	100	0	10	

Details (Explain the purpose of retaining mortalities and/or lethal samples):	For the 15 retained slimy sculpin, the purpose is to provide DNA samples (fin clips) for the University of Montana to identify additional potential conservation units (subspecies, species) for a North America wide project. These individuals will ideally be chosen from any incidental mortalities and will only be retained in the event of no incidental mortalities. If there are any incidental mortalities of other species they will also have fin clips submitted to support this initiative.

Additional details (attach additional page if needed).

Include as much detail as possible including your research activities, methods of collection provide details, disposition of the specimens details of regarding release methods and location, and precautions that will be taken to avoid fish mortality. Provide information on handling of non target species if appropriate. etc..

Sites will be chosen to cover the spatial extent of the Project Area to provide a general understanding of fish distribution in different ordered streams. Each stream site will have a Site Card completed as well as fish sampling and in-situ water quality will be taken. Fish sampling will mostly be conducted using electrofishing methods, with beach seining where necessary on 4th or 5th order streams. Electrofishing effort will be approximately 100-300 meters and for a minimum of 400 seconds in order to adequately sample each site. The length of stream sampled will be proportional to the stream width. Sites will be sampled a minimum of 100 m upstream from the nearest confluence. In-situ water quality will be taken at each site, which includes the collection of temperature (degrees Celsius), pH, dissolved oxygen (mg and %), and specific conductivity (µS/cm). All fish captured will be identified to species and enumerated; up to 10 individuals from each species caught will be measured at each site before being returned to the water. Handling and air exposure will be kept to a minimum for all fish.

Footnotes:
* Scientific Purposes includes: Salvage (for fish collection associated with in-stream works etc.); Environmental Impact assessment (pre and/or post development project monitoring); Inventory (species abundance and distribution and/or presence/absence study)
** Experimental Purposes: Research (i.e., fish collection as part of a experimental procedure, or research to determine how fish populations respond to habitat manipulations)
*** Educational Purposes: Training
**** Public Display Purposes: Samples for display purpose

Applications are to be submitted to:

Attn: Area Licensing Manager

By Mail: 100-419 Range Road
Whitehorse, YT
Y1A 3V1
Fax: (867)393-6738
or
Email: YTLicence@dfo-mpo.gc.ca

PRIVACY NOTICE STATEMENT
The information you provide on this form is collected under the authority of the Fishery General Regulations for the purpose of issuing a licence for scientific, experimental, educational or public display purposes. The information may be used for program planning or management, reporting, audit, administration purposes or disclosed to other government departments or agencies, within other divisions or branches of the institution, with provincial, territorial or foreign government or First Nation organizations as applicable. Failure to provide this personal information may result in your licence being denied. You have the right to the correction of, access to, and protection of, your personal information under the Privacy Act and to file a complaint with the Privacy Commissioner of Canada over DFO's handling of your information. Personal information collected through the processing of your application is described in DFO Personal Information Banks and can be accessed and assessed for accuracy. For more information visit Info Source www.infosource.gc.ca.

5. RELATED LINKS INFORMATION ETC

Collection Period: Sensitive timing periods in aquatic environments in Yukon and transboundary waters can be found at: http://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/index-eng.html. If you plan to sample using instream methods during sensitive periods, we suggest you describe means by which you will mitigate any negative effects.

Transfer or Transplant of Live fish/eggs/milt: Any transfer of live fish into fish habitat and transfer of live fish to a fish rearing facility, requires a permit from the Federal/Provincial/Territorial Introductions and Transfers Committee. Applications and contacts can be found at:
BC - http://www.pac.dfo-mpo.gc.ca/aquaculture/licence-permis/intro-trans/process-processus-eng.html
Yukon – http://www.pac.dfo-mpo.gc.ca/yukon/trans-eng.html

Species At Risk: Research into any species listed in the Species At Risk Act (SARA) requires a permit issued under SARA. Application forms can be found at: http://www.dfo-mpo.gc.ca/species-especes/permits-permis/permits-eng.htm

Canadian Council on Animal Care (CCAC): DFO is a member of the Canadian Council on Animal Care (CCAC) and has committed at the Ministerial level to follow the entire CCAC program in Departmental activities in research, teaching and testing with vertebrate animals. Nearly all universities and colleges in Canada follow this program as well. It is expected that if DFO financial or human resources are involved in the work under this requested licence, or if the applicant is based at an institution having a CCAC-accredited Animal Care Committee, then evidence of an approved Animal Use Protocol (AUP) will be submitted with this application, and CCAC guidelines will be adhered to in any work with live vertebrates. The issuing authority for this licence accepts the CCAC's exemptions for certain animal-use activities as not requiring an approved AUP. More information about the CCAC program is at *www.ccac.ca*.

Note: - Use of carbon dioxide/CO2 (e.g. Alka-Seltzer tablets) to immobilize fish for sampling should not be done without a continuous supply of oxygen, with levels of both gases monitored and regulated.
- Clove-oil products are not regulator-approved in Canada, as a fish anaesthetic.

Aquatic Invasive Species: To prevent the introduction of aquatic invasive species there are a few simple things that can be considered:
a) Before leaving an area: Drain water from boat, trailer and gear, remove all plant parts and mud and.
b) before entering another water body: Wash all your gear including waders with soapy water.
For Further Information:
http://www.dfo-mpo.gc.ca/science/environmental-environnement/ais-eae/index-eng.htm
or
http://www.env.gov.yk.ca/animals-habitat/invasivespecies.php

Fish Sampling Permit for Chance Oil and Gas: Watersheds and Species

Table 1. Watersheds

Name of River/Stream/Lake/Creek	Detail of each sampling method
Chance Creek and tributaries (81809544)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Greaves Creek and tributaries (81809544052517)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
McParlon Creek and tributaries (81840641)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Dalglish Creek and tributaries (210873536)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Enterprise Creek and tributaries (210962555)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Whitestone River tributaries (818; between McParlon and Chance)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Tributary to Eagle River (81517952593396)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Tributary to Eagle River (81517952563022)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Tributary to Eagle River (8151795256302216321)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.
Tributary to Porcupine River (8151795256302216321)	Electrofishing: 5000 seconds combined; beach seining: 6 hauls.

Table 2. Fish Species

Species	Life stage	# of fish sampled	# of fish retained	# estimates of mortalities
Arctic grayling	sub adult/adult	200	0	5
Arctic grayling	juvenile	200	0	10
Slimy sculpin	sub adult/adult	200	0	10
Round whitefish	sub adult/adult	100	0	10
Lake whitefish	sub adult/adult	100	0	10
Longnose sucker	sub adult/adult	100	0	10

APPENDIX 2-D-23. *Draft Project Description* (Version 1)

DRAFT PROJECT DESCRIPTION

Eagle Plains Exploration Project

Prepared for:

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Volume I

June 5, 2019

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ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Definition
2D	two-dimensional
3D	three-dimensional
AER	Alberta Energy Regulator
CPF	Central Process Facility
D50	AEP Directive 50: Drilling Water Management Plan
DFO	Fisheries and Oceans Canada
DST	drill stem test
EBA	EBA Engineering Consultants Ltd.
EFT	extended flow test
ESA	Environmental Site Assessment
GPS	Global Positioning System
MBC	Mix Bury Cover
Plan	North Yukon Land Use Plan
Project	Eagle Plains Exploration Project
Proponent	Chance Oil and Gas Ltd.
YOGA	Yukon *Oil and Gas Act*, SY 2019, c.6
YESAB	Yukon Environmental and Socio-economic Assessment Board

SYMBOLS AND UNITS OF MEASURE

Symbol / Unit of Measure	Definition
º	degrees
%	percent
cm	centimetre
dS/m	
ha	hectare
km	kilometre
km^2	square kilometre
kPa	kilopascals
L	litre
m	metre
mg/L	milligrams per litre
mm	millimetre
m^2	square metre
m^3	cubic metre

PROJECT DESCRIPTION

This document presents the location of the proposed Eagle Plains Exploration Project (Project), the preliminary scope of the Project, the principal and accessory Project components, and Project phases and scheduling. The descriptions provided below are conceptual and intended to provide the level of detail necessary to initiate discussions with stakeholders on the Project Description.

Detailed design and implementation procedures will be developed following Project approvals. All design, methodology, or procedural changes will conform to the commitments made by Chance Oil and Gas Ltd. (Proponent), as well as the terms and conditions stated in any Decision Document resulting from the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Screening process and permits, approvals, and authorizations once issued.

The development of this section is based on the *Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions* (YESAB 2005), specifically Part 1, Section 5.0 Project Description.

The Proponent will develop a series of management plans to provide additional information on infrastructure design and phase-specific activities including monitoring. These management plans are referenced throughout this section where relevant.

1.1 Project Description Overview

The Proponent intends to conduct exploration drilling and flow testing of any discoveries over an area of approximately 2,400 square kilometres (km²) in the Eagle Plains area, located between the Ogilvie and Richardson mountain ranges along the Dempster highway in Yukon. The purpose of this exploration drilling and flow testing program is to confirm the quality, quantity, and areal extent of any accumulations of hydrocarbons. The Proponent will drill up to 30 wells sequentially over a period of up to 10 years. If a well is successful (i.e., if there is a discovery of crude oil or natural gas in sufficient quantities), the Proponent will conduct an extended flow test (EFT) for a period up to 2 years on that particular well. There is considerable uncertainty in terms of outcome from exploration drilling, so it is only possible at this stage to speculate on the number of discoveries that will be made. For the purposes of this assessment, the Proponent estimates that crews may conduct EFTs on up to 20 wells, depending on the drilling success. Due to the exploratory nature of the work, it is impossible to predict the timing of any discovery and therefore the timing of any EFTs.

The Proponent will drill one well at a time and up to five wells per year. Assuming all wells are successful and EFTs are conducted for 2 years at each well, there may be up to 10 EFTs being conducted at one time. The information obtained from the EFTs is critical to establishing the future development plan for each discovery.

If several wells reach successful outcomes and are identified for extended flow testing, the wells will have completion equipment installed within their wellbores, the casing will be perforated, and the wells will be flowed. This would require a completion or service rig to install the completion equipment and the tubing used to conduct produced well fluid to ground surface, at which point surface equipment would then be installed, which may include artificial lift equipment to help the fluid continue to flow.

Fluids produced during EFT will need to be measured, processed, and dealt with in an environmentally responsible manner. Depending on the nature of a discovery, the Proponent anticipates that some combination of natural gas, crude oil, and possibly formation water will be extracted during the EFTs. These fluids are separated and measured in facilities on the surface. Natural gas could be flared for short periods of time, but the Proponent prefers to conserve it to provide fuel for process heating, fuel for engines providing mechanical power, and possibly onsite power generation. If natural gas quantities are significant, the Proponent would consider re-injecting surplus natural gas into a compatible reservoir in the Eagle Plains basin using an existing suspended well. The Proponent currently has 8 suspended wells that were drilled in the past, which could be used for re-injection. Alternatively, some of the new wells, drilled as part of this 30-well Project, may be used.

Fluid transportation vehicles will be required to travel from site to site and transport the produced fluid back to the Central Process Facility for storage, further treatment, and transfer to trucks for transport to market or disposal. To the greatest extent possible, crude oil produced during the EFTs will be conserved instead of flared. This will require some processing to stabilize the crude oil for truck transport to a suitable, approved crude oil marketing point, such as terminals in the vicinity of Fort Nelson or Fort. St. John, British Columbia or Grand Prairie, Alberta. All these locations are ready to receive and utilize crude oil produced from Yukon sources in the absence of such destinations existing within Yukon. The Proponent may also consider trucking crude oil produced during the EFT to ports in Alaska such as Skagway, Haines, or Valdez for onward shipping to suitable markets elsewhere in North America.

Formation water produced in conjunction with crude oil or natural gas will be separated from the hydrocarbon streams and disposed of underground into a compatible and approved geological formation at Eagle Plain using one of the suspended wells or one of the wells drilled as part of this Project. These procedures to process, transport, and dispose of various fluids produced are common practice using proven technologies and equipment in every oil and gas province in Canada.

The Proponent also intends to conduct a seismic exploration program consisting of up to 1,500 km² of three-dimensional (3D) seismic and up to 2,000 km² of two-dimensional (2D) seismic to identify and map oil and gas geological structures in the area.

Additional activities are required to support the drilling and seismic exploration, including:

- Mix Bury Cover (MBC) sump area to dispose of drill cuttings
- Construct winter and all-season access roads
- Construct airstrip
- Advance borrow source developments
- Transport equipment and supplies to the site and within the Project area
- Use existing camp at kilometre (km) 325 of the Dempster Highway and periodic use of the Eagle Plains Hotel.

The Proponent is planning to begin exploration activities as early as the end of 2021 and continue for a period of 10 years to cover the various stages of drilling and extended flow testing of the proposed wells. The execution of the EFTs will likely be phased, depending on the nature of the discovery (e.g., natural gas versus crude oil) and the capacity of the 75-person base camp and the Eagle Plains Hotel to accommodate

the necessary crews. Until there is more information about the resources discovered, it is difficult to accurately predict the full duration the complete flow testing program.

1.2 Project Location

The Project is located within the southern part of Eagle Plain Sedimentary Basin in northern Yukon (**Figure 1.1)**. The main camp is located at km 325 of the Dempster Highway, with one MBC sump area located at km 336. **Figure 1.1** illustrates the overall Project area.

The proposed Project area overlaps with the following three First Nation Traditional Territories:

- Vuntut Gwitchin First Nation
- First Nation of Na-Cho Nyäk Dun
- Tetlit Gwich'in Council Secondary Use Area.

The proposed Project area is north of the Tr'ondëk Hwëch'in First Nation Traditional Territory and Settlement Land. The Traditional Territories and Settlement Land blocks in the vicinity of the Project are detailed on **Figure 1.1**.

The proposed Project is located within the boundaries of the North Yukon Planning Region and is therefore subject to the North Yukon Land Use Plan (Plan). A main purpose of the Plan is to address oil and gas development in North Yukon. The locations of proposed well sites are within the region of the Plan designated for the highest level of development. In the Plan, this designation is described as Lower ecological and heritage/cultural values within a moderately sensitive biophysical setting.

1.3 Project Components and Activities

This section describes the principal Project components, along with accessory components that are necessary to support Project activities. Information provided below for each Project component includes its location, key design features, and, where applicable, the results of any relevant investigations to establish site conditions (e.g., seismicity, geotechnical parameters). The three main components of the Project are described as follows:

1. Exploration well program – comprising 30 wells within an area of approximately 2,400 km². Wells will be located within areas identified in **Figure 1.1**. The program includes drilling, drill stem testing, and extended flow testing of the wells. Hydraulic fracturing is not being proposed as part of the Project. See **Section 1.3.2** for details.
2. Construction of access roads to each proposed well location – roads required for the Project will be a combination of winter and all-season access roads. Details regarding road construction and location are provided in **Section 1.3.3.1**.
3. Construction of a new MBC sump area and all-season access road – (approximately 400 metres (m) long) at km 336 of the Dempster Highway, and construction of additional MBC sumps in other suitable areas. Details are provided in **Section 1.3.2.7**.
4. Seismic exploration program (**Section 1.3.2.9**) consisting of up to 2,000 km² of 2D seismic exploration and up to 1,500 km² of 3D seismic exploration.

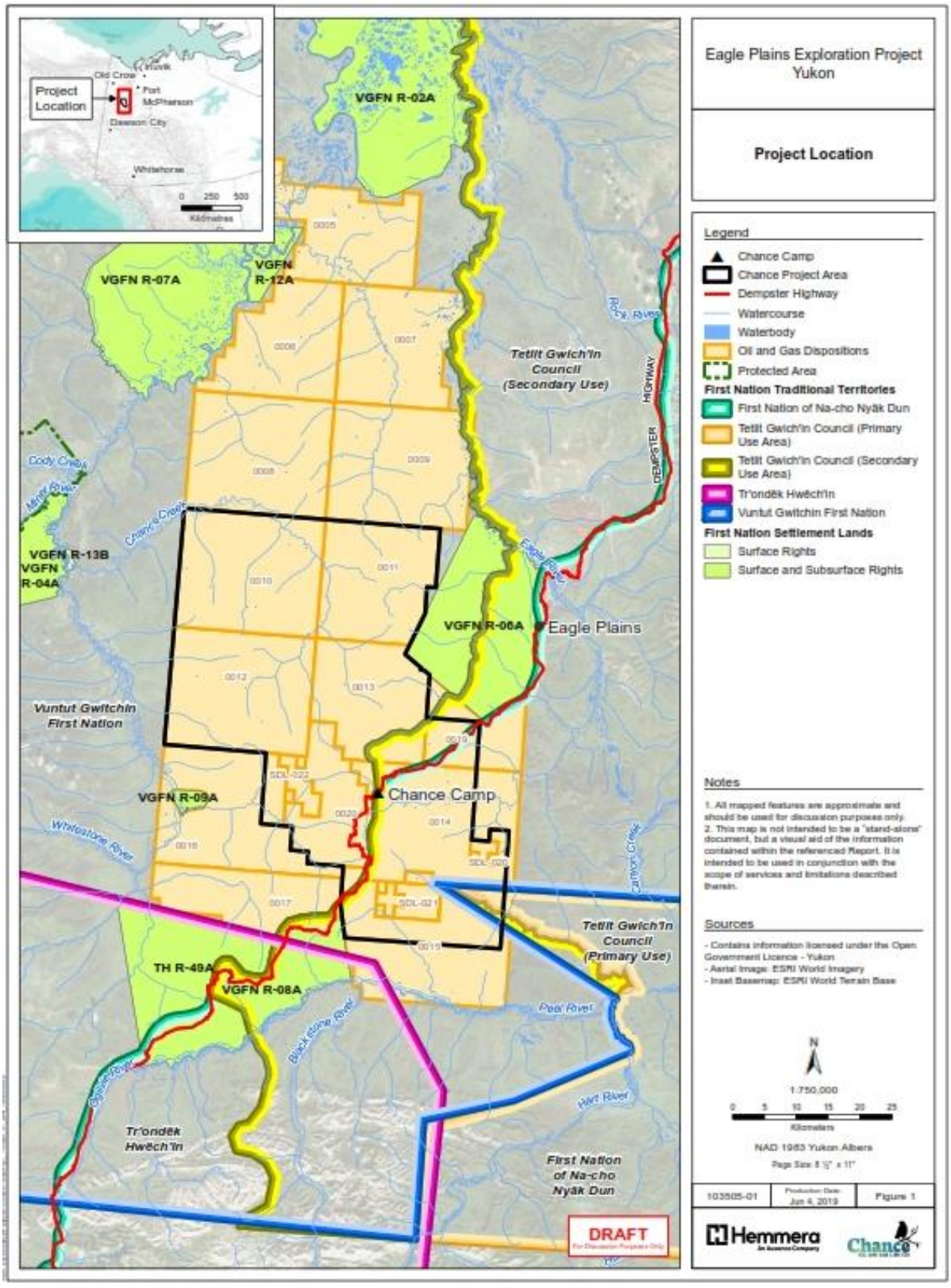

Figure 1.1 Project Location

Details related to the project components and activities are provided in **Section 1.3 Project Components and Activities** noting that the development of some Project components occurs in both phases. That is, once a well site has been prepared, drilling and well development will occur at that site, and additional well sites may be prepared simultaneously. Reclamation activities are described in **Section 1.4.4 Reclamation, Abandonment, and Closure Phase**.

1.3.1 Preliminary Scope of the Project

The preliminary scope of each Project component is described in **Table 1.1**.

Table 1.1 Preliminary Scope of Project

Project Component	Activities
General Project	• Exploration activities for oil and gas in the Eagle Plains area ▫ Exploration well drilling, testing, suspension, decommissioning, and abandonment ▫ Successful wells will be suspended and may be brought forward in future development project proposals ▫ 2D and 3D seismic exploration • Project phases will occur sequentially over a 10-year period and include ▫ Initial mobilization of equipment to the Project site ▫ Construction of required infrastructure ▫ Well development, testing, decommissioning, and abandonment ▫ Progressive reclamation ▫ Final closure and reclamation • The Project will occur over an area covering approximately 2,400 km² located at approximately km 325 of the Dempster Highway
Exploration Well Drilling	• Establishment of up to 30 well sites each, approximately 1.44 hectares (ha) in size within the overall Project area (approximately 2,400 km²) ▫ Site levelling using gravel, packed snow or ice and rig matting as required • Installation of surface infrastructure on drill sites including: ▫ Drill rig ▫ Mud tanks, pumps, and mud processing systems ▫ Power generators ▫ Boilers ▫ Blowout preventer accumulator system ▫ Fuel storage ▫ Flare tank and flare stack ▫ Cement mixing and storage ▫ Storage bins for rock cuttings ▫ Trailers for offices, first aid, rig crew sleeping quarters, water storage and treatment, sewage storage, and food waste incinerator • Drilling of up to 30 wells to a depth up to approximately 2,500 m ▫ Wells will be drilled sequentially, one well at a time, up to four wells per year • Use of low-toxicity, water-based mud system • Use of up to 15 cubic metres (m³) of water per operating day for drilling

Project Component	Activities
Drill Stem Testing	• One or more drill stem tests (DSTs) on each well to analyze prospective/productive formation areas • Potential acid stimulation using a weak concentration (10% to 20%) of hydrochloric acid approximately 5 to 10 m3 per well • Flaring natural gas • Production of crude oil and transport from the site to markets outside of Yukon
Extended Flow Testing	• Conduct EFTs on up to 20 successful wells ▫ May be conducted within a month for a predominantly natural gas well or up to 2 years for a predominately crude oil well ▫ Up to 10 EFTs conducted at the same time • Installation of surface and subsurface equipment and facilities to enable EFT including: ▫ Casing of entire wellbore and perforation of casing at zone or zones of interest ▫ Packer, tubing, and downhole gauges ▫ Wellhead valving assembly ▫ Flare systems ▫ Separator vessel, treating vessel, and storage tanks ▫ Appropriate artificial lift systems ▫ Heaters ▫ Dehydrators ▫ Flow lines ▫ Metering equipment ▫ Portable generators • Separation of natural gas, crude oil, and formation water • Flaring natural gas for a period of several days to several weeks • Production of crude oil and transportation of produced crude oil from the site to markets outside of Yukon • Use of natural gas on site for power generation, tank heating, fuelling artificial lifting to assist crude oil production, or compression for re-injection of natural gas • Disposal of formation water underground in existing suspended wells, or wells suspended as part of this exploration Project
Drilling Waste Disposal	• Construction of MBC sump approximately 6.4 ha in area to dispose of drill cuttings • Disposal of drill cuttings in MBC pods approximately 300 m³ over an area of 800 square metres (m²) (estimated volume of drill cuttings for one well) • Disposal of approximately 200 m³ of drilling mud in MBC and drilling fluid underground in existing suspended wells, or wells suspended as part of this exploration Project • Disposal of the following liquid waste in existing suspended wells, or wells suspended as part of this exploration Project: ▫ Formation water ▫ Saline fluids ▫ Liquid fraction of drilling fluids ▫ Rig wash
Seismic Exploration	• Up to 1,500 km² of 3D seismic

Project Component	Activities
	• Up to 2,000 km² of 2D seismic • Establishment of seismic survey lines • Air hammer drilling • Receiver stations and source stations • Storage (in magazines), transportation, and use (1 kg per source station) of dynamite
Well Maintenance (Workovers)	• Mobilization and installation of a service rig to the well site • Conduct maintenance to: ▫ Install, change, or modify the production flow control equipment ▫ Perforate zones of interest for EFTs ▫ Seal some or all perforations made across productive zones ▫ Re-perforate a zone or zones elsewhere in the wellbore ▫ Other routine maintenance practices to ensure optimal production performance of the producing formation
Access Roads	• Use of permitted Chance Road all-season road for Project activities • Construction of all-season access roads to well sites requiring EFT and borrow source locations ▫ Approximately 7 m in width with pullouts on average every 750 m ▫ Up to approximately 87 km total in length ▫ Clearing and mulching of vegetation ▫ Removal and stockpile of organic cover material for use in reclamation • Construction of winter access to well sites for initial well drilling and DST
Borrow Source Development	• Quarrying of approximately 1,800,000 m³ of aggregate for use in Project activities, including: ▫ Winter development of up to 23 quarries ▫ Use of approximately 450,000 m³ of aggregate for well pads ▫ Use of approximately 1,350,000 m³ of aggregate for access road construction ▫ Use of aggregate for airstrip construction ▫ Use of aggregate for Central Processing Facility construction ▫ Use of explosives • Removal and stockpile of organic cover material and silts for use in reclamation
Central Processing Facility	• Construction of central processing facility adjacent to camp • Processing facility ▫ Multi-stage and multi-phase separators ▫ Heater treaters ▫ Vapour and gas collection system to flares or to provide fuel for camp use ▫ Processing of crude oil to stabilize and meet market specs for truck transport ▫ Storage of approximately 3,180 m³ of produced crude oil ▫ Storage of approximately 119 m³ of produced (formation) water • Fuel storage facility ▫ 151 000 litres (L) diesel fuel ▫ 24 000 L propane

Project Component	Activities
	• Storage and use of chemicals and reagents: ▫ Hydrochloric acid (10% to 20% concentration) ▫ Methanol ▫ Additives to prevent corrosion ▫ Demulsifiers • Bulk explosive compound to store dynamite for use in construction of borrow sources and for seismic exploration
Airstrip	• Construction of airstrip approximately 1,500 m long at km 4 of the Chance winter road • Use of airstrip during all phases of the Project approximately 2 flights in/out per week • Storage of aviation fuel
Water Use	• Use of up to 300 m³ of water per day for making snow to build winter trails, ice roads and temporary well sites, not exceeding 10% of instantaneous flow from the following extraction points: ▫ Year-round extraction from the Eagle River and Ogilvie ▫ Seasonal extraction from Glacier Creek and Fly Camp • Use of up to 300 m³ of water per day for camp from existing onsite groundwater water well. • Construction of portable water reservoir at the camp for water storage and use during low water periods
Transportation	• Use of Dempster Highway, North and South Klondike Highway, and Alaska Highway to access Project site and to transport crude oil to potential markets • Approximate offsite traffic on public roads between the site and supply points • Onsite traffic on Proponent-controlled roads ▫ 15 to 20 truckloads over approximately 5-day period to mobilize the drill rig to each well site
Camp and Workforce	• Workforce up to 75 people during all phases of the Project • Continued use of existing permitted 75-person camp located at km 325 of the Dempster Highway ▫ Municipal waste management and disposal ▫ Sewage treatment facilities
Reclamation and Closure	• Progressive abandonment of unsuccessful wells ▫ Installation of cement plugs across all porous/permeable zones, across the base of each casing string and at surface ▫ Cutting of well casing(s) off 1 m below ground level and weld steel plates across each string ▫ recontouring and revegetation of area • Progressive decommissioning and reclamation of borrow source and quarry areas when they are no longer useful or necessary ▫ Recontouring of area and replacement of stockpiled silts and organic cover material • Well suspension and abandonment at end of Project

1.3.2 Principal Project Components

1.3.2.1 Overview

The principal Project activities are the drilling program, well testing, and seismic exploration program. The goal of the proposed drilling program is to obtain the maximum amount of information to determine the geological settings and evaluate oil and gas reserves in the Eagle Plains area. During operation, drilling will occur 24 hours per day, and 7 days per week. Chance will drill 1, possibly 2, wells at a time and up to 5 wells per year.

Initial drill stem tests (DSTs) will occur on any or all of the 30 proposed wells. Up to 5 wells could be tested each year. Chance will conduct EFT on successful wells, where hydrocarbon resources are discovered, to gather important information about the nature of the resource accumulation and its productive capability. EFT for wells with a primarily natural gas discovery may take place over a maximum period of 1 to 2 months maximum. EFT for wells with a primarily crude oil discovery may take place over a period up to 2 years. Chance may conduct up to 10 EFTs concurrently and EFTs on up to 20 wells over the life of the Project. The information obtained from the EFTs is critical to determining the future development plan for each discovery. **Table 1.2** outlines the sequence of activities in developing the well site areas.

The Proponent also intends to conduct a seismic exploration program consisting of up to 1,500 km² of 3D seismic and up to 2,000 km² of 2D seismic to identify and map oil and gas geological structures in the area. The 3D seismic program is likely going to be undertaken in a series of smaller projects, each of approximately 400 km². The 2D seismic program could be done either as one project or as a series of smaller projects. Details on the Project components and activities are provided in the following sections.

Table 1.2 Sequence of Well Development Activities

Initial Exploration Drilling		
Develop winter access trail to well site		
Develop well site approximately 1.44 ha in area		
Install surface infrastructure on well site necessary for drilling and testing exploratory well		
Drill well		
Transport and dispose of drill cuttings in MBC sump		
Conduct DSTs to determine whether successful or not in order to move on to EFT		
Move drill rig to next well site area		
If not successful	**If successful**	
	Primarily Natural Gas Discovery	**Primarily Crude Oil Discovery**
Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).	Complete well (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).	Complete well (finish casing, perforate the casing, and install production flow control devices, steel tubing, and wellhead components).
Remove all surface infrastructure.	Install required surface facilities (separator vessel, heaters, dehydrators, stock tanks, flow lines,	Construct all-season access to well site.

Initial Exploration Drilling		
	metering equipment, portable generators, and flare stack).	
Remediate well site area (remove mats and gravel fill material).	Conduct EFT over period of 1 – 2 months	Install required surface facilities (separator vessel, heaters, dehydrators, stock tanks, flow lines, metering equipment, portable generators, and flare stack).
Recontour well site area and revegetate disturbed areas to natural conditions.	Measure natural gas and water from wells.	Conduct EFT over period up to 2 years
Recontour access roads and revegetate disturbed areas to natural conditions.	Conduct maintenance on well as required (work over).	Measure, store, and process crude oil, natural gas, and water from wells.
	Once EFT is, complete either 1. develop a new proposal to bring into production, or 2. decommission and abandon well.	Conduct maintenance on well as required (work over).
	Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).	Transport crude oil from EFT to central processing facility then to acceptable market.
	Remove all surface infrastructure.	Once EFT is complete, either 1. prepare development plans for future assessment and regulatory review to bring into production, or 2. decommission and abandon well.
	Remediate well site area (remove mats and gravel fill material).	Abandon well (cement all perforated producing zones, install shallow cement plugs, and cut surface casing 1 m below normal ground surface).
	Recontour well site area and revegetate disturbed areas to natural conditions.	Remove all surface infrastructure.
	Recontour access roads and revegetate disturbed areas to natural conditions.	Remediate well site area (remove mats and gravel fill material).
		Recontour well site area and revegetate disturbed areas to natural conditions.
		Recontour access roads and revegetate disturbed areas to natural conditions.

1.3.2.2 Exploration Well Drilling Program

Establishment of Well Sites and Drilling

Chance will establish up to 30 well sites, each approximately 1.44 ha in size within the overall Project area (approximately 2,400 km²). Total approximate disturbance for well site locations will be up to 43.2 ha if all 30 wells are drilled. Exact well locations and sequencing cannot be determined at this time as they are dependent on seismic data interpretation, drilling results, EFT results, weather, and local surface conditions and other environmental factors. The Proponent is continuing the ongoing process of interpreting seismic data to better understand the geological setting, size, and geometry of potential prospects. Each well drilled will add to that understanding.

Generally, well sites will be located on the heights of land. Criteria for well site locations include the following:

- Avoidance of areas with challenging permafrost conditions and ecologically sensitive areas such as riparian corridors, wetlands, steep slopes, old growth forest, and critical wildlife habitat and permafrost features.
- No drilling within 45 m of a perennial watercourse
- Avoidance of areas identified with heritage values (noted as “avoidance areas”) in the Heritage Resource Overview Assessment and Heritage Resource Impact Assessment (Matrix 2013).
- Requirements from the Yukon *Oil and Gas Act*, SY 2019, c.6 (YOGA) and the Oil and Gas Drilling and Production Regulations.

Drill Program

The first of the exploratory wells will be drilled in winter commencing around mid-January 2021. Pre-drilling preparation will entail building winter trails to gain access to the first selected well sites and to build access roads and the leases to accommodate the mobilization and setup of the drilling rig. Winter road and lease building can only commence once there is the 10 cm of snow cover required to facilitate construction. Based on historical trends, this could occur as early as December or as late as mid- to late January in any year.

Summer well sites may be established if there is already a year-round access road built nearby to service a well or wells undergoing EFT. Summer well sites will allow the Proponent to extend the drilling season into the summer if new wells can be drilled within a few kilometres of an existing road. A summer well site will require all-season access to the site.

Once established, the well site will contain the drill rig, flare stack, rig trailers, and office trailers and will provide sleeping capacity for the required number of key people to stay at the rig full time. Each well site will be approximately 1.44 ha in size to facilitate drilling and any subsequent EFTs. The amount of clearing will be kept to a minimum.

The well site dimensions should be adequate for advancing to a possible production operation in the future and therefore should accommodate all field production equipment.

Winter Matting Use

Matting for winter operations will be used when a) the ground is too uneven, b) it may not be possible to level the lease using earth-moving equipment and when the ground may not be competent enough to support the heavy rig loads, or c) when it is not possible to level the ground by laying down a base of gravel or soils. Matting may be used in drilling operations to reduce ground surface disturbance and distribute the ground pressure of equipment. Matting may also be used to stabilize the drill rig to provide insulation and protection to the snow and ground surface. Matting will not be used on the proposed roads.

The Proponent intends that well sites would be built with fill material from other well sites or from borrow sources. Should matting be used, it may cover the entire well site area (several locations of 1.44 ha) or the area immediately adjacent to where a drilling rig may be placed.

Well sites will be levelled by bringing in material such as gravel, or possibly snow for packing and then icing. An impermeable liner will then be laid on top of the pad, followed by wooden rig mats that interlock. Rig mats are approximately 16 feet by 8 feet in area, though there is some variance from one manufacturer to another.

Any matting used for this Project will be designed to support heavy loads and distribute the weight over large surface areas. The use of matting is a common practice for oil and gas drilling operations in northern locations. Any matting used for this Project will be placed on the frozen ground with snowpack and removed before spring melt.

The well site area adjacent to where the rig is situated and the road access will be matted if an unprecedented early melt occurs. In the event of an unprecedented early melt, rig equipment will be “leapfrogged” along the access road to support equipment and protect the vegetative mat as the rig is being demobilized and on its way out from the well site location. If leases are not constructed from densified fill material, equipment will remain on matted surfaces at all times in the event of early melt conditions.

Mats currently placed on previous well locations are periodically inspected for any movement or deterioration that could affect their ability to support intended loads. All matted well sites are maintained as much as possible because suspended wells must be usable by Chance in future exploratory and appraisal programs.

Summer Matting Use

The laying of matting in summer first requires the frozen level ground to be insulated with an impermeable textile layer. Laying matting early, before the thaw, ensures vegetation is not yet active and may be covered by a layer of snow or frozen soil. The Proponent plans to drill summer wells (following early exploratory successes from the winter wells) by constructing gravel pads of sufficient thickness to facilitate levelling and a firm base to support drilling loads.

The Proponent will likely use double-matting procedures where required to provide a stable, level surface on a summer location if the terrain is uneven. If double matting is used, the upper layer of mats can be lifted independently while the lower mats are left in place if frost adhesion is evident.

The Proponent expects future leases for well sites will be constructed from a more durable borrow site fill material of a suitable thickness to protect and insulate the permafrost and provide a safe and stable working surface for the drilling and subsequent extended flow testing. Should any well also become a long-term producer, the lease condition will be expected to endure for a longer term of several more years.

Geotextile membrane would only be applied over the vegetation surface as an option for locally levelling terrain. This would be necessary if double matting techniques were not possible as a solution for stabilizing mats on the vegetation surface. Geotextile will be used when:

- Levelling using fill material on top of natural vegetation could compromise the stability of the surface under loads.
- Levelling by double matting is not the best solution in the circumstances.
- Geotextile use would help protect vegetation or be a valuable aid in site clean-up.

Geotextile may be used prior to application of fill to level part of the drill site or access route, which could involve applying a minimal thickness of granular material (local rock or soil fill).

The Proponent retained EBA Engineering Consultants Ltd. (EBA) in 2008 to provide permafrost, soil, and vegetation expertise to evaluate the proposed use of industrial wooden mats for summer access. Tetra Tech/EBA (the successor company to EBA) or a similarly qualified individual or firm will be required to perform site-specific geotechnical pre-drilling investigations to confirm amounts of fill required and the proper placement of fill material to support the anticipated rig loads in accordance with good engineering practices.

Well Site Surface Infrastructure

The Proponent plans to use a drill rig with similar characteristics to Chance Rig #1 as presented in past assessments. The rig is capable of drilling to depths of up to 2,500 m. A normal rate of drilling would be to drill 1 well at a time during this exploratory phase.

Figure 1.2 illustrates the general layout of the proposed well site. The rig is designed to fit on a much smaller layout, but the planned 1.44 ha (120 m × 120 m) square layout is designed to accommodate not only the drilling operation but also the well completion and EFT equipment, and to preserve setback distances from surrounding vegetation and from personnel working and sleeping quarters. Note that the final area may not be square since the area will depend on topographical constraints. However, the total area for a well site will be approximately 1.44 ha. The rig layout depicted would likely be for a winter drilling operation distinguished by the number of boilers onsite. Boilers are used extensively in very cold or Arctic climates for preventing equipment and drilling fluids from freezing Arctic temperatures. **Table 1.3** provides a description of the drill rig components identified in **Figure 1.2**.

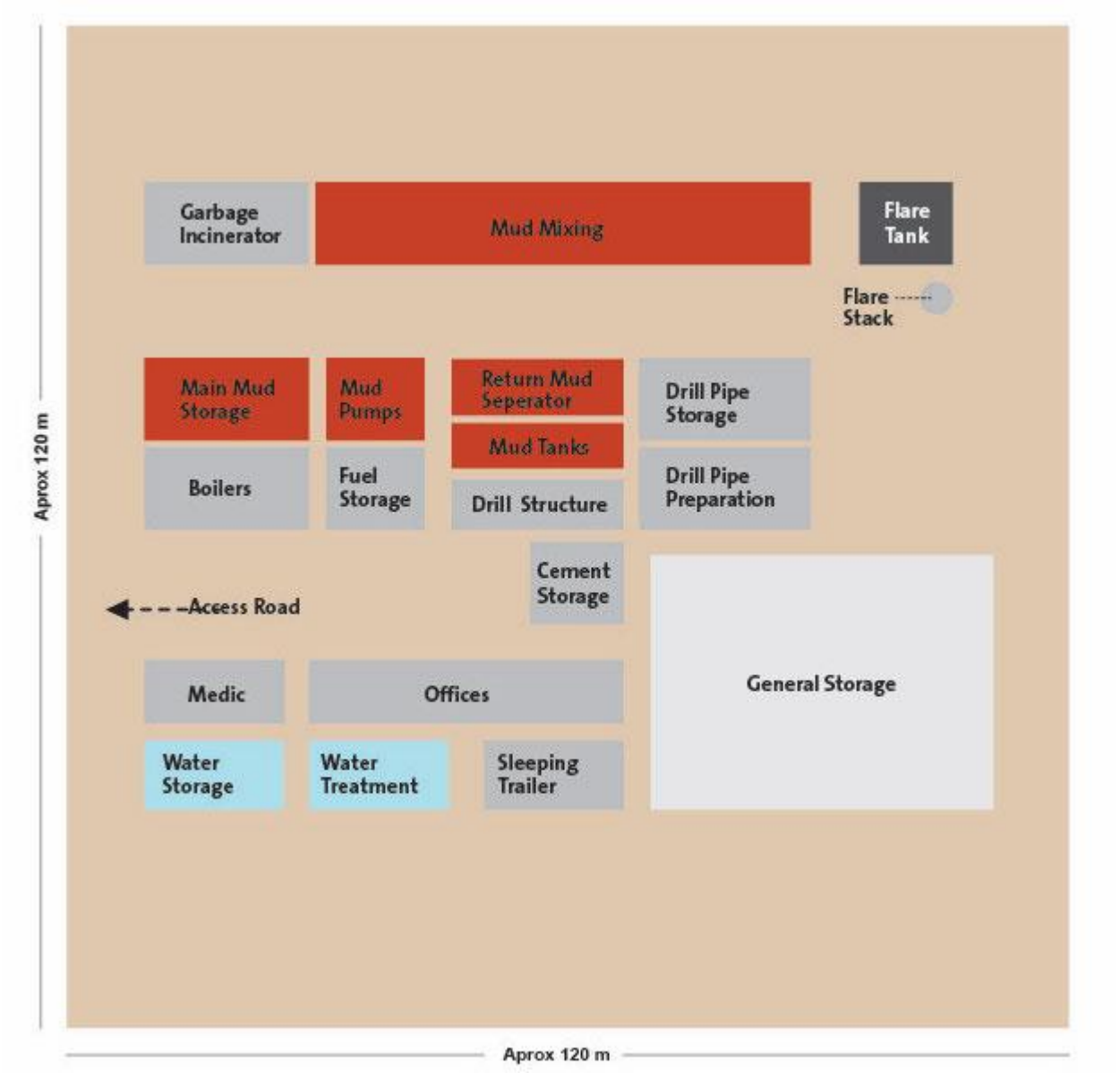

Figure 1.2 General Layout of a Well Site

Table 1.3 Well Site Components Shown on Figure 1-3

Component	Description
Boilers	Used extensively in very cold and Arctic climates for preventing equipment and drilling fluids from freezing Arctic temperatures.
Cement	Cement storage and mixing for use in wells.
Medic, Offices, and Sleeping Trailer	Essential personnel trailers which serve as offices as well as sleeping quarters and include a multi-room sleeper for some of the rig crew.

Component	Description
Flare Tank and Flare	Flare used to incinerate combustible fluids from the well. The flare tank is a reservoir to ensure the flare does not starve of combustible fluids.
Fuel Storage	Fuel for use on well site for equipment including drill rig, pumps, generators, etc.
Garbage and Incinerator	Storage area for waste and incinerator to dispose of food waste.
General Storage	Storage and laydown area for equipment needed onsite.
Mud Tanks	Tanks where all the surface mud volume is stored. Section 31 of the Drilling and Production Regulations under YOGA (Government of Yukon 2004) stipulates that the "combined capacity of the drilling fluid tanks of every fluid system must not be less than the greater of 120 m³ and 50% excess of the volume of the wellbore."
Main Mud Storage	Location where all the mud materials are stored. Normally these materials are delivered on pallets neatly stacked and shrink wrapped to protect them during the truck journey north.
Drill Pipe Storage	Receptacle in which drill pipe is stored until required to be run in the hole.
Mud Mixing	Tank in which certain mud products are first hydrated to render them miscible with the fluid phase of the mud. Products such as bentonite clay, for example, require a caustic soda solution to neutralize the ionic attraction forces between clay flakes, allowing the water to lose its surface tension and to completely wet the flakes.
Mud Tanks	Large tanks, normally upright, fully enclosed and pressurized, where cement or bulk mud products are stored. Cement or barite (drilling mud weighting material) are pneumatically pumped from the P Tank into a smaller surge tank and then to the cementing unit or, alternatively, to the mixing or premix tank to enter the mud system.
Mud Pumps	Pumps used to circulate the drilling mud down the drill pipe, around the drill bit, and up the annular space between the drill pipe and the open hole or casing to surface.
Return Mud Separator	Area where the return mud separator known as a shale shaker is housed. The CF is the centrifuge that uses centrifugal force through high-speed rotation to separate the fluid part of the mud from the solids.
Drill Structure	Components required to drill the well, including: • Sub-structure, or base, to which the derrick is fixed • Derrick that supports the draw works and top drive • Top drive that is a mechanical, electrically powered linking device that attaches to the pipe in the hole and rotates it when drilling while simultaneously pumping drilling mud through the drill pipe and out of the drill bit at the bottom end • Draw works that lifts and lowers the travelling block in the derrick/mast to run pipe in and out of the hole • Blowout preventers, which are a series of closing valves that can hydraulically shut in a well in the event of unplanned influxes of formation fluids into the wellbore
Water Storage and Water Treatment	Water storage tank and treatment containers to provide potable water for the rig crew and personnel.

Any well site is an industrial area and therefore has restricted entry requirements, allowing entry to only authorized personnel wearing personal protective equipment (coveralls, steel-toed boots, hard hat, gloves, and safety glasses).

Figure 1.3 and **Figure 1.4** show the rig set up at the Chance camp located at km 325 of the Dempster Highway.



Figure 1.3 Chance Rig #1



Figure 1.4 Chance Rig #1 and Chance Camp at km 325 of the Dempster Highway

Drilling Operations

Well sites will be designed and constructed to support the rig and ancillary equipment positioned on them. The well site locations will be determined based on geotechnical assessments. Because construction will use borrow source fill, the well sites will be able to accommodate the drilling, EFT, and eventual production phases of well operating life. The lease area will be sized to fully accommodate a purpose-designed well pad, process facilities, and possible service rig equipment spreads that may follow in the future. Eagle Plains well sites and well design will incorporate the following key features to enhance efficiencies and reduce waste and general impact to the surroundings:

- The rig will use the minimal number of casings necessary to reach the projected total depth of approximately 2,500 m. The schematic well profile shown in Figure 1.5 illustrates a cross-section of the casing run, including annular cementation and other well features together with drilling equipment. For reference, the well casing program will typically comprise the following elements:
  - Conductor of 13-3/8-inch diameter to approximately 25 m below ground level, cemented to surface.
  - Surface casing of 9-5/8-inch diameter to approximately 400 m below ground level, cemented to surface.
  - Production casing of 7-inch diameter either to total depth or to just above the top of the Hart River formation at circa 1600 m, to comply with Yukon's Drilling and Production Regulations requirement of not more than 25% of open hole remaining uncased at any time (Drilling and Production Regulations Section 55-(1) (c) (i)). This casing will also be cemented to surface.
  - 4-1/2-inch liner to total depth at 2,200 m, cemented with a minimum 100 m overlap into the previous casing.
- The nominal diameter of the casings (all selected to remain industry standard dimensions) will reduce the size of holes drilled and of drill cuttings generated. For example, a 3,500 m exploratory well would typically produce 400 to 500 metric tons of cuttings. Less than 150 metric tons will be produced for the typical exploratory well depth of 2,200 m proposed at Eagle Plains.
- A water-based mud system will be developed and managed by a specialized service contractor with comprehensive knowledge of the Alberta Energy Regulator (AER) Directive 50 requirements as they pertain to the Yukon jurisdiction being operated in.
- All requirements in Sections 26 to 65 of the Drilling and Production Regulations (covering well design, casing design, groundwater protection, mud products, blowout prevention and choke/kill systems, fire detection and gas detection systems, safety of personnel, mitigation of operations impact, and more) will be either met or exceeded in the design, selection, and deployment of materials.
- The Yukon Oil & Gas drilling and production regulator will review proposed drilling design and planned operations procedures, as well as the health, safety, and environment policies and manual; oil spill contingency plans; and emergency response plans. Any perceived or identified deficiencies will be discussed, addressed and reported back to the regulator to confirm what action had been or needs to be taken before operations can proceed.
- The Proponent will enforce compliance on all third-party service suppliers to ensure that (1) their health, safety, and environment management systems address all regulatory requirements in personnel training and skill development; (2) personal protection equipment provided to workers

meets all Canadian Standards Association and international safety standards; and (3) supervisors are knowledgeable about operational standards related to health, safety, and environment. Periodic inspections and audits will be performed by Chance company representatives while operations are mobilized and ongoing at well sites.

- All wells will be drilled as "keepers" to facilitate EFTs and/or to become early producers in the event the Project advances to a full development. The only wells likely to be abandoned would be unsuccessful (dry) wells with no potential to be used as water or gas disposal wells.
- Leases will be designed and constructed to contain any fluid runoff into purpose-built collection ditches for recovery and disposal. A non-permeable layer will be laid during lease / well pad construction to prevent any seepage into the natural ground layer below the fill material pad.
- Rig deployment will ensure any rig wash; drilling, cementing, or DSTs fluids will be contained and recovered at all times.
- The standard and proven drilling method proposed has many advantages, including the following:
  - Large volumes of water will not be required for the drilling process because of the use of solids control equipment allows recycling of the majority of drilling fluid. Chance Rig #1 normally consumes approximately 15 m^3 water per operating day averaged over the duration of the well being drilled.
  - Minimal volumes of water are expected to be lost into the formation. The Proponent's experience drilling to these depths confirms this. Studies of other offset/nearby wells also confirm this expectation.
  - In the event that hydrocarbons are encountered, they will be controlled by the drilling mud contained in the hole; as a secondary barrier, the blowout preventer system will comprise two or more rams to fully close in the well within seconds of detecting an influx into the wellbore.
  - In the unlikely event that abnormally pressured zones are encountered (all formations to be encountered in the proposed program have been previously drilled in past wells A-25, H-28 and B-73 and no overpressures have been experienced or detected), the Proponent has designed a comprehensive drilling fluids management, casing, and blow-out prevention system to control such occurrences. Well conditions and all pressure parameters are constantly monitored and detected first by the frontline drill crew members (driller constantly on the drilling control brake, mudman aided by the well monitoring personnel constantly viewing and responding to sensor responses). As an added backup, electronic detection alarms are set to trip when very small influxes occur.

Chance Rig #1 is approved to have a Class IV BOP system, which in Yukon Drilling and Production Regulations Section 33 (1) (d) permits the rig to drill wells between 1,800 m and less than 3,600 m and is rated for 21,000 kilopascals (kPa) (3,000 psi) working pressure (Drilling and Production Regulations Section 33 (2) (c)).

Drill crews, by professional training and enforced by regulatory requirement, must be fully trained and certified in blowout prevention and well control. Crews undergo simulated drills at each shift on a 2-shift, 24-hour work rotation. During these drills, the response and efficiency of drill crews are evaluated. The equipment is also evaluated, and any deficiencies are corrected immediately following the drills. Drill crew

and well supervisor well control / blowout prevention / hydrogen sulphide certificates are normally inspected by a visiting inspector to confirm compliance at all times when operating.

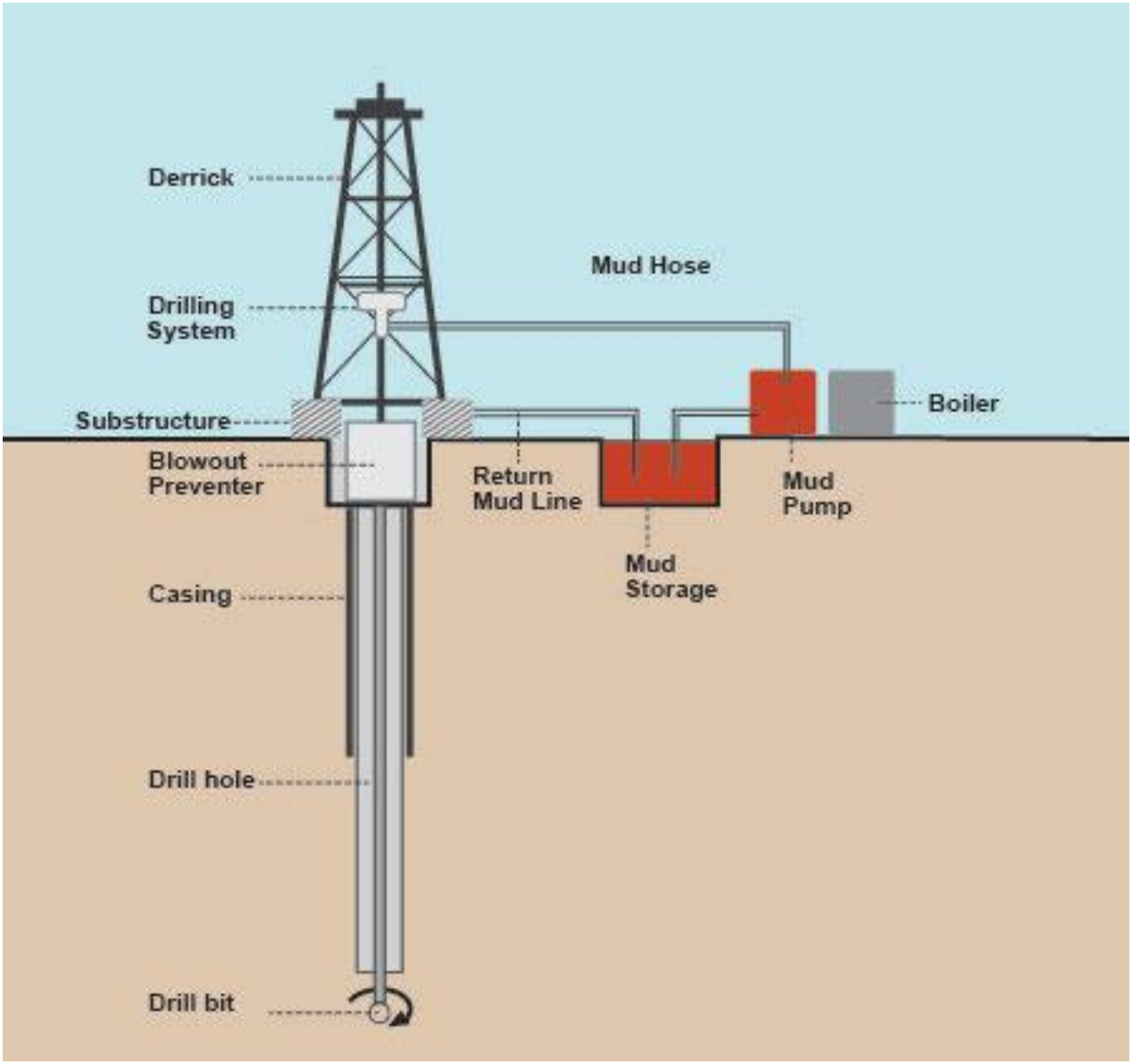

Figure 1.5 Well Profile

Drilling Fluids

Drilling fluid (or mud) is a vital component used in drilling oil, gas, and water wells. The drilling fluid system being currently researched for evaluation will be low-toxicity water-based drilling system similar to those in extensive use in other parts of western Canada. The supplier of any system will be assessed on previous comparative experience and required to pay great attention to mud system drilling performance and enhance ease of disposal to the highest standards demanded by AER Directive 50 for chemical constituents, dissolved salts, minimal oils, miscibility with native soils, and other characteristics.

A typical water-based mud system may be one of the following:

- Weighted (low-solids, non-dispersed) mud
- Glycol/glycerol mud system
- Saturated salt water mud (using sodium chloride, i.e., common salt)
- Calcium-based mud.

The list of typical mud formulations above covers a wide range of basic muds suitable for drilling in relatively benign (non-active clay), low-temperature environments. Simple muds comprise bentonite clay, caustic soda, shale inhibitors (common salt, hydrated gypsum, or lime) all well mixed together to help lift drill cuttings as well as minor additives to prevent drilling equipment corrosion, balance acidity or pH, permit the removal of drilled solids, and keep the ingredients in a slurry rather than separating or flocculating.

The Proponent has used a gel/chemical system on E-78, a relatively shallow well (approximately 1,000 m total depth). This system is used extensively in western Canada and exhibits the low-toxicity features desired for the proposed exploratory program. However, there remains the need to perform compatibility tests or analyses to confirm its suitability for drilling to 2,200 metres at Eagle Plains.

The Proponent is undertaking interviews and expanded discussions with a select number of well-established medium-sized mud services suppliers in conjunction with cuttings disposal specialists, all very active in other drilling jurisdictions. A mud services scope of work will emerge from these discussions to request proposals for providing the service for all exploratory wells. Once the system is designed and validated, all drilling mud characteristics, , such as mineralogy, lithology, pH levels, and others, will be known and can be disseminated to Yukon regulators.

The main function of drilling fluid is to over-balance the well pressure to ensure that the pressure in the wellbore is higher than the pressures expected to be encountered from the various geological formations as the drill bit penetrates them. The drilling fluid prevents formation fluids from entering the wellbore, keeps the drill bit cool and lubricated, circulates out drill cuttings, and keep in fluid suspension the drill cuttings during periods when drilling is paused or when the drilling assembly is cycled in and out of the hole. Drilling fluid is selected to provide operational efficiency, minimize formation damage, reduce corrosion, and minimize environmental impact for handling and disposal.

Project operations will utilize drilling practices that minimize the volume of drill cuttings and drilling waste generated. This minimization will in large part be due to drilling smaller-diameter holes to what will be a relatively shallow total depth. Drilling waste is composed of rock chips and cuttings and the drilling fluid that is recirculated. The drill fluid returned to the surface is sent through a shale shaker and centrifuge where the drill cuttings are separated and have most of the mud removed. The liquid fraction from the separation will be returned to the active tankage system for reuse.

Flaring

Flaring of gases during the drill stem testing part of well evaluation is a widely applied activity. The process, however, can only be undertaken in compliance with rigid regulatory controls. The requirements establish that the flare line must originate downstream of the choke manifold, must be designed to prevent the accumulation of any fluid within the line, and must be properly installed and anchored. Any amount of gas

encountered would be circulated through the rig degasser system to remove it from the drilling mud, thereby rendering the mud safe to pump back into the wellbore. Larger volumes of gas may be control-burned through the flare stack according the flare permit issued by Yukon Oil & Gas.

An example of a typical well site flare layout is illustrated below (**Figure 1.6**). Normally the flare line from the Choke Manifold is connected to the Flare Stack inlet to permit the directing of the gas to the flare until total control in terms of flow rate and flow pressures.

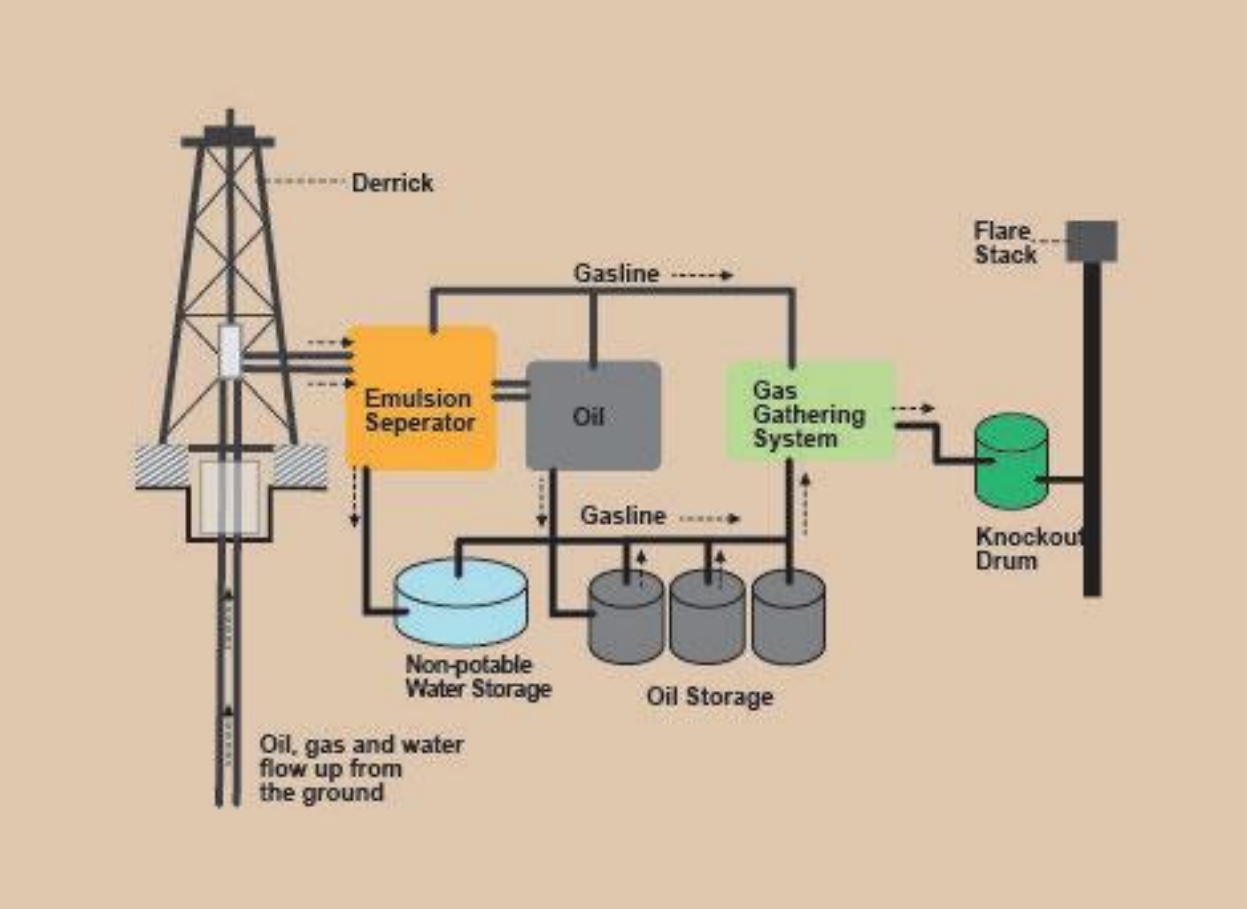

Figure 1.6 Typical Flare Stack and Gas/Vapour Recovery Flowsheet

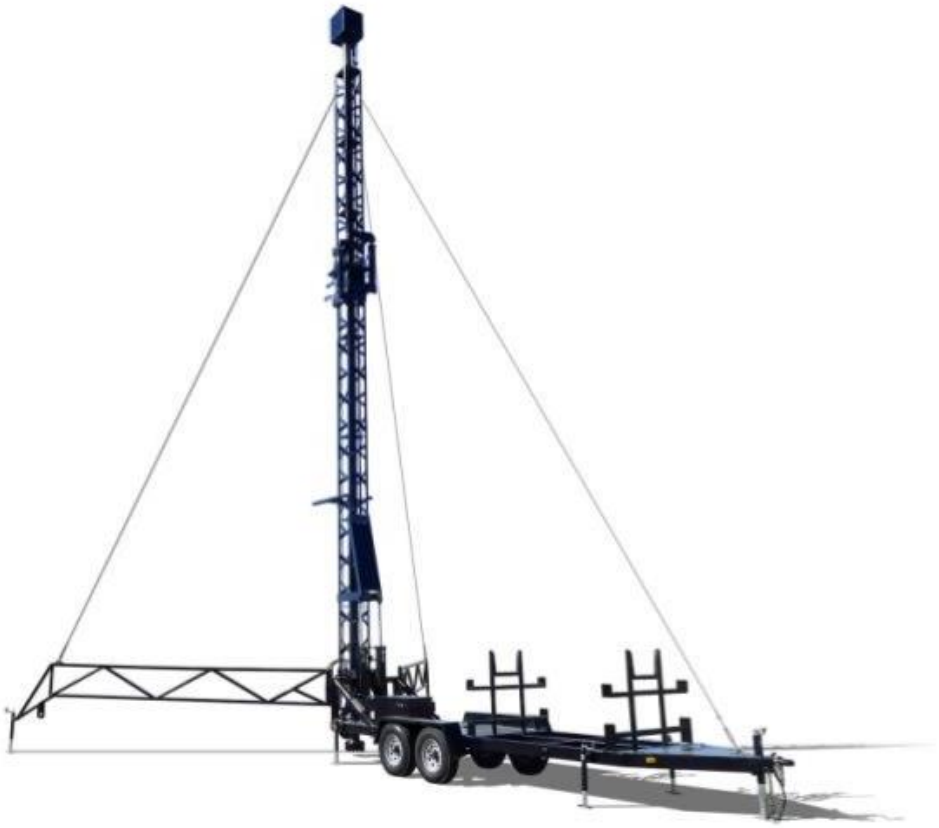

Figure 3-11 Typical Portable Rig Flare Stack Unit

Figure 1.7 Typical Flare Stack Unit on a Portable Rig.

It is expected that the targeted formations will produce less gas than in the past. Newly drilled wells will not contain the anaerobic bacterial contamination present in some of the older wells which may have caused small amounts of H_2S to be present.

The Proponent has not flared gases during the previous exploration programs; however it is likely to occur during some of the flow test operations until a use is found for the gas (heating, power generation, re-injection in a formation etc.).

In the event flaring is necessary, the flare will be higher than the surrounding area and designed to be well above vegetation or trees for example (both specific references made in the YOGA Drilling and Production Regulations quoted earlier). Noise from flaring normally only occurs when very large volumes of high pressure natural gas are being flared.

Flaring would only occur over a period of a maximum 1 day while conducting a DSTs at the end of a drilling program of one well. During extended flow testing, flaring may be necessary for between a few days to a few weeks. After that time actions would be taken to utilize the gas for power generation, tank heating or

possibly, gas lifting to assist crude oil production or re-injection. It would be the intent to eliminate gas flaring and reduce gas emissions to very small amounts when unavoidable.

The Oil and Gas group of Yukon Government's Department of Energy, Mines and Resources has adopted the AER Directive 50 – Drilling Waste Management (as recently amended and updated) procedures for the disposal of drilling wastes within the Yukon. The Proponent will manage the operation in accordance with the MBC requirements of AER Directive 50 – Drilling Waste Management for the remote sump locations and/or Alberta Forestry's "Drilling Waste Management, Disposal on Licence of Occupation" for the LWD disposal method (AER 2016).

It is not anticipated that significant levels of residue chemicals will be deposited on terrestrial and aquatic environmental components. The flare stack will be at 10 m high to assist in air dispersal of combustible end products and will be positioned on the well site in accordance with the regulated spacing requirements. All flaring processes will be in accordance with the air emission permit regulations and best practices.

To ensure that vegetation and soil are not be impacted by residual chemicals, the site design will include an appropriate spacing between the flare stack and any vegetation. Vegetation and soil samples will be taken adjacent and downwind (prevalent) and analyzed for identified chemicals of concern. These lab results will be compared to results obtained from control vegetation and soil samples taken at a similar ecosite, but not near the influence of flaring. Visual monitoring will occur throughout flaring period to ensure safety and protection of nearby vegetation.

YOG Drilling & Production Regulations specify these parameter in Part 9 of the Regulations: In summary the flarestack has to meet the following requirements (Note: operations when flaring will be conducted in full compliance with these requirements):

Flare requirements

128. Unless otherwise approved or directed by the Chief Operations Officer, any gas that is flared will be discharged from a flare stack that:

(a) is at least
    (i) 50 metres from any well, treater, separator, compressor, crude oil storage tank or any other unprotected source of ignitable vapours
    (ii) 80 metres from any right-of-way, easement, road, public utility, building, installation, works, place of public concourse or any reservation for national defence, except only when there may exist special circumstances that, in the opinion of the Chief Operations Officer, justify the positioning of the stack at a greater or lesser distance
(b) is adequately anchored and suitably protected against freezing
(c) is designed to ensure flame stability and efficient combustion
(d) is of sufficient height and diameter to ensure
    (i) that the average concentrations of hydrogen sulphide and sulphur dioxide in the ambient air do not exceed limits specified under the Occupational Health and Safety Act
    (ii) that vegetation combustion is prevented by maintaining an area free of vegetation and combustible debris around the base of the flare stack or the end of the flare line to the following minimum distances:

(A) 10 metres or 1.5 times the stack height, whichever is greater, in cultivated areas

(B) 30 metres or 2.5 times the stack height, whichever is greater, in forested areas

(C) 1.5 times the stack height, in any other area

(ii) that a minimum stack height of 2.5 times the height of the highest third party building located within a distance equal to 5 times the height of the building is maintained

(iii) that any heat generated around the base of the stack does not exceed the manufacturer's specifications for any equipment situated there, to a maximum of 4.73 kW/m²

(e) (e) has a sufficient exit velocity and is provided with guards or other features to prevent extinction of the flame

(f) (f) if the gas flow is intermittent, is provided with an ignition device to ensure continuous ignition of any gases.

Cement Plugs and Permafrost

Cement is a chemical mixture which reacts with and changes form when mixed with water. The reaction gives off heat when mixed with water. As the reaction progresses, the cement hardens. Cementing casing to attain the desired minimum hardness to withstand 500 psi (approximately 3,500 kPa) takes 6-8 hours depending on the amount of accelerator or retarder compound is mixed with the cement. This setting pressure permits the pressure testing of the casing within 12 hours of the cement job concluding to reach 80% of the casing internal yield pressure to confirm pressure integrity. Production casing for example, has an internal yield strength of 56,260 kPa (8160 psi); so 80 % test pressure would be 6525 psi or 45,000 kPa.

Permafrost cement (also named Arcticset or Polarset Cement by different suppliers) is manufactured reduce the amount of heat released during the reaction caused by mixing cement with water by adding Silica Flour mainly. When the cement is mixed with water the reaction proceeds with minimal heat generation and therefore does not contribute to permafrost degradation.

Typical oilfield cements, when mixed with water and begin to set, produce substantial levels of heat, known as the heat of hydration. This heat can melt the permafrost in the near wellbore region. Permafrost cements are a specific mixture of typical oilfield cement (Portland Cements) with additives such as gypsum and/or Calcium sulphate. This blend is specifically designed to create cement that, when mixed with water and begins to set, produces no increase in temperature of the slurry (no additional heat of hydration). This eliminates any permafrost degradation.

Permafrost cement is normally only used for the Surface Casing which is installed to protect any shallow aquifers and permafrost. The Proponent plans to install Surface Casing to a depth of 400 metres at minimum.

1.3.2.3 Drill Stem Testing

All well testing will be performed with the Guidance of AER, Directive 034: Well Testing, Theory and Practice and in consultation with Yukon Government's Energy, Mines and Resources- Oil and Gas Branch. As well, the Proponent will follow related non-discretionary legislations, such as the Drilling and Production Regulations. Part 5 of this Regulation provides detail on well evaluation and testing requirements.

Depending on analysis of rock cuttings, fluid measurements made during the drilling operation, and the well log results, it may be desirable to test prospective zones prior to drilling deeper or running casing. In these cases, a DST is commonly done. Drill stem testing or well flow tests are conducted through a special string of drill pipe anchored at the bottom of the well just above the target zone. The drill pipe would be made up to a packer that isolates the zone from the rest of the well and which would be mechanically fixed to the side wall of the wellbore A special annular pressure operated valve is placed above the packer and with either a small amount of fluid (e.g. water, diesel or other light density fluid) or with the pipe mostly empty of liquid to promote immediate flow from the formation in a controlled manner.

The surface end of the pipe would be connected to a well head made up of a series of valves to control flow and direct it where the operator requires but always with complete control. From the well head, the fluids from the well are carried by surface flow lines to a test separator. The separator splits the fluid mixture into its component elements which could be some combination of crude oil, natural gas and formation water, each stream of which is accurately measured by flow meters, to confirm the volume, pressure, temperature and rate of flow. From the separator, the crude oil stream is sent to a holding tank, the natural gas flows to the choke manifold to the approved flare or other pre-determined place (e.g. burned for heat, power or injected into an appropriate formation below ground) and the water would be filtered or treated in some manner to make is usable elsewhere or pumped back into an approved disposal well (most likely an existing suspended well in the area) in a similar manner as natural gas being injected in a suitable formation.

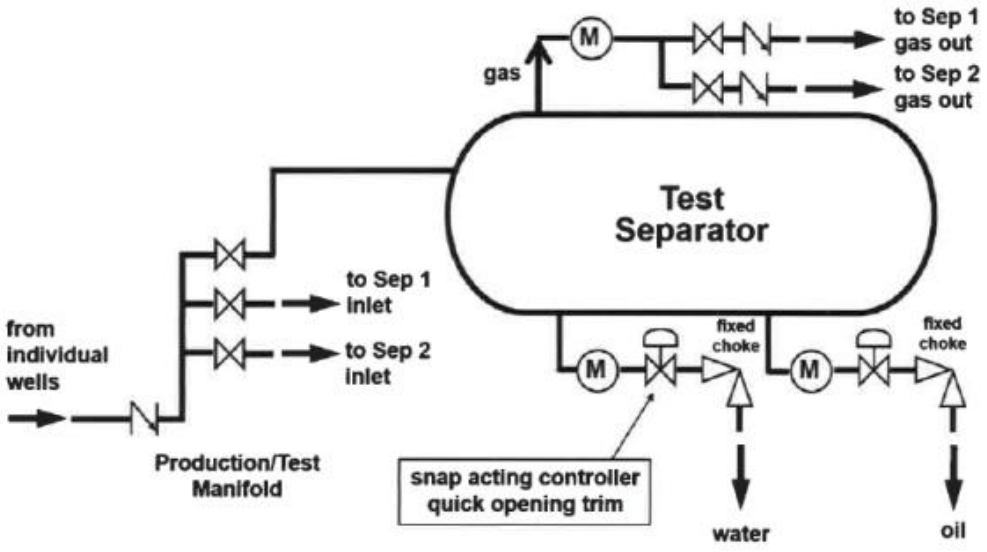

Figure 1.8 Typical Test Separator Schematic

The test separator (**Figure 1.8**) is kept operational permanently in every processing facility. This enables plant operators to assess the performance of the operation periodically. Outflow from the test separator normally is directed to a Central Processing Facility to join production from other wells. Separated natural gas may be piped to a dehydration vessel for future use as fuel or for injection downhole in a suitable well formation.

A typical operational sequence of DST is:

- Well is logged using various diagnostic tools and intervals for testing are selected.
- Test equipment is connected to the end of drill string and run into the well bor. The test equipment, generally consists of one or two packers for isolating the perforated intervals (to be tested), an annular pressure controlled downhole valve to open and shut in the well test and pressure gauges to measure the bottom flowing and shut-in pressures.
- Surface flow lines carry the fluids produced during the test from the wellhead (or surface test tree) to a test separator, where any natural gas is separated and either flared or utilized as fuel and any crude oil is separated and stored in tanks located onsite.
- A cushion of fluid contained in the drill pipe to initially ensure back pressure on the formation, which may be required to control initial flow rates.
- Once the test string is positioned at the zone to be tested, the packer is set and the down hole valve is opened to allow formation fluids to flow into the drill string.
- Initially, the well flows for relatively short period of time to clean up the wells (normally, this period may be a few hours). Following this period, flow is temporarily shut in downhole and a pressure buildup is recorded (with the initial shut-in period lasting for a period lasting 2 or 3 times the initial flow period).
- The test zone is now ready to be flowed at constant or variable rates, with each constant flow period normally followed by a shut-in period.
- Before concluding the series of test rates, bottom hole and surface samples are collected.

At the conclusion of the test, the tools are closed, packers unset and any samples within the drill pipe reverse circulated to surface. Formation fluids that may be produced during a successful test are piped into a test separator with produced gas being metered then flared and oil and/or water stored in sealed tanks.

Samples are taken of all fluids for analysis (both Pressure Volume Temperature samples under the flowing reservoir pressure, temperature conditions and atmospheric samples to check for “base sediments and water characteristics of the produced fluid”). A normal DST duration is approximately a few hours, not including the time required to make up the tools and run pipe to depth and do the reverse on completion. In addition to the time required to flow the well is an even longer period with the well shut in to determine the time it takes for the formation pressure to fully recover to pre-tests levels.

Depending on well log results, sample analysis and potential DST results, the decision is made either to abandon or case the well for further evaluation. In the former event, cement plugs are run using open-ended drill pipe across all porous/permeable zones, across the base of each casing string and at surface, the well casing(s) are cut off 1 m below ground level and steel plates welded across each string, a well sign is erected and the well site returned to original contours and re-vegetated, all pursuant to various oil and gas and land use regulations (all actions in compliance with Sections 90 to 96 of the YOGA Drilling and Production Regulations).

For each DST (minimum one per successful well unless several discrete zones require testing) one well flow should be sufficient and 30 in total days for 30 well DSTs would be typical. Should there be more than one prospective/productive formation which is separate from the other, a second (or more) DST will be

conducted on that formation. In some cases, a DST may need to re-done if there is a misrun. In addition, the DSTs may or may not be done in a steady sequence. Sequencing will depend on where the zones of interest are found in relation to the various casing strings that could be set as the well is being drilled.

Further Testing Details

The DST guidelines outlined in Enform IRP 4 are intended to ensure that safe work procedures are in place and to "minimize the probability of either the mechanical or human systems failing during a test, as well as establishing minimum health, safety and operating standards". In addition, they are "designed to allow flexibility and must be used in conjunction with competent technical judgment".

The exploration wells to be drilled may encounter hydrocarbon bearing zones that could be evaluated by conducting a DST (or DSTs). If DSTs are conducted a plan and testing procedures program will be in place, prior to conducting the test. The plan will be specific to the formation to be tested and the wellbore conditions existing at that time. The plan will be designed to ensure the safety of personnel and equipment and will provide for handling of any fluids that may be recovered. Enform IRP 4 guidelines are one of the sources that will be referenced in preparation of the plan.

Although the Proponent is the only operator currently active in the Eagle Plains basin, there have been several other operators in the past. The records of the historic wells in the basin are available on the website of Yukon Oil and Gas Resources. Nearly 200 DSTs were conducted on approximately 28 wells in the Eagle Plains during the period from 1960 to 2005. To our knowledge, there were no incidents where these tests had any adverse impact on the environment or presented any operational problems. Drill stem tests are a common method of evaluating potential hydrocarbon intervals in exploration wells and have been performed for over 60 years. They are usually of short duration. Flow periods are usually only 1 to 4 hours in duration, and seldom more than one day. The procedures for handling any produced hydrocarbons, and other fluids are the same as for any other operations conducted on the wells.

Three of the wells drilled in the Eagle Plains basin have had one, or more, acid stimulation treatments performed. One of these treatments was conducted by the Proponent. Records of these treatments are available on the Yukon Oil and Gas Resources website. These treatments are usually of small volume where the acid required for the stimulation treatment is transported in a single truck, and the treatment is performed in a single day. The fluid management practices utilized, as for other operations conducted on the well, prevent the release of any fluids to the environment.

Specific details of past drilling experiences can be found on the Yukon Oil and Gas Online Information Site: (http://maps.gov.yk.ca/imf.jsp?site=OilandGas_wells). For reference: the Proponent’s comprehensive casing designs and rig and blow-out prevention system conforms fully to the YOGA (http://www.emr.gov.yk.ca/oilandgas/pdf/unofficial_office_consolidation_oil_and_gas.pdf), and the Drilling and Production Regulations (Sections 33- 61) (http://www.gov.yk.ca/legislation/regs/oic2004_158.pdf).

Further details of the Proponent’s system configuration are confidential as per Section 176 (4) of the Yukon Oil and Gas Regulations. This section outlines what information is required to be non-confidential.

In consideration of the above text, it is not possible to accurately determine the number of DSTs that may be conducted at a well site. A more accurate estimation can only be determined after initial work occurs

which will inform Chance personnel of the geology, potential of oil and gas reserves. Plans for all DSTs will be based on well results and will be discussed with the Oil and Gas Resources branch of the Yukon Department of Energy, Mines and Resources.

Swabbing

There is the possibility that any well may be swabbed (normally a service/work over operation). Swabbing is a procedure to unload wellbores of heavier fluids thereby permitting the formation fluids to enter the wellbore and be circulated to surface. Wells will only be swabbed if the well is drilled, cased and a potential reservoir is:

- Identified,
- Perforated; and,
- Testing reveals that reservoir pressure is insufficient to flow liquids to surface; or,
- If well stimulation results in wellbore liquids that prevent flow to surface.

If the above criteria are met, swabbing is an accepted practice to reduce the pressure preventing a potentially productive formation from flowing to surface naturally. The same regulations affecting the handling and disposal of these fluids apply to fluids produced by swabbing as to recovery by any other means.

Acid Stimulation

Previous formation analyses have indicated small volume acid stimulation treatments would work well to clean up wells, remove scale and other impedances from formation pore throats to allow or improve flow into the wellbore. Acid stimulation entails the pumping of discrete amounts of normally hydrochloric acid at varying concentrations of 10%, 15% or 20%. The acid is trucked to location in specially sealed tanks in compliance with Transport of Dangerous Goods regulations and transferred to the cement pumping unit for pumping downhole. Treatment batches of 10 to 25 barrels (approximately 1.60 to 4 cubic metres) are pumped slowly controlled pressure until the entire batch is pumped. The relatively weak acid serves to dissolve scale (calcium Carbonate) deposited in flow paths over time. Successful stimulation is when the well flows at increased daily rates which could be +30 to 150 % of pre-stimulation rates.

The toxicity limits for oilfield hydrochloric acid are described in the Environment Canada documents and the Material Safety Data Sheets for the products. Hydrochloric acid is a gas dissolved in water to form hydrochloric acid. If heated the gas evaporates from the aqueous phase and water will be left. The chemical reaction of acid with carbonates renders the carbonates to form a harmless Calcium Chloride salt and water as by-products.

Oilfield concentrations are normally 10%, 15%, or 20% concentration hydrochloric acid. 5ppm (5mg/cubic metre) is considered safe concentration from an environmental perspective. Acid stimulation is normally only used once per well operation. The acid is transported in a special truck mounted tank that are designed and constructed for safe acid transport according to Transport Canada and Department of Transport regulations. A small quantity of relatively weak acid (10%, 15% or 20% concentration) is used on any occasion normally 5 to 10 cubic metres maximum. The acid is pumped from the truck into the pumper unit and from there downhole and never actually “sees daylight”. In winter, if acid is spilled as with water, it

would freeze and can be recovered from the surface snow or a thin surface soil layer. In summer, immediately flushing the spill with water would neutralize the acid and render it harmless (less damaging than vinegar). Flowing the well to “clean it up” would return the “spent acid solution” as Calcium Chloride, Carbon Dioxide and water.

In summary, acid stimulation is a common practice and an economic means to enhance well flow and reduce if not remove the materials impairing the ability of the formation to allow fluids to flow into the wellbore.

1.3.2.4 Extended Flow Testing

As noted above, all well testing will be performed with the Guidance of AER, Directive 034: Well Testing, Theory and Practice and in consultation with Yukon Government’s Energy, Mines and Resources- Oil and Gas Branch. As well, the Proponent will follow related non-discretionary legislations, such as the Drilling and Production Regulations. Part 5 of this Regulation provides detail on well evaluation and testing requirements.

In addition to drilling, any discoveries identified through DST are expected to undergo extended flow testing in order to gather important information about the nature of the resource accumulation and its productive capability. Given the remoteness of the region, the limited infrastructure to support oil and gas industry activities and the very early stage of oil industry evolution at Eagle Plains, the duration of these EFTs at each discovery could be up to 2 years. The information obtained from EFTs is critical to determining the future development plan for each discovery. The planned wells are exploratory; any flow testing will be contingent on discovery of formations potentially containing hydrocarbons. Part 8, Section 103 (1) of the Yukon Drilling and Production Regulations requires:

> *“The Licensee of a well shall obtain sufficient well tests, formation flow tests, wireline logs, analyses, surveys, conventional cores, cuttings and samples during the drilling of the well to ensure that a comprehensive geological and reservoir evaluation can be made.”*

EFTs will be undertaken if preliminary results from DST are encouraging and the following criteria have been met:

1. The well is drilled and cased; and,
2. A potential reservoir is:
    a. Identified
    b. DST has been conducted and
    c. Test analysis of the DST concludes sufficient hydrocarbons present to proceed to further evaluation of the hydrocarbon bearing formation.

In such a case, an EFT will be conducted to obtain more extensive information on reservoir characteristics and potential reserves. The same regulatory constraints apply to fluids produced by extended flow testing as to recovery by any other means.

EFT operates in a similar principal to DST. The main difference is that EFTs are undertaken after the well has been cased. To allow the zone of interest to flow into the wellbore, the casing has to be perforated

which is a routine procedure carried by either using a wireline from surface or attached the end of the production tubing from the surface to the zone of interest. The well, in this case, is first completed with a packer attached to a tubing string and have special downhole gauges to record flowing temperatures and pressures in real time. The surface would have the proper “Christmas Tree” wellhead equipment and be flow line connected to the test separator through a choke manifold. Well fluids (gas, oil and water) would then be handled in a similar manner as described previously. In an EFT however, the drilling rig would be removed to drill another well while the drilled well is prepared for testing.

Depending on drilling success several wells in different prospects would be flow tested simultaneously. As each well is drilled and drill stem tested to evaluate its candidacy for extended testing, it is left in a safe, secure state for further testing to take place after the drilling rig has been removed. It may become necessary to mobilize a small service rig to perform the completion work before turning the well to extended testing, but Chance Rig #1 could also perform this task and the solitary drilling/service unit at Eagle Plains. A well service rig has very similar capabilities and equipment as a drilling rig except that it generally has fewer modules and is also lighter equipment. If a service is required, it would be incremental equipment to the drilling rig.

Well testing is normally performed by specialized experts who would provide the specialized equipment, operating and safety procedures and the certification to be able to perform the associated tasks. Extended flow testing however would be handled in the same fashion as production operations and still be conducted by trained professional operators under the direct supervision of a Production Superintendent.

EFTs will require the installation of surface and subsurface equipment and facilities at each well site to measure, store and process produced fluids before it can be safely consumed, transported out of the operating area, or disposed at an approved location. The specific details of this equipment is subject to the nature of the discovery and could include:

- Casing of entire wellbore and perforate casing at zone of interest
- Packer, tubing and downhole gauges
- Wellhead valving assembly
- Flare systems
- Separator vessel
- Treater to do additional phase separation of the fluids
- Storage tanks
- Appropriate artificial lift systems
- Heaters
- Dehydrators
- Flow lines
- Metering equipment
- Portable generators

The Proponent anticipates a period of time to elapse between confirming a discovery worthy of further evaluation and commencing the EFT to allow time to properly design, fabricate, install, and commission the extended flow testing facilities.

The Proponent will conduct EFT on up to 20 successful wells. EFT may be completed within a month for a predominantly natural gas well or up to 2 years for a predominately crude oil well. There may be up to eight EFTs conducted at the same time.

Fluids produced during extended well flow testing will need to be measured, processed and dealt with in an environmentally responsible manner. Depending on the nature of a discovery, the Proponent anticipates that some combination of natural gas, crude oil and possibly formation water will be extracted during the EFTs. These fluids are separated and measured in facilities on the surface.

Natural gas could be flared for short periods of time. However, the Proponent may conserve natural gas and use it to provide fuel for process heating and possibly onsite power generation. Heaters are burners in a contained system of firetubes and the heat given off from combustion is used to provide heat to vessels treating the produced fluids or keeping stored fluids warm. The design of heaters can include heating an intermediate fluid such as glycol at the heater and circulating the glycol in a network of pipes to the places where heat is required. The generators are likely going to be small engines fuelled with natural gas and sized according to the power needs of the location.

Crude oil produced during the EFTs will also be conserved instead of flared to the greatest extent possible. This will require some processing at the well site or the central processing facility to stabilize the crude oil for truck transport to a suitable, approved crude oil marketing point, such as terminals near Ft. Nelson or Ft. St. John in British Columbia or Grand Prairie in Alberta. All of these locations are ready to receive and utilize crude oil produced from Yukon sources in the absence of such destinations within the Yukon. The Proponent may also consider trucking crude oil produced during the EFTs to ports in Alaska such as Skagway, Haines or Valdez for onward shipping to suitable markets elsewhere in North America.

Formation water produced in conjunction with crude oil and/or natural gas will be separated from the hydrocarbon streams and disposed of underground into a compatible and approved formation at Eagle Plains using one of the suspended wells. These procedures to process, transport and dispose of various fluids produced are common practice in every oil and gas province in Canada.

While water injection as a means to replace produced crude oil in the underground reservoir to maintain pressure in the reservoir is universally used in the oil and gas industry. The Proponent does not feel there is enough reservoir information data to predict the need for water injection in the future life of an Eagle Plains producing oilfield. The normal ratio of produced oil to injected water is 1:1. That is for every barrel of oil produced, there will be a requirement for a barrel of water to be injected following an initial period without water injection. The need for and the design of a water injection operational procedure will accompany and be part of a full field development plan should one transpire. One of the objectives of EFT is to gauge whether reservoir pressure maintenance occurs naturally or whether it needs to be done artificially using water or natural gas injection. This information will in turn support any longer term, development plan.

An EFT of any well can only be accomplished when year-round access to the each well is established. Producing wells require periodic inspection by field personnel to ensure the operation is proceeding within design parameters and safely. The well fluids have to be trucked out periodically as well.

During an EFT, all produced fluids will be separated into fluids that can safely be disposed of in the area (clean water) and fluids that must be transported to distant markets or safe disposal sites (crude oil, condensates). The natural gas element will, as previously stated, metered to accurately determine its volume/production rate and likely flared onsite, unless a local use can be identified (or burned for heating, gas lifting and/or power generation).

The average production rate experienced from previous well testing on the Proponent's old wells, 200 barrels of oil per day is expected to be the average per well production and less than 5% water cut is planned for. Therefore 4,000 barrels per day is likely the upper limit and a design limit of 2,000 barrels per day is more realistic for the daily maximums.

1.3.2.5 Well Maintenance (Workovers)

Any well completed for EFT or longer-term production may require workovers during its lifetime. A work over entails the manipulation of the wellbore production equipment (pumps, tubing, packers, etc.) using a suitably sized service rig or occasionally a drilling rig. In this activity the objective would be to change the condition of a well to improve productivity, replace faulty components or extend the well's productive life in some manner.

Over time, a reservoir depletes in such a way at to permit the water interface with crude oil or natural gas in the formation to rise to a point where only water flows from the wellbore. Producing too much water over a period of time could impair the ultimate recovery of crude oil or natural gas and possibly shorten the life of a producing well. Measures are needed to reduce or shut off the water flow to allow continued recovery of crude oil or natural gas. These include plugging some or all of the perforations and perforating at different section of the wellbore casing. Other factors that impair production of crude oil and natural gas include scale buildup, asphaltene (a constituent of some crude oils) plugging, etc. need remediation and this work is done using service rigs, wireline services and so on. These practices are commonly used by the oil and gas industry and conforms to the regulatory requirements to optimize the recovery of the resources from the reservoir.

The well completion design and installation phase is critical in ensuring the well maintains a longer period of uninterrupted production. To this end completions are designed to require minimal intervention for many years by installing simple less mechanically operated systems, superior corrosion protection, erosion protection, possible use of internally coated production tubing etc. All such actions are focused on making product flow as smoothly as possible. Furthermore, the actual tubular components are selected to minimize changes in internal diameter, prevent areas where turbulence is generated and reduce if not eliminate leakage paths.

The completion is also designed to make its installation as trouble free and time saving as possible (have components which could assist in pressure testing the tubing internally while being run to eliminate leaks. The simplest completion should comprise of tubing and perhaps a tubing anchor or packer. Seating or landing nipples are installed to enable internal pressure testing of a completion string as well as land

downhole pressure gauges while flowing, permit circulation of kill fluids from the annulus into the tubing bore or reverse and possibly plug a well at a certain depth. The term “kill fluid” describes a fluid of sufficient density that creates a hydrostatic pressure at the bottom of the fluid column that is equal to or great than the formation pressure and prevents formation fluid from flowing into the wellbore.

Work overs nearly always start with “killing the well” to prevent further flow and circulating the wellbore contents to be replaced with a stable, non-flammable fluid. The kill fluid is normally weighted brine with corrosion inhibitive features. Salt dissolved in water (Brine) makes the water “heavier” (denser) and therefore an over balance medium fluid to keep formation fluids in the formation and not allow then to enter the casing/well. Normal completion brines are Sodium Chloride, Potassium Chloride and Calcium Chloride depending on the bottom hole pressures encountered. Eagle Plains conventional wells can be completed with Sodium Chloride (common salt) brine mediums. Only additives that may be added to the workover brine is corrosion inhibitors and/or biocide.

Following that activity, the wellhead is removed and a blowout preventer is installed to provide additional control of the well during the work over. The production tubing is recovered to surface for reuse or disposal if it is too eroded or corroded for future use. The wellbore would be cleaned of debris accumulating over a production period (normally a bit and casing scraper run accomplishes this). The remedial work is done to the well to fix whatever problems were encountered and the well is returned to a condition that allows production to resume.

1.3.2.6 Drilling By-Products

Within the described drilling program, two forms of drilling by-products will be produced. The following sections will describe and detail their creation and industry wide solutions for dealing with these by-products.

Please note, the Proponent is drilling within a sedimentary basin. Drill cuttings consist of sandstone, shale, and carbonate rock and are therefore, not significantly sulphide bearing. These rocks have been examined by Chance geologists and do not contain the materials that cause acid creation and as such the potential for acid rock drainage caused by the disposal of drill cuttings is remote to non-existent.

Naturally occurring radioactivity will be measured by gamma ray or spectral gamma ray wireline logs, which is a regulatory requirement in the Yukon Government Drilling and Production Regulations. GR is a radioactivity detection device (similar to a Geiger Counter) and therefore detects any existence of radioactive Uranium, Thorium and/or Potassium isotopes in the rock formations drilled. To date no abnormal detections have been made other than that attributed to natural rock formation radioactivity and therefore, radioactivity appears absent or undetectable in the fluid of the Eagle Plains sedimentary formations.

Solid Drill Cuttings

When drilling a well, cuttings are produced. These cuttings are a direct by-product of the drilling action caused by the bit grinding rock. After being drilled, these cuttings are brought to surface with the drilling fluid and separated from the drilling fluid using sophisticated equipment (e.g., shale shakers and centrifuges). These cuttings are stored onsite in metal bins referred to as shale bins. Close attention is

given to the dryness of the cuttings coming across the shale shakers and collected in the shale bins. It is important that as much fluid as possible be recovered from the cuttings for a few reasons:

- Less total weight in the cuttings, hence less cost associated with future handling of the drill cuttings.
- In the winter, it is easier to handle and move dry cuttings as they do not freeze and create large blocks of material.
- Reduces the need for additional make-up drilling fluid by recycling more fluid that is separated from the cuttings.

Drilling Fluid

The Proponent is proposing to use water-based drilling fluid systems. It is not uncommon that after drilling a few wells using the recycled drilling fluids, a mud system may need to be partially or fully reconstituted (disposal of the current system and mixing of fresh water and new drilling fluid products). This ensures the drilling fluid is fresh and capable of drilling through the different rock types found in the proposed wells. It is unclear how often a reconstitution process will be needed. The Proponent has had success with re-using drilling fluid systems across multiple wells to reduce the overall need for make-up water and reduce ultimate disposal of material at the conclusion of its use. As drilling is likely confined to a winter drilling season, the Proponent will likely re-use drilling fluid throughout one drilling season.

The first stage of fluid and material management is called ‘Stripping’; this is the process of running the drilling fluid as it returns to surface through centrifuges multiple times to separate the water from any solids suspended in the fluid stream. The fluid is then either recycled back into the mud system or used elsewhere on the rig

The disposal options outlined for the drilling program have been directly influenced by both the proposed drilling system and the site conditions present at the drilling locations and in the Eagle Plains area generally.

- Accordingly, the following conditions were established for selection of the drilling mud system: a low-toxicity mud system confirmed through laboratory analysis; and
- Meet operational requirements (maintain formation stability, hole cleaning and well control, etc.)
- The following conditions were established for selection of a cutting disposal method:
  - minimize the extent of surface disturbance; and
  - minimize transporting the material off-site for disposal.

In response to both these sets of conditions, the Proponent plans to select a water-based mud system as generally described which has been previously proven suitable for the MBC disposal process in an approved nearby site.

Any drill fluid selected will first have to satisfy Section 32 “Approved Drilling Fluid” of YOGA Drilling and Production Regulations. The type and chemistry of the drilling fluid will be a key part of the drilling Program issued in application for a Well Licence. This is explained and described further in this section.

1.3.2.7 Mix Bury Cover Sump

The Yukon has accepted AER Directive 50 as the governing regulation to determine the eligibility and applicability of various disposal alternatives for various drilling by-products and mud systems. Mix-bury-cover, as described and detailed in AER Directive 50 Section 13, is a method of disposing of drilling waste (both drill cuttings and drilling fluid or just drill cuttings) by which the by-products and spent mud is mixed with a local receiving soil at a specific mix ratio, then deposited into a sump, and then covered with clean subsoil.

A typical MBC sump design consists of three distinct layers:

- A clean subsoil layer 1 to 1.5 m in depth. This layer acts as an insulator between the subsoil/drill cutting mix and the vegetative layer to ensure that, after final reclamation, the site is returned to its original state.
- The subsoil/drill cutting mix layer is where the receiving subsoil is mixed at a specified mix ration with the disposed material (e.g., drill cuttings, spent drilling mud, etc.).
- Clayey material exceeding 1 m in depth, or alternative impermeable liner, acting as a hydraulic isolator.

Sump Suitability

Initial investigation into sump locations is required. AER Directive 50 Section 6.3 specifies the procedures and parameters for sump site investigation. Any proposed location will have cores drilled and the subsoil will be analyzed to confirm the following for a proposed sump:

- Sump soil has appropriate deposits of clayey soils.
- Must have appropriate clayey material of 1 m beyond the horizontal and vertical dimensions of the sump to ensure hydraulic containment.
- Absence of hydraulic defects or ways for fluid to leak out of sump.
- A composite sample, made up of five subsamples, is required for every 3 000 m² proposed to be used for MBC.

In the instance where the subsoil is found to be saline, special care will be taken when these sumps are excavated to ensure the non-saline active layer and subsurface materials are returned to the surface allowing the site to return to its equivalent land capability.

The Proponent has begun a sump suitability study of chosen locations throughout the area proposed in this application. Core samples, from existing and potential future locations for MBC style disposal, are being examined and analyzed by qualified experts. The results of this work will determine the course the Proponent will pursue for MBC at Eagle Plains.

The actual drilling fluid system that the Proponent plans to use has not yet been determined due to the exploratory nature of the drilling program (uncertainty of lithology), more information about this can be found in the Environmental Conditions report (Appendix D) describing the geology in the area. Before the Proponent begins the drilling of a well, a test sample of the drilling fluid will be prepared. The properties of

this fluid will be analyzed and compared against the receiving soils at the MBC site(s) to estimate the soil/waste mix ratio to ensure the final soil composition complies with AER Directive 50 section 3.

The Proponent intends to assign cuttings disposal management and direction to a competent individual representing an organization with the most experience operating under the terms and conditions of AER Directive 50.

MBC is not a viable disposal option if:

- Suitable sump site that meets all of the requirements established under AER directive 50 cannot be found.
- Drilling fluid that is incompatible with receiving soils or prohibited for MBC under AER Directive 50 is used.
- Drilling by-products/receiving-soil properties require a mix ratio greater than 7.

In order to minimize the potential for deep permafrost exposure during summer exploratory drilling program, the following mitigating procedures will be adopted:

- The sump will be excavated as disposal volume is required, in order to minimize the area of basal and wall permafrost exposure at any time. This may be in the form of narrow compartments oriented E-W to maximize shading of the basal permafrost surfaces or any other field procedure determined superior at the time.
- The top of the open area of the sump may be covered if environmental/geotechnical monitoring indicates degradation of wall structures in the sump trench due to thaw.

While an MBC sump is actively being used, the Proponent will monitor and inspect the site to evaluate sump integrity, volumes of material involved and to assess if further work is needed to the sump location. The drilling operations will utilize practices that minimize the volume of drill cuttings and drilling by-products generated.

The Proponent will arrange for full-time disposal expertise, provided from the selected mud services contractor, who will be available for Project management and consultation regarding disposal operations.

As noted above, all materials to be disposed of in the sump will meet AER Directive 50. If materials to be disposed of do not meet AER Directive 50, the disposal material will be transported to an appropriate permitted facility for disposal consistent with the practice employed in previous exploratory wells drilled at Eagle Plains. The Proponent has used permitted facilities that can accept specified waste in Whitehorse and northeast British Columbia.

Drill cuttings and fluids will be held in containers for minimal periods before disposal. After drill cuttings are circulated out of the hole, they are separated from the drilling fluid and stored in 3-sided metal bins. For final disposal, the cuttings are transported to the proposed MBC site for mixing with the subsoil. After the three-sided bins have been emptied, they will be moved, along with the rig, to the next drilling location. Disposal will take place as and when required during drilling or when the shale bins contain a full truck load of material.

For the proposed Project, drill cuttings will be transported to and disposed of at the MBC sump site, while fluids will be reused until the end of the Project. The Proponent plans to construct a new MBC sump adjacent to the Devon sump area to the same specifications to dispose of drill cuttings from the proposed 30 wells (see **Figure 1.9**). The Proponent has not used the Devon site for any drill cuttings or drilling fluid disposal to date and does not intend to use the site for disposal in the future. The Proponent's preferred disposal site is separate from where Devon drill cuttings and drilling fluid were buried but in an adjacent, previously undisturbed area,The Proponent has not monitored or inspected any of the Devon sumps. The proposed exploration drilling program will be performed under a comprehensive drilling fluids management process managed by a services supplier competent in AER Directive 50 and fully versed in safe MBC techniques in use in western Canada.

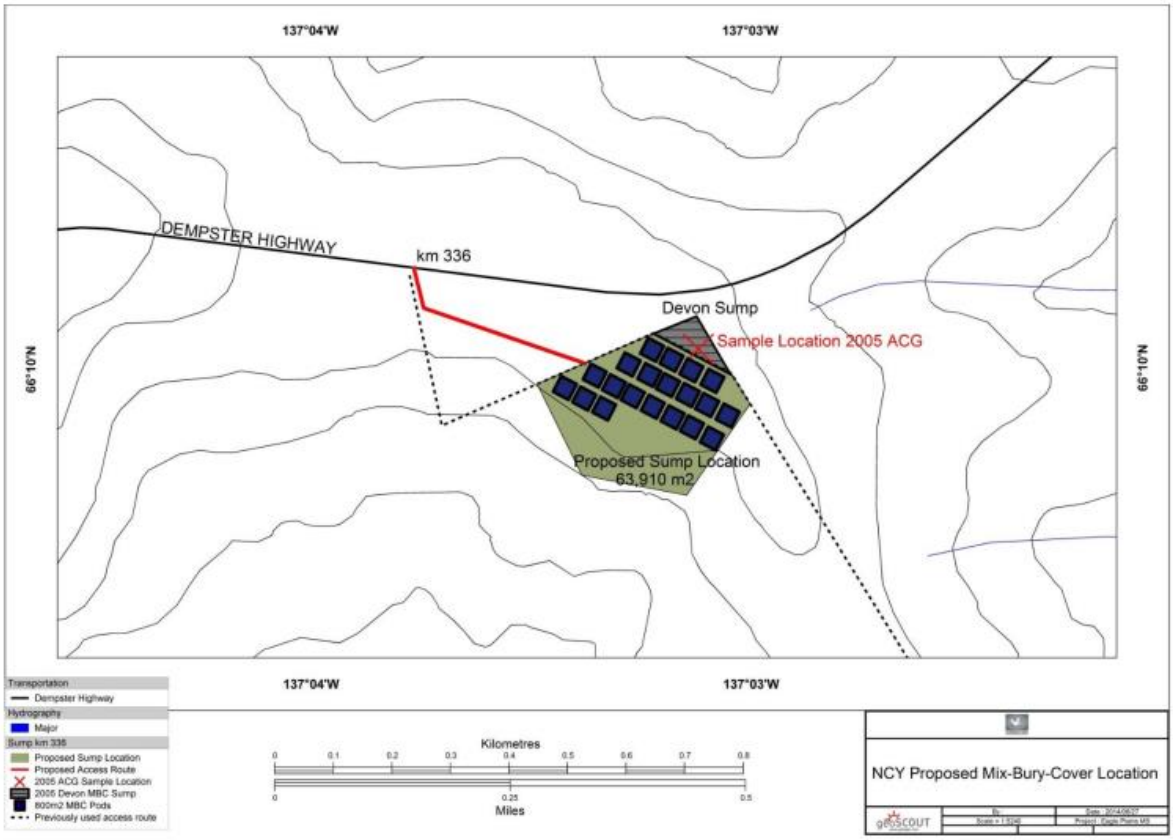

Figure 1.9 General Location and Typical Plan of MBC Sump Site

Figure 1.9 shows the 63,910 m² area proposed for MBC disposal. This area was determined based on the estimated area required for disposal. Each 800 m² MBC pod signifies an estimate of how much area would be required to dispose of one well's drill cuttings. The additional area, a rough estimate, would allow for spacing between MBCs for truck access and to pile excavated material before MBC commences. All estimated calculations, as required by Yukon Government Drilling and Production Regulations (Government of Yukon 2004), were made in accordance with the requirements of AER Directive 50. Typical operational practice is to have only one MBC open at a time.

MBC pods will be sized based on the anticipated volume of drill cuttings disposal required per well. This will ensure that the MBC opening time is minimal. As mentioned previously, a typical well would produce up to 300 m³ of drill cuttings and require an area of approximately 800 m² to dispose the drill cuttings. The Proponent proposes to only use the site described in **Figure 1.9** for the MBC sump. The section of area where the Devon 2005 MBC was located and whose exact location is known, will not be disturbed by any of the proposed operations. The Proponent aims to minimize surface disturbance by using a single previously disturbed area for multiple MBC pods. The site is adjacent to an already disturbed site used by previous oil and gas activity (Devon access road 2004) and it has already proven to have the soil characteristics required as stated in AER Directive 50 Section 6.3. There is no operational need to establish other discrete MBC locations.

1.3.2.8 Injection Well

DIR 50 covers the disposal of drilling fluid. In this case the fluid would be added to the drill cutting and then mixed with the required amount of soil in accordance with AER Dir 50. Drilling fluid may also be stripped back to just the clear portion and disposed of using an approved water injection well.

Well choice requires further injectivity and suitability investigations. This cannot occur until the wells are re-entered and made ready for the investigation trials. Chance Candidate wells could be one or more of the following suspended well(s): Chance J-19, Chance M-08, Chance G-08, Blackie M-59 and Chance E-78 all located within the Chance licence areas. Any well that is not a preferred EFT or future production candidate could be an injection well if strategically located in close proximity to a usable well or wells and if it exhibits the required characteristics for injecting fluids.

The YOGA Drilling and Production Regulations require reservoir produced water not be disposed of at the surface unless its quality and/or salinity is equal to or better than the quality limits set out in producing filed facility licence.

Any plans or intention to dispose of produced water from reservoir fluids separation have to be submitted to the regulatory authority and must meet the pertinent environmental standards as well the oilfield waste disposal standards and limits (reference YOGA Drilling and Production Regulations Sections 122. 123. 124, 130 and 165). The YOG regulator will only authorize produced water disposal when the operator demonstrates all legislation in force requirements have been met and that good oilfield exploitation and reservoir management practices are satisfied.

Once their disposal suitability is established, the following liquid materials (all treated with bactericide) and their volumes may be disposed of:

- Produced water per well (water cut 20% to 60% for 200 BOPD) = 40 to 120 barrels water/day
- Workover fluids: Maximum 7” casing volume full= 276 barrels
- Rig wash: hose flowing at 5gpm water for one hour = ±7 barrels per day in summer
- Saline fluids (completion brines) same as workover fluids = 276 barrels
- Liquid fraction of drilling fluids = approximately 200 cubic metres at end of Project

The zone must have an impermeable barrier above it to prevent migration of the injected fluid and be deeper than 750 metres. Permeability and porosity of the rock must permit pumping of the fluid at low surface pressure and especially well below formation breakdown pressure. Testing will also have to determine injection fluid compatibility between the rock and native reservoir before injection.

The injection pressure and rate, and the pressure in the casing tubing annulus will be monitored at all times. Accurate/calibrated surface pressure gauges will continually monitor pressure readings and any fluctuations. The conditions are injectivity rate, porosity and permeability of the formation being injected into.

Disposal of highly saline produced water at surface disposal sites may be greatly restricted in quality and quantity. To this end and to support best reservoir management practices, it may at times be mandatory to re-inject reservoir produced water back downhole as the only viable and environmentally safe option.

1.3.2.9 Seismic Exploration

The seismic program will consist of approximately 1,500 km² of 3D and 2,000 km² of 2D reflection seismic exploration. Actual final seismic survey location, design and layout will be dependent on drilling outcomes as they progress. Utilization of the low-impact seismic methodology will result in very low impact on the environment. Source lines are limited to 3 metres in width and receiver lines limited to 2 metres in width. The Proponent intends to leave a small amount of snow on the lines so that the tundra and permafrost are not disturbed. The low-impact seismic drills are outfitted with air hammers and as a result will not require water for drilling.

The Proponent plans to deploy a wireless recording system. This wireless system is preferred since a cabled system could present a hazard for migrating animals and requires a larger hand cut line than is necessary for a cable-less system where the layout crew only requires a path 2 metre or less through the land. A cable-less system is also less impactful on the environment as it is easier to carry down the receiver lines and requires fewer personnel on the recording crew.

Preflagging (Cruising)

Prior to line preparation, a detailed line by line spatial analysis (area examination) is performed utilizing a combination of air photos (2011 vintage with 2 m resolution), LIDAR (Light Detecting and Ranging), field scout information, GIS information, First Nation cultural inputs, and any information identified by the preflagging/cruising phase. This greatly helps reduce time spent in the field dealing with localized line preparation issues.

Preflagging (cruising) will be conducted to identify and mark line locations, areas containing riparian areas, difficult terrain, historical/archaeological areas, animal sites and facilities. This is done by having personnel on the ground marking the line locations and areas of concern for the mulchers and chainsaw operators to follow or avoid. These areas will be added to the Project map. Handheld Global Positioning Systems (GPS) units ensures accurate line placement and automatic notifications are sent to management when the mechanical equipment is approaching a “Hot Spot”, or stations that are encroaching any buffered zones or areas.

Line Preparation

A combination of low-impact seismic mulchers and chainsaw operators will be utilized to prepare source and receiver lines. Both source and receiver lines will be slashed to ensure there are no pokers or leaning trees for safety reasons. On board GPS on all mulching equipment ensures accurate line placement and automatic notifications are sent to management when the mechanical equipment is approaching an area of concern, or stations that are encroaching any buffered zones or areas. Lines will be doglegged or bent from any access point to avoid creation of a line of site and will meander to avoid disturbance of any timber larger than 20 to 30 centimetres in diameter. Source lines will be 3.0 metres wide to accommodate vehicles. A minimum of 20 centimetres of packed snow will be left on line to avoid possible damage to vegetation or permafrost. Receiver lines will be 1.75 metres wide to accommodate personnel.

Survey

After source and receiver lines are prepared, surveyors travel the source lines to mark the location of where the low-impact seismic drills will create the source points, and the receiver lines to mark where the recording crew will place the wireless recording equipment. They do this using GPS which allows for meandering and narrow lines.

Source Point Preparation

Source point holes 9 m in depth and 10 cm in diameter will be drilled every 60 m along the source lines using a small, low-impact seismic air hammer drill. A charge of one kilogram of dynamite is then loaded into the hole to be detonated by the recording crew. Dynamite is transported and stored at one of the staging sites in a federally regulated Explosives Magazine.

Recording

With the use of a long line and helibags, a helicopter will place and retrieve recording equipment at pre-determined intervals along the receiver lines. Recording personnel will access the equipment in the helibags and will place a series of geophones every 60 m along the receiver lines. The recording crew will be using a cable-less recording system. Cable-less recording systems are ideal for gathering seismic data because they reduce the constraints on geophone placement, eliminate downtime for cable repair, and reduces the impact on the environment. The geophones record the vibration created by the charges being detonated on the source lines. The data that is recorded is relayed to the observer truck. Once the data is relayed, personnel and helicopter return to retrieve the equipment and any debris used to mark the surveyed receiver and source locations.

The helicopter will be based out of the camp and the use of the helicopter will be minimal. The Proponent will follow the Flying in Caribou Country guide. Helipads will be built for safety and medevac reasons.

Access Trails/Creek Crossings

For safety reasons, vehicular and personnel movement a minimal amount of access trails will be required within the program area. This will be done on existing trails, historical seismic lines or lines that will also be used for source lines and receiver lines. The width of the access trails will be a maximum width of 5.5 metres wide and will also have a minimum of 20 centimetres of packed snow.

1.3.3 Accessory Project Components

The following activities are expected to be completed, as required, to support the principal activity of drilling completing, and testing exploration wells:

- Well site(s) preparation
- Other Project Facilities (i.e., camps and fuel storage)
- Some surface facilities (e.g., storage, processing, injections)
- Airstrip construction and operations, and 2 fixed-wing aircraft flights per week
- Building and maintenance of access roads (all-season and winter roads)
- Development of borrow sources for airstrip and roads
- Water use for drilling and camp

For drilling: Camp 325 will be the main accommodation facility for the exploration program. The Chance Rig #1 will also have a smaller mobile camp, occupied 24 hours per day, 7 days per week, to house essential personnel (rig supervisors, medic, geologist, etc.).

1.3.3.1 Access Roads

Assuming all wells are successful, all-season roads will then be required to access all 30 wells. Access to wells that are proximate to the Dempster Highway , drilled in proximity, or enroute to a successful well will have all-season access built to them. Wells undergoing EFTs, including the legacy suspended wells located on the Chance Significant Discovery Licence, will require all-season access. The Chance Road will be established as an all-season road regardless of the results of the drilling program.

After drilling several wells and depending on success in discovering hydrocarbon-bearing formations, access roads will be upgraded to all-season roads constructed from rock material from borrow fill sites. The diagram below, prepared by Boreal Engineering Ltd., illustrates a typical road construction design. The pad will be constructed to be approximately 7 m in width, sufficient for safely accommodating a transport truck, but also having roadside passing areas to allow 2 trucks to pass beside one another. Passing bays will likely have frequency of 1 approximately every 750 m allowing vehicles coming from opposite directions to have a clear view and prepare to enter the nearest passing area on their side of the road.

The estimated distance between pull outs to be 1 km; however, they should occur as/when required when the roads winds and visibility for oncoming traffic is impaired. Pullouts will be 150 m long, at inter-visible locations and identified with signs indicating the km / station. It is intended that the maximum distance between pullouts will be 1 000 m; however, they may be as close as 300 m to provide a passing lane to ensure that pullouts are inter-visible. The purpose is that if a vehicle were on the road without radio control, a widened road would be available for passing transport trucks. For the purpose of volume calculations, it is estimated that average distance between pullouts will be 750 m. Well site access roads would, in turn, also be constructed using a similar design.

The base road pad will be ultimately covered with a sandy material for protection of the road surface and endurance. All-season roads will require periodic maintenance as surface material is removed or eroded by the elements or vehicular traffic.

Winter road construction will utilize similar techniques as previously applied. Once snow cover equals or exceeds 10 cm there should be adequate snow to build winter roads. Well site access roads will also be constructed in a similar fashion using accumulated snow to construct berms on the road margins and filling the space between with amounts of snow and water trucked from approved sources. All roads will be supervised by a competent and qualified geotechnical engineer to ensure their ability to safely support the drilling rig and other similar heavy loads that will be transported across them.

Water Crossings

The access routes are designed to have as few water crossings as possible by following previously travelled trails and roads located on ridges or higher areas well above the water drainage valleys in between. The normal techniques applied when constructing water crossings is to lay a culvert of a sufficient outside diameter as to not reduce or obstruct the water flow, nor impeded fish movement along the water course. To this end, the Proponent has directed that water crossings must meet all the Yukon Government land use and transportation requirements.

Culverts will be installed per the Yukon Government Highways and Public Works standard drawing for culverts in permafrost conditions. Culverts will be installed using standard engineering practice in permafrost areas and per the attached Yukon Government standard drawing 06010-5. Culverts will be sized following a hydrological assessment by a Professional Engineer registered in Yukon to determine flow volumes. Culverts will be sized accordingly to the 100-year return event. Minimum culvert size will be 600 millimetres (mm). Culvert installation methods will follow those methods provided by *Best Management Practices for Contractors and Inspectors* handbook. The hydrological assessment is necessary to determine the stream flow for culvert sizes of each water crossing. The Alaska document urges the understanding and appreciation for the thermal effects of standing and running water because water can initiate thaw settlement and erosion that can destroy the road.

It is recommended that “the velocity and volume of water running beside the toe of a road should be carefully evaluated, providing for a series of culverts, rather than large culverts at discrete intervals rather than large culverts at great distances” (Author year) The Guidelines further recommend “Culverts should be considered in three distinct phases: 1) during the original deployment, 2) during the first summer after snow is gone and actual drainage cane be seen and reassessed and 3) in subsequent summers when perhaps the roadway and culverts have settled or other factors have influenced their effectiveness” (Author year).

The Proponent will commission a fully qualified road Arctic construction organization currently operating in Yukon who are versed in the construction techniques applied to remote areas as Eagle Plains.

Water courses will not be diverted. A culvert will be installed within the flow path of the stream. Following completion of the culvert installation, water will be directed through the culvert prior to placement of fill for road construction. Following closure of the road, the culvert will be removed and the water course will be returned to its natural state.

MBC Sump Access Road

The Proponent also proposes to construct a 400 m all-season access road to MBC sump area (Error! Reference source not found.). This road will be constructed as early in Project as possible (soon after mid-

January as snow and weather permit) and will take approximately 2 weeks to complete. The minority of the road follows an existing access trail, and no major clearing will be required. Please see photos of access and terrain. The road does not span any waterways and is 800 m away from the nearest water drainage. The road dimensions will be approximately 400 m long by 6 m wide. The material used for road construction will be approximately 3,000 m³ of locally sourced granular material.

Well Site Access – Summer

All material used for road construction will be locally sourced granular material. Materials utilized will be those approved for use as a road construction material. Several identified borrow sites have been cored and evaluated for quality and quantity of fill material by geotechnical engineers from Tetra Tech/EBA and Yukon Engineering Services. Kryotek Engineering and Boreal Engineering have also been consulted for expert advice regarding Arctic road construction techniques in Yukon. A combination of the previously mentioned engineering organizations will be contracted to undertake road design, construction, and general project management. The construction of a summer access road will be completed as described above.

Well Site Access – Winter

Winter access will only be constructed if the ground and water bodies are frozen and if there is adequate snow coverage. The Proponent will ensure there is a minimum packed snow cover of 10 cm to the vegetation layer. Where required, an increased snow depth will be maintained to avoid disturbing surface vegetation and duff (i.e., tussock terrain).

The factors that will be considered while making the determination will be terrain features, vegetation present, and local topography. If this snow depth (minimum of 10 cm) is not sufficient in certain areas, additional snow depth will be ensured to provide adequate protection to surface vegetation and duff (i.e., tussock terrain). If this is required, snow will be removed from appropriate locations in the direct vicinity of the winter road (i.e., surrounding areas that have ample snow coverage) and added to the snow pack on the winter road. Vegetation will be cut, with no disturbances to the vegetation mat. Access routes will be constructed using equipment appropriate for packing snow.

Several water bodies may require ice bridges/snow construction. All water bodies will be treated as fish-bearing and will be constructed as per Fisheries and Oceans Canada's (DFO's) Operational Statement on Ice Bridges and Snowfill (http://www.pac.dfo-mpo.gc.ca/habitat/oseo /icebridge-pontsduglace-eng.htm) as well as the Safety Guide for Operations over Ice. As well, if water is required to be withdrawn from nearby water sources, adequately sized intakes will be used and screened to prevent debris blockage and fish mortality (refer to DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 1995).

A minimum snowpack of 10 cm is required for the winter road. However, if the amount of snowfall in the area allows for a thicker snowpack (i.e. 15 cm to 20 cm) during initial road construction, a thicker snowpack will be used. As the winter progresses, the Proponent will continue to add to the snowpack.

If natural snowfall is below the minimum required to commence access and well site construction, the Proponent will consider artificially making snow to make up the shortfall. This is a contingent consideration and could require up to 300 m³ of water per day for a short period of time (several days to a week) if more than 1 access route is under construction at any given time. The sources of water are likely to include the

Eagle River, the Ogilvie River, and the water well at Chance's camp once proper treatment facilities are in place. The water to be used to make snow and ice the winter road(s) will be trucked from the source to the point of use. At maximum, between 20 and 30 truckloads per day would be needed. The actual number of trucks being used would be less since a truck can probably complete 4 to 6 deliveries per day. Generally low snowpack is only an issue during the early part of winter, so this provision would only apply on a contingent basis during the months of November, December, and January. The timing for making artificial snow will depend on how late in the winter season winter road construction begins. If, for example, in late December there is little or no snow fall or snow accumulation on the ground, snow making could ensure a sufficient snow base to commence winter road construction. Snow can only be made when the ambient temperature drops to 0 degrees (°) Centigrade.

Access Road Maintenance

Maintenance will involve grading and filling to ensure a smooth travelling surface, cleaning/maintenance of drainage structures, snow removal in winter, and to ensure signage remains suitable for service. Maintenance equipment will include a road grader, a mid-size (D6) dozer, trucks to haul aggregate, and an excavator for maintenance of drainage structures. Maintenance of winter access routes may include low-ground-pressure vehicles, a road grader equipped with a wing snow plow, some water application, and use of matting where required. Grading may be required over certain stretches of the routes, and depressions along the roads will be filled with snow to smooth the surface. If required, water will be withdrawn from approved water sources using adequately sized intakes and screened to prevent debris blockage and fish mortality; refer to DFO's Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 1995). The Proponent will avoid using small streams as a water source. Should winter access roads convert to all-season roads, maintenance will be ongoing to ensure road safety and reliability. This will be especially valid when wells are transformed into extended flow sites and require constant year-round access for operational reasons. Road repair and maintenance for all-season roads will require additional machinery, specified and supplied by the selected qualified contractor.

Dust will be kept to a minimum by enforcing reduced speeds on access roads. Dust will also be kept to a minimum by spraying the road surfaces with water whenever they become too dry; some fine airborne dust may become deposited on the surrounding vegetation. The small quantities of fine dust should not cause vegetation to be affected but periodic visual inspections will be made to check for any visible changes to the surrounding areas.

1.3.3.2 Borrow Source Development

Borrow material will be required for the Project for activities such as road and well pad construction. Approximately 21,600 m^3 of borrow material will be needed per well site. The borrow material will come from the closest approved borrow site. In total, the Proponent anticipates requiring up to approximately 1.7 million m^3 of borrow material for the Project.

Borrow Pit locations will be confirmed throughout drilling proposed locations and are identified in **Figure 1.10** and **Table 1.4**. To eliminate any water pooling, borrow pit design and development will be done in the winter while ground is frozen. Borrow pit access roads will be built to the same standards as the main access roads. Timing of construction is for 2016 winter season.

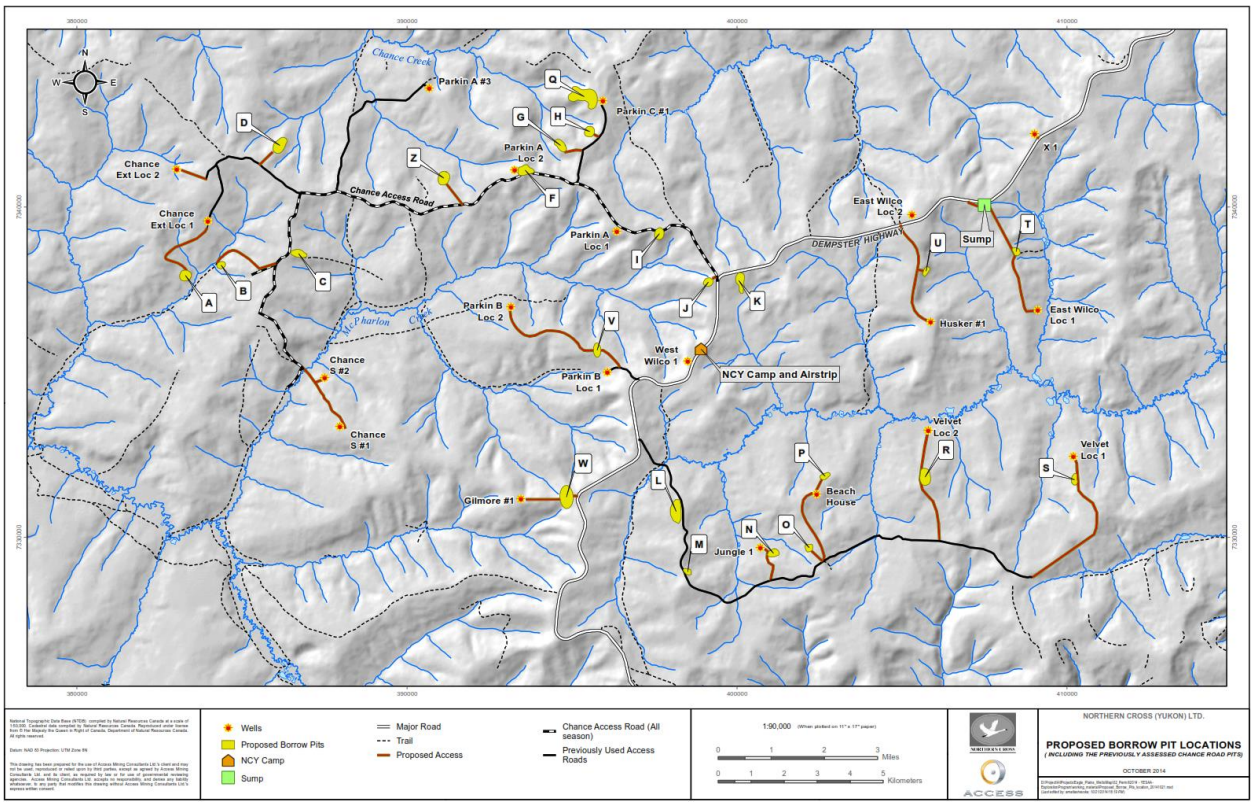

Figure 1.10 Borrow Pit Locations

The Proponent intends that initial access to each well site will be acquired through winter construction of an ice road and placement of rig matting for drilling the well. If the well is successful in finding testable hydrocarbons and it is determined that flow testing will take place, an all-weather road will be constructed. Design and construction of each all-weather access road will only occur once the well has been drilled and a determination has been made whether flow testing will take place. Details of the design of each specific access road including sources, volumes, lifespan, environmental conditions, and closure planning will be provided to regulators prior to construction.

Materials for construction of the access roads will be sourced by drilling the alignment of the proposed access road to each well site to determine the depth of overburden and the geotechnical properties of the bedrock (sand/silt stone, shale, etc.). The general trend has been that those areas higher in elevation along ridges and the crests of hills have less depth of overburden, so materials will be sourced in those locations. There may be a requirement (if the overburden is too deep along the alignment) to source materials from a borrow source off alignment. Access roads will require 15 m³ per m of road constructed plus pullout and drill pad requirements.

The borrow site locations were determined using lithological data gathered from the shot holes drilled as part of the 2014 3D seismic program. Borrow sites will be accessed in March to April of 2021 when sufficient well results are known to merit access. Summer access could be anytime from May to October any year. Fill sources will be located along the road alignment at those locations identified through drilling at which

lesser amounts of overburden will be required to be excavated. The potential life span of the access will be determined by the drilling and any EFT results. The access life span has the potential to be as long as the life of the well. The closure plan will follow the previously submitted plan. Subject to road design, drill samples will be identified to determine the depth of bedrock of the borrow sources adjacent to the proposed road alignment, and information will be taken from the 3D seismic program.

Organic cover will be removed, and stockpiled for reclamation purposes, using a large crawler tractor. Underlying silts will be excavated by ripping and dozing with a large tractor and stock piled separately for reclamation purposes. Bedrock that consists of siltstone and sandstone or shale (depending on the difficulty of using large equipment, it may be necessary to drill and blast) will be excavated with large excavator and or dozer. The excavated material will be loaded directly from the borrow pit for use in the construction of roads. There will be no water pooling; borrow sources will be constructed to prevent water pooling. Any blasting will be performed by a certified experienced blaster according to all applicable Yukon regulations. The necessary metal sulphides required for acid rock drainage are not present because the borrow sites contain sedimentary rock. To date, acid rock is not known to exist in the Eagle Plains area.

For the purpose of the current assessment the following volumes are expected to be sourced, with the preference to source materials along the alignment. (See **Figure 1.10** and **Table 1.4**).

Borrow sources will be decommissioned when the Proponent deems them no longer useful or necessary for the Project. Decommissioning is described in **Section 1.3.4.2** and will be carried out in accordance with the Decommissioning Plan.

Table 1.4 Borrow Source Material Required and Areas of Disturbance

Length and Volume of Pads and Roads

	Length	Volume	Pullouts	Well Sites	Totals	Borrow Source
Chance rd to Parkin A Loc 1	370	5550	0	21,600	27150	
Chance rd to Parkin C	2950	44250	1770	21,600	67620	
Chance rd to Parkin A Loc 2	450	6750	0	21,600	28350	
Chance rd to Parkin A	4950	74250	2970	21,600	98820	
Chance rd to Chance Ext Loc 2	4500	67500	2700	21,600	91800	
Chance Ext Loc 2 rd to Chance Ext Loc 1	1950	29250	1170	21,600	52020	
Chance rd to Chance S	3200	48000	1920	21,600	71520	
Dempster hwy to Parkin B Loc 2	5350	80250	3210	21,600	105060	V
Parkin B Loc 2 rd to Parkin B Loc 1	550	8250	0	21,600	29850	V
Dempster hwy to Gilmore	1700	25500	1020	21,600	48120	W
Dempster hwy to Velvet Loc 1	19250	288750	11550	21,600	321900	S,R,N,M,L
Velvet Loc 1 rd to Velvet Loc 2	3700	55500	2220	21,600	79320	R
Velvet Loc 1 rd to Beach House	2600	39000	1560	21,600	62160	O
Velvet Loc 1 rd to Jungle 1	1100	16500	660	21,600	38760	N
Dempster hwy to Husker	3500	52500	2100	21,600	76200	U
Dempster hwy to East Wilco Loc 1	4000	60000	2400	21,600	84000	T
Dempster hwy to West Wilco 1	0	0	0	0	0	
Dempster hwy to East Wilco Loc 2	100	1500	0	21,600	23100	U,K
Dempster hwy to X-1	250	3750	0	21,600	25350	T
Chance Road	21400	321000	12840	21,600	355440	
Totals	**81870**	**1228050**	**48090**	**410,400**	**1686540**	

Area of disturbance

	Length	Road	Pullouts	Well Sites	Borrow	Totals
Chance rd to Parkin A Loc 1	350	4550	0	14,400.00	925	19875
Chance rd to Parkin C	2950	38350	1180	14,400.00	7375	61305
Chance rd to Parkin A Loc 2	450	5850	0	14,400.00	1125	21375
Chance rd to Parkin A	4950	64350	1980	14,400.00	12375	93105
Chance rd to Chance Ext Loc 2	4500	58500	1800	14,400.00	11250	85950
Chance Ext Loc 2 rd to Chance Ext Loc 1	1950	25350	780	14,400.00	4875	45405
Chance rd to Chance S	3200	41600	1280	14,400.00	8000	65280
Dempster hwy to Parkin B Loc 2	5350	69550	2140	14,400.00	13375	99465
Parkin B Loc 2 rd to Parkin B Loc 1	550	7150	0	14,400.00	1375	22925
Dempster hwy to Gilmore	1700	22100	680	14,400.00	4250	41430
Dempster hwy to Velvet Loc 1	19250	250250	7700	14,400.00	48125	320475
Velvet Loc 1 rd to Velvet Loc 2	3700	48100	1480	14,400.00	9250	73230
Velvet Loc 1 rd to Beach House	2600	33800	1040	14,400.00	6500	55740
Velvet Loc 1 rd to Jungle 1	1100	14300	440	14,400.00	2750	31890
Dempster hwy to Husker	3500	45500	1400	14,400.00	8750	70050
Dempster hwy to East Wilco Loc 1	4000	52000	1600	14,400.00	10000	15950
Dempster hwy to West Wilco 1	0	0	0	0.00	0	0
East Wilco Loc 2	100	1300	0	14,400.00	250	15950
Dempster hwy to X-1	250	3250	0	14,400.00	625	18275
Chance Road	21400	278200	8560	14,400.00	53500	354660
Totals	**81850**	**1064050**	**32060**	**273600**	**204675**	**1512335**

Borrow Source Volumes from East side of Dempster

Borrow Pit	Volume	Areas	Roads
L	45,000	6,000	Dempster to Velvet 1 - 3 km
M	30,000	4,000	Dempster to Velvet 1 - 2 km
N	111,600	14,000	Velvet 1 road to Jungle 1 - 1.1 km plus Dempster to Velvet 1 road - 4 km
O	54,600	7,000	Velvet 1 road to Beach House - 2.6 km plus pit access 200m
P	4,500	5,000	Used if necessary, 300 m of acces to pit
R	142,000	18,000	Velvet 1 road to Velvet 2 - 3.7 km plus Dempster to Velvet road - 4.2 km
S	111,600	14,000	Dempster to Velvet 1 Road - 6 km
T	116,950	15,000	Dempster to East Wilco plus Dempster to X-1
U	60,000	8,000	Dempster to Husker plus 500 m pit access
V	135,000	17,000	Dempster to Parkin B Loc 2 plus Parkin B road to Parkin A
W	48,000	6,000	Dempster to Gilmore 1

*All volumes, areas and distances are in metres

1.3.3.3 Central Processing Facility

The camp's Central Processing Facility (CPF) will comprise additional multi-stage and multi-phase separators, heater treaters (to help remove remaining amounts of emulsified formation water), vapour and gas collection system, and possibly central power generation facility to power all discrete well batteries. Separated water will be further treated to remove any hydrocarbons, scale, anaerobic bacteria, and other colloidal or suspended solids ready for disposal in a suspended well nearby following in a pre-approved process. The CPF will be located at the furthest (southernmost) point away from the camp for safety of the camp and its occupants. Having the CPF at the far end of the camp area will ensure trucks can turn around and exit safely without encroaching on any other activity or building. This should also ensure the camp remains upwind from the CPF.

The CPF will have enough storage to contain produced crude oil for loading onto longer distance trucks ("B" trains) and hauling to a pre-approved market site in British Columbia, Alberta, or possibly Alaska. It is estimated that the CFP will accommodate approximately 10 days of storage capacity for crude oil at an approximate daily rate of 2,000 barrels of oil per day or total 20,000 barrels. The volume (stored in up to 5 surface tanks in full compliance with Yukon and Canadian standards and regulations) also ensures the safe crude stabilization before loading onto southbound trucks. In terms of maintenance, the only treatments appearing necessary at this stage of design are fluid separation (to separate oil from gas and water into 3 distinct streams), heat treating the crude to remove water remnants from the separated crude, and gas dehydration to make the gas useable as a fuel.

1.3.3.4 Airstrip

The Proponent will construct an airstrip located along the existing Chance winter trail at a location approximately 4 km off the Dempster Highway. The airstrip will be approximately 1,500 m long and will be part of the road network west of the Dempster Highway. In the early years of the Project, this airstrip will likely be used only during the winter, but could graduate to year-round usage if discoveries support the investment. Until the Chance road airstrip becomes serviceable each winter, or at the end of the winter season operations when trail conditions deteriorate, the Proponent will continue to use the Dempster Highway adjacent to the camp as a periodic airstrip.

1.3.3.5 Transportation

For the majority of the exploration program, the Proponent will attempt to limit traffic on the winter access roads to authorized personnel. Traffic will include approximately 8 to 9 light-weight service trucks (for supplies and personnel), 1 water truck, and one fuel truck. The fuel and water trucks will come to the Project site approximately once per week or as demand dictates, and there will be occasional transport of drill cuttings from the well sites to the sump location. Air traffic estimated at 2 flights in/out per week (normal arrival times from approximately 10:30 a.m. to 12:00 p.m.).

A majority of the traffic volume will be related to mobilizing the drill rig and constructing the site infrastructure. As mentioned above, the setup of the well sites will take approximately 5 days to complete. Included in this amount, the drill rig will require 15 to 20 loads to mobilize. Unauthorized vehicles will not be permitted on the winter roads and the roads will be restricted from public access. The Proponent will be transporting crews using company vehicles; all vehicles will be equipped with radio communication and,

particularly during busy times (i.e., setup and demobilization), traffic will be radio controlled. For safety reasons, any personnel accessing the areas (i.e., winter roads) will be required to notify appropriate staff (i.e., security personnel and/or managers/supervisors) when they leave the Dempster Highway and when they arrive at the well sites. Access to the winter roads will be monitored by Chance staff hired as wildlife monitors/ security personnel.

A typical description of road traffic during the prime operating periods (January 1 to April 15; May 1 to December 1) is presented in **Table 1.5** below and road users will follow the Operations Activity Schedule introduced in **Section 1.4**.

Table 1.5 Typical Road Traffic during Prime Operating Hours

Table 3-4 Typical Road Traffic During Prime Operating

	Activity Description	Peak Traffic	Normal Traffic
1	Early Season Mobilization (Winter)	High	Medium
2	Rig Mobilization (Winter)	Very High	Medium
3	Winter Operating (Drilling)	Very High/High	Medium
4	Access Road Construction (Winter)	Very High	Medium
5	Summer Mobilization	Very High	Medium
6	Summer Rig Mobilization	Very High	Medium
7	Summer Normal Operating (Drilling)	Medium/High	Medium
8	Extended Testing Winter	High/Medium	Light
9	Extended Flow Testing Summer	Medium	Light

LEGEND:

Very High	More than 50 vehicles per 24 hour day
High Traffic	50 or more vehicles per 24 hour day
Medium Traffic	20-50 vehicles per 24 hour day
Light Traffic	Less than 20 vehicles per 24 hour day

The Proponent expects exploration drilling operations activities will range between medium and light traffic volumes. Crude oil produced during the flow-testing phases of exploration work, as described in this document, will be transported to an acceptable market.

Trucking of a stabilized crude cargo in specially constructed transporting tanks presents the same risk as transporting the diesel fuel required and used in Yukon. The process of loading and dispatching trucks at regular intervals will be planned and handled by professionals who will also maintain constant communication and GPS tracking of trucks as they travel down the Dempster and on other connecting routes to their destination. Trucking is by nature a very controlled process. Truck drivers are only permitted a fixed number of driving hours per 24-hour period and are expected to stop for refresher breaks at regular intervals. All their movements are accurately tracked through their onboard GPS, which can provide any truck's location to within a few metres anywhere in Canada or the USA.

The Proponent has practised Journey Management on its previous exploration drilling work at Eagle Plains. In this instance, any unit transporting materials to Chance's camp 325 will be called and tracked periodically by its company dispatcher. The exact location when reaching certain pre-determined check points will be relayed to Chance camp management and Logistics coordinator; this will ensure road safety for the truck driver and other road users and safety of the vital cargo and provides critical planning information for receiving staff to plan for offloading its cargo and possibly loading backhauls.

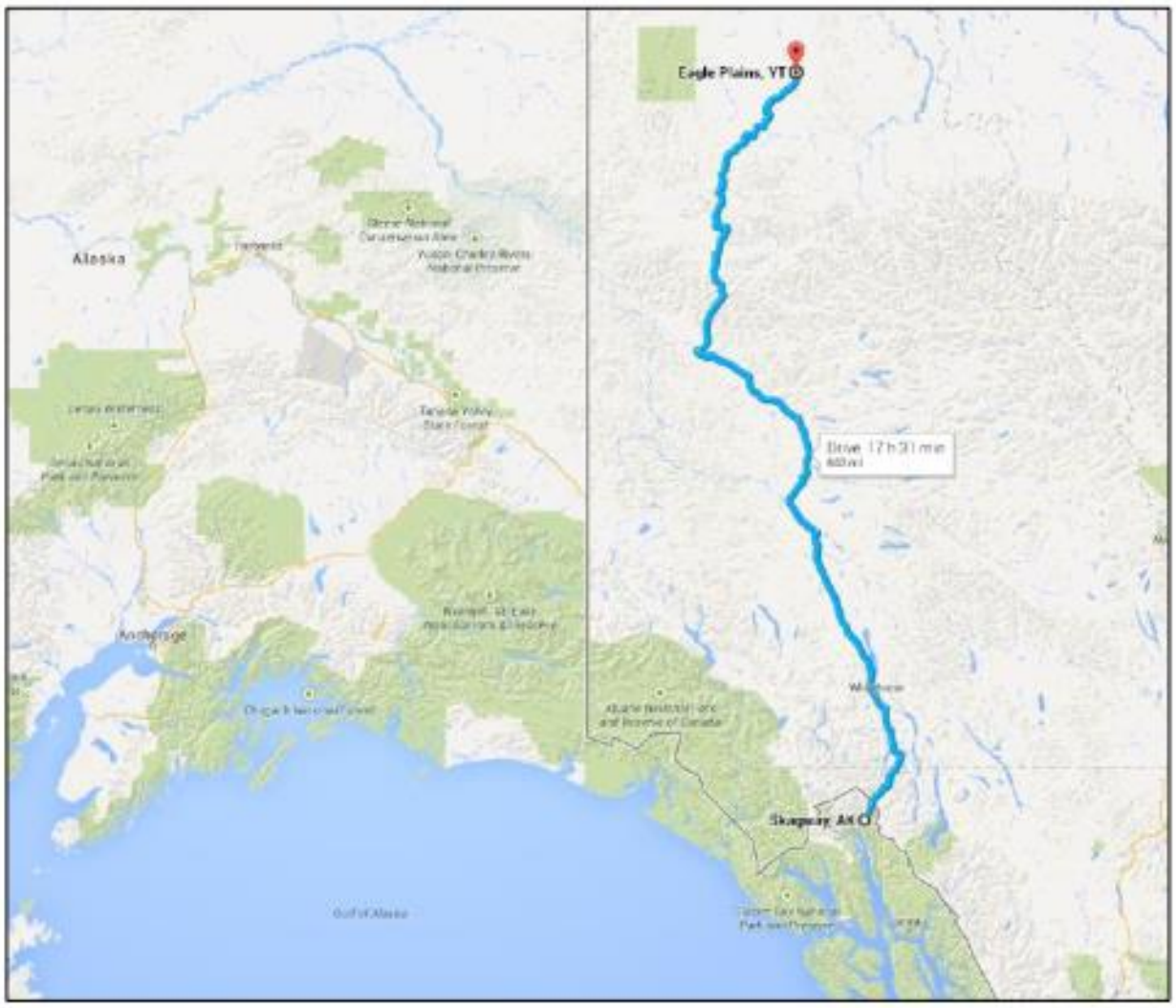

Figure 1.11 Typical Export Truck Route to Skagway, Alaska

Figure 1.11 illustrates one of the possible export truck routes to Skagway Alaska. The journey distance is 1,029 km from Eagle Plains to Skagway. The journey duration is approximately 17.5 hours driving at an average speed 59 km/hr. Other options exist, which include delivery by truck to terminals in Fort Nelson and Fort St. John, British Columbia, or Grand Prairie, Alberta. Depending on which of these options is used, the driving times will vary but the management procedures will remain the same.

The Proponent and its trucking contractor(s) will develop and Alert and Emergency Response Plan to address any incident or accident while in transit on Yukon roads and highways. The same plan will also address any other Provincial routes and routes within the United States border. All reputable trucking contractors versed with transporting flammable liquids and petroleum products in general are mandated to follow the Transportation of Dangerous Goods Federal Legislation. The legislation dictates such activities as how truck contents are identified on the outside of the tank; how the tank is installed on the truck body and strengthened; the level of knowledge and training the driver and any assistant travelling with them must

have to be eligible to operate the particular truck; and the spill response equipment needed to be readily available. Ensuring the truck is safety-checked and the drivers are qualified and adheres to their company's safety policies are the key means of preventing an incident or accident. Tracking the drivers to check on transit speed on a real-time basis means the truck's progress is never neglected and the driver is on notice to observe all road traffic rules at all times.

All incidents affecting the Proponent's trucking contractor are reported back to Chance Operations Management and form part of the Proponent's safety statistics. Every incident is investigated and the causes for each occurrence are closely analyzed and discussed with the truck owner. Should any trucking contractor exhibit an undue number of close calls/near misses or a series of incidents with the same causes, they would be removed from the contract without delay and replaced with a more competent and safety-minded contractor.

1.3.3.6 Workforce

Work force requirements will vary over the life of the Project and will ultimately be limited by the existing camp capacity. During past drilling and seismic exploration programs undertaken between 2012 and 2014, the Proponent had no more than 75 to 80 people onsite at any one time. During drilling, the Proponent operated on a 24-hour clock with a 20-day-on and 10-day-off crew rotation cycle, which means that one-third of the crew was off duty at any point in time. For the seismic exploration program, the Proponent operated on a 12-hour clock and cycled the various services through as the program unfolded with only limited crew changes, mostly connected with the camp catering operation.

The Proponent has an arrangement with Northern First Nation groups and will have time to define their involvement to participate during this exploration program. It is Chance's objective to provide all available work and contracts to its FN/Yukon partners as identified in sec. 68 of YOGA. Chance was successful during its last drilling/seismic program hiring a workforce from the communities from Old Crow, Fort McPherson, Dawson, Whitehorse, and Inuvik.

1.3.4 Reclamation and Closure

1.3.4.1 MBC Sump Site Reclamation

Before the MBC Sump disposal site is opened, the top soil and the vegetative layer will be removed and stored separately from the lower subsoils. This material will then be re-applied after the MBC Sump has been covered by the 1 m of unmixed subsoil. This will bring the disturbed area back to its equivalent land capability. No further reclamation plan is warranted. The standard Directive 050 Drilling Waste Management (D50) plan (AER 2016) of action entails the following:

- The environmental monitor must be onsite during drilling to conduct D50 sampling to ensure that drilling waste is compliant and accurate records are being kept and respond to any spills that may occur.
- The environmental monitor will sample pre- and post-MBC.
- Upon completion of the Project, remote disposal locations will be covered with a minimum of 1.0 m of capping material and contoured to meet background topography.

- A Phase 1 Environmental Site Assessment (ESA) will be completed for each well and corresponding remote MBC location to identify any potential areas of environmental concern.
- If the Phase 1 ESA triggers a Phase 2 ESA, soil samples will be collected and analyzed at an accredited laboratory.
- If contamination is identified, a Remediation Action Plan will be prepared and upon approval, the remedial program will be completed. Once all contamination is addressed either in the Phase 1 ESA, Phase 2 ESA, or Remediation, a surface program including soil and vegetation will be conducted.
- Once vegetation is established, a Detailed Site Assessment; comparing soil lithology and vegetation onsite to offsite) will be completed.

For clarification, environmental monitors will be sampling the following, as per ref AER DIR 50; table 13.1 of this directive lists the Testing Requirements (AER 2016):

1. Receiving soil
    a. Electrical conductivity and sodium adsorption ratio
2. Waste (solids or total waste)
    a. pH, electrical conductivity, sodium adsorption ratio, Sodium (Na)
    b. Nitrogen (N), if additives/products added to the drilling mud/waste system contain any amount of N or if N content was unknown
    c. metals, if concentrations exceeding limits were added to the drilling mud system or if the metal content of additives/products is not known
    d. hydrocarbons, if a hydrocarbon flag was encountered
    e. toxicity, if toxicity data are unknown for any of the mud additives/ products used in the drilling mud system or if concentrations used exceeded pass threshold for luminescent bacteria toxicity test
3. Waste/soil mix (post-disposal)
    a. EC, SAR, and Na, if drilling waste EC > 10 dS/m or Na > 3000 mg/L (saturated paste extract or filtrate from oversaturated waste)
    b. metals, if concentrations in drilling waste exceed concentrations listed
    c. hydrocarbons, if concentrations in the drilling waste exceed concentrations
    d. N, if the nitrogen concentration in the drilling waste (wet weight) is ≥6 mg/kg for disposals in coarse soil or ≥120 mg/kg for disposals in fine soil.

Furthermore, in terms of soil sampling, commencing operations in winter does not necessarily mean sampling would not be possible or even preferable. Sampling can also be accomplished from the surface snow deposits around the well site. The Proponent selected lease dimensions to ensure there is a sizable perimeter for full containment of generated or airborne wastes from the Project.

The first task on any well site would be to construct the well pad or prepare the surface on which matting could be safely placed. The next step is to lay the mats on previously densified/well-trodden surface to render the suface as flat as possible. The final process, before deploying the drilling equipment, would be to undertake a professional geotechnical check on the stability of the surface and its resultant ability to

support the maximum anticipated loads with a suitable safety factor. Finally, the geotechnical engineer will provide a signed/stamped report attesting to the stability and strength of the facility for the work contemplated.

1.3.4.2 Well Decommissioning and Abandonment

As previously mentioned, the 30 proposed wells are part of an exploration program to help determine the oil and gas potential of the region. Depending on the outcome of results, a given well may be tested and additional plans developed to bring into production or be determined to be unproductive and require decommissioning and abandonment. As the Operator, Chance will always carry the full responsibility for all wells deemed to be its property. This responsibility can never be delegated to any other party unless and until such time the Proponent relinquishes ownership according to YOGA and its regulations.

Wells required for further operational uses such as producing wells, water or gas injectors will be maintained in a suspended state with an ability to be converted for use in the future. The Drilling and Production Regulations under YOGA have specific actions required from an operator to maintain a well in a suspended state; key among these actions is to periodically conduct inspections to ensure that the integrity of the well is intact. While in a suspended status, the regulator requires a sum of money be placed on deposit to cover the cost of abandonment and remediation of the site. Once abandoned, the status becomes permanent and there would not be an option to re-enter such a well.

The normal stages before decommissioning/abandonment of a well are as follows:

- The well is first determined as unusable.
- The perforations are first cemented by placing a cement plug below and above them and squeezing some amount of cement into the formations to permanently isolate them within the wellbore. A mechanical shut-off device called a bridge plug may also be wireline set above the cement plug to add protection or isolation.
- Higher in the production casing and below the estimated permafrost maximum depth, a second cement plug would be set. This plug is normally set on top of a bridge plug to ensure it does not leak down in the casing. The plug is also “felt” with a drill bit to confirm its existence and hardness.
- The casing at surface is cut 1 m below the original ground and buried under the soil to finally remediate the location entirely.
- The lease is remediated by removing fill material to restore the location to original status. The surface location would be revegetated with what is normally growing there in the first place.

When appropriate, a decommissioning/abandonment plan for the well sites will be developed that will comply with Part 7 of the Yukon Government Oil and Gas Drilling Regulations (Sections 95, 96, 97, 99). Wells would require final well abandonment according to the YOGA Drilling and Production Regulations. Wells would be sealed with cement, and casings would be cut off below ground level. The casing stubs would be buried below ground surface as required by the Regulations and a surface-visible sign would be installed for identification. The entire site will then be cleared of all debris and refuse. Finally, the site will be contoured, seeded, and left to naturally reclaim.

An outline procedure prepared by the Proponent in compliance with the YOGA Regulations is presented as follows:

- Seal off all perforations in the casings that are not already sealed with cement squeezes.
- Pressure test the casings to 7000 kilopascals (kPa) to confirm formations are isolated and sealed.
- Cut off the wellhead and casings to 1 m below ground level and weld/install plates to cover each casing string at surface.
- Install well identification marker visible above ground level.
- Bury the cut casings to complete the abandonment.

If the entire Project had to be suspended but not completed, the infrastructure would be preserved and maintained until the Project resumes. If it is decided for whatever reason to terminate the Project, then the infrastructure would be decommissioned. While operations are temporarily suspended, the Proponent will ensure access from the Dempster Highway will be barricaded and visually inspected periodically.

1.4 Project Phases and Scheduling

1.4.1 Project Schedule

The Project plan is to have all necessary permitting and approvals in place by the end of 2021 and begin drilling in December 2021. The construction of winter roads, drilling and testing of the first few wells is anticipated to occur during the winter (December to April) and summer months (May 1 to October 31), commencing in December 2021 with the first winter locations.

In the early years it is assumed that all wells will be drilled in the winter. Summer drilling might happen in future locations that are in reasonably close proximity to yet to be developed all-season access. Well priorities and their drilling order can only be best determined after the program commences and in response to drilling results and Chance corporate exploratory information gathering requirements.

The construction of the 400 m all-season access road to the MBC sump location is anticipated to occur in March 2022 and take not more than 2 weeks to complete.

The Proponent anticipates a period to elapse between confirming a discovery worthy of further evaluation and commencing the EFTs to allow time to properly design, fabricate, install, and commission the extended flow testing facilities. This period could be up to 6 months. If drilling is successful and significant hydrocarbons are discovered, the access roads would be upgraded to year-round access to undertake the EFTs. Year-round access to flowing wells is critical to daily well inspections and safety assurance of all operations.

The previously summarized scope of the Proponent’s exploration activity can be expected to start as early as December 2021 and continue over a period up to 10 years to cover the various stages of drilling and extended flow testing of the wells. The actual execution of the EFTs could be phased depending on the nature of the discovery (e.g. natural gas versus crude oil) and the capacity of the base camp and the Eagle Plains Hotel to accommodate the necessary crews. Until there is more information about discovered resources, it is impossible to predict with any precision the full duration of the flow testing program. At least 8 wells could be tested in each year.

In summary, the chronological activities can be best described as follows:

1. Complete 3D seismic processing & interpretation (Chance Exploration rank prospects and establish company exploration objectives to meet Yukon Government lease commitments and CHANCE corporate objectives for exploration)
2. All preparations completed by December 31, 2021 (Seismic, YESAB, Well Licences, Camp, rig upgrade & certify, consumables and services, geotechnical prep work)
3. Prepare first location to mobilize Chance Rig #1 (start January 1, 2022 or soon thereafter)
4. Drill & test winter wells (possibly as many as 4; suspend operations April 15th ±)
5. Prepare for summer drilling (contingent on positive drilling results); ready to construct all-season access to next drill and test targets on schedule. Subsequent wells may be predicated on encouraging well results influencing more follow-up appraisal drilling
6. Continue drilling exploration wells in the remaining prospects to build on positive previous drilling results.
7. Identify wells with positive results meriting extended flow testing to acquire in depth reservoir information.
8. Design order/fabricate well site battery processing equipment in preparation for extended flow testing of selected wells.
9. Re-enter selected wells; install completion tubulars and other accessories, Christmas trees and ready for extended flow testing.
10. Install surface pumping equipment (standard pump jack device to lift the well fluids to surface); hook up well Flowline to well site battery (separator, flare system, crude oil storage tank and water disposal tank).
11. Supervise and operate well pumping, transfer stabilized (crude that has been allowed to “age” in atmospheric storage tanks; made safer for trucking) crude from tanks to truck for transport to the camp’s Central Process Facility.
12. Construct the camp’s Central Process Facility.
13. All vapour and gas removed from the well fluids will either be used for fuel to prevent storage tanks contents from freezing, generating electricity, pumped downhole in an approved manner or flared at site.
14. Progressively more wells would be drilled and brought on stream while extended flow testing and contribute to the accumulated fluid to be removed by trucks to a suitable market.
15. During EFTs flowing information would be gathered including bottom hole pressure profiles to learn about the reservoir flow characteristics and understand more about the prospect’s full development potential.
16. Development would become the subsequent phase of continuing operations. The nature and details of that operation will be described in later submissions as per the YOGA and regulations derived from it.
17. To complete the life cycle of a well, wells drilled, evaluated, tested and completed as part of a field development plan, would be either worked over and recompleted in the event of, for example, water ingress; or, if deemed not having future production potential, would be abandoned according to the YOGA Drilling and Production Regulations. In this instance, all previously perforated producing zones would be cemented shallower cement plugs would be placed and the casing at surface cut

to 1 metre below the normal ground surface. The surface lease would be fully remediated and restored to its original state.

18. The Proponent's future operating schedule for exploratory drilling assumes a continual, year-round program in order to benefit from the economies of scale of uninterrupted operations involving several wells rather than discrete ones with breaks in between. This will also contribute to a stable employment and goods and services market for Yukon residents servicing and supplying operations at Eagle Plains.
19. EFTs involve the flowing of a well or wells. There is no human intervention while wells flow unimpeded for the duration required for the test. In a multi-well producing field, for example, a maximum of three persons can handle all the production operator tasks of a field with 50 or more producing wells (double that number if working a 24-hour day). Field production operators visit each well at least once daily unless there is a need for other demanding work. They record flowing well pressures, ensure fluid pumps operate properly, have enough fuel to continue operating and visually inspect the facility for anything out of the ordinary.
20. The Proponent plans to have three operators managing the EFT wells in any 12-hour cycle. A second set of three will form the cross-shift making a total number of operators 6.

The sequence of wells is dependent on drilling success, discovery, weather and road conditions. The Proponent is continuing the ongoing process of interpreting seismic data in order to better understand the geological setting and size/geometry of potential prospects. Each well drilled will add to that understanding.

In summary: the Proponent will drill up to 30 wells sequentially over a period of 10 years starting in 2022. If a well is successful (i.e., if there is a discovery of crude oil or natural gas in sufficient quantities) the Proponent will conduct an EFT for a period up to 2 years on that particular well. There may be EFTs on up to 20 wells depending on the success of each well. The Proponent will drill one well at a time and up to 5 wells per year. Assuming all wells are successful and EFTs are conducted for 2 years at each well, there may be up to 10 EFTs being conducted at one time.

The schedule illustrates the breakdown as it is known at this time. The maximum time is estimated to be 10 years. The schedule does not account for operations interruptions owing to weather, geological re-interpretation, equipment breakdown or other delays beyond the control of the operator. A normal rate of drilling would be to drill one well at a time during this exploratory phase.

1.4.2 Construction Phase

The mobilization and Construction Phase of the Project is expected to commence in Q4 of 2022. Key activities during the Construction Phase are summarized by Project component in **Table 1.6**.

Table 1.6 Summary of Key Construction Phase Activities

Project Activity	Key Construction Phase Activity
Tree Clearing and Grubbing	Salvage to be completed prior to construction of the well pads and portions of the access roads (winter and all-season)
Road Construction	Completed as roads are required to access facilities and well pads

Project Activity	Key Construction Phase Activity
Quarry Development	Quarries will be developed based on volume of material required to build leases and roads.
Lease Construction	Topsoil and subsoil salvage and local stockpiling
	Lease pads will be constructed on an as-needed basis using material from nearby quarries
Main Camp	Camp will be used to house drilling crew
	Construction of the Central Processing Facility
Accessory Activities	Road construction and upgrades to roads as required
	Construction of an airstrip
	Vehicle traffic related to drilling and construction activities
	Transportation of production fluids to Central Processing Facility and to market
	Follow Blasting Mitigation Plan
	Water use permit for lease and road construction
	Baseline data collection and environmental monitoring
	Monitoring and establishing erosion control features for roads, leases, and the Central Processing Facility
	Updating and following the Emergency Response and Risk Management Plans, as required
	Following a Weed Management Plan for soil stockpiles and leases
	Maintaining and snow-clearing roads and leases for all-season access

1.4.3 Operation Phase

The Operation Phase will begin in Q1 of 2022 and will continue through to the end of 2031. The key activities occurring during this phase are summarized in **Table 1.7**. This section describes the main operational activities that will occur during the Operation Phase.

Table 1.7 Summary of Key Operation Phase Activities

Project Activity	Key Operation Phase Activity
Road Construction	Upgrade roads to all-season roads, with water crossings, as required. Road maintenance will be conducted, as required
Drilling	Up to 30 pads will be constructed and drilled for oil and gas products
	Remote sump access for drilling fluid waste disposal
	Excess drilling mud to be disposed of offsite at the remote sump
	Completing drill stem tests
	Acid stimulation and completion of wells for testing
Well Testing	Facilities to be installed, as needed, for testing and extended well tests
	Routine maintenance of facilities, as needed

Project Activity	Key Operation Phase Activity
	Gas is to be flared off, and oil placed in storage tanks
	Production fluid transport to Central Processing Facility and market
Accessory Activities	Road Maintenance
	Energy may include switching power generation from diesel generators to natural gas produced from the wells
	Updating and following the Emergency Response and Risk Management Plans, as required
	Water permit use for boilers during winter drilling
	Following Weed Management Plan
	Central Processing Facility to handle production fluids, disposal fluids and fuels
	Maintaining and snow-clearing roads and leases for all-season access
	Environmental Monitoring

1.4.4 Reclamation, Abandonment and Closure Phase

Reclamation, abandonment and closure activities will be detailed in a Conceptual Reclamation and Closure Plan. A summary description of key activities is provided below for the Reclamation, Abandonment and Closure phase are described in **Table 1.8**.

Table 1.8 Summary of Key Reclamation Phase Activities

Project Activity	Key Reclamation Phase Activity
Well Abandonment	Wellheads will be abandoned when testing or production phases are complete
	Testing or production facilities are to be removed from each site
MBC Sump Site Reclamation	Site will be reclaimed as per Directive 50
Central Processing Facility	Upon complete field decommissioning activities, the removal of the Central Processing Facility will occur
Well Site Reclamation	Imported material will be removed, and area reclaimed to natural conditions, as much as possible
	Revegetation of disturbed areas to natural conditions and follow-up monitoring
Infrastructure Decommissioning	Water crossings will be removed
	Appropriate sloping and seeding to prevent erosion and scarification to encourage revegetation
Borrow Source Reclamation	To be reclaimed as soon as materials are exhausted or no longer required
	Revegetation to natural conditions and follow-up monitoring
List Accessory Activities	Discussions with YESAB (and other Regulators, as necessary) prior to reclamation work to determine whether there should be changes to the Plan
	Updating the Reclamation Plan to meet new criteria, if required
	Following Weed Management Plan until sufficient revegetation has occurred on reclaimed sites

Project Activity	Key Reclamation Phase Activity
	Annual monitoring until vegetation regrowth deemed satisfactory
	Soil Detailed Site Assessment prior to seeding
	Conduct a Phase 1 Environmental Site Assessment for each location
	Potential Phase 2 environmental assessments of soil and groundwater
	Obtain Regulatory Closure

1.5 References

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Government of Yukon. 2004. Yukon Oil and Gas Act. Oil and Gas Drilling and Production Regulations. O.I.C. 2004/158.

Fisheries and Oceans Canada (DFO). 1995. Freshwater Intake End-of-pipe Fish Screen Guidelines. ISBN 0-662-23168-6. Catalogue No. Fs23-270 / 1995E. Available at www.dfo-mpo.gc.ca/Library/223669.pdf. Accessed June 2019.

Matrix Resarch Ltd. Heritage Resource Overview Assessment for the 2013 Seismic Program, Eagle Plains, on Behalf of Northern Cross (Yukon) Limited. 2013

Yukon Environmental and Socio-economic Assessment Board (YESAB). 2005. Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions. Available at http://www.yesab.ca/wp/wp-content/uploads/2013/04/Proponents-Guide-to-Info-Requirements-for-EC-Project-Submission.pdf. Accessed June 2019.

Yukon Environmental and Socio-economic Assessment Board (YESAB). 2016. Dawson City Designated Office Evaluation Report – Eagle Plains Multi-Well Exploration Program. Project Number: 2014-0112.

APPENDIX 2-D-24. *Community Consultation Program (Proposed Activity Alignment)*

Community Consultation Program – Proposed Activity Alignment

<table>
<tr><th>Activity</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th><th>Jan</th></tr>
<tr><td rowspan="3">Proposal Preparation</td><td colspan="5">Baseline Research</td><td rowspan="3">Conceptual Management Plans</td><td rowspan="3">Final proposal preparation and review</td><td rowspan="4">Proposal Submission (end of month)</td></tr>
<tr><td></td><td colspan="4">Effects Assessment</td></tr>
<tr><td></td><td colspan="4">Traditional Knowledge Studies</td></tr>
<tr><td rowspan="2">Consultation Meetings by Topic</td><td>Project Description (June 6-11)</td><td></td><td>Valued Components</td><td>Baseline Results</td><td>Effects and Mitigation</td><td>Management Plans</td><td></td></tr>
<tr><td colspan="7">Ongoing incorporation of Consultation results into Project Proposal</td></tr>
</table>

APPENDIX 2-D-25. *Draft Annual 2019 Report on the Implementation of Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan*

Hemmera
An Ausenco Company

ANNUAL REPORT

Implementation of the Tr'ondëk Hwëch'in and Chance Oil and Gas Engagement and Communication Plan

Prepared for:

Yukon Energy, Mines and Resources
Oil and Gas Resources (K-11)
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July 31, 2019

1.0 INTRODUCTION

This report demonstrates implementation of the Tr'ondëk Hwëch'in (TH) and Chance Oil and Gas Limited (Chance) Engagement and Communication Plan (Plan) since it was finalized on August 28, 2018. Please see **Appendix A** for the Plan. This report summarizes the discussions held between TH and Chance, the purpose and objectives of each discussion, and outcomes of each discussion to fulfill the requirements of Ministerial Order (MO) 2018/ 42 issued to Chance on August 30, 2018. Please see **Appendix B** for MO 2018/ 42.

2.0 BACKGROUND

The development of communications and engagement plans began with Order in Council (OIC) 2016/ 169 that required Chance to file a First Nations communication and engagement plan with the Minister of Energy, Mines and Resources in order to extend tenure on their Northern permits, 0005, 0006, 0007, 0008, 0009, 0010, and 0011 (**see map in Appendix C**). Chance complied with OIC 2016/ 169 and received their tenure extension.

Upon applying for tenure extension on six of Chance's eight Southern permits, 0012, 0013, 0014, 0015, 0016, and 0017, Chance received MO 2017/ 37 that required Chance to revise the consultation and engagement plan filed under OIC 2016/ 169 with each affected First Nation. The affected First Nations listed in MO 2017/ 37 were Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in (TH), First Nation of Na-Cho Nyak Dun (FNNND), Gwich'in Tribal Council (GTC) and Tetlit Gwich'in Council (TGC).

Chance and TH collaboratively developed their Plan through a series of in-person meetings and conference calls. Hemmera was retained by Chance in November 2017 to facilitate the development and completion of the communications and engagement plans with each of the abovementioned First Nations and facilitated all discussions on the Plan between TH and Chance. Chance and TH submitted their finalized Plan to Minister Ranj Pillai on August 28, 2018. To complete their obligations under MO 2017/ 37, Chance filed four communications and engagement plans which were approved by the Minister and resultantly Chance received a five-year tenure extension on the six Southern permits.

With the five-year tenure extension Chance received MO 2018/ 42 which requires that Chance submit annual reports summarizing the actions taken to implement each communications and engagement plan each year.

3.0 ENGAGEMENT AND COMMUNICATION PLAN IMPLEMENTATION SUMMARY

Since completing the Plan, TH and Chance have continued to build their relationship by discussing advances in Chance's proposed oil and gas exploration project in Eagle Plain Basin along with items outlined in the Plan in Section 7.0 Adaptive Management of the Engagement and Communications Plan. In the following section, a summary is provided of all of Chance and TH meetings conducted since completing the Plan on August 28, 2018.

Chance and TH have had three in-person meetings or teleconferences which are each summarized below. Informal phone calls and emails have also been exchanged between the parties on smaller matters. The main themes of discussion between Chance and TH have been the following:

- Capacity Funding
- Confidentiality Agreement
- All-Party Meeting
- Draft Project Description and scope of activities for Chance's proposed exploration project in Eagle Plains Basin

October 23, 2018 – Teleconference Meeting

Location: Teleconference

Attendees: TH technical staff, Chance management, Hemmera facilitators

The purpose of this meeting was to initiate the implementation the Plan according to Section 7 – Adaptive Management of the Engagement and Communication Plan. This included reviewing the Draft Confidentiality Agreements presented by both TH and Chance and discussing the development of a long-term budget and a formal capacity funding agreement. In addition, Chance's upcoming project plans were also discussed.

When reviewing the Confidentiality Agreements, TH expressed that they had no significant concern with Chance's draft Confidentiality Agreement, however provided some amendments to which Chance agreed. Both parties agreed to a term for the Confidentiality Agreement, and the finalization of the draft was discussed.

Both parties discussed the need for a Capacity Funding Agreement and what this agreement should entail. TH was actioned with providing Chance an initial budget to cover engagement on implementation of the Plan. More in-depth capacity funding would be discussed once Chance was preparing a Project Proposal for the Yukon Environmental and Socio-Economic Assessment Board (YESAB) and further consultation was required.

Chance explained their near-term project plans, which would focus on small geological field studies and preparation of an exploration project proposal for YESAB to allow them to drill exploration wells and do seismic data acquisition in the Eagle Plains basin.

November 23, 2018 – Teleconference Meeting

Location: Teleconference

Attendees: TH technical staff, Chance management, Hemmera facilitators

The purpose of this meeting was to finalize the Confidentiality Agreement and Letter of Agreement for Capacity Funding, discuss the itemized budget for Capacity Funding, and to discuss the All-Party Meeting.

Regarding the Confidentiality Agreement, Chance and TH agreed to the final version; it was prepared for signing after the meeting. Regarding initial capacity funding, Chance was satisfied with the itemized budget structure and the Letter of Agreement for Capacity Funding. Chance and TH agreed that the document would be finalized and sent to TH for signing. TH will provide payment instructions to Chance for the Capacity Funding.

Chance explained that there was interest from the other First Nations for an All-Party Meeting to be held in the new year. TH emphasised the desire that the North Yukon First Nations Chiefs meet first but agreed to check internal availability and confirm by way of email. An action item for Chance after the meeting was to send a brief introduction summary of the All-Party meeting to TH to aid in their internal discussions and planning.

The key meeting outcomes were the finalization of the Confidentiality Agreement, the acceptance of the itemized budget by the Parties and the finalization of the Letter of Agreement for Capacity Funding.

June 11, 2019 – In-person Meeting

Location: Dawson City, Klondike Institute of Art and Culture

Attendees: TH technical staff, Chance management, Hemmera facilitators

The purpose of this meeting was for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin, discuss and answer questions on the proposed activities, as well as to discuss next steps in the YESAB process.

Chance presented the Draft Project Description which included the scope of activities for Chance's proposed Exploration Project in Eagle Plain Basin, the timing of activities, and where the activities would overlap with TH Traditional Territory.

Chance and TH also discussed the expected YESAB process. Hemmera explained that Chance was submitting a project proposal to the Executive Committee for screening and the expected pre-submission engagement and consultation for all First Nations.

Chance and TH agreed to review the Letter of Agreement for Capacity Funding, evaluate what funds are remaining, and confirm additional funding needed for TH to engage on the Exploration Project Proposal.

4.0 PLANS FOR ONGOING ENGAGEMENT AND NEXT STEPS

TH and Chance will continue to hold discussions at regular intervals as Chance develops their project proposal for YESAB. Upcoming engagement activities are expected to involve the following:

- Proposed meeting with TH Chief and Council to present the Draft Project Description
- Discussion on Capacity Funding to enable TH to engage on the Exploration Project Proposal for YESAB
- Meetings between TH technical staff and technical consultants preparing the project proposal
- Community consultation events in Dawson City

5.0 APPROVAL OF IMPLEMENTATION SUMMARY

TH and Chance have reviewed this report and agree to its contents as an accurate summary of the engagement and consultation meetings executed since the completion of the Plan.

Per: Tr'ondëk Hwëch'in

Sidney Schafrik, Senior Advisor, Mining and Strategic Initiatives

Dated: July 29 / 2019

Per: Chance Oil and Gas Limited

Cindy Dickson, Regulatory, Environmental and Community Relations Coordinator

Dated: July 5/2019

APPENDIX A

Tr'ondëk Hwëch'in and Chance Oil and Gas Limited
Engagement and Communication Plan

[Insert Tr'ondëk Hwëch'in Logo]

Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan

1.0 Introduction

Chance Oil and Gas Limited (Chance) is an oil and gas exploration company that holds permits to perform oil and gas exploration activities in the Eagle Plain basin of Yukon Territory, Canada. As part of Chance's exploration program, Chance seeks to develop engagement and communication plans with all the First Nations that are potentially affected by Chance's exploration program activities. Permits 15 and 17 fall partially within Tr'ondëk Hwëch'in Traditional Territory and Chance is seeking to engage Tr'ondëk Hwëch'in (TH) on its activities within these permits.

2.0 Purpose

This document serves as an Engagement and Communication Plan (Plan) to provide a mutually agreed upon framework to support collaborative and effective engagement and communication between Chance and TH now and into the future.

3.0 Relationship

Chance and TH will execute this Plan according to the following principles:

- Transparency and openness;
- Timeliness;
- Integrity;
- Adaptive Management;
- Mutual respect; and
- Working towards trust and understanding of one another.

4.0 Key Tr'ondëk Hwëch'in and Chance Connections

Engagement and communication between Chance and TH will be generally associated with the proposed work and potential effects associated with Chance's oil and gas exploration program and potential opportunities (via training, employment, contracting, and other community investments), as well as any topics or issues identified through engagement and communication associated with Chance's proposed activities. This section of the Plan identifies the key contacts related to these overarching engagement and communication themes. Key representatives involved in engagement and communication are expected to be as follows:

- Chief and Council;
- TH Government department officials and advisors;
- TH Business Development agencies;
- TH Citizens and communities at large; and
- Proponent Management and designated staff and advisors.

The table in the Schedule to this Plan lays out the key engagement and communication topics, in no particular order, and associated key contacts for both Chance and TH.

5.0 Engagement and Communication Methods

Chance and TH will employ the following engagement and communication methods for specific correspondence:

- In person meetings;
- Email;
- Letters;
- Sharing Power Point Presentations (to support in person meetings);
- Sharing reports and other documents (as requested and as required); and
- Telephone (teleconferences and less formal phone calls).

Engagement and communication methods that support general communication of Chance's activities are as follows:

- Chance newsletters; and
- The website for Chance Oil and Gas Limited.

Engagement and communication meetings will be executed in the following manner:

1. Chance or TH will request a meeting in writing to the other party according to the connections iterated in Table 1;
2. The parties to meet will develop the agenda collaboratively;
3. The party requesting the meeting will develop supporting materials (collaboratively, where possible), and share those in advance of the meeting; and
4. The meeting will take place in a mutually agreeable location.

The above general process applies to meetings with subject matter leads (Table 1) as well as meetings with Citizens and communities at large.

Through engagement with North Yukon First Nations, Chance understands that there are existing agreements between Tr'ondëk Hwech'in, the First Nation of Na-Cho Nyak Dun, and Vuntut Gwitchin First Nation. In keeping with the relationship principle of mutual respect, Chance will work within any communications protocols or provisions existing or developed pursuant to these agreements, where applicable and as directed by TH.

The following documentation sharing and review protocols support the methods described above:

- Chance and TH will discuss and establish the confidentiality of meeting minutes in advance of each meeting; i.e. if a meeting is to not be included in the record that will be submitted to regulators and assessors, it is the responsibility of both parties to discuss and agree to this prior to the meeting beginning;
- Chance will take meeting minutes and send these to TH within two weeks via email. Within 30 days of receiving the minutes TH will review and make changes through tracked changes or another method agreed to by both parties. Should TH require more time to review the meeting minutes, TH will notify Chance by email within two weeks of receiving the minutes. The parties will agree on meeting minutes before such minutes become part of the record. No response by TH to Chance's email providing meeting minutes within the 30 days will be interpreted as general acceptance of the meeting minutes by TH, and no response by Chance to TH's email providing amended meeting minutes within 30 days will be interpreted as general acceptance of the amended meeting minutes by Chance;
- Action items and meeting outcomes will be logged during meetings and reviewed by both parties at the end of the meeting to ensure that there is general agreement on the list of actions and parties responsible for those actions. Chance will include the list of action items and meeting outcomes with the meeting minutes;
- Chance and TH will agree upon and use a password-protected file sharing platform to facilitate sharing of large files, such as Power Point presentations and reports; and,
- Should Chance or TH employ a third party for records development and management, the third party will follow the process iterated above for recording and providing meeting minutes.

6.0 Records Management

All information exchanged by Chance and TH is subject to a confidentiality agreement to be agreed upon in the future by Chance and TH.

Subject to collaborative review and the written agreement of both parties, Chance and TH consent to the disclosure of the following information to regulators and assessors for review if and when a potential project is assessed in the future:

- Meeting agendas;
- Non-confidential meeting minutes (finalized versions as described in section **5.0 Engagement and Communication Methods);**
- Invitee/Attendees lists and/or meeting sign-in sheets;
- Records log, which will include summaries of the following:
    - In person meetings;
    - Phone calls and teleconferences;
    - Incoming and outgoing emails between Chance and Chance's representatives and TH representatives;
    - Attachments to the above noted incoming and outgoing emails;

- Reports provided to TH by Chance and reports provided to Chance by TH for review and consideration for engagement and communication purposes; and
- Copies of Power Point presentations delivered by Chance to TH for engagement and communication purposes.

7.0 Adaptive Management of the Engagement and Communication Plan

Chance and TH will review and assess the effectiveness and success of this Plan on at least a 6-month basis.

Within 3 months of the Plan first being agreed to and implemented, Chance and TH will:

- as a first step, sign a confidentiality agreement as contemplated by Section 6.0 above;
- meet to check in on the progress made by both parties in implementing the Plan;
- develop a schedule for review of the Plan; and
- discuss the need for a long-term budget and a comprehensive formal capacity funding agreement to enable TH to participate in future engagement.

Schedule

Key Engagement and Communication Topics and Leads

Role or Subject Matter	TH Key Contact	Chance Key Contact
Project Lead	Sidney Schafrik, Senior Advisor, Mining and Strategic Initiatives (Sidney.schafrik@trondek.ca)	Greg Charlie, VP of Government and Community Relations (gcharlie@chanceyukon.ca)
Culture and Community (includes Indigenous Knowledge and Indigenous Land Use, heritage resources, social, health, and other "human environment" subjects)	Debbie Nagano, Director of Heritage (Debbie.nagano@trondek.ca)	Cindy Dickson Regulatory, Environmental and Community Relations Coordinator (cdickson@chanceyukon.ca)
Engineering and Geology	Sidney Schafrik, Senior Advisor, Mining and Strategic Initiatives (Sidney.schafrik@trondek.ca)	Richard Wyman, President (rwyman@chanceyukon.ca)
Environmental (includes water, aquatic environment, fish, wildlife, forest resources and other plants, and other environmental subjects)	Darren Taylor, Director of Natural Resources (Darren.taylor@trondek.ca)	Greg Charlie VP of Government and Community Relations (gcharlie@chanceyukon.ca) Cindy Dickson Regulatory, Environmental and Community Relations Coordinator (cdickson@chanceyukon.ca)
Opportunities (includes community investment, training, education, contracting, employment, and other business opportunities)	Sidney Schafrik, Senior Advisor, Mining and Strategic Initiatives (Sidney.schafrik@trondek.ca)	Mike Chernoff, Chairman/CEO (mchernoff@cariboucap.com); Richard Wyman, President (rwyman@chanceyukon.ca); Greg Charlie, VP of Government and Community Relations (gcharlie@chanceyukon.ca)
Agreements and Capacity Funding	Pat Titus, Executive Director (Pat.titus@trondek.ca)	Richard Wyman President (rwyman@chanceyukon.ca) Mike Chernoff CEO/Chairman (mchernoff@cariboucap.com)

APPENDIX B

Ministerial Order 2018/ 42

YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,

(d) oil and gas permit No. 0015,

(e) oil and gas permit No. 0016,

(f) oil and gas permit No. 0017. « *permis visé* »

2 The renewal term of each subject permit is extended by five years (so that it ends on August 30, 2023).

3 The resulting total length of the initial term and the renewal term of a subject permit is 16 years.

YUKON

CANADA

ARRÊTÉ MINISTÉRIEL 2018/42

LOI SUR LE PÉTROLE ET LE GAZ

Le ministre de l'Énergie, des Mines et des Ressources, conformément à la *Loi sur le pétrole et le gaz*, arrête :

1 La définition suivante s'applique au présent arrêté.

« permis visé » Les permis suivants de pétrole et de gaz détenus par Chance Oil and Gas Limited :

a) permis de pétrole et de gaz nº 0012;

b) permis de pétrole et de gaz nº 0013;

c) permis de pétrole et de gaz nº 0014;

d) permis de pétrole et de gaz nº 0015;

e) permis de pétrole et de gaz nº 0016;

f) permis de pétrole et de gaz nº 0017. "*subject permit*"

2 La durée du renouvellement de chaque permis visé est prolongée de cinq ans, de façon à ce qu'elle se termine le 30 août 2023.

3 La durée totale d'un permis visé, y compris la durée initiale et la durée du renouvellement, est de 16 ans.

4(1) In this section

"first nations communications and engagement plan" means the plan filed under O.I.C. 2016/169 and revised in accordance with M.O. 2017/37. « *plan de participation et de communication avec les premières nations* »

(2) It is a condition of this Order that Chance Oil and Gas Limited must file annual reports with the Division Head, in accordance with subsection (3) and to the satisfaction of the Division Head, about the implementation of the first nations communications and engagement plan.

(3) For the purposes of subsection (2), Chance Oil and Gas Limited must file

(a) the first annual report on or before July 31, 2019, in respect of the period beginning on September 1, 2018, and ending on May 31, 2019; and

(b) each subsequent annual report on or before July 31 of each year in respect of the period beginning on June 1 of the preceding year and ending on May 31 of the year in which the report is to be filed.

4(1) La définition suivante s'applique au présent article.

« plan de participation et de communication avec les premières nations » Le plan déposé en vertu du Décret 2016/169 et révisé en conformité avec l'Arrêté 2017/37. "*first nations communications and engagement plan*"

(2) À titre de condition du présent arrêté, Chance Oil and Gas Limited dépose des rapports annuels auprès du chef de division, en conformité avec le paragraphe (3) et à la satisfaction du chef de division, concernant la mise en œuvre du plan de participation et de communication avec les premières nations.

(3) Pour l'application du paragraphe (2), Chance Oil and Gas Limited dépose :

a) le premier rapport annuel au plus tard le 31 juillet 2019, pour la période débutant le 1er septembre 2018 et se terminant le 31 mai 2019;

b) chaque rapport annuel subséquent, au plus tard le 31 juillet de chaque année pour la période débutant le 1er juin de l'année précédente et se terminant le 31 mai de l'année au cours de laquelle le rapport doit être déposé.

Dated at Whitehorse, Yukon,
~~on~~ August 30th 2018.

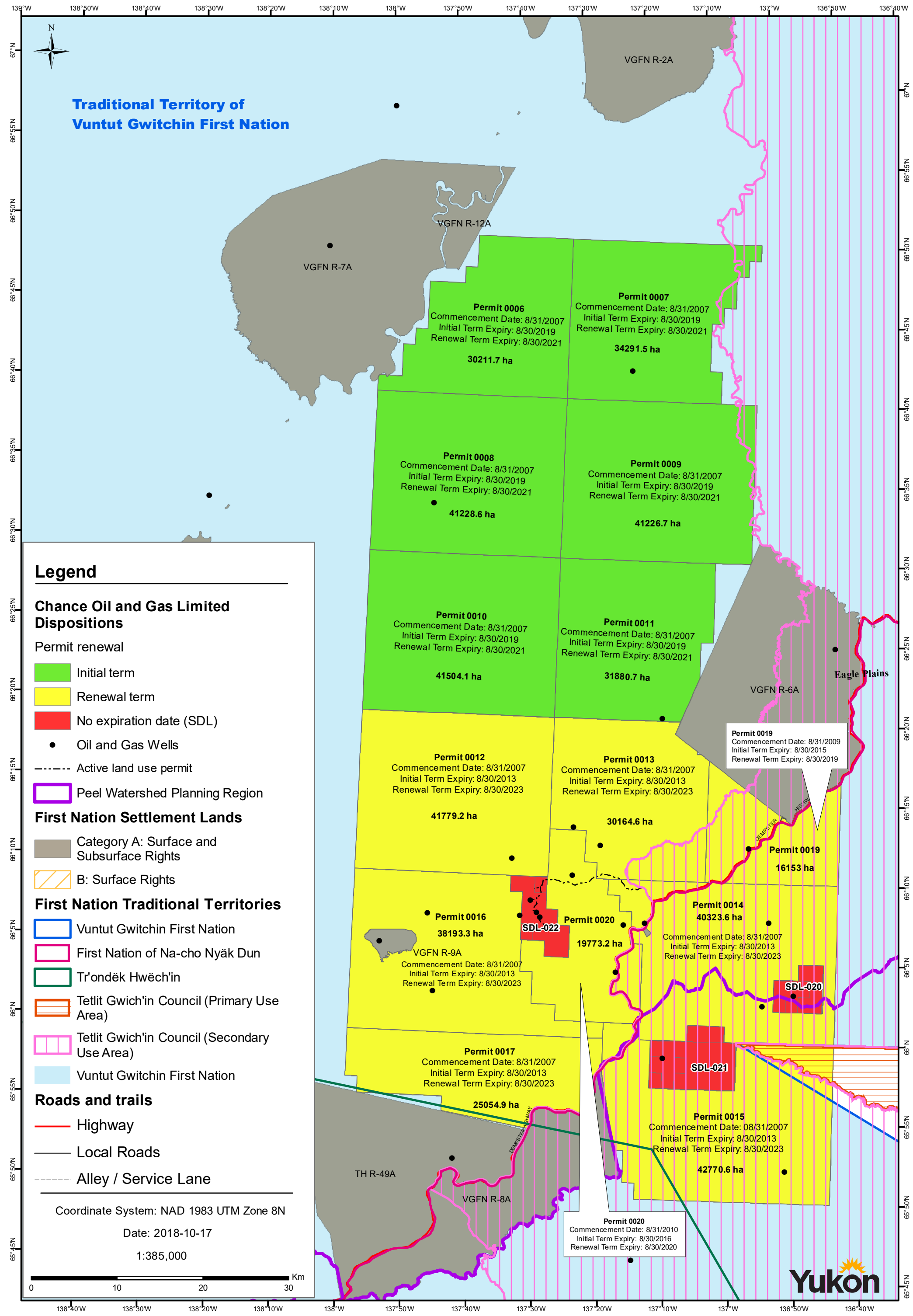
Fait à Whitehorse, au Yukon,
le August 30th 2018.

Minister of Energy, Mines and Resources/Ministre de l'Énergie, des Mines et des Ressources

APPENDIX C

Map of Chance Dispositions and Wells

Chance Oil and Gas Limited Dispositions and Wells



APPENDIX 2-D-26. Draft *Project Proposal* (Version 1)

YESAB PROJECT PROPOSAL

Eagle Plains Well Maintenance

Chance Oil and Gas Limited

Prepared for:

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Prepared by:

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July 21, 2020
File No. 104709-01

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LIST OF ACRONYMS AND ABBREVIATIONS

List of Acronyms	
Acronym	**Definition**
ANWR	Arctic National Wildlife Refuge
BOP	Blowout Preventer
DO	Designated Office
DFO	Fisheries and Oceans Canada
ELC	Ecological and Landscape Classification
FNNND	First Nation of Na-Cho Nyäk Dun
GTC	Gwich'in Gwich'in Tribal Council
HRIA	Heritage Resource Impact Assessment
HROA	Heritage Resource Overview Assessment
LUP	Land Use Permit
mKB	Meters below Kelly bushing
NYLUP	North Yukon Land Use Plan
OGDPR	Yukon Oil and Gas and Drilling Production Regulations
PWLUP	Peel Watershed Land Use Plan

SCVF	Surface casing vent flow
TH	Tr'ondëk Hwëch'in
VC	Valued Component
VGFN	Vuntut Gwitchin First Nation
VRLA	Vegetation Local Assessment Area
VRAA	Vegetation Regional Assessment Area
YESAA	Yukon Environmental and Socio-Economic Act
YESAB	Yukon Environmental and Socio-Economic Assessment Board

1.0 INTRODUCTION

Chance Oil and Gas Limited (Chance) (the "Proponent") is proposing to conduct routine maintenance on eight of its suspended wells near Eagle Plains, Yukon (the "Project"). Government of Yukon, Oil and Gas Branch (the "Regulator"), has notified Chance that well maintenance is required in order to maintain the suspended well status on four of the wells: NCY McParlon A-25, NCY Ehnjuu Choo B-73, NCY East Chance E-78 and NCY West Chance H-28. Wells Canoe River Chance J-19, Socony Mobil WM Blackie No 1 M-59, Socony Mobil WM Chance YT No 1 YT G-08, and Western Minerals Chance YT No 1 M-08 will also undergo maintenance work. A suspended well is considered a well that is not producing and has been safely secured. With a well in suspension, there is potential to restart production later. This differs from well abandonment where the well is permanently shut down, plugged, the well head is removed and is considered safe and secure by regulators (CAPP, 2019). The well maintenance activities will be executed within the confines of the Oil and Gas Drilling and Production Regulations (OGDPR). Well maintenance activities, also known as well workovers, generally include the following activities:

- Pressure testing to confirm integrity of the casing and well head valves;
- Removal of equipment in the well bores such as tubing and plugs;
- Wireline investigations to measure temperatures and cement integrity and to convey any perforating equipment;
- Remedial work such as cement squeezes; and
- Conducting a wellbore integrity analysis to determine possible well abandonment.

To mobilize maintenance equipment and crews to the well sites, the project will require re-establishment of the Chance and Blackie winter roads.

The proposal is being submitted to the Yukon Environmental and Socio-economic Assessment Board (YESAB) for an assessment under the *Yukon Environmental and Socio-economic Act* (YESAA). This is required in order to obtain the necessary permits and authorizations to perform the work.

1.1 Proponent Contact Information

The Proponent has retained Hemmera to prepare and submit the Project Proposal to the Dawson Designated Office (DO).

The Proponent contact information is:

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The preferred method of communication for the Proponent and Agent is via email. The Agent authorization form has been submitted to the Dawson DO as part of the Project Proposal documents.

1.2 Location

The Project is located 30 to 70 km south of Eagle Plains Hotel, in northeast Yukon (**Figure 1-1**). The exploration wells requiring maintenance are detailed in **Table 2-1** and **Figure 2-1**.

Seven of the wells are located in the upper reaches of the Porcupine River watershed on the west side of the Dempster Highway and one is located in the upper reaches of the Peel River watershed on the east side of the Dempster Highway. The nearest watercourse to the wells located in the Porcupine watershed are McParlon Creek which has two tributaries framing the south and western sides of the Chance Significant Discovery License and Ehnjuu Choo Creek. The watercourse nearest the Blackie M-59 well is Dalgleish Creek which flows into the Ogilvie River. There are no water bodies (i.e., lakes or ponds) in the area of proposed activities.

The Dempster Highway transects the area and provides the all season access to the Blackie winter road, the Chance winter road, and the suspended wells at McParlon A-25 and Ehnjuu Choo B-73 which are located immediately adjacent to the Dempster Highway. The nearest outpost is the Eagle Plains Hotel and Highway Maintenance Base which is located approximately 30 to 70 km north of the locations where the workovers are planned to occur. (**Figure 2-1**).

The latitude and longitude coordinates for the proposed Project are:

NW:	66.20808719	(lat/northing)	-137.6280058	(long/easting)
NE:	66.21832565	(lat/northing)	-136.9320243	(long/easting)
SW:	65.96218433	(lat/northing)	-137.6037058	(long/easting)
SE:	65.97269282	(lat/northing)	-136.9164459	(long/easting)

Figure 1-1 Project Location

1.3 Regional Land Use Plans

The proposed Project is located within the boundaries of the North Yukon Planning Region and Peel Watershed Planning Region and is therefore subject to the North Yukon Land Use Plan and (NYLUP) Peel Watershed Land Use Plan (PWLUP). Locations of proposed Project activities are within Land Management Unit (LMU) 9 of the NYLUP and LMU 7 of the PWLUP. (**Table 1.1**). Both are located within the Eagle Plains basin, with the highest potential for oil and gas development. Details regarding how the Project will meet the requirements of the Northern Land Use Plan and Peel Watershed Land Use Plan is provided in **Section 7.5** and **Table 7.2**.

Table 1.1 Landscape Management Units Overlapping the Project

Landscape Management Unit Number	Landscape Management Unit Name	Integrated Management Area (IMA)
9 (NYLUP)	Eagle Plains	4
7 (PWLUP)	Dalglish Creek	4

1.3.1 First Nations and Indigenous Groups

The proposed Project is located in the following First Nations and Indigenous groups' traditional territories (**Figure 1.1**):

- First Nation of Na-Cho Nyäk Dun (FNNND)
- Tetlit Gwich'in Council (TGC)
- Gwich'in Gwich'in Tribal Council (GTC)
- Vuntut Gwitchin First Nation (VGFN)

Vuntut Gwitchin First Nation (VGFN) and Tetlit Gwich'in Council (TGC) are Gwich'in First Nations that have traditionally used and occupied lands in the Northwest Territories and the Yukon, and are linked by close cultural and linguistic (Athapaskan) traditions. VGFN are based in Old Crow, Yukon, while the TGC are based in Fort McPherson, Northwest Territories. The Gwich'in Tribal Council (GTC) is an Indigenous organization based in Inuvik, Northwest Territories. The GTC holds rights under Section 35 of the Constitution Act, 1982, Treaty 11 and the Gwich'in Comprehensive Land Claim Agreement (GCLCA),– Yukon Transboundary Agreement (YTA). Under the GCLCA, GTC is the body responsible for representing the collective rights of GCLCA participants, including all Tetlit Gwich'in as defined in the YTA. Yukon lands of the TGC are identified in the YTA as the Primary Use Area and the Secondary Use Area lands.

The proposed Project area is immediately north of the Tr'ondëk Hwëch'in First Nation Traditional Territory and Settlement Land. The Tr'ondëk Hwëch'in (TH) are a Yukon First Nation based in Dawson City, Yukon. They are descendants of the Hän-speaking people and are a diverse mix of families descended from Gwich'in, Northern Tutchone, and other language groups. The First Nation of Na-Cho Nyäk Dun (FNNND) are a Yukon First Nation based in Mayo, Yukon. They are also of the Northern Tutchone language and cultural group.

1.3.2 Yukon Environmental and Socio-Economic Assessment Act (YESAA) Triggers

The proposed Project requires an evaluation by a Yukon Environmental and Socio-economic Assessment Board (YESAB) Designated Office (DO) because:

1. The project location is in the Yukon;
2. The *Assessable Activities, Exceptions and Executive Committee Projects Regulations* identifies several triggers for the Project including:
    a. Schedule 1, Part 3, Oil and Natural Gas, Item 2:

    On other than an Indian reserve, drilling, operation, modification, decommissioning or abandonment of, or other activity in relation to, an oil or natural gas well or seismic shot hole, but not including a hole drilled to obtain geological information.

    b. Schedule 1, Part 13, Miscellaneous, Item 13:

    On Crown land or settlement land, levelling, grading, clearing cutting or snow ploughing of a route that provides access to land for the purposes of a geophysical, geological or engineering survey.

3. An authorization by a government agency is required for the activities to be undertaken.

The Project is located near Eagle Plains, Yukon and it is understood that the Dawson Designated Office will carry out the evaluation.

1.4 Permits and Licenses / Regulatory Requirements

Chance currently holds the following licenses and approvals from previous activities at the Site:

- Type B Water Licence (MN12-061-1)

To complete the Project the following approvals are required.

- Air Emission Permit
- Land Use Permits
- Dempster Highway Authorization Permit
- Storage Tank Permit
- Waste Management Permit
- Work within Highway Right-of-Way Permit

1.5 Alternatives

Currently there are no alternatives being considered. The proposed well maintenance work has been directed by the Government of Yukon and is designed in accordance with Part 7 of the OGDPR. Alternative technologies and methods for accessing the well sites are also not feasible. Winter access and work are being proposed in order to reduce and eliminate potential effects to various valued components (e.g., permafrost, vegetation, etc.) and has been designed according to best practices and Government of Yukon standards. Other means of access such as helicopter supported are not feasible during winter and low light conditions for personnel health and safety considerations.

2.0 PROJECT DESCRIPTION

2.1 Project Activities

This section provides an overview of the proposed Well Maintenance Program. There are two main components to the Project that include:

- Routine maintenance of suspended wells (well workover); and
- Re-establishment of the Chance winter road and Blackie winter road.

The well maintenance activities proposed are being conducted in order to satisfy a direct order from Government of Yukon, Oil and Gas Branch. Accessory activities, such as construction and re-establishment of the winter roads, is required to access the suspended well sites and complete the maintenance of each well. A letter outlining the order from the Government of Yukon, Oil and Gas Branch is provided in **Appendix A**. Locations for each of the wells is provided in **Table 2.1** and **Figure 2-1**.

2.2 Well Maintenance

The following section describes the work proposed at each of the wells. Each of the wells is deemed suspended by the *Yukon Oil and Gas and Drilling Production Regulations* (OGDPR) (is not producing and safely secured). Well maintenance is required to continue to meet the OGDPR suspended well status regulations. Well servicing equipment may include a service rig, wireline truck and cementing trucks along with the associated support equipment. All equipment will be mobilized to each of the wells on a sequential basis (one at a time) to complete the required maintenance work (downhole suspension, wellbore fluid replacement, replace substandard equipment). The eight wells that require maintenance include:

- Socony Mobil WM Blackie No 1 M-59 (M-59);
- Western Minerals Chance YT No 1 M-08 (M-08);
- Canoe River Chance YT J-19 (J-19);
- Socony Mobil WM Chance YT No 1 YT G-08 (G-08);
- NCY McParlon A-25 (A-25);
- NCY Ehnjuu Choo B-73 (B-73);
- NCY West Chance H-28 (H-28); and
- NCY East Chance E-78 (E-78).

A detailed description of the planned maintenance activities at each well is summarized in the following sections. A summary of the activities at each well is provided in **Table 2.2**.

Table 2.1: Well Locations

Well Name	Location	
	Latitude	Longitude
Socony Mobil WM Blackie No 1 YT M-59	65° 58’ 54.93.9” N	137° 18’ 58.2” W
Western Minerals Chance YT No 1 M-08	66° 07’ 46.0” N	137° 31’ 27.3” W
Canoe River Chance YT J-19	66° 08’ 31.0” N	137° 32’ 27.0” W
Socony Mobil WM Chance YT No 1 YT G-08	66° 07’ 18.1” N	137° 30’ 50.8” W
NCY McParlon A-25	66° 04’ 10.3” N	137° 18’ 58.2” W
NCY Ehnjuu Choo B-73	66° 12’ 10.3” N	136° 59’ 01.5” W
NCY West Chance H-28	66° 07’ 29.8” N	137° 34’ 05.6” W
East Chance E-78	66° 07’ 18.5” N	137° 14’ 46.8” W

Table 2.2 Summary of well maintenance activities

Well Name	Wellhead Inspection	Pressure Test	Surface Casing Vent Flow	Gas Migration	Temperature Log	Cement Bond Log	Hydraulically isolate formations	Well Bore Fluid Test
Socony Mobil WM Blackie No 1 M-59	-	X	X	X	X	X	X	-
Western Minerals Chance YT No 1 M-08	-	X	X	X	-	X	X	-
Canoe River Chance YT J-19	X	X	X	X	X	X	X	-
Socony Mobil WM Chance YT No 1 YT G-08	X	X	X	X	X	X	X	-
NCY Ehnjuu Choo B-73	X	X	X	X	X	X	X	-
NCY West Chance H-28	X	X	X	X	X	X	X	-
NCY McParlon A-25	X	-	X	X	X	-	-	X
East Chance E-78	X	-	X	X	X	-	-	X

Figure 2-1: Well and winter road locations

2.2.1.1 Legacy Wells

Legacy wells were drilled by other operators from 1959-1968,and are located on Significant Discovery Licenses Blackie (021) and Chance (022).The Legacy wells requiring maintenance include:

- Socony Mobil WM Blackie No 1 YT M-59
- Western Minerals Chance YT No 1 M-08
- Canoe River Chance YT J-19, and
- Socony Mobil WM Chance YT No 1 YT G-08

A pressure test is conducted to ensure the integrity of the wellhead and the existing casing in the wellbore. The well will then undergo surface casing vent flow and gas migration testing. Surface casing vent flow (SCVF) is a condition where fluid or gas is flowing from the surface casing vent assembly. A well that has a leak, or a well integrity problem may exhibit signs of SCVF. Gas migration tests are conducted to determine if the well has a gas migration problem. For the purpose of this test, gas migration can be defined as the movement of gas from a subsurface zone to surface through a barrier that should prevent its movement, whether this barrier is natural (overburden, shale) or artificial (cement sheath, external casing packed, pipe joints etc.). It should be noted that during annual inspections, no SCVF has ever been detected. If there is evidence of surface casing vent flow the well will be logged with a variety of tools (e.g., noise tool, temperature tool, bond log tool) to determine the source of the surface casing vent flow and/or gas migration. The logs will be analyzed and a plan will be formulated to complete a downhole shut off at the source of the surface casing vent flow and/or gas migration.

Once the pressure testing, surface casing vent flow testing and gas migration testing is complete, the service rig, support equipment and wireline will be moved to the wellsite. A blowout preventer (BOP) will be installed on the well. Blowout preventers are specialized pressure-control equipment attached to the wellhead to seal, control and monitor oil and gas wells to prevent the uncontrolled release of crude oil or natural gas while operations are occurring on the well. A temperature log will then be conducted to a depth of 300 meters below Kelly bushing (mKB). The temperature log is interpreted by looking for anomalies, or departures, from the reference gradient. This reference gradient might be the geothermal gradient, a log recorded before production or started, or a log recorded with the well shut in. Most anomalies are related to the entry of fluids into the borehole or fluid exit into the formation. Following the temperature log, a cement bond log will be run. The cement log is a log that uses the variations in amplitude of an acoustic signal travelling down the casing wall between a transmitter and receiver to determine the quality of cement bond on the exterior casing wall. The fundamental principal is that the acoustic signal will be more attenuated in the presence of cement than if the casings were uncemented. The cement log is used to identify sections of the well bore that will need interventions to isolate porous formations from adjacent formations.

To isolate a formation from an adjacent formation, the casing will be perforated at the appropriate depth with a wireline conveyed perforating gun. Tubing will then be used to inject cement through the perforations in sufficient quantity to ensure adjacent formations are isolated from each other, at which point pressure will be applied from surface to force the cement into the perforations. Once the cement has cured, the cement will be pressure tested as per the Yukon Oil and Gas and Drilling Production Regulations. The process is then repeated until all formations are isolated from one another and pressure tested. The isolation operations will begin with the deepest non-isolated formation and progress to the shallowest non-isolated formation. Once all the testing/isolation procedures are complete, the tubing will be pulled from the

well, a new well head assembly will be installed, and the well head will be pressure tested once more. The service rig and all support equipment will then be removed from the site.

Additional activities at M-59 include installation of a wellhead that conforms to the OGDPR regulation. In addition, for G-08 and J-19, the tubing and packer will be removed during the workover following completion of gas migration testing.

2.2.1.2 Modern Wells

The modern wells were drilled by Chance/Northern Cross in 2012-2013. The modern wells requiring maintenance include:

- NCY McParlon A-25
- NCY Ehnjuu Choo B-73
- NCY West Chance H-28, and
- NCY East Chance E-78

A pressure test is conducted to ensure the integrity of the wellhead and the existing casing in the wellbore. The well will then undergo surface casing vent flow and gas migration testing. SCVF is a condition where fluid or gas is flowing from the surface casing vent assembly. A well that has a leak, or a well integrity problem may exhibit signs of SCVF. Gas migration tests are conducted to determine if the well has a gas migration problem. For the purpose of this test, gas migration can be defined as the movement of gas from a subsurface zone to surface through a barrier that should prevent its movement, whether this barrier is natural (overburden, shale) or artificial (cement sheath, external casing packed, pipe joints etc.). It should be noted that during annual inspections, no SCVF has ever been detected on any of the wells. If there is evidence of surface casing vent flow the well will be logged with a variety of tools (e.g., noise tool, temperature tool, bond log tool) to determine the source of the surface casing vent flow and/or gas migration. The logs will be analyzed and a plan will be formulated to complete a downhole shut off at the source of the surface casing vent flow and/or gas migration.

A temperature log will then be conducted to a depth of 300 meters below Kelly bushing (mKB). The temperature log is interpreted by looking for anomalies, or departures, from the reference gradient. This reference gradient might be the geothermal gradient, a log recorded before production or started, or a log recorded with the well shut in. Most anomalies are related to the entry of fluids into the borehole or fluid exit into the formation. Following the temperature log, a cement bond log will be run. The cement log is a log that uses the variations in amplitude of an acoustic signal travelling down the casing wall between a transmitter and receiver to determine of the quality of cement bond on the exterior casing wall. The fundamental principal is that the acoustic signal will be more attenuated in the presence of cement than if the casings were uncemented. The cement log is used to identify sections of the well bore that will need to be hydraulically isolated.

The wellbore fluid will be sampled and tested to determine if the fluid meets the OGDPR regulations. After the wellbore fluid is tested and if necessary, a service rig may be moved in to replace the well fluid to conform to the Yukon Oil and Gas and Drilling Production Regulations 99(a) and 99(b). A wellbore fluid test is a test or series of tests, performed to check that no undesirable reactions occur with a specific fluid. The testing process may include checks for compatibility with other treating fluids, wellbore fluids, reservoir fluids, and the reservoir formation. The removed fluid from the wellbore is anticipated to be recycled and

used in the well to meet OGDPR Part 7 Section 99 requirements. If it can't be recycled the fluid will be transported to and disposed of at a permitted waste disposal site. No other activities are anticipated at these wells.

2.2.1.3 Wellbore Integrity Analysis

To determine if a well will be abandoned, the wellbore integrity will be analyzed to determine the suitability of the well for future use. The wellbore integrity analysis will include:

- Pressure testing of the wellhead and casing;
- Bit and scraper run on tubing to ensure the wellbore is still full drift;
- Analysis of the cement behind the production casing and/or liner casing with a cement bond log tool to determine the cement quality;
- Geological analysis to determine what formations need to be isolated after the cement analysis;
- Sampling of wellbore fluid on the wells (if necessary); and
- Location of the well with respect to the other wells which remain.

The wellbore integrity analysis is required to formulate the final plan for each of the wellbores. The analysis will determine if any the following are required:

- No action;
- Cement squeezes to isolate formations from other formations in accordance with OGDPR Part 7 Section 95(1)(b);
- Casing patches to repair any casing breaches found;
- Cement plugs and/or bridge plugs set to suspend or abandon producing formations in accordance with OGDPR Part 7 Section 97 (1) and Section 97 (2); and
- Surface abandonment in accordance with OGDPR Part 7 Section 96.

Cement squeezes, if required to isolate a formation to satisfy OGDPR Part 7 Section 95(1)(b), will entail perforating an interval close to the formation top and squeezing arctic compatible cement in to the annular space between the production casing and the formation face to create a cement sheath that will isolate the formation from other formations above it in the wellbore. The cement squeeze and remaining plug left in the wellbore will conform to the requirements set out in OGDPR Section 98 (1)(b) and Section 98(2) and location of the remaining cement plug will be located afterwards with the method of setting down on the cement plug with a minimum 90 kN force with the cementing string after 12 hours as set out in OGDPR Section 100(1)(b). Fluid in the wellbore may have to be replaced in a wellbore if it does not meet the requirements of OGDPR Part 7 Section 99.

2.2.1.4 Equipment

Equipment required for well maintenance is described below in **Table 2.3**. Equipment will be stored on site mainly on trucks and flatbed trailers. Some items such as the boiler and cement tanks will be placed on the ground on skids.

Table 2.3: Equipment and Infrastructure components

Quantity	Component	Description
	Re-establishment of Winter Road	
Multiple as needed	Construction Equipment	Challenger cats, D6 cats, snow cats, graders, snow making equipment, water trucks and with drags (small trailer pulled behind truck) will be utilized during the initial phase of the project to prepare the roads and well pads for the operations
	Mobilization and Demobilization for Well Maintenance	
6	8' x 40' mats	These can be wooden or steel mats placed on the ground in an interlocking manner for the service rig and connected equipment to sit on.
1	Skid Service Rig Structure (likely 32-40 wheeled loads)	Components required to service the well, including: • Sub-structure, or base, to which the derrick (i.e., framework to support drilling apparatus) is fixed • Derrick that supports the draw works and handling equipment • Draw works that lifts and lowers the handling equipment in the derrick/mast to run pipe in and out of the hole • Blowout preventers, which are pressure control equipment that can hydraulically shut in a well in the event of unplanned influxes of formation fluids into the wellbore
1	Skid Dog House	Skid mounted unit which contains a generator for supplying power to the rig, an office and change rooms for the crew, and a hydraulic control system to operate the BOP stack remotely
1	Skid Pump	Skid mounted unit which contains a pump to provide hydraulic pumping power to pump fluids in to the wellbore (same as pumps below)
1	Skid Tank	Skid mounted fluid storage tank for the service rig. Can store fluid to be pumped in to the wellbore or store fluid which is pumped out of the wellbore.
1	Skid Boiler	Used extensively in very cold and Arctic climates for preventing equipment and fluids from freezing.
1	Junk Skid	This is skid mounted trailer with an inventory of spare parts and equipment used during the well maintenance work
1	Catwalk and Pipe Racks	These are used for the storage of tubing or tools which is removed from or to be ran in to the wellbore and for picking up / laying down tubing or tools.
1	Enclosed Trailer (chemicals, tools, etc)	Dry storage trailer to keep tools, and chemicals to be used during the operations
5	Baskets of Tools	Tools used in the operation of the service rig
350	Tubing Storage: Joints of 73.0 mm, L-80, 9.67 kg/m tubing (9.5 m average length)	Tubing will be stored on location until required to be run in the hole.
1	Super Single Shack	Skid mounted office and accommodation for wellsite supervisors
3	20 kw Generator / Light towers, miscellaneous equipment	Light towers will be required on the wellsites as the operations will run 24 hours a day

Quantity	Component	Description
2	400 bbl tanks	These are skid mounted cylindrical steel tanks about 10 feet in diameter and stand about 20 feet high used for the storage of fluid
1	Miscellaneous Equipment	Additional equipment brought up on a trailer to be used in the operation of the service rig (example – downhole tools, fan heaters, etc.)
1	Skidded Office/Medic Trailer	Essential personnel trailers which serve as offices. All office trailers will have self-contained sewage storage and sewage will be moved periodically to the sewage lagoon at the Chance camp at Km 324.
1	Fuel Storage	Fuel for use for equipment including service rig, pumps, generators, etc. Bulk fuel will be staged at the Chance camp at Km 324 and daily needs will be distributed via pickup trucks with slip tanks during crew changes.
1	Tank Truck	Used to transport fluid to the service rig during operations (mainly fresh water)
1	Vacuum Truck	Used for removal and transportation of wastewater and sewage from the medic/first aid trailer for disposal.
1	Cement Bulker	Cement storage and mixing for use in wells.
1	Cementing Unit	Unit used top pump cement in to the wellbore during the required cementing operations
1	Cement Bins	Large tanks, normally upright, fully enclosed and pressurized, where cement products are stored. Cement is pneumatically pumped from the tank into the cementing unit.
1	Wireline Unit	Unit to convey tools into the wellbore on wire rope to allow for analysis of the casing integrity, setting of bridge plugs and perforating of the casing
1	Slickline Unit	Unite to convey tools into and out of the wellbore on steel wire to allow for the pulling or setting of bridge plugs in the tubing
1	Pumps	Pumps used to circulate the fluid down the pipe, around and up the annular space between the pipe and the casing to surface.
1	Main Workover Fluid Storage	Location where all the fluid additive materials are stored. Normally these materials are delivered on pallets neatly stacked and shrink wrapped to protect them during the truck journey north.
1	Flare Tank and Flare	Flare used to burn combustible gas from the well. The flare tank is a reservoir to ensure the flare does not starve of combustible gases. Flaring is only planned in the unlikely event the wells that have perforated intervals require depressurization prior to the planned workover operations. The flaring cannot be scheduled in an operation as it may or may not be required depending on the circumstances encountered. The flare stack will be a minimum of 18 metres off the ground.
1	Water Storage and Water Treatment	Water storage tank and treatment containers to provide potable water for the rig crew and personnel.
6-10	1/2 Ton Trucks	Pickup trucks will be used for transportation of work crews, fuel and other supplies between the camp/Eagle Plains Hotel and the wellsites.
	Throughout Project	
1	Cement Bulker (2 -3 times throughout project)	A transport truck to deliver cement to the sites for cementing operations
1	Fuel Tank Bulker (7-8 times throughout project)	A transport truck to deliver fuel (diesel and gasoline) to site to be used for fueling equipment on the sites.

2.2.2 Winter Road Construction

2.2.2.1 Site Access

The Project is accessed via the Dempster Highway. Wells H-28, J-19, M-08, G-08 and H-28 will be accessed by re-establishing the Chance winter road. Wells A-25 and B-73 are located immediately adjacent to the Dempster highway, and already have access with rig matting in place. Well M-59 will be accessed by re-establishing the Blackie winter road. The Blackie winter road is approximately 6.5 km in length and approximately 8-10 m in width. The Chance winter road is approximately 25 km long and 8-10 m in width (**Figure 2.1**). The total surface area of the both the Chance winter road and Blackie winter road is approximately 1,875 m^2. The footprint at each wellsite is anticipated to be approximately 100 m x 100 m (1 Ha) with the wellhead at the centre. Exact dimensions of the well sites are dependent on topography and may not be exact squares but will cover an area approximately 1 Ha (e.g., 125 m x 80 m).

2.2.2.2 Winter Road Construction Methods

Winter road construction will utilize similar techniques as previously applied by Chance in previous assessments (YESAB # 2006-0237, 2006-0285, 2007-0219, 2008-0047 and 2012-0140). Before any winter road construction will proceed, a minimum snow depth of 10 cm will be verified to ensure there is sufficient snow cover to protect the ground surface from tires or tracks of vehicles. To promote snow compaction in the early winter, the Chance winter road and Blackie winter road will be driven with snowmobiles and snowcats in late fall/early winter. Priority will be given to re-establishing the Chance winter road first and the Blackie winter road second. This is because there are four wells to access from the Chance road and no overgrowth limiting access, while there is only one well to access from the Blackie winter road, which is more overgrown and requires the development of a substantial snowpack. This will allow more time for the snowpack to develop at the Blackie winter road. Upon construction, if the snow depth (minimum of 10 cm) is not sufficient in certain areas, additional snow will only be collected from areas where a surplus of snow is available or from areas where there is no potential for disturbance to the surrounding environment. These areas may include depressions where significant amounts of snow have accumulated. Snow will only be removed where 10 cm of base will remain compacted to protect surface vegetation. Alternatively, as done in previous years, additional snow may be removed from the Chance camp laydown area (approximately 13 Ha area). Only clean snow, free of deleterious substances, will be used for winter road re-establishment.

Once the snow depth is adequate (i.e., 10 cm or greater in depth without compaction), vegetation along the routes will be cleared using a bulldozer and mulcher. The bulldozer blade will be raised off the ground such that it does not cut the tops of hummocks, tussocks or high spots. The vegetation removed will be mulched with a track mounted mulcher and distributed on the road. Any trees or large brush encountered will be removed at the ground surface using a mulcher to avoid tearing the surface organic layer thereby reducing the chance of thawing ice-rich mineral soil beneath. The mulch helps keeps the soil in place while protecting the root system of ground-cover plants and natural grasses. The likelihood of large trees or brush is low on the Chance winter as the road was last used in April 2014. Where it is safe and practical, standing live or dead trees along the route that provide wildlife habitat will be saved.

Following vegetation removal, the surface of the road will be constructed using accumulated snow to construct berms on the road margins and filling the space at the roads edge with snow and water trucked from approved sources. A combination of snowcats and bulldozers using drags will be used to push and

compact the snow along the access routes. To ensure the roads ability to safely support the service rig and other heavy loads, all construction activities will be supervised by a qualified geotechnical engineer.

The same methods will be utilized to establish well sites and clear any vegetation surrounding the well site for equipment and site infrastructure.

2.2.2.3 Water Withdrawal

Water for the service rig and winter road icing will be primarily sourced from existing withdrawal locations on the Eagle River, with locations on the Ogilvie River as an alternative source. The Eagle River is preferred due to its closer proximity to Chance's operations, with the Ogilvie River being more convenient for the Socony Mobil WM Blackie No 1 (M-59) and NCY McParlon (A-25) operations. No more than 100 m³ of water will be withdrawn daily. All water withdrawal will be conducted following Department of Fisheries and Oceans (DFO) Freshwater Intake End-of-Pipe Fish Screen Guidelines (DFO 2020).

2.2.2.4 Maintenance

Maintenance of winter access routes may include low ground pressure vehicles (e.g., snowcats), a road grader equipped with a wing snow plow and some water application. Grading may be required over certain stretches and depressions along the roads filled with snow, to smooth the surface.

In the event that natural snowfall is below the minimum required depth to construct and maintain the winter roads, snow making may be used to make up the shortfall. This is a contingent consideration and could require up to 100 m³ of water per day for a short period of time (a few days to a week). The sources of water include the Eagle River and the Ogilvie River. The water to be used to make snow and ice the winter road(s) will be trucked from the source to the point of use. The actual number of trucks being used will be less since a truck can probably complete 1 to 3 deliveries per day. Generally low snowpack is only an issue during the early part of winter so this provision would only apply on a contingent basis during the months of November, December and January. The timing for making artificial snow will depend on how late in the winter season winter road construction begins. If, for example, in late December there is little or no snowfall or snow accumulation on the ground, snow making could ensure a sufficient snow base to commence winter road construction. Snow can only be made when the ambient temperature drops to zero degrees centigrade.

2.2.2.5 Equipment

Equipment will be required for clearing, grading, water transport, and material transport. Light equipment for personnel, fuel and other supply transport will be required periodically during construction and well maintenance.

It is anticipated that Challenger cats, D6 cats, snow cats, graders, snow making equipment, water trucks and drags will be the primary construction equipment. Pickup trucks will be used for transportation of work crews, fuel and other supplies. Water trucks will be used for transport of water from the Eagle River and the Ogilvie River to the Project. Flatbed trailers would be used to transport equipment and larger supplies.

2.2.3 Access Control

Chance understands that increased winter access into the area is of significant concern to First Nations and Indigenous Groups, local residents, trappers and outfitters. Chance has safety concerns regarding unauthorized users due to the potential for sour gas (H_2S) to be present at some wells, and the use of narrow access routes. Additionally, Chance cannot allow the use of firearms in areas where crews are working to ensure safety of their crew. These access routes will be radio controlled by Chance to ensure authorized personnel gain unobstructed access, but this could be adversely impacted by the presence of unauthorized users. To address concerns related to access (e.g., increased use and ease of access, increased hunting, public safety, and safety of Chance personnel) gates will be placed at the junction of the Blackie and Chance winter roads with the Dempster Highway. The gates will be constructed of heavy materials and located such that there are obstacles on either side as much as possible (e.g., heavy forest) to restrict vehicle access.

2.2.4 Anticipated Road Use

The majority of the traffic volumes include mobilizing the service rig and site infrastructure, the setup of the service rig will take approximately one day to complete at each well site. A total of approximately eleven flatbed truck loads will be required to mobilize equipment into each well site. Once a site is established (i.e., maintenance equipment set up), traffic will include approximately 1-2 pickup trucks (for supplies and personnel), 1 water truck and one fuel truck. The fuel and water trucks will come to the project site approximately every three days or as demand dictates.

All vehicles will be equipped with radio communication and any traffic on the roads will be radio controlled. Unauthorized vehicles will not be allowed on the winter roads and the roads will be restricted from public access.

2.2.5 Reclamation

The Project proposes to re-establish the Blackie winter road to one existing well site (M-59), and the Chance winter road for J-19, M-08, G-08 and H-28. Wells A-25, E-78 and B-73 are located immediately adjacent to the highway, and already have access with rig matting in place and/or pre-existing cleared area as a borrow pit or Chance's Base Camp.

Reclamation activities will aim to return the site as closely as possible to its pre-project condition. These activities are intended to effectively:

- Leave the site clean following project completion;
- Remove all garbage, petroleum products, and equipment; and
- Prevent long-term erosion/slumping and promote successful natural revegetation of disturbed areas.

Given the winter road construction methods employed (i.e. allowing for 10cm of snow cover before building the winter road) it is not anticipated that additional reclamation is required for the winter roads. As discussed in **Section 2.1.3**, access to each of the roads will be restricted during operations and following the completion of the proposed activities. This will ensure that the road can fully melt, without any potential for more disturbance from outside users. It is less harmful to leave the road to melt in the spring.

2.2.6 Camp Facilities

Chance anticipates using the Eagle Plains Hotel for housing workers for the Project. The Eagle Plains Hotel, located at kilometer 371 of the Dempster Highway, has been operating since the late 1970's and provides a variety of services including hotel facilities, accommodations (64 people during peak use), restaurant, lounge, public washroom, laundromat and service garage. The hotel is a recognized tourist destination and provides support services to the Government of Yukon, Department of Highways and Public Works, Eagle Plains Maintenance Camp.

Chance's existing camp, office and storage yard was established in October 2011 and is located at km 325 of the Dempster Highway. It is accessible year-round by vehicle unless the highway is closed due to weather or construction. For this Project, Chance plans to utilize the camp for storing and transporting equipment and supplies needed for operations, but Chance personnel will not stay at the camp, and will instead utilize the Eagle Plains Hotel.

Approximately 7-12 fixed wing flights over the course of the entire project, with up to 2 flights per week, will be required for shift changes. Flights will be privately chartered from Edmonton to Inuvik and then to the Wiley airstrip located at km 389.5 of the Dempster highway or the Chance Camp airstrip, located at km 325 of the Dempster highway.

A small medic/first aid trailer equipped with a heater may be installed at the wellsite being where work over operations are occurring to provide refuge for workers and essential first aid supplies. Sewer facilities and water will be available in the trailer. All wastewater and sewage will be collected in CSA approved tanks and transported offsite for disposal at an approved facility in Fort McPherson.

2.2.7 COVID-19 Safety Considerations

Coronaviruses are a large family of viruses found mostly in animals. In humans, they can cause diseases ranging from the common cold to more severe diseases such as Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS). The disease caused by the new coronavirus has been named COVID-19.

While many of the characteristics of COVID-19 are still unknown, mild to severe illness has been reported for confirmed cases. Common symptoms for COVID-19 are:

- Fever
- Cough
- Sneezing
- Sore throat
- Difficulty breathing

Coronavirus is transmitted via larger liquid droplets when a person coughs or sneezes. The virus can enter through these droplets through the eyes, nose or throat if you are in close contact. The virus is not known to be airborne (e.g., transmitted through the particles floating in the air) and it is not something that comes in through the skin. It can be spread by touch if a person has used their hands to cover their mouth or nose when they cough.

Droplet Contact: Some diseases can be transferred by large infected droplets contacting surfaces of the eye, nose, or mouth. For example, large droplets that may be visible to the naked eye are generated when a person sneezes or coughs. These droplets typically spread only one to two metres and are too large to float in the air (i.e., airborne) and quickly fall to the ground. Influenza and SARS are two examples of diseases capable of being transmitted from droplet contact. Currently, health experts believe that coronavirus can also be transmitted in this way.

Airborne transmission: This occurs when much smaller evaporated droplets or dust particles containing the microorganism float in the air for long periods of time. Currently, health experts believe that coronavirus cannot be transmitted through airborne transmission.

At present, COVID-19 is a public health emergency in Yukon. Guidelines for ensuring public safety have been established by the Chief Medical Officer of Health for Yukon. These guidelines include physical distancing, enhanced cleaning, infectious disease control strategies, and hand hygiene. The state of the pandemic and the responding guidelines are rapidly evolving and will be monitored and followed throughout the duration of the Project.

The camp utilized for Project activities and the Eagle Plains Hotel used for crew housing will follow all guidelines including physical distancing and sanitization procedures to ensure a healthy environment for workers. The Eagle Plains Hotel currently abides to all guidelines established by the Chief Medical Officer of Health for Yukon. Crew members will be provided with up to date information regarding the current state of the pandemic and the procedures in place to address it while they are at camp. A screening procedure conducted prior to a worker's arrival at the Eagle Plains Hotel will include questions related to symptoms, travel, and known interaction with an infected person. Face masks will be worn during air travel to the site. Crew members who fail the pre-screening will not be permitted to travel to site. As per the Yukon Government guidelines, only staff arriving from outside British Columbia, Yukon, Northwest Territories and Nunavut will be required to self-isolate prior to their travel to site. During the duration of construction, daily screening, including temperature checks, will occur and workers will be instructed to monitor and report any symptoms they may develop. In the event that a crew member reports a COVID-19 symptom, they will be isolated until a COVID-19 test result can be confirmed. Confidential documentation of Project information including crew member names, arrivals and departures details, and worker origin will be kept.

2.2.8 Fuel Storage

A draft Spill Response Plan is available in **Appendix B**. The plan will outline the procedures to be followed in the event of a petroleum product spill during all phases of the project. Safety procedures for personnel and proper equipment usage during such operations will be discussed in the plan

Fuel will be stored in portable tanks (i.e., slip tanks) and tanker trucks and will not exceed 8000 litres in aggregate. Fuel storage will only occur during periods necessary for the road construction and well maintenance and will be removed upon completion. All fuel caches will be located a minimum of 60 m from the high water mark of any nearby watercourse. Fuel will be transported in tidy tanks or by tanker truck, as required. A fuel spill contingency plan will be posted at all storage areas and fueling stations.

The fluid additive materials will be stored in the Chance lay down yard located at km 325 of the Dempster Highway. They will be stored in a dry trailer/s in their original packaging. The cement will be transported to site in a bulk trailer and left at the lay down yard. Fluid additive materials will include:

- Potassium Chloride (KCL)
- Fluid Inhibitor
- Cement

2.2.9 Waste Management

All garbage and recyclable materials will be taken off site and disposed of at a licensed disposal facility.

Once all the testing/isolation procedures are complete, the tubing will be pulled from the J-19 and G-08 wells. If it is deemed that it is still usable, it will be stored at Chance's camp and if not, it will be transported to approved disposal facilities in Yukon, Alberta or British Columbia. Cement waste and wastewater will be collected and transported to an approved disposal facility.

2.3 Project Schedule / Temporal Scope of Activities

Construction of the winter roads and well maintenance is anticipated to occur during the winter of 2020/2021. Initial site visits would occur in late November or early December of 2020, timed to meeting the minimum snowpack, to pack the access routes with snowmobiles. Winter road construction is anticipated to occur in late December to February. Well maintenance activities are anticipated to take approximately up to 70 days to complete the work at all eight wells. It is anticipated that well maintenance activities will commence in February and be completed by mid-April.

3.0 SUMMARY OF CONSULTATION

The Proponent recognizes the importance of consulting affected First Nations governments prior to making decisions about the Project.

3.1 Potentially Affected Parties

The Project and all proposed Project activities are located within the traditional territories of the Vuntut Gwitchin First Nation and the First Nation of Na-cho Nyäk Dun, as well as the Tetlit Gwich'in Secondary Use Area of the Gwich'in Settlement Region. The proposed Project is also located to the north of Tr'ondëk Hwëch'in Traditional Territory.

Based on the location of the Project within a First Nation's Traditional Territory and/or the proximity of the Project to a First Nation's Traditional Territory (with the potential for indirect effects), the project team identified the following First Nations as potentially affected parties:

- Vuntut Gwitchin (VG)
- First Nation of Na-Cho Nyäk Dun (FNNND)
- Gwich'in Tribal Council (GTC)
    - Tetlit Gwich'in Council (TGC)
- Tr'ondëk Hwëch'in (TH)

Engagement activities were designed to inform potentially affected parties of the proposed Project, and to provide those parties with a reasonable opportunity to engage the project team, to learn about the proposed Project, and to provide input or feedback. Chance's approach to engagement was guided by existing

engagement and communications plans that Chance has with each of the potentially affected First Nations that are identified above.

3.2 Summary of Engagement Activities

The following sub-sections provide brief summaries of engagement activities with each potentially affected First Nation.

3.2.1 Initiation

Written communication was sent via email to FNNND, GTC (including TGC), and TH in order to initiate engagement. Initial communication packages for these First Nations included a high-level overview of the proposed Project (e.g., project activities, components, goals and outcomes), the regulatory submissions Chance would be making, a brief introduction to Hemmera and it's role, as well as the request to discuss any concerns the affected party may have and the offer to arrange a conference call should they so desire. Also included was a 4-page project summary and map of the Project Location.

A distinct communication package was sent via email to initiate engagement activities with VG. This package was structured in accordance with protocols outlined in the *Vuntut Gwitchin Government Oil and Gas Engagement Policy*. As such, this package included an earlier draft of the Project Description dated May 22, 2020.

3.2.1 Vuntut Gwitchin

Initial notification was sent to VG's Director of Natural Resources on May 25, 2020. VG and Chance organized a conference call July 9, 2020 wherein VG requested a high-level overview of the proposed Project. VG asked Chance questions in order to attain additional information for the First Nation to complete their review of the draft Project Description dated May 22, 2020. To assist Chance in preparing meeting materials for the July 9th meeting, VG provided an agenda and questions ahead of time. On July 10, 2020, VG provided Chance with formal information requirements related to the proposed Project. Themes raised by VG included:

- Requiring additional information on mitigation measures to avoid or minimize potential environmental effects (specifically with respect to Porcupine Caribou)
- Requiring additional information on the regulatory context
- Requiring additional details on well tests (e.g., vary tests between the wells, how would Chance address evidence of gas migration, what would be done with removed fluid) and project components (e.g., what materials would be stored on site, what materials will be incinerated, vehicles planned to be used)
- Requiring additional information on water withdrawal (e.g., sources, volume, schedule)

The additional information requested by VG was drafted and refined during the effects assessment and development of the Project Proposal. However, feedback from VG impacted the development of mitigation measures and contributed to identifying information that was previously inadequate in the earlier draft project description and the project proposal as a whole (e.g., additional information on the regulatory context, additional information on the rationale for maintaining the wells in suspended well status versus abandonment).

Chance responded to VG, in the format requested, on July 22, 2020. This document can be provided upon request.

A draft of the Project Proposal was shared with VG July 22, 2020.

In the coming weeks Chance will be initiating discussions with VG in order to meet requirements under section 68 of *YOGA* (i.e., benefits agreements).

3.2.2 First Nation of Na-cho Nyäk Dun

Initial notification was sent to FNNND May 25, 2020. Additional communications followed June 9th, June 24th, and July 20th. Chance did not receive feedback from FNNND while the Project was being refined and the Project Proposal was being drafted. A draft of the Project Proposal was shared with FNNND July 24, 2020.

Chance looks forward any feedback FNNND may provide in the future and to initiating discussions with FNNND in order to meet requirements under section 68 of *YOGA* (i.e., benefits agreements).

3.2.3 Gwich'in Tribal Council

Initial notification was to GTC and TGC May 25, 2020. On June 12, 2020, GTC provided input from its departments of Lands and Resources, Cultural Heritage, and Economic Development. Themes raised by GTC included:

- High environmental standards in the Peel River watershed and protection of scattered wetlands within the Land Management Unit 7
- Protection of wildlife and wildlife habitats
- Protection of the environment, water quality, and quantity and risks with respect to potential spills
- Protection of cultural heritage resources/values

GTC also requested that Chance share the Project Description and any other materials related to the Project that might be available. Chance was able to send a draft Project Description dated May 22, 2020 to both GTC and TGC, however no other materials (e.g., effects assessments, summaries of mitigation measures, management plans) were available at that time.

GTC's original feedback helped Chance select Valued Components, identify mitigation measures, and identify where additional detail was needed in the Project Description. Chance was able to provide a response to GTC on July 9, 2020.

Chance and GTC organized a conference call for July 22, 2020 where parties were able to further discuss the proposed Project. During this call Chance was able to update GTC on any changes that had been made to the project design since the draft Project Description dated May 22, 2020, and GTC was able to ask Chance follow-up questions about potential project impacts.

A draft of the Project Proposal was shared with GTC/TGC July 24, 2020.GTC also flagged potential services that Gwich'in businesses might be able to offer Chance and inquired as to what employment opportunities would be available as a result of the Project. Chance indicated that it welcomes the opportunity to have further discussions with GTC to identify and facilitate potential economic development opportunities.

Chance will balance these interests with requirements to source specific equipment/professions for the maintenance work and requirements under section 68 of *YOGA* (i.e., benefits agreements with Yukon First Nations).

3.2.4 Tr'ondëk Hwëch'in

Initial notification was sent to TH on May 25, 2020. A conference call was organized between Chance and TH for June 17, 2020. The purpose of that meeting was for Chance to provide an overview of the proposed Project and to provide an opportunity for TH to ask questions and/or provide any feedback with respect to the proposed Project. During the conference, TH requested that Chance ensure that TH is identified as a potentially affected First Nation. Even though Project Activities do not occur in TH Traditional Territory, TH are indirectly affected by activities (e.g., increased traffic, impacts to wildlife in the region). Themes raised by TH included:

- Requiring additional information with potential risks associated with the Project and identified mitigation measures
- Requiring additional information with respect to the Project's potential wildlife management plan and information on how Project Activities would be affected if Porcupine Caribou are in the area (possibly the 40 Mile Caribou Herd and Hart River Caribou Herd as well)

TH also recommended that Chance look in the availability of traffic data in the Project Area and surrounding region. The presence and absence of traffic data in the region could inform what baseline studies Chance may need to conduct for future project proposals.

At the time of Chance and TH's initial call, no other materials (e.g., effects assessments, summaries of mitigation measures, management plans) were available. However, when the draft Project Proposal was completed, a draft was shared TH on July 24, 2020.

3.3 Ongoing Engagement Activities

Chance continues to be committed to engaging with potentially affected First Nations, should they wish to discuss the Project in more detail, and look forward to their involvement throughout the DO evaluation process.

4.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS ASSESSMENT METHODOLOGY

The assessment methodology outlined in this section provides a structured framework that is consistently applied to all valued components. The following guidance documents were considered when developing the Project's effects assessment methodology:

- *Proponent's Guide to Project Proposal Submission to a Designated Office* (YESAB 2010)

This methodology makes use of assessment terms Valued Components (VCs), defined as elements of the environmental and socio-economic systems valued for environmental, scientific, social, aesthetic, or cultural reasons.

The assessment methodology for VCs follows the main steps described below:

- Conduct assessment scoping (i.e., identify VC subcomponents and establish assessment boundaries);
- Establish baseline and existing conditions;
- Identify Project-related interactions and potential effects;
- Apply mitigation measures to address potential effects; and,
- Conduct effects characterization and significance determination.

4.1 Assessment Scope

The scope of the effects assessment focuses the application on the Project activities with the greatest potential to cause significant adverse effects on selected VCs. The VCs selected for this assessment were based on Project relevance and importance to First Nations, government agencies, and stakeholders, as well as previous assessment documents for related oil and gas and winter road projects in Yukon. VCs selected are discussed further in **Section 5.0**.

4.2 Establishing Assessment Boundaries

Assessment boundaries have been identified to define the spatial and temporal extent of the assessment. The spatial assessment boundaries are based on the spatial characteristics of the Project and the VC, and the areas where the Project-VC interactions and effects are expected to occur. Temporal boundaries encompass periods when the Project is expected to affect VCs. The temporal boundaries were determined based on the timing and duration of the Project. The spatial and temporal boundaries for the assessment of the Project are defined in **Table 4-1**.

Table 4.1 Spatial and Temporary Boundary Definition

Boundary	Definition
Spatial Boundaries	The spatial boundaries of the Project Area are outlined in Inset A of Figure 2-1.
Temporal Boundaries	The temporal boundaries for the assessment of the Project covers the construction, operation and maintenance of the winter roads and maintenance of the wells. To include permitting and construction timelines with some contingency, the temporal scope of this assessment is 2 years.

4.3 Establishing Baseline Conditions

The first step in performing an environmental and socio-economic effects assessment is to understand the existing environmental and socio-economic conditions currently present within the assessment area. The existing environmental and socio-economic conditions within the Project Area are based on a number of sources including historic literature, recent technical reports, databases, monitoring programs, government information, and first-hand knowledge. A summary of existing conditions is provided as part of each VC assessment to establish the setting for the assessment of Project-related effects on each VC. The level of detail provided for the existing conditions is sufficient to enable potential Project–VC interactions to be identified and understood.

4.4 Identifying Project-Related Interactions and Potential Effects

A key step in performing the environmental and socio-economic effects assessment is to understand the Project-related activities that are proposed and how those activities are likely to interact with the selected VCs. The intensity of the interaction will result in the potential effect on the VC and will ultimately dictate the mitigation measures implemented to minimize the effect of that interaction. The intensity of the interaction may be “none”, “negligible”, or “potential”. All Project components/activities that will not interact with a VC and will not result in potential effects are not considered further in the assessment. Where a potential interaction is predicted, a potential effect is identified and carried forward in the assessment. Where there is potential for the effect to be significant, mitigation measures are developed.

Consistent with direction provided in *YESAA*, each VC assessment section includes descriptions of mitigation measures of relevance to the particular VC to eliminate, reduce, or control adverse Project-related effects, as well as measures contained in industry codes and standards. The effectiveness of mitigation measures in reducing the potential effect is considered in the effects characterization.

4.5 Effects Characterization and Determination of Significance

For each VC, an effects characterization is performed, which evaluates the potential Project-specific effects with the implementation of the mitigation. Each effect is characterized based on its direction, magnitude, geographic extent, timing, frequency, duration, reversibility, and probability of occurrence. Each VC assessment section provides a description of the relative context for the assessment in terms of the resiliency and sensitivity of the VC. General definitions for these characteristics are presented in **Table 4.2.**

Table 4.2 Residual Effects Characteristics

Residual Effect Characteristic	General Definition	General Rating
Direction	Identifies whether the residual effect will be adverse or positive	• Adverse • Positive
Magnitude	Size or severity of the residual effect relative to the existing condition of the VC, generally measured in terms of the proportion of the VC affected within the Project Area, relative to the range of natural variation (or historic variation in the case of human environment VCs)	• Low • Moderate • High
Geographic Extent	Geographic area where the residual effect is likely to occur	• An area within the Project Area
Timing	Occurrence of the residual effect with respect to a temporal attribute important to the VC (e.g., time of day, season, stage in life cycle, etc.)	• VC-specific
Frequency	How often the residual effect is likely to occur, taking into account VC-specific temporal characteristics	• Infrequent • Frequent • Continuous
Duration	Length of time the residual effect to the VC is likely to persist, taking into account VC-specific temporal characteristics	• Short-term • Long-term • Permanent

Residual Effect Characteristic	General Definition	General Rating
Reversibility	Degree to which the residual effect can be reversed once the causal factors cease; irreversible effects are considered to be permanent	• Fully reversible • Partially reversible • Irreversible
Context	The extent to which the VC has been affected by past and present environmental and socio-economic processes and conditions, and its potential sensitivity to the Project-related residual effect, and its ability to recover from that effect	• Undisturbed • Disturbed • Resilient • Sensitive
Probability of occurrence	Likelihood that the residual effect will occur, taking into account how probable it is that a disturbance will actually be caused by the Project or that a specific mitigation will be successful	• Likely • Unlikely

The significance of effect on the VC will be assessed based on the effects characteristics, and the likelihood of the effect. The likelihood of the effect is in part determined by the scientific certainty relative to the quantification of the effect, scientific certainty relative to the effectiveness of the proposed mitigation, and professional judgement based on prior experience in assessing effects and the known effectiveness of proven mitigation measures. The rationale for the determination of significance is provided for each VC.

5.0 VALUED COMPONENT SCOPING

Valued ecological, social, cultural, and economic components (VC) identified for the Project form the basis of the assessment conducted in **Section 6.0**. These components were selected based on the results of environmental and archaeological field studies, literature reviews, consultation with First Nations, and professional expertise. The valued components are described in **Section 5.1**, along with a rationale for their selection. The assessment in **Section 6.0** focuses on these valued components.

Potential VCs and VC subcomponents were selected based on (1) their value as ecological, social, cultural or economic factors, (2) spatial, temporal, and mechanistic ability to interact with the Project, and (3) technical feasibility of conducting an assessment. Ecological values included consideration of foundational environmental factors or processes, species of conservation concern (e.g., caribou), and more general species or processes that represent biodiversity. Social and cultural values were based primarily on current and historic human use, such as hunting, recreation, and heritage values. Economic values relate to existing or future use of resources to derive monetary benefits. Often potential VC subcomponents can include multiple value types. For example, furbearers have ecological, cultural, and economic values.

VC's and subcomponents were also screened based on their ability to interact with the Project, including the degree of spatial and temporal overlap with the Project and mechanism to be affected by the Project. For example, birds are sometimes included as a VC subcomponent for EAs for some projects because of the numerous species that contribute to biodiversity and diverse habitat associations the group has. However, for this Project the potential to interact with the VC is low because most species have migrated south during the winter when the Project will be active and the project has low potential to affect the few resident birds that are present.

Finally, technical feasibility was considered for selection of VC subcomponents. These criteria relate to technical factors that could affect the effects assessment, such as the availability of baseline data or the level of understanding of how the project could affect the VC subcomponent.

Potential VCs that were considered in the scoping exercise but were NOT carried through for assessment are described in **Section 5.2**. These issues were investigated for potential interactions with the Project and were determined to not require further assessment. **Section 5.2** provides a description of the issues, and a rationale for not including them as valued components. Mitigation measures and best practices are identified for these issues where applicable.

5.1 Valued Components Selected

The VCs selected for assessment are wildlife and wildlife habitat, vegetation and wetlands, and heritage resources. The rationale for selecting these VCs and specific subcomponents within each VC to be assessed are provided below.

5.1.1 Wildlife and Wildlife Habitat

Wildlife and wildlife habitat were selected as a VC because there is a potential for interaction between wildlife and wildlife habitat and Project activities. Wildlife and wildlife habitat are valued as important ecological components, for aesthetic and cultural reasons, and as subsistence food sources. Sensitive species and/or habitats will be given special consideration within this VC. The indicators used to describe and evaluate potential Project-related effects on wildlife and wildlife habitat include habitat, movement and distribution, and mortality or injury.

As a group, ‘wildlife’ encompasses numerous taxa with diverse habitat requirements. Effects assessments for most resource development projects include a suite of species or species groups as subcomponents to represent the diversity encompassed within the wildlife VC. The suite of species and species groups that were considered during VC selection are outlined in **Table 5.1**. Based on the selection process, caribou and moose were selected as VC subcomponents for effects assessment.

Table 5.1: Summary of selection process for wildlife valued components

Potential Subcomponent	Value (Ecological, Social, Economic)	Potential to Interact with Project (Spatial, Temporal, Mechanism)	Evaluation Outcome
Caribou	High. The Porcupine Caribou Herd is highly valued for subsistence hunting, cultural values, and ecological values.	Moderate. The Project occurs within the PCH winter range when caribou may be present; however, caribou do not use the Project area every year. If caribou do occur, the Project have the potential to affect local movements and habitat availability.	Selected as a VC subcomponent.
Moose	Moderate. Moose are valued as a secondary species for subsistence hunting, after caribou.	Moderate. The Project occurs within annual moose range and Project activities could have a localized effect on moose distribution and habitat availability.	Selected as a VC subcomponent.
Furbearers	Moderate. Marten and lynx have high cultural and moderate economic value for trapping, but the area has not been actively trapped for several years.	Low. The Project occurs within marten and lynx ranges, but these species tend to be tolerant or adaptive to low levels of industrial work, as required for this project. The project will not create new access on which snowmobiles cannot already travel.	Not selected as a VC subcomponent, but mitigations are provided
Grizzly Bears	Moderate. Grizzly bears are often a species of conservation concern because they occur at low densities and can be sensitive to human disturbance.	Very Low. Grizzly bears will be denning while the Project is active and the chance of a den occurring near work areas is very low.	Not selected as a VC subcomponent, but mitigations are provided
Wolves	Moderate. Wolves play an important role in large mammal predator-prey relationship in northern ecosystems; however, they generally have low social and economic value.	Low. Wolves occur within the project area but tend to relatively tolerant or adaptive to low levels of industrial work, such as required for this Project.	Not selected as a VC subcomponent; no specific mitigations
Birds	Moderate. Birds are often included as a VC subcomponent in effects assessments because, as a group, it includes numerous species that contribute to biodiversity and have diverse habitat associations.	Very Low. The Project has very low potential because the majority of birds in the area are migratory and will be on their wintering grounds, the timing of work is outside the breeding season, when birds may be sensitive to disturbance, and affects to bird habitat are very limited.	Not selected as a VC subcomponent; no specific mitigations

5.1.2 Vegetation and Wetlands

Vegetation and wetlands were selected as a VC because there is a potential for interactions with Project activities, and because of their role supporting biodiversity and wildlife habitat. Further, they are valued by First Nations and local residents who may use certain species as a subsistence and economic resource. Project activities may disturb, change, or remove vegetated areas, habitat containing traditional and medicinal plants, and ecological communities that may host rare plants or wetlands.

5.1.3 Heritage Resources

Heritage Resources were selected as a VC because of the value of heritage sites and historic resources rests within their context in the land in which they are located and there is potential for interactions with Project activities. Once disturbed or removed, that value cannot be restored. The term “heritage resources” is used here to refer to archaeological resources, historical resources, and paleontological resources collectively (i.e., all are considered to be types of heritage resources). In Yukon, the *Historic Resources Act* (RSY 2002, c.109) and Archaeological Sites Regulation contain legislation that mandates the management and protection of Yukon archaeological, historical, and paleontological resources. This legislation applies to heritage resources on both private and public land that are older than 45 years. Archaeological, historical, and paleontological resources are protected from unpermitted surveys, disturbances, alterations, or excavations.

5.2 Other considerations

Other valued components considered in our report but not included in the effects assessment include fish and fish habitat, permafrost, air quality, fish and wildlife harvesting, community safety and well-being of indigenous people; tourism and aesthetics; economic activity; land use and recreation; traditional land use; health and safety; and site access and traffic.

5.2.1 Fish and Fish Habitat

Fish and fish habitat are recognized as important values in the Eagle Plains area. However, Fish and fish habitat are not included as valued components because they have negligible potential to interact with the Project. No direct effects to fish and fish habitat will occur because access roads do not cross any streams and all well sites and access roads are greater than 200 m from mapped water courses or water bodies. Indirect effects, such as sedimentation or water quality are deemed to be negligible because winter roads have minimal effect on natural drainage patterns and do not expose soil for sediment transfer (i.e., there is no ditching along the winter roads and the duff layer and ground vegetation are protected).

5.2.2 Permafrost

Permafrost was considered as a potential VC for the assessment. However, the timing of the proposed activities (i.e., completed in winter) and the relatively short duration of the Project greatly limit any potential effects on permafrost in the area. Additionally, the methods proposed for winter road construction are designed to reduce ground disturbance by mulching large vegetation (trees) rather than pushing it over with a bulldozer, which could potentially pull up root systems and expose underlying sediments. Winter road construction will leave the surface organic mat (moss and peat) intact and uncompressed, minimizing effects on permafrost. Winter roads actually promote penetration of wintertime cold into the ground due to higher thermal conductivity of ice than adjacent snow, a response that will help counteract any minor reduction in cold penetration below road-edge berms. Excess accumulation or piling of snow will not occur

to avoid potential effects on local ground temperatures. Well maintenance activities will not have the opportunity to adversely affect permafrost. Therefore, permafrost was not considered further in this effects assessment.

5.2.3 Air Quality

Air quality was considered as a potential VC for the assessment. However, given the remoteness of the Project site, the relatively short duration of the Project, the air quality within the Project area will not deteriorate with the installation of the winter roads or well maintenance activities. The Project will involve burning of fossil fuels to operate the equipment to work on the winter roads as well maintenance activities. Emissions from equipment will be relatively low and localized to the areas of active construction and at each well. Additionally, the construction phase of the Project is only projected to last one winter at which point air quality will return to baseline conditions and will not have a lasting effect on local air quality. Therefore, air quality was not considered further in this effects assessment.

5.2.4 Fish and Wildlife Harvesting

Fish and wildlife harvesting were considered as a potential VC given the importance of this activity for both traditional and subsistence purposes. In this context, harvesting includes hunting, fishing, and berry picking. Harvesting is important for First Nations to maintain their connections to their traditional territories and helps to preserve and enhance their culture, identity and values. Since Project activities will be located primarily in previously established well sites and where roads had historically been constructed it is anticipated that the effects to opportunities to practice harvesting caused by the project will be minimal. If Project activities overlap spatially and temporally with Porcupine Caribou Herd migration, there could be potential interactions between Project activities and caribou hunters, specifically human health and safety. Negative effects caused by these interactions will be mitigated by the measures implemented in Section 6.1 – Wildlife and Wildlife Habitat. Therefore, fish and wildlife harvesting were not considered further as a VC in this assessment.

5.2.5 Community Safety and Well-being of Indigenous People

Community Safety and Well-being of Indigenous People was considered as a potential VC in response to the Calls for Justice for Extractive and Development Industries from the National Inquiry into Missing and Murdered Indigenous Women and Girls (MMIWG1b 2019). Resource extraction and development projects can exacerbate issues of violence against Indigenous women and girls (MMIWG1a 2019).This potential VC was not carried forward in the assessment because of the Project's approach to staffing the site; staff will not be spending time in nearby communities or along public roadways during their transit to site and instead will arrive on site via a fixed-wing aircraft directly to the Eagle Plains airstrip.

5.2.6 Tourism and Aesthetics

Tourism and aesthetics were considered as a potential VC due to the Klondike and Dempster Highway's use as a popular tourism route in the territory. Two of the wells are located immediately adjacent to the highway and already have access routes with rig matting in place. These wells will be visible to the public, however tourism and aesthetics were not carried forward in the assessment because the Project activities likely to affect tourism and aesthetics will be limited to the construction period of the winter of 2020/2021 during the tourism off season. Project activities will also be localized to the areas of active construction, and will return to baseline conditions following the end of the construction period.

5.2.7 Economic Activity

Economic activity in the area surrounding the Project site was considered as a potential VC because it was identified as an area of interest for the affected First Nations. The Project has limited interaction with local businesses aside from necessary stops (i.e., fuel stations) by resource delivery drivers during construction and is therefore not considered further in this assessment.

5.2.8 Land Use and Recreation

Land use and recreation were considered as a potential VC given the high volume of traffic along the Dempster Highway and use of the area for land use activities and recreational purposes. The Project is not likely to overlap with land use and recreation activities potentially occurring in the area. Effects will be localized to the areas where roads had previously been built and to previously established well sites and camp facilities. Furthermore, the proposed activities are anticipated to be completed in one winter (December to March). Therefore, it is not expected that Project activities will have lasting interactions with land use and recreation beyond the Project's construction schedule and is therefore not considered further in this assessment.

5.2.9 Traditional Land Use

Traditional Land use was considered as a potential VC for the project. Give the location of the Project, it is not expected that Project activities will have lasting interaction with traditional land use beyond the Project's construction schedule and is therefore not considered further in this assessment. The Project is not likely to overlap with land use and recreation activities potentially occurring in the area. Effects will be localized to the areas where winter roads had previously been built and to previously established well sites and camp facilities. Furthermore, the proposed activities are anticipated to be completed in one winter (December to March).

5.2.10 Site Access and Traffic

Site access and traffic were considered a potential VC for the assessment given the high volume of traffic along the Klondike and Dempster Highway and a potential increased level of access among travellers to the surrounding lands and site area via the winter access road that will be constructed for the Project. Due to the implementation of security measures (included a gated entrance) at the commencement of the winter access roads, this VC was not carried forward to assessment.

6.0 ENVIRONMENTAL AND SOCIO-ECONOMIC EFFECTS ASSESSMENT

6.1 Wildlife and Wildlife Habitat

6.1.1 Existing Conditions

6.1.1.1 Caribou (Rangifer tarandus)

The Project occurs exclusively within the range of the Porcupine Caribou Herd. The transport of equipment to and from the Project, likely from Alberta or northeastern British Columbia, would travel through several additional caribou herds, including the Forty Mile Herd and the Hart Herd along the Dempster Highway. However, the incremental amount of Project traffic compared to regular highway traffic is small and, as

such, the effects of travel to and from the Project are not included in this assessment. Project equipment would consist of approximately two dozen trucks which would travel to and from the Project area over a 3 to 5 day period.

The Porcupine Caribou Herd is a subpopulation of barren-ground caribou. Barren-ground subpopulations are known for their large aggregations, dramatic population fluctuations, lengthy migrations, and significant cultural and social value to northern Indigenous people and other Canadians (COSEWIC 2016). Barren-ground caribou have been assessed as "Threatened" by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC 2016). Within Yukon barren-ground caribou are considered "Vulnerable/Apparently Secure" (Yukon Government 2020). Although many barren-ground caribou are declining, the Porcupine Caribou Herd has been increasing at a rate of approximately 4% from 123,000 animals in 2001 to 218,000 in 2017 (Yukon Government 2018).

The Porcupine Caribou Herd's annual range extends approximately 250,000 km² from Alaska, through Yukon, and into the western edge of Northwest Territories. The herd undertakes long distance migrations across seasonal ranges necessary for key aspects of their life cycle. Seven primary life cycle periods occur for the Porcupine Caribou Herd (**Table 6-1**) (Porcupine Caribou Technical Committee 1993). The timing of this Project (December to mid April) coincides with the *Early, Mid, and Late Winter* season and the *Spring, Spring Migration, and Pre-calving* season of the Porcupine Caribou Herd.

Winter is considered the season of lowest importance to the herd (Porcupine Caribou Technical Committee 1993). The herd is at its most dispersed stage during winter, both in terms of the extent of the range it uses and in terms of group aggregations. Average daily movement distances (2-5 km/day) (Russell and Gunn 2017) are lower than other seasons, except for cows during calving. Winter range use varies from year to year depending on snow depth and condition. In Yukon, during deep snow years, use is concentrated in the Richardson Mountains and the Ogilvie-Hart basins. In low snow years, the Whitestone River and Eagle Plains areas, which contain abundant lichen resources, are used more. Forage, primarily lichens, is generally not limiting during the winter and in shallow to normal snow years the caribou appear to maintain neutral to surplus energy balances. The Porcupine Caribou Herd are relatively tolerant to human activity during the winter (Porcupine Caribou Technical Committee 1993).

During the *Spring, Spring Migration, and Pre-calving* season caribou begin moving north towards the calving grounds. Average daily movement rates increase from approximately 6 km/day at the start of the season to approximately 24 km/day through May. Caribou, especially pregnant cows, typically enter an energy deficit during spring due to reduced forage availability, as they leave the lichen-rich taiga and before forbs have emerged, and higher energy expenditure associated with migration. Spring is rated higher importance than winter, but still relatively low overall, due to lack of association with specific habitats, relatively low threats from predators, and lack of insect harassment (Porcupine Caribou Technical Committee 1993).

No Wildlife Key Areas occur for caribou within the Project area (Environment Yukon 2016a).

Table 6.1: Key life cycle periods for the Porcupine Caribou Herd (from Porcupine Technical Committee, 1993)

Season	Dates	Characteristics	Importance
Early, Mid and Late Winter	Dec 1 to Mar 31	The herd is at its most dispersed at this time across two winter ranges: in Yukon, mostly south of the Porcupine River in boreal taiga and, in Alaska, centred in the Chandalar River/Arctic Village area. Winter range use varies from year to year depending on snow depth and condition. Caribou at this time of year are relatively tolerant to human activity. In shallow to normal snow years animals can gain weight.	4 (Lowest)
Spring, Spring Migration, and Pre-calving	Apr 1 to May 31	Distribution of the herd varies depending on snow melt; migration routes vary from year to year. Pregnant females are typically in energy deficit due to reduced forage once they leave the lichen rich taiga.	3
Calving (cows)	June 1 to 10	Calving occurs on the coastal plain of NE Alaska and, to a lesser degree, NW Yukon. This area offers reduced predators and abundant spring forage; no alternative range is available. Cows are at the lowest point of physical condition and are least tolerant to human disturbance.	1 (Highest)
Post-calving and Movement (cows)	June 11 to 30	As calves develop over the first two weeks of life the cows and calves tend to aggregate into larger groups and increase movement rates to track plant green-up. The post calving period imposes high energetic demands on lactating females and cow/calf groups are relatively intolerant of disturbance. The post-calving range is primarily in Alaska and cows that calved in Yukon tend to move west along the foothills into Arctic National Wildlife Refuge (ANWR). Insect avoidance can affect distribution by the end of June.	1 (Highest)
Calving to Movement (bulls)	June 1 to 30	Bulls, non-pregnant cows, and subadults tend to concentrate east of the calving grounds in the northern Yukon. Animals track the progression of greenup from the coastal plains to the northern foothills, to intermountain regions.	3
Early Summer	July 1-15	Cows continue to require high energy intake for milk production, but insect avoidance also drives distribution. Key areas selected for insect avoidance are the coastal plain adjacent to the Beaufort Sea (mostly cows/calves) and mountains in the Brooks and British Mountains (mostly bulls and cows without calves). Long distance movements during this period are also an insect avoidance behaviour.	2
Mid Summer	July 16 to Aug. 7	Mid summer continues to be a period of high insect harassment. Two areas are consistently used – the northern Richardson Mountains in Yukon and the southern portion of the Brooks Range in Alaska. Females with cows may be in energy deficit.	2
Late Summer and Fall Migration	Aug. 8 to Oct. 7	As insect activity declines the herd disperses widely but mostly stays north of the tree line until the latter part of the period – in Alaska south of the Brooks Range and in Yukon north of the Porcupine River. Animals exhibit high feeding rates and gaining fat for the winter.	3
Rut and Late Fall	Oct 8 to Nov 30	The region where rut occurs has no affinity from year to year; rut occurs wherever the herd happens to be along fall migration. In Yukon distribution can occur from the southern Olgilvie Mountains to the Richardson Mountains.	4 (Lowest)

6.1.1.2 Moose (Alces alces)

Moose occur throughout the Project area and are present in all seasons; however, population levels are poorly known. The Regional Biologist with Environment Yukon has suggested that the density of moose in Eagle Plains is low compared to populations in central and southern Yukon, but relatively high compared to other areas in north Yukon, and may be rising (M. Suitor, pers. comm.). Extensive wildfires within the Eagle Plains area over the last 30 years are currently in shrub-dominated successional stages that offer productive summer and winter forage for moose, which are expected to support higher numbers of moose than later successional black spruce forests. In November 2000 an aerial moose survey was conducted for a study area that mostly overlapped with the project area for this Project (Access Consulting Group and EBA Engineering Consultants Ltd. 2001). That survey observed 30 moose and estimated a total population of 60-90 based on additional tracks seen and a low sight ability factor.

Winter is normally a limiting season for moose. Reduced forage, higher energy expenditures, due to snow and cold, and higher vulnerability to predation all contribute to limit moose fitness during the winter. During winter, moose are primarily associated with shrub-dominated habitats for forage, which include regenerating burns, riparian areas, shrub-carrs, wetlands, stream valleys, and upland deciduous and mixed forest (Suring and Sterne 1998, Environment Yukon 2016b, McCulley et al. 2017). In other areas in Yukon, moose typically use higher elevation area in early winter and move to lower elevations in late winter to avoid deep snow and to utilize habitats such as riparian areas with shrubs for forage (Environment Yukon 2016b). It is unverified if this occurs in the Project area, but winter snow depths often exceed 50 cm in the Eagle Plains area (Russell and Gunn 2017), which is the threshold at which moose tend to exhibit winter movements to seek lower snow packs (Poole and Stuart-Smith 2005).

No Wildlife Key Areas for moose occur within the Project area (Environment Yukon 2016a)

6.1.2 Project Interactions and Potential Effects

Potential effects to VC subcomponents were evaluated based on the degree of spatial and temporal overlap between Project activities and the VC subcomponents and the type of interactions the Project could have on the VC subcomponents. Types of interaction include both direct affects, such as displacing animals due to sensory disturbances, and indirect effects, such as increasing mortality risk from hunters or natural predators. Project activities and interactions could result in effects to wildlife and wildlife habitat during three primary Project stages (**Table 6-2**).

Table 6.2: Potential interactions between Project activities Wildlife and Wildlife Habitat

Activity	Project Interactions	Potential Effects
Winter road construction	• Vegetation Removal • Use of heavy equipment • Human presence	• Sensory disturbance • Localized effects to movement and distribution • Direct and indirect habitat effects
Road travel (along the Dempster and winter roads)	• Vehicle travel	• Sensory disturbance • Localized effects to movement and distribution • Indirect habitat effects • Direct and indirect mortality

Well site maintenance	• Vegetation Removal • Use of heavy equipment • Human presence	• Sensory disturbance • Localized effects to movement and distribution • Mortality or injury

6.1.2.1 Caribou

A detailed assessment of potential effects of oil and gas activities in Eagle Plains on caribou was conducted by Russell and Gunn (2017). This assessment draws from their work, adapting to the limited scope of this well maintenance program.

There is increasing evidence that ungulates, including caribou, tend to respond to human presence and activities in similar manners to how they respond to predators (Frid and Dill 2002). The most common response of caribou is to avoid human activity areas or to exhibit greater vigilance behaviours. Reported response distances of caribou vary widely but are mostly in the magnitude of several hundred metres (e.g., 600 m (Murphy and Curatolo 1987). Caribou may also change their distribution relative to disturbance. In most studies, avoidance of roads is less than 4 km (Vistnes and Nellemann 2001, Cameron et al. 2005), but avoidance of the Dempster Highway varied from 18-30 km over a twenty year period depending on land use and hunting regulations (Johnson and Russell 2014). Responses by caribou to human disturbances vary widely and causal relationships are often poorly understood.

Patterns of avoidance by caribou to human disturbances are often affected by the nature of the human activity, specifically, whether caribou are directly hunted or harassed by humans, and time since disturbance began. Reduced behavioural response and apparent avoidance in distribution patterns (i.e., habituation) appear to be associated with lack of hunting and predation (Lawhead et al. 2006, Haskell and Ballard 2008). This highlights the importance of factoring hunting management into mitigations. However, effects on distribution can occur outside of hunted areas and several years after the disturbance began (Johnson et al. 2019).

Russell and Gunn (2017) frame their assessment in terms of *sensitivity* of the Porcupine Caribou Herd to potential effects and degree of *exposure* to effects. Sensitivity relates to factors such as herd size and trend, seasonal body condition, ecological life history activities, and environmental stressors, like insects. Caribou are generally more sensitive to effects when populations are low and declining, when their body condition is low or they are exposed to other stresses (e.g., insect harassment), and during critical life history periods, notably calving. In the context of the current condition of herd and the timing when the Project could interact with it, the sensitivity of the herd is low:

- The herd is at a historically high population level and showing an increasing trend.
- During winter, when the Project would occur, Porcupine Caribou are typically in good body condition and free of stressors, such as insects.
- The winter period is not associated with a critical life history stage.

Exposure relates to the degree of spatial and temporal overlap between caribou and potential human effects, as well as the mechanisms of effects (e.g., type, magnitude, and duration of effects). In terms of type of effects, the most likely effects of the Project are localized, temporary effects to distribution, which can translate to indirect habitat effects. The only potential source of direct mortality from the Project would

be vehicle collisions, and those can be effectively mitigated. Linear features can indirectly affect the rate of mortality of caribou caused by natural predators and hunters, by increasing ease of travel. However, this Project will avoid creating new linear features by re-establishing existing winter roads. The Project is aiming to have a neutral effect on hunting, to balance mitigating effects to caribou while maintaining indigenous hunting opportunities. Although hunting will not be available from the Blackie and Chance winter roads, the project will not inhibit hunting indigenous hunting opportunities in the broader area that may be accessed from the Dempster Highway.

Russell and Gunn (2017) assessed the potential spatial and temporal overlap between the Porcupine Caribou Herd and a similar, but slightly larger extent, as this Project, using thirty years of telemetry data. Their primary analysis area was a 30 km buffer around the project, based on the maximum distance that caribou avoided the Dempster Highway in another study (Johnson and Russell 2014). Russell and Gunn (2017) found that a collared caribou occurred in the 30 km buffer area during the months of January to April in 15-22% of the years. The average percentage of the herd using the 30 km buffer area ranged from 3% in January to approximately 1% in February to April. Average residency times varied from 9 to 17 days/month during the January to April period. In other words, on average, 98% of the herd's movements during the winter occur outside the 30 km buffer surrounding the Project and, for any animal that does occur in the area, they typically spend a third to half of a month there before moving out of the area.

6.1.2.2 Moose

Moose can be affected by human land use activities, although moose are generally less sensitive than caribou. As outlined below, Project activities could result in four types of effects to moose.

1. Sensory disturbance. Human presence, work activities and vehicle travel/equipment operation will generate noise and other sensory effects that moose may respond to. The most likely response of moose to sensory disturbance is to avoid areas where disturbances are occurring. This could result in localized effects to movement and distribution and indirect habitat effects (Lykkja et al. 2009) (see 2 and 3, below, respectively). When moose are unable to move away from sensory disturbances, it can result in physiological stress responses and behavioural modifications (e.g., increased vigilance). However, these responses are not anticipated to occur for this Project because moose can move away from the work areas to avoid them.
2. Localized effects to movement and distribution. Numerous studies have examined responses of moose to human activities, including roads, industrial activity, and rural residences (Andersen et al. 1996, Burson et al. 2000, Yost and Wright 2001, Lykkja et al. 2009). Most studies found avoidance of human activity areas out to approximately 300 m (EDI Environmental Dynamics Inc. 2017). However, there are also cases where moose appear to choose to be nearer to human activity to avoid natural predators (Muhly et al. 2011). Similar to caribou, responses are greatest when moose are directly harassed or hunted.
3. Indirect habitat effects. A consequence of localized avoidance of human activity areas is that the habitat within the zone of influence is temporarily not used by animals. As per the effects on movement and distribution, the zone of influence for indirect habitat effects is approximately 300 m.
4. Direct and indirect mortality. The Project has the potential to have a direct effect on moose mortality via vehicle collisions (EDI Environmental Dynamics Inc. 2015). However, mitigation measures, below, are expected to effectively eliminate the risk of vehicle collisions. The Project could have an indirect affect on mortality by improving access along the winter roads for human hunters and natural predators.

6.1.3 Mitigation Measures

6.1.3.1 General Mitigation Measures for Wildlife and Wildlife Habitat

- All Project personnel will be required to complete formal orientation and training related to wildlife mitigation measures.
- Work will be scheduled to minimize the spatial extent across which work is concurrently occurring.
- Access to the well sites will utilize existing and historic winter roads to minimize the creation of new linear features.
- Project footprints, notably the widths of winter roads, will be minimized as much as possible. On the Chance Road, the width will not exceed the existing right-of way extent.
- Firearms are not allowed on-site by Project personnel. No hunting or shooting rules will be in effect.
- A no harassment of wildlife policy applies to all personnel. This includes attempts to chase, catch, divert, follow, photograph, feed, or otherwise harass wildlife, whether on foot, in on-road or off-road vehicles, heavy equipment, or aircraft.
- The use of on-road and off-road vehicles, including snowmobiles, will be restricted to essential Project access routes.
- Personal use of unmanned aerial vehicles (UAVs or drones) is prohibited.

6.1.3.2 Road Operations

The following measures are designed to mitigate the risk of vehicle collisions and effects of road use on wildlife movements.

- The maximum speed limit along the Dempster Highway is 90 km/h.
- The maximum speed along winter roads is 30 km/h.
- Wildlife will always have the right-of-way. This requires vehicle operators to stop when wildlife are observed on or beside the road, allowing them to cross safely. If wildlife stays on the road or right-of-way for >5 minutes, drivers may resume travel and pass the animals at <10km/h.
- Special rules apply to caribou.
    - For Caribou within 100 m from the road:
        - Stop as far back as possible;
        - Alert other drivers;
        - Wait until caribou have crossed and moved beyond 500 m from the road or are lost from sight before proceeding;
        - Proceed with caution.
    - For Caribou beyond 100 m from the road:
        - Proceed with caution;
        - Alert other drivers;
        - Watch for direction of movement and change in behaviour.

- When moose and caribou are on a road they will sometimes run down the road away from a vehicle. If this happens, stop and wait at least 5 minutes to allow the animal to move off the road. If the animal remains on the road, drive forward at 10 km/h, then stop again when the animal begins to run away. Wait 2 minutes and repeat this procedure. If the animal still does not leave the road, wait 10 minutes and repeat the procedure, alternating with a 2- and 10-minute stop between driving attempts.
- Drivers are required to use two-way radio communication. The location of any wildlife observed along Project roads is to be communicated to other road users on the radio.
- Drivers will not exit the vehicle to chase, catch, divert, follow, photograph, or otherwise harass wildlife.
- Along winter roads:
    - snow banks will be maintained at heights <1 m to reduce the hinderance to wildlife crossing them;
    - where snow banks exceed 60 cm in height, regular breaks (at least every 500m) will be created to facilitate easier animal crossing and as 'escape routes' off the road.
        - Create matched breaks on either side of the road that animals can use to cross.
        - On corners, create run-outs, in each direction, that are obvious alternative routes for animals to use, instead of following the road.
        - Avoid breaks at seismic lines, which could provide human access.

6.1.3.3 Aircraft Operations

The following measures are designed to mitigate the effects of aircraft use on wildlife:

- Altitudes of greater than 300 m above ground level will be maintained at all times of the year.
- Altitudes of greater than 600 m above ground level will be maintained during sensitive times of the year.
- Areas where caribou have been observed in the past will be avoided.
- Flights paths will be designed to avoid important areas during sensitive times of the year.
- No caribou observed will be flown towards, circled, or harassed.
- If caribou are seen to be in a panic or startled the plane will ascend to a higher elevation.

6.1.3.4 Caribou

The majority of potential effects to caribou will be mitigated via measure for general wildlife, road operations and aircraft operations. Additional measure specific to caribou include:

- Packing of snow will not occur on any linear features that are not essential to Project work.
- Access to linear features off the winter roads will be minimized by avoiding creation of breaks in snow berms at junctions with linear features.
- All sightings of caribou will be reported to the Environmental Monitor.
- If more than a dozen caribou are observed, or if any number of caribou are observed in the same location for longer than a three-day period, a qualified environmental professional (QEP) will be consulted to determine if site-specific mitigations may be warranted.

Due to the variable nature of caribou occurrence and snow conditions from year to year, a pre-operations assessment will be conducted in December, prior to Project initiation, to assess local conditions (specifically including information about caribou occurrence and snow conditions) that could warrant tailored management measures. For example, if telemetry data indicated that several collared caribou were in the Project area, near work areas, additional measures may be put in place to mitigate potential effects.

6.1.4 Effects Characterization and Significance

6.1.4.1 Caribou

With the mitigation measures listed in **Section 6.1.3** applied, it is predicted that Project activities will not result in significant effects to habitat, movement and distribution, and mortality or injury to caribou. Detailed effects assessments are provided for each indicator in Table 6.3, Table 6.4 and Table 6.5 respectively. Key factors that result in this significance determination are:

- Although the timing of the Project does overlap with the potential occurrence of the Porcupine Caribou Herd in the area, the extent of the Project area, including a zone of influence, is a small proportion of the herd's total winter range. If caribou choose to avoid the work areas (i.e., due to sensory disturbance) alternative habitat is available.
- The timing of the Project, during winter, is a season of lowest importance for the ecology of the Porcupine Caribou Herd and a period when the caribou are relatively tolerant of human disturbance (Porcupine Caribou Technical Committee 1993).
- The most likely potential effect to caribou is temporary, localized avoidance of work areas due to sensory disturbance.
- The Project will be re-establishing existing winter access, not creating new access features, and will therefore not result in a change in access for human hunters and natural predators.

Table 6.3: Characterization of potential effects to caribou habitat.

Residual Effect Characteristic	General Definition	Rating
Description of Interaction	The Project will consist of work at 8 well sites plus access via 30.2 km of winter roads. This will result in direct habitat effects due to vegetation clearing along the access routes and well sites. It may also result in indirect habitat effects if caribou choose to avoid areas in proximity to the roads and well sites due to sensory disturbance or perceived predation risk.	
Direction	Effects to habitat will be adverse.	Adverse
Magnitude	The magnitude of effects is low, due to the small extent and narrow width of areas that are affected.	Low
Geographic Extent	Direct habitat will be limited to the footprint of the winter roads and well sites (approximately 60 ha). Indirect effects can extend out to 4000 m, depending on site conditions and variation in caribou behaviour. These extents are small relative to the herd's total winter range.	Low
Timing	The timing of the Project, during winter, is a season of lowest importance for the ecology of the Porcupine Caribou Herd and a period when the caribou are relatively tolerant of human disturbance	Low
Frequency	Direct effects will be continuous, though diminishing in magnitude, as vegetation regenerates. Indirect effects will be continuous when work activities are active.	Continuous

Residual Effect Characteristic	General Definition	Rating
Duration	Direct effects to the road and well site footprints will take years to regenerate (long-term). Indirect effects will cease once work activities are completed (short-term).	Short-term Long-term
Reversibility	The effects to habitat are fully reversible. Indirect effects will cease immediately upon stoppage of work activities. Direct effects along the winter roads will take several years for vegetation to regrow.	Fully reversible
Context	Work for this project will occur on previously disturbed sites. Measures to protect the duff layer and ground vegetation will maximize the resiliency of the site to regenerate to similar habitat.	Existing Disturbed/ Resilient
Probability of occurrence	Based on historic telemetry data it is likely that caribou will encounter areas affected by this Project at some point in the future. The likelihood that caribou will be present during the year the Project is active is moderate (over 24, years collared caribou occurred within 4km of the Project area in 17% of the years).	Likely

Table 6.4: Characterization of potential effects to caribou movement and distribution.

Residual Effect Characteristic	General Definition	Rating
Description of Interaction	The Project will consist of work at 8 well sites plus access via 30.2 km of winter roads. This work will result in sensory disturbance that could cause caribou to avoid the areas. Responses to sensory disturbance are mostly ≤4 km but vary in relation to site conditions and caribou behaviour. Effects are most likely to be expressed as temporary, localized avoidance of work areas. No effects to migration are expected because the extent of the Project area is small relative to the extent of winter range available for caribou to travel through.	
Direction	Effects to movement and distribution could be adverse.	Adverse
Magnitude	The magnitude of effects is low due to the limited consequence if caribou chose to avoid work areas. Alternative habitat is available, and avoidance of the area would not hinder migration or sub-regional movements within the winter range.	Low
Geographic Extent	Responses to sensory disturbance are mostly ≤4 km but vary in relation to site conditions and caribou behaviour. These extents are small relative to the herd's total winter range.	Low
Timing	The timing of the Project, during winter, is a season of lowest importance for the ecology of the Porcupine Caribou Herd and a period when the caribou are relatively tolerant of human disturbance	Low
Frequency	Potential effects to movement will occur daily, corresponding to periods when project activities are active.	Frequent
Duration	Project work will occur on a daily basis, for approximately a 12 h period, over an eight to 12-week work period in mid-January to mid-April.	Short-term
Reversibility	The potential effects to movement are fully reversible. Effects will cease immediately upon cessation of work activities.	Fully reversible
Context	Oil and gas exploration activities have occurred intermittently in the Eagle Plains area over the last 50 years. Responses of caribou have not been studied in detail, but use of the area by caribou has continued, demonstrating general resiliency to exploration activities.	Existing Disturbed/ Resilient

Residual Effect Characteristic	General Definition	Rating
Probability of occurrence	Based on historic telemetry data it is possible, but uncertain, that caribou will occur in the Project area when work is active. Over 25 years, collared caribou occurred within 4km of the Project area in 17% of the years.	Possible

Table 6.5: Characterization of potential effects to caribou mortality and injury.

Residual Effect Characteristic	General Definition	Rating
Description of Interaction	The Project will consist of work at 8 well sites plus access via 30.2 km of winter roads. Road use has the potential to cause direct mortality to caribou via vehicle collisions; however, that risk is negligible after mitigations. The project also has the potential to affect indirect mortality via packing of winter roads that could enhance travel rates by wolves or access to hunters. However, the potential for this effect is reduced by potential avoidance of work areas by both caribou and wolves due to human activity/sensory disturbance and hunter access management for safety.	
Direction	Effects to mortality or injury could be adverse.	Adverse
Magnitude	The magnitude of potential effects of direct mortality is negligible after mitigations. Effects of indirect mortality are estimated to be low due to potential avoidance of the work areas by both caribou and wolves and hunter access management.	Low
Geographic Extent	The winter roads total 30.15 km. This extent is small relative to the herd's total winter range, and the number of caribou that are likely to encounter the road is small.	Low
Timing	The timing of the Project, during winter, coincides with the potential occurrence of the Porcupine Caribou Herd in the area.	Moderate
Frequency	The potential encounter rate between caribou and wolves or hunters along or adjacent to winter roads is unknown, but is likely infrequent, due to factors listed above. Caribou would have the potential to encounter project traffic daily (i.e., frequent), but the risk of mortality is negligible after mitigation.	Infrequent
Duration	Project work will occur on a daily basis, for approximately a 12 h period, over an eight to 12-week work period in mid-January to mid-April.	Short-term
Reversibility	The potential effects to mortality are fully reversible. Potential direct effects will cease immediately upon completion of work activities. Vegetation regeneration will take several years to reach a stage that hinders travel by hunters and natural predators.	Fully reversible
Context	A network of winter roads and seismic lines exists in the area from past exploration. This work will not add new features, but it will clear some regenerating vegetation and temporarily pack snow that could temporarily enhance access by hunters and natural predators.	Existing Disturbed/ Resilient
Probability of occurrence	Based on historic telemetry data it is possible, but uncertain, that caribou will occur in the Project area when work is active. Over 24 years, collared caribou occurred within 4km of the Project area in 17% of the years. If caribou do occur in the area during the year that work occurs, there is low probability that the Project will contribute to indirect mortality.	Unlikely

6.1.4.2 Moose

With the mitigation measures listed in **Section 6.1.3** applied, it is predicted that Project activities will not result in significant effects to habitat, movement and distribution, and mortality or injury to moose. Detailed effects assessments are provided for each indicator in **Table 6-6**, **Table 6-7**, and **Table 6-8** for each indicator, respectively. Key factors that result in this significance determination are:

- Although the timing of the Project does occur during winter, which is a sensitive season for moose, the extent of the Project area, including a zone of influence, is a small proportion of winter range that is available to the species. If moose choose to avoid the work areas (i.e., due to sensory disturbance) alternative habitat is available.
- The most likely potential effect to moose is temporary, localized avoidance of work areas due to sensory disturbance.
- The Project will be reactivating existing winter access, not creating new access features, and will not result in a significant change in access for human hunters and natural predators.

Table 6.6: Characterization of potential effects to moose habitat.

Residual Effect Characteristic	General Definition	Rating
Description of Interaction	The Project will consist of work at 8 well sites plus access via 30.2 km of winter roads. This will result in direct habitat effects due to vegetation clearing along the access routes and well sites. It may also result in indirect habitat effects if moose choose to avoid areas in proximity to the roads and well sites due to sensory disturbance or perceived predation risk.	
Direction	Effects to habitat will initially be adverse but may switch to positive for several years if shrubs regenerate on the winter roads.	Adverse/Positive
Magnitude	The magnitude of effects to habitat is low, due to the small extent and narrow width of areas that are affected.	Low
Geographic Extent	Direct habitat will be limited to the footprint of the winter roads and well sites (approximately 60 ha). Indirect effects to habitat are mostly within 300 m, depending on site conditions and variation in moose behaviour. These extents are small relative to the total winter range available to moose.	Low
Timing	The timing of the Project, during winter, is a sensitive season for moose due to limited forage and higher energetic outputs due to snow and cold temperatures.	Moderate
Frequency	Direct effects will be continuous, though diminishing in magnitude, as vegetation regenerates. Indirect effects will be continuous when work activities are active.	Continuous
Duration	Direct effects to the road and well site footprints will take years to regenerate (long-term). Indirect effects will cease once work activities are completed (short-term).	Short-term Long-term
Reversibility	The effects to habitat are fully reversible. Indirect effects will cease immediately upon stoppage of work activities. Direct effects along the winter roads will take several years for vegetation to regrow.	Fully reversible

Residual Effect Characteristic	General Definition	Rating
Context	Work for this project will occur on previously disturbed sites. Measures to protect the duff layer and ground vegetation will maximize the resiliency of the site to regenerate to similar habitat. The extent of this project, and historic oil and gas disturbances, are small relative to natural disturbances (i.e., fire) that affect moose habitat. Approximately two thirds of the area along the Chance road has burnt in the last 30 years.	Existing Disturbed/ Resilient
Probability of occurrence	Moose are known to use the Project area in winter and some of the moose in the area will encounter the effects the Project has on habitat.	Likely

Table 6.7: Characterization of potential effects to moose movement and distribution.

Residual Effect Characteristic	General Definition	Rating
Description of Interaction	The Project will consist of work at 8 well sites plus access via 30.2 km of winter roads. This work will result in sensory disturbance that could cause moose to avoid the areas. Responses to sensory disturbance are mostly ≤1 km but vary in relation to site conditions and moose behaviour. Effects are most likely to be expressed as temporary, localized avoidance of work areas. Moose do not normally make seasonal movements in the Eagle Plains area.	
Direction	Effects to movement and distribution could be adverse.	Adverse
Magnitude	The magnitude of effects is low due to the limited consequence if moose chose to avoid work areas. Alternative habitat is available, and avoidance of work areas is unlikely to impair within-range movements.	Low
Geographic Extent	Responses to sensory disturbance are mostly ≤300 m but vary in relation to site conditions and moose behaviour. These extents are small relative to the total winter range available in the area.	Low
Timing	The timing of the Project, during winter, is a sensitive season for moose due to limited forage and higher energetic outputs due to snow and cold temperatures.	Moderate
Frequency	Potential effects to movement will occur daily, corresponding to periods when project activities are active.	Frequent
Duration	Project work will occur on a daily basis, for approximately a 12 h period, over an eight to 12-week work period in mid-January to mid-April.	Short-term
Reversibility	The potential effects to movement are fully reversible. Effects will cease immediately upon cessation of work activities.	Fully reversible
Context	Oil and gas exploration activities have occurred intermittently in the Eagle Plains area over the last 50 years. Responses of moose have not been studied in detail, but use of the area by caribou has continued, demonstrating general resiliency to exploration activities. The extent of this project, and historic oil and gas disturbances, are small relative to natural disturbances (i.e., fire that affect moose habitat and distribution).	Existing Disturbed/ Resilient
Probability of occurrence	Moose are known to use the Project area in winter and some of the moose in the area will likely encounter the work areas and be subject to sensory disturbance associated with those areas.	Likely

Table 6.8: Characterization of potential effects to moose mortality or injury.

Residual Effect Characteristic	General Definition	Rating
Description of Interaction	The Project will consist of work at 8 well sites plus access via 30.15 km of winter roads. Road use has the potential to cause direct mortality to moose via vehicle collisions; however, that risk is negligible after mitigations. The project also has the potential to affect indirect mortality via packing of winter roads that could enhance travel rates by wolves or access by hunters. However, the potential for this effect is reduced by potential avoidance of work areas by both moose and wolves due to human activity/sensory disturbance and hunter access management for safety.	
Direction	Effects to mortality or injury could be adverse.	Adverse
Magnitude	The magnitude of potential effects of direct mortality is negligible after mitigations. Effects of indirect mortality are estimated to be low due to potential avoidance of the work areas by both moose and wolves and hunter access management.	Low
Geographic Extent	The winter roads total 30.15 km. This extent is small relative to the herd's total winter range, and the number of moose that are likely to encounter winter roads and well sites is small.	Low
Timing	The timing of the Project, during winter, is a sensitive season for moose due to limited forage and higher energetic outputs due to snow and cold temperatures.	Moderate
Frequency	The potential encounter rate between moose and wolves or hunters along or adjacent to winter roads is unknown, but is likely infrequent, due to factors listed above. Moose would have the potential to encounter project traffic daily (i.e., frequent), but the risk of mortality is negligible after mitigation.	Infrequent
Duration	Project work will occur on a daily basis, for approximately a 12 h period, over an eight to 12-week work period in mid-January to mid-April.	Short-term
Reversibility	The potential effects to mortality are fully reversible. Potential direct effects will cease immediately upon completion of work activities. Vegetation regeneration will take several years to reach a stage that hinders travel by hunters and natural predators.	Fully reversible
Context	A network of winter roads and seismic lines exists in the area from past exploration. This work will not add new features, but it will clear some regenerating vegetation and temporarily pack snow that could temporarily enhance access by hunters and natural predators.	Existing Disturbed/ Resilient
Probability of occurrence	Moose are known to use the Project area in winter and some of the moose in the area will likely encounter the work areas. However, the probability of direct and indirect mortality associated with Project activities is low.	Unlikely

6.2 Vegetation

The Project falls within the Taiga Cordillera Ecozone and Eagle Plains Ecoregion. Descriptions of the ecoregion are drawn from the Ecological Stratification Working Group (1995) and Yukon Ecoregions Working Group (2004). The following sections describe the known baseline information for vegetation and wetlands in these regions, the likely Project interactions and potential effects resulting from Project

activities, mitigation measures to reduce or eliminate those effects, and a summary statement concluding the overall significance of the Project on vegetation and wetlands.

6.2.1 Existing Conditions

The Project falls within the Eagle Plains Ecoregion, a 20,400 km² region in north Yukon between the Richardson and Ogilvie Mountains. Most of the region is low altitude rolling topography, between 300 m and 600 m above sea level (asl), with few scattered peaks to approximately 1,000 m asl, outside the Project area. Most of the watercourses in the ecoregion drain north into the Yukon River via the Whitestone, Porcupine and Eagle rivers. The southeast corner of the region drains east to the Mackenzie River via the Peel, Wind and Ogilvie Rivers. The few lakes that exist in the region are generally oxbow or thermokarst lakes (Yukon Ecoregions Working Group 2004). The Eagle Plains Ecoregion is within the continuous permafrost zone where permafrost can be found up to 200 m thick. Several permafrost produced landforms and processes can be found across the region, including ice-wedge polygons, cryoturbation, solifluction, soil creep and active layer detachment slides on shale (Yukon Ecoregions Working Group 2004).

The Eagle Plains Ecoregion experiences a moderate amount of precipitation, with annual amounts around 400 mm. Most of the precipitation falls as rain throughout the summer months, averaging 50 to 80 mm per month, June through August. Precipitation is lighter through September to April and falls as snow. Average winter temperatures on the Eagle Plains Plateau are around -30°C and -25°C, with extremes as low as -60°C. Winter conditions usually last from October to May. Average summer temperatures are around 13°C, with extremes as high as 30°C. Due to its proximity to the Arctic Circle, this region experiences brief periods of continuous sun above and below the horizon (Yukon Ecoregions Working Group 2004).

The vegetation of the Eagle Plains Ecoregion is primarily boreal forest. The most common climax forest community is black spruce woodland associated with hummocks. Tree growth is often limited by the presence of permafrost in many areas of the Ecoregion, causing open, stunted forests and shrub-dominated communities at tall and low shrub structural stages. Upland black and white spruce forests typically have well-developed shrub communities, including Labrador tea, shrub birch, willow, alder, rose, spiraea and blueberry, with a ground cover of lichen and moss. Moderately well to well drained sites commonly have white spruce or deciduous stands with lichen ground cover. More poorly drained areas with low slope gradients and fine-textured soils are associated with overstory species such as black spruce, shrub birch, Labrador tea, and occasionally tamarack, and often have ground cover dominated by cottongrass tussocks. Deciduous or mixed stands are also often found in areas of recent anthropogenic disturbance, such as old roads, drill sites and gravel pits. Deciduous trees in the Eagle Plains Ecoregion include Alaskan paper birch, balsam poplar, trembling aspen, and willow (Yukon Ecoregions Working Group 2004).

Graminoid and shrubby fens, shrubby bogs and graminoid marshes are scattered throughout the Ecoregion. Several sedge species are dominate in both the graminoid fens and marshes, including narrow-leaf cottongrass, aquatic sedge, northern beaked sedge and mud sedge. Shrub species in fens include leatherleaf and bog rosemary. The ground cover of the shrubby bogs is dominated by sphagnum, sometimes with extensive lichen cover. Shrub species typically include low bush cranberry, bog cranberry, bog rosemary, cloudberry, Labrador tea, shrub birch, willow, black spruce and occasionally tamarack. Riparian forests of white and black spruce are found as narrow strips along most major watercourses in the Ecoregion (Yukon Ecoregions Working Group 2004).

Evidence of forest fires can be observed throughout the Project area, as fires are relatively common. Regenerating burns are dominated by shrubby vegetation, including willow, shrub birch, and alder. Alaskan paper-birch is commonly the first tree species to colonize burn areas. Occasionally, on well-drained sites trembling aspen and balsam poplar may be the first tree species to re-colonize. The extent of old burns can be recognized by the presence of the current black spruce – Alaskan paper birch woodlands (Yukon Ecoregions Working Group 2004).

Ecological and Landscape Classification (ELC) mapping was completed for the Eagle Plains Exploration Project in 2019 and 2020, which encompassed the Project area. The ELC mapping was based on manual delineation and attribution of digital ortho-imagery following the Yukon Ecological and Landscape Classification and Mapping Guidelines, Version 1.0. (Environment Yukon 2016c) and the Standard for Terrestrial Ecosystem Mapping in British Columbia (Resources Inventory Committee 1998). ELC mapping was further informed by extensive field sampling of vegetation communities across a diversity of ecosystems, slope positions, and moisture and nutrient regimes throughout the Eagle Plains Exploration Project.

Vegetation was examined at three scales to assess potential effects of the Project: Vegetation Regional Assessment Area (VRAA), Vegetation Local Assessment Area (VLAA), and the road footprint itself. The VRAA includes vegetation within a 2 km buffer on either side of the Chance and Blackie winter roads, and represents the vegetation communities surrounding the roads to provide context for more localized potential effects. The VLAA includes vegetation within a 100 m buffer on either side of the Chance and Blackie winter roads, and represents the extent where potential direct and indirect Project-related effects could occur. The footprint is the 20 m wide path of the access roads and the well sites where tree and shrub clearing will occur.

The ELC units (ecosites) comprising the VRAA and VLAA are summarized in **Table 6-9** (the footprint is not included because it is such a narrow strip that ELC mapping does not accurately reflect the previous disturbance along it at that fine a scale). Comparison of the VRAA and the VLAA indicates that the relative proportions of ecosites are similar across both study areas. Both areas are dominated by:

- Moist Spruce – Labrador Tea forest (shrub structural stage)
- Moist Spruce – Labrador Tea forest (mature forest structural stage)
- Moist Spruce – Alder – Labrador Tea forest
- Mesic White Spruce – Alaska Paper Birch – Alder

A small number of ecosites occur more frequently in the VLAA than the VRAA. These occur in two circumstances. The first are ecosites associated with prior anthropogenic disturbance along the roads and well sites: Mesic birch-willow, Anthropogenic, and Road. The second group includes sites associated with upper and crest topographic positions, where the existing winter roads were situated: Mesic black spruce – Labrador tea (conifer), Dry spruce – lichen (conifer).

One ecosite that occurs less frequently in the VLAA than in the VRAA is Moist Shrub \ Scrub Birch – Labrador Tea – Willow, which is associated with lower slope and valley bottom positions, which the Project access routes avoid.

Both the Chance and Blackie winter roads have been cleared and used for access in previous years. Their footprints are in early- to mid-seral stages and differ from the surrounding vegetation. Chance Road was last used in 2014, and is currently regenerating to low and tall shrub communities undergoing either normal or stagnated succession. Chance Road is dominated by dense shrub birch, willow, alder, and paper birch, ranging from 25% to 60% cover, and with thick herbaceous vegetation (i.e., graminoids and forbs), ranging from 40% to 75% cover (Photo 1). In burned areas, Chance Road is similar to the surrounding vegetation, while in unburnt areas, the surrounding vegetation consists of taller, more mature black spruce forest. Blackie Road has not been used in several decades and is more successionally advanced – dominated by fairly open (25% cover) black spruce and shrub birch at a tall shrub structural stage (Photo 2).This represents a similar vegetation community but a different structural stage than the surrounding vegetation, which is characterized by taller, mature black spruce forest with willow and paper birch shrub layers. There have been no rare nor invasive plants documented in the VRAA, VLAA, or footprint, although targeted rare and invasive plant surveys have not been conducted in the Project area.

As documented in the ELC mapping, wetlands and watercourses cover 49.9 ha in the RAA and include rivers and black spruce bogs. There are no wetlands nor mapped watercourses within 200 m of the road and well site footprints.



Photo 1. View of a typical section of Chance Road, regenerating to a low shrub vegetation community dominated by deciduous shrubs.



Photo 2. View of a section of Blackie Road, regenerating to a tall shrub vegetation community dominated by black spruce.

Table 6.9: Vegetation communities occurring within the Vegetation Regional Assessment Area and Vegetation Local Assessment Area.

Ecosite Code	Ecosite Name	VRAA		VLAA	
		Area (ha)	Area (%)	Area (ha)	Area (%)
02	Mesic birch-willow	66.6	0%	31.8	5%
04	Mesic White Spruce – Alaska Paper Birch - Alder	1111.0	8%	39.6	7%
05	Mesic Alaska Paper Birch (Deciduous)	654.6	5%	24.7	4%
06	Mesic Black Spruce – Labrador Tea (Conifer)	685.9	5%	40.8	7%
14	Dry Spruce-Lichen (Conifer)	138.9	1%	15.7	3%
15	Dry Aspen-Lichen (Deciduous)	2.3	0%	0.0	0%
16	Dry Spruce-Birch-Lichen (Mixedwood)	173.0	1%	1.6	0%
20	Shrubby Riparian Birch – Willow	8.0	0%	0.0	0%
22	Riparian Spruce – Birch - Willow	15.2	0%	0.0	0%
23	Drainage Shrubby Riparian	195.4	1%	4.6	1%
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	590.3	4%	5.6	1%
33	Moist Spruce – Labrador Tea (shrub stage)	5422.9	40%	227.2	37%
33	Moist Spruce – Labrador Tea (mature forest stage)	1202.1	9%	67.0	11%
34	Moist Spruce – Alder – Labrador Tea	1446.1	11%	70.0	12%

35	Moist Spruce – Scrub birch – Labrador Tea	591.7	4%	23.2	4%
36	Moist Birch – Willow	2.7	0%	0.9	0%
41	Wet Shrub – Tamarack	1.0	0%	0.0	0%
42	Wet Shrub – Black Spruce – Tussock Cottongrass	654.3	5%	25.0	4%
43	Wet Shrub – Black Spruce - Sphagnum	28.2	0%	0.0	0%
44	Wet Shrub – Scrub Birch – Tussock Cottongrass	150.3	1%	0.0	0%
46	Wet Black Spruce – Labrador Tea – Cladonia	228.7	2%	20.5	3%
47	Wet Black Spruce – Tussock Cottongrass - Sphagnum	169.7	1%	0.0	0%
48	Wet Black Spruce – Carex	0.3	0%	0.0	0%
AN	Anthropogenic	18.9	0%	5.2	1%
B1	Bog – Black spruce – Lichen	10.2	0%	0.0	0%
B2	Bog – Black Spruce – Sphagnum	24.4	0%	0.0	0%
ES	Exposed Soil	9.2	0%	1.0	0%
RI	River	15.2	0%	0.0	0%
RZ	Road	21.2	0%	3.5	1%
Total		13,638.5	100%	608.0	100%

6.2.2 Project Interactions and Potential Effects

Re-establishment and construction of the winter roads will result in alteration of up to 60.4 ha of vegetation within the road footprint. The footprint will be cleared of vegetation through mulching and manual felling. The cutters of the mulcher will be raised off the ground to minimize disturbance to hummocks, tussocks, and high spots, but will remove taller shrubs and trees to allow safe vehicle and equipment travel. Mulching will remove shrubs and trees while protecting the moss layer, soil and root systems of low-growing plants.

In addition to the direct loss of vegetation within the road footprint due to clearing, re-establishment, construction and travel within the road footprint may cause potential effects to vegetation by altering underlying soils. These potential effects include soil disturbance, soil compaction, root damage, altered soil moisture regime, and permafrost thaw. Soil disturbance and root damage would most likely be caused by physical interactions from machinery during clearing, while soil compaction, altered soil moisture, and permafrost thaw would most likely be caused by repeated travel of heavy equipment compressing underlying soils, which can lead to altered thermal and hydrological characteristics.

Vegetation clearing within the road footprint could have both direct and indirect potential effects. Potential direct effects including change to earlier successional stage, change of wildlife habitat and forage, loss of primary productivity and carbon sequestration, reduction of biodiversity, and aesthetic impacts. Potential indirect effects, which may extend into the VLAA and are generally attributable to edge effects, include altered light availability, altered temperature regimes, altered wind patterns, increased nutrient availability from cleared and mulched vegetation, altered seed dispersal, changes to vegetation composition and growth such as infiltration of early seral plants, and altered herbivory patterns.

Potential effects to rare plants include disturbance or destruction during construction if rare plants occur within the footprint, and changes to habitat characteristics caused by vegetation removal and edge effects in the VLAA. There are no tracked shrub or tree species occurring within the Eagle Plains Ecoregion, so only rare ground cover plants (e.g., forbs, graminoids, mosses, and lichens) would be at risk of physical disturbance (Yukon Conservation Data Centre 2019). Ensuring a minimum 10 cm snowpack on all areas to be cleared will greatly reduce the potential for physical disturbance or destruction of any rare plants occurring in the footprint.

Potential effects to invasive plants include introduction and spread of invasive plants via equipment or personnel brought in from infested areas.

All of the aforementioned effects have potential to effect wetlands within the footprint or VLAA, often with increased significance due to the sensitivity to wetlands (e.g., more sensitive soils, hydrological regimes, higher biodiversity and wildlife value, wetland-obligate species). However, as there are no wetlands documented within the footprint or VLAA in the ELC mapping, these effects are unlikely.

The construction phase of the Project could also result in degradation of vegetation due to spills (e.g., hydraulic fluid, fuel etc.) along the access roads.

6.2.3 Mitigation Measures

Mitigation measures related to vegetation and wetlands include:

- Existing and historic winter roads will be used as the primary access routes to minimize the amount of vegetation that is cleared.
- Winter roads will consist of packed and frozen snow and ice to maintain ground vegetation and to avoid site disturbance to the underlying duff layer, soil and permafrost. A minimum 10 cm snowpack will be required over all road surfaces.
- The extent of vegetation clearing, notably the widths of winter roads and areas at well sites, will be minimized. On the Chance Road, the width will not exceed the existing right-or way extent. This will minimize the direct loss of vegetation and reduce potential edge effects.
- Shrubby vegetation will be cut as high as possible, normally at least 30 cm above the ground. Where possible, shrubs will be pushed over instead of cut.
- The winter roads are located primarily on crest and upper slope positions which minimizes potential overlap with wetlands and riparian areas. If small wetlands or riparian areas along non-classified drainages are encountered, special efforts will be made to minimize effects by enhancing the thickness of the packed snow/ice base and minimizing the right-of-way width.
- To avoid the spread of invasive plants, equipment will be washed and inspected prior to transport to site.

6.2.4 Effects characterization and Significance Determination

With the mitigation measures listed in **Section 6.2.3** applied, it is predicted that the Project activities will not result in significant effects to vegetation and wetlands. Most of the effects are low to moderate in magnitude and considered unlikely to occur and/or reversible over the long-term.

Loss and Alteration of Vegetation

The loss and alteration of vegetation will be mitigated primarily by using existing and historic access roads to minimize the area to be disturbed, and by limiting use to winter. A maximum of 60.4 ha of vegetation will cleared within the footprint, which represents only 0.44% of the RVAA. Existing and historic winter roads in the area typically support early to mid-seral vegetation at a lower structural stage than the surrounding vegetation. Re-activating previously used roads avoids disturbance to mature forests and surrounding vegetation and the overall change in seral stage is minimized. By limiting activities to winter and maintaining a 10 cm snowpack overlying frozen ground, ground vegetation, along with its root structure and litter layer, will be protected from physical disturbance. Cutting vegetation as high as possible will similarly reduce the total amount of vegetation loss, reduce disturbance to root structure, and increase potential for regrowth from the root mass. This will accelerate regeneration after the winter roads have been decommissioned.

Overall, potential effects of loss and alteration of vegetation are low in magnitude and reversible with regeneration. The loss and alteration of vegetation will be limited to a small area that has been previously disturbed, will only remove trees and shrubs greater than 30 cm tall while leaving ground vegetation intact, and will facilitate regeneration. Potential effects are limited in geographic and temporal extent; they will only occur in the footprint of existing roads during a single winter and will start to regenerate the following spring. With mitigations applied, the potential effects of loss and alteration of vegetation are not considered significant.

Creation of Edge Effects

Creation of edge effects (e.g., light availability, temperature regime, wind patterns, vegetation composition and growth, seed dispersal) will be mitigated by using existing and historic access roads and by limiting use to winter. Using previously disturbed access roads that already experience some edge effects will minimize the creation of new edges and thus reduce overall edge effects. Limiting use to winter and minimizing disturbance to ground vegetation will preserve ground vegetation integrity, which will further reduce the potential effects of forest edges. Potential edge effects will decrease as the footprint regenerates once well maintenance activities are completed.

Overall potential effects of edge creation are low in magnitude and reversible with regeneration. The footprint and VLAA already experiences some edge effects from past disturbance along the proposed routes; the Project may reinforce pre-existing edge effects but will minimize new edge creation. Potential effects are limited in geographic and temporal extent; they will only occur in the footprint and VLAA and will diminish as regeneration progresses. With mitigations applied, the potential effects of edge creation are not considered significant.

Disturbance to Soils

The disturbance to soils will be mitigated by creating a frozen snow and ice surface on existing and historic winter roads which will avoid effects to soils and permafrost. Using previously disturbed access roads will avoid potential effects to undisturbed sites. Re-activating and using access roads during winter while the soil is frozen, and maintaining a 10 cm snowpack, will protect the duff layer, soil surface, and soil structure from disturbance, and minimize potential permafrost thaw.

Overall, potential effects of soil disturbance are low in magnitude and unlikely to occur. Potential effects are limited in geographic and temporal extent; they will only occur in the footprint, and work will only occur in a single winter. With mitigations applied, the potential effects of soil disturbance are not considered significant.

Disturbance to Rare Plants

Disturbance to rare plants will be mitigated by limiting road re-establishment and use to winter, and by minimizing ground disturbance. There are no rare shrub or tree species documented within the Eagle Plains Ecoregion; only rare ground vegetation species have the potential to be affected by the Project. Ground vegetation will be dormant in winter, and protected by a minimum 10 cm snowpack, so any rare plants occurring within the footprint will be protected. Potential changes to habitat characteristics affecting rare plants will be mitigated by minimizing the creation of edge effects and overall vegetation loss and alteration.

Overall potential effects to rare plants are low in magnitude and unlikely to occur. Potential effects are limited in geographic and temporal extent; they may only occur in the footprint and VLAA, and physical disturbance may only occur during road re-establishment and use in a single winter. With mitigations applied, the potential effects to rare plants are not considered significant.

Spread of invasive species

Spread of invasive species will be mitigated by limiting road re-establishment and use to winter and inspecting equipment for cleanliness. Vegetation will be dormant in winter, so potential for seed dispersal from plants within the footprint will be low. Potential introduction of invasive species from off-site will be minimized by inspecting equipment brought on-site for cleanliness, including any dirt wads or old vegetation that may be harbouring seeds.

Overall potential effects of invasive species are moderate in magnitude but unlikely to occur. Potential effects are limited in geographic and temporal extent; they may only occur in the footprint and VLAA, and introduction of plants may only occur during road re-establishment and use in a single winter. With mitigations applied, the potential effects of invasive species are not considered significant.

Alteration of Wetlands

Alteration of wetlands will be mitigated by using existing and historic access roads that follow upland topography such as ridges to avoid wetland areas. Although there are no wetlands or named watercourses documented within the footprint or VLAA, snowpack depth will be increased if small wetlands or riparian areas along non-classified drainages are encountered.

Overall potential effects to wetlands are low in magnitude and unlikely to occur. Potential effects are limited in geographic and temporal extent; they may only occur in the footprint and VLAA, and only during road re-establishment and use in a single winter. With mitigations applied, the potential effects to wetlands are not considered significant.

Degradation of Vegetation or Wetlands Due to Spills

Spills will be mitigated by implementing the Spill Contingency Plan which is currently in development.

Overall potential effects of spills are moderate in magnitude but unlikely to occur. Potential effects are limited in geographic and temporal extent; they can occur only in the footprint, and potential occurrence is limited to a single winter. Potential effects would be short-term and would be at least partially reversible. With mitigations applied, the potential effects of spills are not considered significant.

6.3 Heritage Resources

The human history of the Yukon, from the earliest Indigenous groups to the arrival of fur traders and prospectors in the 19th century and beyond, is preserved in the Yukon's heritage or historic resources.

Historic resources include historic sites, historic objects, and any work or assembly of works of nature or of human endeavour that is of value for its archaeological, palaeontological, pre-historic, historic, scientific, or aesthetic features (*Historic Resources Act*, RSY 2002, c 109).

Historical sites generally date to a time of written history (i.e., in the Yukon, the past 100 to 150 years) and typically contain examples of built heritage or structures (e.g., cabins, caches, graves, and brush camps) (Gotthardt and Thomas 2007). Archaeological sites are older (i.e., typically older than 150 years) and can be found on the surface (i.e., artifacts that have been exposed or were never buried) or buried in the ground (e.g., stone tools and chips, animal bone fragments, and remains of ancient hearths and campfires) (Gotthardt and Thomas 2007).

Archaeological sites and resources are culturally meaningful and connect community members to the past and represent a collective identity. These resources represent ways of knowing and generational knowledge which are passed on through the generations. Every Indigenous group manages their cultural heritage in a unique way, but always with respect for the past and future generations.

6.3.1 Existing Conditions

In 2013, a Historic Resources Overview Assessment (HROA) was conducted by Matrix Research Ltd. for the 2013 Seismic Program at Eagle Plains, on behalf of Northern Cross (Yukon) Limited. The intent of this assessment was to determine the heritage potential within the proposed development area and provide recommendations for heritage management.

The HROA determined that a "significant portion of the study area is considered to have low pre-contact heritage resources potential (Matrix Research 2013)." However, the HROA also identified several areas that are considered to have high heritage resources potential. These areas of high potential are associated with locations along streams and along the upland areas overlooking these tributaries. The HROA recommended that further heritage resources investigations, specifically a Heritage Resource Impact Assessment (HRIA), be conducted within the zones of high heritage resource potential prior to any potentially land-altering development activities (Matrix Research 2013).

An HRIA was then conducted later in 2013 by Matrix Research, in which the identified zones of high potential were further assessed (**Appendix C**). As indicated by a Letter Report dated May 15, 2014, to Northern Cross (Yukon) Limited, Matrix Research concluded that the proposed well sites and access roads do not conflict with any of the areas containing heritage values (**Appendix D**). Matrix Research did however identify areas within the study area containing heritage values, identified in **Appendix D**, as high potential areas to avoid and labeled as 'avoidance areas'. Matrix Research recommended that these areas, "be

avoided by any potential land-altering activities and that if avoidance was not possible further heritage assessment should be conducted prior to any development (Matrix Research 2014)."

6.3.2 Project Interactions and Potential Effects

Results of the 2013 HROA and HRIA, conducted by Matrix Research, indicate that no Project interactions and/or potential effects are anticipated for Heritage Resources. Should the Project development areas/locations be altered and fall outside of the currently assessed area, further Heritage Resource assessment will be undertaken.

6.3.3 Mitigation Measures

The following list describes the mitigation measures the proponent has committed to eliminate, reduce or control potential effects to Heritage Resources caused from Project activities:

- Develop and implement a Project specific Heritage Resources Chance Find Procedure to ensure that the discovery of any unanticipated Heritage Resources is addressed. In the event Heritage Resources are encountered, all development activities in the vicinity of the Heritage Resources will be suspended immediately. In such cases, the Cultural Services Branch, Department of Tourism and Culture, Government of Yukon, the Vuntut Gwitchin First Nation, and First Nation of Na-Cho Nyak Dun will be contacted immediately with information on the heritage remains and nature of the disturbance.
- The Project will avoid any land-altering activities in the avoidance areas identified in the Matrix Research 2014 Letter Report, as to protect Heritage Resources.

6.3.4 Effects characterization and Significance Determination

With the mitigation measures listed in **Section 6.4.3** applied, it is predicted that Project activities will not result in significant effects to Heritage Resources. Should the Project development areas/locations be altered and fall outside of the currently assessed area, or within areas identified as high potential and or avoidance areas, further Heritage Resource assessment should be undertaken in order to determine any potential effects to Heritage Resources.

7.0 SUMMARY OF MITIGATION MEASURES

The following sections describe the mitigation measures the proponent has committed to eliminate, reduce or control potential effects of the Project to the selected values components.

7.1 Wildlife and Wildlife Habitat

7.1.1 General Mitigation Measures for Wildlife and Wildlife Habitat

- All Project personnel will be required to complete formal orientation and training related to wildlife mitigation measures.
- Work will be scheduled to minimize the spatial extent across which work is concurrently occurring.
- Access to the well sites will utilize existing and historic winter roads to minimize the creation of new linear features.

- Project footprints, notably the widths of winter roads, will be minimized as much as possible. On the Chance Road, the width will not exceed the existing right-or way extent.
- Firearms are not allowed on-site by Project personnel.
- A no harassment of wildlife policy applies to all personnel. This includes attempts to chase, catch, divert, follow, photograph, feed, or otherwise harass wildlife, whether on foot, in on-road or off-road vehicles, heavy equipment, or aircraft.
- The use of on-road and off-road vehicles, including snowmobiles, will be restricted to essential Project access routes.
- Personal use of unmanned aerial vehicles (UAVs or drones) is prohibited.

7.1.2 Road Operations

The following measures are designed to mitigate the risk of vehicle collisions and effects of road use on wildlife movements.

- The maximum speed limit along the Dempster Highway is 90 km/h.
- The maximum speed along winter roads is 30 km/h.
- Wildlife will always have the right-of-way. This requires vehicle operators to stop when wildlife are observed on or beside the road, allowing them to cross safely. If wildlife stays on the road or right-of-way for >5 minutes, drivers may resume travel and pass the animals at <10km/h.
- Special rules apply to caribou.
    - For Caribou within 100 m from the road:
        - Stop as far back as possible;
        - Alert other drivers;
        - Wait until caribou have crossed and moved beyond 500 m from the road or are lost from sight before proceeding;
        - Proceed with caution.
    - For Caribou beyond 100 m from the road:
        - Proceed with caution;
        - Alert other drivers;
        - Watch for direction of movement and change in behaviour.
- When moose and caribou are on a road they will sometimes run down the road away from a vehicle. If this happens, stop and wait at least 5 minutes to allow the animal to move off the road. If the animal remains on the road, drive forward at 10 km/h, then stop again when the animal begins to run away. Wait 2 minutes and repeat this procedure. If the animal still does not leave the road, wait 10 minutes and repeat the procedure, alternating with a 2- and 10-minute stop between driving attempts.
- Drivers are required to use two-way radio communication. The location of any wildlife observed along Project roads is to be communicated to other road users on the radio.
- Drivers will not exit the vehicle to chase, catch, divert, follow, photograph, or otherwise harass wildlife.
- Along winter roads:

- snow banks will be maintained at heights <1 m to reduce the hinderance to wildlife crossing them;
- where snow banks exceed 60 cm in height, regular breaks (at least every 500) will be created to facilitate easier animal crossing and as 'escape routes' off the road.
    - Create matched breaks on either side of the road that animals can use to cross.
    - On corners, create run-outs, in each direction, that are obvious alternative routes for animals to use, instead of following the road.
    - Avoid breaks at seismic lines, which could provide human access.

7.1.3 Aircraft Operations

The following measures are designed to mitigate the effects of aircraft use on wildlife:

- Altitudes of greater than 300 m above ground level will be maintained at all times of the year.
- Altitudes of greater than 600 m above ground level will be maintained during sensitive times of the year.
- Areas where caribou have been observed in the past will be avoided.
- Flights paths will be designed to avoid important areas during sensitive times of the year.
- No caribou observed will be flown towards, circled, or harassed.
- If caribou are seen to be in a panic or startled the plane will ascend to a higher elevation.

7.1.4 Caribou

The majority of potential effects to caribou will be mitigated via measure for general wildlife, road operations and aircraft operations. Additional measure specific to caribou include:

- Packing of snow will not occur on any linear features that are not essential to Project work.
- Access to linear features off the winter roads will be minimized by avoiding creation of breaks in snow berms at junctions with linear features.
- All sightings of caribou will be reported to the Environmental Monitor.
- If more than a dozen caribou are observed, or if any number of caribou are observed in the same location for longer than a three-day period, a qualified environmental professional (QEP) will be consulted to determine if site-specific mitigations may be warranted.

Due to the variable nature of caribou occurrence and snow conditions from year to year, a pre-operations assessment will be conducted in December, prior to Project initiation, to assess local conditions (specifically including information about caribou occurrence and snow conditions) that could warrant tailored management measures. For example, if telemetry data indicated that several collared caribou were in the Project area, near work areas, additional measures may be put in place to mitigate potential effects.

7.2 Vegetation and Wetlands

Mitigation measures related to vegetation and wetlands include:

- Existing and historic winter roads will be used as the primary access routes to minimize the amount of vegetation that is cleared.

- Winter roads will consist of packed and frozen snow and ice to maintain ground vegetation and to avoid site disturbance to the underlying duff layer, soil and permafrost. A minimum 10 cm snowpack will be required over all road surfaces.
- The extent of vegetation clearing, notably the widths of winter roads and areas at well sites, will be minimized. On the Chance Road, the width will not exceed the existing right-or way extent. This will minimize the direct loss of vegetation and reduce potential edge effects.
- Shrubby vegetation will be cut as high as possible, normally at least 30 cm above the ground. Where possible, shrubs will be pushed over instead of cut.
- The winter roads are located primarily on crest and upper slope positions which minimizes potential overlap with wetlands and riparian areas. If small wetlands or riparian areas along non-classified drainages are encountered, special efforts will be made to minimize effects by enhancing the thickness of the packed snow/ice base and minimizing the right-of-way width.
- To avoid the spread of invasive plants, equipment will be washed and inspected prior to transport to site.

7.3 Heritage Resources

The following list describes the mitigation measures the proponent has committed to eliminate, reduce or control potential effects to Heritage Resources caused from Project activities:

- Develop and implement a Project specific Heritage Resources Chance Find Procedure to ensure that the discovery of any unanticipated Heritage Resources is addressed. In the event Heritage Resources are encountered, all development activities in the vicinity of the Heritage Resources will be suspended immediately. In such cases, the Cultural Services Branch, Department of Tourism and Culture, Government of Yukon, the Vuntut Gwitchin First Nation, and First Nation of Na-Cho Nyak Dun will be contacted immediately with information on the heritage remains and nature of the disturbance.
- The Project will avoid any land-altering activities in the avoidance areas identified in the Matrix Research 2014 Letter Report, as to protect Heritage Resources.

7.4 Fish and Fish Habitat

The Project has no direct interaction with fish and fish habitat. Potential indirect effects are also limited due to the location of winter roads and well sites at least 200 m from streams and waterbodies. The following measures are designed to further mitigate indirect effects relating to water quality.

- If non-classified drainages are encountered, special efforts will be made to minimize effects to downstream water quality and sedimentation risk. These include:
  - enhancing the thickness of the packed snow/ice base over and adjacent to the drainage area,
  - minimizing the width of the right-of-way through the area, and
  - ensuring that slash from vegetation clearing is removed from the area so it will not be transported downstream during spring run off.
- If any site disturbance occurs during winter road construction or operation (i.e., exposure of organic or mineral soil), the location and extent of the site will be documented during operations and the area will be treated for sediment control and vegetation regeneration the following summer.

- In the event of a hydrocarbon spill, follow measures described in the Spill Contingency Plan, to contain the spill and prevent the spill from affect adjacent water courses.

7.5 Regional Land Use Plans

The proposed Project is located within the boundaries of the North Yukon Planning Region and Peel Watershed Planning Region and is therefore subject to the North Yukon Land Use Plan and (NYLUP) Peel Watershed Land Use Plan (PWLUP). Locations of proposed Project activities are within Land Management Unit (LMU) 9 of the NYLUP and LMU 7 of the PWLUP. (**Table 7.1**). Both are located within the Eagle Plains basin, with the highest potential for oil and gas development. Details regarding how the Project will meet the requirements of the Northern Land Use Plan and Peel Watershed Land Use Plan is provided in **Table 7.2**.

Table 7.1 Landscape Management Units Overlapping the Project

Landscape Management Unit Number	Landscape Management Unit Name	Integrated Management Area (IMA)
9 (NYLUP)	Eagle Plains	4
7 (PWLUP)	Dalglish Creek	4

Table 7.2 Commitments and Mitigations to meet the requirements of the North Yukon Land Use Plan and Peel Watershed Land Use Plan

Topic	Recommendation		Best Management Practices		Commitment/Mitigation
	NYLUP	PWLUP	NYLUP	PWLUP	
Surface Disturbances	• Site closure/remediation plans should be developed and monitored that create significant disturbance. • To provide a benchmark for the monitoring of cumulative effects indicator levels, the status of existing surface disturbances should be documented.	• In the IMA, the amount of surface disturbance should be maintained below the cumulative effects indicator levels recommended in the plan.	• The size, intensity and duration of all surface disturbances should be reduced. • Native endemic plants should be used for active reclamation of disturbed sites	• Reduce size, intensity and duration of human-caused physical surface disturbances (e.g. utilize low impact seismic, winter roads and principle of full reclamation.	• The size, intensity, and duration of human caused physical disturbances will be mitigated primarily by using existing and historic access roads to minimize the area to be disturbed, and by limiting use to winter.
Wildlife Habitat	• Reduce size, intensity and duration of human-caused physical surface disturbances (e.g. utilize low impact seismic, winter roads and enhanced reclamation. • Reduce other human land use impacts such as noise, smell and light. • Avoid or reduce activities in significant wildlife habitats during important biological periods (e.g., utilize timing windows). • Coordinate, manage and minimize new road and trail access.	• In the IMA, the protection of Boreal caribou habitat should be given special consideration in the assessment of potential development. • Ensure adequate wildlife and habitat baseline data collection is completed prior to any development activities.	• Avoid or minimize the creation of new access roads and trails; utilize existing routes unless their use will cause additional long term environmental impacts. • Avoid or minimize the size, extent and duration and level of activities in concentrated seasonal use areas. • Use appropriate operational timing-windows in significant wildlife habitats to minimize activities wherever possible, during periods of wildlife use. • When new access creation is necessary: • Non-permanent winter access routes should be developed and utilized versus all-season access routes. • Gate or otherwise restrict hunting along new access routes. • Where possible, direct new access routes through less significant wildlife habitats.	• Coordinate, manage new road and trail access. ○ To the extent possible, avoiding routing new roads and trails through concentrated seasonal use areas and significant habitats. ○ Avoid using or crossing seasonal migration corridors. • Avoid or reduce activities in significant wildlife habitats during important biological periods (e.g. utilize timing windows). ○ Porcupine Caribou are typically in the region during winter period (December to March). ○ Avoid concentrated woodland caribou use areas. • Reduce other human land-use related disturbances such as noise, odours, light.	• The size, intensity, and duration of human caused physical disturbances will be mitigated primarily by using existing and historic access roads to minimize the area to be disturbed, and by limiting use to winter. • The timing of the Project, during winter, is a season of lowest importance for the ecology of the Porcupine Caribou Herd and a period when the caribou are relatively tolerant of human disturbance (Porcupine Caribou Technical Committee 1993). • Work will be scheduled to minimize the spatial extent across which work is concurrently occurring. • Access to linear features off the winter roads will be minimized by avoiding creation of breaks in snow berms at junctions with linear features. • Packing of snow will not occur on any linear features that are not essential to Project work. • All sightings of caribou will be reported to the Environmental Monitor. • If more than a dozen caribou are observed, or if any number of caribou are observed in the same location for longer than a three-day period, a qualified environmental professional (QEP) will be consulted to determine if site-specific mitigations may be warranted. • The use of on-road and off-road vehicles, including snowmobiles, will be restricted to essential Project access routes. • Personal use of unmanned aerial vehicles (UAVs or drones) is prohibited.
Focal Species Management – Porcupine Caribou Herd (NYLUP)	See recommendations for Wildlife Habitat.		• Avoid or minimize the size, extent, duration and level of activities in concentrated seasonal use areas. • Avoid using or crossing seasonal migration corridors with new access routes.	Not applicable	

Topic	Recommendation		Best Management Practices		Commitment/Mitigation
	NYLUP	PWLUP	NYLUP	PWLUP	

			• Define and implement safe operation distances from the herd.
			• Consider the following seasons when determining appropriate operational timing windows (seasons when Porcupine caribou occupy the region):
			  ○ Spring migration – April 1 to May 31
			  ○ Early summer – July 1 to July 15
			  ○ Mid to late summer – July 16 to August 7
			  ○ Fall migration – August 8 to October 7
			  ○ Rut – October 8 to
			  ○ Winter – December 1 to March 31		

Fish Habitat	• Water withdrawals in sensitive fish over-wintering areas should be prohibited.	• Ensure adequate fish, waterbird, aquatic habitat and water quality baseline data collection is completed prior to any development activities .	• The use of ice roads or winter roads as river/creek crossings is generally considered adequate to mitigate potential impacts to fish and fish stocks.	• Minimize surface and vegetation disturbance in riparian areas.
				• Avoid or minimize indurstrial land use activities in wetlands and riparian areas.
				• Prohibit significant levels of winter in-stream water withdrawals in sensitive over-wintering fishing habitat.
				• Avoid large scale-industrial and/or infrastructure projects within major river corridors.
				• Minimize stream crossings; if stream crossings are required ensure proper bridge and crossing structures are used, and are designed for ease of removal (i.e., temporary structure).
					The Project has no direct interaction with fish and fish habitat. Potential indirect effects are also limited due to the location of winter roads and well sites at least 200 m from streams and waterbodies. The following measures are designed to further mitigate indirect effects relating to water quality and fish habitat.
					• If non-classified drainages are encountered, special efforts will be made to minimize effects to downstream water quality and sedimentation risk. These include:
					  ▫ enhancing the thickness of the packed snow/ice base over and adjacent to the drainage area,
					  ▫ minimizing the width of the right-of-way through the area, and
					  ▫ ensuring that slash from vegetation clearing is removed from the area so it will not be transported downstream during spring run off.

8.0 CONCLUSION

The proposed Project requires an evaluation by a YESAB Designated Office because the *Assessable Activities, Exceptions and Executive Committee Projects Regulations* of YESAA identified three accessible activities:

1. The project location is in the Yukon;
2. The *Assessable Activities, Exceptions and Executive Committee Projects Regulations* identifies several triggers for the Project including:
    a. Schedule 1, Part 3, Oil and Natural Gas, Item 2:

    On other than an Indian reserve, drilling, operation, modification, decommissioning or abandonment of, or other activity in relation to, an oil or natural gas well or seismic shot hole, but not including a hole drilled to obtain geological information.

    b. Schedule 1, Part 13, Miscellaneous, Item 13:

    On Crown land or settlement land, levelling, grading, clearing cutting or snow ploughing of a route that provides access to land for the purposes of a geophysical, geological or engineering survey.

3. An authorization by a government agency is required for the activities to be undertaken.

The proponent understands that the purpose of the YESAB Designated Office evaluation process in Yukon is to inform planning and decision-making by governments to avoid or minimize significant environmental and socio-economic effects while realizing development objectives. The proponent also recognizes that the YESAB Designated Office evaluation process provides an integrated means of identifying, evaluating, and mitigating a proposed project's potential adverse environmental and socio-economic effects. Valued components for the assessment were selected based on the potential for Project activities for this proposal to interact with the identified VC and result in adverse effects. Where effects assessments indicated that adverse effects could occur to a VC, the assessment proposed technically feasible and appropriate mitigation measures to avoid or minimize those effects. With the implementation of the proposed mitigation measures, Project-related residual adverse effects to the selected VCs are likely to be not significant.

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APPENDIX A

Letter from Yukon Government Oil and Gas Branch

APPENDIX B
Spill Contingency Plan

APPENDIX C

Heritage Resource Impact Assessment

APPENDIX D

Letter Report for the Heritage Review of 2014 Proposed Well Sites and Access Roads

APPENDIX 2-D-27. *Emergency Spill Response Plan*

1.5.13 Spills

In any incident, the first priority is Life Safety. This includes the protection of the public and the safety of response personnel.

Life Safety will always be the top strategic priority

Public safety actions begin at the source of the release and are undertaken in a coordinated manner by Chance Oil and Gas Limited, the local authority and other responders as needed at the time of the incident.

The types of containment and recovery efforts depend on the type of spill. Containment and recovery response actions focus on minimizing the effects of the spill on the surrounding area.

Clean-up activities will be conducted after containment and recovery actions are completed. Clean-up and disposal of contaminated material and site remediation work will continue until the spill site is returned as nearly as possible to pre-spill conditions and company environmental specialists and the agencies are satisfied.

Chance Oil and Gas Limited is an active member of the Western Canadian Spill Services (WCSS). Chance Oil and Gas Limited is expected to assess the risk that its operation poses to the environment and be prepared to provide effective emergency response capability in the event of a spill.

1.5.13.1 Initial Spill Response Actions

- Follow First On-Scene Strategy (Section 1.2.1).
- Size up considerations for a spill site:
  - Is there a fire or explosion hazard? What is the ignition source?
  - Is there H_2S or other toxin present?
  - Are there any areas deemed hazardous? (Mark with flags).
  - What are the ground and weather conditions? (Snow, gravel, sand etc.)
  - Where is the location of the leak, the type of release and the volume released?
  - How long has the spill been taking place?
  - Is the spill into a watercourse, watershed or a water body?
  - Is the spill contained or migrating? Which direction? How far can it go?
  - If the spill is not contained, determine and prioritize the containment points and methods to be used.
  - What lands will be affected? (Farm, livestock, brush, drinking water, etc.)
  - How is it going to be contained and cleaned up?
  - How to access the spill site, the source of the spill and recovery points?
  - What equipment is required? Is oil spill equipment (oil spill co-op) required?
  - Where can spill responders park so as not to interfere with spill equipment? (Minimize vehicular traffic as much as possible at the spill site.)
  - Are there any residences in the area? Do they have water wells that could be affected?
  - Should the spill site be cordoned off to prevent wildlife / livestock from entering?
- Relay information to internal company contacts, government agencies and if required, landowner, spill response contractors and the designated Public Information Officer.

1.5.13.2 General Control and Containment

- If possible, immediately shut off the source of the spill ensuring your own safety.
- Prioritize and set up containment points
- Where possible, prevent a spill from entering a watercourse.
- Use safest and simplest method to get job done within resource and safety capabilities.
    - Isolate and depressurize (ESDs, manual block valves, manual valve isolation).
    - Plug and patch (e.g. fix faulty valve or hole in drum).
    - Absorb or adsorb (e.g. applying adsorbent pads to oil spill).
    - Transfer (e.g. removing product to waste truck or new container).
    - Containerize (e.g. put leaking drum into over-pack drum).
    - Reposition (e.g. upright or roll and chock leaking container).
    - Others (e.g. hot-tap, vent and burn, flaring).
- Contain the spill – containment is a priority for limiting environmental damage.
- Contain as close to source as safe and practical.
- Avoid excessive walking or driving on the spill area.
- Do not use absorbents on large spills.
- Consider ground disturbance guidelines.
- Determine where bell holes or trenches would be most effective.
- Keep trenches shallow and narrow as possible, to prevent additional clean-up.
- Use practical containment tools and equipment including shovels, dump trucks, sand bags, plastic bags, heavy earth moving equipment, "Plug and Patch", foam, salvage covers, adsorbents, booms, hose, redwood plugs, etc.
- If weirs are installed, they should be able to handle large flow rates and surges.
- Surface run off may have to be diverted from the spill site if wet conditions are present.

1.5.13.3 Recovery of product and/or clean-up of the spill

- Ensure the health and safety of the persons responding to the spill.
- Once containment has been achieved, recovery and clean-up operations begin immediately.
    - Recover as much product and saturated debris as possible.
    - Keep environmental disturbance to a minimum.

1.5.13.4 Land Spills

Land spills will spread outward from the initial spill point toward lower-lying areas. Penetration downward into the soil will also occur at a rate that is dependent on the soil type and the nature of the product spilled. During spills in winter, petroleum will spread under the snow making definition of the extent of the spill area difficult.

- attempt to restrict spills on land to as small an area as possible based on site conditions.
- prevent the spill from entering water bodies or flowing watercourses or flowing into manholes or culverts, within the bounds of safety and practicality.

The method chosen for land containment and recovery is dependent on site conditions and the equipment available. A summary of common options is presented in the following table:

Land Containment Options		
Containment Method	**Technique Description**	**Comments**
Earth or Sand Dike (All seasons)	Earth or sand at or near the site is used to contain spilled material on flat or sloped surfaces. Sandbags filled with soil or sand are used to contain spill.	Sufficient dry earth, gravel or sand must be available to contain spill. Earth may be frozen. Surface disturbance to remove earth or sand may result in erosion, especially on steep slopes. Work crews and/or earth-moving equipment are required to build dike.
Snow or Ice Dike (Winter only)	Snow or ice at or near the site is used to contain spilled material on flat or sloped surfaces.	Sufficient snow or water must be available to contain spill. Snow or ice dike will melt quickly in warm weather. Contaminated snow or ice may need to be removed or stored for treatment. Work crews and/or earth-moving equipment are required to build snow dike. Water spraying equipment may be required to construct ice dike.
Land Containment Options		
Containment Method	**Technique Description**	**Comments**
Sorbent Dike (All seasons)	Sorbent material is used to contain spill.	Useful only in small spills, as purchase of large quantities of sorbent is expensive and impractical. Contaminated sorbent may need to be replaced or squeezed out during incident. Contaminated sorbents must disposed in compliance with government legislation. Sufficient sorbent or sorbent boom, work crews and storage containers or a lined storage area for contaminated sorbents must available to build sorbent dike.
Trench or Sump (All seasons)	A trench or sump is excavated downslope on sloping terrain to limit surface or subsurface spill movement. Work crews and/or earth-moving equipment are required to build trench or sump, as well as plastic or other impermeable sheeting for a trench liner.	Clean topsoil should be removed before trench construction. Frozen soil, bedrock close to the surface or soil type (e.g. sand) may make this option impractical. Surface disturbance to remove earth or sand may result in erosion or further penetration in sandy soil.
Land Recovery Options		
Recovery Method	**Technique Description**	**Comments**
Vacuum Truck	A vacuum truck is used to recover spilled material from a dike or trench in areas accessible by trucks or heavy equipment.	The method depends on site access. Surface disturbance and soil damage may result from movement of the vacuum truck to and from the site. Topsoil may need to be stripped from the site before starting recovery activities.

Land Recovery Options		
Recovery Method	**Technique Description**	**Comments**
Pumping Spilled Material into Storage	A pump is used to recover spilled material from a dike or trench in areas not accessible by vacuum trucks.	Pumps must be safe for use at the spill site and compatible with the product to be pumped. Surface disturbance and soil damage may result from movement of the pump and storage equipment to the site. Skid tanks, tanker trucks, port-a-tanks, fuel bladders, permanent tanks, or a lined excavated area must be available to provide storage for the recovered material. A work crew and power supply for the pump must also be available.

1.5.13.5 Spills into a Watercourse

Petroleum products will spread outward from the origin of the spill, eventually achieving a stable thickness on the water. Spills on rivers, creeks, or streams will flow downstream, contaminating riverbanks and vegetation, affecting wildlife, fish and water users in the area of the spill.

The rate of spill movement will depend on the current speed of the water and the time of year. Current may flow faster in the deepest channels in the river and slower in shallower areas, due to varying volumes of water. Flow in a watercourse will also be faster in the spring, because of snowmelt entering the watercourse from the surrounding area. River currents in summer and fall will be generally slower than in the spring. Wind and wave action will also affect the rate and direction of spill travel.

Spill velocity on a watercourse may be estimated quickly by using a current velocity meter or by timing the movement of a floating object on the watercourse over a set distance.

The following table is used for estimating spill velocity based on a 30 metre (100 foot) distance:

Time Required For Object to Travel 100 meters (seconds)	Surface Current Speed		Boom Angle (degrees)
	(km/hr)	(m/s)	
720	0.5	0.14	60°
360	1.0	0.28	60°
240	1.5	0.42	60°
180	2.0	0.56	45°
143	2.5	0.69	45°
120	3.0	0.83	45°
103	3.5	0.97	15°
90	4.0	1.11	15°
80	4.5	1.25	15°
73	5.0	1.39	15°
60	6.0	1.67	15°

Note: In currents faster than 6.0 km/h, or in excessively turbulent waters, the use of containment booms may be impractical, and other containment or protection methods such as the use of diversion or exclusion booms may be required.

The velocity calculated will be an approximation only, as the watercourse velocity varies at different points across the river, due to changes in river depth and at various points upstream and downstream on the river. In the initial stages of the spill on a watercourse, lighter-end materials will tend to evaporate, especially in warm weather. Other processes that might affect spill behaviour include dispersion of the petroleum into the water, formation of stable oil/water emulsions and stranding or oil along the shoreline.

Containment of a spill on a watercourse should be completed as quickly as possible as the spilled material has the potential to travel a much greater distance and contaminate a larger area than spills on land. The Incident Commander and Incident Command System Operations personnel will implement appropriate containment actions based on the size of the watercourse and current velocity.

Watercourse Containment Options		
Containment Method	**Technique Description**	**Comments**
Containment Boom (Spring to Fall)	A containment boom is placed in the watercourse to prevent migration of the spilled material down-stream of the containment point.	The watercourse must be accessible to allow containment activities. If water is too shallow, or current is too fast, the containment boom may not be effective in containing the oil. Oil spill containment equipment, work and safety boats, and a work crew must be available to conduct this method.
Diversion Boom (Spring to Fall)	Diversion booms are used in large or swift rivers to divert spilled material to calmer water for containment and recovery. May be used in combination with containment boom.	The watercourse must be accessible to allow boom to be deployed. High current speeds or turbulence may make deployment impossible, or may cause deployed boom to fail, releasing spilled material downstream. Oil spill containment equipment, work and safety boats, and a work crew must be available to conduct this method.

Watercourse Containment Options		
Containment Method	**Technique Description**	**Comments**
Sorbent boom (Spring to Fall)	Sorbent booms may be used in narrow, low flow streams or rivers to remove small amounts of surface oil. Chicken wire or containment boom may be used to back up sorbent boom.	The watercourse must be accessible to allow boom to be deployed. Sorbent boom use is only viable in low flow watercourses, as boom is not very sturdy and breaks easily. (Chicken wire or containment boom may be used behind sorbent boom to reinforce sorbent boom and prevent breakage). Sorbent boom also has no skirt allowing large amounts of oil to easily flow under it. Sorbent boom will pick up sheen but not large amounts of oil. Sorbent boom is not very effective in cold weather. Large amounts of sorbent boom are expensive, and must be replaced in the watercourse when saturated. Used sorbent must be stored and disposed of in compliance with government legislation. Sorbent boom, work crew and possibly boats may be required.
Earth or Sand Dike (Spring to Fall)	Dikes are used across very shallow streams and intermittent creeks to contain flowing oil. Dikes can also be used to contain spilled materials along a shoreline.	Sufficient earth or sand is needed to construct the dike. Flowing may be caused if stream or creek is dammed (a containment weir may be used to alleviate this problem – see below) Damage may be caused by evacuation and construction in the watercourse and along the banks. A work crew with shovels, earth-moving equipment, earth or sand, sandbags and/or sheets of metal or wood may be required.
Containment Weir (Spring to Fall)	Containment weirs are physical dams with culverts or pipes constructed in the dam to allow free water movement from a site while containing surface oil.	Containment weirs are used in shallow streams and creeks and are suitable for maintaining a constant water level at the site and preventing flooding. Damage may be caused by excavation and construction in the watercourse and along the banks. A work crew with shovels, earthmoving equipment, earth or sand and piping or culvert material is required.

Watercourse Recovery Options		
Recovery Method	**Technique Description**	**Comments**
Vacuum Truck	A vacuum truck is used to recover free petroleum from water in areas accessible by trucks or heavy equipment.	A vacuum truck and operator are required. Use of this method is subject to site access. Surface disturbance and soil damage may result from movement of the vacuum truck to and from the site. Topsoil may need to be stripped from the site before conducting recovery activities.
Pumping of Spilled Material into Storage	A pump is used to recover free oil from the watercourse in areas not accessible by vacuum trucks.	Pumps must be safe for use at the spill site and be compatible with the product to be pumped. Surface disturbance and soil damage may result from movement of the pump and storage equipment to the site. Technique will generate large volumes of contaminated water that will require storage. Skid tanks, tankers, port-a-tanks, fuel bladders, permanent tanks or a lined excavated area must available to provide storage for the recovered material. A work crew and power supply for the pump must also be available.
Skimmers	Mechanical devices are used to skim oil from water surface or remove oil/water mixture for storage.	Skimmer will need sufficient water depth to float. Weir skimmers work best on thicker layers of oil in flowing water. Will generate large quantities of water/oil mixture. Drum or disc skimmers will pick up thinner layers of oil on slow moving water. Debris and vegetation may clog skimmer making oil pickup difficult. A suction, floating weir, disc or drum skimmer, pump and work crew are required. A secure storage facility (tanker, portable tanks, fuel bladders or excavated, lined storage site) is also required.

1.5.13.6 Spills into Water bodies

In the absence of any current or wind, spills on water bodies such as lakes will spread out in all directions from the site of the spill until a uniform stable thickness is reached. If a wind and/or current is present, the spill will move with the wind or current until it reaches the shoreline.

Wave action in the water body may also affect the spill causing oil-in-water or water-in-oil emulsions to form, making recovery and clean-up efforts more difficult.

Response personnel should attempt to contain the spill to as small an area as possible on the water body near the spill source. Dispersion of the spill over a large area on the water body could cause widespread impacts when the spill reaches the shore. If the spill can be contained on the water body, the spilled material is moved toward shore for recovery.

Containment options for spills on water bodies use a containment boom to surround the spill. See the local Oil Spill Contingency Plan for a discussion of containment booms and for boom configurations used to contain a boom in open water. If the area that may be impinged by the spilled materials is environmentally sensitive, appropriate shoreline protection measures may be implemented as recommended by company Environmental Specialists.

1.5.13.7 Spills into Wetlands or Muskeg

Wetlands are areas with high organic content, which contain large amounts of water in the soil. Wetlands may be continuously covered in water or water levels may fluctuate throughout the year. Muskeg is a land area that contains a high moisture content and is boggy in the summer because of large quantities of peat, moss, or other vegetative material in the soil. In winter, muskeg will freeze making excavation extremely difficult.

Spills in wetlands or muskeg can be some of the most difficult spills to contain, recover and clean up because of limited site access for both manpower and equipment. Because of the sensitive nature of these ecosystems, more damage may be caused by emergency response operations than was caused by the original spill. The Incident Commander may consult with government officials or environmental specialists before conducting emergency response operations in wetlands or muskegs. This will ensure that containment, recovery, and clean-up operations represent the most viable option for the spill, based on the type of product, size of spill and site specific safety, operational or environmental concerns.

If all other options are considered unviable, natural recovery may be approved by environmental protection agencies. Natural recovery uses micro-organisms already present in the ecosystem to degrade the oil. Degradation of the oil may be enhanced by addition of other nutrients required by the micro-organisms, to ensure sufficient levels of these nutrients are present to allow degradation to continue.

Natural recovery may be preferable to recovery and clean-up depending on:

- the amount, type and persistence of the oil
- the location of the site
- the nature and uses of the area
- whether the impacts of various clean-up methods are greater than damage related to the actual spill

Natural recovery should be considered if:

- clean-up activities will cause more harm than leaving the site to recover naturally
- leaving the area to recover naturally will not cause further harm to environmentally sensitive areas

Containment operations for wetland or muskeg spills in winter are similar to those for spills on land or ice. If containment operations are conducted at the site in the summer, a combination of land containment and water containment options will be used as appropriate.

Wetland or Muskeg Containment Options		
Containment Method	**Technique Description**	**Comments**
Containment Boom	A containment boom is placed in wetland to prevent migration of oil into non-contaminated areas.	If water is too shallow, or the current is too fast, the containment boom may not be effective in containing the oil. Oil spill containment equipment, work and safety boats and a work crew must be available to use this method.
Containment Weirs	Containment weirs are physical dams with culverts constructed in the dam to allow free water movement from a site while containing surface oil. Containment weirs are used to maintain a constant water level at spill site for easy oil recovery.	Access to the site by manpower and equipment may be limited. Building of containment weirs may be labour-intensive and time-consuming if done manually. Damage may be caused by excavation and construction in the watercourse and along the banks. A work crew with shovels, earthmoving equipment, earth or sand and piping or culvert material is required to use this method.
Vacuum Truck	Muskeg or wetland areas must be accessible. A vacuum truck can recover from a trench or water surface.	Surface disturbance and soil damage may result from movement of the vacuum truck to and from the site. Topsoil may need to be stripped from the site before undertaking recovery activities.
Pumping of Spilled Material into Storage	A pump is used to recover free oil from wetlands or muskeg.	The wetland or muskeg area must be accessible for equipment. Pumps must be safe for use at the spill site and be compatible with the product to be pumped. The technique will generate large volumes of contaminated water that will require storage. Skid tanks, tanker trucks, port-a-tanks, fuel bladders, permanent tanks or a lined excavated area must be available. A work crew and power supply for the pump must also be available.
Skimmers	Used to skim oil from water surface or remove oil/water mixture for storage. Drum or disc skimmers will pick up thinner layers of oil on slow moving water.	The wetland or muskeg area must be accessible. Skimmer will need sufficient water depth to float. Debris and aquatic vegetation may clog skimmer, making oil pickup difficult. A suction, floating weir, disc or drum skimmer, pump and work crew are required to undertake method. A secure storage facility is also required.

Wetland or Muskeg Containment Options		
Containment Method	**Technique Description**	**Comments**
Fresh Water Flushing	Water is flushed through an area to push oil that is in vegetation or on the water surface toward a collection point for recovery. The method can be used in conjunction with trenches.	The wetland or muskeg area must be accessible for equipment to allow recovery activities to be conducted. The method is not suitable for areas with extensive vegetation or obstructions. Physical damage may be caused to sensitive environmental areas. Pumps, a power supply, hoses, hot or cold water, and a work crew are required. A lined, excavated area or storage tanks may be required to hold water for treatment or testing.

1.5.13.8 Spills on Ice

Spills on ice will tend to spread out from the spill source toward lower-lying areas. Surface depressions, cracks and pockets in the ice will cause the spilled material to pool. A significant volume of some oils can be absorbed into ice.

The presence of oil on or in ice increases solar heating and the rate of melting. Subsequent freezing and melting may eventually cause the oil to migrate throughout the surface of the ice. Openings in the ice may allow the spilled material to migrate into open water or allow the spill to be swept under ice, making response operations more difficult.

The information presented should be used as a guideline only in determining typical load-bearing capacity of ice. The Incident Commander and Incident Command System Operations personnel must determine whether it is safe to work on ice based on actual site conditions.

The ability for ice on a river, stream or lake to support the weight of workers and equipment is determined by effective ice thickness which is based on the thickness of clear ice and presence of white ice.

Clear ice (sometimes called blue ice) is translucent and well compressed with few air pockets. This ice is very strong and has a high load-bearing capacity.

White ice (or snow ice) is very porous, with many air pockets and is much weaker. White ice has approximately half the load-bearing capacity of clear ice. White ice is formed by constant melting and freezing of the top layer of ice due to solar heating or mild temperatures and is normally found on top of clear ice.

Holes should be drilled in the ice at the work site, before starting any on ice operations, to determine the average thickness of white and clear ice.

Effective ice thickness then can be calculated, using the formula in the following table:

Effective Ice Thickness = clear ice thickness + ½ white ice thickness
Example: The spill site has 20 inches of clear ice and 10 inches of white ice 20 inches clear ice + ½ x 10 inches white ice = 25 Effective Ice Thickness
Note: If water lies between layers, use the depth of only the top layer of white ice

Based on the effective ice thickness, a determination can be made as to the stationary and moving loads that may be supported by the ice. Normally less ice is required for continuous movement on the ice than for stationary loads as less pressure is exerted on any one point on the ice during movement.

LOAD-BEARING CAPACITY OF ICE THICKNESS FOR CONTINUOUS TRAVEL [1]		
Permissible Load	**Effective Ice Thickness inches (centimetres)**	
	Lake	**River**
One person on foot	2.0 (5.0)	2.5 (6.3)
Group, in single file	3.2 (8.0)	3.5 (8.8)
Passenger car 4,400 lbs. (2000 kg)	7.1 (17.8)	8.3 (20.8)
Light Truck 5,500 lbs (2500 kg)	7.9 (19.8)	9.1 (22.8)
Medium Truck 7,700 lbs (3500 kg)	10.2 (25.5)	11.8 (29.5)
Heavy Truck 15,000 – 17,500 lbs (6800 – 8000 kg)	13.8 (34.5)	16.1 (40.3)
20,000 lbs (9000 kg)	15.0 (37.5)	17.3 (43.3)
50,000 lbs (23,000 kg)	24.8 (62.0)	28.7 (71.8)
99,000 lbs (45,000 kg)	31.5 (78.8)	36.2 (90.5)
150,000 lbs (68,000 kg)	39.4 (98.5)	45.3 (113.3)
240,000 lbs (109,000 kg)	49.2 (123.0)	56.7 (141.8)

WEIGHT-BEARING CAPACITY FOR STATIONARY LOADS AND WORKING ON ICE		
Permissible Load	**Effective Ice Thickness inches (centimetres)**	
	Lake	**River**
2,200 lbs (1000 kg)	8.0 (20.0)	9.1 (22.8)
4,400 lbs (2000 kg)	12.0 (30.0)	14.0 (35.0)
8,800 lbs (4000 kg)	18.0 (45.0)	21.0 (52.5)
17,600 lbs (8000 kg)	24.0 (60.0)	27.0 (67.5)
50,000 lbs (23,000 kg)	44.0 (110.0)	50.0 (125.0)
99,000 lbs (45,000 kg)	59.0 (147.5)	68.0 (170.0)
150,000 lbs (68,000 kg)	71.0 (177.5)	82.90 (205.0)
240,000 lbs (109,000 kg)	91.0 (227.5)	105.0 (262.5)

Note: These tables are guidelines only for determining the typical load-bearing capacity of ice.

[1] Does not apply to parked loads, or where ice faults are evident.

Temperature may affect the load-bearing capacity of ice on a water body. Air temperatures must remain below the freezing point of water (0°C) for a sufficient period to allow the ice to adequately support a stationary or moving load. Temperature effects are dependent on ice thickness, as follows:

- less than 50 centimetres (20 inches) of ice: temperature must be constant for 3 days
- between 50 and 100 centimetres (20 and 40 inches) of ice: temperature must be constant for 4 days
- over 100 centimetres (40 inches) of ice: temperature must be constant for 5 days

Sudden drops or increases in temperature can also cause thermal stressing or cracking of ice requiring temporary load restrictions for 3 to 5 days following the change. Thawing due to warm temperatures may also significantly affect ice conditions. On-site personnel should take extreme care when evaluating ice conditions during a thaw and limit work on or near ice under these conditions.

Containment and clean-up options for spills on ice are similar to those on land and are summarized in the following tables:

On-Ice Containment Options

Containment Method	Technique Description	Comments
Earth or Sand Dike (All seasons)	Earth or sand at or near the site is used to contain spilled material on flat or sloped surfaces. Sandbags filled with earth or sand are used to contain spill.	Effective ice thickness must be sufficient to support the weight of manpower and equipment required to build dike. Sufficient dry earth, gravel or sand must be available to contain spill. Earth may be frozen. Surface disturbance to remove earth or sand may result in erosion, especially on steep slopes. Earth or sand placed on ice must be removed before spring break-up. Work crews and/or earth-moving equipment are required to build dike.
Snow or Ice Dike (Winter only)	Snow or ice at or near the site is used to contain spilled material on flat or sloped surfaces.	Effective ice thickness must be sufficient to support the weight of manpower and equipment required to build dike. Sufficient snow or water must be available to contain spill. Snow or ice dike may melt quickly in warm weather. Contaminated snow or ice may need to be removed or stored for treatment. Work crews and/or earth-moving equipment is required to build snow dike. Water spraying equipment may be required to construct and maintain an ice dike.

On-Ice Containment Options		
Containment Method	**Technique Description**	**Comments**
Sorbent Dike (All seasons)	Sorbent material is used to contain spill.	Useful only in small spills, as purchase of large quantities of sorbent is expensive and impractical. Contaminated sorbent may need to be replaced or squeezed out during incident. Contaminated sorbents must be disposed of properly to comply with government regulations. Sufficient sorbent or sorbent boom, work crews and storage containers or a lined storage area for contaminated sorbents must be available to build sorbent dike.

On-Ice Cleanup Options		
Clean-up Method	**Technique Description**	**Comments**
Manual Removal by Work Crew and/or Equipment (Winter)	A work crew or earth-moving equipment are used to remove thick oil or contaminated snow and ice.	Effective ice thickness must be sufficient to support the weight of manpower and equipment required. All necessary safety precautions should be undertaken for personnel who work near any open water. Manual removal may be a difficult and time-consuming process. A work crew with hand tools or earth-moving equipment (e.g. backhoe) and operators, as well as ice cutting equipment, may be required. Lined storage area or storage drums are required to store contaminated material before treatment or disposal. Oil present in snow may be skimmed off during spring thaw.
Steaming of Ice Surface	Steam is used to melt ice surface to aid in spill clean-up. The technique may be used in association with other clean-up and recovery techniques.	Effective ice thickness must be sufficient to support the weight of manpower and equipment required. All necessary safety precautions should be undertaken for personnel who work near any open water. A work crew with steaming equipment is required to undertake this method.

On-Ice Cleanup Options		
Clean-up Method	**Technique Description**	**Comments**
Sorbents (Spring to Fall)	The method is used in isolated areas to clean up small amounts of oil.	Clean-up is labour-intensive and time-consuming. Limited access to site may make this method difficult or impossible. Sorbents are not very effective on weathered oil or in cold weather. Sorbents may freeze to the surface. Sorbents must be disposed of properly to comply with government regulations. Sufficient sorbent, work crews and storage containers or a lined storage area for contaminated sorbents must be available.
Snow or ice melting	Snow or ice is removed from the clean-up site and melted in heated tanks to allow spilled material to be skimmed off the surface of the melt water. The technique may be used in association with other clean-up and recovery techniques.	Contaminated snow or ice must be removed from clean-up site and placed in melting tanks. The method may be labour-intensive and time-consuming, as melting is not be very efficient for clean-up of large volumes of petroleum-contaminated ice. In very cold temperatures, sufficient heat may not be available in the tanks to melt ice. A work crew, heating tanks, skimming equipment, transfer vehicles and operators are required. A lined storage facility for storage of contaminated ice or snow before melting may also be required, as well as storage tanks for storing recovered petroleum.

1.5.13.9 Spills Under Ice

Spills of petroleum under ice will spread and will travel under the ice at a velocity that is less than the current speed of the watercourse. The spill will tend to follow the path of the main current flow. The spill product may become trapped in crevices, cracks, pockets, and other irregularities under the ice and may freeze from the underside of the ice anywhere downstream or outward from the original spill. This will make recovery and clean-up operations extremely difficult.

Before conducting any response operations to contain, remove and clean up oil under ice, the Incident Commander should ensure that the response personnel have calculated the effective ice thickness to ensure it will support the weight of personnel and equipment.

For spills under ice, the Incident Commander and response personnel should attempt to determine the location of the spilled material and bring the spill to the surface of the water for containment and recovery. Spill movement under the ice is normally located by drilling holes through the ice using an ice auger downstream of the spill source on a flowing watercourse or outward from the spill source on a non-flowing water body. Alternately, aerial reconnaissance may be used to attempt to locate spilled material in cracks at the surface or under thin ice. Once the spill has been located, containment operations can be conducted to bring the spilled product to the surface.

Containment operations are normally accomplished by constructing slots in the ice. Ice slots allow petroleum products trapped under the ice to rise to the surface for recovery.

The slot is normally constructed at an angle in relation to the shore toward the area of strongest current flow in the river. If the slot is constructed correctly, the spilled material will rise into the slot and flow along it toward the shore for recovery.

The angle of slot construction in relation to the shore depends on the current velocity, similar to a containment boom placed in a flowing river. For higher currents in the river, a shallower angle is used for the ice slot, while a larger angle may be used for lower current flows.

If a slot is constructed at too great an angle to the current, turbulence may occur, sweeping the spilled material under the ice on the downstream side. Plywood or other types of sheeting may be placed on the downstream side of the slot and frozen in place to facilitate containment of the spilled material. The ice slot should be 0.5 to 1.0 metres (1.6 to 3.3 feet) wide, to aid in containment. Ice blocks may be cut using a ditch witch or backhoe if the effective ice thickness is sufficient to allow stationary equipment on the ice. [If ice is too thin for equipment but safe for personnel, crews equipped with chainsaws and proper safety gear can cut the ice.] Ice blocks can be removed to clear the slot or pushed under the ice downstream of the slot if sufficient water depth is available.

Ice blocks are extremely heavy (one cubic foot of ice weighs 24 kilograms (53 pounds). Blocks should be cut to a size that will allow the crews or equipment to remove them easily. To aid in block removal, the ones nearest the shore should be removed first and remaining blocks should be floated toward shore for removal. Plywood or other sheeting can be used upstream of the slot to divert oil into the slot for recovery. Narrow slots may be cut into the ice with a chain saw and sheeting may be wedged into the slots to channel the main current toward the ice slot in a manner similar to a diversion boom in open water.

Under-Ice Containment Options

Containment Method	Technique Description	Comments
Ice Slotting	Ice slots are cut into ice on rivers to collect oil moving under the ice. The technique is best used for rivers with current, as oil will be moved toward slot by current.	Effective ice thickness must be sufficient to support the weight of manpower and equipment required to build slot. All personnel working near any open water must take all required safety precautions. The location of the spill must be confirmed by drilling holes downstream of the spill source before constructing the ice slot. Total containment of spilled petroleum in an ice slot is unlikely, due to material trapped under ice. Snowmobiles, communications gear, and ice augers may be required to determine the location of the spill. Work crews, chain saws and/or a backhoe or ditch witch are required to construct an ice slot. A recovery device such as a heat-traced ice skimmer is required to recover spilled material. Storage tanks or a lined excavated storage area may be required to store recovered oil/water mixture.

1.5.13.10 Spills in Broken Ice

The risk to Life Safety of the personnel attempting spill response in broken ice conditions using existing technology is extreme. Emergency operations in broken ice conditions during spring thaw or winter freeze-up are extremely difficult. When oil is mixed with floating ice or covered by a very thin ice cover, ice interferes with the collection of the oil and could damage containment and recovery equipment. The presence of ice also makes the use of boats difficult.

Before authorizing any spill response operations in broken ice conditions, the Incident Commander and response personnel, along with the appropriate regulatory agencies, will evaluate whether it is safe or feasible to undertake containment and recovery operations and what methods should be used.

Containment options for spills during freeze-up or break-up are similar to those for spills on a river and on ice. If containment operations are determined to be feasible based on site conditions, response personnel will attempt to deflect ice away from the containment site.

Deflection of ice may be achieved using log booms or ice dams. A log boom consists of logs cabled together with chain, anchored upstream of a conventional containment boom. An ice dam is constructed upstream of the oil spill site and containment site, to attempt to divert upstream ice away from a containment site.

Log booms are deployed at an angle away from the containment site. Logs are spaced to allow spilled materials and water to move directly toward the containment site, while diverting the ice toward the opposite shore, allowing the ice to pass around the containment site.

1.5.13.11 Spill Control Point Descriptions

Control points are pre-identified locations on watercourses that allow for the staging and deployment of oil spill containment and recovery equipment in response to oil spills that have occurred upstream of the control point. Control point selection is critical to an effective oil spill response and part of your risk assessment and development of site-specific emergency response plan information.

Each oil spill cooperative conducts control point evaluation for the whole geographic co-op area.

Chance Oil and Gas Limited may decide to provide additional control points in the site-specific sections of this Emergency Response Plan.

An ideal control point should have:

- quick access to the watercourse in all seasons, using clear ground, a road or a trail
- adequate work space to conduct operations and to store required equipment with minimal need for clearing of brush and vegetation
- sufficient space to deploy containment and recovery equipment quickly with minimal effort or obstructions (i.e. trees, rocks, steep banks, etc.) and minimal environmental impact
- boat launch location(s) for boats assisting in containment and recovery operations.

Selection of control points with public access is preferred.

For control points on private property - landowner approval and necessary permits for emergency access should be obtained in advance.

Designated site specific control points need to be reviewed at least annually. Each control point site should be visited periodically to evaluate suitability and to ensure information is accurate and complete. Old unsuitable control points should be removed and new control points added, as a part of revisions to site specific information, as required. Control point listings should include a site description, site diagram, access description, landowner/occupant phone number, site suitability and any other information related to the site.

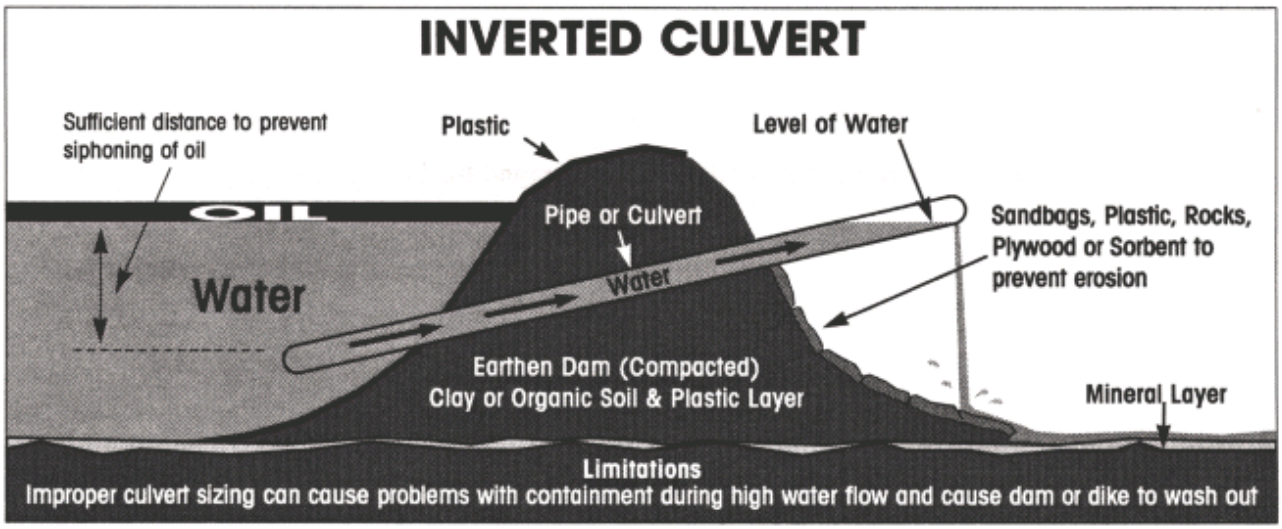
Disposal and Remedial Operations

The proper disposal of contaminated materials as well as site remediation options is outside the scope of this Emergency Response Plan. Site restoration will be determined by consultation among the Incident Commander, company Environmental staff, environmental protection agency personnel and any external environmental consultants that are contracted by Chance Oil and Gas Limited

1.5.13.12 Watercourse Spill Containment and Recovery Techniques

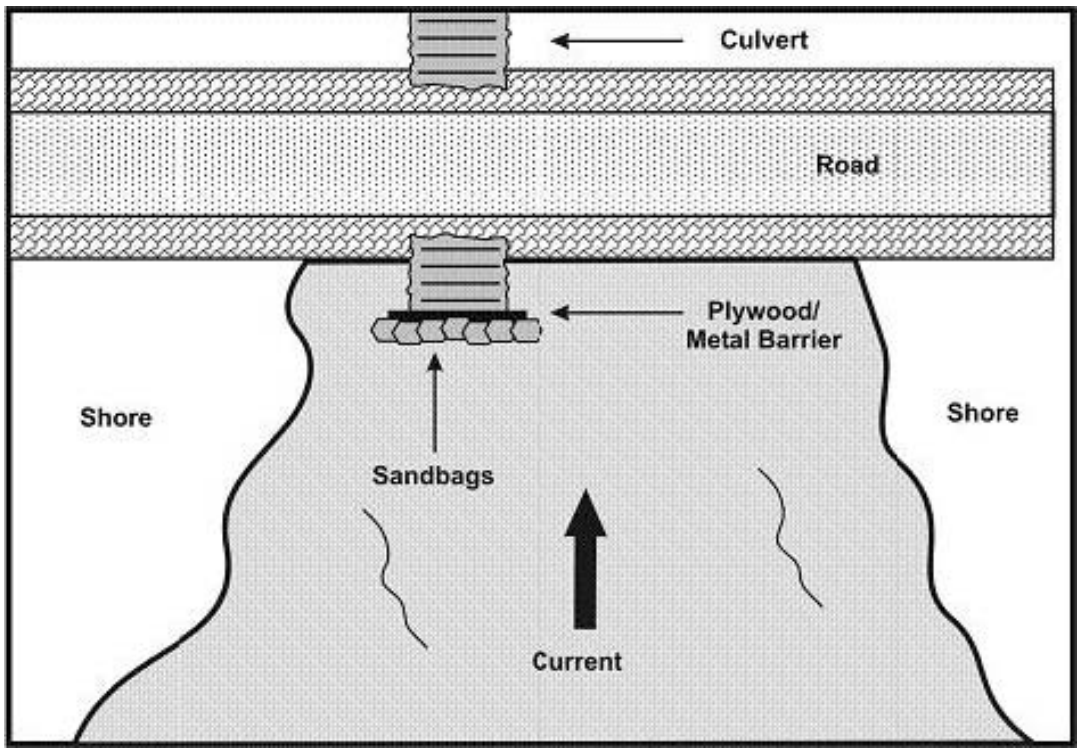
Standing Water

Figure 1: Inverted Culvert Technique



Low Volume Flow

Figure 2: Culvert Blocking



High Volume Flow

Figure 3: Containment Boom

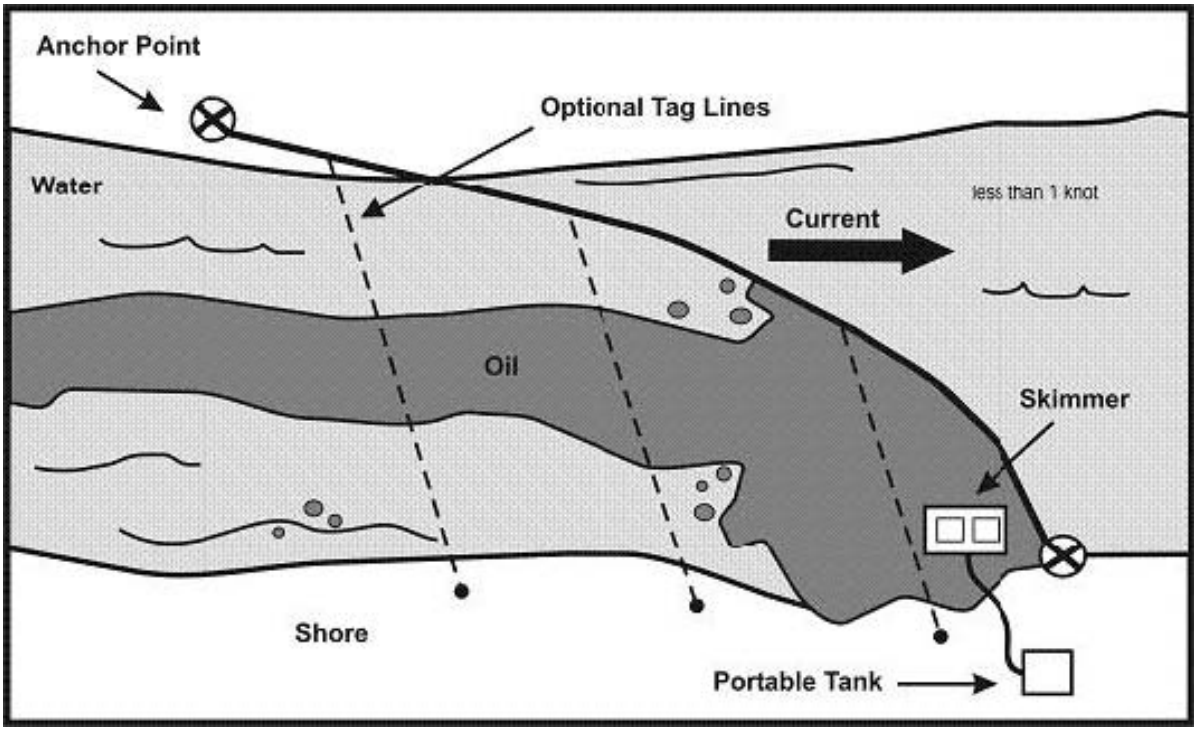


Figure 4: Containment Boom

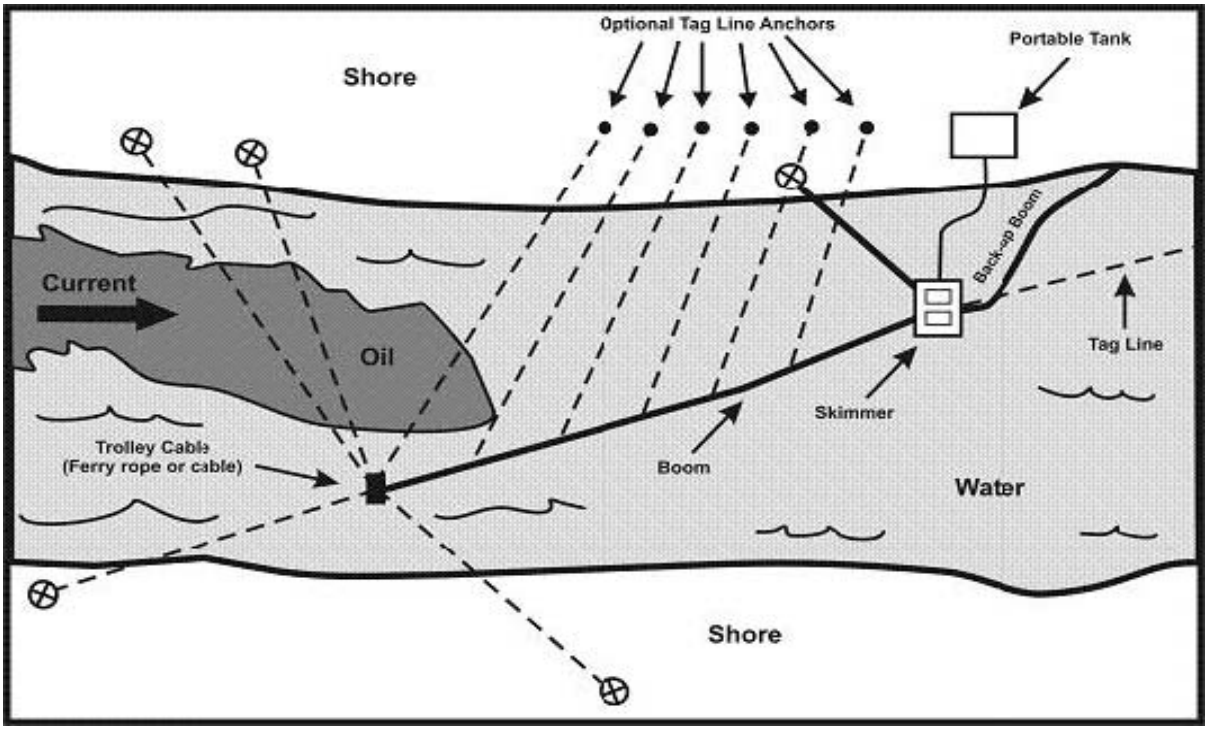


Figure 5: Containment Boom

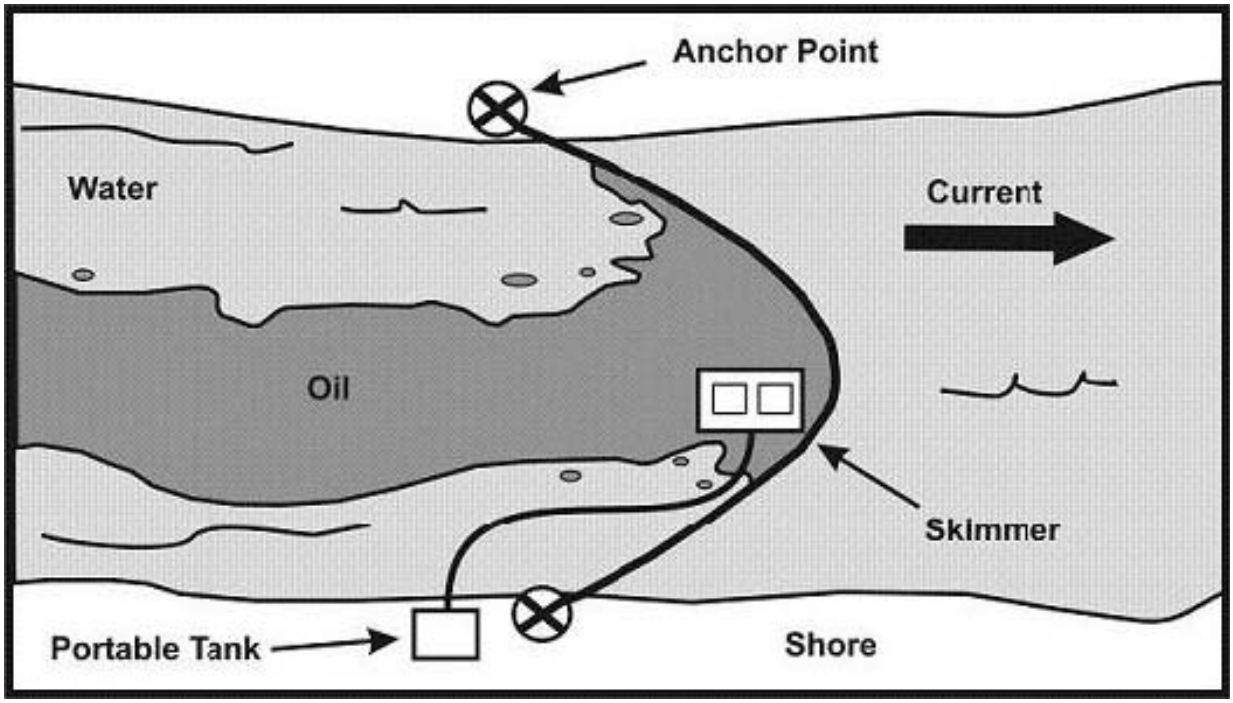


Figure 6: Ice Slotting Strategy

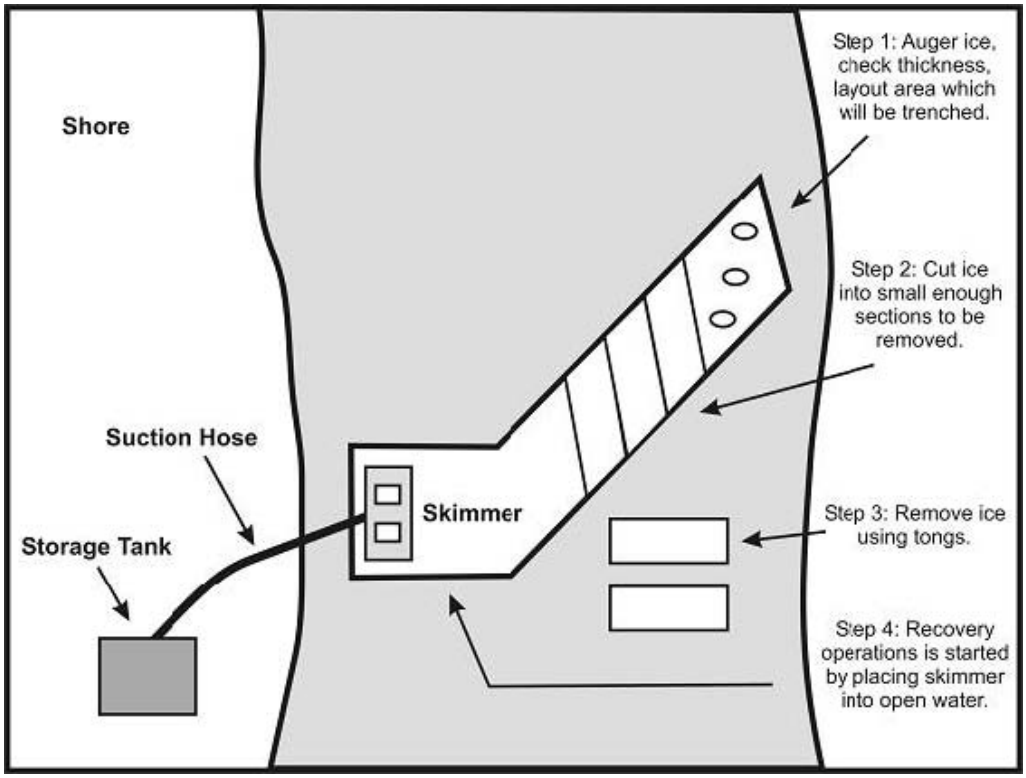
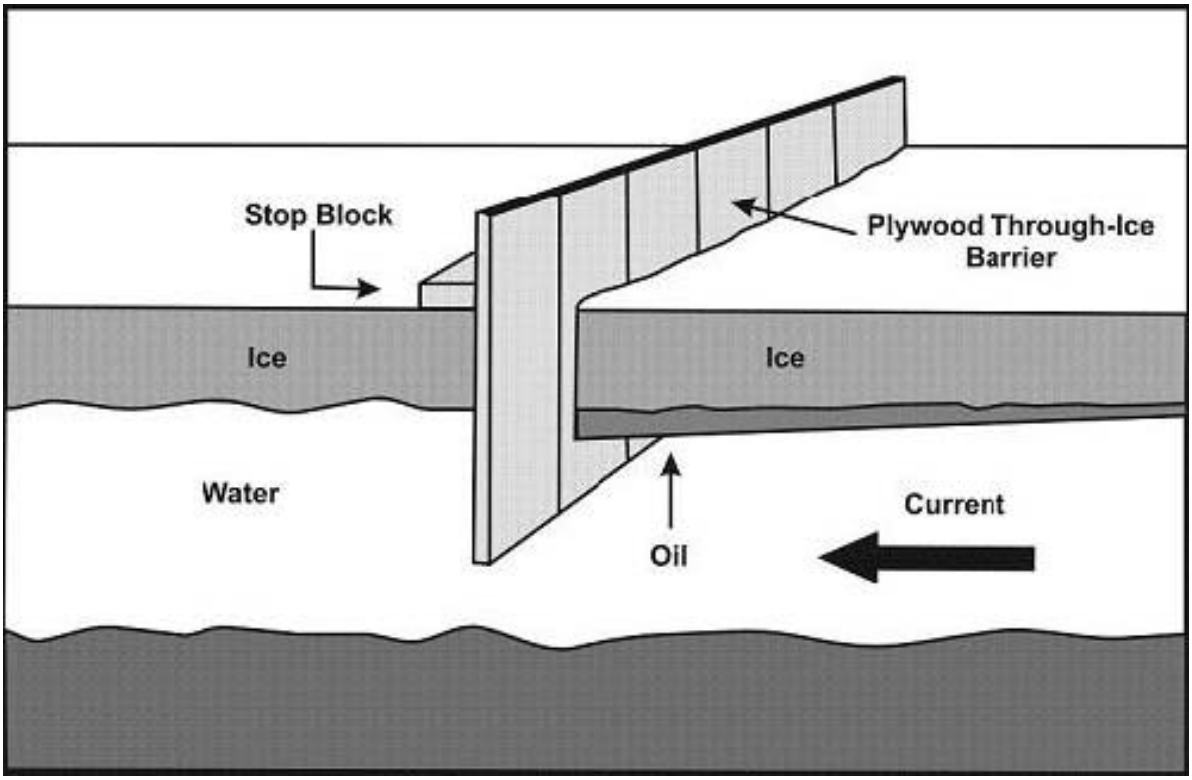


Figure 7: Deflective Board Strategy



APPENDIX 2-D-28. *An overview of hydraulic fracturing and other formation stimulation technologies for shale gas production*

European Commission

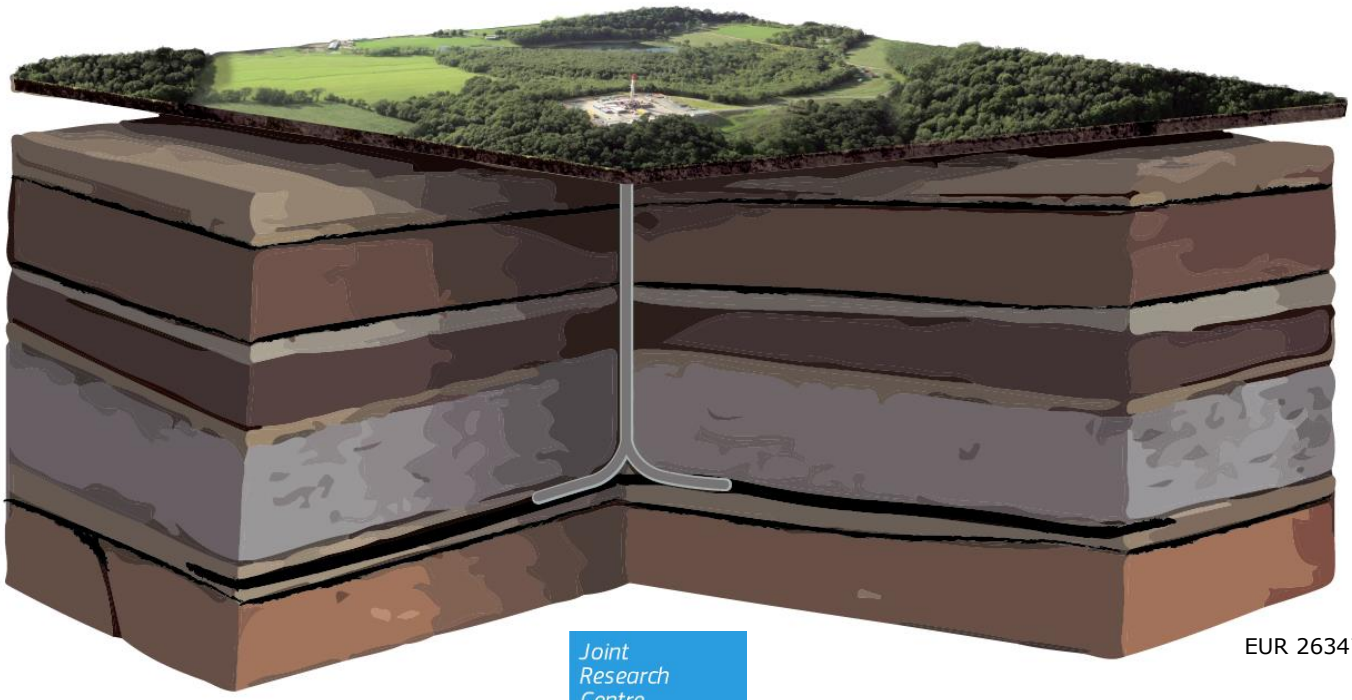
JRC SCIENCE FOR POLICY REPORT

An overview of hydraulic fracturing and other formation stimulation technologies for shale gas production

Update 2015

Luca Gandossi, Ulrik Von Estorff

2015



Joint Research Centre

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Abstract

An overview of hydraulic fracturing and other formation stimulation technologies for shale gas production – Updated 2015

This report presents an update of the original study carried out in 2013 (EUR 26347). It reviews the latest trends in hydraulic fracturing and alternative fracturing technologies. For each identified technique, an overview is given along with its rationale. Potential advantages and disadvantages are identified and the technological readiness status is identified for its application to shale gas production.

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Executive summary

The technology of hydraulic fracturing for hydrocarbon well stimulation is not new, but only fairly recently has become a very common and widespread technique, especially in North America, due to technological advances that have allowed extracting natural gas from so-called unconventional reservoirs (tight sands, coal beds and shale formations). The conjunction of techniques such as directional drilling, high volume fracturing, micro-seismic monitoring, etc. with the development of multi-well pads has been especially successful in the last years in their application to shales, making gas production from shales technically and economically feasible.

In Europe, the potential application of this technology has led to both great worries and high expectations: worries regarding the alleged magnitude of the environmental impact, and expectations about production of indigenous hydrocarbons. Other types of formation stimulation exist that do not make use of water-based fluids (for instance, explosive fracturing, dynamic loading, etc.), or that make use of fluids other than water. These are currently not extensively applied due to performance considerations.

As for any other industrial activity, the deployment of high-volume hydraulic fracturing could potentially entail some risks to the environment. Among the concerns raised are high usage of water, methane infiltration in aquifers, aquifer contamination, extended surface footprint, induced local seismicity, etc. New technologies could help addressing these concerns (for instance by using non-toxic chemicals, by reducing or eliminating altogether the usage of water, by considerably reducing the surface footprint of a well, etc.).

This report is an update of the original study carried out in 2013 (2013). It reviews the latest trends in hydraulic fracturing and alternative fracturing technologies, by searching the open literature, patent databases and commercial websites (mainly in the English language). For each identified technique, an overview is given. The technique is then briefly explained, and its rationale (reasons for use) is identified. Potential advantages and disadvantages are identified, and some considerations on costs are given. Finally, the status of the technique (for instance, commercially applied, being developed, concept, etc.) is given for its application to shale gas production.

1. Introduction

1.1. Background

This report is an updated of the original JRC report published in 2013 (Gandossi 2013), compiled taking into account new relevant information that has been published in the course of 2014 and 2015.

The technology of hydraulic fracturing for hydrocarbon well stimulation is not new, with the first experiments done in 1947, and the first industrial use in 1949. It has been used since then for reservoir stimulation (in Europe as well) and enhanced hydrocarbon recovery.

Hydraulic fracturing has become a very common and widespread technique, especially in North America, due to technological advances that have allowed extracting natural gas from so-called unconventional reservoirs (tight sands, coal beds and shale formations). The so-called high volume hydraulic fracturing (with treatments typically an order of magnitude larger than the conventional fracturing procedures) began in 1968. This was complemented by horizontal drilling since the late 1980s, and the use of chemicals (known as "slickwater fracturing") since 1997.

The conjunction of these techniques (directional drilling, high volume fracturing, fracture divergence systems, slickwater) with the development of multi-well pads has been especially successful in North America in the last years in their application to shales, making gas production from shales technically and economically feasible. Shale gas development is considered "unconventional" when contrasted with "conventional" subterranean natural gas reservoirs.

In Europe, experience to date has been focused on low volume hydraulic fracturing in some conventional and tight gas reservoirs, mostly in vertical wells, and constituted only a small part of past EU oil and gas operations. The scale, frequency and complexity of the fracking technique necessary for shale gas extraction differ from past EU experiences, and the potential application of this technology has therefore led to both great worries and high expectations: worries regarding the alleged magnitude of the environmental impact, and expectations about production of indigenous hydrocarbons.

Other methods for fracturing (or, more broadly, formation stimulation) exist that do not make use of water-based fluids (for instance, explosive fracturing, dynamic loading, etc.), or that make use of fluids other than water. These are not extensively applied due to performance considerations.

Foam technologies, thus more expensive than water based stimulations do offer an alternative to reduce the amount of water used in shale gas stimulation. These are available across the industry.

The deployment of high-volume hydraulic fracturing could entail some risks to the environment. Among the concerns raised the following can be mentioned: high usage of water, methane infiltration in aquifers, aquifer contamination, extended surface footprint, induced local seismicity, etc.

New technologies could help addressing these concerns (for instance by using non-toxic chemicals, by reducing or eliminating altogether the usage of water, by considerably reducing the surface footprint of a well, etc.), but it is noted that hydraulic fracturing is still the preferred method by the industry (OGP 2013).

1.2. Scope and objective

This paper reviews hydraulic fracturing and alternative fracturing technologies, by searching the open literature, patent databases and commercial websites (mainly in the English language).

For each identified technique, an overview is given. The technique is then briefly explained, and its rationale (reasons for use) is identified. Potential advantages and disadvantages are identified, and some considerations on costs are given. Finally, the status of the technique (for instance, commercially applied, being developed, concept, etc.) is given for its application to shale gas production.

1.3. Method and limitations

This report was compiled by and large by accessing available literature (relevant journal and conference papers, patent databases and commercial websites), sometimes authored by individuals or organisations wishing to promote a certain technology.

The report does not include full life cycle analysis of cost or environmental impacts, nor any other measure of quantification of advantages or disadvantages of the specific technologies at hand. Thus, the inclusion of positive or negative aspects of a certain technology (economic, environmental, or otherwise) does not constitute an endorsement of the net benefits and/or costs and disadvantages of that stimulation method in comparison with other methods.

Advantages and disadvantages of any applied technology are in most cases dependent on the specific situation under which formation stimulation is performed (location, formation characteristics, etc.). In this report, no objective criteria were developed and applied to identify potential advantages and disadvantages of each technique. As an example, when it is noted that a certain technology leads to "reduced water usage", this is not a judgment to whether there is an environmental, economic or otherwise need to reduce water consumption, and whether the alternative is overall a better choice. Such a choice would typically depend on the specific condition for a given situation.

1.4. Report structure

The paper is structured as follows. The technologies are divided in four main chapters:

- **Hydraulic Fracturing** chapter 2
- **Pneumatic Fracturing** chapter 3
- **Fracturing with Dynamic Loading** chapter 4
- **Other Methods** chapter 5

Hydraulic Fracturing is herein defined as the technique that makes use of a liquid fluid to fracture the reservoir rocks. The following techniques are identified and discussed:

- Water-based fluids section 2.2
- Foam-based fluids section 2.4
- Oil-based fluids section 2.5
- Acid-based fluids section 2.6
- Alcohol-based fluids section 2.7
- Emulsion-based fluids section 2.8
- Cryogenic fluids (CO_2, N_2, etc.) section 2.9
- Fluids based on produced water section 2.10.1

Pneumatic Fracturing is the technique that makes use of a gas (typically air or nitrogen) to fracture the reservoir rock. It is a technique normally used in shallow formations.

In **Fracturing with Dynamic Loading** fluids are not used. The following techniques are identified and discussed:

- Explosive fracturing section 4.1
- Electric fracturing section 4.2

Under **Other Methods** we review all remaining fracturing techniques that do not readily fall in one of the previous categories. The following techniques are identified and discussed:

- Cryogenic fracturing section 5.1
- Mechanical cutting of the shale formation section 5.2
- Enhanced bacterial methanogenesis section 5.3
- Heating of the rock mass section 5.4
- In-situ combustion section 5.5
- Enhanced oil recovery in shale reservoirs section 5.6

Summary and conclusions are given in Chapter 6.

2. Hydraulic fracturing

The technique of hydraulic fracturing makes use of a liquid to fracture the reservoir rocks. A hydraulic fracture is formed by pumping the fracturing fluid into the wellbore at a rate sufficient to increase pressure downhole to exceed the strength of the rock.

The term "hydraulic fracturing" is nowadays widely used to mean the process of fracturing rock formations with water-based fluids. In general terms, hydraulics is a topic in applied science and engineering dealing with the mechanical properties of liquids (not just water). Though a matter of definitions, in this note we choose to categorize under "hydraulic fracturing" all techniques that make use of liquids (including foams and emulsions) as the fracturing agent.

Indeed, using water as base fluid for hydraulic fracturing is a more recent development. (Montgomery and Smith 2010) give a good account of the history of hydraulic fracturing. The first fracture treatments were initially performed with gelled crude and later with gelled kerosene. By the end of 1952, many fracturing treatments were performed with refined and crude oils. These fluids were inexpensive, permitting greater volumes at lower cost. In 1953 water started to be used as a fracturing fluid, and a number of gelling agents was developed. Surfactants were added to minimize emulsions with the formation fluid. Later, other clay-stabilizing agents were developed, permitting the use of water in a greater number of formations.

Other innovations, such as foams and the addition of alcohol, have also enhanced the use of water in more formations. Aqueous fluids such as acid, water, and brines are used now as the base fluid in approximately 96% of all fracturing treatments employing a propping agent. In the early 1970s, a major innovation in fracturing fluids was the use of metal-based crosslinking agents to enhance the viscosity of gelled water-based fracturing fluids for higher-temperature wells.

As more and more fracturing treatments have involved high-temperature wells, gel stabilizers have been developed, the first of which was the use of approximately 5% methanol. Later, chemical stabilizers were developed that could be used alone or with the methanol. Improvements in crosslinkers and gelling agents have resulted in systems that permit the fluid to reach the bottom of the hole in high-temperature wells prior to crosslinking, thus minimizing the effects of high shear (Montgomery and Smith 2010).

The fracturing fluid used is a crucial component of hydraulic fracturing, not only concerning the technical characteristics (rheology[1], formation compatibility, etc.) but its environmental impact. Indeed, several among the main environmental concerns associated with shale gas fracturing today are due to the usage of water: the high volumes of water used and lost underground, the need to process flowbacks, the potential contamination of aquifers by leaks of chemicals employed in the fracturing fluids, etc.

2.1. Hydraulic fracturing of shales

Shale formations present a great variability, and for this reason no single technique for hydraulic fracturing has universally worked. Each shale play has unique properties that need to be addressed through fracture treatment and fluid design. For example, numerous fracture technologies have been applied in the Appalachian basin alone, including the use of CO_2, N_2 and CO_2 foam, and slickwater fracturing. The composition of fracturing fluids must be altered to meet specific reservoir and operational conditions. Slickwater hydraulic fracturing, which is used extensively in Canadian and U.S. shale basins, is suited for complex reservoirs that are brittle and naturally fractured and are tolerant of large volumes of water.

[1] Rheology is the branch of physics concerned with the study of the deformation and flow of matter.

Ductile reservoirs require more effective proppant placement to achieve the desired permeability. Other fracture techniques, including CO_2 polymer and N_2 foams, are occasionally used in ductile rock (for instance, in the Montney Shale in Canada). As discussed below in Sections 2.4 and 2.9.1, CO_2 fluids eliminate the need of water while providing extra energy from the gas expansion to shorten the flowback time.

In general, a fracturing fluid can be thought as the sum of three main components:

Fracturing Fluid = **Base Fluid** + **Additives** + **Proppant**

A fracturing fluid can be "energized" with the addition of compressed gas (usually either CO_2 or N_2). This practice provide a substantial portion of the energy required to recover the fluid and places much less water on water-sensitive formations, but has the disadvantage that it reduces the amount of proppant that is possible to deposit in the fracture. Table 1 summarises a useful classification system developed to characterise different types of hydraulic fracturing fluid systems (Patel, Robart et al. 2014).

Table 1. Classification system for different types of hydraulic fracturing, from (Patel, Robart et al. 2014).

Fracturing type	***Definition***
Conventional	Treatment type that uses a gelling agent and one or more crosslinkers in order to transport proppant into a hydraulic fracture.
Water Frac	Treatment type that uses a friction reducer, a gelling agent or a viscoelastic surfactant in order to transport proppant into a hydraulic fracture.
Hybrid	Treatment type that uses a combination of a friction reducer, gelling agent, acid gelling agent, or one or more crosslinkers in order to transport proppant into a hydraulic fracture.
Energized	Treatment type that incorporates an energizer, normally nitrogen or carbon dioxide, into the base fluid in order to generate foam that transport proppant into a hydraulic fracture.
Other/Unknown	Treatment type category that includes the following less common types: acid frac, gas frac, matrix acidizing.

Typically, water-based fluids are the simplest and most cost-effective solution to fracture a rock formation. However, alternatives to water-based fluids have significantly outperformed water treatments in many reservoirs. For instance, foams have been extensively used in the seventies in depleted conventional reservoirs in which water fractures were not effective. More recently, the development of some unconventional reservoirs (tight gas, shale gas, coal bed methane) has prompted the industry to reconsider "waterless" fracturing treatments as viable alternatives to water-based fracturing fluids. In these reservoirs, the interactions between the rock formation and the fracturing fluids may be detrimental to hydrocarbon production. (Ribeiro and Sharma 2013). There are several reasons to consider fluids that contain little or no water, namely:

1. Water sensitivity of the formation. The base mineral composition of a given rock formation impacts the recovery process of water, gas, and oil. For example, oil-based fluids, LPG, C02 and high-quality foams are recommended in water-sensitive formations to prevent excessive fines migration and clay swelling. In many shales, proppant conductivity drops considerably in the presence of water because the rock-fluid interactions soften the rock leading to proppant embedment.

2. Water blocking. In under-saturated gas formations, the invasion of water from the fracturing fluid can be very detrimental to gas productivity as any additional water remains trapped because of capillary retention. The increase in water saturation (referred to as water blocking or water trapping)) significantly reduces the relative permeability to gas, sometimes by orders of magnitude (Parekh and Sharma 2004).

3. Proppant placement. Foams and other gelled non-aqueous fluids can transport proppant much more effectively than slickwater fluids. At high foam qualities (gas volume fraction typically higher than 0.5), the interactions between gas bubbles cause a large energy dissipation that results in a high effective viscosity. At low foam qualities (less than 0.5) the interactions between bubbles are minimal so the fluid viscosity resembles that of the base fluid (which is typically gelled).

4. Water availability and cost. Operators are limited by the equipment and the fluids readily available on site. In areas prone to drought fresh water can become difficult to obtain. In some regions, the local legislation even limits water usage, which has prompted some operators to use waterless fracturing treatments. Alternatively, the supply and the cost of Liquefied Petroleum Gas (LPG), $C0_2$ and N_2 are strongly site-specific. Much of the cost savings depend on the availability of the fluid. The use of large quantities of gases requires the deployment of many trucks, pressurized storage units, and specific pumping equipment. In addition, handling of LPG will require additional safety measures

Table 2 broadly summarizes the different fluids that are used for hydraulic fracturing (EPA 2004; PetroWiki - Society of Petroleum Engineers 2013). In Section 2.3, recent analyses of trends in hydraulic fracturing fluids, additives and proppants are summarised. It is also worth to mention that (Barati and Liang 2014) very recently presented a review of fracturing fluid systems used for hydraulic fracturing.

Table 2. Different fluids used for hydraulic fracturing (adapted and expanded from (EPA 2004), Appendix A and (PetroWiki - Society of Petroleum Engineers 2013)

Base Fluid	***Fluid type***	***Main Composition***	***Section***
Water-based	Slickwater	Water + sand (+ chemical additives)	2.2
	Linear fluids	Gelled water, GUAR<HPG, HEC, CMHPG	
	Cross-linked fluids	Crosslinker + GUAR, HPG, CMHPG, CMHEC	
	Viscoelastic surfactant gel fluids	Electrolite+surfactant	
Foam-based	Water based foam	Water and Foamer + N_2 or CO_2	2.4
	Acid based foam	Acid and Foamer + N_2	
	Alcohol based foam	Methanol and Foamer + N_2	
Oil-based	Linear fluids	Oil, Gelled Oil	2.5
	Cross-linked fluid	Phosphate Ester Gels	
	Water Emulsion	Water + Oil + Emulsifiers	
Acid-based	Linear	-	2.6
	Cross-linked	-	
	Oil Emulsion	-	
Alcohol-based	Methanol/water mixes or 100% methanol	Methanol + water	2.7
Emulsion-based	Water-oil emulsions	Water + Oil	2.8
	CO_2-methanol	CO_2 + water + methanol	
	Others	-	
Other fluids	Liquid CO_2	CO_2	2.9.1
	Liquid nitrogen	N_2	2.9.2
	Liquid helium	He	2.9.3
	Liquid natural gas	LPG (butane and/or propane)	2.9.4

2.2. Water-based hydraulic fracturing

Table 2, adapted from (King 2012), demonstrates how unconventional gas production is driven by the development and application of technologies, by showing the increased recovery of gas and oil from the shales. An essential element, not only from a technological point of view but also from an environmental one, is the type of fluid used to perform the fracturing of the formation. This will dictate the type of required chemical additives, the need for flowback treatment, etc.

The predominant fluids currently being used for fracture treatments in the gas shale plays are water-based fracturing fluids mixed with friction-reducing additives (called slickwater). Many other water-based fluids are used, broadly speaking: linear fluids, cross-linked fluids, and viscoelastic surfactant fluids. These are discussed in the following.

Slickwater fracturing is probably the most basic and most common form of well stimulation in unconventional gas. The fracturing fluid is composed primarily of water and sand (> 98%). Additional chemicals are added to reduce friction, corrosion, bacterial-growth, and provide other benefits during the stimulation process. Low viscosity slick-water fluids generate fractures of lesser width and therefore greater fracture length, theoretically increasing the complexity of the created fracture network for better reservoir-to-wellbore connectivity.

Unfortunately, slickwater fluid is an inherently poor proppant carrier, necessitating high pump rates to achieve flow velocities sufficient to overcome the tendency of the proppants to settle. Proppant settling within surface equipment or long horizontal laterals can result in premature treatment termination and poor productivity. Linear gel and crosslinked systems have been used to mitigate the proppant settling and placement concerns, but the high viscosity that accomplishes this objective may significantly reduce the desired fracture complexity. Also, the long fracture closure times and the lack of efficient gel delayed breakers makes the proppant placement advantage of gel systems very limited as proppant settles while gel is breaking up and fracture has not yet closed.

More than 30% of stimulation treatments in 2004 in North America have been slickwater fracturing (Schein, 2005). The most important benefits of slickwater fracturing are reduced gel damage, cost containment, higher stimulated reservoir volume, and better fracture containment. But there are concerns such as poor proppant transport, excessive usage of water, and narrower fracture widths .(Kishore K. Mohanty 2012).

Some fracturing treatments require a higher viscosity fluid, such as **linear fracturing fluids**. These are formulated by adding a wide array of different polymers to water. Such polymers are dry powders that swell when mixed with an aqueous solution and form a viscous gel. The gel-like fluid is then more able to transport the proppant than would a normal low-viscous (slickwater) fluid. Common polymer sources used with the linear gels are guar, Hydroxypropyl Guar (HPG), Hydroxyethyl Cellulose (HEC), Carboxymethyl hydroxypropyl guar (CMHPG), and Carboxymethyl Hydroxyethyl cellulose (CMHEC) (EPA 2004). In low-permeability formations, linear gels control fluid loss very well, whereas in higher-permeability formations fluid loss can be excessive. Linear gels tend to form thick filter cakes on the face of lower-permeability formations, which can adversely affect fracture conductivity. The performance of linear gels in higher-permeability formations is just the opposite, since it forms no filter cake on the formation wall. Much higher volumes of fluid are lost due to viscous invasion of the gel into the formation.

Crosslinked fluids were developed in order to improve the performance of gelling polymers without increasing their concentration. Borate crosslinked gel fracturing fluids utilize borate ions to crosslink the hydrated polymers and provide increased viscosity. The polymers most often used in these fluids are guar and HPG. The crosslink obtained by using borate is reversible and is triggered by altering the pH of the fluid system. The reversible characteristic of the crosslink in borate fluids helps them clean up more effectively, resulting in good regained permeability and conductivity.

Table 3. Increased recovery of gas and oil from shales driven by the development and application of technologies (adapted from (King 2012))

Year	*Technologies Applied*	*% Recovery of Original Gas in Place*	*Shale Play*
1980's	Vertical wells, low rate gel in fracs	1%	Devonian
1990's	Foam fracs 1st slickwater in shale	1.5 to 2%	Devonian
2001	High rate slickwater fracs	2 to 4%	Barnett
2004	Horizontal well dominant, 2 to 4 fracs	5 to 8%	Barnett
2006	Horiz, 6 to 8 fracs, stimul fracs, water recycle trial	8 to 12%	Barnett
2008	16+ fracs per well, Petrophysics increases	12 to 30%	Barnett
2010	Technology to flatten decline curve, feeling pinch for frac water	30 to 40%	Haynesville
2011	Pad development drains 5000 acres, salt water displacing fresh for fracs	45%+	Horn River
Future developments	Green chemicals, salt water fracs, low disposal volume, reduced truck traffic, pad drilling, electric rigs and pumps	45 - 55%	Numerous

Borate crosslinked fluids have proved to be highly effective in both low and high permeability formations. They offer good proppant transport, a stable fluid rheology at temperatures as high as 300°F, low fluid loss and good cleanup properties (Haliburton 2011). Organometallic crosslinked fluids are also a very popular class of fracturing fluids. Primary fluids that are widely used are zirconate and titanate complexes of Guar, Hydroxypropyl Guar (HPG) and Carboxymethyl-Hydroxypropyl Guar (CMHPG). Organometallic crosslinked fluids are routinely used to transport the proppant for treatments in tight gas sand formations that require extended fracture lengths. They provides advantages in terms of stability at high temperatures and proppant transport capabilities. According to Halliburton, they provides excellent stability at high temperatures and proppant transport capabilities and offer more predictable rheological properties (Halliburton 2011a).

Viscoelastic surfactant gel fluids (VES) have been described in the patent literature for friction reduction and as well treatment fluids since the early 80s, but their use as fracturing fluids is relatively a new phenomenon. Principally, these fluids use surfactants in combination with inorganic salts to create ordered structures, which result in increased viscosity and elasticity. These fluids have very high zero-shear viscosity and can transport proppant with lower loading and without the comparable viscosity requirements of conventional fluids (Satya Gupta in (EPA 2011).

The technology of VES systems can be broken down into several categories based on the structure the system creates: worm-like micelles, lamellar structures or vesicles. As the concentration of surfactant increases in water, micelles start to form and start interacting with each other. These interactions are based on ionic forces and can be amplified by adding electrolytes (salts) or other ionic surfactants. These fluids are operationally simple: only one or two additives are added without any need to hydrate polymers. They do not require any biocides because they do not contain any biopolymers. They do not require additional flowback surfactants because they have inherently low surface and interfacial tension. No additional clay control additives are needed.

(Stringfellow, Domen et al. 2014) is a recent, thorough analysis of the characteristics of the chemicals found in hydraulic fracturing fluids with the aim to evaluate potential environmental fate and human health impacts. In this study, eighty-one common chemical additives were identified and categorized according to their functions. Physical and chemical characteristics of these additives were determined using publicly available chemical information databases. Most of the hydraulic fracturing chemicals evaluated were identified as non-toxic or of low toxicity and only three were classified as Category 2 oral toxins according to standards in the Globally Harmonized System of Classification and Labeling of Chemicals. Toxicity information was not located for thirty of the hydraulic fracturing chemicals evaluated, suggesting a certain deficiency in the current state of knowledge.

Several interesting technologies have been recently developed. These are reviewed in the following.

2.2.1. Zipper fracturing

Zipper fracturing involves simultaneous stimulation of two parallel horizontal wells. In this technique, created fractures in each cluster propagate toward each other so that the induced stresses near the tips force fracture propagation to a direction perpendicular to the main fracture (Rafiee, Soliman et al. 2012). This technique typically makes use of slick-water as fracturing fluid, and it is applied to shale formations (Yu and Sepehrnoori 2013).

2.2.2. Cavitation Hydrovibration fracturing

Cavitation Hydrovibration is a proprietary technique developed at the Institute of Technical Mechanics in Dnipropetrovsk, Ukraine, and it is designed to fracture rock using a pressurized water pulse action. No literature sources or patent applications were found to confirm the technical details of the status of application of the system, except for an online article authored by blogger Walter Derzko (Derzko 2008).

The technique is described as a green technology that operates using pure water, without the use of any chemical. The cavitation hydrovibrator is mounted in a drilling line and inserted into a vertical or horizontal borehole at the appropriate stratum level. Pressured water is fed to the cavitation hydrovibrator inlet through the drilling line using a drill pump. Then the water passes through the hydrovibrator flow passage and enters the borehole where the gas-saturated stratum is located. Due to the pressure differential across the hydrovibrator, the regime of periodically detached cavitation is set up in its flow passage. In this regime, the steady water flow is transformed into a high-frequency pulsating flow. The pulse-repetition frequency can be varied from 100 to several thousand Hertz. The water pressure pulse acts on the gas-bearing formation and it increases its degree of fracturing.

(Derzko 2008) reports that this method has been tested and used in the Novojarovskoje sulfur deposit (in the Lviv Region of Ukraine) and that the method performed well in the recovery of old water wells in the Moscow region and in the Pskov region (Russian Federation). It appears that the technology has not been tested yet to enhance gas recovery in conventional reservoirs, nor for shale gas production.

2.2.3. Hydra-jet fracturing

Hydrajet fracturing combines hydrajetting with hydraulic fracturing. This process involves running a specialized jetting tool on conventional or coiled tubing. To initiate the hydraulic fracture, dynamic fluid energy jets form tunnels in the reservoir rock at precise locations. The hydraulic fracture is then extended from that point outward. By repeating the process, one can create multiple hydraulic fractures along the horizontal wellbore (Loyd E. East, Grieser et al. 2004; Mcdaniel and Surjaatmadja 2009; Gokdemir, Liu et al. 2013).

This technique is applied on unconventional reservoirs, including shales (McKeon 2011). It appears to offer improvements on how the fractures are initiated, but it does not offer substantial advantages regarding the usage of water and chemical additives in the fracturing fluid.

(McDaniel 2014) offers a recent and pretty comprehensive review of the use of hydrajetting deployed in conjunction with coiled tubing technology. According to this author, hydrajet perforating has been used in many new oilfield applications since the mid-1990's, and many promising variations (improved jetting nozzles, tool compositions, etc.) are being developed.

2.2.4. Exothermic hydraulic fracturing

(Al-ajwad, Abass et al. 2013) describe the idea of injecting chemicals during the hydraulic fracturing treatment that – upon reaction – generate heat and gas. The temperature and gas increase then create localized pressure that results in thermal and mechanical fracturing.

This idea was tested in laboratory specimen (cores) collected from tight reservoirs in Saudi Arabia. The permeability of tested cores showed significant increase after applying the new treatment technique. Enhanced communication between micro and macro pores was also found.

A likely shortcoming of this technique is the localized effect. Unconventional gas reservoirs, being so tight, require stimulation that reaches far into the reservoir. As shown in thermal heavy oil recovery projects, it takes substantial energy (or well count) to cover a large extension of the reservoir with relevant temperature changes.

2.2.5. Hydraulic fracturing enhanced by water pressure blasting.

(Huang, Liu et al. 2011) describe the idea of enhancing the effectiveness of hydraulic fracturing by using water blasting for fracturing coal seams.

Water pressure blasting is a method that combines the use of water with that of explosives (note that explosive fracturing is discussed in details in section 4.1). In this technology, water is used as a coupling medium to transfer the generated explosion pressure and energy as to break the rock.

According to (Huang, Liu et al. 2011), traditional hydraulic fracturing techniques generally form main hydraulic cracks and airfoil branch fissures, with the former relatively fewer in number. These authors state that experimental tests prove that the method is an effective way to increase the number and range of hydraulic cracks, as well as for improving the permeability of coal seams.

The working principles of the method are described in the following. A hole is drilled in the coal seam and is injected with a gel explosive. Water is injected into the hole to seal it (at low enough pressure to prevent cracks from forming).Water pressure blasting is carried out by detonating the explosive. The water shock waves and bubble pulsations produced by the explosion cause a high strain rate in the rock wall surrounding the hole. The rock breaks and numerous circumferential and radial fractures propagate outward. Finally, conventional hydraulic fracturing is performed. The fissures open by the detonation are further expand.

This technique has been proposed very recently (2011) and it appears an experimental idea. It has been suggested for low-permeability coal-seam gas extraction, but it is judged that it could potentially be applied to shale formations. It appears to offer improvements on how the fractures are initiated, and could potentially reduce the quantity of water required for the hydraulic fracturing stage. Without any reports on depth of stimulation away from the well, this technique does not appear to be economical.

2.3. Trends in hydraulic fracturing fluids, additives and proppants

Some excellent studies were published in 2014 and 2015, analysing trends in the deployment of hydraulic fracturing, mainly in North America where the overwhelming majority of activities has taken place: distributions, treatment fluids, additives, proppants, water volumes, etc.

(Gallegos and Varela 2015) is a report of the US Geological Survey. They noted that comprehensive and publicly available information regarding the extent, location, and character of hydraulic fracturing in the United States is scarce. They nonetheless analysed data related to nearly 1 million hydraulically fractured wells and 1.8 million fracturing treatment records from 1947 through 2010 and used such information to identify hydraulic fracturing trends in drilling methods and use of proppants, treatment fluids, additives, and water. These trends were then compared to the literature to establish a common understanding of the differences in drilling methods, treatment fluids, and chemical additives and of how the newer technology has affected the water use volumes and areal distribution of hydraulic fracturing. The analysis showed that directional drilling increased from 6 percent of new hydraulically fractured wells drilled in the United States in 2000 to 42 percent of new wells drilled in 2010. This also coincided with the emergence of water-based fracturing fluids.

(Patel, Robart et al. 2014) provided a comprehensive analysis of hydraulic fracturing fluid systems and proppant trends across major shale plays in the United States between 2011 and the first half of 2013, by categorizing and analyzing over 55000 hydraulic fracturing treatments collected from FracFocus.org, a web-based initiative established in early 2011 with a centralized database to provide hydraulic fracturing chemical disclosures across the United States. The analysis identified changes over time in fracturing type, using the broad categories reported in Table 1. It also included a study on proppant trends, including usage rates for key proppant types (sand, resin-coated sand, and ceramics) and proppant loading trends. The full results cannot be summarized here for reasons of space, and the interested reader is referred to the original source.

(Al-Muntasheri 2014) presented a review of the available water-based fracturing fluids over the last ten years for fracturing reservoirs with low permeability. The review revealed the evolution of several interesting developments, including the use of cleaner guar-based polymers, of synthetic polymers and of larger-sized crosslinker molecules. The study also concluded that nanotechnology can be a promising tool to develop better performing fluids. According to the author, guar-based polymers are still being used for fracturing oil and gas wells, mainly because of their high shear stability and better cleanup compared with other systems. When fracturing hot reservoirs, synthetic polyacrylamide-based polymers can be used. The use of larger-sized boronic-based crosslinkers is helping reducing the concentration of polymers used in preparing fracturing fluids, even if no field application data have been reported yet for this system. Nanoparticles are being used to improve leak-off of viscoelastic-surfactant-based fluids, but an optimal employment of such materials still requires further research. Produced water can present an opportunity to address environmental concerns about water preservation. However, not all produced waters are compatible with fracturing fluids.

A review of fracturing fluid systems used for hydraulic fracturing was also very recently presented by (Barati and Liang 2014).

We conclude this brief section by mentioning an investigation by (Lee and Sohn 2014), who studied the current development status of shale gas technology in China as compared to that in the US by analysing patents registered in the two countries.

2.4. Foam-based fluids

Overview

For water-sensitive formations and environments where water is scarce, foams have long been considered as one of the best fracturing fluids (Neill, Dobbs et al. 1964; Komar, Yost II et al. 1979; Gupta 2009). In particular, **foams** are believed to be an appropriate means for fracturing shale gas reservoirs. They require lower (or no) water consumption, cause less damage in water sensitive formations and there is less liquid to recover and handle after the fracturing process. Expansion of the gas phase after the treatment also helps recover the liquid phase introduced into the formation with foams (Edrisi and Kam 2012).

Foams are being used in a number of petroleum industry applications that exploit their high viscosity and low liquid content. Some of the earliest applications for foam dealt with its use as a displacing agent in porous media and as a drilling fluid. In the mid-1970's, N_2-based foams became popular for both hydraulic fracturing and fracture acidizing stimulation treatments.

Most recently, CO_2 foams have been found to exhibit their usefulness in hydraulic fracturing stimulation. Different foam-based fluids can be used, as summarized in the table below (adapted from (EPA 2004). The liquid CO_2-based fluid consists of a foam of N_2 gas in liquid CO_2 as the external phase stabilized by a special foamer soluble in liquid or supercritical CO_2 (Gupta 2003). The main advantage of this fluid is the additional viscosity gained by the foam over liquid CO_2. The use of 75% volume of N_2 makes the fluid very cost-effective. The fluid has also found niche application in coalbed fracturing in Canada on dry coalbeds where any water introduced into the formation damages the cleats (Gupta in (EPA 2004)). Table 4 gives a broad summary of the types of foams used as fracturing fluids.

Table 4. Types of foams used as fracturing fluids.

Type of foam	***Main composition***
Water-based foams	Water and Foamer + N_2 or CO_2
Acid-based foams	Acid and Foamer + N_2
Alcohol-based foams	Methanol and Foamer + N_2
CO_2-based foams	Liquid CO_2 + N_2

The influence of foam quality on effectiveness of hydraulic fracturing in shales was recently studied by (Gu and Mohanty 2014)

Description

A foam is used as the fracturing fluid. Foams are structured, two-phase fluids that are formed when a large internal phase volume (typically 55 to 95%) is dispersed as small discrete entities through a continuous liquid phase (Reidenbach, Harris et al. 1986).

Foams are very unique and versatile because of low-density and high-viscosity characteristics. Previous studies show that foam viscosity strongly depends on foam quality (the gas fraction in the total gas and liquid mixture) and foam texture (the number of bubbles in unit mixture volume) (Edrisi and Kam 2012).

Rationale

It is claimed (Edrisi and Kam 2012) that for shale gas development in environmentally sensitive regions, foam fracturing appears to be advantageous over the conventional water-based hydraulic fracturing because less amount of water usage can be translated into fewer amounts of health-hazardous chemical additives in fracturing liquid. Expansion of the gas phase after the treatment also helps recover the liquid phase introduced into the formation with foams.

The most common application for high-quality foams is in water-sensitive gas-bearing formations, typically an under-saturated gas reservoir where water blockage is a major concern. Foams are beneficial when used for liquids-rich gas wells, such as in the Alberta Deep Basin and work in certain oil-bearing formations, such as the Cardium. Lastly, in areas where water is in short supply or hard to source, foams can present a very obvious advantage.

Potential advantages and disadvantages

Potential advantages

- Water usage reduced (or completely eliminated in case of CO_2-based foams).
- Reduced amount of chemical additives.
- Reduction of formation damage.
- Better cleanup of the residual fluid.

Potential disadvantages

- Low proppant concentration in fluid, hence decreased fracture conductivity.
- Higher costs.
- Difficult rheological characterization of foams, i.e. flow behaviour difficult to predict.
- Higher surface pumping pressure required.

Status of technique application for unconventional reservoirs

Foams are commercially used to fracture shale formations. For instance, (Rowan 2009) reports the use of foams to stimulate gas wells in the Lower Huron Shale in the Appalachian Basin. (Brannon, Kendrick et al. 2009) discuss the application of foams in the Big Sandy (a productive field of more than 25,000 wells, located in the eastern USA), characterized by ultra-low permeability, the Berea tight gas sands and Devonian Ohio shales such as the Huron formation.

NETL has an ongoing project[2] (2013 to 2016) on the development of nanoparticle-stabilized foams to improve performance of water-less hydraulic fracturing. One of the objectives of the project is to develop nanoparticle-stabilized foams that have a very low water content (< 25 vol. %) yet exhibit high apparent viscosity, so that they can be used as nearly water-less fracturing fluids. The latest quarterly report available (Bryant and Huh 2014) reports on the examination of the effects of polymer addition upon increasing the foam quality (reducing water content) without breaking the foam and on the development of a mechanistic foam dynamics model.

2.5. Oil-based fluids

Oil-based fracturing fluids were the first high-viscosity fluids used in hydraulic fracturing operations. A major advantage to this type of fluid is its compatibility with almost any formation type. Disadvantages are associated with potential high costs and greater concerns regarding personnel safety and environmental impact as compared to most water-based fluids. There are several oil-based fluids, for instance based on diesel, but a

[2] http://www.netl.doe.gov/research/oil-and-gas/project-summaries/enhanced-oil-recovery/fe0013723-UTA

promising technique, which has been developed especially for shale gas production, makes use of liquefied petroleum gas (LPG[3]). This is analysed in details in the following section.

2.5.1. LPG

Overview

Liquefied petroleum gas has been used as stimulation fluid for fifty years. It was developed for conventional reservoirs before being adapted to unconventional reservoirs. For instance, it was used to stimulate (or re-stimulate) oil wells. It has also been used to stimulate tight sands because of recovery improvements in reservoirs exhibiting high capillary pressures by eliminating phase trapping.

In 2007, the Canadian company GasFrac, based in Calgary (Alberta), started to use LPG gel to stimulate shale rocks. Since then, over 1500 operations of stimulation have been performed using this gellified propane technique both in Canada and United-States. The LPG used in the GASFRAC system is primarily propane (C3H8) (GasFrac 2013).

The technology is also developed by ecorpStim, based in Houston (Texas). In 2012, ecorpStim was at the origin of several technological developments: (1) removal of chemicals, by developing a new formula for the stimulation fluid (now composed exclusively of pure propane and sand, with no chemicals additives) and (2) reduced volumes of propane to meet stricter safety requirements. Pure propane is used (with the possibility of using butane and/or pentane for some rock types) (ecorpStim 2013a).

A recent analysis of effective fracture lengths and clean-up behaviour is presented by (Soni 2014). This paper also discusses major advantages and disadvantages of this technique along with some considerations on economics.

A fracturing fluid based on LPG as base fluid is proposed by (Xiangqian, Yongjun et al. 2013). The developed fracturing fluid system uses dialkyl phosphate ester as the gelling agent and a ferric complex as the cross-linking agent, and it is shown to have a very good crosslinking performance which makes it suitable for unconventional reservoirs.

According to a report commissioned by Arnaud Montebourg, French Minister of the Economy, Industrial Recovery and Digital Development (Montebourg 2015), the Ministry identified the LPG technology implemented by eCorp as very promising to address the environmental concerns raised by water-based hydraulic fracturing. The Ministry was concerned about the high flammability of LPG, and toward the end of 2012 asked eCorp to perfect a technology that would eliminate such risk. eCorp is thus developing a fracturing technology based on non-flammable propane (NFP), i.e. heptafluoropropane, combined with and a proppant (mesoporous silica), described more in detail below (ecorpStim 2013b).

In 2015 ecorpStim has announced a non-flammable, non-toxic shale stimulation fluid based on light alkanes (ecorpStim 2015). This technology makes use of naturally occurring components in conventional and shale hydrocarbon production , i.e. a selection of low molecular weight alkanes ("light alkanes"). These alkanes are non-flammable are approved by the U.S. Food and Drug Administration for human ingestion and exposure. They also have no adverse impacts on the environment: they are non-ozone depleting and have zero global warming potential.

Description of the technique

LPG is used as the fracturing fluid (Taylor, Lestz et al. 2006; Lestz, Wilson et al. 2007). In the GasFrac system, LPG is gelled before the fracturing to allow better transport of

[3] Liquefied petroleum gas (LPG) is a flammable mixture of hydrocarbon gases normally used as a fuel in heating appliances and vehicles. Varieties of commercial LPG include mixes that are primarily propane (C_3H_8), primarily butane (C_4H_{10}) or mixtures including both propane and butane.

proppant into the fracture. In the ecorpStim system, LPG is not gelled. Buoyant proppants such as fine sand and carbon fullerenes are used, but it still needs to be proven that they are strong enough for widespread application.

When fracturing, the LPG remains liquid, but after completing the process it goes into solution with the reservoir gas.

Rationale

Liquid propane is particularly suitable for use as fracturing fluid because it is less viscous than water. Many shale formations are water-sensitive, and using LPG would avoid this problem.

The GasFrac LPG gel properties include: low surface tension, low viscosity, low density, and solubility within naturally occurring reservoir hydrocarbons. These properties are suggested to lead to more effective fracture lengths are created and thus enable higher production of the well. Another reported advantage is the ability to evenly distribute proppant. The fracturing fluids are totally recovered within days of stimulation, creating economic and environmental advantages by reducing clean-up, waste disposal and post-job truck traffic (GasFrac 2013).

The ecorpStim system completely avoids the use of chemical additives. The company reports that, while in hydraulic fracturing 30-80% of water is recovered, propane stimulation allows a recovery of 95-100% of injected gas. The recovered propane can be sold as such (i.e. directly inserted in the pipelines) or used for another stimulation operation. The seismic risk related to the injection of waste water in the subsoil is suppressed as well (ecorpStim 2013a).

When gelled, LPG provides a consistent viscosity, does not require the costly use of CO_2 or N_2, nor does it require any special cool down or venting of equipment. LPG is an abundant by-product of the natural gas industry and is stored at ambient temperature. Using LPG also reduces the need to flare production to clean up the traditional fracturing fluids, reducing CO_2 emissions. Because propane liquid is half the specific gravity of water, there is reduced trucking to the site and no trucking to transport post stimulation - which can reduce truck traffic by up to 90%.

The main drawback of this technology is that it involves the manipulation of large amounts (several hundred tons) of flammable propane (and the associated risks/safety hazards). It is therefore a more suitable solution in environments with low population density, provided of course that the workers safety can be strictly guaranteed.

As described above, to mitigate the risk of flammability, ecorpStim is currently developing and testing a technology that makes using of non-flammable propane (NFP), i.e. heptafluoropropane. Non-flammable propane is a well-known gas, used in products including fire extinguishers and medical inhalers. NFP stimulation is reported to have all the advantage of pure propane stimulation (no water, no chemical additives), and to eliminate the risks of flammability associated with propane (Montebourg 2015). Other advantages are associated with non-flammable propane, as replacing water with propane leads to a reduction of the footprint on the surface, the equipment needed, the number of heavy vehicles and the volumes of fluids required. The time needed to stimulate the rock is also reported to be between one third and one tenth shorter. The reduction of the volume of fluid necessary to carry out a stimulation operation (estimated at between 1/10th to 1/30th when compared to water) means that an extra layer of tubing can be added to the well, reinforcing the protection of the well and thus reducing the risk of breaching the well integrity during the stimulation phase.

Light alkanes stimulation is based on the idea that – just like in pure propane stimulation – these alkanes are a component of natural hydrocarbon production from shales and conventional reservoirs. Thus, their use as the stimulation fluid does not damage the reservoir rock and therefore should allow increased production from the well compared with traditional hydraulic fracturing. Likewise, light alkanes can also be self-supplied

from the reservoir being stimulated. Finally, they can be recycled through the reservoir and recovered for further use, in the same way as for propane and heptafluoropropane (ecorpStim 2015). According to the developers, light alkanes stimulation provides a greater flexibility (broad range of viscosity / density) which enables this new method to be used in different shale formations and under varied operating conditions.

Potential advantages and disadvantages

Potential advantages

- Water usage much reduced or completely eliminated.
- Fewer (or no) chemical additives are required.
- Flaring reduced.
- Truck traffic reduced.
- Abundant by-product of the natural gas industry.
- Increased the productivity of the well.
- Lower viscosity, density and surface tension of the fluid, which results in lower energy consumption during fracturing.
- Full fluid compatibility with shale reservoirs (phase trapping virtually eliminated).
- No fluid loss. Recovery rates (up to 100%) possible.
- Very rapid clean up (often within 24 hours).

Potential disadvantages

- Involves the manipulation of large amounts of flammable propane, hence potentially riskier than other fluids and more suitable in environments with low population density. This disadvantage completely disappears if using heptafluoropropane.
- Higher investment costs.
- Success relies on the formation ability to return most of the propane back to surface to reduce the overall cost.
- Heptafluoropropane is a very stable hydrocarbon, and as such presents a global warming potential.

Costs

Investment costs are estimated to be higher than for hydraulic fracturing, because LPG is pumped into well at a very high pressure, and after each fracturing it has to be liquefied again (Rogala, Krzysiek et al. 2013). In addition, propane costs more than water both initially and as an ongoing cost, to make up for the portion that is not returned to the surface after each operation.

Status of technique application

The LPG-based fracturing techniques reviewed (GasFrac and ecorpStim) are both commercially applied in unconventional reservoirs in North America. (Lenoir and Bataille 2013) report that between 2008 and 2013, 2000 fracturing operations were carried out by the GasFrac company in North America (primarily in Canada and, since 2010, in Texas). In 2013 ecorpStim announced the successful field application of the technique employing pure liquid propane, by stimulating the Eagle Ford Shale at a depth of 5950 feet. The test took place in Frio County, Texas, and was completed in late December 2012. No chemical additives of any kind were used.

Heptafluoropropane stimulation is being tested in field experiments by ecorpStim at the time of writing (November 2015).

Light Alkanes Stimulation is being patented by ecorpStim and the company was conducting further testing and experimentation of this technology in several basins in the United States during the course of 2015.

2.6. Acid-based fluids

Overview

The main difference between acid fracturing and proppant fracturing is the way fracture conductivity is created. In proppant fracturing, a propping agent is used to prop open the fracture after the treatment is completed. In acid fracturing, acid is used to "etch" channels in the rock that comprise the walls of the fracture. Thus, the rock must be partially soluble in acid so that channels can be etched in the fracture walls.

In shale formations, although many have a significant amount of dissolvable carbonate and limestone, the content in the rock is not a continuous phase. Hence, it is difficult to use acid-based fluids even in the few high carbonate reservoirs such as the Eagle Ford in the USA. Without a continuous carbonate/limestone phase it is very difficult to etch the required "continuous" channel. Also, flow-back needs to manage the disposal of significant calcium carbonate/limestone volumes that come dissolved in the spent acid. Long etched fractures are difficult to obtain, because of high leakoff and rapid acid reaction with the formation (PetroWiki - Society of Petroleum Engineers 2012). However, (Burgos, Buijse et al. 2005) have recently reported on how better acid fracturing mixtures have improved penetration even at higher temperatures.

More recently (Sanchez Bernal, Tate et al. 2015) have discussed acid fracturing in tight gas carbonates reservoirs using CO_2 to assist stimulation fluids. This paper outlines the fact that there are very limited applications for low permeable tight carbonate reservoirs due to complexities associated with the physical and mechanical properties of carbonate rocks and its interaction with fracturing fluid. Nevertheless the advantages of using assisted CO_2 stimulation fluids are noteworthy, because of the elimination of potential formation damage normally associated with fracturing fluids and the very rapid clean-up. The study presents one of the first acid fracturing jobs assisted with CO_2 conducted on a tight gas well reservoir in Saudi Arabia, and concluded that CO_2 used to energized fracturing fluids can increase the productivity of the well while using less water and less acid than conventional acid fracturing.

(Gensheng, Mao et al. 2012) presents an acid fracturing methodology, called "hydraulic jet acid fracturing technique", for deep carbonate reservoirs, where high temperature, high fracture pressure (>2.0 MPa/m), high flow friction, and strong reservoir heterogeneity present severe challenges.

Status of technique application

For the reasons highlighted above, the application of acid fracturing is confined to carbonate reservoirs and is never used to stimulate sandstone, shale, or coal-seam reservoirs.

2.7. Alcohol-based fluids

Overview

In the 1990s and up until 2001, some companies (for instance BJ Services, now part of Barker Hughes) used methanol as a base fluid in fracturing applications in Canada and Argentina (Antoci, Briggiler et al. 2001). In those cases, the fractured formations either had low permeability with high clay content, low bottom-hole pressure, and/or minimal load fluid recovery.

However, a recent report prepared for Methanol Institute in 2012 ("White Paper - Methanol Use in Hydraulic Fracturing Fluids") reviewed the literature and concluded that methanol was used infrequently as a base fluid (Saba, Mohsen et al. 2012). The main reason given was the problem of safe handling issues and additional expenses to ensure that all personnel involved with methanol treatments are thoroughly trained in the proper procedures for handling flammable materials. This study also concluded that,

compared to water-based fracture fluids, methanol-based fluids are 3 to 4 times as expensive. In summary, concerns about safety and associated costs to use methanol has led to shifting away from methanol as a base fluid and limiting its use to being only an additive.

Nonetheless, in formations with severe liquid (aqueous and hydrocarbon) trapping problems, non-aqueous methanol fluids may be a solution (Gupta 2010). Over the years, several authors have identified the advantages of alcohol-based fluids, including low freezing point, low surface tension, high water solubility, high vapor pressure and formation compatibility. Methanol is also the fluid of choice for formations with irreducible water and/or hydrocarbon saturation (Bennion, Thomas et al. 1996; Bennion, Thomas et al. 2000).

Methanol-based fluids have been used on low permeability reservoirs, but it is not clear if their application has been extended to shales.

Description of the technique

A methanol-based fluid is used as the fracturing fluid.

Several methods to increasing the viscosity of methanol have been described in the literature, ranging from foaming methanol to gelling it with synthetic polymers and guar. Attempts have also been made to crosslink gelled methanol with metal crosslinkers. The most recent development (Gupta, Pierce et al. 1997) describes a modified guar dissolved in anhydrous methanol crosslinked and has been successfully used in the field. In underpressured wells, it has been energized with N_2. Methanol-based fluids can also be energized with CO_2 for formations with severely under-pressured wells.

These fluids should be selectively used with special safety considerations due to the flammability of methanol. The flash point (i.e. the lowest temperature at which it can vaporize to form an ignitable mixture in air.) of methanol is 53°F (11.6°C) and its density is greater than that of air, which presents a safety hazard to field personnel. Oxygen contact must be avoided and therefore a "blanket" of CO_2 vapor is used to separate methanol vapor from any oxygen source. Personnel must wear fire-resistant coveralls.

Rationale

For formations with severe liquid trapping problems or irreducible water and/or hydrocarbon saturation, non-aqueous methanol fracturing fluids may be the best (or the only viable) a solution.

Methanol has excellent properties such as high solubility in water, low surface tension and high vapor pressure. These are favorable for the recovery of the fracture and formation fluids, hence increasing the permeability of the gas in the treated zone (Hernandez, Fernandez et al. 1994).

Potential advantages and disadvantages

Potential advantages

- Water usage much reduced or completely eliminated.
- Methanol is not persistent in the environment (biodegrades readily and quickly under both anaerobic and aerobic conditions and photo-degrades relatively quickly).
- Excellent fluid properties: high solubility in water, low surface tension and high vapor pressure.
- Very good fluid for water-sensitive formations.

Potential disadvantages

- Methanol is a dangerous substance to handle:
    a. Low flash point, hence easier to ignite.
    b. Large range of explosive limits.
    c. High vapor density.
    d. Invisibility of the flame.

Costs

(Saba, Mohsen et al. 2012) indicate that, because of its low viscosity compared to water, methanol reduces the pumping pressure required to deliver the fracturing fluids to the formation. Because lower piping friction requires less hydraulic power, this can have a significant impact on reducing costs.

(Antoci, Briggiler et al. 2001) describe a study where more than 200 hydraulic fracturing jobs using crosslinked anhydrous methanol as fracture fluid were performed in Argentina. These treatments were carried out in conventional (sandstone) reservoirs. The introduction of crosslinked methanol was aimed at reducing treatment cost while maintaining better stimulation results associated with CO_2 foam. This was accomplished: crosslinked methanol cost was less than 50% compared to using CO_2 foam. Other cost-reducing advantages were given by the nature of the completion procedure, for instance by allowing fracturing in as many intervals as considered necessary without killing the well or without having to invade the zones with water base completion fluids.

Status of technique application

Methanol-based fluids have been used on low permeability reservoirs, but it is not clear if their application has been extended to shales.

Methanol as an additive is widely used in hydraulic fracturing, for instance as a corrosion or scale inhibitor, friction reducer, formation water flowback enhancer and fracturing fluid flowback enhancer (Saba, Mohsen et al. 2012).

2.8. Emulsion-based fluids

Overview

There are many different emulsion-based fluids that have been developed and used as fracturing fluids. Many of such fluids use emulsions of oil and water, and could therefore be classified under the oil-based fluids (section 2.5). A comprehensive review of these fluids is beyond the scope of this review. Broadly speaking, emulsion-based fluids reduce or completely eliminate the use of water.

A high-quality emulsion of $C0_2$ in aqueous alcohol-based gel was used in the western Canadian sedimentary basin as a fracturing fluid in 1981. Since then, the use of such fluid has been very successful, particularly in low-pressure, tight gas applications. The fluid has the same advantages as conventional high-quality $C0_2$ foams, with the added advantage of minimizing the amount of water introduced into the well (Gupta, Hlidek et al. 2007).

(Liu, Fan et al. 2010) describe a new fracturing fluid (called SPME-Gel) obtained with the combination of a single phase micro-emulsion and a gellable polymer system. A microemulsion is defined as a dispersion consisting of oil, surfactant and aqueous phase, which is a single optically isotropic liquid solution with a droplet diameter usually within the range of 10–100 nm. This formulation was prepared by adding a microemulsion into a gelable polymer system at various concentrations obtaining the characteristics of high viscosity, low fluid loss and low friction. It was also shown that the broken SPME-Gel systems have low residues remaining in formation, low surface tension, low pressure to initiate cleanup and high core permeability maintaining, thus offering promising characteristics.

Description of the technique

An emulsion, i.e. a mixture of two or more liquids that are normally immiscible (i.e. non-mixable), is used as the fracturing fluid.

Rationale

Certain formations have potential to retain even the small amounts of water contained in foams. These fluids may damage these sensitive formations because of irreducible water saturation and liquid trapping. In these formations, replacing 40% of the water phase used in conventional CO_2 foams with methanol can minimize the amount of water. (Gupta, Hlidek et al. 2007) showed that a 40% methanol aqueous system yielded gave very good production results in several Canadian gas formations (Gupta et al., 2007).

Potential advantages and disadvantages

Potential advantages

- Depending on the type of components used to formulate the emulsion, these fluids can have potential advantages such as:
    a. Water usage much reduced or completely eliminated.
    b. Fewer (or no) chemical additives are required.
- Increased the productivity of the well.
- Better rheological properties.
- Fluid compatibility with shale reservoirs.

Potential disadvantages

- Potentially higher costs.

Costs

Costs could potentially be higher when compared to water-based hydraulic fracturing, depending on the type of emulsion formulation.

Status of technique application

Emulsion-based fluids have been used on several unconventional (low permeability) formations, but no direct usage for shale gas stimulation could be found as a part of the present study.

2.9. Cryogenic fluids

2.9.1. Liquid CO_2

Overview

It appears that CO_2 is (or can be) used in different ways:

- Liquid CO_2 for hydraulically fracturing the reservoir (commercially used).
- Super-critical CO_2 for hydraulically fracturing the reservoir (concept stage).
- CO_2 foams. These are described more in detail in section 2.4.
- CO_2 thermal hydraulic fracturing, a method that combines conventional hydraulic fracturing with fractures caused by the thermal stresses that are generated when the cold fluid enters the hotter reservoir). This method is described more in detail in section 2.9 (concept stage).
- Hybrid systems: CO_2 in conjunction with other fluids.

Description of the technique

Liquid (or super-critical) CO_2 is used instead of water as the fracturing fluid. The family of these fluids consists of pure liquid CO_2 and a binary fluid consisting of a mixture of liquid CO_2 and N_2 to reduce costs.). In these systems, the proppant is placed in the formation without causing damage of any kind, and without adding any other carrier fluid, viscosifier or other chemicals.

Liquid CO_2 has been used in fracture operation since the early 1960's. In the beginning it was used as an additive to hydraulic fracturing and acid treatments to improve recovery of treating fluid. (Mueller, Amro et al. 2012). The concept of fracturing with 100% CO_2 as the sole carrying fluid was first introduced in 1981.(Sinal and Lancaster 1987)

The use of supercritical CO_2 for fracturing has been recently suggested ((Gupta, Gupta et al. 2005; Gupta 2006), (Al-Adwani, Langlinais et al. 2008)). Two recent papers discussing opportunity and challenges for supercritical CO_2 fracturing are (Middleton, Viswanathan et al. 2014) and (Middleton, Carey et al. 2015).

The physical properties of liquid CO_2 make it a unique fluid. CO_2 is relatively inert compound that, depending on the temperature and pressure, exists as a solid, liquid, gas or super critical fluid. Above the critical point, it is considered to be a super critical fluid. In field operations, liquid C02 is at 2.0 MPa and -35°C in the storage vessel. After the addition of proppants, high pressure pumps increase the pressure (example 35 to 40 MPa). As the fluid enters the formation, the temperature increases toward bottom-hole temperature. During flow back, the pressure decreases and CO_2 comes to the surface as a gas.

Supercritical CO_2 is a fluid state where CO_2 is held at or above its critical temperature (31.1°C) and critical pressure (72.9 atm or 7.39 MPa). Owing to its unique physical and chemical properties, supercritical CO_2 can obtain a higher penetration rate in shale formation and adds no damage to the reservoir.

A 2014 review of application status and development trends of CO_2 fracturing is offered in (He, Feng et al. 2014). (Godec, Koperna et al. 2014) reports on research sponsored by the U.S. Department of Energy to assess factors influencing enhanced gas recovery and CO_2 storage in selected shale basins in the Eastern USA. Other very recent studies are given by (Song, Su et al. 2015)

Hybrid systems making use of CO_2 in conjunctions with other fluids have been recently proposed (Ribeiro, Li et al. 2015).

Rationale

According to D.V. Satya Gupta (quoted in (EPA 2011), fluids based on liquid CO_2 are at the technological cutting edge. These fluids have been very successfully used in tight gas applications in Canada and several US formations.

During hydraulic stimulation using conventional fracturing fluid, water-based fracturing fluids can get trapped as liquid phase in rock pores next to the fractures due to very low permeability in tight gas and shale formations. This phenomenon is called water-phase trapping and can significantly damage the region near the wellbore. Water blocking may plague the success of hydraulic fracturing in low permeability gas reservoirs, and resulted significant loss of relative permeability due to the capillary effects between the treatment fluid and reservoir fluids. Another problem could be the swelling of clays which reduce the permeability as well. The injected fluid during hydraulic fracturing should be compatible with the formations to avoid swelling. CO_2 has the necessary properties that may support such requirements (Mueller, Amro et al. 2012).

An important feature is the fact that the CO_2 adsorption capacity with shale is stronger than that of methane (CH4). Thus, it can replace CH4 in the shale formation, enhancing gas production and at the same time remaining locked underground. At reservoir

conditions, CO_2 adsorption exceeded CH4 adsorption by a factor of five, suggesting that CO_2 enhanced gas recovery from shale could serve as a promising mean to reduce life cycle CO_2 emission for shale gas. On a strictly volumetric basis, gas shales have the potential to sequester large amounts of CO_2, provided that CO_2 can diffuse deep into the matrix (Nuttall, Eble et al. 2005).

When taken into fracturing, it can cause much more complicated fractures for its lower viscosity property, which has a benefit to shale gas exploitation (Al-Adwani et al., 2008; Wang, 2008; Gupta et al., 2005).

After the treatment, the evaluation of a fractured zone can take place almost immediately because of rapid clean-up. The energy provided by CO_2 results in the elimination of all residual liquid left in the formation from the fracturing fluid. The gaseous CO_2 also aids in lifting formation fluids that are produced back during the clean-up operation.

The biggest advantage is that the CO_2 adds no pollution to the environment, and it can have a positive net effect when considering the greenhouse gas emissions issue. An article in New Scientist has recently discussed the possibility that fracturing with CO_2 could spur the development of large-scale carbon sequestration (McKenna 2012).

(He, Feng et al. 2014) conclude that liquid CO_2 fracturing offers unique advantages but their analysis also shows that there are still existing disadvantages. These authors identify the high friction of liquid CO_2; the lack of suitable drag reducer; the very low viscosity of the fluid and its poor proppant carrying capacity; and the high fluid loss in fracturing. They also conclude that the CO_2 phase behaviour change is very complicated, and precise prediction methods are lacking. Finally, they identify supercritical CO_2 fracturing, because of better stimulation capability, reduced fracturing pressure and hence lesser requirements on equipment, as representing the development trend within the field of CO_2 fracturing.

Some researchers are proposing the use of supercritical CO_2 as a fracturing fluid for shale gas production in conjunction with gas turbines using the same fluid (Contri 2015; Giacomazzi and Messina 2015).

(Ribeiro, Li et al. 2015) have very recently introduced a new CO_2-hybrid fracturing design, consisting of (1) injecting pure CO_2 to generate a complex fracture network and (2) injecting a gelled slurry to generate near-wellbore conductivity. According to the authors, the motivation behind this concept is that while current aqueous fluids provide sufficient primary hydraulic fracture conductivity back to the wellbore, they under-stimulate the reservoir and/or leave behind damaged stimulated regions deeper in the fracture network. The proposed design is indicated as particularly attractive for brittle reservoirs, capable of sustaining substantial production from unpropped fractures. The concept is based on experimental and numerical studies and has not been applied as yet in the field.

Potential advantages and disadvantages

Potential advantages

- Potential environmental advantages:
    a. Water usage much reduced or completely eliminated.
    b. Few or no chemical additives are required.
    c. Some level of CO_2 sequestration achieved.
- Reduction of formation damage (reduction of permeability and capillary pressure damage by reverting to a gaseous phase; no swelling induced).
- Form more complex micro-fractures, which can connect many more natural fractures greatly, increasing maximally the fractures conductivity. (Wang, Li et al. 2012).

- Enhance gas recovery by displacing the methane adsorbed in the shale formations (Wang, Li et al. 2012).
- Evaluation of a fracture zone is almost immediate because of rapid clean-up. The energy provided by CO_2 results in the elimination of all residual liquid left in the formation from the fracturing fluid.
- Better cleanup of the residual fluid, so smaller mesh proppant can be used and supply adequate fracture conductivity in low permeability formations.
- The use of low viscosity fluid results in more controlled proppant placement and higher proppant placement within the created fracture width.

Potential disadvantages

- The main disadvantages follow from the fluids' low viscosity. Proppant concentration must necessarily be lower and proppant sizes smaller, hence decreased fracture conductivity.
- CO_2 must be transported and stored under pressure (typically 2 MPa, -30°C).
- Corrosive nature of CO_2 in presence of H_2O.
- Unclear (potentially high) treatment costs.

Costs

Some sources indicate that one of the major limitations of this technology has been their high treatment cost. Although stimulation treatments using the low-viscosity liquid CO_2 system have been successful, the high pumping rates required to place these jobs and the associated frictional losses raised horsepower requirements. [D.V. Satya Gupta, quoted in (EPA 2011)]

Other authors state that fracturing with CO_2 can be economical. For instance, Sinal and Lancaster 1987) state that the costs for fracturing fluid clean-up and associated rig time are considerably less than with conventional fracturing fluids. These advantages are reported: swabbing of the well is completely eliminated as a post-fracturing treatment; no disposal of recovered fracturing fluid is required; and evaluation of the well takes less time.

(Wang, Li et al. 2012) state that fracturing with supercritical CO_2 can offer a reduction of costs, mainly because of an enhancement of gas.

Status of technique application

Liquid CO_2 as fracturing fluid is already commercially used in many unconventional applications (most notably, tight gas) in Canada and the US (EPA 2011). (Yost II, Mazza et al. 1993) reports that wells in Devonian shale formations (Kentucky, USA) were stimulated with liquid CO_2 and sand as early as 1993.

Super-critical CO_2 use appears to be at the concept stage. Studies have analysed its potential use to fracturing shale formation, with positive conclusions. (Ishida, Niwa et al. 2012; Wang, Li et al. 2012). According to (Ishida, Niwa et al. 2012), "*combining the characteristics of SC-CO_2 fluid and shale gas reservoir exploitation, the feasibility of shale gas exploitation with SC-CO_2 is demonstrated in detail*". Another 2study (2015) is (Fang, Chen et al. 2014).

2.9.2. Liquid Nitrogen (N_2)

Overview

Generally, fracturing using nitrogen tend to use the gas mixed with other fluids: mists (mixtures composed of over 95% nitrogen carrying a liquid phase), foams (mixture composed of approximately 50% to 95% of nitrogen formed within a continuous liquid phase), or energized fluids (mixtures composed of approximately 5% to 50% nitrogen).

Liquid nitrogen used as a hydraulic fracturing fluid is a technology that is still fairly new, but it has been applied for fracturing shale formations (Grundmann, Rodvelt et al. 1998; Rowan 2009).

The extremely low temperature of the fluid (-184°C to -195°C) will induce thermal tensile stresses in the fracture face. These stresses exceed the tensile strength of the rock, causing the fracture face to fragment. Theoretically, self-propping fractures can be created by the thermal shock of an extremely cold liquid contacting a warm formation. As the fluid warms to reservoir temperature, its expansion from a liquid to a gas results in an approximate eightfold flow-rate increase (Grundmann, Rodvelt et al. 1998). Recently, (Cai, Li et al. 2014) have carried out an experimental study on the effect of liquid nitrogen cooling on rock pore structure.

Description of the technique

Liquid nitrogen is used as the fracturing fluid.

For nitrogen to be pumped safely into a well, the entire surface manifold and wellhead must be made of stainless steel. In some cases, operators may use special fiberglass tubing to protect the casing from the extremely low temperatures.

Rationale

The two main reasons for using pure nitrogen as fracturing fluid in shale formations are (1) when the formation is under pressured and (2) because shale can be sensitive to fluids. The nitrogen helps fluid recovery by adding energy to help push any fluid from the fracturing process or the reservoir out of the wellbore. These fluids can accumulate and create enough hydrostatic pressure that the reservoir cannot overcome.

Potential advantages and disadvantages

Potential advantages

- Potential environmental advantages:
    a. Water usage completely eliminated.
    b. No chemical additives are required.
- Reduction of formation damage.
- Self-propping fractures can be created by the thermal shock, hence need for proppant reduced or eliminated.

Potential disadvantages

- Special equipment required to safely handle liquid N2, due to the very low temperature of the fluid.
- Higher costs.
- Difficult to implement as liquid nitrogen travelling down the well will heat up and become a gas thus not able to transport proppant. Even if well temperature insulation is applied successfully, the nitrogen will become a gas very soon after entering the formation thus losing all ability to place proppant.

Costs

Nitrogen is a very common component of the atmosphere (~78% in volume) so it is assessed that liquid nitrogen can be manufactured anywhere and will still be relatively cheap. The need to use special pumping and handling equipment will increase costs.

Status of technique application

Using nitrogen as a component (in mists, foams or other energised fluids) of the fracturing medium is very common in the petroleum industry. The use of gaseous nitrogen in pneumatic fracturing is discussed in Chapter3. On the other hand, the use of

liquid nitrogen is less typical. The technique is commercially available, and it has been applied for fracturing shale formations (Grundmann, Rodvelt et al. 1998), but its usage appears to be limited. This is probably due to its higher costs.

2.9.3. Liquid Helium

The use of liquid helium as fracturing fluid is mentioned in very few sources, notably in a study prepared for the Parliamentary Office for the Evaluation of Scientific and Technological Choices of the French Republic[4] (Lenoir and Bataille 2013). No further details or references were given therein, except for a passing mention.

Chimera Enery Corp announced in 2012 the development of a fracturing technique that makes use of liquid helium. No literature sources or patent applications were found to confirm the technical details of the status of application of the system at the time of publication of (Gandossi 2013).

On 25 October 2012, Chimera Energy Corporation was suspended from trading by the US Securities and Exchange Commission because of questions regarding the accuracy of its statements in press releases to investors concerning, among other things, the company's business prospects and agreements. Its website (http://www.chimeraenergyusa.com/) did not appear to be working.

It now appears that the company run a fraudulent scheme in which media hype was created by issuing news releases about a fracturing technology touted as an environmentally friendly alternative to hydraulic fracturing, with the aim of increasing the company's stock price. After an investigation whose results were published in 2014, the Securities and Exchange Commission (a US Federal regulatory agency) concluded that Chimera never had any significant assets and that the technology was fictitious. The owners of the company were charged with securities fraud (http://fuelfix.com/blog/2014/08/15/sec-charges-houston-energy-firm-in-stock-pump-and-dump-scheme/).

2.9.4. Other cryogenic fluids

Overview

Other cryogenic fluids can be used. For instance, Expansion Energy has patented a technique that makes use of **cryogenically processed natural gas** extracted from nearby wells or from the targeted hydrocarbon formation itself (Vandor 2012; Expansion Energy 2013). According to the developers, this technique has been developed especially to target shale formations. The invention is called VRGETM (also called "dry fracturing", US Patent N. 8342246).

VRGETM creates cold compressed natural gas (CCNG) at the well site. This fluid is then pumped to high pressure before expanding it and blending it with a proprietary, foam-based proppant delivery system. This "gas-energized" fluid is then sent down-hole where it fractures the formation and holds open the fissures in the formation with proppant delivered by the foam system.

Expansion Energy claims that VRGE virtually eliminates the use of chemical additives because VRGE uses little or no water. Further, natural gas used by VRGE for fracturing eventually resurfaces and can be sold to the market or used for additional VRGE fracturing. As a result, there is no economic loss from using natural gas as the fracturing medium. After fracturing is complete, the CCNG plant can either be moved to the next well site for fracturing or it can remain at the original well site to produce LNG for the market.

[4] Office parlementaire d'évaluation des choix scientifiques et technologiques (OPECST).

Status of technique application

According to the developers, the method is "available for license". It is not clear if it has been already commercially deployed.

2.10. Potential new developments

Gupta (in (EPA 2011) suggests the following potential new developments in the area of unconventional fluids:

- High-temperature viscoelastic fluids;
- Polymers that associate with surfactants that can be used as straight fluid or foams (Gupta and Carman 2011);
- Fluids based on produced water (also based on associative polymers). These fluids are described more in detail in the following sub-section.

2.10.1. Fluids based on produced water

With the increasing demands and rising cost of fresh water for oilfield operations, there is a drive to use produced water in place of fresh water in stimulation operations (Li, Sun et al. 2014). Produced water in the oil industry usually refers to water that is produced along with oil and/or gas from hydrocarbon wells, whereas flowback water usually refers to the fraction of the original fracturing fluid that flows back through the well after the treatment is performed. Flowback water can be considered as a subcategory of produced water.

Produced water often contains high levels of salinity. For instance, produced water from shale formations such as the Marcellus and Bakken basins has high total dissolved solids (TDS) content and high hardness. TDS are the total amount of mobile charged ions, including minerals, salts or metals dissolved in a given volume of water, whereas hardness is defined as the amount of dissolved calcium and magnesium in the water. High levels of TDS and hardness in produced water can pose challenges for a wide spectrum of fracturing fluids that are commonly formulated with clean water. Many fracturing fluids that are originally prepared with clean water may show significantly lower performance or even completely fail if salty produced water is used instead.

Some companies treat produced water to obtain a water quality suitable for formulating a suitable fracturing fluid. However, it is often cost-prohibitive to treat high-TDS produced water enough that it can be stably used to formulate fracturing fluids. At the same time, it can also be expensive to dispose of produced water by underground deep well injection or to transport it to a suitable disposal facility. Fluid systems that can be formulated directly with salty produced water without compromising the performance are therefore very desirable.

To be considered practical and successful, a fracturing fluid prepared with treated high-TDS and hard produced water should deliver a comparable performance as the fluid formulated with fresh water. For example, the fluid should possess sufficient viscosity to transmit the high pumping pressure exceeding the rock strength to create fractures in the formation and to transport proppant into the created fractures.

Untreated produced water has been used directly to formulate a number of fracturing fluid systems. For example, zirconium -crosslinked CMHPG fluids have been reported to work with produced water with some water having TDS above 300k mg/L (Kakadjian, Hamlat et al. 2013). Borate-crosslinked guar fluids were successfully made with produced water for bottom hole temperature up to about 212°F (Fedorov, Carrasquilla et al. 2014). Several other examples are available (Li, Sun et al. 2014)

3. Pneumatic fracturing

Overview

Pneumatic fractures can be generated in geologic formations when air or any other gas is injected at a pressure that exceeds the natural strength as well as the in situ stresses present in the formation (Suthersan 1999). It is a technique normally used in shallow formations, and it has emerged as one of the most cost effective methods for enhanced remediation of contaminated soil and groundwater.

Nitrogen gas fracturing is used primarily for water-sensitive, brittle, and shallow unconventional oil and gas formations. The use of nitrogen prevents clay swelling that would otherwise be caused by slickwater. Pure gaseous nitrogen produces best results in brittle formations that have natural fractures and stay self-propped once pressure pumping is completed. This is because nitrogen is an inert and compressible gas with low viscosity, which makes it a poor proppant carrier. In addition, due to the low density of gaseous nitrogen, the main applications for nitrogen gas fracturing are shallow unconventional plays, namely coal bed methane, tight sands, and shale formations up to 5000 ft (1524 meters) in depth. Formations best suited for nitrogen gas fracturing also tend to have low permeability (less than 0.1 md) and low porosity (less than 4%) (Air Products 2013).

Description of the technique

In pneumatic fracturing, a gas (air, nitrogen, etc.) is injected into the subsurface at pressures exceeding the natural in-situ pressures present in the formation interface and at flow volumes exceeding the natural permeability of the rock.

The pneumatic fracturing procedure typically does not include the intentional deposition of foreign propping agents to maintain fracture stability. The created fractures are thought to be self-propping, a circumstance which is attributed to both the asperities present along the fracture plane as well as the block shifting which takes place during injection.

There is no theoretical maximum depth limit for initiating a fracture in a geologic formation as long as sufficient pressure and flow can be delivered to the fracture zone. In pneumatic fracturing the injection pressure required to lift the formation is typically two to three times higher than for hydraulic fracturing on account of gas compressibility effects in the system.

To date, the target depths of most pneumatic fracturing projects have ranged from 3 to 15 meters. The deepest applications of pneumatic fracturing for site remediation purposes have been 60 meters. For fracturing applications below a depth of around 25 to 30 meters, it may be advisable to use proppants since elevated overburden pressures can inhibit self-propping.

Rationale

Without the carrier fluids used in hydraulic fracturing, there are no concerns with fluid breakdown characteristics for pneumatic fracturing. There is also the potential for higher permeabilities within the fractures formed pneumatically, in comparison to hydraulic fractures, as these are essentially air space and are devoid of propping agents. The open, self-propped fractures resulting from pneumatic fracturing are capable of transmitting significant amounts of fluid flow. Pneumatic fractures, in particular, may propagate along existing fracture patterns. Hydraulic fractures have been found to be less influenced by existing fractures.

Gaseous nitrogen is widely available and non-expensive. It is an inert gas and hence does not damage rock formation. The gas can be removed easily after the treatment and hence the clean-up process is fast (Rogala, Krzysiek et al. 2013).

(Rogala, Krzysiek et al. 2013) conclude that the many advantages offered by nitrogen would suggest nitrogen fracturing as a very good technical solution. However, they also conclude that placing the proppant in high velocity gas stream is problematic, as well as resulting in erosion, and that the technology is limited to shallow wells or geologies that can fail the rock in a self-propping manner. It is nonetheless questionable if such geologies are widespread.

Potential advantages and disadvantages

Potential advantages

- Potential environmental advantages:
    a. Water usage completely eliminated.
    b. No chemical additives are required.
- Potential for higher permeabilities due to open, self-propped fractures that are capable of transmitting significant amounts of fluid flow.

Potential disadvantages

- Limited possibility to operate at depth.
- Limited capability to transport proppants.

Status of technique application

Shallow shale formations have been fractured with pneumatic fracturing (EPA 1993) with the purpose of facilitating the removal of volatile organic contaminants.

Pneumatic fracturing with gaseous nitrogen is applied to shale gas production (Rogala, Krzysiek et al. 2013). (Gottschling and Royce 1985) report that as early as 1985 a technology was developed, using nitrogen for the extraction of gas from Devonian shale formations in Ohio (USA). In this system, gaseous nitrogen was injected at a pressure of 24 MPa in shallow wells. Approximately 60% of the volume used was a pure nitrogen gas without proppant, designed to produce fractures in the stimulated formation. The remaining 40% carried sand.

The Canadian company Canyon has patented a process called Grand Canyon™. This uses a high-pressure pumping unit that accurately meters a proprietary light-weight proppant into a stream of pure nitrogen. This allows creating a very thin fracture held open by a partial monolayer (i.e. a proppant pack that is literally "one particle thick"). Canyon reports that the technique has been used to perform thousands of fracturing jobs (delivering hundreds of successful wells) in water-sensitive Cretaceous shales and silts. Their proprietary proppant is being tested for deeper applications, specifically in the Montney and Cardium plays (Canyon 2013).

4. Fracturing with dynamic loading

In this section we review fracturing techniques that do not make use of fluids, but rather by inducing a dynamic loading by detonating explosives placed at the bottom of the well or by applying electrical impulses.

4.1. Explosive fracturing

Overview

Using explosives to fracture rock formations and hence stimulate production is a very old technique. From the 1860s until the late 1940s, explosives were commonly used in wells to increase production ("well shooting"). Liquid nitroglycerin in a tin cylinder was lowered down the well and detonated. The technique was both effective and dangerous (Hyne 2001).

In the late 1960s nuclear devices were tested as a mean to fracture rock formations in order to enhance the recovery of natural gas. In the United States, Project Gasbuggy (Lemon and Patel 1972; American Oil & Gas Historical Society 2012) tested a 29-kiloton nuclear device lowered at a depth of 1288 meters underground. The detonation created a molten glass-lined cavern about 160 feet in diameter and 333 feet tall, which collapsed within seconds. Subsequent measurements indicated that fractures extended more than 200 feet in all directions – and significantly increased natural gas production. Two further nuclear explosions (Project Rulison and Project Rio Blanco) were also carried out in Colorado. The natural gas proved to be too radioactive to be commercially viable. It is also reported that similar test where conducted in Russia to fracture oil and gas wells. The Soviet Union had a similar program: "Peaceful Nuclear Explosions for the National Economy", also referred to as "Program 7," involved testing of industrial nuclear charges for use in peaceful activities. (Nordyke 2000) reports that nuclear detonations were conducted with the stated purpose of searching for useful mineral resources with reflection seismology, breaking up ore bodies, stimulating the production of oil and gas, and forming underground cavities for storing the recovered oil and gas. All together, the Program 7 conducted 115 nuclear explosions, among them 12 explosions for oil stimulation and 9 explosions for gas stimulation (Nordyke 2000).

In the 1970s many different explosive-based fracturing techniques were studied, for instance: (1) displacing and detonating nitro-glycerine in natural or hydraulically induced fracture systems, (2) displacing and detonating nitro-glycerine in induced fractures followed by wellbore shots using pelletized TNT, and (3) detonating wellbore charges using pelletized TNT. These techniques were for instance applied to oil shale formations. (Miller and Johansen 1976).

Problems of wellbore damage, safety hazards, and unpredictable results reduced the relative number of wells stimulated by high-strength explosives. More recently, studies have shown that propellants have strong advantages over explosives. Propellants are substances which deflagrate rather than detonate. (Schmidt, Warpinski et al. 1980). The propellant techniques seem to offer a potential use for shale gas extraction and are reviewed more in details in the following. They are known by several generic names, such as Dynamic Gas Pulse Loading (Servo-Dynamics), High Energy Gas Frac (Sandia National Laboratories), Controlled Pulse Fracturing (Mobil Research and Development Corporation), and others.

(Boyun Guo 2014) presents an analysis of well productivity of different types of well architectures to be completed with the explosive fracturing in liquid-rich shale gas formations. The analysis is based on numerical modelling but case studies indicate a good agreement between the result given by the models and field observation. Sensitivity analyses indicate that the initial productivity of fractured wells increases non-linearly with the number of radial fractures and fracture penetration, but the benefits of increasing fracture depth reaches a plateau as the amount of explosives increases.

Description of the technique

Substances (**solid propellants**) are deflagrated at appropriate locations in the rock formation. These generate high pressure gases at a rate that creates a fracturing behaviour dramatically different from either hydraulic fracturing or explosives.

The time to peak pressure is approximately 10,000 times slower than explosives and 10,000 times faster than hydraulic fracturing. Unlike explosives, the burn front in these materials travels slower than the speed of sound. The pressure-time behaviour of propellants differs from explosives in that peak pressures are lower, and burn times are longer.

The solid propellant does not detonate, but deflagrates. Deflagration is a burning process that takes place without any outside source of oxygen. Gas pressures in the range of 20,000 psi are produced that last approximately 10 milliseconds. No shock wave is produced, the rock is split rather than compacted, and multiple fractures are created (GasGun 2013).

Depending on the tools used, the reservoir lithology and the depth, propellant fracture lengths are generally in the range from a few feet to a maximum, under the very best of conditions, of a few tens of feet (Schatz 2012).

Different commercial techniques have been identified. Some may simply be the same technique with a different company name.

A significant disadvantage to propellant fracturing is that it does not carry proppant into the fracture. Instead, propellant fracturing relies upon shear slippage to prevent the fracture from fully closing back on itself, leaving a conductive path back to the wellbore. (Page and Miskimins 2009)

GasGun

The Gas Gun uses solid propellant to generate high pressure gas at a rapid rate. The rate is tailored to the formation characteristics to be rapid enough to create multiple fractures radiating 10 to 50 feet from the wellbore, but not so rapid as to pulverize and compact the rock as is experienced with classic high explosives such as nitroglycerine. The star-shaped pattern of multiple fractures removes wellbore damage or blockage and increases the formation permeability near the wellbore (GasGun 2013).

High Energy Gas Fracturing

This technology (Servo-Dynamics 2013) consists of a perforating with propellants, which are transported to the area of interest by wireline, coiled tubing or tubing. The propellant is an oxidizing agent consisting of potassium perchlorate particles and epoxy resin. Once ignited the propellant deflagrates, releasing gas (contained in a column of fluid in the face of the well), which in tum produces the pressure pulse and by the expansion is responsible for generating multiple fractures of short length (up to 50 feet in shale), in all radial directions in the well where the perforating was oriented. Successful stimulations are reported to have been achieved in many lithologies, including shale (Plata, Castillo et al. 2012).

Dynamic Gas Pulse Loading

Dynamic Gas Pulse Loading (DGPL) is a the commercial name of a technique for inducing multiple, radial fractures in a wellbore, using rapid gas-pressure loading of the rock during the deflagration (burning) of downhole gas generators (Servo-Dynamics 1998). By controlling the energy release during this process, the in situ stresses can be exceeded by a substantial amount while pressures remain significantly below the level which deforms and crushes the rock.

StimGun

StimGun is a propellant-assisted perforating system, developed by a group of industries that includes among others Marathon Oil Company and Weatherford. The propellant releases a controlled-dynamic pulse of high-pressure gas at the time of perforating. The tool simultaneously perforates and stimulates the well. A cylindrical sleeve of propellant is placed over a specially configured perforating carrier. The pressure wave generated by the perforating charge ignites the propellant. Gas from the propellant enters the newly created perforations, breaking them down and stimulating the formation (StimGun 2012).

Dry Fracturing EPS

This technique is at the concept stage, and is being developed by Prof. J. Krzysiek of Gdansk University of Technology to target the fracturing of shale formations. It is designed to combine feature from StimGun and GasGun. StimGun is classic perforator with external sleeve as elastic propellant in combined perforation and stimulation. GasGun has two type propellant loaded with staged ignition system used for stimulation of already perforated intervals. Dry Fracturing EPS intends to extend the traditionally limited perforation range of propellant fracturing systems and to offer controllable fracturing geometry, regardless of formation stress direction and shale water sensitivity. Both the energy of perforation and stimulation are concentrated in perforation tunnels for optimal fracture propagation (Krzysiek 2013; Rogala, Krzysiek et al. 2013).

Rationale

The use of propellants and other so-called tailored-pulse techniques depend on a controlled pressure-time behaviour to minimize wellbore damage and maximize fracture growth by gas penetration.

High explosives, such as nitroglycerine or gelatin, detonate and create a shock wave. Pressures created are extremely high but last only a few microseconds. Extensive research has shown that the pressure pulse created by high explosives enlarges the wellbore by crushing and compacting the rock. The enlarged wellbore is left with a zone of residual compressive stress. These residual stresses and compacted rock can actually reduce permeability near the wellbore. Extensive cavings often fill the wellbore with debris that require days, even weeks, to clean up (GasGun 2013).

The problems commonly associated with hydraulic fracturing are avoided. No water is used (and hence no chemical additives). The energy released underground, albeit relatively low, could potentially induce seismic events.

Potential advantages and disadvantages

Potential advantages

- Potential environmental advantages:
    a. Water usage completely eliminated.
    b. No chemical additives are required.
- Minimal vertical growth outside the producing formation.
- Multiple fractures.
- Selected zones stimulated without the need to activate packers[5].
- Minimal formation damage from incompatible fluids.
- Homogeneous permeability for injection wells.
- Minimal on-site equipment needed.
- Lower cost when compared to hydraulic fracturing.

[5] Packers are special equipment used to isolate zones of the well where hydraulic fracturing is carried out.

- Can be used as a pre-fracturing treatment (to reduce pressure losses by friction in the near wellbore).

Potential disadvantages

- Can replace hydraulic fracturing only for small to medium treatments, i.e. the fracture penetration is somewhat limited.
- Proppant is not carried into the fracture. Instead, propellant fracturing relies upon shear slippage to prevent the fracture from fully closing back on itself.
- The GasGun website explicitly admits that "*the GasGun will never replace hydraulic fracturing. Large hydraulic fracture treatments can create a fracture hundreds, if not thousands, of feet in length. But many small pay zones in marginal wells cannot justify the expense of these treatments*". (GasGun 2013)
- The energy released underground, albeit relatively low, could potentially induce seismic events.

Costs

Costs are impossible to assess given the scarce experience.

Status of technique application

Techniques based on explosive fracturing seem to have been largely superseded. On the other hand, techniques based on propellant fracturing are commercially available, have been used on shale formations and they appear to be a potential alternative to high-volume hydraulic fracturing in some situations.

Laboratory and field experiments were conducted to compare hydraulic and propellant fracturing techniques in the Mancos Shale in Colorado (a Cretaceous shale approximately 2,000 feet thick) (Page and Miskimins 2009). This study concluded that both propellant and hydraulic fracturing can provide stimulation benefits, but only when applied in appropriate situations.

Dry Fracturing EPS is at the concept stage, but it is reported that a pilot study will be conducted in the near future on wells operated by PGNiG in Poland (Krzysiek 2013).

4.2. Electric fracturing

Overview

In electric fracturing, electricity is used to induce mechanical loads into the rock. If high enough, this loading will fracture the rock.

Laboratory studies to evaluate the use of electricity for fracturing various grades of Colorado oil shale were started in 1964, the rationale being that it was necessary to develop techniques to increase the permeability of the oil shale formation in order to carry out an in-situ retorting[6] process (Melton and Cross 1968).

NOVAS Energy, a US company based in Houston, currently offers a technology that makes uses plasma pulses to enhanced oil recovery in conventional reservoirs (NOVAS Energy 2014).

A technique that could be especially applied for shale gas stimulation is being developed and tested at the University of Pau and Pays de l'Adour (Chen 2012; Martin, Reess et al.

[6] Retorting is the oldest and the most common extraction method for oil shale. In this process oil shale is heated in the absence of oxygen (pyrolysis) until its kerogen decomposes into condensable shale oil vapours and non-condensable combustible oil shale gas. Oil vapours and oil shale gas are then collected and cooled, causing the shale oil to condense.

2012a; Martin, Reess et al. 2012b). This makes use of pulsed arc electrohydraulic discharges, and it is described in Section 4.3.1.

Another experimental technique has been identified, called Plasma Stimulation & Fracturing (Awal 2013). This is described in Section 4.3.2.

4.3.1. Pulsed Arc Electrohydraulic Discharges (PAED)

Description of the technique

The method proposed by the researchers at the University of Pau and Pays de l'Adour is based on generating a pressure wave by an electrical discharge between two electrodes placed in a wellbore filled with water. The amplitude of this wave of pressure can reach up to 200 MPa (2000 times the atmospheric pressure) while its duration is around one hundredth of microsecond. This pressure wave is transmitted to the rock by the fluid inside the wellbore, and will create micro-cracks of decreasing density, according to the distance from the well (Chen 2012; Martin, Reess et al. 2012a; Martin, Reess et al. 2012b).

Rationale

This technique would allow fracturing of the rock without any use of fracturing fluids (and hence no chemical additives).

(Kalaydjian and Goffé 2012) report that in 2011 Total commissioned research on this technique, and concluded that the technology is not a currently viable alternative to hydraulic fracturing. One major problem seems to be that rock permeability is increased only up to several meters from the wellbore, but no further. The authors also conclude that the technique would require management of electrical installations on the surface and that the environmental consequences of this remain to be studied.

Potential advantages and disadvantages

Potential advantages

- Potential environmental advantages:
    a. Water usage much reduced or completely eliminated.
    b. Few or no chemical additives are required.

Potential disadvantages

- Limited capability of increase rock permeability away from the wellbore.
- Proppant not carried into the fracture.
- Can only replace hydraulic fracturing only for small to medium treatments, i.e. the fracture penetration is somewhat limited.

Costs

Costs are impossible to assess given the current knowledge.

Status of technique application

The technique is at the concept stage, and it is being developed as a potential alternative to hydraulic fracturing.

One journal article (Chen, Maurel et al. 2012), two patents applications (Martin, Reess et al. 2012a; Martin, Reess et al. 2012b) and two doctoral theses (Chen 2012; Martin 2013) documenting the ongoing research at the University of Pau and Pays de l'Adour were found. The authors have announced that the main results of their research will be published in the near future in different international journals (Reess 2013).

4.3.2. Plasma Stimulation & Fracturing Technology (PSF)

Description of the technique

The method has been recently proposed by Dr. M. R. Awal at the Texas Tech University (Department of Petroleum Engineering). Development was started in February 2010 (Awal 2013).

According to the inventor, PSF creates multiple radial fractures of self-propped type fractures by fast-expanding plasma generated using a proprietary, high-energy pulsed-power electrical discharge technique. While the plasma tool alone can create 5-20 ft (1.5-6 meters) long multiple radial fractures of self-propped type, the implementation of the pulse stepping algorithm can extend these fractures over 50 ft (15.2 meters).

PSF employs multiple cycles of extremely fast (in the micro-second range) dynamic pressurization in the wellbore. The multiple radial fractures created by PSF are self-propped because of shear displacement. This phenomenon occurs by virtue of emergence of shear stresses along the newly created fracture planes aligned in the directions of non-principal in-situ stresses. Hydraulic fracturing never generates such shear stresses along the bi-wing fractures, which are aligned in the direction of principal stress.

Rationale

This technique would allow fracturing of the rock without any use of fracturing fluids (and hence no chemical additives).

According to the inventor, "*PAED employs a 1st generation, very low efficiency (~10%) electric-to-shockwave conversion (ESC) process, compared to Texas Tech's 3rd generation highly energy efficient (70-80%) process. Besides, PFS continues its lead by growing into a full scale prototype for field demonstration*" (Awal 2013).

Potential advantages and disadvantages

Potential advantages

- Potentially more environmentally friendly than high-volume water fracturing:
    a. Water usage much reduced or completely eliminated.
    b. Few or no chemical additives are required.
    c. Technique deployable with a very limited number of trucks, hence much reduced traffic.

Potential disadvantages

- Limited capability of increase rock permeability away from the wellbore.
- Proppant is not carried into the fracture.

Costs

Costs are impossible to assess given the current knowledge. The inventor claims that "*the estimated revenue from PSF job is approx. $1,000 per foot of depth*" (Awal 2013).

Status of technique application

According to the inventor, PSF can be custom-designed for use in both conventional and unconventional oil and gas reservoirs (Awal 2013).

The technique appears to be at the concept stage, but the inventor reports that the design parameters for an up-scaled field prototype have been established, and hence that a pilot project can be undertaken. The pilot would entail fabricating the PSF hardware for demonstration in a 10,000 ft vertical or horizontal well.

5. Other methods

In this section we review some other formation stimulation techniques that do not fall directly under the previous categories

5.1. Cryogenic fracturing

Overview

Fracturing can be achieved by using a fluid colder than the reservoir. This will create thermal stresses that could fracture the rock. Even if a fluid is used this is not strictly speaking hydraulic fracturing in the traditional sense, because it is not the elevated pressure of the fluid and high injection rates that breaks the rock.

Several authors (Svendson, Wright et al. 1991; Charlez, Lemonnier et al. 1996) have shown that thermally induced fractures may take place in oil and gas reservoir stimulation applications. They investigated different cases where cold water was injected into deep hot reservoirs with a constant injection rate (below the formation collapse pressure). After a certain time a sharp increase in injectivity was observed, as if the formation were fractured.

Recently an interesting fracturing technique has been proposed, based on the injection of large quantities of cold C02 to create thermal stresses that lead to fractures in significant magnitude. (Mueller, Amro et al. 2012). This technique, discussed more in details below, is at the concept stage and it has been proposed for tight reservoirs.

(Cha, Yin et al. 2014) report a very recent laboratory study of cryogenic fracturing. It was shown that the injection of liquid nitrogen in laboratory specimen created cracks and altered rock properties. Fractures were created by generating a strong thermal gradient. Several topics requiing further investigation were identified, for instance the poorly understood effect of borehole pressurization, the effects of stress level and stress anisotropy the characteristics of material properties.

An ongoing study funded by RPSEA is concerned with the study, testing and development of a cryogenic fracturing technology to obtain a significant reduction of flow resistance near the well and to increase mobile gas volume in unconventional gas reservoirs (http://www.rpsea.org/projects/10122-20/). The study is expected for completion in July 2016. The first year report is available (Yu-Shu Wu 2013).

Description of the technique

(Mueller, Amro et al. 2012) have proposed a technique called "CO_2 thermal hydraulic fracturing". It combines conventional hydraulic fracturing and fractures which are caused by thermal stresses, due to the injection of cold C02.

To create thermal stresses that lead to fractures in significant magnitude, a large quantity of liquid CO_2 is needed to be injected. During high pressure injection the CO_2 will stay in liquid state. Due to its low temperature and the high quantity of CO_2 a large area around the wellbore will cool down. Depending on the injection rate a temperature reduction of 50-100°C might be achieved in this way. This effect should lead to large thermal stresses in the ground which cause fracturing along with the hydraulic pressure of the injection pump.

According to (Mueller, Amro et al. 2012), the temperature reduction would not be high enough to achieve the necessary thermal stresses to induce fractures in the first months of the process. During this initial period, the injection would take place in the so-called "frac" regime, i.e. injection at high pressure. CO_2 injection would continue for several years, and gas production would only start after two years from the beginning of the treatment. Through the continuous injection, the temperature front propagates, inducing an ongoing fracturing process in reservoir regions farther away from the well. The cap

rock above the formation should guarantee the sealing of the reservoir and prevent seismic impact on the overburden layers.

Rationale

As discussed in Section 2.9.1, using CO_2 as fracturing fluid offers many advantages.

Large quantities of liquid CO_2 would be needed for injection. One promising sources could be power plants which have a CO_2 emission up to 1 million tons/ year. Transport could be realized by pipelines from the plant site to the injection site.

Potential advantages and disadvantages

Potential advantages

- Potentially more environmentally friendly than high-volume water fracturing:
    a. Water usage much reduced or completely eliminated.
    b. No chemical additives are required.
- Could be used in conjunction with CO_2 sequestration schemes.
- Reduction of formation damage (reduction of permeability and capillary pressure damage by reverting to a gaseous phase; no swelling induced).
- Enhance gas recovery by displacing the methane adsorbed in the shale formations (Wang, Li et al. 2012).

Potential disadvantages

- Large quantities of liquid CO_2 would be needed.
- Long times required: CO_2 injection would need to occur for several years, and gas production would only start after 2 years from the beginning of the treatment.

Costs

Costs associated with this technique are impossible to evaluate with the current status of knowledge.

Status of technique application

The concept idea has been proposed for tight formations (Mueller, Amro et al. 2012). No specific information relating to its application to shales could be found.

5.2. Mechanical cutting of the shale formation

Overview

A patent from 2010 (Coleman and Hester 2010) presented a method to remove mass from a formation between two connected wellbores using a flexible cutting cable. According to this idea, two wellbores are drilled and connected; a cutting cable is inserted into the first well and fished out from the second; finally, the cable is repeatedly pulled back and forth. This sawing action removes formation material between the wellbores to form an opening in the shape of a plane. Earlier patents were filed proposing methods to remove minerals such as coal from seams using a chain cutter that is pulled through the seam, for instance from a tunnel drilled in a U shape (Hurd 1980; Farrar, Mayercheck et al. 1991). Other patents presenting similar ideas can be found, for instance (Carter 2009).

Drawing on these ideas, an interesting project ("Novel Concepts for Unconventional Gas Development in Shales, Tight Sands and Coalbeds") was launched and funded by the

National Energy Technology Laboratory (NETL)[7] and performed by Carter Technologies between 2008 and 2009 (Carter 2009).

The project objective was to develop an alternative method of stimulation to increase the net production of gas from shale while reducing the amount of water required. Over a dozen new concepts (from rotating mills to high-pressure water jets) were evaluated including one promising method (called Slot Drill) that appears to be able to cut 100 foot deep slots all along a 2500 foot long horizontal well. According to the project's final report (Carter 2009), the method appears to have a low capital cost and be sufficiently robust to withstand the rigors of the down hole drilling environment.

Description of the technique

The Slot-Drill is an advanced cable saw method that operates like a down-hole hacksaw, and it is hence mechanically simple. A well is drilled to depth in the target formation and a casing cemented. The hole is then directionally drilled to curve back upward in the shape of a "J" within the producing formation. The drill string is retrieved back to the surface and an abrasive cable is attached to the tip of the drill pipe. A winch on the rig holds a specific tension on the cable as the pipe is lowered back into the hole under its own weight. Such tension causes the cable to hug the inside radius of the curved hole. The cable is moved back and forth, and this motion cuts a pathway upward from the hole on each downward stroke. The cutting force at any point is a function of local cable tension and radius of curvature so the shape of the cut may be tailored to some extent. The cut is nominally upward along a vertical path but can also be made to turn horizontally.

An operation may last for 2 to 5 days, depending on the desired depth of cut and the hardness of the rock. Drilling fluid is circulated through the drill pipe to flush the cuttings back to the surface. The abraded cuttings are very small particles and circulate out easily. A special tool is also used to allow a standard blow out preventer to seal on the cable and drill pipe.

The system should be able to cut a 100 foot deep vertical slot upward from the horizontal lateral in a shale formation, and the cut length could exceed 2500 feet. This system would operate in a blind hole from a conventional drilling rig and is powered by the drilling rig. The only special equipment required is a constant tension winch and a downhole tool that connect the abrasive cable to the drill pipe.

Rationale

Successful development of the proposed Slot Drill concept could provide an alternative stimulation method comparable to high-volume hydraulic fracturing but at a lower cost and without the very high water resource requirements.

Fully developed Slot-Drilled wells could result in much greater total recovery from a given lease acreage, thus increasing the total proven reserves. These slots may also reduce production decline, reduce the effects of formation damage, and allow a larger percentage of the in-place gas to be recovered.

According to the project results, reservoir simulations indicated that the slot alone may increase well flow rates significantly compared to current state of the art fracturing treatments. Unlike hydraulic fracturing, the location of a slot can be selected and precisely placed, is much thicker, and has near unlimited conductivity (Carter 2009).

[7] NETL is part of the U.S. Department of Energy (DOE) national laboratory system. NETL supports DOE's mission is to advance the national, economic, and energy security of the United States.

Potential advantages and disadvantages

Potential advantages

- Potentially more environmentally friendly than high-volume water fracturing:
    a. Water usage much reduced or completely eliminated.
    b. No chemical additives are required.
- Possibly enhanced recovery of total gas in place, accelerated rates of unconventional gas production, and development of reserves in fields that would not otherwise be produced.

Potential disadvantages

- None identified.

Costs

The primary costs of the method are the rig time, the winch, and the consumable abrasive cable materials. The total cost for comparable stimulation benefit is estimated to be less than half the cost of current fracturing technology.

Status of technique application

This is a technique specifically developed for shale formations. The technique is at the concept stage, and the project was currently awaiting funding to perform a demonstration in a test well in 2009 (Carter 2009).

5.3. Enhanced bacterial methanogenesis

Overview

A significant part of organic-rich shales have not undergone a sufficient burial to generate the pressure and temperature conditions necessary for the complete transformation of the organic matter into oil or coal. These immature source rocks may represent a huge fossil carbon resource.

Microbiologically assisted methanization of the organic matter is a promising technologies being considered. Methanization is known to occur in shales from field data showing the natural accumulation of biogenic methane in several sedimentary basins (Meslé, Charlotte Périot et al. 2012).

Research projects have been carried out very recently, in both the Antrim shale formation in the Michigan Basin and in the western Canadian sedimentary basin.

RPSEA conducted a seed study on Antrim Shale (Michigan) and the Forest City Basin (Kansas) formations (Martini, Nüsslein et al. 2004). The results of this project indicated that microbial methane generation in sedimentary basins is an active process, with a high potential for stimulation. The project's final report concluded that the research may contribute towards development of technologies to enhance methane production in shale gas plays, and thus to help secure natural gas resources from the extensive occurrence of fractured black shales and coal beds found throughout the USA (Salehi and RPSEA 2012).

Schlumberger-Doll Research funded a project ("Toward microbially-enhanced shale gas production.") to genetically profile the bacterial communities present in formation water of three gas-producing Antrim shale wells. Incubation experiments were established by adding different substrates to aliquots of these waters in an effort to stimulate the microbial methane generation. Increases in direct methane production were obtained. (Coolen 2013; Wuchter, Banning et al. 2013).

(Cokar, Ford et al. 2013) reported a study conducted on shales from the Abbey Field in Western Canada, in which the reaction rate kinetics for methane production were

determined from experimental data using produced water and core samples from a shallow shale gas reservoir. The results showed that biogenic shale gas generation accounted for about 12% of the total gas produced. According to the authors, this is a significant percentage of the total gas production and hence there is great potential to enhance methanogenesis within these reservoirs.

Description of the technique

Naturally-occurring microorganisms (methanogens) are stimulated within the shale formations to enhance the production of methane as by-product of their normal metabolic processes.

Rationale

It is reported that shallow biogenic shale gas reservoirs generate gas by microbial activity, implying that current production to the surface consists of ancient adsorbed gas as well as recent biogenerated gas. Approximately 20% of all of the methane generated is generally thought to be of microbial origin. Most shallow shale gas reservoirs are at temperatures of less than 80 °C, and given the supply of carbon, water, and minerals, they can be thought of as multi-kilometer-scale bioreactors. (Cokar, Ford et al. 2013)

Enhanced bacterial methanogenesis may have a large impact, especially in shallow reservoirs. Methanogens can produce a significant amount of methane without any stimulation. As shown in preliminary modelling by (Cokar, Ford et al. 2013), microbial methane generation can account for 12% of the total gas production.

Potential advantages and disadvantages

Potential advantages

- Potential to tap into hydrocarbon resources of immature source rock (which would otherwise be unusable).
- Potential environmental advantages: no usage of water nor chemical additives, etc.

Potential disadvantages

- None identified.

Costs

Costs are impossible to assess given the current knowledge.

Status of technique application

Enhanced bacterial methanogenesis appears to be at the concept stage for what it concerns in-situ application. The technique has been successfully applied in laboratory. Further work is required to determine how to stimulate the microorganisms within the reservoir to consume more of the organic carbon and thus increase gas production rates.

5.4. Heating of the rock mass

Overview

Technologies based on heating the underground formations exist and have been used by the oil industry for many applications, in particular to increase the recovery of oil or to increase the thermal maturity of organic material. These processes can for instance use steam (without fracturing) in porous rocks or electric heaters.

A very interesting discussion on the possibilities of this technology and its application to unconventional hydrocarbon production is given in (Kalaydjian and Goffé 2012).

A conceptual study of thermal stimulation in shale gas formations was more recently published by (Han Yi Wang 2014) to understand the effects of fracture heating on the shale gas adsorption and desorption characteristics, and how these can be exploited to enhance shale gas recovery from hydraulically fractured reservoirs.

Description of the technique

The rock is heated, for instance by injecting steam or by other suitable methods. This enhances the permeability of the reservoir and/or increase the thermal maturity of the organic matter (kerogen) in the formation, as discussed in the next section.

Rationale

(Kalaydjian and Goffé 2012) identify three principal mechanisms by which the effects of heating the rock mass could have beneficial effects:

- Mineralogical changes;
- Changes in the chemical decomposition of kerogen;
- Evolution of the carbon structure of kerogen.

The first possible beneficial effect of heat is to induce mineralogical changes. A relevant effect when considering rock types containing clay (such as shales) is dehydration. (Vidal and Dubacq 2009) demonstrated that dehydration may indeed produce up to 150 liters of water per cubic meter of clay in place. The space vacated by removing water increases the porosity and therefore the permeability. Also, the thermal expansion of the rock can result in beneficial changes in permeability.

The second desired effect of heating is the chemical decomposition of kerogen heavy hydrocarbons to light hydrocarbons. The increase in temperature makes it possible to degrade certain kerogen molecules (in the case of incomplete maturation), and to promote the conversion of heavier hydrocarbons to lighter compounds. These techniques are especially applicable in the case of oil shales. Fluids and gases increase local pressures and either allow the use of existing microcracks or create new ones (Kobchenko, Panahi et al. 2011). The increase in permeability is achieved by induced microcracks in the rock.

The third effect is the possible evolution of the carbon structure of kerogen. The increased temperature may have the effect to open up porosity of micro-scale and nano-scale carbon structures in the kerogen.

These effects, combined, could have the effect to significantly enhancing the permeability of the shale formations, without the need to perform any hydraulic fracturing.

Potential advantages and disadvantages

Potential advantages

- Water usage much reduced.
- No chemical additives are required.

Potential disadvantages

- None identified.

Costs

(Kalaydjian and Goffé 2012) argue that one of the main challenges of this technology (if using electrical heating) would be its economic profitability, which in turn would be strongly dependent on the cost of electricity consumed and the efficiency of the gas production.

Status of technique application

The technique is applied for producing oil shale. It is at the concept stage concerning application for other unconventional hydrocarbons such as shale gas. (Kalaydjian and Goffé 2012) present a very good discussion on the possibilities and challenges offered by the technique.

5.5. In-situ combustion

(Chapiro and Bruining 2015) have recently presented a conceptual study on the possibility of using in-situ combustion to stimulate production in shale gas formations. The main goal of this paper was to understand under which conditions this is feasible. Two possibilities for the in-situ fuel source were considered: methane or kerogen.

The authors concluded that possibility of using this method for recovery of shale gas needs to consider a number of mechanisms such as gas production from kerogen, initial permeability of the reservoir, compression costs and the coupling of the method to existing fracturing techniques. In summary, more research is needed.

5.6. Enhanced oil recovery in shale reservoirs

(Sheng 2015) recently provided a review of the current status of enhanced oil recovery (EOR) methods in shale oil and gas condensate reservoirs that have already a network of fractures (for instance created by one of the fracturing methods described elsewhere in this report. The focus of the study is on gas injection, but other possible methods are also considered, such as thermal recovery, chemical methods (by water injection) and microbial methods. The data presented show that gas injection is more feasible in shale reservoirs than water flooding and any other EOR methods, but the study also concludes that enhanced oil recovery in shale reservoirs is a new topic and more research is needed.

6. Summary and conclusions

In this report we reviewed hydraulic fracturing and other formation stimulation technologies, by searching the open literature, patent databases and commercial websites (mainly in the English language). This is an updated version of the original JRC report published in 2013 (Gandossi 2013), compiled taking into account new relevant information that became available during 2014 and 2015.

Several techniques were identified and described, at various level of technological readiness: some are commercially available, whilst many others are currently being developed or are at the concept stage.

Table 5, below, present an overall summary of the information gathered, showing in particular some of the potential advantages and disadvantages that each technique could offer.

Table 5. Summary of potential advantages and disadvantages for identified fracturing techniques

Technique		Potential advantages	Potential disadvantages	Status of application for shale gas production
Hydraulic Fracturing	**Foam-based fracturing fluids**	- Water usage reduced (or completely eliminated in case of CO2-based foams). - Reduced amount of chemical additives. - Reduction of formation damage. - Better clean-up of the residual fluid.	- Low proppant concentration in fluid, hence decreased fracture conductivity. - Higher costs. - Difficult rheological characterization of foams, i.e. flow behaviour difficult to predict. - Higher surface pumping pressure required.	Commercially applied to fracture shale formations.
	Oil-based fracturing fluids **(→ LPG)**	- Water usage much reduced or completely eliminated. - Fewer (or no) chemical additives are required. - Flaring reduced. - Truck traffic reduced. - Abundant by-product of the natural gas industry. Increased the productivity of the well. - Lower viscosity, density and surface tension of the fluid, which results in lower energy consumption during fracturing. - Full fluid compatibility with shale reservoirs (phase trapping virtually eliminated). - No fluid loss. - Recovery rates (up to 100%) possible. - Very rapid clean up (often within 24 hours).	- Involves the manipulation of large amounts of flammable propane, hence potentially riskier than other fluids and more suitable in environments with low population density. This disadvantage disappears if using heptafluoropropane. - Higher investment costs. - Success relies on the formation ability to return most of the propane back to surface to reduce the overall cost. - Heptafluoropropane is a very stable hydrocarbon, and as such presents a global warming potential.	Commercially applied to fracture unconventional reservoirs (not clear if this include shales).
	Acid-based fracturing fluids	The application of acid fracturing seems to be confined to carbonate reservoirs. Not used to stimulate sandstone, shale, or coal-seam reservoirs.		
	Alcohol-based fracturing fluids **(→ Methanol)**	- Water usage much reduced or completely eliminated. - Methanol is not persistent in the environment. - Excellent fluid properties: high solubility in water, low surface tension and high vapour pressure. - Very good fluid for water-sensitive formations.	- Methanol is a dangerous substance to handle: a. Low flash point, hence easier to ignite. b. Large range of explosive limits. c. High vapour density. d. Invisibility of the flame.	Methanol-based fluids have been used on low permeability reservoirs, but it is not clear if their application has been extended to shales.

Table 5 (cont.) Summary of potential advantages and disadvantages for identified fracturing techniques

Technique		Potential advantages	Potential disadvantages	Status of application for shale gas production
Hydraulic Fracturing	Emulsion-based fluids	- Depending on the type of components used to formulate the emulsion, these fluids can have potential advantages such as: a. Water usage much reduced or completely eliminated. b. Fewer (or no) chemical additives are required. - Increased the productivity of the well; better rheological properties (i.e. better flow behaviour); fluid compatibility with shale reservoirs.	- Potentially higher costs.	Emulsion-based fluids have been used on unconventional (low permeability) formations, but no direct usage for shale gas stimulation could be found as a part of the present study.
	Cryogenic fluids: Liquid CO_2	- Potential environmental advantages: a. Water usage much reduced or completely eliminated. b. Fewer (or no) chemical additives are required. c. Some level of CO_2 sequestration achieved. - Reduction of formation damage. - Form more complex micro-fractures. - Enhance gas recovery by displacing the methane adsorbed in the shale formations. - Evaluation of a fracture zone is almost immediate because of rapid clean-up. Better clean-up of the residual fluid, so smaller mesh proppant can be used. More controlled proppant placement and higher proppant placement within the created fracture width.	- Proppant concentration must necessarily be lower and proppant sizes smaller, hence decreased fracture conductivity. - CO_2 must be transported and stored under pressure (typically 2 MPa, -30°C). - Corrosive nature of CO_2 in presence of H_2O. - Unclear (potentially high) treatment costs.	Liquid CO_2 as fracturing fluid is commercially used in unconventional applications (most notably, tight gas) in Canada and the US. Devonian shale formations in Kentucky (USA) have been stimulated with liquid CO_2 as early as 1993. Super-critical CO_2 usage appears to be at the concept stage.
	Cryogenic fluids: Liquid N_2	- Potential environmental advantages: a. Water usage much reduced or completely eliminated. b. Fewer (or no) chemical additives are required. - Reduction of formation damage. - Self-propping fractures can be created by the thermal shock, hence need for proppant reduced or eliminated.	- Special equipment required to safely handle liquid N_2, due to the very low temperature of the fluid. - Higher costs.	Nitrogen as a component (in mists, foams or other energised fluids) of the fracturing medium is common. The use of liquid nitrogen is less typical. The technique is commercially available and has been applied for fracturing shale formations but its usage appears limited.

Table 5 (cont.) Summary of potential advantages and disadvantages for identified fracturing techniques

Technique		Potential advantages	Potential disadvantages	Status of application for shale gas production
Hydraulic Fracturing	Cryogenic fluids: Liquid He	N/A	N/A	See Section 2.9.3
	Cryogenic fluids: Liquid LPG	N/A	N/A	Very little information available. See section 2.9.4
Pneumatic Fracturing	(→Air) (→N_2)	- Potential environmental advantages: — Water usage completely eliminated. — No chemical additives are required. - Potential for higher permeabilities due to open, self-propped fractures that are capable of transmitting significant amounts of fluid flow.	- Limited possibility to operate at depth. - Limited capability to transport proppants.	Shallow shale formations have been fractured with pneumatic fracturing (EPA 1993) with the purpose of facilitating the removal of volatile organic contaminants. Pneumatic fracturing with gaseous nitrogen is applied to shale gas production, but limited information on the scale is available.
Dynamic loading	Explosive fracturing (→ solid propellants)	- Potential environmental advantages: — Water usage completely eliminated. — No chemical additives are required. - Minimal vertical growth outside the producing formation. - Multiple fractures. - Selected zones stimulated without the need to activate packers . - Minimal formation damage from incompatible fluids. - Homogeneous permeability for injection wells. - Minimal on-site equipment needed. - Lower cost when compared to hydraulic fracturing. - Can be used as a pre-fracturing treatment (to reduce pressure losses by friction in the near wellbore).	- Can replace hydraulic fracturing only for small to medium treatments, i.e. the fracture penetration is somewhat limited. - Proppant is not carried into the fracture. Instead, propellant fracturing relies upon shear slippage to prevent the fracture from fully closing back on itself. - The energy released underground, albeit relatively low, could potentially induce seismic events.	Techniques based on explosive fracturing seem to have been largely superseded. On the other hand, techniques based on propellant fracturing are commercially available and have been used on shale formations, but very limited information on the scale is available. New techniques are currently being developed (for instance, Dry Fracturing EPS).

Table 5 (cont.) Summary of potential advantages and disadvantages for identified fracturing techniques

Technique		Potential advantages	Potential disadvantages	Status of application for shale gas production
Dynamic loading	**Electric fracturing**	- Potential environmental advantages: – Water usage much reduced or completely eliminated. – Few or no chemical additives are required.	- Limited capability of increase rock permeability away from the wellbore. - Proppant not carried into the fracture. - Can only replace hydraulic fracturing only for small to medium treatments, i.e. the fracture penetration is somewhat limited.	Both identified technologies (see section 4.2.1 and 4.2.2) are at the concept stage. Plasma stimulation (4.2.2) is reported as ready for being tested in the field.
Other methods	**Thermal (cryogenic) fracturing**	- Potential environmental advantages: a. Water usage much reduced or completely eliminated. b. No chemical additives are required. - Could be used in conjunction with CO_2 sequestration schemes. - Reduction of formation damage. - Enhance gas recovery by displacing the methane adsorbed in the shale formations.	- Large quantities of liquid CO_2 would be needed. - Long times required: CO_2 injection would need to occur for several years, and gas production would only start after two years from the beginning of the treatment.	The concept idea has been proposed for tight formations.
	Mechanical cutting of the shale formation	- Potential environmental advantages: – Water usage much reduced or completely eliminated. – No chemical additives are required. - Possibly enhanced recovery of total gas in place, accelerated rates of production, and development of reserves in fields that would not otherwise be produced.	- None identified.	This is a technique specifically thought for shale formations. The technique is at the concept stage.
	Enhanced bacterial methanogenesis	- Potential to tap into vast hydrocarbon resources of immature source rock. - Potential environmental advantages: no usage of water nor chemical additives, etc.	- None identified.	Enhanced bacterial methanogenesis appears to be at the concept stage. The technique has been successfully applied in laboratory specimen.
	Heating of the rock mass	- Water usage much reduced or completely eliminated. - No chemical additives are required.	- None identified.	The technique is applied for producing oil shale. No information on the extent of the use. It is at the concept stage concerning application for other unconventional hydrocarbons such as shale gas.

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APPENDIX 2-D-29. *Eagle Plains Exploration Project Proposal Schedule for Engagement*

MEMORANDUM

Date:	May 12, 2021
To:	Tr'ondëk Hwëch'in (TH)
From:	Chance Oil and Gas Limited (Chance)
File:	103505-01
Re:	Eagle Plains Exploration Project Proposal Schedule for Engagement

1.0 INTRODUCTION

In order to clarify the process for completing Chance's Eagle Plains Exploration Project (Project) Proposal for the Executive Committee of Yukon Environmental and Socio-economic Assessment Board (YESAB), Hemmera has drafted the schedule below.

Hemmera is proposing in-person engagement activities in the Yukon in accordance with all COVID-19 precautions and preferences of affected First Nations. Activities with affected First Nations in the Northwest Territories will be conducted via video conference until such time as we are sharing a 'travel bubble'. This memo may be amended depending on feedback from affected First Nations and the evolution of COVID-19 and associated orders of the Chief Medical Officer of the Yukon.

2.0 BACKGROUND

In the spring and summer 2018, Chance and TH developed the *Engagement and Communication Plan* (Plan). Since that time both parties have made progress in the implementation of the Plan.

3.0 SCHEDULE

The schedule below indicates the order and timing of engagement sessions that Chance is proposing in order to prepare its Project Proposal for submission to YESAB. This is a high-level schedule and timeframes may change due to a number of factors such as:

- Availability of necessary information from Chance's technical consultants.
- Changes in COVID-19 restrictions and associated orders of the Chief Medical Officer of the Yukon.
- Evolution in the engagement preferences of the Tr'ondëk Hwëch'in.
- Unforeseen events in the community.

4.0 GENERAL APPROACH

At this time Chance is proposing five engagement events between June and September 2021. Each event will entail Chance and technical consultants going to Dawson or providing information in a virtual format, if preferred. The goal of each event will be to hold an open house / information session for TH Citizens and,

where schedules allow, hold meetings with the First Nation government, Renewable Resource Council, and/or other key entities based in the community.

Each event is intended to have a pre-determined theme. Identifying themes in advance, as well as scheduling approximately one event every month, enables each of Chance's consultants to prepare the necessary materials required in order to deliver effective and informative engagement events. Chance is proposing the follow themes:

1. Project Description and Candidate Valued Components (June)
2. Baseline Findings (July)
3. Caribou and Land Use (August)
4. Permafrost, Water, and Terrain (September)
5. Effects Assessment and Mitigation Measures (October)

There is little flexibility in the themes of the first and second events. While Chance has previously shared and presented a description of the Project, those activities took place in 2019. Not only did that take place approximately two years ago, but since that time Chance has engaged on another project (i.e., Eagle Plains Well Maintenance and Winter Activities project for Designated Office evaluation). Chance believes providing a re-fresher on the Project Description will be key.

The themes selected for events number three and four have been informed by feedback raised to date. However, these themes are flexible and can be adjusted. Additional details pertaining to specific issues and/or content for discussion will be developed prior to each session. Chance intends for its fifth event to prioritize a discussion of the Project's draft effects assessment, as well as proposed mitigation measures (e.g., draft management plans).

For each open house / information session Chance and Hemmera will produce a PowerPoint presentation, information sheets, and posters for the anticipated theme. Copies of engagements materials will be shared with the TH approximately one week in advance.

APPENDIX 2-D-30. *Eagle Plains Oil and Gas Exploration Planning: Surficial Geology/Permafrost and Exploration Development Suitability Mapping*

Palmer™

470 Granville Street, Suite 630, Vancouver, BC V6C 1V5
Tel: 604-629-9075 | www.pecg.ca

Memorandum

Date: January 22, 2021
Project #: 1903401
File #: 1

To: Richard Wyman, Chance Oil and Gas Limited

From: Robin McKillop, Cory McGregor

cc:

Re: Eagle Plains Oil and Gas Exploration Planning: Surficial Geology/Permafrost and Exploration Development Suitability Mapping

---

1. Introduction

Palmer is pleased to submit this report to Chance Oil and Gas Limited (Chance) to accompany and explain the interpretive surficial geology/permafrost and exploration development suitability mapping in a priority area of its Eagle Plains property in northern Yukon. Our work provides a basis for Chance to effectively plan upcoming maintenance programs for its abandoned wells and the next phase of its exploration, by distinguishing areas well and poorly suited to road and well pad construction, and mix-bury-cover (MBC) drill cuttings disposal. It also aims to help streamline Chance's exploration permitting process by proactively characterizing the distribution and relative ice content of permafrost in anticipation of related information requests from the Yukon Environmental and Socio-economic Assessment Board (YESAB).

Following provision of important background information (Section 1), we provide an overview of the physical setting (Section 2) and describe the methods used to produce the interpretive mapping and derivative products (Section 3). Key results portrayed by the maps, including the areal distribution of distinct areas and implications for exploration development, are highlighted in Section 4. Recommended follow-up investigations are highlighted in Section 5.

1.1 Background

Chance is interested in expanding its exploration for oil and gas reserves within its property near Eagle Plains. Exploration is planned in phases across a 2,400 km^2 area within its property. To support exploration planning and associated permitting, Chance is seeking insight into the distribution, characteristics, and sensitivity of permafrost terrain within its exploration area as a basis for optimizing initial ground testing and ultimate site selection for its exploration wellpads, access roads and MBC disposal sites. A number of key characteristics are particularly important for assessing site-specific sensitivities to disturbance, including: permafrost extent (laterally) and depth (active layer thickness) with consideration of potential talik (unfrozen) zones; relative ice content (e.g., ice-rich or ice-poor); and past or present instabilities expressed by

thermokarst, gullying, shallow landslides and ice-wedge polygons. Indicators of concentrated and seasonally prolonged shallow groundwater flow, such as slopewash runnels and the margins of existing or recently abandoned water bodies, are also important considerations for site selection and land management as these may increase construction costs and maintenance requirements.

Palmer previously completed surficial geology/permafrost and derivative suitability mapping for a 440 km^2 subset of the Chance Eagle Plains property, located approximately 40 km southwest of Eagle Plains. This study builds on and refines the previous work to complete seamless mapping expanding from the 440 km^2 subset into the surrounding area. In addition, this study takes advantage of the previous reporting by Palmer (2015a), which has been adapted for the current objectives, updated based on limited field observations, and revised where necessary.

1.2 Study Area

The study area is located approximately 20 km southwest of Eagle Plains, and measures approximately 2,400 km^2, inclusive of the 440 km^2 subset mapped in 2015 (Figure 1). The Dempster Highway diagonally crosses the southern half of the study area between kilometres 300 and 347. The northern edge of the study area roughly coincides with the Arctic Circle at 66°30’00” N, while the southern edge is approximately 8 km north of the Peel River valley at 65°55’00” N.

1.3 Objectives

The overall objective of this study is to expand the existing understanding of terrain and permafrost distribution and will ultimately provide Chance with advance knowledge of permafrost sensitivity and development suitability across its 2,400 km^2 Eagle Plains study area. To accomplish this main objective, Palmer completed the following:

- A field reconnaissance program to calibrate the terrain and permafrost characteristics with limited helicopter- and ground-based observations;
- Surficial geology mapping for the study area, including delineation of terrain features through the newly added 1,960 km^2 expansion area and review and refinement of the original 440 km^2 subset;
- Classification of permafrost conditions across the study area, with a focus on describing relative active layer thickness and permafrost ice content; and
- Derivation of an Exploration Development Suitability map with a focus on highlighting regions where constraints related to terrain and permafrost conditions are most likely to affect road routing and design, wellpad siting and layout, and future construction and maintenance activities. The Exploration Development Suitability map also draws attention to areas potentially suitable for MBC disposal of drill cuttings.

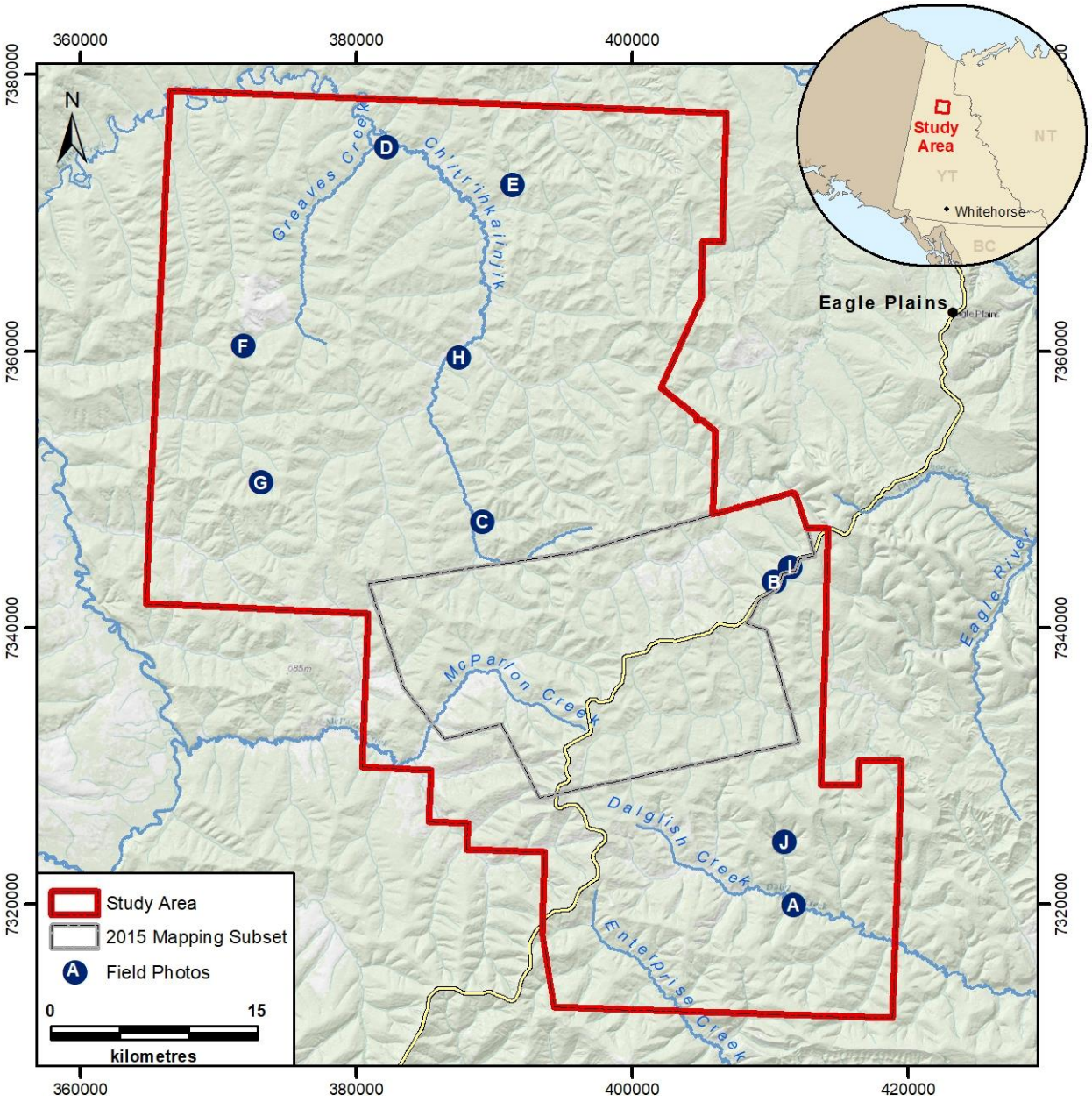

Figure 1. Eagle Plains study area and locations of representative field photos included below.

2. Physical Setting

The study area lies within the Eagle Plains Ecoregion, an area of modest relief in the lowlands between the North Ogilvie and Richardson mountain ranges (Yukon Ecoregions Working Group, 2004). Elevation ranges between 350 m asl at the base of the northernmost river valleys to 750 m asl at high points along the broad ridge system followed by the Dempster Highway. Climate is characterized by prolonged winter conditions which persist up to eight months of the year. Mean annual temperature is near -7.5°C, with mean July temperatures around 13°C and mean January temperatures slightly colder on the valley floors (-31°C) than over higher terrain (-25°C) due to strong temperature inversions associated with Arctic high pressure.

Annual precipitation is approximately 400 mm, falling mostly as rain during the summer months (Yukon Ecoregions Working Group, 2004). Most surface water drains into the northern-flowing Porcupine River, via major tributaries such as the Eagle River and Whitestone River; in the southeastern corner, Dalglish Creek and Enterprise Creek drain into the Peel River, which flows east to the Mackenzie River.

2.1 Bedrock Geology

The bedrock geology of the study area is dominated by the Upper Cretaceous rocks of the Cody Creek, Burnthill Creek, and Eagle Plain formations (Yukon Geological Survey, 2020). These rocks comprise fine- to medium-grained sedimentary sequences including sandstone, shale, siltstone, bituminous shale, mudstone, and coal. The easternmost edges of the study area intersect the mixed carbonate and clastic rocks of the Hart River and Ford Lake formations.

Differential weathering of these lithologies has contributed to the unique landscape in the study area. Broad ridges are formed by comparatively erosion-resistant sandstone beds. The Dempster Highway and Chance Road generally follow a network of these more resistant ridges. Isolated knolls along the ridge crests are likely remnants of the more competent bedrock in the area.

2.2 Landscape Evolution

Much of Yukon has been repeatedly glaciated during the Pleistocene, causing multiple episodes of erosion and deposition of thick and extensive glacial sediments. Beyond the maximum limit of glaciation, however, surficial deposits generally comprise deeply weathered bedrock and soils on plateaux and slopes, organic-rich soils and peat in depressions, and fluvial silts, sands, and gravels along river valleys (Hughes, 1972). During the last glaciation, the Laurentide Ice Sheet reached its all-time limit occupying the region surrounding the lower Mackenzie River Valley and reaching as far west as parts of the Richardson and Mackenzie Mountains. The study area lies within an unglaciated region to the west of this limit (Duk-Rodkin, 1999), and is generally unaltered by glacial processes. However, Laurentide ice obstructing the Peel River valley and impounding Glacial Lake Hughes diverted meltwater flow northward through the Eagle River valley (Duk-Rodkin and Hughes, 1995). Thus, glacial processes may have had an indirect effect on the study area by lowering the base level of the Eagle River and increasing the rate of incision of its upstream tributaries.

The lack of glacial erosion has resulted in broad, rolling uplands that are typically covered by veneers of relatively fine-grained colluvium or weathered bedrock and commonly bounded by well-drained scarps where more resistant bedrock transitions into fluvially incised, V-shaped valleys. The valley sides are covered by thick, fine-grained colluvium, locally overlain by organics. Thick, fine-grained to gravelly fluvial deposits occupy the valley bottoms. Remnant terraces perched above the floodplains within some of the larger valleys are composed of peat overlying fine sands and silts (Thomas and Rampton, 1982). The lower permeability and valley bottom position of these thicker sediments results in the preservation of ice-rich permafrost, which can introduce challenges for exploration and infrastructure development in these areas.

2.3 Permafrost and Periglacial Processes

Permafrost is ground, including both unconsolidated sediments and bedrock, that remains below 0°C for more than one year. Chance's Eagle Plains property is entirely within the zone of continuous permafrost,

based on property-specific geological and geophysical field data, ground surface expression visible in aerial photography, and regional-scale permafrost mapping compiled by Heginbottom et al. (1995) (Palmer, 2015b).

The depth to permafrost (or active layer thickness) varies spatially at regional and local scales, and temporally with changing seasons. The active layer is generally <1 m thick in the study area, even at its late summer maximum, although it may reach around 2 m in particularly well drained, elevated sites. Active layers may be even thicker, locally reaching bedrock at a depth of 3-4 m, following wildfire (Coates, 2008; Kryotek Arctic Innovation, 2015). At a local scale, active layer thickness primarily depends on elevation, aspect, slope position and shape, soil texture and drainage, snow pack and vegetation cover (Williams and Burn, 1996; Bonnaventure et al., 2012; McKillop et al., 2013). Well drained soils insulated by thick annual snow cover tend to have thicker active layers (deeper permafrost table) than wind-swept, poorly drained areas (shallower permafrost table). In areas of thick, mossy organic cover, permafrost may be encountered at depths as shallow as just a few tens of centimetres even at the end of summer. Active layer thickness increases following snowmelt in spring, and typically peaks in late summer.

Permafrost may or may not contain ice, depending primarily on the material within which it exists and its hydro-geomorphic setting. Most commonly, ice is restricted to the pores or fractures within surficial materials or bedrock, respectively. Such ‘ice-poor’ permafrost is widespread in the study area and most common in areas of exposed or shallow bedrock, along ridges of weathered bedrock, and on relatively well drained colluvial slopes. Where soil textures and drainage conditions permit, thin seams or small lenses of ice may form, representing a more moderate volumetric content of ice. Broad valley bottoms, which have been infilled with mixtures of fine-grained colluvium, fluvial deposits and organic matter, may contain ‘ice-rich’ permafrost. In addition to pore and lens ice, massive bodies of ice may exist within the unconsolidated material. Such bodies grow and shrink in response to changing climatic conditions and ground thermal regime (e.g., organic cover thickness, local drainage conditions). They may form ice wedges, which commonly form geometric networks well expressed at surface by interconnected, linear furrows. Ice-wedge polygons also occur on some gentle slopes, including broad ridge crests and shoulders within portions of the study area.

The sensitivity of permafrost to disturbance depends on a variety of factors, including its temperature, ice content, insulating ground cover (e.g., organics) and the material within which it is held. Relatively warm permafrost (i.e., warmer than -2°C) is more susceptible to thaw due to localized and even minor disturbances to the ground surface, whereas cooler permafrost is able to withstand minor disturbances without appreciable effect. Permafrost that is decoupled from current climatic conditions and only persists in areas of thick, mossy organic cover is more sensitive to disturbance through ground disturbance (e.g., stripping or compaction of organics). Permafrost within fine-grained materials is more likely to contain discrete bodies of ice and, thus, is more sensitive than that within weathered bedrock or coarse-grained colluvium.

Permafrost has a strong influence on soil and drainage conditions, the rates and mechanisms of colluvial (mass movement) processes, and overall hillslope and valley bottom morphology. An appreciation for periglacial processes is important to exploration planning. Permafrost acts as a barrier to water flow, in the absence of any taliks (unfrozen areas bounded by permafrost), so unconsolidated materials within the

active layer commonly become saturated during the summer. On level ground, differential frost heave may occur in the snow-free season, resulting in frost (mud) boils, irregular micro-topography and the formation of earth hummocks. Ice-wedge polygons may form under certain conditions. In areas of ice-rich permafrost, even minor ground disturbances may trigger thermokarst activity (e.g., natural windthrow ripping the surface organic mat and exposing underlying sediments), through which the ground subsides and slumps in response to the melting of buried ice bodies. Thermokarst commonly continues for extended periods of time (i.e., years to decades), once initiated, through a positive feedback cycle between increases in thaw and increases in water ponding. Retrogressive slumping is common along the shores of thaw ponds and along the banks of thermokarst gullies, which incrementally enlarges the area of subsidence.

On slopes, summertime saturation reduces the shear strength of the soil and promotes solifluction, the gradual, downslope creep of material on the permafrost table; or active-layer detachment, the rapid, downslope slide and/or flow of material on the permafrost table. Both processes increase in frequency and magnitude shortly after wildfire (Coates, 2008), mainly due to the loss of rooting strength and insulating organic cover (thaw rate and depth increase). Solifluction is best recognized at surface by conspicuous ‘lobes’ of organics and sediment, defined by a steep, rounded front and a gradual tail. Areas of active solifluction can destabilize roads through irregular settlement and mounding. Certain slopes are commonly prone to active-layer detachments; their histories of landslides are commonly indicated by conspicuous fall line-oriented ‘stripes’ of deciduous trees.

Slopewash is another widespread and important process on slopes underlain by permafrost, through which material is transported downslope through a combination of sheetwash (entrainment in surface runoff) and piping (entrainment in water percolating through the active layer). Shallow ‘runnels’ (also known as ‘water tracks’) are a surface manifestation of slopewash, formed by the repeated and preferential downslope transport of sediments along natural drainage paths. As slopewash runnels deepen, they concentrate and prolong the conveyance of surface runoff and shallow groundwater, resulting in a local depression in the permafrost table (thickening of the active layer). The interception of slopewash runnels by roads necessitates cross-ditching or drainage culvert installation; still, such sites may form ‘icings’ during the winter and spring months, which increase maintenance requirements on road surfaces and embankments.

3. Methods

3.1 Field Reconnaissance

A one-week field reconnaissance program was completed between July 1 to 7, 2019. Weather conditions were generally clear and sunny with brief periods of light rainfall. The program was undertaken with the support of a helicopter and included reconnaissance flights over much of the study area as well as ground-based assessments. The program was completed with a focus on characterizing a diversity of landforms, surficial materials, and permafrost conditions across the study area. Ground-based field observations were made through a series of foot traverses to document changes across the landscape. Field assessment involved examining sediments and visible ice in hand-dug soil pits and natural exposures (e.g., landslide scarps, gullies, stream cut-banks); measuring depth to frost (which may not have represented the true depth to permafrost at the start of the summer); determining material textures, origins, and expressions; and describing geomorphological processes. The program was completed in parallel with an ecological field program undertaken by Environmental Dynamics Inc. (EDI). Where possible, terrain interpretations were

supplemented by opportunistic field observations made and shared by EDI's ecologists as part of their field program.

3.2 Terrain Mapping

Palmer completed surficial geology/permafrost mapping for the 2,400 km^2 study area as a basis for communicating the distribution of distinct ground conditions. The mapping represents the seamless integration of the previously mapped 440 km^2 area (Palmer, 2015a) with the expanded interpretations within the surrounding 1,960 km^2. The 440 km^2 subset was reviewed and standardized for consistency with the surrounding area. Terrain interpretations were completed using a combination of multiple stereo-imagery sources in combination with high-resolution LiDAR-derived elevation data. Aerial photographs were acquired by Chance over the northern and southern regions of the study area, but smoke from wildfires precluded acquisition within the central portion of the study area. Satellite imagery acquired between 2014 and 2019 were overlain onto a digital elevation model to generate pseudo-stereo imagery and were used as a substitute for stereo aerial photographs in this region. Terrain interpretations were refined based on LiDAR-derived elevation data, available across the study area at a resolution of 2 m. Surficial mapping was digitized directly into a geographic information system (GIS) using DAT/EM's Summit 3D mapping software in conjunction with Esri's ArcMap.

Surficial geology/permafrost mapping was completed at a view scale of 1:20,000 using the standardized Yukon surficial geology mapping protocols (Lipovsky and Bond, 2014), which are an adaptation of the *Terrain Classification System for British Columbia* (Howes and Kenk, 1997), with modifications to accommodate project-specific objectives. Terrain polygons were delineated based on internally homogenous combinations of surficial materials, textures, surface expressions, drainage classes, and geomorphological processes. Under this system, up to two surficial materials were identified in each polygon as either a primary or secondary material, or in stratigraphic relation to each other. Relative depth to, and relative ice content of, permafrost were estimated for each map polygon using the terrain characteristics and calibrated based on ground observations made during the field reconnaissance program. Relative depth to permafrost refers to the approximate maximum (end of summer) depth of the permafrost table (active layer thickness) and is an inferred average value for the polygon (Table 1). Relative ice content is an inference of the amount of pore ice, segregated ice, massive ice, and/or excess ice (Table 2). Terrain and permafrost interpretations are limited by the mapped scale, and represent the average conditions within each map unit (polygon). It is possible that ground ice is more or less extensive than its mapped representation due to a necessary generalization of the terrain characteristics or geomorphological processes of the map unit. Polygons have been symbolized based on the primary surficial material. Discrete terrain features and geomorphic processes too small to be mapped as individual polygons, such as thermokarst subsidence and active-layer detachments, have been identified using on-site point and line features. All codes used in the mapping are defined in the legend.

3.3 Exploration Development Suitability

The Exploration Development Suitability maps represent the general suitability of distinct areas for the establishment and maintenance of access roads and wellpads, and for disposal of drill cuttings using MBC techniques. The general characteristics of terrain suitable for wellpads and access roads were assumed to be similar in the study area, so these suitabilities have been considered together.

Table 1. Inferred relative depth to permafrost.

Depth Classification	Definition	Description
Near-surface	Permafrost table located less than 0.4 m from the ground surface.	Permafrost is typically found within or at the base of surface organics. Includes map units overlain by organic blankets and veneers; very poorly to imperfectly drained fluvial fans, terraces, veneers; and inactive floodplains.
Shallow	Permafrost table located between 0.4 and 1.0 m from the ground surface.	Applies to relatively fine-grained and matrix-supported sediments and is considered the typical permafrost depth class through the study area. Includes most imperfectly to moderately well drained deposits, active floodplains and most deposits with mapped ice-wedge polygons or thermokarst subsidence.
Deep	Permafrost table located more than 1 m from the ground surface.	Typically applies to relatively coarse-grained and clast-supported deposits. Includes bedrock and most moderately to well drained colluvium and weathered bedrock along convex ridges and scarps.

Table 2. Inferred relative ice content of permafrost.

Ice Content Classification	Pore Ice	Segregated Ice	Massive Ice	Excess Ice[1]	Description
Ice-rich	Continuous	Extensive	Indicated (Xw), Inferred (Xt), or likely; widespread	Major	Typically includes sediments overlain by organic blankets and veneers; poorly to very poorly drained, mostly inactive fluvial deposits; and map units affected by ice-wedge polygons or thermokarst subsidence.
Ice-moderate	Continuous	Widespread, in seams and lenses	Possible, locally	Moderate	Includes fluvial deposits not previously classified as ice-rich; fine-grained colluvial aprons and blankets; imperfectly to poorly drained matrix-supported colluvial blankets; and map units affected by sheetwash or solifluction.
Ice-poor	Discontinuous to Continuous	Local, mostly in seams	Unlikely, except in isolated areas	None to minor	Applies to most moderately to well drained terrain throughout the rolling uplands and colluvial slopes and is considered the typical ice content class in the study area.

[1] Excess ice refers to the volume of ice that exceeds the total voids (e.g., pore space) that would be present under natural, unfrozen conditions.

The road and wellpad suitability and MBC disposal suitability classifications were derived from the 1:20,000-scale surficial geology interpretations and are specific to (and relative within) the project area. Map units (polygons) were categorized into five road and wellpad suitability classes (ranging from Very High to Very Low) and two MBC disposal suitability classes (Potentially Suitable and Probably Unsuitable) based on terrain characteristics, site drainage, and permafrost conditions, also considering field observations and professional experience in unglaciated Yukon (e.g., McKillop et al., 2013; McKillop et al., 2016). Definitions, explanations and implications of each class are outlined in Section 4.3 in association with the presentation of results. A lower suitability rating does not necessarily mean suitable terrain is not present in the map unit; localized portions of these polygons may be suitable for exploration development or MBC disposal based on site-specific terrain characteristics. Similarly, a higher rating does not necessarily mean the entire polygon is suitable for exploration development or MBC disposal. Field investigations remain warranted to evaluate suitability classifications at a site-specific level.

4. Results and Discussion

4.1 Key Field Observations

Ground observations were made at 103 field reconnaissance sites and supplemented by opportunistic observations and photographs taken along foot traverses and helicopter flights. An overview of representative photograph locations is shown in Figure 1, and examples of common terrain units and processes are presented in Figure 2. Most of the study area consists of gently sloping uplands dissected by stream valleys punctuated by bluffs at the crests of slopes (Photos A to C). Geomorphological processes related to ice-rich permafrost are visible by surface expressions including ice-wedge polygons (Photo D) and thermokarst subsidence (Photo E). Mass movements such as active-layer detachments were observed on gentle to moderate gradients along valley walls (Photo F).

Representative photographs of permafrost conditions and sediments in the study area are presented in Figure 3. Measurements of the active layer thickness at the time of site inspection (July 1 to 7, 2019) are estimated to be slightly thinner than the late summer maximum. In general, depth to frost was less than 1 m throughout the study area. Measurements were generally deeper near active streams and were assumed to be relatively deep on well drained, weathered bedrock ridges where high clast content typically restricted measurements using a frost probe. Permafrost was near-surface (<0.4 m) beneath areas of thick organic cover, such as fluvial terraces and inactive floodplains. Typically, ice content increases toward lower valley positions, and was noticeably higher within inactive floodplains. In one such environment, an eroding stream bank exposed massive ground ice in wedges >2 m high (Photo G). Excess ice was also observed within thick, fine-grained colluvial deposits (Photo H).

Competent bedrock rarely outcrops at surface through most of the study area, but several conspicuous outcrops of sandstone and conglomerate were observed near the Dempster Highway (e.g., Figure 3 Photo I). Most ridge crests appear as weathered bedrock and consist largely of well drained sands and angular clasts (Photo J).


A


B


C


D

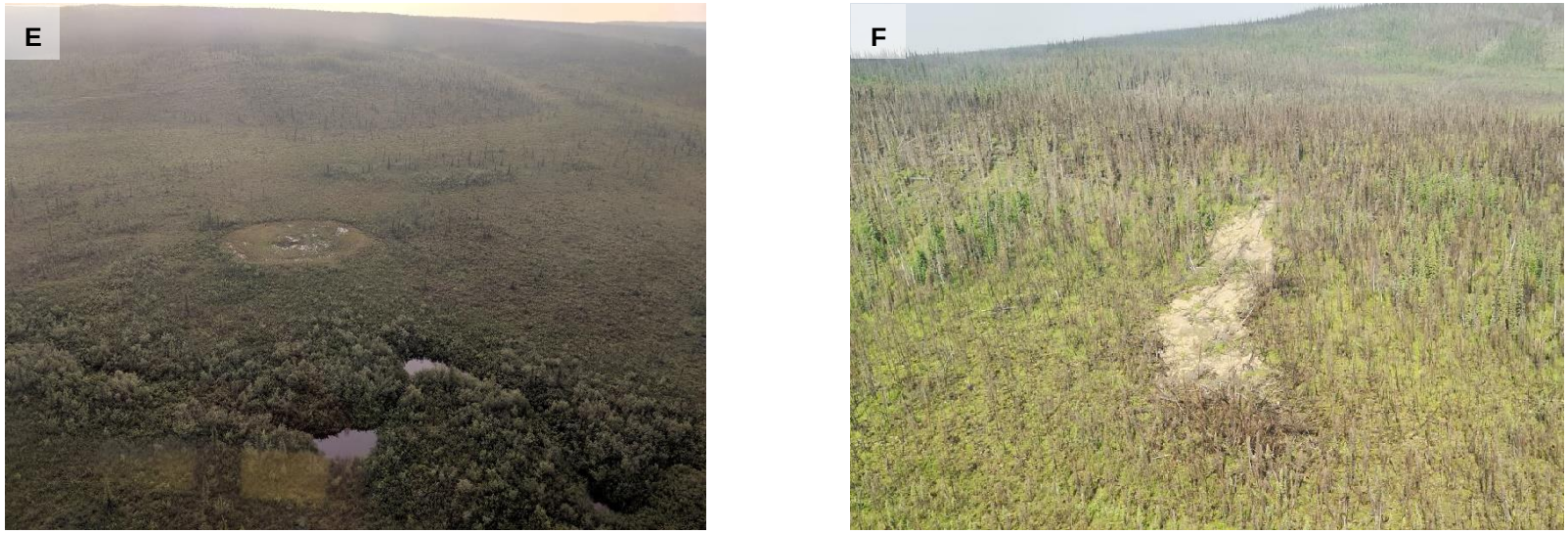

Figure 2. Field photographs representative of common landforms and geomorphological processes within the study area: A) View of the Dalglish creek valley, showing an irregularly meandering channel and several areas of lateral erosion where the creek has cut into the valley walls; B) Convex, mid-slope composed of more-resistant bedrock mantled by a veneer of weathered bedrock and colluvium; C) Gentle fluvial fan exhibiting a triangular- or wedge-shape, transitioning into a modern stream valley (lower right); D) Geometric surface expression of ice-wedge polygons over an inactive region of the floodplain; E) Thermokarst depression in an inactive region of the floodplain; and F) Recent active-layer detachment initiated at the crest of a gentle colluvial slope.



Figure 3. Field photographs representative of typical surficial material characteristics: G) Ice wedge exposed in freshly eroded stream bank (1.9 m-tall person for scale); H) Ice lens within fine-grained, colluvial sediment; I) Outcrop of more-resistant conglomerate exposed in a bluff near the Dempster Highway; J) Sandy, clast-supported veneer of weathered bedrock, typical of deposits found in weathered bedrock bluffs and knolls.

4.2 Surficial Geology and Permafrost

The results of the surficial geology/permafrost mapping are presented in the series of maps shown in **Appendix A**. Most landforms and materials in the study area are interpreted to have originated prior to the last glaciation. Apart from organics, recent fluvial deposits, and areas recently affected by active geomorphological processes, the landscape is dominated by deeply weathered sediments that have developed on slopes and ridges over many millennia.

Colluvial deposits (aprons, veneers, blankets, and mantles of variable thickness) are the most extensive surficial material, located ubiquitously on slopes and ridges and comprising 71.8% of the study area (Table 3). Fluvial deposits comprise 8.4% of the study area and are generally identified along the bottoms of broad valleys, although fans and veneers of fluvial sediments are mapped at confluences and within narrow ravines, respectively. Organic material accumulates on most imperfectly to very poorly drained deposits throughout the study area, but it is only identified in the terrain code when its thickness exceeds about 0.5 m. Organic veneers and blankets are generally mapped in low valley positions near active streams, and comprise 1.6% of the study area. Bedrock within the study area is commonly fissile and deeply weathered, located along ridge tops and convex slope-breaks along the crests of valley walls. Weathered veneers of bedrock cover 17.3% of the study area. Intact bedrock is rare at surface and is limited to exposures in steep scarps lining the broad ridge tops, covering 0.9% of the study area. Areas significantly disturbed by human activity (excluding road networks) have been mapped as anthropogenic landforms, and cover <0.1% of the study area

Table 3. Areal distribution of surficial materials and landforms by primary surface material.

Surficial Material and Landform	Terrain Code	Areal Extent	Areal Percentage
Anthropogenic	A	1.41 km^2	< 0.1%
Organic Veneer	Ov	10.24 km^2	0.4%
Organic Blanket	Ob	28.85 km^2	1.2%
Colluvial Apron	Ca	188.77 km^2	7.9%
Colluvial Veneer	Cv	816.12 km^2	34.0%
Colluvial Blanket	Cb	401.01 km^2	16.7%
Colluvial Mantle of Variable Thickness	Cw	315.50 km^2	13.2%
Weathered Bedrock Veneer	Dv	414.07 km^2	17.3%
Fluvial Plain (active and inactive)	FAp; Fp	111.80 km^2	4.7%
Fluvial Veneer (active)	FAv	49.53 km^2	2.1%
Fluvial Fan (active and inactive)	FAf; Ff	36.29 km^2	1.5%
Fluvial Terrace	Ft	2.87 km^2	0.1%
Bedrock	R	20.47 km^2	0.9%
Total		**2,396.93 km^2**	**100%**

Relative depth to permafrost is estimated to be shallow (0.4-1 m) across the majority of the study area (86.2%), and is found on most broad ridges, colluvial slopes, and around active floodplains (Table 4). Relative depth to permafrost is estimated to be near-surface within poorly drained valley bottoms and beneath organic deposits, comprising 3.6% of the study area. Relative depth to permafrost is estimated to be deep (> 1 m) across 10.2% of the study area and is commonly mapped in association with coarse colluvial or weathered bedrock deposits typically found along convex ridges and bluffs, and bedrock scarps.

Permafrost is estimated to be ice-rich across 12.9% of the study area, and is commonly found below poorly drained, inactive fluvial deposits and below organic cover (Table 4). Ice-rich permafrost may also be found along fine-grained colluvial slopes and even along some ridges where the surface expression of ice-wedge polygons is visible in LiDAR data or aerial imagery. Ice-moderate permafrost comprises 40.8% of the study area, and is commonly found below imperfectly drained fluvial deposits and thick, fine-grained colluvial deposits. Ice-moderate permafrost is also inferred in regions affected by sheetwash or solifluction. Nearly half the study area has been estimated to contain ice-poor permafrost (46.3%), which applies to most moderately to well drained terrain along ridges and upper valley slopes.

Table 4. Area distribution of permafrost conditions by relative depth and relative ice content.

Permafrost Condition Classification		**Estimated Relative Ice Content**			
		Ice-poor	**Ice-moderate**	**Ice-rich**	**Total**
Estimated Relative Depth	**Near-surface (<0.4 m)**	0% *(0 km²)*	0.1% *(2.2 km²)*	3.5% *(84.1 km²)*	**3.6% *(86.3 km²)***
	Shallow (0.4 – 1 m)	37.0% *(885.8 km²)*	39.9% *(955.6 km²)*	9.4% *(224.7 km²)*	**86.2% *(2,066.1 km²)***
	Deep (>1 m)	9.4% *(224.3 km²)*	0.8% *(20.2 km²)*	0% *(0 km²)*	**10.2% *(244.5 km²)***
	Total	**46.3% *(1,110.2 km²)***	**40.8% *(977.9 km²)***	**12.9% *(308.8 km²)***	**100% *(2396.9 km²)***

4.3 Exploration Development Suitability and Associated Implications

The series of Exploration Development Suitability maps is provided in **Appendix B**. The maps combine the results of the road and wellpad suitability classifications with the MBC disposal suitability classifications.

Road and wellpad suitability are presented as a five-class system (Table 5). A total of 17.4% of the study area has been classified as Very High or High suitability. These areas comprise ice-poor, isolated topographic highs and moderately to well drained ridge systems, which form sinuous networks through the landscape. Conversely, lower valley terrain such as floodplains and fine-grained colluvial aprons are generally prone to higher ice contents, and active permafrost and periglacial processes, including active-layer detachments, solifluction, thermokarst, and sheetwash. A total of 54.2% of the study area was classified as Low to Very Low suitability, due to one or more development constraints. The remaining 28.4% of terrain was considered moderately suitable for development and may be reasonable for road and wellpad establishment by employing proactive mitigation measures where necessary.

Table 5. Road and wellpad suitability classification and implications for construction and maintenance.

Road and Wellpad Suitability	Description	Implications for Construction and Maintenance	Percent of Study Area
Very High	Moderately well to well drained, isolated topographic highs with deep or shallow, ice-poor permafrost. Generally considered to be stable terrain, and typically located along wide, rounded ridge crests.	Favourable conditions for access road and wellpad establishment through standard best management practices. Minimal expectation for maintenance requirements.	8.1%
High	Generally, moderately well to well drained areas with deep or shallow, ice-poor permafrost. Typically associated with ridges of weathered bedrock or shallow colluvium over convex topography.	Generally favourable conditions for access road and wellpad establishment through standard best management practices. Low to moderate expectation for maintenance requirements.	9.3%
Moderate	Imperfectly to moderately well drained colluvial slopes with deep to shallow permafrost, commonly with poor to moderate ice content; Convex weathered bedrock bluffs, typically at moderate slope gradients; and fluvial terraces above the influence of modern stream processes.	Generally reasonable conditions for access road and wellpad establishment. Where necessary, employment of mitigations may be to proactively manage natural concentrations of surface runoff and to protect thaw-sensitive permafrost. Moderate expectation for maintenance requirements. Field reconnaissance would help inform route/site selection and mitigation requirements.	28.4%
Low	Poorly to imperfectly drained, thick colluvial slopes with shallow permafrost, commonly with moderate to rich ice content; imperfectly drained fluvial fans and veneers. Regions affected by sheetwash, gully erosion, and ice-wedge polygons are typically included in this category. Surface runoff becomes concentrated.	Generally unfavourable conditions for access road and wellpad establishment, except through mitigations to proactively manage natural concentrations of surface runoff and to protect thaw-sensitive permafrost. Moderate to high expectation for maintenance requirements. Field reconnaissance is necessary to inform route/site selection and mitigation requirements.	32.8%
Very Low	Very poorly to imperfectly drained areas with shallow or near-surface permafrost, commonly with rich to moderate ice content. Includes most floodplains and steep bedrock scarps. Thermokarst subsidence and ice-wedge polygons are common on level to gently sloping ground, and slopes may be subjected to mass movements including solifluction and active-layer detachments.	Unfavourable conditions for access road and wellpad establishment. Any necessary crossings will require comprehensive mitigations to protect thaw-sensitive permafrost and manage surface runoff and compressible, fine grained sediments. Road construction through steep bedrock scarps would require earthworks and potentially localized blasting. Maintenance expectations are high. Field reconnaissance is critical to inform route/site selection and mitigation requirements.	21.4%

Most moderate terrain can be found over mid- to upper-valley slopes and is mantled by imperfectly drained colluvial veneers and convex, moderately sloping weathered bedrock ridge crests. A summary of the implications for construction has been presented in association with typical constraints expected within each class (Table 5). Design, construction and maintenance of exploration infrastructure generally require greater effort and more complex mitigative solutions as road and wellpad suitability decreases.

The MBC disposal suitability serves to highlight ice-poor, gently-sloping, and relatively stable regions of the landscape set back from significant watercourses as potentially suitable for MBC disposal (Table 6). These criteria were generally met along broad ridge systems and isolated knolls. A total of 13.2% of the study area has been classified as potentially suitable for MBC drill cuttings disposal, most commonly in association with areas classified as High or Very High suitability for road and wellpad suitability. Runoff may be variable at the mapped scale such that different areas within a polygon may have less or more interaction with surface water. For example, polygons affected by slopewash may show discrete runnels where runoff is concentrated. As a result, field investigations are suggested to refine the MBC disposal suitability classifications at a site-specific scale which would better determine target areas for cuttings disposal within each map unit (polygon).

Table 6. Mix-bury-cover (MBC) disposal suitability classification.

MBC Disposal Suitability	Description	Percent of Study Area
Potentially Suitable	Generally geomorphologically isolated regions on level or near-level, elevated areas with minimal or no receipt of surface runoff (i.e., 'shedding sites'). Areas are typically located along broad to rounded ridge crests and knolls that are set back from significant watercourses.	13.2%
Probably Unsuitable	Includes moderate to steeply sloping regions; areas with ice-rich permafrost; and areas exhibiting evidence of geomorphological instability such as fluvial erosion, thermokarst subsidence, solifluction, and active-layer detachments.	86.8%

5. Recommendations

Palmer recommends Chance consider a number of logical follow-up initiatives based on the results of this mapping project to help optimize its upcoming multi-year, multi-well drilling program:

- **GIS-based road routing optimization analysis** – To minimize design, construction, maintenance, and rehabilitation costs, project elements and infrastructure should be site to minimize exposure to low Exploration Development Suitability terrain to the extent possible. This may be accomplished through a collaborative GIS-based road routing analysis between Palmer and the Chance project team, whereby effort and cost are attributed to distinct terrain units, and optimized for development.

- **Incorporation of environmental discipline perspectives into suitability** – The Exploration Development Suitability classification was prepared with a focus on terrain and permafrost constraints. Combining this with the perspectives of other environmental disciplines would yield a more robust suitability classification by accounting for additional environmental values (e.g., vegetation, wildlife habitat, First Nations land uses, archaeological resource potential, etc.).
- **Road alignment delineation** – Following determination of an approximate road route at the polygon-scale (two bullets above), more precise delineation of an actual road alignment would help enable avoidance of local terrain and permafrost constraints (e.g., drainage runnels, thermokarst).
- **Targeted field investigations of complex terrain and areas for MBC disposal** – Complete avoidance of terrain with low or very low Exploration Development Suitability may not be feasible given its abundance in lower valley and floodplain positions. Targeted field investigations in these locations would serve to fine-tune the alignment and confirm the interpretations, site conditions, and cost implications. As local permafrost and runoff conditions may show slight variability at the mapped scale, targeted field investigations would also benefit the selection of specific sites for MBC disposal within polygons identified as Potentially Suitable for MBC disposal.
- **Proactive identification of rehabilitation plans** – It may be productive for Chance to proactively identify its planned approaches for site, road, and wellpad rehabilitation following the completion of work, in anticipation of comments by YESAB, First Nations, and other stakeholders. Rehabilitation plans are best tailored to existing ground and runoff conditions.

6. Statement of Limitations

This report has been prepared by Palmer for Chance in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the “Master Service and Supply Agreement”). The report and the information it contains may be used and relied upon only by Client, except (1) as agreed to in writing by Consultant and Client, (2) as required by-law.

The extent of this study was limited to the specific scope of work for which Palmer was retained and is described in this report. Palmer has assumed that the information and data provided by the client or any secondary sources of information are factual and accurate. Palmer accepts no responsibility for any deficiency, misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or negligent acts from relied-upon data. Judgement has been used by Palmer in interpreting surficial geology, geomorphological processes, and exploration development susceptibility based on desktop analysis and limited field reconnaissance. Interpretations of subsurface conditions have been made based on surface observations and limited subsurface exposures and may not fully capture the variability in the study area or within a given map unit (polygon).

Palmer is not a guarantor of site conditions or potential hazards or risks but warrants only that our work was undertaken and our report prepared in a manner consistent with the level of skill and diligence normally exercised by competent geoscience professionals practicing in Yukon. Our findings, conclusions and recommendations should be evaluated in light of the limited scope of our work.

7. Certification

This memorandum was prepared and reviewed by the undersigned.

Prepared By: DRAFT

Cory McGregor, GIT
Geoscientist

Reviewed By: DRAFT

Robin McKillop, M.Sc., P.Geo.
Principal, Geomorphologist

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Appendix A.

Surficial Geology and Permafrost Classification.
Eagle Plains, Yukon

Appendix B.

Exploration Development Suitability.
Eagle Plains, Yukon

APPENDIX 2-D-31. *Land Tenure Extension Request for Exploration Permits 0008-0017, 0019 and 0020 ("Permits")* Letter

Chance
OIL AND GAS LIMITED

December 15, 2021

Government of Yukon
Department of Energy, Mines and Resources
P.O. Box 2703
Whitehorse, YT
Y1A 1B2

sent via emai [redacted]

Attention: Hon. [redacted] **Minister of Energy, Mines and Resources**
Dear Sir:

Re: Land Tenure Extension Request for Exploration Permits 0008-0017, 0019 and 0020 ("Permits")

Chance Oil and Gas Limited ("Chance", the "Company") hereby requests that the referenced Permits be extended for an additional five years pursuant to Sections 27(b), 28(1)(c) and (d) and 31.01 of the Yukon *Oil and Gas Act* (the "Act"). The basis for this extension request is described in the following paragraphs and has not materially changed since the last request for tenure extension was made on March 11, 2020 for one of the Exploration Permits. Timelines to be able to exercise exploration rights in Yukon are long and growing.

The actions of Chance and its predecessor, Northern Cross (Yukon) Limited, in respect of the rights under the Permits have been consistent with the Act by diligently trying to conduct an exploration program at Eagle Plains to evaluate the crude oil and natural gas resource potential. These efforts are substantially documented in the records of a variety of government departments, including Energy Mines and Resources. The Company has only been partially successful accomplishing its exploration objectives.

Unfortunately, Chance has been subjected to external influences beyond the control of the Company. These include the indefinite, perhaps permanent, moratorium on hydraulic fracture

stimulation ("Moratorium") in the Eagle Plain Sedimentary Basin, the impact of the Peel Watershed Land Use Planning exercise which challenged access, and the inconsistent, unpredictable and expanded time and information requirements of environmental impact assessment processes with the Yukon Environmental and Socio-economic Assessment Board ("YESAB"). Timelines and conditions related to the conduct of exploration activities are further increased by the requirement under Ministerial Orders whereby Chance has established Engagement and Communication Plans ("Plans") with four First Nations, including designated organizations. The Company is using its best efforts to actively implement these Plans in respect of a significant exploration project, but the pace of this implementation is slow and uneven and has been dramatically affected by Covid 19. The collective impact of these influences was not reasonably foreseen at the time Chance was awarded the Permits nor after exploration activities commenced, but they have adversely affected the ability of the Company to exercise its exploration rights either in a timely way or at all.

Since the Permits were originally awarded during the period between 2007 and 2010, Chance has demonstrated its commitment to oil and gas exploration in Yukon by diligently undergoing several YESAB assessments, obtaining regulatory approvals, and executing drilling and seismic data acquisition programs within the area of the Permits. This work was conducted in an environmentally and corporately responsible manner and in full compliance with various permits and licenses issued to undertake this exploration work. The efforts of the Company have advanced the geological understanding of the Eagle Plain Sedimentary Basin while providing very significant benefits to Yukon in the form of employment, training, and business opportunities. Well over $100 million has been spent, which is about five times the amount that was committed at the time these Permits were originally awarded. Most of this investment is now stranded in view of the Moratorium.

Chance has undertaken or consultants acting on behalf of Chance have undertaken the following activities related to the proposed multi-well exploration and seismic data acquisition program:

1. Geological field program to sample rocks at various outcrops at Eagle Plain to help mature new prospects,
2. Purchased under license vintage 2D seismic data in the Eagle Plain area,
3. Bird survey,
4. Fish and other aquatic surveys,
5. Site investigations of vintage and modern seismic lines to understand use by wildlife and humans and regeneration patterns,
6. Field studies covering a range of permafrost processes;
7. Water sampling at various locations in the proposed area of exploration interest;
8. Porcupine Caribou studies in collaboration with the Porcupine Caribou Management Board,
9. LiDAR and aerial photography surveys; and

10. Meetings with affected First Nations in Old Crow, Inuvik, Tsiigehtchic, Ft. McPherson, Aklavik, Dawson City, Mayo and Whitehorse in respect of a proposed multi-well exploration and seismic data acquisition plan.

More field work is planned for the winter of 2022-2023 to evaluate the condition of 8 suspended wells operated by Chance with the objective of remediating any problems so the wells can remain suspended until used in future operations, converting two wells to become deep zone injectors or disposal wells, extended flow testing of three natural gas formations in three vintage wells and abandoning at least 3 of the suspended wells. Where possible, Chance hires First Nation citizens to participate in these field programs. In the past three years, the approximate expenses incurred to undertake these activities was $6.7 million. Spending at this level or higher is anticipated to continue for additional exploration work and related activities as described above for well maintenance and continuance. Preserving suspended status of wells that are sound and secure supports the request for tenure extension as well.

Chance is hopeful that it will be in a position to submit to the Executive Committee of YESAB under new processes expected to commence in the first quarter of 2022 to begin the assessment of the multi-well exploration drilling and seismic data acquisition project, but First Nation engagement under the Plans may be a rate determining step.

The maintenance program planned for the winter of 2022-2023 offers a great opportunity to measure the depth of permafrost and Chance plans to run a temperature survey in a number of the suspended wells to determine the geographic extent of permafrost and any variability of its depth.

Notwithstanding very limited oil field service and supply capacity resident in Yukon, the historical exploration drilling and seismic data gathering programs operated by the Company were organized and executed in a way that responded to concerns expressed by many Yukon stakeholders to maximize Yukon participation and mitigate the historical experience of intensive, short term projects punctuated by lengthy periods of inactivity that collectively had the effect of restricting local participation in employment, training and business opportunities. For almost two years, Chance's drilling and seismic programs provided reasonably steady employment for many Yukon citizens working directly or indirectly on the projects. Going forward, to overcome the frustration of starting and stopping, future activities are expected to be small scale and be undertaken over longer time periods. This style of operation has the objective of providing opportunities for Yukon citizens and businesses to invest in training and equipment to be able to assume growing roles in any activities that Chance might propose while benefitting from learning curve efficiency and economy of scale arising from steady, predictable operations. Environmental impacts are expected to be significantly reduced by operating on a small scale over longer periods of time, too.

Future exploration activities will require maximum allowable tenure extensions in order to satisfy commitments anticipated to be made under the Plans as they are implemented, undergo higher level YESAB impact assessments, obtain required regulatory approvals and ultimately undertake any planned activities. For example, in several meetings with your officials, Chance has outlined an exploration plan to drill up to thirty (30) exploration and appraisal wells, acquire up to fifteen hundred (1,500) square kilometres of new 3-D seismic data and acquire up to two thousand (2,000) kilometres of new 2-D seismic data. This plan will take years to complete especially if the scale of operations is small in order to minimize environmental impacts and maximize participation of Yukon citizens and businesses. Prior to undertaking this program, environmental impact assessments are required which are expected to take at least a couple of years to complete with more time needed to execute on approved activities.

Developing Yukon energy resources will also have a beneficial impact on greenhouse gas emissions by displacing imported fuels extracted and processed thousands of kilometres away from Yukon. In addition, as the energy market transitions to a lower or no carbon condition, the hydrocarbons in Yukon offer a great source of hydrogen and the geological formations at Eagle Plains provide opportunities to sequester CO2.

This letter has been prepared on a "Without Prejudice" basis given the unresolved legal claim that the Company has made against Yukon in respect of the damages caused by the Moratorium. Tenure extension is needed to continue implementing the Plans and advance the proposed exploration project through the YESAB process to execution.

In conclusion, Chance believes that it has diligently acted and continues to act in a manner that is consistent with the Act, that the exercise of its exploration rights has been significantly impaired by circumstances that were neither foreseen nor within the Company's control. Throughout the evolving landscape of procedural changes, political sensitivity and growing obligations to engage with aboriginal communities, Chance has taken numerous and costly measures to mitigate the impediments where it can.

Chance trusts that you will consider this tenure request in the face of expanding timelines and complexities associated with the undertaking of exploration projects.

Yours truly,
Chance Oil and Gas Limited

[redacted]

FOR [redacted]

Cc: [redacted]

[redacted]

Chief [redacted]
Chief [redacted]
Chief [redacted]
Grand Chief [redacted]

APPENDIX 2-D-32. *2022 Annual Report on the Implementation of Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan*

2022 ANNUAL REPORT

Implementation of the Tr'ondëk Hwëch'in and Chance Oil and Gas Engagement and Communication Plan

Prepared for:

Yukon Government
Department of Energy, Mines and Resources
Oil and Gas Resources
Box 2703
Whitehorse, YT Y1A 2C6

July 22, 2022

Prepared by:

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1.0 INTRODUCTION

This report demonstrates implementation of the *Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan* (Plan) (see **Appendix A**) finalized on August 28, 2018. It summarizes discussions held between Tr'ondëk Hwëch'in (TH) and Chance Oil and Gas Limited (Chance) between June 1, 2021 and May 31, 2022. The purpose, objectives, and outcomes of each discussion are described below in order to fulfill the requirements of Ministerial Order (MO) 2018/42 (see **Appendix B**) issued to Chance on August 30, 2018.

2.0 BACKGROUND

The development of communications and engagement plans began with Order in Council (OIC) 2016/169. OIC 2016/169 required Chance to file a First Nations communication and engagement plan with the Minister of Energy, Mines and Resources in order to extend tenure on their northern permits: 0005, 0006, 0007, 0008, 0009, 0010, and 0011. Chance complied with OIC 2016/169 and received their tenure extension.

Chance subsequently received MO 2017/37 when applying for tenure extension on six of eight southern permits: 0012, 0013, 0014, 0015, 0016, and 0017. MO 2017/37 required Chance to revise, in consultation with affected First Nations, the consultation and engagement plan filed under OIC 2016/169. The affected First Nations listed in MO 2017/37 were Vuntut Gwitchin First Nation, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Gwich'in Tribal Council, and Tetlit Gwich'in Council.

TH and Chance collaboratively developed their Plan through a series of in-person meetings and conference calls. Hemmera was retained by Chance in November 2017 to facilitate the development and completion of the communications and engagement plans with the affected First Nations and facilitated all discussions between TH and Chance.

TH and Chance submitted their finalized Plan to Minister Ranj Pillai on August 28, 2018. To satisfy its obligations under MO 2017/37, Chance filed a total of four communications and engagement plans. All four plans were approved by the Minister and Chance received a five-year tenure extension on the six southern permits.

A condition of the five-year tenure extension, issued via MO 2018/42, required that Chance submit annual reports summarizing actions taken to implement each communications and engagement plan.

See **Appendix C** for a map of Chance's current permits.

3.0 ENGAGEMENT AND COMMUNICATION PLAN IMPLEMENTATION SUMMARY

3.1 Overview

Between June 1, 2021 and May 31, 2022, TH and Chance had one meeting on the Eagle Plains Exploration Project. Their meeting frequency over the past year was impacted by Chance's internal work to advance its project description. Additionally, the COVID pandemic posed challenges to safely conducting engagement activities. Preventing the transmission of COVID and adhering to public health measures were

a priority. While TH and Chance did not substantially advance discussions related to the Eagles Plains Exploration Project, have maintained their relationship.

No additional engagement activities occurred for Chance's Well Maintenance and Extended Flow Testing Project while it underwent YESAB review.

3.2 June 8, 2021 - Meeting

Chance hosted a virtual meeting with TH Chief Roberta Joseph and TH Technical Staff, Palmer, and Hemmera. The purpose of this meeting was for Chance and Palmer to present baseline information on Permafrost studies and to provide an opportunity for parties to discuss engagement preferences, planning, and upcoming engagement reports. During the meeting TH requested additional information around Chance's consultation with other First Nations, probed around topics including subsurface geology work, hydrogeology, sampling methodologies, climate change and inquired about progress on the Information Request for the Designated Office project (i.e., Chance's Well Maintenance and Extended Flow Testing Project).. Chief Roberta Joseph shared her sentiments about the communication difficulties between Chance and with the Vuntut Gwitchin and expressed the importance of the Porcupine Caribou for cultural and spiritual wellbeing, and protection of water.

Chance has shared baseline information for wildlife studies.

3.3 Communication Log

The correspondence between Chance and TH is documented in the Engagement Log (see **Appendix D**).

4.0 PLANS FOR ONGOING ENGAGEMENT AND NEXT STEPS

On July 27th, 2022, there was correspondence from Chance to TH about how a planning meeting went with Yukon Government and a brief summary of current activities was given. Although this meeting is outside of the scope of this 2022 implementation report, it is important to mention that there was a discussion about developing a comprehensive submission to go into the Executive Committee Screening Process. Also in the correspondence about the meeting, Chance stated to Yukon Government that Consultation will be a priority during this process and other things also discussed was the baseline data gathering, including terrestrial and water, and adding an affects assessment. For the update component of current works, Chance stated that Heritage work is underway in Eagle Plains and that Chance is also working on the valued components for the project and is going to proceed with a referral to the Executive Committee.

TH and Chance will be re-engaging on the Eagle Plains Exploration Project during summer and fall of 2022.

5.0 APPROVAL OF IMPLEMENTATION SUMMARY

TH and Chance have reviewed this report and agree to its contents as an accurate summary of the engagement activities carried out between June 1, 2021 and May 31, 2022.

Per: Tr'ondëk Hwëch'in

[redacted]

Per: Chance Oil and Gas Limited

[redacted]

APPENDIX A

Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan

Tr'ondëk Hwëch'in and Chance Oil and Gas Limited Engagement and Communication Plan

1.0 Introduction

Chance Oil and Gas Limited (Chance) is an oil and gas exploration company that holds permits to perform oil and gas exploration activities in the Eagle Plain basin of Yukon Territory, Canada. As part of Chance's exploration program, Chance seeks to develop engagement and communication plans with all the First Nations that are potentially affected by Chance's exploration program activities. Permits 15 and 17 fall partially within Tr'ondëk Hwëch'in Traditional Territory and Chance is seeking to engage Tr'ondëk Hwëch'in (TH) on its activities within these permits.

2.0 Purpose

This document serves as an Engagement and Communication Plan (Plan) to provide a mutually agreed upon framework to support collaborative and effective engagement and communication between Chance and TH now and into the future.

3.0 Relationship

Chance and TH will execute this Plan according to the following principles:

- Transparency and openness;
- Timeliness;
- Integrity;
- Adaptive Management;
- Mutual respect; and
- Working towards trust and understanding of one another.

4.0 Key Tr'ondëk Hwëch'in and Chance Connections

Engagement and communication between Chance and TH will be generally associated with the proposed work and potential effects associated with Chance's oil and gas exploration program and potential opportunities (via training, employment, contracting, and other community investments), as well as any topics or issues identified through engagement and communication associated with Chance's proposed activities. This section of the Plan identifies the key contacts related to these overarching engagement and communication themes. Key representatives involved in engagement and communication are expected to be as follows:

- Chief and Council;
- TH Government department officials and advisors;
- TH Business Development agencies;
- TH Citizens and communities at large; and
- Proponent Management and designated staff and advisors.

The table in the Schedule to this Plan lays out the key engagement and communication topics, in no particular order, and associated key contacts for both Chance and TH.

5.0 Engagement and Communication Methods

Chance and TH will employ the following engagement and communication methods for specific correspondence:

- In person meetings;
- Email;
- Letters;
- Sharing Power Point Presentations (to support in person meetings);
- Sharing reports and other documents (as requested and as required); and
- Telephone (teleconferences and less formal phone calls).

Engagement and communication methods that support general communication of Chance's activities are as follows:

- Chance newsletters; and
- The website for Chance Oil and Gas Limited.

Engagement and communication meetings will be executed in the following manner:

1. Chance or TH will request a meeting in writing to the other party according to the connections iterated in Table 1;
2. The parties to meet will develop the agenda collaboratively;
3. The party requesting the meeting will develop supporting materials (collaboratively, where possible), and share those in advance of the meeting; and
4. The meeting will take place in a mutually agreeable location.

The above general process applies to meetings with subject matter leads (Table 1) as well as meetings with Citizens and communities at large.

Through engagement with North Yukon First Nations, Chance understands that there are existing agreements between Tr'ondëk Hwëch'in, the First Nation of Na-Cho Nyäk Dun, and Vuntut Gwitchin First Nation. In keeping with the relationship principle of mutual respect, Chance will work within any communications protocols or provisions existing or developed pursuant to these agreements, where applicable and as directed by TH.

The following documentation sharing and review protocols support the methods described above:

- Chance and TH will discuss and establish the confidentiality of meeting minutes in advance of each meeting; i.e. if a meeting is to not be included in the record that will be submitted to regulators and assessors, it is the responsibility of both parties to discuss and agree to this prior to the meeting beginning;
- Chance will take meeting minutes and send these to TH within two weeks via email. Within 30 days of receiving the minutes TH will review and make changes through tracked changes or another method agreed to by both parties. Should TH require more time to review the meeting minutes, TH will notify Chance by email within two weeks of receiving the minutes. The parties will agree on meeting minutes before such minutes become part of the record. No response by TH to Chance's email providing meeting minutes within the 30 days will be interpreted as general acceptance of the meeting minutes by TH, and no response by Chance to TH's email providing amended meeting minutes within 30 days will be interpreted as general acceptance of the amended meeting minutes by Chance;
- Action items and meeting outcomes will be logged during meetings and reviewed by both parties at the end of the meeting to ensure that there is general agreement on the list of actions and parties responsible for those actions. Chance will include the list of action items and meeting outcomes with the meeting minutes;
- Chance and TH will agree upon and use a password-protected file sharing platform to facilitate sharing of large files, such as Power Point presentations and reports; and,
- Should Chance or TH employ a third party for records development and management, the third party will follow the process iterated above for recording and providing meeting minutes.

6.0 Records Management

All information exchanged by Chance and TH is subject to a confidentiality agreement to be agreed upon in the future by Chance and TH.

Subject to collaborative review and the written agreement of both parties, Chance and TH consent to the disclosure of the following information to regulators and assessors for review if and when a potential project is assessed in the future:

- Meeting agendas;
- Non-confidential meeting minutes (finalized versions as described in section **5.0 Engagement and Communication Methods);**
- Invitee/Attendees lists and/or meeting sign-in sheets;
- Records log, which will include summaries of the following:
    - In person meetings;
    - Phone calls and teleconferences;
    - Incoming and outgoing emails between Chance and Chance's representatives and TH representatives;
    - Attachments to the above noted incoming and outgoing emails;

- Reports provided to TH by Chance and reports provided to Chance by TH for review and consideration for engagement and communication purposes; and
- Copies of Power Point presentations delivered by Chance to TH for engagement and communication purposes.

7.0 Adaptive Management of the Engagement and Communication Plan

Chance and TH will review and assess the effectiveness and success of this Plan on at least a 6-month basis.

Within 3 months of the Plan first being agreed to and implemented, Chance and TH will:

- as a first step, sign a confidentiality agreement as contemplated by Section 6.0 above;
- meet to check in on the progress made by both parties in implementing the Plan;
- develop a schedule for review of the Plan; and
- discuss the need for a long-term budget and a comprehensive formal capacity funding agreement to enable TH to participate in future engagement.

Schedule

Key Engagement and Communication Topics and Leads

Role or Subject Matter	TH Key Contact	Chance Key Contact
Project Lead	[redacted]	[redacted]
Culture and Community (includes Indigenous Knowledge and Indigenous Land Use, heritage resources, social, health, and other "human environment" subjects)	[redacted]	[redacted]
Engineering and Geology	[redacted]	[redacted]
Environmental (includes water, aquatic environment, fish, wildlife, forest resources and other plants, and other environmental subjects)	[redacted]	[redacted]
Opportunities (includes community investment, training, education, contracting, employment, and other business opportunities)	[redacted]	[redacted]
Agreements and Capacity Funding	[redacted]	[redacted]

APPENDIX B

Ministerial Order 2018/42

YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,

(d) oil and gas permit No. 0015,

(e) oil and gas permit No. 0016,

(f) oil and gas permit No. 0017. « *permis visé* »

2 The renewal term of each subject permit is extended by five years (so that it ends on August 30, 2023).

3 The resulting total length of the initial term and the renewal term of a subject permit is 16 years.

YUKON

CANADA

ARRÊTÉ MINISTÉRIEL 2018/42

LOI SUR LE PÉTROLE ET LE GAZ

Le ministre de l'Énergie, des Mines et des Ressources, conformément à la *Loi sur le pétrole et le gaz*, arrête :

1 La définition suivante s'applique au présent arrêté.

« permis visé » Les permis suivants de pétrole et de gaz détenus par Chance Oil and Gas Limited :

a) permis de pétrole et de gaz nº 0012;

b) permis de pétrole et de gaz nº 0013;

c) permis de pétrole et de gaz nº 0014;

d) permis de pétrole et de gaz nº 0015;

e) permis de pétrole et de gaz nº 0016;

f) permis de pétrole et de gaz nº 0017. "*subject permit*"

2 La durée du renouvellement de chaque permis visé est prolongée de cinq ans, de façon à ce qu'elle se termine le 30 août 2023.

3 La durée totale d'un permis visé, y compris la durée initiale et la durée du renouvellement, est de 16 ans.

4(1) In this section

"first nations communications and engagement plan" means the plan filed under O.I.C. 2016/169 and revised in accordance with M.O. 2017/37. *« plan de participation et de communication avec les premières nations »*

(2) It is a condition of this Order that Chance Oil and Gas Limited must file annual reports with the Division Head, in accordance with subsection (3) and to the satisfaction of the Division Head, about the implementation of the first nations communications and engagement plan.

(3) For the purposes of subsection (2), Chance Oil and Gas Limited must file

(a) the first annual report on or before July 31, 2019, in respect of the period beginning on September 1, 2018, and ending on May 31, 2019; and

(b) each subsequent annual report on or before July 31 of each year in respect of the period beginning on June 1 of the preceding year and ending on May 31 of the year in which the report is to be filed.

4(1) La définition suivante s'applique au présent article.

« plan de participation et de communication avec les premières nations » Le plan déposé en vertu du Décret 2016/169 et révisé en conformité avec l'Arrêté 2017/37. *"first nations communications and engagement plan"*

(2) À titre de condition du présent arrêté, Chance Oil and Gas Limited dépose des rapports annuels auprès du chef de division, en conformité avec le paragraphe (3) et à la satisfaction du chef de division, concernant la mise en œuvre du plan de participation et de communication avec les premières nations.

(3) Pour l'application du paragraphe (2), Chance Oil and Gas Limited dépose :

a) le premier rapport annuel au plus tard le 31 juillet 2019, pour la période débutant le 1er septembre 2018 et se terminant le 31 mai 2019;

b) chaque rapport annuel subséquent, au plus tard le 31 juillet de chaque année pour la période débutant le 1er juin de l'année précédente et se terminant le 31 mai de l'année au cours de laquelle le rapport doit être déposé.

Dated at Whitehorse, Yukon,
~~Dc~~ August 30th 2018.

Fait à Whitehorse, au Yukon,
le August 30th 2018.

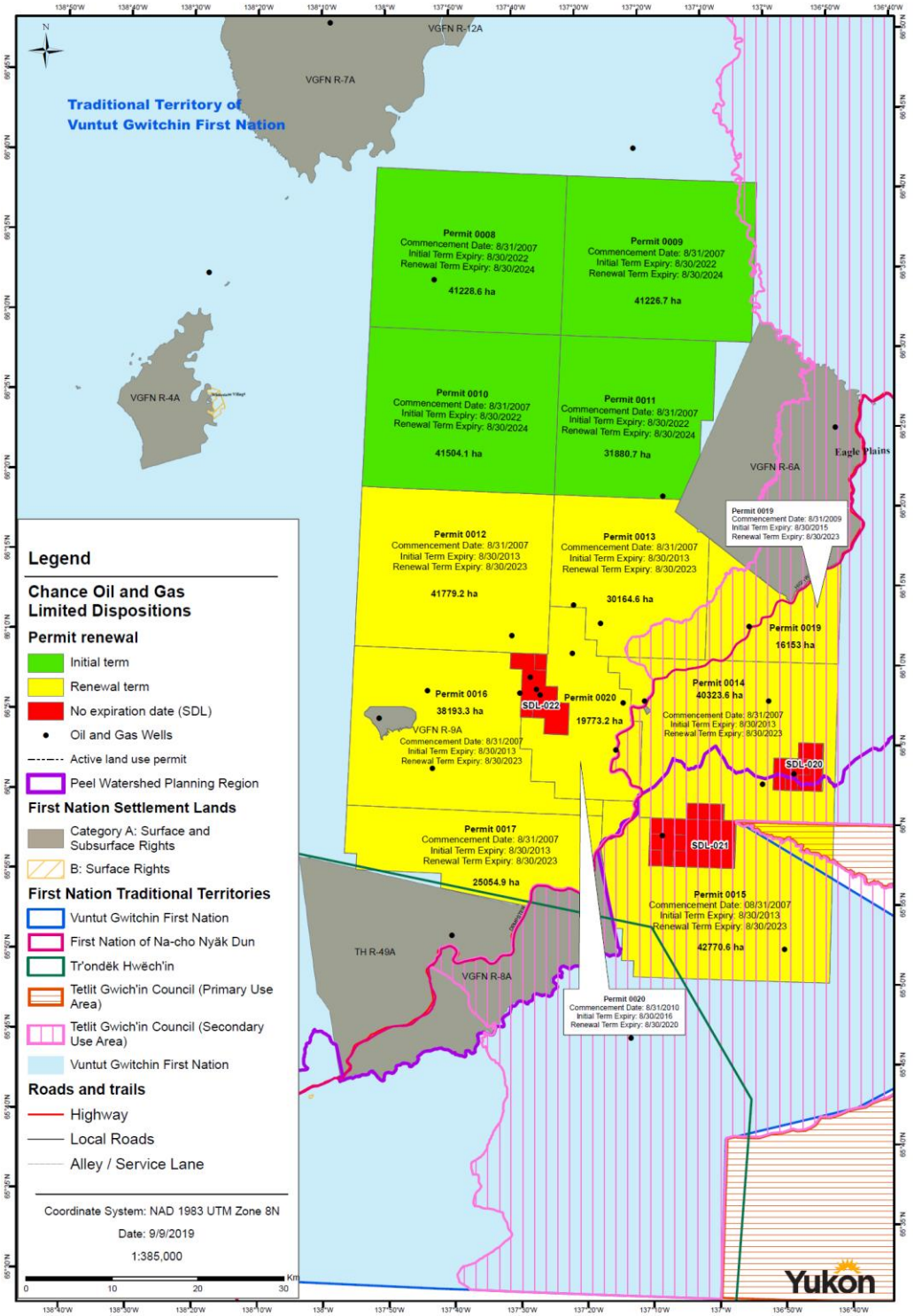
[redacted]

Minister of Energy, Mines [redacted] ergie, des Mines et des Ressources

APPENDIX C

Map of Chance Dispositions and Wells

Chance Oil and Gas Limited Dispositions and Wells



APPENDIX D

Engagement Log

Reference	Date	Contact Type	In / Out	Organization	Author	Proponent/Proponent Rep	External Organization Names	Topic/Regarding	Meeting/Correspondence Summary	Additional Comments	Record Name
E00038	January 7, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement/Consultation Confidentiality Agreement Benefits/Capacity Agreement	Confidentiality agreement and capacity funding letter on January Council meeting (Jan 10). Will let know of any updates		E00038_190207_RE_ Chance Oil and Gas Update_3
E00081	January 7, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement/Consultation	Follow up on action items from last meeting		E00081_190212_Chance Oil and Gas Update
E00015	January 10, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Asking about who is confirmed for YG attendance		E00015_190206_Re_ Chance All-Party Meeting Logistics_2
E00069	January 10, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Travel details, costs that will be covered, suggested flights.		E00069_190211_Chance All-Party
E00097	January 10, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Listing YG people attending meeting		E00097_190212_RE_ Chance All-Party Meeting Logistics
E00039	January 15, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement/Consultation Confidentiality Agreement Benefits/Capacity Agreement	Confidentiality agreement and capacity funding letter approved by TH Chief and Council. Please send funding letter signed by Chance		E00039_190207_RE_ Chance Oil and Gas Update_4
E00091	January 15, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Minister[redacted] attend portion of chance meeting.		E00091_190212_Minister Pillal at All-Party Meeting
E00086	January 16, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Confidentiality Agreement Engagement/Consultation Benefits/Capacity Agreement Meeting Coordination/Planning	Forwarded message from[redacted] about approval. Next steps to arrange signing of Confidentiality Agreement and capacity funding letter.		E00086_190212_FW_ Chance Oil and Gas Update
E00115	January 16, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Confidentiality Agreement	Thanks for update, can TH arrange signing of Confidentiality Agreement then send to Chance?		E00115_190212_RE_ Chance Oil and Gas Update
E00142	January 18, 2019	Phone Call	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Chance called TH to follow up on TH's attendance at the All-Party Meeting.		
E00143	January 18, 2019	Phone Call	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Benefits/Capacity Agreement Confidentiality Agreement	Chance called TH to follow up on the completion of the Confidentiality Agreement and the Letter of Agreement for Capacity Funding.		
E00144	January 18, 2019	Phone Call	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Benefits/Capacity Agreement	Chance called TH to follow up on the completion of the Letter of Agreement for Capacity Funding.		
E00014	January 22, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Benefits/Capacity Agreement Confidentiality Agreement Engagement/Consultation	Attached Confidentiality Agreement between TH and Chance. Chance should address initial capacity funding letter to TH's Acting Executive Director,[redacted]. Noted previous version sent by chance was a tracked changes version dated 2018. Working on confirming attendees to the all party meeting.		E00014_190206_RE_ Capacity Funding Letter and All-Party Meeting
E00068	January 22, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Who to address Capacity Funding Letter to. Will TH be attending all-party meeting?		E00068_190208_Capacity Funding Letter and All-Party Meeting
E00003	January 24, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	TH cannot attend the All-Party Meeting. They suggested an alternate meeting date.		E00003_190124_FW_ All Parties Meeting
E00004	January 24, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Chance is sorry that TH cannot attend all-party Meeting but will proceed with the meeting in Vancouver on February 1. Chance will provide presentations and material to TH after the meeting.		E00004_190124_FW_ All Parties Meeting
E00007	January 24, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Confidentiality Agreement	Attached Confidentiality Agreement between TH and Chance, dated Jan 22, 2019.		E00007_190206_Executed CA
E00096	January 24, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	[redacted] has sent completed Capacity Funding letter and cheque to TH		E00096_190212_RE_ Capacity Funding Letter and All-Party Meeting
E00163	March 27, 2019	Letter	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Tenures/Dispositions/Permits	Request to extend tenure on Exploration Permits 0006-0011 and 0019 at Eagle Plains		E00163_190401_Letter advising TH of Chance's desire to extend Exploration Permits tenure
E00244	May 13, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Looking to meeting in Dawson on June 11 with[redacted] and colleagues involved in the assessment of the Eagle Plain exploration project. Want to provide an update and share the concept of the project scope and discuss the process of engagement with the TH. Hoping to submit project description to YESAB in the Fall. Would like input of the TH to both project description and other related contributions. Doing a similar exercise with each of the affected First Nations.		E00244_Meeting June 11_
E00279	May 13, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Asking for meeting June 11th, in Dawson with[redacted] and any colleagues involved in the assessment of the Eagle Plain exploration project. Doing the initial work to develop the project description and want to provide an update to you. Would like to share our concept of the project scope and discuss the process of engagement with the TH. Hoping to submit to YESAB in the fall, likely to the Executive Committee and would like input of the TH to both the project description and other related contributions needed to satisfy YESAB. Doing similar with other affected First Nations.		E00279_RE_ Meeting June 11__
E00280	May 13, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	June 11th should be good, including Chief so she is aware.		E00279_RE_ Meeting June 11__
E00281	May 27, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Following up that June 11th Meeting in Dawson still works. Please advise who is attending and where it will be held.		E00279_RE_ Meeting June 11__
E00299	May 31, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Following up on voicemail left by[redacted] trying to book a room for meeting June 11th. Looking for other suggestions on where the meeting can be hosted.		E00299_RE_ Meeting between TH and Chance June 11-1
E00300	May 31, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Happy to help, rooms are full. There is one option that is fairly small, please let us know how many people.		E00299_RE_ Meeting between TH and Chance June 11-1
E00301	June 3, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	There will be approximately 10 people		E00299_RE_ Meeting between TH and Chance June 11-1

E00302	June 3, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	No meeting spaces available June 11 at 8:30		E00299_RE_ Meeting between TH and Chance June 11-1
E00303	June 3, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Asking if small room is booked. Might be able to squish, or reduce number of people attending. Asking if there is a non-convectional meeting space that could be used.		E00299_RE_ Meeting between TH and Chance June 11-1
E00304	June 3, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Check with [redacted] at front desk to see if hall is available. Would have to pay rental fees, but it would be a spot.		E00299_RE_ Meeting between TH and Chance June 11-1
E00305	June 3, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Found a room at KIAK, the Odd Fellows Ballroom that is reserved. Thanks for help finding a place.		E00299_RE_ Meeting between TH and Chance June 11-1
E00306	June 6, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Can you send a meeting request, so she can forward to her team.		E00299_RE_ Meeting between TH and Chance June 11-1
E00307	June 6, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Sorry for delay, will send meeting request shortly. Would you like us to include conference call-in details in the invite and agenda?		E00299_RE_ Meeting between TH and Chance June 11-1
E00308	June 6, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Yes, please send call in details. We will review the agenda together. We will need to make a version for you public disclosure.		E00299_RE_ Meeting between TH and Chance June 11-1
E00309	June 6, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Attached Draft agenda, please advise of any changes.	Attachment: 190606_TH_Chance_Meeting Agenda for June 11_DRAFT	E00309_RE_ Meeting between TH and Chance June 11-2
E00310	June 6, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Will provide feedback shortly, can you send a meeting request as well?		E00310_RE_ Meeting between TH and Chance June 11-3
E00311	June 6, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thank you for your patience. I can also make changes to meeting request.		E00311_RE_ Meeting between TH and Chance June 11-4
E00318	June 6, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Meeting invitation for June 11. This meeting is for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin. Additional agenda items include next steps with YESAB and the process for reviewing Tr'ondëk Hwëch'in Project Effects as well as the annual reporting required on the implementation of the Engagement and Communication Plan.		E00318_Tr'ondëk Hwëch'in and Chance Oil and Gas Exploration Project Description Meeting
E00296	June 7, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	Draft Project Description and presentation for meeting attached. Please distr bute to those attending the meeting. Will bring paper copies. Please provide an estimate of attendees.	Attachments: 190605_Chance Oil and Gas Eagle Plains Project Description, 190604_Chance_Presentation_ProjectDescription+ExCom_THDawson_v0.4	E00296_Meeting Material for Chance Meeting June 11
E00312	June 10, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Updated agenda for meeting	Attachment: TH Chance meeting agenda for June 11,2019 (00052582xDD1F1)	E00312_RE_ Meeting between TH and Chance June 11-5
E00313	June 10, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Agenda looks good. Will need to end meeting at 10:15 rather than 11, due to weather moving in and flights plans. Will be at KIAK ballroom early and have everything set up to begin at 9.		E00313_RE_ Meeting between TH and Chance June 11-6
E00476	June 11, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Information Sharing Project Description/Activities	We forwarded this material to [redacted] last week, just making sure you have it for our call. We have a conference line set up for our meeting with TH at 9am.	Attached: 190604_Chance_Presentation_ProjectDescription+ExCom_THDawson_v0.4.pdf, 190605_Chance oil and Gas Eagle Plains Project Description.pdf	E00476_FW_ Meeting Material for Chance Meeting June 11
E00253	June 24, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Fish Information Sharing	Attached notice letter regarding DFO licence application for Environmental Dynamics Inc's fish studies	Attachment: DFO license application Tr'ondëk Hwëch'in	E00253_Notice Letter_ DFO application for upcoming fish studies (1)
E00267	June 24, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Information Sharing Engagement/Consultation	Draft Summary of the June 11, 2019 meeting in Dawson City between Chance and Tr'ondëk Hwëch'in	Attachment: 190617 Draft June 11 TH-Chance Meeting Summary_v.3	E00267_Draft June 11 Meeting Summary for Review
E00298	June 25, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	Attached Chance Project Description also a separate clip of Chance's Community Consultation Program (Proposed Activity Alignment)	Attachment: 190604_Chance_Presentation_ProjectDescription+ExCom_THDawson_v0.4, 190611_Chance_CommunityConsultationProgram_ProposedActivityAlignment	E00298_RE_ Draft June 11 Meeting Summary for Review
E00290	June 27, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Fish Information Sharing	Revisions from EDI for their DFO Application, see Attached	Attachment: 190627_TH_Notice Letter_DFO Permit_WithRevisions and peel_watershed_fish_habitat_assessment	E00290_RE_ Notice Letter_ DFO application for upcoming fish studies (1)
E00317	June 27, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Fish Information Sharing	Thank you		E00317_RE_ Notice Letter_ DFO application for upcoming fish studies (5)

E00331	July 15, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Would you and your colleagues be able to meet with us and our Hemmera advisors either August 12 or 13? My party will be returning south from the GA in Old Crow on Aug 10/11 and could stop in Dawson if you are able to meet. We are also trying to set up a meeting with the Na-Cho Nyäk Dun in Mayo around those dates as well. For now, if you can offer some flexibility on those two dates until we can confirm the interest of the NND for a meeting that would be appreciated. I am thinking that we would allow two or three hours for the meeting to cover the material.		E00331_Meeting on either Aug 12 or 13_5
E00486	July 15, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Hemmera has prepared draft reports on the implementation of the Communications and Engagement Plan for both VGG and Chance to review. This report summarizes meeting we have had since completing the plan. Please make any desired revisions to the document in tracked changes and send back to me to finalize. Once I have incorporated the changes, I will send final versions to both parties to sign. Please have revisions in by July 26, then I will finalize, get them signed and submit to Yukon Government for July 31.	Attached: 190715_DRAFT Plan Implementation Report_TH.docx	E00486_Draft Plan Implementation Report for Review_2
E00332	July 18, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	We can set up a meeting August 12. Would you please be able to send me an agenda we can work on?		E00333_RE_ Meeting on either Aug 12 or 13_4
E00333	July 18, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	It is great that TH can meet. I will start to prepare the agenda. Chance would like to cover are project updates, capacity funding, and the development of a draft cooperation agreement. I will put these items in a draft agenda and send it to you early next week. Inquiring who from TH will attend. What time? Morning would make sure we have enough time to cover all the material. Please advise a time that works best ad I will book a conference room accordingly.		E00334_RE_ Meeting on either Aug 12 or 13_3
E00334	July 22, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	From TH, myself, NR Director [redacted], and [redacted] (by phone) will be in attendance. When possible, could you please send through the meeting invite and initial agenda for discussion.		E00334_RE_ Meeting on either Aug 12 or 13_3
E00335	July 24, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Sent along meeting invite and the agenda. Thinking this visit to Dawson would be a great opportunity to host a dinner for TH citizens as well. Do you think that a dinner from 5:30 -8:00 pm would work on Aug 12? If so, could you suggest a typical venue for community dinners and who I could talk to about advertising and catering?		E00336_RE_ Meeting on either Aug 12 or 13_2
E00336	July 24, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	We at TH are ok with discussing our implementation plan and next steps, but a community consult is not a good idea at this time. We can put this topic as an item on our agenda for the future.		E00336_RE_ Meeting on either Aug 12 or 13_2
E00337	July 24, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement Reports/OIC Requirements	Thanks for advising on the community dinner. We will leave our plans at just meeting with yourself and your colleagues. Would TH like to provide feedback on the Draft Engagement and Communications Plan Implementation Report? I am looking for feedback this week so I have time to finalize the reports next week and submit to YG.		E00331_RE_ Meeting on either Aug 12 or 13_1
E00490	July 24, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	Meeting invitation. Chance and TH will use this time to discuss Chance's exploration project description and discuss capacity funding and a cooperation agreement. Attached Agenda	Attached: 190723_TH-Chance_MeetingAgenda_Aug12_DRAFT.docx	E00490_Chance and TH Meeting_1
E00338	July 25, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I will provide comments at end of day tomorrow or early Friday morning. Thank you.		E00331_RE_ Meeting on either Aug 12 or 13_1
E00498	July 25, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Attached are Chance's edits to the Draft Plan Implementation report	Attached: 190715_DRAFT Plan Implementation Report_TH_RMW.docx	E00498_FW_ Draft Annual Communications and Engagement Report to YG
E00501	July 26, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I will be available to attend this meeting, however I have another meeting at 10:30. If I am able to cancel or reschedule the other meeting, I will be available for the whole meeting.		E00501_RE_ Chance and TH Meeting_1
E00502	July 26, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thanks for letting me know. If you would like to adjust the agenda to review certain items when you are able to attend the meeting, please let me know.		E00501_RE_ Chance and TH Meeting_1
E00504	July 26, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Please find TH's edits to the document. If they are acceptable to you , I can finalize the draft on Monday.		E00504_RE_ Draft Annual Communications and Engagement Report to YG
E00505	July 26, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I have accepted all of TH and Chance's tracked changes and removed the draft watermark. If all looks good for you, this version is ready for signing.	Attached: 190726_DRAFT Plan Implementation Report_TH_RMW_TH Comments_Hemmera.docx	E00504_RE_ Draft Annual Communications and Engagement Report to YG
E00508	July 26, 2019	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I will be attending the meeting Aug 12. Please note my role has changed to Land and Resources Manager. Out new Development Assessment coordinator will likely also attend, but TBC.		E00508_RE_ Chance and TH Meeting_2
E00509	July 29, 2019	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Thanks for letting me know. We will have lots of space in the Downtown Boardroom, the Development Assessment Coordinator is welcome		E00508_RE_ Chance and TH Meeting_2

E00343	July 30, 2019	Email	Out	Tr'ondëk Hwëch'in	Hemmera	[redacted]	[redacted]	[redacted]	Looking for signed letter for the Capacity Funding Agreement. Chance sent a signed copy to Tr'ondëk Hwëch'in at the end of January, but after some house keeping, realized we don't have a final version with both signatures.		E00343_Signed copy of Tr'ondëk Hwëch'in Letter for Initial Capacity Funding Agreement
E00344	July 30, 2019	Email	In	Tr'ondëk Hwëch'in	Ewa Holender	[redacted]	[redacted]	[redacted]	Attached signed letter. TH sent a signed hard copy by mail in February, but sounds like it never arrived.	Attachment: Chance Executed Capacity Funding Letter_022019	E00344_RE_ Signed copy of Tr'ondëk Hwëch'in Letter for Initial Capacity Funding Agreement_1
E00345	July 30, 2019	Email	Out	Tr'ondëk Hwëch'in	Hemmera	[redacted]	[redacted]	[redacted]	Thank you		E00345_RE_ Signed copy of Tr'ondëk Hwëch'in Letter for Initial Capacity Funding Agreement_2
E00546	July 31, 2019	Email	Out	Tr'ondëk Hwëch'in YG	Hemmera	[redacted]	[redacted]	[redacted]	Attached Annual Report on the implementation of the TH and Chance Communication and Engagement Plan	Attached: 190731_TH and Chance Plan Implementation Report	E00546_Annual Plan Implementation Report - TH and Chance
E00547	July 31, 2019	Email	Out	Tr'ondëk Hwëch'in YG	Hemmera	[redacted]	[redacted]	[redacted]	Attached Annual Report on the implementation of the Gwich'in Partners and Chance Communication and Engagement Plan	Attached: 190731_Gwich'in Partners and Chance Plan Implementation Report	E00547_Annual Plan Implementation Report - Gwich'in Partners and Chance
E00551	August 7, 2019	Email	In	Tr'ondëk Hwëch'in	Sidney Schafrik	[redacted]	[redacted]	[redacted]ent	Can you please send the Draft Template that you have generated for the Cooperation Agreement? We would like to be able to review for our discussions Monday.		E00551_RE_ Meeting on either Aug 12 or 13_4
E00552	August 8, 2019	Email	Out	Tr'ondëk Hwëch'in	Hemmera	[redacted]	[redacted]	[redacted]	We don't have a Draft Template to send at this time. Instead we are hoping to use the time for that agenda item to discuss and draft an outline for the cooperation's. The help facilitate the discussion, Hemmera would like to propose the following sections for the agreement: Recitals (or Whereas), Purpose and/or Objectives of the Parties, Term and Termination, Cooperation Commitments, General. Using these as well as any other proposed by Chance or TH, can have high level discussion about the outline and contents of cooperation agreement. Let me know what you think of this approach, happy to adapt or change.		E00551_RE_ Meeting on either Aug 12 or 13_4
E00554	August 9, 2019	Email	Out	Tr'ondëk Hwëch'in	Hemmera	[redacted]	[redacted]	[redacted]	In our meeting Monday, we are going to go through the proposed Cooperation Agreement sections listed below and fill in content that is suggested during the meeting. To do this, we want to share our screen using Skype. I wanted to confirm this could work for you. We can do a trial Monday morning before the meeting if you are available. If this doesn't work, we'll send a word doc with proposed headers for you to follow along during the meeting. We have a better meeting speaker with us for this meeting, so audio will be much better than last time.		E00554_RE_ Meeting on either Aug 12 or 13_5
E00555	August 9, 2019	Email	In	Tr'ondëk Hwëch'in	Ewa Holender	[redacted]	[redacted]	[redacted]	I appreciate your efforts to ensure I can participate from down south. I am happy to do a trial Monday morning if that would work for you. I'm on Skype already.		E00555_RE_ Meeting on either Aug 12 or 13_6
E00556	August 12, 2019	Email	Out	Tr'ondëk Hwëch'in	Hemmera	[redacted]	[redacted]	[redacted]	We are just waiting for the conference phone to be set up. Are you able to access the skype meeting through the link in the meeting invite? In my experience personal skype and business skype do no work together.		E00555_RE_ Meeting on either Aug 12 or 13_6
E00557	August 12, 2019	Email	Out	Tr'ondëk Hwëch'in	Hemmera	[redacted]	[redacted]	[redacted]	We are set up. I am sharing my screen, and we have a speaker in the middle of the table that is picking up all voices. We are still waiting on TH folks. If you are not able to access Skype I've attached the final agenda, the presentation from our last meeting for reference, and the cooperation agreement discussion.	Attached: 190811_TH-Chance_MeetingAgenda_Aug12_FINAL, 190812_Chance and TH Cooperation Brainstorming, 190604_Chance_Presentation_ProjectDescription+ExCom_GtCInuvik_NNDMayo_THDawson_v0.4	E00557_RE_ Meeting on either Aug 12 or 13_7
E01187	August 12, 2019	Meeting		Tr'ondëk Hwëch'in		[redacted]	[redacted]	[redacted]	Meeting summary		E01187_190723_TH-Chance_MeetingAgenda_Aug12_DRAFT.docx E01187_190826_Aug12_TH-Chance_MeetingSummary_Final.docx
E00448	August 26, 2019	Email	Out	Tr'ondëk Hwëch'in	Hemmera	[redacted]	[redacted]	[redacted]	Attached is the draft summary of our meeting August 12, 2019. If you have any revisions, please make them in tracked changes and send to [redacted] to finalize	Attached: 190826_Aug_12_TH-Chance_Meeting_Summary_draftforreview	E00448_TH and Chance Aug 12 Meeting Summary for Review
E00559	September 4, 2019	Email	In	Tr'ondëk Hwëch'in	Sidney Schafrik	[redacted]	[redacted]	[redacted]	I am ok with the contents		E00559_RE_ TH and Chance Aug 12 Meeting Summary for Review
E00560	September 4, 2019	Email	Out	Tr'ondëk Hwëch'in	Hemmera	[redacted]	[redacted]	[redacted]	Thank you, I'll wait for Chance's feedback then finalize the meeting summary		E00559_RE_ TH and Chance Aug 12 Meeting Summary for Review

E00601	January 28, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Tenures/Dispositions/Permits DO Project Engagement/Consultation	Chance will be applying to the Yukon Government very shortly to extend the tenure of Exploration Permit 20. Application will be for maximum allowable under the Oil and Gas Act of 5 years. This permit has one suspended well at McParlon A-25 which we hope to use for fluid disposal of any produced water associated with the proposed exploration project. We are at an intermediate stage of discussions with the Manager of Oil and Gas Operations with Yukon to extend the suspended well status on the suspended wells at Eagle Plain. Manager has indicated hat Chance will need to do some physical assessments of the legacy wells to confirm the integrity of the wells before granting an extension. Assessments will require access to 3 suspended wells at SDL M-08, G-08, and J-19 and well as M-59 in order to do the work. A service rig, cement pumping equipment, and wireline services are expected to be used to conduct the assessments. Anticipate taking temperature measurements in wells to evaluate permafrost depth. The program is expended to take 1-2 months. This is a winter operation and will be done during the winter of 2020-2021 and may require Designated Office screening b y YESAB. We will provide more information as soon as we can.		E00601_FW_ Suspended wells and Exploration Permit 20_3
E00647	March 23, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Information Sharing	Chance Oil and Gas (COG) has several initiatives on the go, some of which are time sensitive and all require engagement with the affected First Nations. The following is a summary of these initiatives: 1.Application to the Yukon Government to get tenure extension on Exploration Permit 0020 which is set to expire on August 30, unless extended. This permit is located mostly in the Traditional Territory of the Vuntut Gwitchin, but a portion is in the Secondary Use Area of the Tetlit Gwich'in and in the overlap area with the Na-cho Nyak Dun Traditional Territory. There is a suspended well in this Permit at McParlon A-25 which has ongoing value to COG. 2.There are several suspended wells at the Chance Significant Discovery License (SDL 022) and one at the Blackie SDL 021 which the Yukon Government requires COG to undertake some maintenance work. This activity will require an impact assessment by the Designated Office (DO) of YESAB in Dawson prior to permissions being granted by Yukon to undertake the work. The plan is to submit to the DO the program in the next month or so with the objective of being able to do the work over approximately a 6 week to two month period in the winter of 2020-2021. This is a regulatory requirement made by the Manager of Oil and Gas Operations with the Yukon Government. Importantly for your knowledge, there is no indication that these suspended wells have any problems, but they are wells that were drilled in the 1960's so the regulator has asked for work to be done in order to be able to continue the suspended status of these wells. 3.Continuing engagement with respect to the multi-well drilling and seismic data acquisition project that has been descr bed to you in the past couple of years. A current map of COG landholdings is attached for your reference. In view of the COVID 19 outbreak, travel and face to face get [redacted]	Attachment:Chance_Permits_geoscience_9Sept2019.pdf	E00647_Chance Oil and Gas Update_TH
E00790	May 25, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Chance Oil and Gas Limited is preparing a proposal for well maintenance work in the Eagle Plains. Please see the attached letter meant to initiate engagement and to provide initial project information.		
E00674	May 26, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Project Description/Activities DO Project	Chance Oil and Gas Limited is preparing a proposal for well maintenance work in the Eagle Plains. Please see the attached letter meant to initiate engagement and to provide initial project information. Please let me know if you have any issues opening the attachment.	Attachment: 200522_Chance_WellMaintenance_Initiation_of_Engagement_TH_FINAL_signed_map	E00674_Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in)
E00676	May 31, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning DO Project	I am currently on vacation this week, but I look forward to coming up with a date to discuss the project with your team when I return.		E00676_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in) (16)
E00792	May 31, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	I am currently on vacation this week, but I look forward to coming up with a date to discuss the project with your team when I return.		E00792_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in) (39).msg
E00677	June 1, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Thank you for your response and hope you're doing well! When you're back in the office we can work together to coordinate a meeting.		E00677_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in) (15)
E00793	June 1, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Thank you for your response and hope you're doing well! When you're back in the office we can work together to coordinate a meeting.		E00792_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in) (39).msg

E00678	June 3, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Hope your keeping healthy during this pressing time with the pandemic. Somethings come to an end, and due to COVID-19 Tr'ondek Hwech'in was unable to hold our election, thus; today is the end of my term. If you could send all future email to our new in-coming Deputy Chief [redacted], his email will come into effect tomorrow, [redacted], your cooperation is greatly appreciated. Keep up the good work!		E00678_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in) (13)
E00794	June 3, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Hope your keeping healthy during this pressing time with the pandemic. Somethings come to an end, and due to COVID-19 Tr'ondek Hwech'in was unable to hold our election, thus; today is the end of my term. If you could send all future email to our new in-coming Deputy Chief [redacted], his email will come into effect tomorrow, [redacted], your cooperation is greatly appreciated.		E00792_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in) (39).msg
E00679	June 8, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	How does the 2pm on 17th in the afternoon work for your team?		E00679_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in)
E00791	June 8, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	How does the 2pm on 17th in the afternoon work for your team?		E00790_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in) (38)
E00680	June 9, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	I hope you enjoyed your time off! June 17th at 2:00 PM works for us. I will send a placeholder for everyone's calendar shortly (it'll be barebones to start). I am hoping to send a brief draft agenda later today or tomorrow, for you and Chance to review. Once that is finalized, I can attach it to the invite. Do you think we'll need an hour and a half? Or would you like more time? We are flexible.		E00679_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in)
E00795	June 11, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning Engagement/Consultation	Attached is a draft agenda for our call next Wednesday. Please feel free to make any changes or corrections.	Attachment: 200522_Chance_DO_ProjectDescription_DRAFT.pdf	E00795_RE_ Chance Oil and Gas_ Proposal for Well Maintenance Work - Draft Agenda for Review (29)
E00688	June 12, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning Engagement/Consultation	Attached is a draft agenda for our call next Wednesday. Please feel free to make any changes or corrections.		E00688_RE_ Chance Oil and Gas_ Proposal for Well Maintenance Work - Draft Agenda for Review (7)
E00689	June 12, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	I will get back to you on Monday with some updates from the TH side. Have a great weekend.		E00688_RE_ Chance Oil and Gas_ Proposal for Well Maintenance Work - Draft Agenda for Review (7)
E00691	June 15, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Information Sharing	I would like to add to the agenda a quick TH government update as well as an update on Chance's overall permit renewals. Also, is there any material that you can send on the well maintenance program ahead of time?		E00691_RE_ Chance Oil and Gas_ Proposal for Well Maintenance Work - Draft Agenda for Review (4)
E00692	June 15, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning Engagement/Consultation	I'll make those changes to the agenda and then add it to the invite. Do you expect anyone else from TH to join you on the call? I've also attached the draft Project Description for the well maintenance program. The summary information attached to our initial letter is based on this larger document.	Attachment: 200522_Chance_DO_ProjectDescription_DRAFT	E00692_RE_ Chance Oil and Gas_ Proposal for Well Maintenance Work - Draft Agenda for Review (3)
E00693	June 15, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	I will be able to tell you the participants tomorrow afternoon.		E00693_RE_ Chance Oil and Gas_ Proposal for Well Maintenance Work - Draft Agenda for Review
E00762	June 16, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning	Accepted meeting invitation for June 17, 2020 titled Chance Oil and Gas - Proposal for Well Maintenance Work		E00762_Accepted_Updated_Chance Oil and Gas - Proposal for Well Maintenance Work.msg
E01188	June 17, 2020	Meeting		Tr'ondëk Hwëch'in		[redacted]	[redacted]	DO Project Engagement/Consultation	The purpose of this meeting is for Chance to provide an overview of the proposed Eagle Plain Well Maintenance Project and to provide an opportunity for Tr'ondëk Hwëch'in to ask questions and/or provide any feedback with respect to the proposed project.		E01188_200710_TH-Chance_MeetingSummary_June17_FINAL.docx
E00697	June 19, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Meeting Coordination/Planning Information Sharing Project Description/Activities	Attached is a draft summary of our call on Wednesday. Let me know if you have any revisions.	Attachment: 200618_TH-chance_MeetingSummary_June17_Draft_v.02	E00697_Chance DO Project (Well Maintenance)_ June 17 Draft Meeting Summary for Review

E00708	July 13, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Hemmera has prepared a draft report on implementation of TH and Chance Engagement and Communication Plan for TH and Chance to review. This report summarizes meetings/correspondance that have occurred between TH and Chance since completing the 2019 Annual Report. I have attached the draft as a Word Document, If both TH and Chance could make revisions to that document in tracked changes, that would assist me in creating a final version. If there are any issues that arise between parties' revistion, we can address them via e-mail or a quick call. Once revisions have been incorporated and the document is considered final by TH and Chance, I will send the final version to both parties to sign. I have also attached, as a pdf, a draft of TH and Chance's Engagement Log which functions as Appendix D for the report. Please complete revelws by Friday, July 24th. Reminder that reports need to be signed and submitted to YG on July 31st.	Attachments: 200713_Plan Implementation Report_TH_DRAFTv0.3.docx, 200713_AppendixD_TH_EngagementLog_DRAFT.pdf	E00708_DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review(0)
E00728	July 15, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thank you for the information and we shall have any comments by July 24th.		E00728_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review
E00729	July 15, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thanks[redacted] much appreciated! I ought to acknowledge my typo below. The reports are due to YG on July 31, 2020 not 2019. No time travel is involved.		E00729_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (1)
E00730	July 24, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I thought I would check in and see how the review of the draft engagement report is fairing? My apologies, I meant to send this reminder earlier in the week.		E00730_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (2)
E00731	July 24, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thanks for the reminder as I was thinking about this as well. I have limited office access today, but I will send in any comments on Monday. I understand your deadline so I will try to get it in the morning.		E00731_Re_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (3)
E00732	July 24, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Much appreciated[redacted]		E00732_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (4)
E00764	July 24, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement/Consultation DO Project	Attached is a draft copy of Chance Oil and Gas (Chance)'s YESAB Project Proposal for the Eagle Plains Well Maintenance Project. In order for Chance to get all its approvals in hand before thw winter season, Chance's application will need to be submitted very shortly after sending this draft to you. At this time, our goal is to submit the Project Proposal middle of next week. I remember from our June phone call that[redacted] had inquired about a Wildlife Management Plan. As it happens, all mitigation measures with respect to wildlife and caribou is located within the body of the proposal. I wanted to flag that for your attention. As this document has not gone through Hemmera's formatting procedure, it is absent of some of the figures and appendices. However, I also remembered your interest in the Spill Response Plan, so I've made sure it is attached. Chance continues to be committed to engaging with Tr'ondëk Hwëch'in. Should you wish to discuss the proposed Project in more detail, please don't hesitate to contact Chance or Hemmera.	Attachment: 200724_Chance_YESAB_PP_DRAFT.docx.; Spill Response Plan.docx	E00764_Chance Eagle Plains Well Maintenance Project - Draft YESAB Project Proposal (3).msg
E00733	July 27, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	I have reviewed the document and the only correction is in the Engagement Plan[redacted] now replaces[redacted] When do you believe the official YESAB submission will be filed? We can then set up the next meeting to review. We can then talk about the next steps going forward.		E00733_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (5)
E00734	July 27, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Okay. In the Schedule ("Key Engagement and Communication Topics and Leads") to the Engagement Plan, I will change the TH Key Contact for Agreements and Capacity Funding to [redacted] and delete[redacted] . I was wondering, would you be able to send a JPEG of the logo for Tr'ondëk Hwëch'in? I could add that to the Engagement Plan. It seems like it's always been missing. With respect to your question below. Are you referring to Chance's YESAB DO submission for the proposed Well Maintenance Project? When Chance hopes to file it? I'm fairly certain Chance and my colleagues are aiming for middle of this week.		E00734_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (6)
E00735	July 28, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thanks for the information about when the well program will be submitted and you are correct about the change to the Key Contacts. I think that it is best to use the Chance logo only at this time since it will take approval and we are in an election cycle and time is an issue. Once prepared I can sign off of the document and we can talk about scheduling a meeting once the project is submitted.		E00735_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (7)

E00736	July 28, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Attached is the revised version of the Tr'ondëk Hwëch'in and Chance 2020 Annual Report of the Engagement Plan. Sidney asked me to make the following change: In the Schedule of the Engagement and Communication Plan (Appendix A), change the TH Key Contact for Agreements and Capacity Funding to [redacted] and delete [redacted] Sidney, if you could print page 5, scan, and send it back. Then Greg can sign. Once the signing sheet is complete, I'll put that into the PDF and send the Final version to both TH and Chance.	Attachment: 200728_PlanImplementation Report_TH_FINALwAppendIxD.pdf	E00736_2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Signing
E00737	July 29, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Please find the signed 2020 Annual Report attached. I hope to h	Attachment: Chance TH (Signed 2020) Annual Report 2020.pdf	E00737_RE_ 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Signing
E00738	July 29, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thank you [redacted] On to you[redacted]	Attachment: Chance TH (Signed 2020) Annual Report 2020.pdf	E00738_FW_ 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Signing
E00739	July 30, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Attached is the Final version of the Engagement Report for 2020. I will be sending it to YG shortly.	Attachment: 200730_PlanImplementation Report_TH-FINALwAppD Signed.pdf	E00739_RE_ 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Signing (8)
E00740	July 30, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Please see attached for the 2020 Annual Report on the Implementation of the Tr'ondëk Hwëch'in and Chance Oil and Gas Engagement and Communication Plan.	Attachment: 200730_PlanImplementation Report_TH-FINALwAppD Signed.pdf	E00740_2020 Annual Report - Tr'ondëk Hwëch'in and Chance Oil and Gas Engagement and Communication Plan
E00817	August 7, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Meeting Coordination/Planning	This email is intended to give you early notice that Chance Oil and Gas has not yet submitted our Well Maintenance Program Project Proposal to YESAB due to evolving discussions with the regulator. The amendments are being incorporated into the Project Description and effects assessment over the next week or two as we manage vacation absences. Once updated, we will share the updated YESAB submission with you to review. I suggest that a follow up conference call or Microsoft Teams meeting be arranged to address your questions or respond to your comments to the amendments.		E00817_Well Maintenance Program amendments
E00867	August 28, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	Email read receipt		E00867_Read_ Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED (68)
E00868	August 28, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	Email read receipt		E00868_Read_ Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED (69)
E00912	August 28, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities	Further to [redacted] email dated August 7th (attached), Chance Oil and Gas (Chance) has made a few revisions to their Project Description for the Designated Office Evaluation of their proposed Well Maintenance Program. As a result of those changes, Hemmera has also revised the effects assessment sections of the Project Proposal. Below are the reasons for the revision that have been provided to us by Chance and a brief summary of the amendment itself: 1.Ongoing conversations between Chance and Yukon Government, Oil and Gas Branch (YG) have necessitated changes. While Chance was previously of the impression wells could continue to be suspended, YG is now directing Chance to conduct inspection and maintenance activities for all eight suspended wells and then abandon those wells or bring them into active status (i.e., end the period of well suspension). Chance is now proposing to abandon six wells (i.e., M-59, M-08, J-19, G-08, B-73, and H, 28) and to bring the remaining two wells (i.e., A-25 and E-78) into active status as deep-injection wells. Waste fluid produced during the abandonment of the six wells can then be disposed of via injection into the deep-injection wells. No oil or gas is expected to be produced from the two wells proposed to be activated; they would specifically be used for disposal of waste fluid from activities associated with these maintenance activities. (See sections 2.1.4 and 2.1.5 for further description) 2.At this time, Chance cannot confirm whether it will use the Eagle Plains Hotel or the existing Chance Camp for housing workers over the duration of the Project. The decision to utilize the Eagle Plains Hotel or the Chance Camp will be made when the Project schedule is finalized. It will also have to take into consideration the Hotel's ability to accommodate Chance workers over the full duration of the Project as well as COVID-19 related self-isolation requirements at that time. As a result both options are considered in the effects assessment for the housing of the project workforce. (See sections 2.2 and 2.3 for further description)	Attachments: Fwd: Well Maintenance Program amendments.msg, 200828_Chance_YESAB-DO_ProjectProposal_REVISED.pdf	E00912_Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED

E00901	September 15, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Project Description/Activities	Since my email dated August 28th, Hemmera has been in the final stages of concluding the revised DO Project Proposal for Chance's Well Maintenance program. We have appreciated your feedback and worked to include that into the application. As you know, Chance's timeline for completing this work was tied to compliance with regulations, so in an effort to ensure that the maintenance activities could occur this winter Chance needed to submit the application last week. It was submitted late Friday evening and today Hemmera received confirmation that the project was on the YESAB registry. We acknowledge that you may have future comments on the project as it progresses through the YESAB process. We continue to look forward to hearing your views and are happy to hold additional meetings to discuss and answer any questions you may have. Please see the link to the registry here: Project 2020-0151 Eagle Plains Well Maintenance and Winter Activities	E00901_Chance DO Project (Well Maintenance) - YESAB Registry Information (50)
E00863	September 16, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	Email read receipt	E00863_Read_ Chance DO Project (Well Maintenance) - YESAB Registry Information (47)
E00864	September 16, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	Email read receipt	E00864_Read_ Chance DO Project (Well Maintenance) - YESAB Registry Information (48)
E01026	September 16, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities	Thank you for the information and we will be in contact with you to discuss the project in the near future. For continuing communications, can you please add Chief [redacted] (cc'd here) in these notifications?	E01026_RE_ Chance DO Project (Well Maintenance) - YESAB Registry Information (45).msg
E01027	September 16, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities	Should I also still include the Deputy Chief or just the Chief moving forward?	E01026_RE_ Chance DO Project (Well Maintenance) - YESAB Registry Information (45).msg
E01028	October 2, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Project Description/Activities Meeting Coordination/Planning	I just wanted to follow up, if you have or still working on your questions/information request? Let us know if we can address any questions or we can set up another meeting via conference call/Zoom.	E01028_RE_ Chance DO Project (Well Maintenance) - YESAB Registry Information.msg
E00907	November 2, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	After further consideration of the proposed Project (Eagle Plains Well Maintenance and Winter Activities) activities and the requirements of the Yukon Oil and Gas Act, Chance Oil and Gas Ltd. (Chance) has determined that changes are required to the Project submitted to the Dawson Designated Office on September 11, 2020 (Project #2020-0151). As such, Chance has decided to withdraw its Project proposal and will be informing the Yukon Environment and Socio-Economic Assessment Board today, November 2, 2020. Chance intends to incorporate changes into a revised Project proposal. Once the revised proposal has been drafted, Chance will notify you by sharing a draft and requesting a meeting to discuss the changes further. After Chance has discussed those changes with the Tr'ondëk Hwëch'in, the Project proposal will be finalized and resubmitted to the Dawson Designated Office. Chance understands and appreciates that making changes to this Project a second time is requesting additional effort and capacity of the Tr'ondëk Hwëch'in. Chance looks forward to continuing to work with the Tr'ondëk Hwëch'in and will do its best to ease this process	E00907_Chance DO Proposal Withdrawal - Tr'ondëk Hwëch'in Notification
E00861	November 19, 2020	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	Email read receipt	E00861_Read_ Chance Designated Office Project Proposal - Revised Draft for Sharing with Tr'ondëk Hwëch'in

E00892	November 19, 2020	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation Project Description/Activities	Further to my email dated November 2nd (attached), Chance Oil and Gas (Chance) has revised its Project Proposal (including updated Project Description and Effects Assessment) for Designated Office Evaluation. Below is the key project component that has changed: •Extended Flow Testing: After maintenance activities are complete and depending on wellbore integrity (as confirmed through maintenance activities), Chance proposes to conduct Extended Flow Testing (EFT) on up to three of the wells which have the highest potential for natural gas reserve. The reason for this change is to allow Chance to gather important information about the nature of the natural gas resource accumulation and its productive capability. a.Wells proposed for EFT are M-59, M-08, and J-19 (see PDF attached for Figure 2-1). Please note, Figure 2-1 is currently being updated to reflect this change. b.Revert up to three wells to suspended status (if the EFT results prove to have sufficient resource). c.Abandon three to six wells (the three remaining wells (G-08, B-73, and H-28) will be abandoned and up to additional three wells may be abandoned if wel bore integrity is not confirmed or if EFT results prove insufficient resources). •Timelines: If work cannot be completed this winter season (due to low snow pack, COVID considerations, or permitting delays), Chance will complete the project during the winter of December 2021 to March 2022. Additional detail is within the attached revised Draft Project Proposal. While revisions were made throughout the document, Section 2.1.3 is the substantive addition with respect to EFT. We've attached both a clean version and a version with tracked changes to facilitate your review. Given the very short time frame for winter work, Chance will be submitting the application to YESAB on Friday, November 20th. Hemmera anticipates Tr'ondëk Hwëch'in requiring additional discussions with Chance to review these changes and look forward to scheduling a meeting where we can	Attachments: Chance DO Proposal Withdrawal - Tr'ondek Hwech'in Notification.msg, 102229_Chance_YESAB_PP_Revised_v2.0.docx, 201119_Chance_YESAB_PPRevised_v2.0_redline.docx, Fig2_1_104709_01_Overview_200828.pdf	E00892_Chance Designated Office Project Proposal - Revised Draft for Sharing with Tr'ondëk Hwëch'in
E00898	January 19, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	DO Project Engagement/Consultation	A brief update on Chance's proposed Eagle Plains Well Maintenance and Extended Flow Testing project is provided below: •Project was submitted to the Dawson District Office (DO) December 24, 2020. •Adequacy Review started December 29, 2020 and was extended January 11, 2021. oThe Adequacy Review period was extended for 21 days due to the complexity of the Project. •Dawson DO issued an Information Request on January 15, 2021 Chance is currently working on its response to Information Request 1 which you can find here. Additionally, here is the link to the project's page on the YESAB registry: 2020-0197.		E00898_Chance DO Project_ Eagle Plains Well Maintenance and Extended Flow Testing (Update for Tr'ondëk Hwëch'in)
E01120	March 28, 2021	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	Here is the document I was referring to yesterday on the call along with my personal work on the topic.	Methods of Hydraulic Fracturing.pdf Sidney Schafr k dissertation_2.pdf	E01120_RE_ draft project description (1).msg
E01121	March 28, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	We really appreciate you sending us this material,		E01121_RE_ draft project description.msg
E01066	April 7, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Hemmera is currently resuming work on Chance's Executive Committee project titled Eagle Plains Exploration Program. Seeing as it's been quite some time since Chance and Tr'ondëk Hwëch'in (TH) have discussed this particular project, Chance was hoping to schedule a meeting. Some items that Chance would like to discuss are: •a refresher of the draft project description •update of events since Chance last engaged on the ExCom project •anticipated timeline for submission to YESAB, and •TH's preferences/guidance for engagement with its government and its citizens over the coming months. Do you have any availability the week of April 26th – 30th?		E01066_Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in .msg
E01112	April 14, 2021	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	Thank you for the notification. If poss ble, could we set up a meeting on Tuesday the 27th in the afternoon? I do not believe that Chie[redacted] will be attending.		E01112_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in (2).msg
E01113	April 14, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	I'll send along a placeholder for everyone's calendars for 2:00 pm on Tuesday April 27th.Once we have the date/time nailed down, I'll send out a draft agenda for review and comment.		E01112_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in (2).msg
E01092	April 15, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	Booking this time for Chance and Tr'ondëk Hwëch'in to meet and discuss Chance's proposed Eagle Plains Exploration Project. Sidney, feel free to forward this invite to anyone else from your team that you would l ke to attend.		E01092_Placeholder for Chance and TH Meeting re Eagle Plains Exploration Project (ExCom) (6).msg
E01114	April 15, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Attached is a draft agenda for the Chance and Tr'ondëk Hwëch'in meeting April 27th. Please let me know if you have any changes you would l ke me to make. Then I'll finalize the agenda and attach it to the meeting invite.	210414_TH-Chance_MeetingAgenda_April27_DRAFT_v0.2.docx	E01112_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in (2).msg
E01115	April 19, 2021	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Benefits/Capacity Agreement	We will need to add an item on the agenda for the next wave of Capacity Funding according to our Engagement Plan.		E01112_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in (2).msg

E01093	April 23, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Attaching the agenda.	210414_TH-Chance_MeetingAgenda_April27_DRAFT_v0.2.docx	E01093_Placeholder for Chance and TH Meeting re Eagle Plains Exploration Project (ExCom).msg
E01116	April 23, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Attached is the updated agenda for next week's call. I will also add it to the meeting invite. Changes to the agenda can be made the day of as well.		E01112_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in (2).msg
E01063	April 26, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Booking this time for Chance and Tr'ondëk Hwëch'in to meet and discuss Chance's proposed Eagle Plains Exploration Project. [redacted] feel free to forward this invite to anyone else from your team that you would like to attend.	210414_TH-Chance_MeetingAgenda_April27_DRAFT_v0.2.docx	E01063_Chance and TH Meeting re Eagle Plains Exploration Project (ExCom).msg
E01072	April 27, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Project Description/Activities	Here you go!	210414_Chance_ProjectDescription_April2021.pdf	E01072_draft project description.msg
E01117	April 27, 2021	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	I am wondering if you have a draft of the EXComm proposal I can look at?		E01112_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in (2).msg
E01118	April 27, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Project Description/Activities Meeting Coordination/Planning	Attached is the draft project description for Chance's Eagle Plains Exploration project. It's the same document that you would have received way back in 2019. We are in the process of updating it, but we can talk about that more on the call at 2:00.	190605_Chance Oil and Gas Eagle Plains Project Description_V3.pdf	E01118_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in .msg
E01192	April 27, 2021	Meeting		Tr'ondëk Hwëch'in	[redacted]			Project Description/Activities Fracking Water - Ground Well Location Water - Surface Dempster Highway Caribou	The purpose of this meeting was for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plain Basin. Chance provided recent information and updates regarding baseline information gathered by consultants (Environmental Dynamics Inc (EDI), Peer Solutions, Palmer) and Parties discussed next steps with community engagement and consultation schedules for Tr'ondëk Hwëch'in (TH).	See meeting summary for details.	E01192_210512_April27_TH-Chance_MeetingSummary_Draft_v0.3.docx
E01148	May 12, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement/Consultation Meeting Coordination/Planning	I've attached the April 27th Tr'ondëk Hwëch'in / Chance Meeting Summary Draft for review. I've also attached Chance's 2021 Engagement Schedule memo that was identified as an action item. [redacted] are you interested in starting to schedule the meeting for the 2nd week of June?	210512_Chance_ScheduleMemo_for_TH_v0.2.docx 210512_April27_TH-Chance_MeetingSummary_Draft_v0.3.docx	E01148_April 27_ Meeting Summary Review & .msg
E01149	May 17, 2021	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I am good with the meeting notes. How would Tuesday the 8th sound for a follow-up?		E01149_RE_ April 27_ Meeting Summary Review & 1 .msg
E01150	May 17, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Tuesday June 8th works for Hemmera for the follow-up meeting. Does Tuesday June 8th at 2pm Yukon Time work for everyone?		E01150_RE_ April 27_ Meeting Summary Review & .msg
E01152	May 17, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	The timing on June 8 works for me too.		E01152_RE_ April 27_ Meeting Summary Review & .msg
E01153	May 17, 2021	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	I am ok with the timing.		E01153_RE_ April 27_ Meeting Summary Review & (2).msg
E01154	May 17, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	This works for me.		E01154_RE_ April 27_ Meeting Summary Review & (1).msg
E01151	May 21, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Meeting Invite: Here is the meeting invite for the June 8th Tr'ondëk Hwëch'in / Chance Meeting. This meeting will focus on the permafrost baseline and suitability information collected by Palmer. A draft agenda will be sent out prior to the meeting.		E01151_June 8th Tr'ondëk Hwëch'in _ Chance Meeting .msg
E01173	May 21, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Information Sharing Meeting Coordination/Planning	I wanted to check-in and see if you had any issues with downloading the maps. Additionally, I wanted to propose that an agenda item for the June 8th meeting be a presentation from Palmer. Perhaps an overview of their work and then an opportunity for questions/discussion. Chance was fine with this idea and if you are too, then Hemmera can draft an agenda around that and send it out to the parties.		E01173_RE_ Chance Eagle Plains Exploration Project - Baseline information on terrain_ permafrost_ and suitability maps (1TH).msg
E01224	June 7, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning	Here is the meeting invite for the June 8th Tr'ondëk Hwëch'in / Chance Meeting. This meeting will focus on the permafrost baseline and suitability information collected by Palmer. A draft agenda will be sent out prior to the meeting.	210607_June8_TH-Chance_MeetingAgenda.docx	E01224_June 8th Tr'ondëk Hwëch'in _ Chance Meeting (5).msg
E01225	June 7, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Meeting Coordination/Planning Engagement/Consultation	Palmer's PDF Presentation attached. Draft Meeting Agenda attached.	210607_June8_TH-Chance_MeetingAgenda.docx Palmer_Chance_EaglePlains_Summary.pdf	E01225_June 8th Tr'ondëk Hwëch'in _ Chance Meeting .msg
E01239	June 7, 2021	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Information Sharing	Thank you for your note and I am reading it now since I was on vacation. I did receive the maps and a presentation from Palmer would be acceptable for Tuesday's meeting.		E01239_RE_ Chance Eagle Plains Exploration Project - Baseline information on terrain_ permafrost_ and suitability maps (1).msg
E01240	June 7, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Information Sharing	I remembered you were away when I thought of this idea, so I reserved Palmer in the hopes that you'd support a presentation. [redacted] will be sending out a draft agenda later this morning for everyone's review.		E01240_RE_ Chance Eagle Plains Exploration Project - Baseline information on terrain_ permafrost_ and suitability maps.msg
E01351	June 7, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Information Sharing	Attached is Palmer's PDF version of their presentation for tomorrow. A few slides have been duplicated to simulate the 'appear' animation, so it's a little shorter than its page count suggests.	E01351_Palmer_Chance_EaglePlains_Summary.pdf	E01351_RE_ Draft Meeting Agenda - June 8th.msg

E01215	June 8, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	Engagement/Consultation	Attached is a draft agenda for the Chance and Tr'ondëk Hwëch'in meeting June 8th. Please let me know if you have any changes you would like me to make.	210607_June8_TH-Chance_MeetingAgenda.docx	E01215_Draft Meeting Agenda - June 8th.msg
E01261	June 8, 2021	Meeting		Tr'ondëk Hwëch'in	[redacted]	Engagement/Consultation Information Sharing Permafrost Mitigation Measure Project Description/Activities	Meeting summary		E01261_210617_June8_TH-Chance_MeetingSummary_v0.5
E01202	June 17, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	Engagement/Consultation	Attached is the June 8th Chance - Tr'ondëk Hwëch'in draft meeting summary for review. Happy to make changes if anyone sees an issue.	210617_June8_TH-Chance_MeetingSummary_v0.4.docx	E01202_Chance - Tr'ondëk Hwëch'in June 8th Draft Meeting Summary.msg
E01247	June 19, 2021	Email	In	Tr'ondëk Hwëch'in	[redacted]	Engagement Reports/OIC Requirements	Hello again, As mentioned in my email on Friday, attached is a copy of Chance's Engagement Log which will serve as Appendix D. I look forward to your comments on the draft Annual Report. Thank you for your time, Cheers!	210714_ChanceCommunicationLog_v7TH.pdf 210716_EngagementPlan_2021ImplementationReport_TH_v0.5.docx	E01247_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (2).msg
E01233	June 22, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	Engagement/Consultation	All of our contributions seem to have been captured well. Hard to dispute things when you have almost a word-for-word account of the discussion!		E01233_Re_ Chance - Tr'ondëk Hwëch'in June 8th Draft Meeting Summary (1).msg
E01235	June 22, 2021	Email	In	Tr'ondëk Hwëch'in	[redacted]	Engagement/Consultation	I am fine with the notes and await any changes to the project description and await any further baseline data.		E01235_RE_ Chance - Tr'ondëk Hwëch'in June 8th Draft Meeting Summary.msg
E01212	July 16, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	Engagement Reports/OIC Requirements	Hemmera has prepared a draft report on the implementation of the Tr'ondëk Hwëch'in and Chance Oil and Gas Engagement and Communication Plan for Tr'ondëk Hwëch'in (TH) and Chance to review. This report summarizes meetings/correspondence that have occurred between TH and Chance since completing the 2020 Annual Report. I have attached the draft as a word document. If both TH and Chance could make revisions to that document in tracked changes, that would assist me in creating a final version. If there are any issues that arise between the parties' revisions, we can address them via email and/or a quick call. Once revisions have been incorporated and the document is considered final by TH and Chance, I will send the final version to both parties to sign. Either later today, or Monday, I will send a follow-up email with a draft of TH and Chance's Engagement Log which will serve as Appendix D.	210716_EngagementPlan_2021ImplementationReports_TH_v0.5.docx	E01212_DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review.msg
E01218	July 19, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	Engagement Reports/OIC Requirements	As mentioned in my email on Friday, attached is a copy of Chance's Engagement Log which will serve as Appendix D. I look forward to your comments on the draft Annual Report.	210714_ChanceCommunicationLog_v7TH.pdf	E01218_FW_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review.msg
E01321	July 19, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	Engagement Reports/OIC Requirements	Hello again, As mentioned in my email on Friday, attached is a copy of Chance's Engagement Log which will serve as Appendix D. I look forward to your comments on the draft Annual Report. Thank you for your time,		E01321_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (2).msg
E01219	July 21, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	Engagement Reports/OIC Requirements	Hello Everyone, This looks pretty good to me.	Note - typo in title of document and email - report is for 2021 not 2020	E01219_FW_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review.msg
E01306	July 27, 2021	Email	In	Tr'ondëk Hwëch'in	[redacted]	Engagement Reports/OIC Requirements	Sidney said that the only correction is about [redacted] appointment to [redacted] former position.	E01306_210714_ChanceCommunicationLog_v7TH.pdf E01306_210716_EngagementPlan_2021ImplementationReport_TH_v0.5.docx	E01306_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (7).msg
E01307	July 27, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	Engagement Reports/OIC Requirements	Hi [redacted], Thank you for your review. I've attached an updated version with the revision you've provided below. I've also removed DRAFT from the title of the document and the DRAFT watermark. [redacted] could you sign on your end (once you've finished your approval process) and send a copy to me, [redacted] and [redacted] are actually in Eagle Plains right now, but I have [redacted] scheduled to stop by the Hemmera Office to sign on Monday once he's returned. I've confirmed with [redacted] that submitting the report on Monday August 2nd is acceptable. Thanks everyone	E01304_210727_EngagementPlan_2021ImplementationReport_TH_v0.6	E01304_FW_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review.msg

E01282	August 2, 2021	Email	Out	Tr'ondëk Hwëch'in YG	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Hello[redacted] Please see attached for the DRAFT 2021 Annual Report on the Implementation of the Tr'ondëk Hwëch'in (TH) and Chance Oil and Gas Engagement and Communication Plan. This report has been prepared using meeting agendas and summaries drafted by Hemmera and subsequently reviewed and agreed to by the parties. This report has been reviewed and approved by Chance. TH reviewed the report and provided revisions to Hemmera. Those revisions are incorporated into the report attached, however, Hemmera was unable to secure approval and a signature from TH. To that end, the signature lines have been removed and the DRAFT watermark remains. Should TH provide a signature at a date, Hemmera would be happy to prepare a final version of the report for submission to Yukon Government. Thank you for your time,	E01282_210802_EngagementPlan_DRAFT2021ImplementationReport_TH_v0.7wAppD.pdf	E01282_2021 Annual Report - Tr'ondëk Hwëch'in and Chance Oil and Gas Engagement and Communication Plan.msg
E01308	August 2, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	H[redacted] Hope you had a good weekend! Will you be able to send a signed copy of the signature page today? Then Chance can sign on this end and I can submit the engagement report to YG.	E01304_210727_EngagementPlan_2021ImplementationReport_TH_v0.6.docx	E01304_FW_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review.msg
E01322	August 2, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Hello again, Sorry to bother you again[redacted] As Chance must submit their engagement reports to YG today, I can submit the report as DRAFT. I can remove the signing page, keep DRAFT in the title, and keep the DRAFT watermark on the report. Additionally, in my email to YG, I can cc TH indicate that while the DRAFT report does incorporate revisions from TH the parties were unable to sign it. If I don't hear from TH before 2:30 pm, I'll proceed as outlined above. Hope you're well,	E01322_210727_EngagementPlan_2021ImplementationReport_TH_v0.6.docx	E01322_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (5).msg
E01315	August 4, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]		Engagement Reports/OIC Requirements	Greg signed TH/Chance Implementation Report	E01315_img-210804121653-0001.pdf	E01315_FW_ Scan Data from _XRX9C934E2E3310_.msg
E01323	August 4, 2021	Email	In	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Hello[redacted] I have been on site for the past couple of days and unable to sign the 2021 Engagement Plan report. Please find attached a signed version for this year. Regards, Sid	E01323_Chance Engagement Plan Signed (Aug 4 2021).pdf	E01323_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (3).msg
E01324	August 4, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	Thanks[redacted] [redacted] can you please sign page 5 and send a scanned copy back to me? Then I will provide an updated version to Derek.		E01321_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (2).msg
E01325	August 4, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	[redacted] thanked[redacted]		E01325_Re_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (4).msg
E01326	August 4, 2021	Email	Out	Tr'ondëk Hwëch'in	[redacted]	[redacted]	[redacted]	Engagement Reports/OIC Requirements	[redacted] attached the final version of the 2021 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities.	E01326_210804_EngagementPlan_FINAL2021ImplementationReport_TH_v0.6_SIGNEDwAppD.pdf	E01326_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review.msg

APPENDIX 2-D-33. Project Update Letter

Chance
OIL AND GAS LIMITED

June 27, 2023.

Chief [redacted]
Tr'ondek Hwech'in First Nation
P.O Box 599
Dawson, YT
Y0B 1G0

sent via email: [redacted]

Dear Chief [redacted]

I am writing to congratulate you on your recent election success to become Chief of the Tr'ondek Hwech'in First Nation ("TH"). My colleagues and I look forward to working with you, your council members, and the TH Government.

As you will recall from previous meetings, Chance Oil and Gas Limited ("Chance") is planning to undertake a small scale, multi-year exploration project at Eagle Plain. The project could involve the drilling of up to 30 new exploration wells, acquiring up to 1,500 sq kms of new 3D seismic data, and acquiring up to 2,000 kms of new 2D seismic data. These activities are going to be undertaken for the most part during the winter months and done in a logical sequence based on information gathered as the program unfolds. Because of the seasonal restrictions, the overall project will be broken down into smaller pieces to reduce overall environmental impacts and that can be largely completed during the winter seasons. In addition to this work, significant discoveries of crude oil and/or natural gas would undergo extended flow testing to help understand the nature of the deposit and provide valuable information to help plan for development. Modern industry practices have significantly reduced the footprint of this work and are done in an environmentally responsible manner. It is our objective to file a submission with the Executive Committee of YESAB on or about December 14, 2023.

Chance has undertaken a number of baseline environmental studies using expert consultants such as EDI, Palmer, Tetratech, Peer Solutions, and drilling engineer [redacted]. In addition to these technical consultants, Chance has retained the services of Two Worlds Consulting, an aboriginal owned service provider based in BC. Two Worlds is assisting Chance with communication and engagement practices with First Nations.

CHANCE OIL AND GAS LIMITED

☐ **Whitehorse Office:**
Suite 202, 208 Main Street
Whitehorse, YT Y1A 2A9
Telephone (867) 456-7805

☒ **Calgary Office:**
Suite 1000, 340 - 12th Ave S.W.
Calgary, AB T2R 1L5
Telephone (403) 699-0055
Fax (403) 699-0044

A project description is being finalized to provide more complete information about the activities that are planned. Chance is interested in sharing this information with the affected First Nations to get advice and comments to help develop plans needed to undertake the program.
In closing, my colleagues in Whitehorse, [redacted] and [redacted], will be in contact with you and members of the TH Government to share information and arrange meetings in the coming weeks and months. We look forward to working with you and the TH in a cooperative and collaborative way to advance exploration activities at Eagle Plain.

Once again, congratulations on being elected to be Chief of the TH.

Yours truly,
Chance Oil and Gas Ltd.

[redacted]

President

Cc [redacted]

APPENDIX 2-D-34. Project Information Video – not available to append.

APPENDIX 2-D-35. Proposed Eagle Plains Exploration Project Engagement and Consultation Update Letter

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

Via Mail and Email

November 22, 2023

Chief [redacted]
Tr'ondëk Hwëch'in First Nation
PO Box 599
Dawson City, Yukon Y0B 1G0

Dear Chief [redacted]

RE: Proposed Eagle Plains Exploration Project Engagement and Consultation Update

Chance Oil and Gas Limited (Chance) is in the process of developing a Project Proposal for the proposed Eagle Plains Exploration Project (the proposed Project) for submission to the Yukon Environmental and Socio-economic Board (YESAB) Executive Committee. The Project Proposal is scheduled to be submitted for assessment in February 2024.

Chance is committed to engaging and consulting with potentially affected First Nations and communities about the proposed Project. It values open communication and receiving feedback, concerns, and questions. Chance will consider and address comments received throughout all stages of the proposed Project.

Chance is committed to meet consultation requirements under sections 3 and 50(3) of the *Yukon Environmental and Socio-economic Assessment Act* (YESAA) and section 14 of the Yukon *Oil and Gas Act* (YOGA). Under YOGA, Chance is required to consult with First Nations whose Traditional Territories overlap with oil and gas permitted land during the Government of Yukon's permit extension process.

In preparation for the Project Proposal submission, Chance is requesting feedback from Tr'ondëk Hwëch'in regarding your interest in being further consulted about the Project. Chance is also requesting feedback from Tr'ondëk Hwëch'in First Nation regarding your interest in being consulted about the draft Project Proposal. Chance is requesting written direction from Tr'ondëk Hwëch'in First Nation about this prior to the Project Proposal submission to the YESAB Executive Committee.

Chance Oil and Gas Ltd.
Suite 1000, 340–12th Avenue SW
Calgary, AB T2R 1L5

If, at any time, Tr'ondëk Hwëch'in First Nation wishes to be consulted regarding the proposed Project or the Project Proposal, please let me know and Chance will follow-up and provide relevant documentation. Until then, Chance will continue to provide Project updates and share important information by email and/or letter.

Sincerely,

[redacted]

VP Government and Community Relations
Suite 202, 208 Main Street
Whitehorse, YT Y1A 2A9
Office: 867.456.7805
Cell: 867.3330010

cc: [redacted] Executive Director, Tr'ondëk Hwëch'in First Nation
[redacted] Consultant, Tr'ondëk Hwëch'in First Nation
[redacted] Senior Assessment Officer, YESAB
[redacted] Major Project Manager, Major Projects Yukon, Executive Council Office
[redacted], President, Chance Oil and Gas

APPENDIX 2-D-36. Chance Oil and Gas Limited June 2019 Presentation

Chance Oil and Gas Limited
June 2019



Table of Contents

- General Project Description
- Project Location
- Exploration Drilling
- Flow Testing
- Seismic Exploration Program
- Workforce Requirements
- Closure and Reclamation
- YESAB – Executive Committee Process
- Timelines
- Engagement Plans – Annual Reports

Chance
OIL AND GAS LIMITED

General Project Description

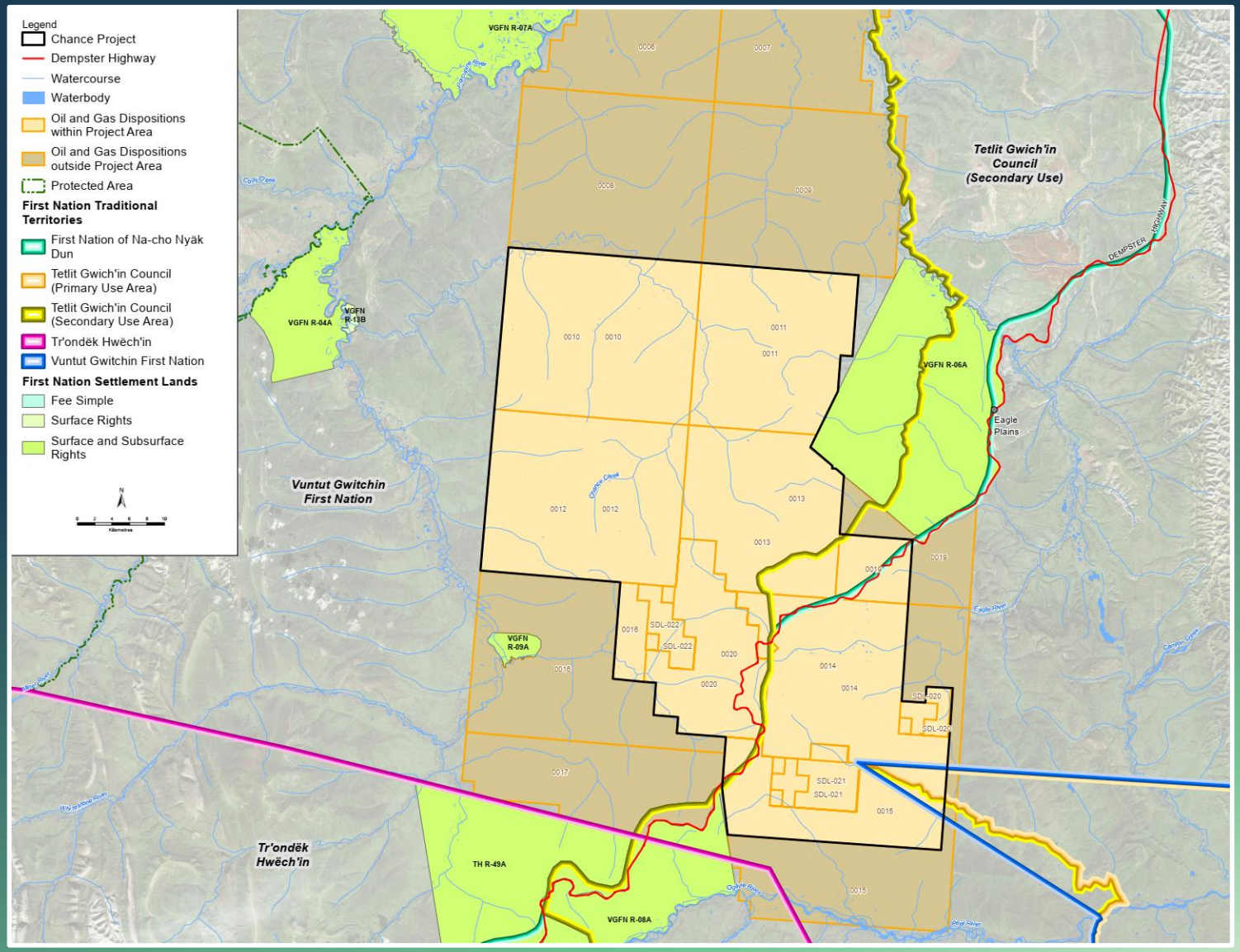
- Drilling over an exploration permit area of 2,400 km²
- Flow testing
- Construction of Mix Bury Cover Sump
- Seismic exploration program
- Construction of access roads for proposed well locations





Chance
OIL AND GAS LIMITED

Project Location





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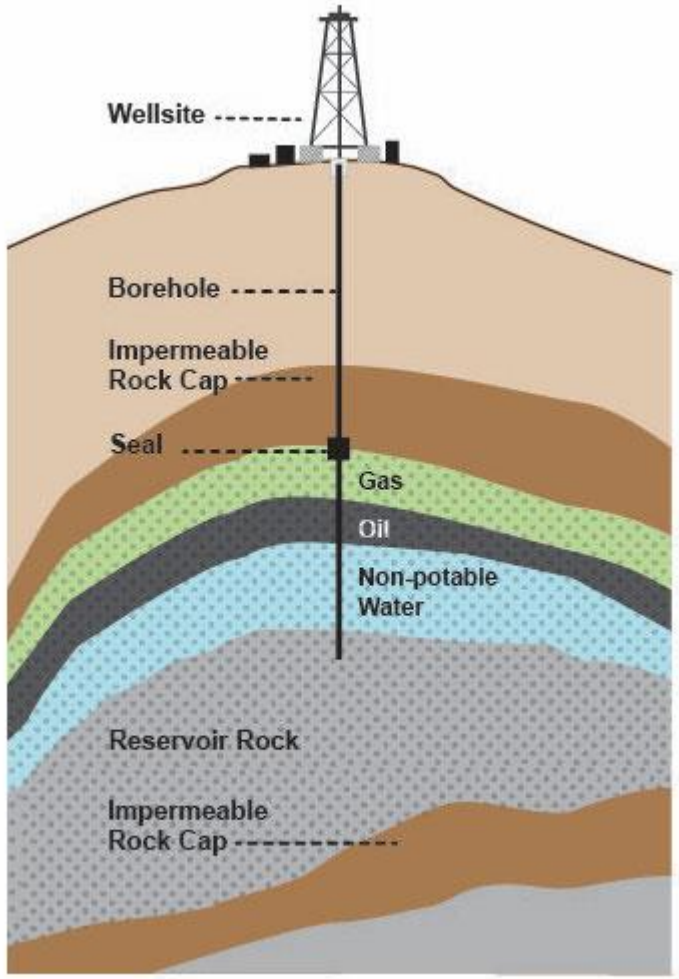
OIL AND GAS LIMITED

Exploration Drilling

- Drilling up to 30 exploratory wells over a period of up to10 years (up to 5 wells per year)
- Well sites approximately 1.44 Ha in area
- Located generally on heights of land:
  - Avoiding permafrost conditions and ecologically sensitive areas
  - Avoiding areas identified with heritage values
  - No drilling within 45 m of a perennial watercourse
  - In accordance with *Yukon Oil and Gas Act* and *Oil and Gas Drilling and Production Regulations*

Chance
OIL AND GAS LIMITED

Well Drilling Diagram





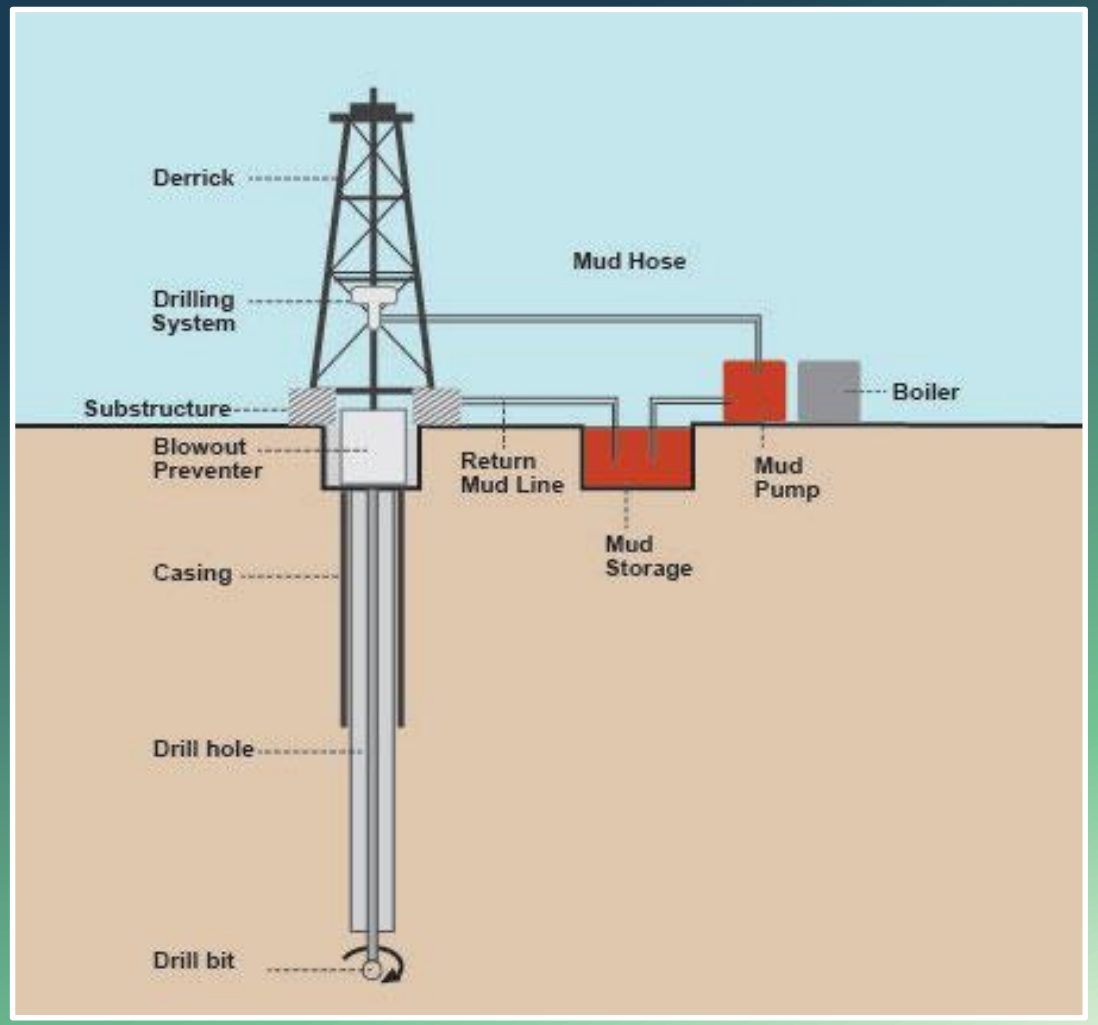
View: Elevated Rigfloor
(White BOPs underneath)

View: Vee Door Ramp with Pipe Rack in Foreground
(Catwalk up to Rig Floor in Background)

Chance
OIL AND GAS LIMITED

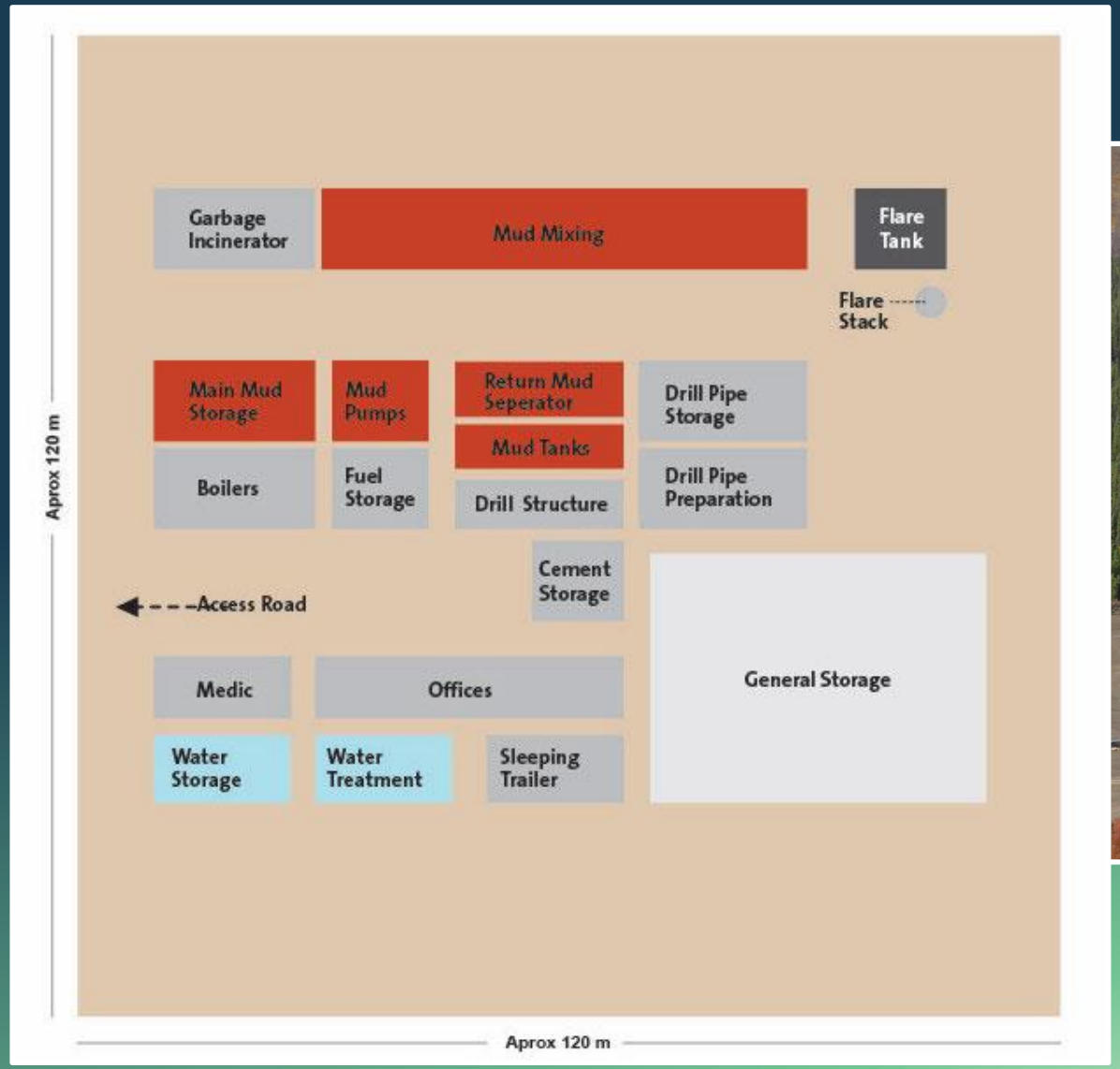
Well Drilling





Chance
OIL AND GAS LIMITED

Examples of Well Sites





Chance
OIL AND GAS LIMITED

Extended Flow Testing

- Drill Stem Testing on each well
- Extended Flow Tests on up to 20 wells
  - May occur for up to 2 years
  - Could result in up to 10 Extended Flow Tests occurring at the same time
- Extended Flow Tests will require additional surface infrastructure

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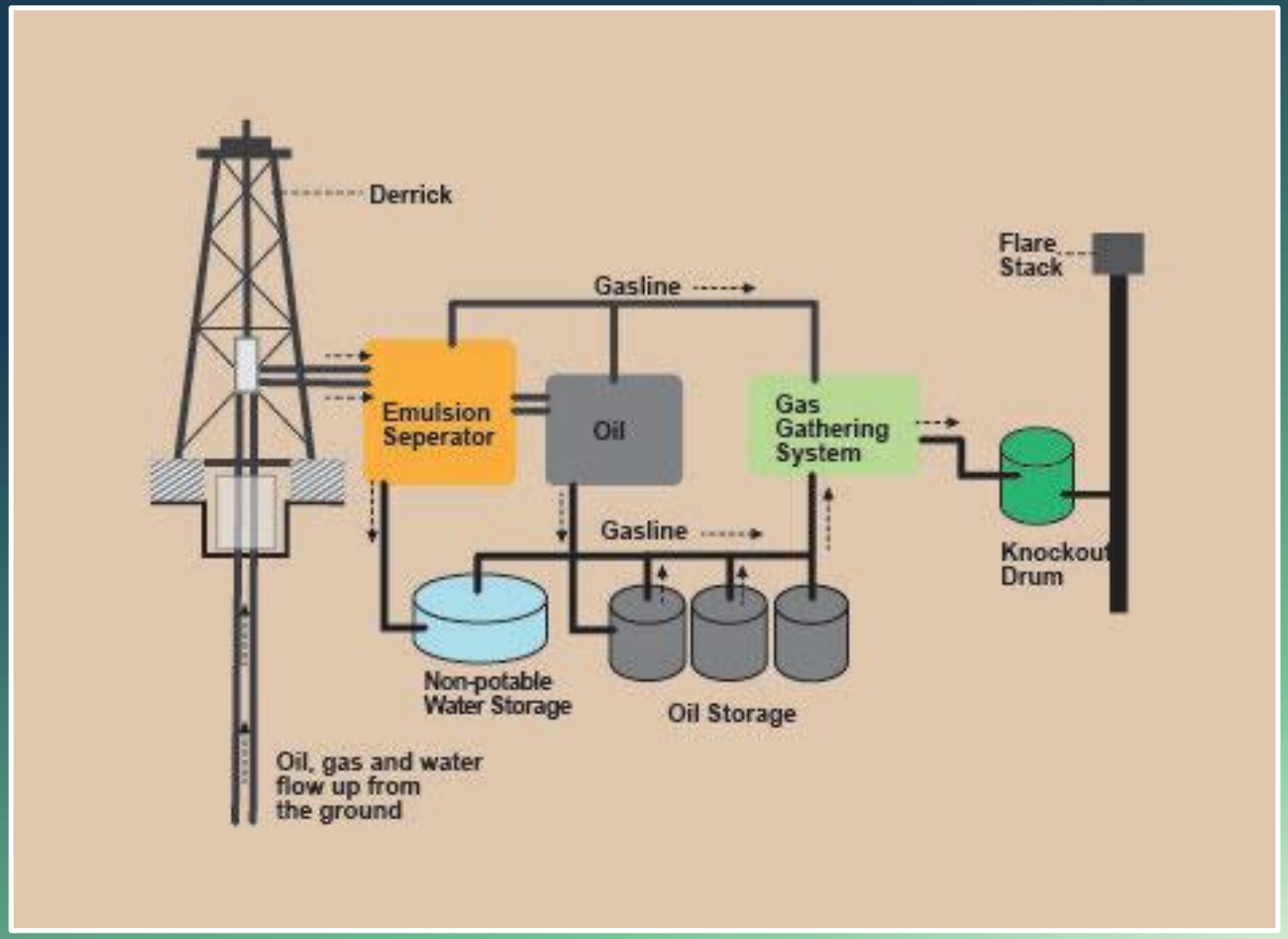
OIL AND GAS LIMITED

Extended Flow Testing: Infrastructure

- Construction of all-season access road to well site
- Drilling, followed by:
  - Abandoning (reclamation) of well site; or
  - Casing of well bore and installation of wellhead
- Well completion: Installing service rig
- Installation of surface equipment and facilities
- Measurement, treatment, and separation of natural gas, crude oil, and formation water

Chance
OIL AND GAS LIMITED

Extended Flow Testing: Diagram



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Drill Cuttings and Flow Testing Products

- Drill Cuttings and Waste Drilling Fluid: Disposed of in Mix Bury Cover Sumps
- Natural Gas: Flared, used for on-site for heating/power, re-injected into wells
- Crude Oil: Up to 4,000 barrels per day stabilized and transported from site to markets outside of Yukon
- Formation Water: Disposed of underground into injection wells

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Seismic Exploration Program

- Used to identify and map oil and gas geological structures in the area
- Up to 1500 km² of 3D seismic
- Up to 2000 km² of 2D seismic





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Workforce Requirements

- Workforce of approximately 75-85 people during all phases of the project
- Continued use of existing camp
  - Permitted 75-person camp
  - Located KM 325 of the Dempster Highway
- Use of Eagle Plains Hotel
- Potential use of Remote Shelters
- Objective to provide all available work and contracts to First Nation and Yukon partners.



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Closure and Reclamation

- Progressive abandonment (reclamation) of un-successful wells
- Progressive decommissioning and reclamation of borrow source and quarry areas
- Progressive decommissioning and reclamation of access roads
- Closure of the Mix Bury Cover Sump areas

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YESAB Executive Committee Screenings

- Similar to Designated Office Evaluations
  - Adequacy Review
  - Opportunity to provide comments and input
  - Assessment and Recommendation to Decision Bodies
- Key differences:
  - Requirement for proponents to consult with potentially affected First Nations and residents of communities **before** submitting a Project proposal.
  - Adequacy Review of Consultation and Adequacy Review of Project Proposal
  - Longer periods for stages of screening
  - Additional opportunities to provide comments and input into screening
  - Opportunity to provide input on Draft Screening Report and Recommendation

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Pre-submission Consultation YESAA S. 50(3)	Chance Oil and Gas is required to consult with First Nations and Residents of communities before submitting a Project Proposal to the Executive Committee (EC)
Project Proposal submitted to Executive Committee	Chance Oil and Gas finalizes their Project Proposal and submits it. This initiates the formal EC Screening process.
Executive Committee Conducts Adequacy Review	EC reviews the Project Proposal to determine if the Chance has conducted consultation and if the Project Proposal is adequate. In the past, the EC has invited First Nation input at this stage.
Seeking Views and Information on Project Proposal	Opportunity to provide comments and input on the Project Proposal to the EC. Minimum of 30 days. Maximum of 60 days.
Executive Committee develops and issues Draft Screening Report	EC reviews comments and then develops and issues the Draft Screening Report for comments.
Seeking Views and Information on Draft Screening Report	Opportunity to provide comments and input on the Draft Screening Report to the EC. Minimum of 30 days. Maximum of 60 days.
Executive Committee issues Final Screening Report and Recommendation	EC reviews comments and finalizes the Screening Report and Recommendation. Then issues both to Decision Bodies.

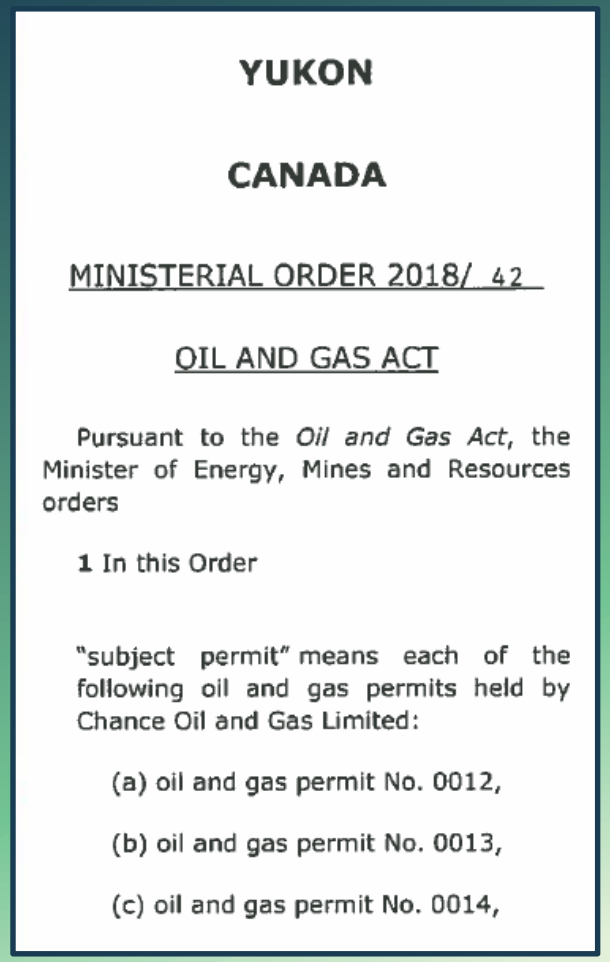
Chance
OIL AND GAS LIMITED

Community Consultation Program – Proposed Activity Alignment

<table>
<tr><th>Activity</th><th>Jun</th><th>Jul</th><th>Aug</th><th>Sep</th><th>Oct</th><th>Nov</th><th>Dec</th><th>Jan</th></tr>
<tr><td rowspan="3">Proposal Preparation</td><td colspan="5">Baseline Research</td><td rowspan="3">Conceptual Management Plans</td><td rowspan="3">Final proposal preparation and review</td><td rowspan="4">Proposal Submission (end of month)</td></tr>
<tr><td></td><td colspan="4">Effects Assessment</td></tr>
<tr><td></td><td colspan="4">Traditional Knowledge Studies</td></tr>
<tr><td rowspan="2">Consultation Meetings by Topic</td><td>Project Description (June 6-11)</td><td></td><td>Valued Components</td><td>Baseline Results</td><td>Effects and Mitigation</td><td>Management Plans</td><td></td></tr>
<tr><td colspan="7">Ongoing incorporation of Consultation results into Project Proposal</td></tr>
</table>

Engagement Plan - Annual Reports

- M.O. 2018/ 42 orders that Chance submit annual reports on the First Nations Engagement Plans
- Due on July 31, 2019
- Proposed format:
  - Communication and Engagement Summary
  - Type of communication and engagement and when this happened
  - High-level summary of what was accomplished between the First Nation and Chance
  - Prepared by Hemmera and reviewed by First Nation and Chance



YUKON

CANADA

MINISTERIAL ORDER 2018/ 42

OIL AND GAS ACT

Pursuant to the *Oil and Gas Act*, the Minister of Energy, Mines and Resources orders

1 In this Order

"subject permit" means each of the following oil and gas permits held by Chance Oil and Gas Limited:

(a) oil and gas permit No. 0012,

(b) oil and gas permit No. 0013,

(c) oil and gas permit No. 0014,

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Questions?



Thank You

Chance
OIL AND GAS LIMITED

APPENDIX 2-D-37. Tr'ondëk Hwëch'in Record of Contact

Tr'ondëk Hwëch'in First Nation Pre-Submission Record of Contact (January 1, 2014 - December 20, 2023)

Reference	Date	Communication Method	In / Outgoing	First Nation	Author	Proponent Names	First Nation and/or Organization Names	Subject	Summary	Additional Comments	Attachments
Note: Reference ID formatting and ordering may not be consistent or sequential due to splitting out the Master Record of Contact into First Nation-specific Record of Contacts.											
TH0096	18-Jun-14	Meeting - In Person	N/A	Tr'ondëk Hwëch'in	Not available	Not available	Not available	Open House	Chance Oil and Gas Limited (Chance) held an open house in Dawson City at the YOOP Hall, from 4:00PM - 6:00PM. Chance provided information that was obtained from the recently concluded 3D seismic program. The next phase of exploration activity was planned to be a targeted exploration drilling program. The format of the Open House was a formal presentation by representatives of Northern Cross followed by a period of questions and answers.	N/A	N/A
TH0099	18-Jun-14	Community Event	N/A	Tr'ondëk Hwëch'in	N/A	N/A	N/A	Community Open House	Chance held a community open house event in Dawson City at the YOOP Hall from 4:00PM - 6:00PM. Chance shared Project information by presentation and had a question-and-answer period after.	N/A	Dawson City Open House Notice for June 18 2014
TH0101	26-Sep-16	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Bruce Charlie (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Chief Joseph, Albert Peter (First Nation of Na-cho Nyäk Dun)	Draft Engagement and Communication Strategy	Richard (Chance) emailed Chief Bruce Charlie (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), and Chief Roberta Joseph (Tr'ondëk Hwëch'in) and cc'd Cindy (Chance), Greg (Chance), and Albert (First Nation of Na-Cho Nyäk Dun). attaching a Draft Engagement and Communication Strategy. Richard (Chance) requested they review and share comments. Richard (Chance) requested a meeting to go over the document and advance their relationship.	N/A	N/A
TH0001	1-Dec-17	Letter	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Roberta Joseph (Tr'ondëk Hwëch'in)	Engagement Plan	Richard (Chance) sent a letter to Tr'ondëk Hwëch'in about the Communications and Engagement Plan that Chance wishes to develop in partnership with Tr'ondëk Hwëch'in and an introduction of Hemmera as Chance's support on developing this engagement strategy.	N/A	N/A
TH0002	9-Jan-18	Phone call	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Roberta Joseph (Tr'ondëk Hwëch'in)	Engagement Plan	Richard (Chance) attempted to call the Chief of Tr'ondëk Hwëch'in at 11:05AM to follow up on the December 1, 2017 letter. He left a message on her voicemail to call back.	N/A	N/A
TH0003	27-Feb-18	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Roberta Joseph (Tr'ondëk Hwëch'in)	Engagement Plan	Richard (Chance) sent an email with a letter attached requesting a meeting with Tr'ondëk Hwëch'in on developing a Communication and Engagement Plan. The letter was a follow up to the letter sent December 1, 2017.	N/A	N/A
TH0004	15-Mar-18	Phone call	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Roberta Joseph (Tr'ondëk Hwëch'in)	Engagement	Richard (Chance) had a phone call with the Chief of Tr'ondëk Hwëch'in to follow up the December 1st and February 27, 2018 letters. She acknowledged receiving them and thought an original was to come in the mail so did not forward letters on to anyone. She will now act upon the letters, discuss with other members of her government and have someone get back to Chance. Chance suggested a meeting in April.	N/A	N/A
TH0005	28-Mar-18	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting	Richard (Chance) sent Tr'ondëk Hwëch'in a Draft agenda and a map showing the settlement lands, traditional territories and the location of the exploration permits and significant discovery licenses owned by Chance.	N/A	N/A
TH0006	9-Apr-18	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in), Darren Taylor (Tr'ondëk Hwëch'in), Margaret Rosling	Meeting	Sidney (Tr'ondëk Hwëch'in) emailed Chance with an attached revised agenda for the meeting the next day.	N/A	N/A
TH0007	10-Apr-18	Meeting		Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Rick Nielson, Cindy Dickson (Chance)	Executive Director Pat Titus (Tr'ondëk Hwëch'in), Darren Taylor (Tr'ondëk Hwëch'in), Land and Resources Manager Kay Linley, Manager of Legislation and Policy Monina Wittfoth, and Senior Advisor, Mining and Strategic Initiatives, Dr. Sidney Schafrik (Tr'ondëk Hwëch'in), Kelly Constable (Hemmera), Emily Mann (Hemmera)	Engagement Plan	Chance meeting with Tr'ondëk Hwëch'in to discuss Chance as a company, to re-set the relationship with Tr'ondëk Hwëch'in, and to discuss collaborative development of a Communications and Engagement Plan per OIC 2017/037.	Tr'ondëk Hwëch'in identified and Chance confirmed that the Tr'ondëk Hwëch'in Executive Director and Tr'ondëk Hwëch'in Advisor for Mining and Strategic Initiatives will be the main contacts for Chance to communicate with Tr'ondëk Hwëch'in moving forward.	N/A
TH0008	23-Apr-18	Email	Outgoing	Tr'ondëk Hwëch'in	Kelly Constable (Hemmera)	Richard Wyman (Chance), Rick Nielsen, Greg Charlie (Chance), Cindy Dickson (Chance)	Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement	Kelly (Hemmera) sent the Draft meeting notes for review and comment, for the meeting held April 10th, 2018. Kelly (Hemmera) also noted that Tr'ondëk Hwëch'in would review information presented by Chance with Chief and Council and get back to Chance with next steps, including Tr'ondëk Hwëch'in's interest in Chance providing a Draft Engagement and Communication Plan to Tr'ondëk Hwëch'in as a starting point. Hemmera asked Tr'ondëk Hwëch'in's representatives if they had met with Chief and Council and had an update.	N/A	N/A
TH0009	24-Apr-18	Email	Outgoing	Tr'ondëk Hwëch'in	Kelly Constable (Hemmera)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance), Rick Nielsen (Chance)	Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in), Kelly Constable (Hemmera)	Engagement	Kelly (Hemmera) sent a copy of the Tr'ondëk Hwëch'in meeting notes with Chance's edits incorporated. She said that there was a notable decimal place error in the first version; on page 3, well sites are 1.5 hectares, not 1500 like she had incorrectly written.	N/A	N/A
TH0010	1-May-18	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement	Sidney (Tr'ondëk Hwëch'in) sent in their addition to the meeting notes of April 10th, 2018 between Chance and Tr'ondëk Hwëch'in.	N/A	N/A
TH0011	8-May-18	Email	Outgoing	Tr'ondëk Hwëch'in	Kelly Constable (Hemmera)	Richard Wyman (Chance), Rick Nielsen, Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in)	Engagement Plan	Kelly (Hemmera) sent an attachment with the most recent version of the notes with the edits from both Tr'ondëk Hwëch'in and Chance. Hemmera also extended the offer once again for Hemmera to provide a Draft document or annotated table of contents for an Engagement and Communications Plan for Tr'ondëk Hwëch'in and Chance. Hemmera would like to know their thoughts on this. As well, Hemmera asked if they were able to discuss the meeting with Chief and Council of Tr'ondëk Hwëch'in. Chance would welcome a short teleconference to touch base.	N/A	N/A
TH0012	8-May-18	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Chief Roberta Joseph (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in)	Tenure Extension	A representative from Chance sent a letter to Tr'ondëk Hwëch'in to provide notification that Chance will be submitting a request to extend the tenure of the exploration permits numbered 0012-117, which are about to expire in August if not extended. Chance said if there are any questions or comments please contact Chance.	N/A	N/A
TH0013	8-May-18	Email	Outgoing	Tr'ondëk Hwëch'in	Kelly Constable (Hemmera)	Richard Wyman (Chance), Rick Nielsen, Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in)	Engagement Plan	Hemmera sent an attachment with the most recent version of the notes with the edits from both Tr'ondëk Hwëch'in and Chance. Hemmera also extended the offer once again for Hemmera to provide a Draft document or annotated table of contents for an Engagement and Communications Plan for Tr'ondëk Hwëch'in and Chance. Hemmera would like to know their thoughts on this. As well, Hemmera asked if they were able to discuss the meeting with Tr'ondëk Hwëch'in Chief and Council. Chance would also welcome a short teleconference to touch base.	N/A	N/A
TH0014	8-May-18	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Roberta Joseph (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in)	Tenure Extension	A representative from Chance sent a letter to Tr'ondëk Hwëch'in to provide notification that Chance will be submitting a request to extend the tenure of the exploration permits numbered 0012-117, which are about to expire in August if not extended. Chance said if there are any questions or comments please contact Chance.	N/A	N/A
TH0015	17-May-18	Email	Outgoing	Tr'ondëk Hwëch'in	Kelly Constable (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Plan	Hemmera sent an attached "without prejudice" Draft Engagement and Communications Plan for Tr'ondëk Hwëch'in to review and consider. Hemmera also said as we quickly approach summer and the August 1st deadline as described in Ministerial Order 2017/037, Chance would like to set up a meeting or teleconference with Tr'ondëk Hwëch'in to provide an update on its progress in developing Engagement and Communications planed with other First nations. Hemmera asked that they please let Hemmera know at their earliest convenience a date and time that works for Tr'ondëk Hwëch'in.	N/A	N/A
TH0016	17-May-18	Email	Outgoing	Tr'ondëk Hwëch'in	Kelly Constable (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Plan	Hemmera sent Tr'ondëk Hwëch'in an email further to the conversation Hemmera and Sidney had earlier in the day. Attached is a "without prejudice" Draft Engagement and Communications Plan for Tr'ondëk Hwëch'in to review and consider. As was communicated in the April 10th, 2018 meeting between Chance and Tr'ondëk Hwëch'in, Tr'ondëk Hwëch'in is interested in seeing a Draft Engagement and Communications Plan as a starting point. Chance is open to a framework that suits Tr'ondëk Hwëch'in's engagement and communications preferences and welcomes feedback on this Draft, or alternatively an original Tr'ondëk Hwëch'in Draft of an Engagement and Communication Plan for Chance to review and consider should the attached not serve as an appropriate starting point.	N/A	N/A

TH0017	28-May-18	Email	Outgoing	Tr'ondëk Hwëch'in	Kelly Constable (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Plan	A representative from Hemmera sent an email to Tr'ondëk Hwëch'in to follow up on their email just over a week ago. Hemmera seeks Tr'ondëk Hwëch'in's availability for a teleconference to discuss the attachment (Draft TH_Chance_ Engagement and Communication Plan). She asked them to let her know what dates and times work for them.	N/A	Draft TH_Chance_Engagement and Communication Plan
TH0018	13-Jun-18	Email	Outgoing	Tr'ondëk Hwëch'in	Kelly Constable (Hemmera)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in)	Meeting	A representative from Hemmera sent representatives from Tr'ondëk Hwëch'in an email, to check in with them regarding setting up a call either June 22, 25, or 26. Hemmera asked if there was a one-hour window on one of those days to connect.	N/A	N/A
TH0019	18-Jun-18	Email	Outgoing	Tr'ondëk Hwëch'in	Kelly Constable (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in), Shena Shaw (Hemmera) Emily Mann (Hemmera)	Engagement Plan	A representative from Hemmera sent Tr'ondëk Hwëch'in an email with a Draft agenda as an attachment. Hemmera said this agenda has been developed with the assumption that they had received direction from Chief and Council to pursue engagement and developing an Communications and Engagement Plan with Chance and requested confirmation if the assumption is incorrect.	N/A	N/A
TH0020	29-Jun-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Shena Shaw (Hemmera), Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in)	Engagement Plan	A representative from Hemmera thanked everyone for their time on yesterday's afternoon teleconference. As discussed, Hemmera is to follow up with scheduling the next teleconference meeting and gave a suggested date and timeframe: • July 13th, any time • July 16th, in the morning • July 17th, in the afternoon • July 18th, any time	N/A	N/A
TH0021	5-Jul-18	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	Greg Charlie (Chance)	Ewa Holender (Tr'ondëk Hwëch'in)	Engagement Plan	A representative from Chance sent Tr'ondëk Hwëch'in an email, thanking them for their response and documents for review. Capacity funding details were discussed.	N/A	N/A
TH0022	12-Jul-18	Email	Incoming	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in)	Meeting	Emily (Hemmera) sent out the meeting minutes from the June 28 meeting and sent to Tr'ondëk Hwëch'in and Chance at the same time. Hemmera also wanted to add the meeting minutes as an agenda item.	A representative from Hemmera emailed First Nation of Na-Cho Nyäk on July 13th, 2018 and carbon copied Representatives from Hemmera, Chance Oil & Gas and First Nation of Na-Cho Nyäk, to thank First Nation of Na-Cho Nyäk for getting back to everyone. Hemmera then asked First Nation of Na-Cho Nyäk if they had a phone number that First Nation of Na-Cho Nyäk could be reached at and if they could send a few dates and times within the next week to that they might be able to have a quick conference call.	N/A
TH0023	19-Jul-18	Email	Outgoing	Tr'ondëk Hwëch'in	Shena Shaw (Hemmera)	N/A	Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in)	Engagement Plan	Shena (Hemmera) sent Tr'ondëk Hwëch'in the latest version of the Engagement and Communication Plan, the map of Chance's permits issued by Yukon Government for reference purposes, and meeting notes from the July 13th meeting. Chance also suggested agenda items for the next meeting.	N/A	N/A
TH0024	19-Jul-18	Email	Incoming	Tr'ondëk Hwëch'in	Ewa Holender (Tr'ondëk Hwëch'in)	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in), Shena Shaw (Hemmera)	Engagement Plan	Ewa (Tr'ondëk Hwëch'in) sent Chance comments from the June 28th meeting minutes. Tr'ondëk Hwëch'in committed to reviewing the July 13th meeting minutes and sending comments in due course.	N/A	N/A
TH0025	19-Jul-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Meeting	Meeting invitation for July 23rd sent by Emily (Hemmera) to Tr'ondëk Hwëch'in.	N/A	N/A
TH0026	20-Jul-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Engagement Plan	Emily (Hemmera) sent Tr'ondëk Hwëch'in the latest Draft of the Engagement and Communication Plan. This Draft incorporated changes that were discussed in the meeting the previous day and suggested that comments and further changes be discussed in the meeting , July 23rd. The email also included an agenda for the meeting on July 23.	N/A	N/A
TH0027	23-Jul-18	Email	Outgoing	Tr'ondëk Hwëch'in	Shena Shaw (Hemmera)	N/A	Ewa Holender (Tr'ondëk Hwëch'in)	Engagement Plan	Shena (Hemmera) replied to an email from Tr'ondëk Hwëch'in saying they would use the latest Engagement and Communication Plan sent via email.	N/A	N/A
TH0028	23-Jul-18	Email	Incoming	Tr'ondëk Hwëch'in	Ewa Holender (Tr'ondëk Hwëch'in)	Chance	Ewa Holender (Tr'ondëk Hwëch'in)	Engagement Plan	Ewa (Tr'ondëk Hwëch'in) sent Chance the Tr'ondëk Hwëch'in Traditional Territory Shape files. Tr'ondëk Hwëch'in also asked that Chance please share the shapefiles for the permits once they have received them from Yukon Government to better understand the overlap area.	N/A	N/A
TH0029	23-Jul-18	Meeting	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Ewa Holender (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Plan	This meeting was used to go over final edits to the Engagement and Communications Plan. According to Tr'ondëk Hwëch'in internal protocol, the final Draft of the Engagement and Communications Plan would be submitted to Tr'ondëk Hwëch'in Chief and Council with a letter for final approval.	N/A	N/A
TH0030	26-Jul-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Engagement Plan	Emily (Hemmera) sent Tr'ondëk Hwëch'in an email with the final Draft of the Tr'ondëk Hwëch'in and Chance Engagement and Communication Plan that is meant to be reviewed by Tr'ondëk Hwëch'in Chief and Council.	N/A	N/A
TH0031	26-Jul-18	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Plan	Richard (Chance) contacted Tr'ondëk Hwëch'in to provide them with a letter for Tr'ondëk Hwëch'in to provide to Chief and Council to update them on the work that Chance and Tr'ondëk Hwëch'in have done to design an Engagement and Communications Plan in a cooperative and collaborative manner. Chance asked VGG to include this letter in the package that Tr'ondëk Hwëch'in will be presenting to Chief and Council for the Council meeting. Chance also noted that the final version of the Plan was sent to Tr'ondëk Hwëch'in earlier that day.	N/A	N/A
TH0032	26-Jul-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Engagement Plan	Emily (Hemmera) sent Tr'ondëk Hwëch'in and Chance staff an email asking if anyone had any more edits to the July 13th meeting summary between Chance and Tr'ondëk Hwëch'in.	N/A	N/A
TH0033	26-Jul-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Engagement Plan	Emily (Hemmera) sent Tr'ondëk Hwëch'in an email asking if anyone had further comments or changes to make to the July 13th meeting notes.	N/A	N/A
TH0034	31-Jul-18	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Plan	Sidney (Tr'ondëk Hwëch'in) emailed Yukon Government Energy Mines and Resources to let them know that that Tr'ondëk Hwëch'in should be ratifying the Plan at the next Council Meeting during the week of August 6th through August 10th. Tr'ondëk Hwëch'in said that if Yukon Government Energy Mines and Resources has any questions, to feel free to ask.	N/A	N/A
TH0035	2-Aug-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Engagement Plan	Emily (Hemmera) sent out meeting summary of the July 23rd teleconference. If Tr'ondëk Hwëch'in has revisions it was asked that they made them in tracked changes and return to sender to finalize. Meeting summary was attached.	N/A	N/A
TH0036	10-Aug-18	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Plan	Sidney (Tr'ondëk Hwëch'in) informed Yukon Government that Tr'ondëk Hwëch'in Chief and Council had asked for continuation of approval until the next Chief and Council meeting on August 23rd. Tr'ondëk Hwëch'in Chief and Council was reviewing the plan but was unable to pass the item due to the bulk of items required for the upcoming General Assembly.	N/A	N/A
TH0037	23-Aug-18	Email	Incoming	Tr'ondëk Hwëch'in	Ewa Holender (Tr'ondëk Hwëch'in)	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Engagement Plan	Ewa (Tr'ondëk Hwëch'in) said Chief and Council asked that the table of the key contacts in the Plan be moved to a Schedule to the Plan and sent along a tracked changes Draft. Tr'ondëk Hwëch'in asked that Chance confirm that the change is acceptable in order to move forward with putting the Plan to Chief and Council for approval.	N/A	N/A
TH0038	23-Aug-18	Email	Incoming	Tr'ondëk Hwëch'in	Ewa Holender (Tr'ondëk Hwëch'in)	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Engagement Plan	Ewa (Tr'ondëk Hwëch'in) representative thanked Emily (Hemmera) for sending along a version of the Plan with tracked changes accepted. The Tr'ondëk Hwëch'in representative confirmed that they would move forward with sending the Plan to Chief and Council for approval. Chance was asked to let Tr'ondëk Hwëch'in know when Richard gave official approval or if there was any other feedback.	N/A	N/A
TH0039	23-Aug-18	Email	Incoming	Tr'ondëk Hwëch'in	Ewa Holender (Tr'ondëk Hwëch'in)	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Engagement Plan	Ewa (Tr'ondëk Hwëch'in) thanked Chance for confirming their approval of the changes to the Plan. Tr'ondëk Hwëch'in said that they would be in touch as soon as the Plan goes through the Chief and Council process and to arrange how the Plan will be submitted to Yukon Government.	N/A	N/A

TH0040	23-Aug-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Engagement Plan	Emily (Hemmera) thanked Tr'ondëk Hwëch'in for sending the updated Plan and said that they could move forward to submit the Plan for Chief and council for approval. One member of the chance team was not in the office to provide feedback. Given the small change, Tr'ondëk Hwëch'in was told to move forward and Chance would let Tr'ondëk Hwëch'in know if there was additional feedback as soon as they could.	N/A	N/A
TH0041	23-Aug-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Engagement Plan	Emily (Hemmera) confirmed with Tr'ondëk Hwëch'in that all members were fine with the Plan. Chance asked that Tr'ondëk Hwëch'in send any updates on the approval of the Plan and also to talk about the submission of the Plan to Yukon Government.	N/A	N/A
TH0043	28-Aug-18	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Engagement Plan	Sidney (Tr'ondëk Hwëch'in) emailed their Engagement and Communications Plan to Yukon Government as agreed to by Tr'ondëk Hwëch'in Chief and Council and Chance.	N/A	N/A
TH0044	2-Oct-18	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Pat Titus (Tr'ondëk Hwëch'in) and Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting	Richard (Chance) wrote to representatives of Tr'ondëk Hwëch'in: "Now that we have established an Engagement and Communications Plan, I am writing to initiate the process of implementation. The plan calls for a number of things to be at least started in the first three months following the approval of the plan: 1) a confidentiality agreement; 2) capacity funding and associated budget; and 3) plan implementation discussion. It might be helpful to include some discussion about the exploration project to be able to complete some of the objectives cited above. Using August 28 as the approval date for the engagement plan, the three month initial period will conclude November 28. Asked to please let Chance know some dates that you can meet either by conference call or in person to advance the objectives of the plan."	N/A	N/A
TH0045	5-Oct-18	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting	Sidney (Tr'ondëk Hwëch'in) suggested a teleconference meeting on October 23rd to initiate the implementation of the Engagement and Communications Plan.	N/A	N/A
TH0046	11-Oct-18	Email	Outgoing	Tr'ondëk Hwëch'in	Shena Shaw (Hemmera)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting	Shena (Hemmera) told Tr'ondëk Hwëch'in that they would send a scheduler and sought to confirm attendees for the meeting.	N/A	N/A
TH0047	11-Oct-18	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Shena Shaw (Hemmera)	Meeting	Sidney (Tr'ondëk Hwëch'in) confirmed that the meeting attendees and Chance sending out a scheduler were fine.	N/A	N/A
TH0048	17-Oct-18	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in)	Agreements	Richard (Chance) forwarded a Draft Confidentiality Agreement that was prepared by their counsel for Tr'ondëk Hwëch'in to consider and advise of any amendments. Notwithstanding the efforts of Ewa Holender (Tr'ondëk Hwëch'in), Chance prefers to use their own form of agreement since there are five First Nation groups that the company has to engage. For reasons of fairness and consistency, Chance is proposing that the attached form of agreement be used by each of the parties having interests in the Eagle Plain project area. Tr'ondëk Hwëch'in will see that the attached Draft is already marked up with a correction and with Notes to Draft that Chance did. Please mark up this one so there is continuity as the Drafting progresses. Please review and perhaps this can be part of the meeting agenda for next week.	N/A	N/A
TH0050	23-Oct-18	Meeting		Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement	Chance and Tr'ondëk Hwëch'in met to discuss the implementation of the Communications and Engagement Plan.	A Chance representative explained Chance's plans for the next 12-months, beginning by saying that not much will happen in the next year. Chance is planning a small geological field study in permits 9, 11, and 13. This will involve helicopter time to perform the local geological field sample and take place 30km to 50km North of Tr'ondëk Hwëch'in Territory. Looking at Chance's longer-term exploration plans, they would also occur north of Tr'ondëk Hwëch'in Territory in permits 12, 13, 14, 19, and 20, and perhaps in permits 10 and 11. This would be where the 3D seismic program would take place. The program would involve small-scale activity and have 1-2 drilling rigs operating at a time. The camp is not large enough to do drilling and seismic at the same time because of limited occupancy.	N/A
TH0051	23-Oct-18	Meeting		Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Camp	Chance and Tr'ondëk Hwëch'in met to discuss the implementation of the Communications and Engagement Plan.	Chance responded that they were, but most of the activity they are looking at would require additional YESAB assessment and permitting.	N/A
TH0052	23-Oct-18	Meeting		Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Economic Effects or Benefits	Chance and Tr'ondëk Hwëch'in met to discuss the implementation of the Communications and Engagement Plan.	Chance responded that the Project would only use public highways up to the winter road access off the Dempster Highway. Employment is hard to gauge. The drilling program would involve approximately 40 jobs including camp maintenance, catering, construction, and maintenance of access roads. There would be four to six people working at a time, but the work would be shift work. Chance would look to Vuntut Gwitchin first to offer positions because they would be operating in Vuntut Gwitchin Traditional Territory, and then expand hiring when more positions were available. A Chance representative added that historically Chance has hired employees from Vuntut Gwitchin First Nation, First Nation of Na-Cho Nyäk, and the Dawson area. They would look at candidates with oil and gas experience.	2018.10.23 Chance and TH Meeting Summary
TH0053	23-Oct-18	Meeting		Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Economic Effects or Benefits	Chance and Tr'ondëk Hwëch'in met to discuss the implementation of the Communications and Engagement Plan.	Chance agreed and added that there are cycles in the exploration that require different skills and services, Chance will go to where these skills and services are available.	2018.10.23 Chance and TH Meeting Summary
TH0054	23-Oct-18	Meeting		Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Project Design	Chance and Tr'ondëk Hwëch'in met to discuss the implementation of the Communications and Engagement Plan.	A Chance representative said that this is correct and added that Chance will usually do drilling in the winter months, then move to a year-round operation.	2018.10.23 Chance and TH Meeting Summary
TH0055	23-Oct-18	Meeting		Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Project Design	Chance and Tr'ondëk Hwëch'in met to discuss the implementation of the Communications and Engagement Plan.	Chance said that they have undertaken 3D seismic survey already and have identified prospects. They may choose to drill using old data and then evaluate. Chance would keep Tr'ondëk Hwëch'in in the loop. A Chance representative added that once Chance is drafting a formal submission to YESAB, Chance will meet with communities as part of the consultation process.	2018.10.23 Chance and TH Meeting Summary

TH0056	23-Oct-18	Meeting		Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Information Sharing	Chance and Tr'ondëk Hwëch'in met to discuss the implementation of the Communications and Engagement Plan.	N/A	2018.10.23 Chance and TH Meeting Summary
TH0057	23-Oct-18	Meeting		Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Agreements	Chance and Tr'ondëk Hwëch'in met to discuss the implementation of the Communications and Engagement Plan.	N/A	2018.10.23 Chance and TH Meeting Summary
TH0058	23-Oct-18	Meeting		Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Agreements	Chance and Tr'ondëk Hwëch'in met to discuss the implementation of the Communications and Engagement Plan.	Chance responded that they were okay with having the terms of the Confidentiality Agreement linked to the length of land tenure or duration of activity and subject to extension when both parties agree. A Chance representative suggested 5 years might be most appropriate because that is the longest length of tenure that Chance currently holds on any exploration permits. Tr'ondëk Hwëch'in said that five years is preferable for Tr'ondëk Hwëch'in. Chance followed and said that the next step was to get a mark-up of the Confidentiality Agreement from Tr'ondëk Hwëch'in.	2018.10.23 Chance and TH Meeting Summary
TH0059	23-Oct-18	Meeting		Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Agreements	Chance and Tr'ondëk Hwëch'in met to discuss the implementation of the Communications and Engagement Plan.	A Chance representative asked if Chance could get an itemized budget of what would be included in the initial capacity funding. Tr'ondëk Hwëch'in responded that they could and a Tr'ondëk Hwëch'in representative said that she could get this done soon. Sidney (Tr'ondëk Hwëch'in) said that the timeline for funding was the end of next month.	2018.10.23 Chance and TH Meeting Summary
TH0060	23-Oct-18	Meeting		Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement	Chance and Tr'ondëk Hwëch'in met to discuss the implementation of the Communications and Engagement Plan.	N/A	2018.10.23 Chance and TH Meeting Summary
TH0061	23-Oct-18	Meeting		Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Plan	Chance and Tr'ondëk Hwëch'in met to discuss the implementation of the Communications and Engagement Plan.	Chance answered that they had, and that they had a condition on tenure extension that they had to report to Yukon Government on Plan implementation annually for the duration of the permit tenure.	2018.10.23 Chance and TH Meeting Summary
TH0063	6-Nov-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Meeting	Emily (Hemmera) sent Tr'ondëk Hwëch'in the completed meeting summary for the October 23rd meeting for Chance to review. If Tr'ondëk Hwëch'in would like to make any changes, they can do so in tracked changes and send to Chance to finalize.	N/A	2018.10.23 Chance and TH Meeting Summary
TH0064	15-Nov-18	Email	Incoming	Tr'ondëk Hwëch'in	Ewa Holender (Tr'ondëk Hwëch'in)	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Meeting	Ewa (Tr'ondëk Hwëch'in) sent an attached version of the October 23rd meeting Summary with marked up changes.	N/A	N/A
TH0065	16-Nov-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Meeting	Emily (Hemmera) thanked Tr'ondëk Hwëch'in for sending changes to the October 23rd meeting summary. The Chance representative said these would be finalized for the record.	N/A	N/A
TH0066	21-Nov-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Meeting	Emily (Hemmera) sent Tr'ondëk Hwëch'in a Draft working agenda for the November 23 teleconference.	N/A	N/A
TH0067	23-Nov-18	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Ewa Holender (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement	Richard (Chance) sent Tr'ondëk Hwëch'in edits to the October 23rd meeting minutes that had Tr'ondëk Hwëch'in's comments.	N/A	N/A
TH0068	23-Nov-18	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Kaylynn Litton, Ewa Holender (Tr'ondëk Hwëch'in)	Agreements	Richard (Chance) forwarded a clean copy of the Confidentiality Agreement in Word format for Tr'ondëk Hwëch'in to arrange execution. Noted that there are two bullets on the first page which were to be updated for the date of execution which should coincide with the timing of Tr'ondëk Hwëch'in signing. Chance presentative indicated that once that was done, to forward to them to execute o behalf of Chance. Noted that this was a bit different to the sequence Chance had proposed in the meeting with Tr'ondëk Hwëch'in in the morning, but this now acknowledged some of the timing uncertainty Tr'ondëk Hwëch'in described at their end and provided Tr'ondëk Hwëch'in the flexibility to put in an accurate date of execution. Indicated that if Tr'ondëk Hwëch'in has any questions or comments, to please call or email Chance.	N/A	N/A
TH0069	23-Nov-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Ewa Holdener, (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in), Pat Titus (Tr'ondëk Hwëch'in), Greg Charlie (Chance), Cindy Dickson (Chance), Emily Mann (Hemmera)	Meeting	Emily (Hemmera) sent Tr'ondëk Hwëch'in their changes to the October 23rd meeting minutes saying they would finalize and send to both parties.	N/A	N/A
TH0070	23-Nov-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Meeting	As mentioned in the Chance and Tr'ondëk Hwëch'in meeting this morning, Chance is interested in planning an All-Party Meeting for February 1st, 2019, and would like to invite Tr'ondëk Hwëch'in. An All-Party Meeting is meant to bring together Tr'ondëk Hwëch'in, Vuntut Gwitchin, Gwich'in Tribal Council, Tetlit Gwich'in Council, First Nation of Na-cho Nyak Dun, and Yukon Government to discuss matters related to Chance's upcoming exploration project. Shared the proposed agenda. Noted Chance would like to host the meeting in Vancouver on February 1st, 2019, the day after AME Roundup (BC's Annual Mining Conference). Details around capacity funding were discussed. Chance is still in the early stages of planning this event, but wanted to let Tr'ondëk Hwëch'in know in advance so that the date could be reserved. Chance is happy to have further conversations regarding your attendance and meeting logistics. Chance can give Emily at Hemmera a call at any time if you have questions. Her contact information is below. Chance is looking to know if this date works for the above mentioned representatives to attend. Please respond to Emily (Hemmera) if you are available to attend the meeting and we will send a meeting scheduler to specific attendees shortly.	N/A	N/A
TH0071	27-Nov-18	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Meeting	Sidney (Tr'ondëk Hwëch'in) asked if Ministers for Yukon Government would be attending the All-Party Meeting, or just representatives like Deputies.	N/A	N/A
TH0072	27-Nov-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Meeting	Emily (Hemmera) responded to Tr'ondëk Hwëch'in's questions about the attendance of a Minister or deputy at the All-Party Meeting. Chance was currently planning to have the ADM of Oil and Gas and Mineral Resources, and the Director Oil, Gas and Mineral Resources.	N/A	N/A
TH0073	27-Nov-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Meeting	Emily (Hemmera) informed Tr'ondëk Hwëch'in that in addition to having the ADM and Director of Oil and gas and Mineral Resources, Chance was looking to bring the Minister or Deputy to the meeting as well.	N/A	N/A
TH0074	4-Dec-18	Email	Incoming	Tr'ondëk Hwëch'in	Ewa Holender (Tr'ondëk Hwëch'in)	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Agreements	Ewa (Tr'ondëk Hwëch'in) thanked a Chance representative for their time on the phone. As discussed, Tr'ondëk Hwëch'in attached the final version of the initial capacity funding letter, which they hoped to get to Council that week. They asked to please arrange for Chance to sign the letter and send it to Tr'ondëk Hwëch'in at their earliest convenience. Tr'ondëk Hwëch'in would then arrange for this to be countersigned on behalf of Tr'ondëk Hwëch'in. Capacity funding details were discussed. Tr'ondëk Hwëch'in hoped that Council could also approve the Confidentiality Agreement that week. Tr'ondëk Hwëch'in would send Chance a copy signed by Tr'ondëk Hwëch'in as soon as possible, for countersignature by Chance. Tr'ondëk Hwëch'in stated to please let Tr'ondëk Hwëch'in know if Chance had any questions or required further information.	N/A	N/A

TH0075	6-Dec-18	Email	Outgoing	Tr'ondëk Hwëch'in	Calista Morrison (Hemmera)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Calista Morrison (Hemmera)	Meeting	Calista (Hemmera) sent out Draft summary of the November 23rd, 2018 meeting for comments and review. (Attachment Title: 2018.11.23Chance and TH Meeting Summary). The purpose of this meeting was to discuss the implementation of the Tr'ondëk Hwëch'in and Chance Engagement and Communications Plan. Items also on the agenda were discussing the Confidentiality Agreement, and Letter of Agreement for Capacity Funding sent from Tr'ondëk Hwëch'in to Chance on November 5, 2018. Chance also wished to discuss their proposal for an All-Party Meeting where the Five First Nations, Yukon Government, and Chance would meet to discuss key project items and areas for collaboration. Emily (Hemmera) began the meeting by introducing meeting attendees and reviewing the agenda. Sidney (Tr'ondëk Hwëch'in) informed attendees that Pat Titus (Tr'ondëk Hwëch'in) was no longer working for Tr'ondëk Hwëch'in. Hemmera initiated discussion of the Confidentiality Agreement. Richard (Chance) expressed that the Confidentiality Agreement was good to go, and that he would clean up the document and send it to Tr'ondëk Hwëch'in for signing. Sidney (Tr'ondëk Hwëch'in) stated that because of the staffing change an Acting-Executive Director would likely have to sign the agreement. He stated that he would get direction from Council and that the process might take a couple weeks. Details around capacity funding were discussed. Transition to the new Chief and Council is expected to take place Jan 2019 and that there would likely be a series of information sessions over the coming months to bring them up to speed with respect to Chance. Richard (Chance) mentioned that there appears to be interest in the other First Nations for an All-Party Meeting in the new year. They are tentatively scheduling this for February 1, 2019. Because of the change with VGFN, it's possible the Northern Chiefs would want to meet ahead of time. Tr'ondëk Hwëch'in confirmed that a private meeting of the Northern Chiefs is desired. Chance stated that could be arranged either before the All-Party Meeting or during it.Tr'ondëk Hwëch'in will have to seek internal instructions and confirm schedules and availability for the date proposed. Sidney (Tr'ondëk Hwëch'in) stated that Roundup is very busy for Tr'ondëk Hwëch'in. Sidney (Tr'ondëk Hwëch'in) mentioned that he would work internally to check availability and will try to confirm dates and availability over email by December 13. Hememra informed Tr'ondëk Hwëch'in that Chance/Hemmera were hoping to include an In-Camera session in the agenda for the All-Party Meeting. It was also mentioned that Yukon Government is assisting with booking a room for the meeting. Hemmera offered to send a brief summary of the All-Party meeting to Tr'ondëk Hwëch'in to aid in their internal discussions and planning. Chance asked who the Letter of Agreement for the Capacity Funding should be addressed to. Sidney (Tr'ondëk Hwëch'in) said to send the clean Draft to himself and that he would follow up internally as to next steps and signatures. Similar to the direction required for the Confidentiality Agreement. Sidney will also check in with the Tr'ondëk Hwëch'in Finance Department on payment instructions (i.e., who to send the letter to and who it should be addressed to).	N/A	N/A
TH0076	13-Dec-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Meeting	Emily (Hemmera) responded to Tr'ondëk Hwëch'in's question regarding if there was an update on the attendance of the Minister or Deputy Minister at the Chance All-party Meeting. Chance said unfortunately not. A Yukon Government representative had been in touch with them to try and schedule their attendance, and at that point, it was still too early for them to commit. The Yukon Government representative said they would probably find out if a Yukon Government representative would attend in early January. They did have confirmed attendance from multiple government officials from the other First Nations, however, many were waiting to learn if an elected official would be attending as well. Chance asked Tr'ondëk Hwëch'in about how the Chief and Council meeting went. They asked how Chief and Council's review went pertaining to the Confidentiality Agreement, Capacity Funding Letter, and the All-party Meeting. Chance asked if there were any action items for Chance.	N/A	N/A
TH0077	13-Dec-18	Email	Outgoing	Tr'ondëk Hwëch'in	Emily Mann (Hemmera)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Emily Mann (Hemmera)	Meeting	Emily (Hemmera) acknowledged receiving an update from Tr'ondëk Hwëch'in that the Chief and Council meeting had been moved to that night and there was no update from Tr'ondëk Hwëch'in regarding the capacity funding, or confidentiality agreement.	N/A	N/A
E00038	7-Jan-19	Email	Incoming	Tr'ondëk Hwëch'in	Ewa Holender (Tr'ondëk Hwëch'in)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Engagement/Consultation Confidentiality Agreement Benefits/Capacity Agreement	Ewa (Tr'ondëk Hwëch'in) said that the confidentiality agreement and Capacity Funding letter was discussed at the January Council Meeting (January 10, 2019). Ewa stated they would be in touch with any updates.	N/A	E00038_190207_RE_ Chance Oil and Gas Update_3
E00081	7-Jan-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Engagement/Consultation	Hemmera sent Tr'ondëk Hwëch'in follow up on action items from last meeting.	N/A	E00081_190212_Chance Oil and Gas Update
E00015	10-Jan-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Hemmera, Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) asked Hemmera about who was confirmed for Yukon Government attendance.	N/A	E00015_190206_Re_ Chance all party Meeting Logistics_2
E00069	10-Jan-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Hemmera discussed travel details, costs that will be covered, suggested flights with Tr'ondëk Hwëch'in.	N/A	E00069_190211_Chance all party
E00097	10-Jan-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera listed Yukon Government representatives attending meeting.	N/A	E00097_190212_RE_ Chance all party Meeting Logistics
E00028	11-Jan-19	Email	Incoming	Tr'ondëk Hwëch'in	Leslie Blake	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation), (Vuntut Gwitchin First Nation), Darius Elias (Vuntut Gwitchin First Nation), Rosa Brown (Vuntut Gwitchin First Nation), Kris Statnyk (Vuntut Gwitchin First Nation), Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), Dawna Hope (Fist Nation of Na-cho Nyäk Dun), Catherine Mallon (Gwich'in Tribal Council), Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender, Grand Chief Bobbie Jo Greenland Morgan (Gwich'in Tribal Council), Leslie Blake (Gwich'in Tribal Council), Stephen Charlie (Gwich'in Tribal Council), David MacMartin (Gwich'in Tribal Council), John Fox (Yukon Government), Derek Fraser (Yukon Government)	Meeting Coordination/Planning	Leslie Blake confirmed attendance in Vancouver.	N/A	E00028_190207_Re_ Chance Oil and Gas all party Meeting Draft Working Agenda_1
E00077	11-Jan-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Dana Tizya-Tramm, Darius Elias, Rosa Brown, Kris Statnyk, Simon Mervyn, Dawna Hope, Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Bobbie Jo Greenland-Morgan, Leslie Blake, Stephen Charlie, David MacMartin, John Fox, Derek Fraser	Engagement/Consultation Meeting Coordination/Planning	Hemmera distributed attached Draft Working Agenda for All-party meeting February 1, 2019 which was to be finalized.	N/A	E00077_190211_Chance Oil and Gas all party Meeting Draft Working Agenda_1
E00039	15-Jan-19	Email	Incoming	Tr'ondëk Hwëch'in	Ewa Holender (Tr'ondëk Hwëch'in)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in)	Engagement/Consultation Confidentiality Agreement Benefits/Capacity Agreement	Ewa (Tr'ondëk Hwëch'in) sent Confidentiality agreement and Capacity Funding letter approved by Tr'ondëk Hwëch'in Chief and Council. They asked Chance to please send the signed funding letter.	N/A	E00039_190207_RE_ Chance Oil and Gas Update_4
E00091	15-Jan-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera explained that Minister Pillai would attend a portion of the meeting with Chance.	N/A	E00091_190212_Minister Pillai at all party Meeting
E00086	16-Jan-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Ewa Holender (Tr'ondëk Hwëch'in)	Confidentiality Agreement Engagement/Consultation Benefits/Capacity Agreement Meeting Coordination/Planning	Hemmera forwarded message from Ewa (Tr'ondëk Hwëch'in) about approval. Hemmera explained that next steps would be to arrange signing of Confidentiality Agreement and Capacity Funding letter.	N/A	E00086_190212_FW_ Chance Oil and Gas Update
E00115	16-Jan-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Confidentiality Agreement	Hemmera thanked Ewa (Tr'ondëk Hwëch'in) for update, and asked if Tr'ondëk Hwëch'in could arrange signing the Confidentiality Agreement then sending it to Chance.	N/A	E00115_190212_RE_ Chance Oil and Gas Update
E00142	18-Jan-19	Phone Call	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Ewa Holender (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Chance called Tr'ondëk Hwëch'in to follow up on Tr'ondëk Hwëch'in's attendance at the All-party meeting.	N/A	N/A

E00143	18-Jan-19	Phone Call	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Ewa Holender (Tr'ondëk Hwëch'in)	Benefits/Capacity Agreement Confidentiality Agreement	Chance called Tr'ondëk Hwëch'in to follow up on the completion of the Confidentiality Agreement and the Letter of Agreement for Capacity Funding.	N/A	N/A
E00144	18-Jan-19	Phone Call	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Ewa Holender (Tr'ondëk Hwëch'in)	Benefits/Capacity Agreement	Chance called Tr'ondëk Hwëch'in to follow up on the completion of the Letter of Agreement for Capacity Funding.	N/A	N/A
E00014	22-Jan-19	Email	Incoming	Tr'ondëk Hwëch'in	Ewa Holender (Tr'ondëk Hwëch'in)	Richard Wyman (Chance)	Ewa Holender (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Benefits/Capacity Agreement Confidentiality Agreement Engagement/Consultation	Ewa (Tr'ondëk Hwëch'in) attached Confidentiality Agreement between Tr'ondëk Hwëch'in and Chance. Ewa explained that Chance should address initial Capacity Funding letter to Tr'ondëk Hwëch'in's Acting Executive Director, Debbie Nagano. Noted previous version sent by chance was a tracked changes version dated 2018. Ewa said they were working on confirming Tr'ondëk Hwëch'in attendees to the All-party meeting.	N/A	E00014_190206_RE_ Capacity Funding Letter and all party Meeting
E00068	22-Jan-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance)	Ewa Holender (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera asked Tr'ondëk Hwëch'in to whom the Capacity Funding Letter should be addressed, and also asked if Tr'ondëk Hwëch'in would be attending All-party meeting.	N/A	E00068_190208_Capacity Funding Letter and all party Meeting
E00003	24-Jan-19	Email	Incoming	Tr'ondëk Hwëch'in	Roberta Joseph (Tr'ondëk Hwëch'in)	Richard Wyman (Chance)	Roberta Joseph (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Roberta (Tr'ondëk Hwëch'in) said that Tr'ondëk Hwëch'in could not attend the All-party meeting. They suggested an alternate meeting date.	N/A	E00003_190124_FW_ All Parties Meeting
E00004	24-Jan-19	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Roberta Joseph (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Richard (Chance) said they were sorry to hear that Tr'ondëk Hwëch'in could not attend the All-party meeting but would proceed with the meeting in Vancouver on February 1, 2019. Chance explained they would provide presentations and material to Tr'ondëk Hwëch'in after the meeting.	N/A	E00004_190124_FW_ All Parties Meeting
E00007	24-Jan-19	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Ewa Holender (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Confidentiality Agreement	Richard (Chance) sent the attached Confidentiality Agreement between Tr'ondëk Hwëch'in and Chance, dated January 22, 2019.	N/A	E00007_190206_Executed CA 0839_001
E00096	24-Jan-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance)	Ewa Holender (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera confirmed that Richard (Chance) had sent completed Capacity Funding letter and cheque to Tr'ondëk Hwëch'in.	N/A	E00096_190212_RE_ Capacity Funding Letter and all party Meeting
E00163	27-Mar-19	Letter	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Tenures/Dispositions/Permits	Richard (Chance) sent the request to extend tenure on Exploration Permits 0006-0011 and 0019 at Eagle Plains.	N/A	E00163_190401_Letter advising TH of Chance's desire to extend Exploration Permits tenure
E00244	13-May-19	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement/Consultation Meeting Coordination/Planning	Richard (Chance) said they were looking forward to meeting in Dawson on June 11, 2019 with Sidney (Tr'ondëk Hwëch'in) and colleagues involved in the assessment of the Eagle Plains exploration Project. Chance wanted to provide an update and share the concept of the Project scope and discuss the process of engagement with Tr'ondëk Hwëch'in. Chance was hoping to submit Project description to YESAB in the Fall. Chance explained they would like input of the Tr'ondëk Hwëch'in to both Project description and other related contributions, and that they were doing a similar exercise with each of the affected First Nations.	N/A	E00244_Meeting June 11_
E00279	13-May-19	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance) cc: Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Richard (Chance) asked Tr'ondëk Hwëch'in for a meeting on June 11 in Dawson with Sidney (Tr'ondëk Hwëch'in) and any colleagues involved in the assessment of the Eagle Plains exploration Project. Chance was doing the initial work to develop the Project description and wanted to provide an update to Tr'ondëk Hwëch'in. Chance wanted to share our concept of the Project scope and discuss the process of engagement with Tr'ondëk Hwëch'in. Chance explained they were hoping to submit to YESAB in the fall, and likely to the Executive Committee and would like input of Tr'ondëk Hwëch'in to both the Project description and other related contributions needed to satisfy YESAB, and that they were doing similar with other affected First Nations.	N/A	E00279_RE_ Meeting June 11__
E00280	13-May-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance) cc: Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Roberta Joseph (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) said that June 11 should be good for a meeting, and included Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in) in the correspondence so they were aware.	N/A	E00279_RE_ Meeting June 11__
E00281	27-May-19	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance) cc: Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Roberta Joseph (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Richard (Chance) followed up with Tr'ondëk Hwëch'in and said that the June 11 meeting in Dawson still works. They asked Tr'ondëk Hwëch'in to please advise who would attending and where it would be held.	N/A	E00279_RE_ Meeting June 11__
E00299	31-May-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Charles Pugh, Jamie Sachi Richardson (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera followed up on a voicemail left by Tamara, to try to book a room for the meeting on June 11. They were looking for other suggestions on where the meeting could be hosted.	N/A	E00299_RE_ Meeting between TH and Chance June 11-1
E00300	31-May-19	Email	Incoming	Tr'ondëk Hwëch'in	Jamie Sachi Richardson (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	N/A	Jamie Sachi Richardson (Tr'ondëk Hwëch'in), Charles Pugh, Hemmera	Meeting Coordination/Planning	Jamie (Tr'ondëk Hwëch'in) said they were happy to help with bookings but the rooms were full. There was one option that was fairly small that was still available. Tr'ondëk Hwëch'in asked Hemmera to please let them know how many people were coming.	N/A	E00299_RE_ Meeting between TH and Chance June 11-1
E00301	3-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Jamie Sachi Richardson (Tr'ondëk Hwëch'in), Charles Pugh	Meeting Coordination/Planning	Hemmera confirmed there would be approximately 10 people.	N/A	E00299_RE_ Meeting between TH and Chance June 11-1
E00302	3-Jun-19	Email	Incoming	Tr'ondëk Hwëch'in	Jamie Sachi Richardson (Tr'ondëk Hwëch'in)	N/A	Jamie Sachi Richardson (Tr'ondëk Hwëch'in), Charles Pugh, Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Jamie (Tr'ondëk Hwëch'in) said there were no meeting spaces available June 11 at 8:30 AM.	N/A	E00299_RE_ Meeting between TH and Chance June 11-1
E00303	3-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Jamie Sachi Richardson (Tr'ondëk Hwëch'in), Charles Pugh, Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Hemmera asked Tr'ondëk Hwëch'in if the small room was booked. They said they might be able to squish, or reduce number of people attending. Hemmera asked if there was a non-conventional meeting space that could be used.	N/A	E00299_RE_ Meeting between TH and Chance June 11-1
E00304	3-Jun-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Jamie Sachi Richardson (Tr'ondëk Hwëch'in), Charles Pugh, Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) said they would check with Julia at front desk to see if the hall was available. They noted that they would have to pay rental fees, but it would be a spot.	N/A	E00299_RE_ Meeting between TH and Chance June 11-1
E00305	3-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Jamie Sachi Richardson (Tr'ondëk Hwëch'in), Charles Pugh, Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera said they had found a room at KIAK, the Odd Fellows Ballroom that they had now reserved. Hemmera thanked TH for help finding a place.	N/A	E00299_RE_ Meeting between TH and Chance June 11-1
E00306	6-Jun-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in) , Jamie Sachi Richardson (Tr'ondëk Hwëch'in), Charles Pugh, Hemmera	Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) asked Hemmera to send a meeting request for June 11, so they could forward to their team.	N/A	E00299_RE_ Meeting between TH and Chance June 11-1
E00307	6-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera apologized for the delay, and said they would send the June 11 meeting request shortly. Hemmera asked if Tr'ondëk Hwëch'in would you like them to include conference call-in details in the invitation and agenda.	N/A	E00299_RE_ Meeting between TH and Chance June 11-1
E00308	6-Jun-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Charles Pugh (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) said yes to please send call in details. Sidney and other Tr'ondëk Hwëch'in colleagues would review the agenda together. Tr'ondëk Hwëch'in also said they would need Hemmera to make a version for public disclosure.	N/A	E00299_RE_ Meeting between TH and Chance June 11-1
E00309	6-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Charles Pugh (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning Engagement/Consultation	Hemmera sent Tr'ondëk Hwëch'in the attached Draft June 11 meeting agenda, and asked Tr'ondëk Hwëch'in to please advise of any changes.	Attachment: 190606_TH_Chance_Meeting Agenda for June 11_DRAFT	E00309_RE_ Meeting between TH and Chance June 11-2
E00310	6-Jun-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Charles Pugh (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) said they would provide feedback shortly, and asked Hemmera to send a meeting request as well.	N/A	E00310_RE_ Meeting between TH and Chance June 11-3
E00311	6-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Charles Pugh (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Hemmera thanked Sidney (Tr'ondëk Hwëch'in) for their patience. Hemmera stated they could also make changes to the June 11 meeting request.	N/A	E00311_RE_ Meeting between TH and Chance June 11-4
E00318	6-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Hemmera sent the meeting invitation for June 11. The purpose of the meeting was for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plains Basin. Additional agenda items included next steps with YESAB and the process for reviewing Tr'ondëk Hwëch'in Project Effects as well as the annual reporting required on the implementation of the Engagement and Communications Plan.	N/A	E00318_Tr'ondëk Hwëch'in and Chance Oil and Gas Exploration Project Description Meeting

E00296	7-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Project Description/Activities Meeting Coordination/Planning	Hemmera sent Tr'ondëk Hwëch'in the Draft Project Description and presentation for meeting attached. Hemmera asked Tr'ondëk Hwëch'in to please distribute to those attending the June 11 meeting. Hemmera said they would also bring paper copies to the meeting. Hemmera asked Tr'ondëk Hwëch'in to please provide an estimate of attendees.	Attachments: 190605_Chance Oil and Gas Eagle Plains Project Description, 190604_Chance_Presentation_ProjectDescription+ExCom_THDawson_v0.4	E00296_Meeting Material for Chance Meeting June 11
E00312	10-Jun-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Charles Pugh, Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning Engagement/Consultation	Sidney (Tr'ondëk Hwëch'in) sent Hemmera the updated agenda for June 11 meeting.	Attachment: TH Chance Meeting agenda for June 11,2019 (00052582xDD1F1)	E00312_RE_ Meeting between TH and Chance June 11-5
E00313	10-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Charles Pugh, Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Hemmera said the June 11 meeting agenda looked good. Hemmera said that they needed to end the meeting at 10:15am rather than 11am, due to weather moving in and flight plans. Hemmera said they would arrive at KIAK ballroom early and have everything set up to begin at 9:00 AM.	N/A	E00313_RE_ Meeting between TH and Chance June 11-6
E00476	11-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning Information Sharing Project Description/Activities	Hemmera sent material to Ewa (Tr'ondëk Hwëch'in) and stated that they had had previously forwarded this material to Sidney (Tr'ondëk Hwëch'in) the week prior, but they wanted to make sure Ewa also had it for their call. They stated that had a conference line set up for our meeting with TH at 9am.	attached: 190604_Chance_Presentation_ProjectDescription+ExCom_THDawson_v0.4.pdf, 190605_Chance oil and Gas Eagle Plains Project Description.pdf	E00476_FW_ Meeting Material for Chance Meeting June 11
E00253	24-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Fish Information Sharing	Hemmera sent the attached Notice Letter regarding DFO Licence Application for Environmental Dynamics Inc.'s Fish Studies.	Attachment: DFO license application Tr'ondëk Hwëch'in	E00253_Notice Letter_ DFO application for upcoming fish studies (1)
E00267	24-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Information Sharing Engagement/Consultation	Hemmera sent the Draft meeting summary of the June 11, 2019 meeting in Dawson City between Chance and Tr'ondëk Hwëch'in.	Attachment: 190617 Draft June 11 TH-Chance Meeting summary_v.3	E00267_Draft June 11 Meeting summary for Review
E00298	25-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Project Description/Activities Meeting Coordination/Planning	Hemmera sent the attached Chance Project Description and also a separate clip of Chance's Community Consultation Program (Proposed Activity Alignment).	Attachment: 190604_Chance_Presentation_ProjectDescription+ExCom_THDawson_v0.4, 190611_Chance_CommunityConsultationProgram_ProposedActivityAlignment	E00298_RE_ Draft June 11 Meeting summary for Review
E00290	27-Jun-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Fish Information Sharing	Hemmera sent revisions from EDI for their DFO Application.	Attachment: 190627_TH_Notice Letter_DFO Permit_WithRevisions and peel_watershed_fish_habitat_assessment	E00290_RE_ Notice Letter_ DFO application for upcoming fish studies (1)
E00317	27-Jun-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Fish Information Sharing	Sidney (Tr'ondëk Hwëch'in) thanked Hemmera for providing the documents.	N/A	E00317_RE_ Notice Letter_ DFO application for upcoming fish studies (5)
E00331	15-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Lynn O'Neil (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Richard (Chance) asked if Sidney (Tr'ondëk Hwëch'in) and their colleagues would be able to meet with Chance and their Hemmera advisors either on August 12 or 13. Richard said that the Chance team would be returning south from the GA in Old Crow on August 10/11 and could stop in Dawson if Tr'ondëk Hwëch'in representatives were able to meet. Chance was also trying to set up a meeting with the First Nation of Na-Cho Nyäk Dun in Mayo around those dates as well. Chance explained that for now, if Tr'ondëk Hwëch'in could offer some flexibility on those two dates until Chance could confirm the interest of First Nation of Na-Cho Nyäk Dun for a meeting it would be appreciated. Richard explained they were thinking that they could allow two or three hours for the meeting to cover the material.	N/A	E00331_Meeting on either August 12 or 13_5
E00486	15-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance) , Cindy Dickson (Chance), Greg Charlie (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Engagement Reports/OIC Requirements	Hemmera has prepared Draft reports on the Implementation of the Communications and Engagement Plan for both Tr'ondëk Hwëch'in and Chance to review. This report summarizes meeting since completing the plan. Hemmera requested Tr'ondëk Hwëch'in to make any desired revisions to the document in tracked changes and send back to Hemmera to finalize. Hemmera will send final versions to both parties to sign. Requests to have revisions in by July 26, and Hemmera will get them signed and submit to Yukon Government for July 31.	attached: 190715_DRAFT Plan Implementation Report_TH.docx	E00486_Draft Plan Implementation Report for Review_2
E00332	18-Jul-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Lynn O'Neil (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) said they could set up a meeting with Chance on August 12, 2019. They asked if Chance would please be send an agenda that they could work on.	N/A	E00333_RE_ Meeting on either August 12 or 13_4
E00333	18-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance), Lynn O'Neil (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Hemmera said that it was great that Tr'ondëk Hwëch'in can meet. Hemmera said that they would start to prepare the agenda. Chance would like to cover are Project updates, capacity funding, and the development of a Draft cooperation agreement. Hemmera said they would put these items in a Draft agenda and send it to Tr'ondëk Hwëch'in early the following week. Hemmera also inquired about who from Tr'ondëk Hwëch'in would attend and at what time would they be available. Hemmera explained that morning would be better to make sure there was enough time to cover all the material. Hemmera asked Tr'ondëk Hwëch'in to please advise a time that would work best and said that they would book a conference room accordingly.	N/A	E00334_RE_ Meeting on either August 12 or 13_3
E00334	22-Jul-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance), Lynn O'Neil (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) said that from Tr'ondëk Hwëch'in, the August 12 meeting attendees would include themself, NR Director Darren Taylor (Tr'ondëk Hwëch'in), Kirsten Scott (Tr'ondëk Hwëch'in), and Ewa Holender (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in, by phone) would be in attendance. Sidney asked that Hemmera please send through the meeting invite and initial agenda for discussion, and that this was the case for all meetings in general (whenever possible).	N/A	E00334_RE_ Meeting on either August 12 or 13_3
E00335	24-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance), Lynn O'Neil (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Hemmera sent along the meeting invite and the agenda to Tr'ondëk Hwëch'in. Hemmera said they were thinking this visit to Dawson would be a great opportunity to host a dinner for Tr'ondëk Hwëch'in Citizens as well. They asked if a dinner from 5:30-8:00pm may work for Tr'ondëk Hwëch'in Citizens on August 12. Hemmera said that if this would work, for Sidney (Tr'ondëk Hwëch'in) to please suggest a typical venue for community dinners. Hemmera asked Sidney who they could speak with about advertising and catering.	N/A	E00336_RE_ Meeting on either August 12 or 13_2
E00336	24-Jul-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance), Lynn O'Neil (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) stated that Tr'ondëk Hwëch'in were ok with discussing their implementation plan and next steps, but a Tr'ondëk Hwëch'in community dinner would not be a good idea at this time. Sidney said that they could put this topic as an item on a future meeting agenda.	N/A	E00336_RE_ Meeting on either August 12 or 13_2
E00337	24-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance), Lynn O'Neil (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning Engagement Reports/OIC Requirements	Hemmera thanked Tr'ondëk Hwëch'in for advising on the community dinner. Hemmera stated that they would leave their plans at just meeting with Sidney (Tr'ondëk Hwëch'in) and their TH colleagues. Hemmera asked if Tr'ondëk Hwëch'in would like to provide feedback on the Draft Engagement and Communications Plan Implementation Report. Hemmera stated they were looking for feedback this week so they had time to finalize the reports the following week and submit to Yukon Government.	N/A	E00331_RE_ Meeting on either August 12 or 13_1
E00490	24-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Darren Taylor (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Kirsten Scott (Tr'ondëk Hwëch'in), Hemmera	Engagement/Consultation Meeting Coordination/Planning	Hemmera sent out a meeting invitation. The purpose of this meeting was for Chance and Tr'ondëk Hwëch'in to discuss Chance's exploration Project description and discuss capacity funding and a cooperation agreement. Hemmera attached a meeting agenda.	attached: 190723_TH-Chance_MeetingAgenda_August12_DRAFT.docx	E00490_Chance and TH Meeting_1
E00338	25-Jul-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance), Lynn O'Neil (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in) , Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Engagement Reports/OIC Requirements	Sidney (Tr'ondëk Hwëch'in) said they would provide comments at end of day tomorrow or early morning and thanked Hemmera.	N/A	E00331_RE_ Meeting on either August 12 or 13_1
E00498	25-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Engagement Reports/OIC Requirements	Hemmera sent Tr'ondëk Hwëch'in an attachment with Chance's edits to the Draft Plan Implementation report.	attached: 190715_DRAFT Plan Implementation Report_TH_RMW.docx	E00498_FW_ Draft Annual Communications and Engagement Report to Yukon Government
E00501	26-Jul-19	Email	Incoming	Tr'ondëk Hwëch'in	Chief Darren Taylor	N/A	Darren Taylor (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Darren (Tr'ondëk Hwëch'in) said they would be available to attend this meeting, however they had another meeting at 10:30am. Darren noted if they were able to cancel or reschedule the other meeting, they would be available for the whole meeting.	N/A	E00501_RE_ Chance and TH Meeting_1

E00502	26-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Darren Taylor (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera thanked Darren (Tr'ondëk Hwëch'in) for letting them know. Hemmera stated if Darren would like to adjust the agenda to review certain items when they were able to attend the meeting, to please let them know.	N/A	E00501_RE_ Chance and TH Meeting_1
E00504	26-Jul-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in) , Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Engagement Reports/OIC Requirements	Sidney (Tr'ondëk Hwëch'in) sent Hemmera and Chance the Draft Plan Implementation report with Tr'ondëk Hwëch'in's edits to the document. Sidney noted if Tr'ondëk Hwëch'in's changes were acceptable to them, Tr'ondëk Hwëch'in could finalize the Draft.	N/A	E00504_RE_ Draft Annual Communications and Engagement Report to Yukon Government
E00505	26-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in) , Ewa Holender (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera said they had accepted all of Tr'ondëk Hwëch'in and Chance's tracked changes in the Draft Plan Implementation report and removed the Draft watermark. Hemmera said if all looked good for all parties, this version was now ready for signing.	attached: 190726_DRAFT Plan Implementation Report_TH_RMW_TH Comments_Hemmera.docx	E00504_RE_ Draft Annual Communications and Engagement Report to Yukon Government
E00508	26-Jul-19	Email	Incoming	Tr'ondëk Hwëch'in	Kristen Scott (Tr'ondëk Hwëch'in)	N/A	Kristen Scott (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Kristen (Tr'ondëk Hwëch'in) said they would be attending the meeting August 12. Kristen noted that their role had changed to Land and Resources Manager, and that Tr'ondëk Hwëch'in's new Development Assessment coordinator would also likely attend, but that remained to be confirmed.	N/A	E00508_RE_ Chance and TH Meeting_2
E00509	29-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Kristen Scott (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera thanked Kristen for letting them know. They noted that they would have a lot of space in the Downtown Boardroom at the August 12 meeting, and that the Development Assessment Coordinator would be welcome to attend.	N/A	E00508_RE_ Chance and TH Meeting_2
E00343	30-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Ewa Holender (Tr'ondëk Hwëch'in)	Benefits/Capacity Agreement	Hemmera said they were looking for a signed letter for the Capacity Funding Agreement. Details about capacity funding were discussed.	N/A	E00343_Signed copy of Tr'ondëk Hwëch'in Letter for Initial Capacity Funding Agreement
E00344	30-Jul-19	Email	Incoming	Tr'ondëk Hwëch'in	Ewa Holender (Tr'ondëk Hwëch'in)	N/A	Ewa Holender (Tr'ondëk Hwëch'in) , Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Benefits/Capacity Agreement	Ewa (Tr'ondëk Hwëch'in) attached the signed letter for the Capacity Funding Agreement. Ewa noted that TH sent a signed hard copy by mail in February, but that is sounded like it never arrived.	Attachment: Chance Executed Capacity Funding Letter 022019	E00344_RE_ Signed copy of Tr'ondëk Hwëch'in Letter for Initial Capacity Funding Agreement_1
E00345	30-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Ewa Holender (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Benefits/Capacity Agreement	Hemmera thanked you Tr'ondëk Hwëch'in for the signed copy of the Capacity Funding Agreement.	N/A	E00345_RE_ Signed copy of Tr'ondëk Hwëch'in Letter for Initial Capacity Funding Agreement_2
E00546	31-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Derek Fraser (Yukon Government), Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera attached the Annual Report on the Implementation of the Tr'ondëk Hwëch'in and Chance Communication and Engagement Plan.	attached: 190731_TH and Chance Plan Implementation Report	E00546_Annual Plan Implementation Report - TH and Chance
E00547	31-Jul-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Derek Fraser (Yukon Government), David MacMartin (Gwich'in Tribal Council)	Engagement Reports/OIC Requirements	Hemmera sent Yukon Government the Annual Report on the Implementation of the Gwich'in Partners and Chance Communications and Engagement Plan.	attached: 190731_Gwich'in Partners and Chance Plan Implementation Report	E00547_Annual Plan Implementation Report - Gwich'in Partners and Chance
E00551	7-Aug-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Greg Charlie (Chance), Cindy Dickson (Chance), Lynn O'Neil, Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning Cooperation Agreement	Sidney (Tr'ondëk Hwëch'in) asked Hemmera to please send the Draft Template that you have generated for the Cooperation Agreement. Tr'ondëk Hwëch'in stated they would like to be able to review for our discussions .	N/A	E00551_RE_ Meeting on either August 12 or 13_4
E00552	8-Aug-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Lynn O'Neil (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning Cooperation Agreement	Hemmera stated that they didn't have a Draft Template for the Cooperation Agreement to send at this time. Hemmera said that instead, at that time they were hoping to use the time for that agenda item to discuss and Draft an outline for the Cooperation Agreement. The help facilitate the discussion, Hemmera would like to propose the following sections for the agreement: Recitals (or Whereas), Purpose and/or Objectives of the Parties, Term and Termination, Cooperation Commitments, General. Hemmera stated that using these sections as well as any other proposed by Chance or Tr'ondëk Hwëch'in, can have high level discussion about the outline and contents of cooperation agreement. Let me know what you think of this approach, happy to adapt or change.	N/A	E00551_RE_ Meeting on either August 12 or 13_4
E00554	9-Aug-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance)	Ewa Holender (Tr'ondëk Hwëch'in) , Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning Cooperation Agreement	Hemmera stated that in their meeting August 12, they would be going through the proposed Cooperation Agreement sections listed in the thread below and to fill in content that is suggested during the meeting. Hemmera said that in order to do this, they wanted to share their screen using Skype. Hemmera wanted to confirm if this could work for Tr'ondëk Hwëch'in. Hemmera also said they could do a trial morning before the meeting if Tr'ondëk Hwëch'in representatives were available. Hemmera said that if this approach didn't work, they could send a word doc with proposed headers for Tr'ondëk Hwëch'in to follow along during the meeting. Hemmera said that they would have a better meeting speaker with them for this meeting, so audio would be much better than last time.	N/A	E00554_RE_ Meeting on either August 12 or 13_5
E00555	9-Aug-19	Email	Incoming	Tr'ondëk Hwëch'in	Ewa Holender (Tr'ondëk Hwëch'in)	Richard Wyman (Chance)	Ewa Holender (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Benefits/Capacity Agreement Meeting Coordination/Planning	Ewa (Tr'ondëk Hwëch'in) stated that they appreciated Hemmera's efforts to ensure that they could participate from down south. Ewa said they were happy to do a trial morning if that would work for Hemmera, and that they had Skype already.	N/A	E00555_RE_ Meeting on either August 12 or 13_6
E00556	12-Aug-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Ewa Holender (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera said to Ewa (Tr'ondëk Hwëch'in) that they were just waiting for the conference phone to be set up. Hemmera asked if Ewa was able to access the Skype meeting through the link in the meeting invitation. Hemmera stated that in their experience personal Skype and Business Skype do no work well together.	N/A	E00555_RE_ Meeting on either August 12 or 13_6
E00557	12-Aug-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance)	Ewa Holender (Tr'ondëk Hwëch'in) , Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning Cooperation Agreement	Hemmera said to Tr'ondëk Hwëch'in that they were set up for the meeting. Hemmera said they were sharing their screen, and that they had a speaker in the middle of the table that was picking up all voices. Hemmera said they were still waiting for some Tr'ondëk Hwëch'in folks. Hemmera said that if they were not able to access Skype they had attached the final agenda, the presentation from their last meeting for reference, and the Cooperation Agreement discussion.	attached: 190811_TH-Chance_MeetingAgenda_August12_FINAL, 190812_Chance and TH Cooperation Brainstorming, 190604_Chance_Presentation_ProjectDescription+ExCom_Gwich'in Tribal CouncilInuvik_First Nation of Na-cho Nyäk DunMayo_THDawson_v0.4	E00557_RE_ Meeting on either August 12 or 13_7
E01187	12-Aug-19	Meeting	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Darren Taylor (Tr'ondëk Hwëch'in), Ewa Holender (Tr'ondëk Hwëch'in), Kirsten Scott (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Engagement/Consultation Benefits/Capacity Agreement Project Description/Activities	The August 12 meeting summary was distributed.	N/A	E01187_190723_TH-Chance_MeetingAgenda_August12_DRAFT.docx E01187_190826_August12_TH-Chance_Meetingsummary_Final.docx
E00448	26-Aug-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement/Consultation	Hemmera sent the attached is Draft summary of the meeting August 12, 2019. Hemmera said that if Tr'ondëk Hwëch'in had any revisions, to please make those in tracked changes and send to Emily (Hemmera) to finalize.	attached: 190826_August_12_TH-Chance_Meeting_summary_draftforreview	E00448_TH and Chance August 12 Meeting summary for Review
E00559	4-Sep-19	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in) , Ewa Holender (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) said they were ok with the contents of the August 12, 2019 meeting summary.	N/A	E00559_RE_ TH and Chance August 12 Meeting summary for Review
E00560	4-Sep-19	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in) , Ewa Holender (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera thanked Tr'ondëk Hwëch'in, and said they would wait for Chance's feedback and then finalize the meeting summary.	N/A	E00559_RE_ TH and Chance August 12 Meeting summary for Review
E00601	28-Jan-20	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Scharfrik cc: Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Tenures/Dispositions/Permits DO Project Engagement/Consultation	Richard (Chance) sent Tr'ondëk Hwëch'in an email describing that Chance would be applying to the Yukon Government very shortly to extend the tenure of Exploration Permit 20. They said that the Application would be for maximum allowable under the Oil and Gas Act of 5 years. This permit had one suspended well at McParlon A-25 which Chance hoped to use for fluid disposal of any produced water associated with the proposed exploration Project. Chance was at an intermediate stage of discussions with the Manager of Oil and Gas Operations with Yukon to extend the suspended well status on the suspended wells at Eagle Plains. The Manager had indicated that Chance would need to do some physical assessments of the legacy wells to confirm the integrity of the wells before granting an extension. The assessments would require access to 3 suspended wells at SDL M-08, G-08, and J-19 and well as M-59 in order to do the work. A service rig, cement pumping equipment, and wireline services were expected to be used to conduct the assessments. Chance anticipated taking temperature measurements in wells to evaluate permafrost depth. The program was expected to take 1-2 months. This was a winter operation and would be done during the winter of 2020-2021 and may require Designated Office screening by YESAB. Chance stated that they would provide more information as soon as possible.	N/A	E00601_FW_ Suspended wells and Exploration Permit 20_3

E00647	23-Mar-20	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Darren Taylor	Information Sharing	Richard (Chance) stated that Chance had several initiatives on the go, some of which are time sensitive and all required engagement with the affected First Nations. They provided a summary of these initiatives below: 1. Application to the Yukon Government to get tenure extension on Exploration Permit 0020 which was set to expire on August 30, unless extended. This permit was located mostly in the Traditional Territory of the VGFN, but a portion is in the Secondary Use Area of the Tetlit Gwich'in and in the overlap area with the First Nation of Na-Cho Nyäk Dun Traditional Territory. There is a suspended well in this Permit at McParlon A-25 which had ongoing value to Chance. 2. There were several suspended wells at the Chance Significant Discovery License (SDL 022) and one at the Blackie SDL 021 which the Yukon Government required Chance to undertake some maintenance work. This activity would require an impact assessment by the Designated Office (DO) of YESAB in Dawson prior to permissions being granted by Yukon to undertake the work. The plan was to submit to the DO the program in the next month or so with the objective of being able to do the work over approximately a 6 week to two month period in the winter of 2020-2021. This was a regulatory requirement made by the Manager of Oil and Gas Operations with the Yukon Government. Importantly, for Tr'ondëk Hwëch'in's knowledge, there was no indication that these suspended wells had any problems, but they were wells that were drilled in the 1960's so the regulator had asked for work to be done in order to be able to continue the suspended status of these wells. 3. Continuing engagement with respect to the multi-well drilling and seismic data acquisition Project that has been described to you in the past couple of years. a current map of Chance's landholdings was attached for your reference. In view of the COVID-19 outbreak, travel and face to face get togethers were not appropriate, if not prohibited, so they would have to make arrangements to exchange information in writing, electronically and by conference call. Chance noted there was quite a geographic spread for everyone to manage and that they looked forward to hearing Tr'ondëk Hwëch'in's preferences for engagement. Chance also asked Tr'ondëk Hwëch'in to please forward this email to anyone they may have missed who is working on the Chance file.	Attachment:Chance_Permits_geoscience_9Sept2019.pdf	E00647_Chance Oil and Gas Update_TH
E00674	26-May-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Darren Taylor	Project Description/Activities DO Project	Hemmera stated that Chance was preparing a proposal for well maintenance work in the Eagle Plains. They asked Tr'ondëk Hwëch'in to please see the attached letter meant to initiate engagement and to provide initial Project information. Hemmera said for Tr'ondëk Hwëch'in to please let them know if they had any issues opening the attachment.	Attachment: 200522_Chance_WellMaintenance_Initiation_of_Engagement_TH_FINAL_signed_map	E00674_Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in)
E00676	31-May-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Darren Taylor, Hemmera	Meeting Coordination/Planning DO Project	Sidney (Tr'ondëk Hwëch'in) said they were currently on vacation that week, but that they looked forward to schedule a date to discuss the Project with the Chance team when they returned.	N/A	E00676_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in) (16)
E00677	1-Jun-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Darren Taylor	DO Project Meeting Coordination/Planning	Hemmera thanked Sidney (Tr'ondëk Hwëch'in) for their response and said that when Sidney was back in the office they could work together to coordinate a meeting.	N/A	E00677_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in) (15)
E00793	1-Jun-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in) , Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Darren Taylor	DO Project Meeting Coordination/Planning	Hemmera thanked Sidney (Tr'ondëk Hwëch'in) for their response and said that when Sidney was back in the office they could work together to coordinate a meeting.	N/A	E00792_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in) (39).msg
E00678	3-Jun-20	Email	Incoming	Tr'ondëk Hwëch'in	Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Darren Taylor, Hemmera	DO Project Meeting Coordination/Planning	Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in) notified Hemmera and Chance that due to COVID-19 TH was unable to hold their election, thus; today was the end of their term as Chief. Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in) advised all future communications should be sent to the new incoming Deputy Chief Chief Simon Nagano (Tr'ondëk Hwëch'in), whose email would come into effect the following day, deputychief.simon.nagano@trondek.ca.	N/A	E00678_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in) (13)
E00791	8-Jun-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	DO Project Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) provided an option for a meeting time to Hemmera on June 17.	N/A	E00790_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in) (38)
E00680	9-Jun-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	DO Project Meeting Coordination/Planning	Hemmera confirmed that June 17 at 2:00 PM worked for them. Hemmera said they would send a placeholder for everyone's calendar shortly (which would be barebones to start). Hemmera stated they were hoping to send a brief Draft agenda later that day or the next day, for Tr'ondëk Hwëch'in and Chance to review. Once that is finalized, Hemmera said they would attach it to the meeting invitation. Hemmera asked Tr'ondëk Hwëch'in if they thought they may need an hour and a half to meet, or if they may want more time. Hemmera stated that they were flexible.	N/A	E00679_RE_ Chance Oil and Gas - Proposal for Well Maintenance Work (Initiation of Engagement with Tr'ondëk Hwëch'in)
E00795	11-Jun-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	DO Project Meeting Coordination/Planning Engagement/Consultation	Hemmera sent an attached Draft agenda for the June 17 call. Hemmera stated that Tr'ondëk Hwëch'in or Chance feel free to make any changes or corrections.	Attachment: 200522_Chance_DO_ProjectDescription_DRAFT.pdf	E00795_RE_ Chance Oil and Gas_ Proposal for Well Maintenance Work - Draft Agenda for Review (29)
E00688	12-Jun-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	DO Project Meeting Coordination/Planning Engagement/Consultation	Hemmera sent an attached Draft agenda for the June 17 call. Hemmera stated that Tr'ondëk Hwëch'in or Chance feel free to make any changes or corrections.	N/A	E00688_RE_ Chance Oil and Gas_ Proposal for Well Maintenance Work - Draft Agenda for Review (7)
E00689	12-Jun-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	DO Project Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) said they would review the June 17 agenda and add some updates from Tr'ondëk Hwëch'in and provide them to Hemmera.	N/A	E00688_RE_ Chance Oil and Gas_ Proposal for Well Maintenance Work - Draft Agenda for Review (7)
E00691	15-Jun-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	DO Project Information Sharing	Sidney (Tr'ondëk Hwëch'in) said to Hemmera that they would like to add to the agenda a Tr'ondëk Hwëch'in government update as well as an update on Chance's overall permit renewals. Tr'ondëk Hwëch'in asked if there was any material that could be sent about the Well Maintenance Project ahead of time.	N/A	E00691_RE_ Chance Oil and Gas_ Proposal for Well Maintenance Work - Draft Agenda for Review (4)
E00692	15-Jun-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	DO Project Meeting Coordination/Planning Engagement/Consultation	Hemmera confirmed they would make those changes to the June 17 meeting agenda and then add it to the invitation. Hemmera asked Sidney (Tr'ondëk Hwëch'in) if they expected anyone else from Tr'ondëk Hwëch'in to join the call. Hemmera also attached the Draft Project Description for the well maintenance program. Hemmera noted that the summary information attached to our initial letter was based on this larger document.	Attachment: 200522_Chance_DO_ProjectDescription_DRAFT	E00692_RE_ Chance Oil and Gas_ Proposal for Well Maintenance Work - Draft Agenda for Review (3)
E00693	15-Jun-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	DO Project Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) said they would be able to confirm the June 17 meeting participants for Hemmera by tomorrow afternoon	N/A	E00693_RE_ Chance Oil and Gas_ Proposal for Well Maintenance Work - Draft Agenda for Review
E00762	16-Jun-20	Email	Incoming	Tr'ondëk Hwëch'in	Kirsten Scott (Tr'ondëk Hwëch'in)	N/A	Hemmera	DO Project Meeting Coordination/Planning	Kristen (Tr'ondëk Hwëch'in) accepted June 17 meeting invitation from Hemmera.	N/A	E00762_Accepted_Updated_Chance Oil and Gas - Proposal for Well Maintenance Work.msg

E01188	17-Jun-20	Meeting		Tr'ondëk Hwëch'in	N/A	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Kirsten Scott (Tr'ondëk Hwëch'in), Hemmera, Todd Mahon (Environmental Dynamics Inc.)	DO Project Engagement/Consultation	The purpose of this meeting was for Chance to provide an overview of the proposed Eagle Plains Well Maintenance Project and to provide an opportunity for Tr'ondëk Hwëch'in to ask questions and/or provide any feedback with respect to the proposed Project.	N/A	E01188_200710_TH-Chance_Meetingsummary_June17_FINAL.docx
E00697	19-Jun-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), cc. Nathan Aasman, Andrew MacPhail	Sidney Schafrik, Kirsten Scott, cc: Todd Mahon	DO Project Meeting Coordination/Planning Information Sharing Project Description/Activities	Hemmera sent a Draft meeting summary to Chance from the June 17 meeting. Hemmera stated to let them know if they had any revisions.	Attachment: 200618_TH-chance_Meetingsummary_June17_Draft_v.02	E00697_Chance DO Project (Well Maintenance)_ June 17 Draft Meeting summary for Review
E00708	13-Jul-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Deputy Chief Chief Simon Nagano (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera prepared a Draft report on Implementation of Tr'ondëk Hwëch'in and Chance Engagement and Communications Plan for Tr'ondëk Hwëch'in and Chance to review. This report summarized meetings/correspondence that occurred between Tr'ondëk Hwëch'in and Chance since completing the 2019 Annual Report. Hemmera attached the Draft as a Word Document, and stated that both Tr'ondëk Hwëch'in and Chance could make revisions to that document in tracked changes, that would assist them in creating a final version. Hemmera said that if any issues arose between parties' revisions, those could be addressed via email or a quick call. Once revisions have been incorporated and the document was considered final by Tr'ondëk Hwëch'in and Chance, Hemmera would send the final version to both parties to sign. Hemmera also attached, as a pdf, a Draft of Tr'ondëk Hwëch'in and Chance's Engagement Log which would function as Appendix D for the report. Hemmera asked the parties to please complete reviews by July 24, and also sent a reminder that reports needed to be signed and submitted to Yukon Government on July 31, 2019.	Attachments: 200713_Plan Implementation Report_TH_DRAFTv0.3.docx, 200713_AppendixD_TH_EngagementLog_DRAFT.pdf	E00708_DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review(0)
E00728	15-Jul-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Deputy Chief Chief Simon Nagano (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Sidney (Tr'ondëk Hwëch'in) thanked Hemmera for the information and stated they would provide their comments by July 24.	N/A	E00728_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review
E00729	15-Jul-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Deputy Chief Chief Simon Nagano (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera thanked Sidney (Tr'ondëk Hwëch'in) and acknowledged their typo in the earlier email below. The reports were due to Yukon Government on July 31, 2020 not 2019.	N/A	E00729_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (1)
E00730	24-Jul-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera checked in on the review of the Draft engagement report. Hemmera apologized as they meant to send that reminder earlier in the week.	N/A	E00730_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (2)
E00731	24-Jul-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Hemmera	Engagement Reports/OIC Requirements	Sidney (Tr'ondëk Hwëch'in) thanked Hemmera for the reminder, and stated that they had limited office access that day, but would send in any comments on the Draft engagement report. Sidney stated they understood the deadline so they would try to get it into Hemmera in the morning.	N/A	E00731_Re_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (3)
E00732	24-Jul-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	NA	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera thanked Sidney (Tr'ondëk Hwëch'in) for responding and noting comments will be forthcoming on the Draft engagement report.	N/A	E00732_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (4)
E00764	24-Jul-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Deputy Chief Chief Simon Nagano (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Hemmera	Engagement/Consultation DO Project	Hemmera sent an attached Draft copy of Chance's YESAB Project Proposal for the Eagle Plains Well Maintenance Project. Hemmera explained that in order for Chance to get all of its approvals in hand before the winter season, Chance's application would need to be submitted very shortly after the Draft was sent to Tr'ondëk Hwëch'in. Hemmera stated that at that time, their goal was to submit the Project Proposal by the middle of the following week. Hemmera recalled that from their June phone call, Kristen (Tr'ondëk Hwëch'in) had inquired about a Wildlife Management Plan. Hemmera stated that all mitigation measures with respect to wildlife and caribou was located within the body of the proposal, and so they wanted to flag that for Tr'ondëk Hwëch'in's attention. Hemmera indicated that since the document had not yet gone through Hemmera's formatting procedure, some of the figures and appendices were absent. Hemmera also said that they recalled Tr'ondëk Hwëch'in's interest in the Spill Response Plan, so they had made sure it was attached. Hemmera stated that Chance continues to be committed to engaging with Tr'ondëk Hwëch'in. Hemmera indicated that if Tr'ondëk Hwëch'in wished to discuss the proposed Project in more detail, to please contact Chance or Hemmera.	Attachment: 200724_Chance_YESAB_PP_DRAFT.docx.; Spill Response Plan.docx	E00764_Chance Eagle Plains Well Maintenance Project - Draft YESAB Project Proposal (3).msg
E00733	27-Jul-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Sidney (Tr'ondëk Hwëch'in) stated that they had reviewed the document and that the only correction was in the Engagement Plan where Charles Pugh (Tr'ondëk Hwëch'in) charles.pugh@trondek.ca now replaced Pat Titus (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in). Sidney asked when Hemmera thoughts that the official YESAB submission would be filed. Tr'ondëk Hwëch'in could then set up the next meeting to review, and could talk about next steps going forward.	N/A	E00733_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (5)
E00734	27-Jul-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera acknowledged the change suggested by Sidney (Tr'ondëk Hwëch'in) in the Schedule ("Key Engagement and Communication Topics and Leads") to the Engagement Plan, and stated they would change the Tr'ondëk Hwëch'in Key Contact for Agreements and Capacity Funding to Charles Pugh and delete Pat Titus (Tr'ondëk Hwëch'in). Hemmera asked if Sidney (Tr'ondëk Hwëch'in) could send a JPEG of the logo for TH so that it could be added to the Engagement Plan. Hemmera asked with respect to Sidney's (Tr'ondëk Hwëch'in) question below, if they were referring to Chance's YESAB DO submission for the proposed Well Maintenance Project, and when Chance was hoping to file it. Hemmera said that they were fairly certain Chance and their colleagues were aiming for middle of that same week.	N/A	E00734_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (6)
E00735	28-Jul-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Sidney (Tr'ondëk Hwëch'in) thanked Hemmera for the information about when the well program would be submitted and said they were correct about the change to the Key Contacts. Sidney explained it was best to use the Chance logo only at this time since it would take approval to use the Tr'ondëk Hwëch'in logo and they were in an election cycle and time was an issue. Once prepared, Sidney said they could sign off on the document and they could talk about scheduling a meeting once the Project wa submitted.	N/A	E00735_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (7)
E00736	28-Jul-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance) , Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera sent Chance the attached revised version of the 2020 Annual Report on the Implementation of the TH and Chance Engagement and Communication Plan. Hemmera noted that Sidney (Tr'ondëk Hwëch'in) asked them to make the following change: In the Schedule of the Engagement and Communication Plan (Appendix A), change the Tr'ondëk Hwëch'in Key Contact for Agreements and Capacity Funding to Charles Pugh and delete Pat Titus (Tr'ondëk Hwëch'in). Hemmera asked that Sidney (Tr'ondëk Hwëch'in) print page 5, scan, and send it back, and then noted that Greg (Chance) could sign Hemmera stated that once the signing sheet was complete, they would put that into the PDF and send the Final version to both Tr'ondëk Hwëch'in and Chance.	Attachment: 200728_PlanImplementationReport_TH_FINALwAppendixD.pdf	E00736_2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Signing
E00737	29-Jul-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance) , Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Engagement Reports/OIC Requirements	Sidney (Tr'ondëk Hwëch'in) sent Hemmera and Chance the attached signed 2020 Annual Report on the Implementation of the Tr'ondëk Hwëch'in and Chance Engagement and Communication Plan.	Attachment: Chance TH (Signed 2020) Annual Report 2020.pdf	E00737_RE_ 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Signing
E00738	29-Jul-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance) , Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera thanked Sidney (Tr'ondëk Hwëch'in) for signing and reminded Greg (Chance) for their signature on the 2020 Annual Report on the Implementation of the Tr'ondëk Hwëch'in and Chance Engagement and Communication Plan.	Attachment: Chance TH (Signed 2020) Annual Report 2020.pdf	E00738_FW_ 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Signing
E00739	30-Jul-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance) , Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera sent TH and Chance the attached 2020 Annual Report on the Implementation of the TH and Chance Engagement and Communication Plan. Hemmera indicated they would be sending it to Yukon Government shortly.	Attachment: 200730_PlanImplementationReport_TH-FINALwAppD_Signed.pdf	E00739_RE_ 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Signing (8)

E00740	30-Jul-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance) , Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in),Deputy Chief Chief Simon Nagano (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera sent the attached 2020 Annual Report on the Implementation of the TH and Chance Engagement and Communication Plan.	Attachment: 200730_PlanImplementationReport_TH-FINALwAppD_Signed.pdf	E00740_2020 Annual Report - Tr'ondëk Hwëch'in and Chance Oil and Gas Engagement and Communication Plan
E00817	7-Aug-20	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance) , Cindy Dickson (Chance)	Sidney Schafik (Tr'ondëk Hwëch'in), Deputy Chief Chief Simon Nagano (Tr'ondëk Hwëch'in), Hemmera	DO Project Engagement/Consultation Meeting Coordination/Planning	Richard (Chance) sent an email intended to give Tr'ondëk Hwëch'in early notice that Chance had not yet submitted their Well Maintenance Program Project Proposal to YESAB due to evolving discussions with the regulator. Chance explained that the amendments were being incorporated into the Project Description and effects assessment over the next week or two as they manage vacation absences. Once updated, Richard indicated that Chance would share the updated YESAB submission with Tr'ondëk Hwëch'in to review. Richard suggested that a follow up conference call or Microsoft Teams meeting be arranged to address Tr'ondëk Hwëch'in's questions or to respond to any comments about the amendments.	N/A	E00817_Well Maintenance Program amendments
E00867	28-Aug-20	Email	Incoming	Tr'ondëk Hwëch'in	Deputy Chief Chief Simon Nagano (Tr'ondëk Hwëch'in)	N/A	Deputy Chief Chief Simon Nagano (Tr'ondëk Hwëch'in)	DO Project Engagement/Consultation	Email read receipt.	N/A	E00867_Read_ Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED (68)
E00868	28-Aug-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	DO Project Engagement/Consultation	Email read receipt.	N/A	E00868_Read_ Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED (69)
E00912	28-Aug-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Deputy Chief Chief Simon Nagano (Tr'ondëk Hwëch'in)	DO Project Project Description/Activities	Further to Richard's email dated August 7 (attached), Hemmera explained that Chance had made a few revisions to their Project Description for the Designated Office Evaluation of their proposed Well Maintenance Program. As a result of those changes, Hemmera had also revised the effects assessment sections of the Project Proposal. Hemmera provided a summary of the reasons for the revision that had been provided to us by Chance and a brief summary of the amendment itself: 1. Ongoing conversations betwee Chance and Yukon Government, Oil and Gas Branch (Yukon Government) had necessitated changes. While Chance was previously of the impression wells could continue to be suspended, Yukon Government was now directing Chance to conduct inspection and maintenance activities for all eight suspended wells and then abandon those wells or bring them into active status (i.e., end the period of well suspension). Chance was now proposing to abandon six wells (i.e., M-59, M-08, J-19, G-08, B-73, and H, 28) and to bring the remaining two wells (i.e., A-25 and E-78) into active status as deep-injection wells. Waste fluid produced during the abandonment of the six wells could then be disposed of via injection into the deep-injection wells. No oil or gas was expected to be produced from the two wells proposed to be activated; they would specifically be used for disposal of waste fluid from activities associated with these maintenance activities. (Sections 2.1.4 and 2.1.5 had further description). 2. At that time, Chance could not confirm whether they would use the Eagle Plains Hotel or the existing Chance Camp for housing workers over the duration of the Project. The decision to utilize the Eagle Plains Hotel or the Chance Camp was to be made when the Project schedule was finalized. It would also have to tak into consideration the Hotel's ability to accommodate Chance workers over the full duration of the Project as well as COVID-19 relate self-isolation requirements at that time. As a result, both options were considered in the effects assessment for the housing of the Project workforce. (Sections 2.2 and 2.3 had further description). 3. When the Chance field team were at Eagle Plains early August, they observed that the route used to access M-59 would require realignment of the final portion of Blackie Winter Road. The section o the original route that proceeded north for the final kilometer was not ideal for traffic due to steeper terrain. The steeper route would result in a significant risk to the trucks bearing heavy loads, fuel supply, and other fluid handling shipments. Chance was proposing shifting the final portion of Blackie Winter Road east of the original route in order to attain a much gentler gradient. (Section 2.1.1 and Figure 2-1 had further description).	Attachments: Fwd: Well Maintenance Program amendments.msg, 200828_Chance_YESAB-DO_ProjectProposal_REVISED.pdf	E00912_Chance Eagle Plains Well Maintenance - Draft YESAB Project Proposal REVISED
E00901	15-Sep-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Deputy Chief Chief Simon Nagano (Tr'ondëk Hwëch'in)	DO Project Engagement/Consultation Project Description/Activities	Since my email dated August 28, Hemmera had been in the final stages of concluding the revised DO Project Proposal for Chance's Well Maintenance program. They had appreciated Tr'ondëk Hwëch'in's feedback and worked to include that into the application. Hemmera explained that Chance's timeline for completing the work was tied to compliance with regulations, so in an effort to ensure that the maintenance activities could occur that winter Chance needed to submit the application last week. Hemmera stated that it wa submitted late evening and today Hemmera received confirmation that the Project was on the YESAB registry. Hemmera indicated that they acknowledged that Tr'ondëk Hwëch'in may have future comments on the Project as it progressed through the YESAB process. They continued to look forward to hearing Tr'ondëk Hwëch'in's views and were happy to hold additional meetings to discuss and answer any questions Tr'ondëk Hwëch'in may have. Hemmera provided the link to the registry here: Project 2020-0151 Eagle Plains Well Maintenance and Winter Activities	N/A	E00901_Chance DO Project (Well Maintenance) - YESAB Registry Information (50)
E00863	16-Sep-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Hemmera	DO Project Engagement/Consultation	Email read receipt.	N/A	E00863_Read_ Chance DO Project (Well Maintenance) - YESAB Registry Information (47)
E00864	16-Sep-20	Email	Incoming	Tr'ondëk Hwëch'in	Deputy Chief Chief Simon Nagano (Tr'ondëk Hwëch'in)	N/A	Hemmera	DO Project Engagement/Consultation	Email read receipt.	N/A	E00864_Read_ Chance DO Project (Well Maintenance) - YESAB Registry Information (48)
E01026	16-Sep-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Deputy Chief Chief Simon Nagano (Tr'ondëk Hwëch'in) , Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Hemmera	DO Project Project Description/Activities	Sidney (Tr'ondëk Hwëch'in) thanked Hemmera for the information and stated Tr'ondëk Hwëch'in would be in contact to discuss the Project in the near future. For continuing communications, Sidney asked that Hemmera add Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in) (who was in cc) in these notifications.	N/A	E01026_RE_ Chance DO Project (Well Maintenance) - YESAB Registry Information (45).msg
E01027	16-Sep-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	DO Project Project Description/Activities	Hemmera asked Sidney (Tr'ondëk Hwëch'in) if they should also still include the Deputy Chief or just the Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in) moving forward on communications.	N/A	E01026_RE_ Chance DO Project (Well Maintenance) - YESAB Registry Information (45).msg
E01028	2-Oct-20	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Erika Tizya (Tr'ondëk Hwëch'in), Hemmera	DO Project Project Description/Activities Meeting Coordination/Planning	Greg (Chance) followed up to see if Erika (Tr'ondëk Hwëch'in) had or was still working on their questions/information request. Chance stated to let them know if they could address any questions or we can set up another meeting via conference call/Zoom.	N/A	E01028_RE_ Chance DO Project (Well Maintenance) - YESAB Registry Information.msg
E00907	2-Nov-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Hemmera	DO Project Engagement/Consultation	Hemmera stated that after further consideration of the proposed Project (Eagle Plains Well Maintenance and Winter Activities activities and the requirements of the Yukon Oil and Gas Act, Chance had determined that changes were required to the Project submitted to the Dawson Designated Office on September 11, 2020 (Project #2020-0151). Hemmera explained that as such, Chance had decided to withdraw its Project Proposal and would be informing YESAB today, November 2, 2020. Hemmera indicated that Chance intended to incorporate changes into a revised Project Proposal. Once the revised proposal had been Drafted, Chance would notify Tr'ondëk Hwëch'in by sharing a Draft and requesting a meeting to discuss the changes further. After Chance had discussed those changes with Tr'ondëk Hwëch'in, the Project Proposal would be finalized and resubmitted to the Dawson Designated Office. Hemmera noted that Chance understood and appreciated that making changes to this Project a second time was requesting additional effort and capacity from Tr'ondëk Hwëch'in. Chance looked forward to continuing to work with Tr'ondëk Hwëch'in and would do its best to ease this process	N/A	E00907_Chance DO Proposal Withdrawal - Tr'ondëk Hwëch'in Notification
E00861	19-Nov-20	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Hemmera	DO Project Engagement/Consultation	Email read receipt	N/A	E00861_Read_ Chance Designated Office Project Proposal - Revised Draft for Sharing with Tr'ondëk Hwëch'in

E00892	19-Nov-20	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance) , Richard Wyman (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Hemmera	DO Project Engagement/Consultation Project Description/Activities	Further to Hemmera's email dated November 2nd (attached), Chance revised its Project Proposal (including updated Project Description and Effects Assessment) for Designated Office Evaluation. Below were the key Project components that changed: • Extended Flow Testing: After maintenance activities are complete and depending on wellbore integrity (as confirmed through maintenance activities), Chance proposes to conduct Extended Flow Testing (EFT) on up to three of the wells which have the highest potential for natural gas reserve. The reason for this change is to allow Chance to gather important information about the nature of the natural gas resource accumulation and its productive capability. a. Wells proposed for EFT are M-59, M-08, and J-19 (see PDF attached for Figure 2-1). Please note, Figure 2-1 is currently being updated to reflect this change. b. Revert up to three wells to suspended status (if the EFT results prove to have sufficient resource). c. Abandon three to six wells (the three remaining wells (G-08, B-73, and H-28) will be abandoned and up to additional three wells may be abandoned if wellbore integrity is not confirmed or if EFT results prove insufficient resources). • Timelines: If work cannot be completed this winter season (due to low snow pack, COVID considerations, or permitting delays), Chance will complete the Project during the winter of December 2021 to March 2022. Additional detail is within the attached revised Draft Project Proposal. While revisions were made throughout the document, Section 2.1.3 is the substantive addition with respect to EFT. We've attached both a clean version and a version with tracked changes to facilitate your review. Given the very short time frame for winter work, Chance will be submitting the application to YESAB on November 20. Hemmera anticipates Tr'ondëk Hwëch'in requiring additional discussions with Chance to review these changes and look forward to scheduling a Meeting where we can discuss these matters further to support your future submissions to the YESAA process.	Attachments: Chance DO Proposal Withdrawal -Tr'ondëk Hwëch'in Notification.msg, 102229_Chance_YESAB_PP_Revised_v2.0.docx, 201119_Chance_YESAB_PPRevised_v2.0_redline.docx. Fig2_1_104709_01_Overview_200828.pdf	E00892_Chance Designated Office Project Proposal - Revised Draft for Sharing with Tr'ondëk Hwëch'in
E00898	19-Jan-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Hemmera	DO Project Engagement/Consultation	Hemmera provided a brief update on Chance's proposed Eagle Plains Well Maintenance and Extended Flow Testing Project below: • Project was submitted to the Dawson District Office (DO) December 24, 2020. • Adequacy Review started December 29, 2020 and was extended January 11, 2021. o The Adequacy Review period was extended for 21 days due to the complexity of the Project. • Dawson DO issued an Information Request on January 15, 2021 Chance was currently working on its response to Information Request 1 which could be found here. Additionally, Hemmera provided the link to the Project's page on the YESAB registry: 2020-0197.	N/A	E00898_Chance DO Project_ Eagle Plains Well Maintenance and Extended Flow Testing (Update for Tr'ondëk Hwëch'in)
E01120	28-Mar-21	Email	Outgoing	Tr'ondëk Hwëch'in	N/A	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Project Description/Activities Meeting Coordination/Planning	Discussed the Project and Sidney said they would send their own work around hydraulic fracturing to Hemmera.	N/A	N/A
E01120	28-Mar-21	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Project Description/Activities Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) shared a document Hemmera and Chance that they had referred to on the call dated March 27, along with their personal work on hydraulic fracturing.	N/A	E01120_RE_ draft Project description (1).msg Methods of Hydraulic Fracturing.pdf
E01121	28-Mar-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Project Description/Activities Meeting Coordination/Planning	Hemmera thanked Sidney (Tr'ondëk Hwëch'in) for sharing the materials mentioned on the call dated Mach 27.	N/A	E01121_RE_ draft Project description.msg
E01066	7-Apr-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Hemmera	Meeting Coordination/Planning Engagement/Consultation	Hemmera explained they were currently resuming work on Chance's Executive Committee Project titled Eagle Plains Exploration Program. Seeing as it had been quite some time since Chance and Tr'ondëk Hwëch'in have discussed this particular Project, Hemmera indicated that Chance was hoping to schedule a meeting. Some items that Chance would like to discuss were: • a refresher of the Draft Project description • update of events since Chance last engaged on the ExCom Project • anticipated timeline for submission to YESAB, and • Tr'ondëk Hwëch'in's preferences/guidance for engagement with its government and its Citizens over the coming months. Hemmera asked if TH had any availability to meet the week of April 26 – 30.	N/A	E01066_Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in .msg
E01112	14-Apr-21	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Hemmera	Project Description/Activities Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) thanked Hemmera for the notification. Tr'ondëk Hwëch'in asked if a meeting could be set up on the 27 in the afternoon, and noted that Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in) would likely not be attending.	N/A	E01112_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in (2).msg
E01113	14-Apr-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Project Description/Activities Meeting Coordination/Planning	Hemmera indicated they would send along a placeholder for everyone's calendars for 2:00pm on April 27. Once they had the date/time confirmed, Hemmera stated they would send out a Draft agenda for review and comment.	N/A	E01112_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in (2).msg
E01092	15-Apr-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Project Description/Activities Meeting Coordination/Planning	Hemmera sent a meeting invitation for April 27 and said they were booking a time for Chance and Tr'ondëk Hwëch'in to meet and discuss Chance's proposed Eagle Plains Exploration Project. Hemmera stated that Sidney (Tr'ondëk Hwëch'in), could feel free to forward the invitation to anyone else from the Tr'ondëk Hwëch'in team that would like to attend.	N/A	E01092_Placeholder for Chance and TH Meeting re Eagle Plains Exploration Project (ExCom) (6).msg
E01114	15-Apr-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning Engagement/Consultation	Hemmera sent the attached Draft agenda for the Chance and Tr'ondëk Hwëch'in meeting on April 27. Hemmera asked participants to please let them know if they had any changes they would like to make. Hemmera indicated that they would then finalize the agenda and attach it to the meeting invitation.	210414_TH-Chance_MeetingAgenda_April27_DRAFT_v0.2.docx	E01112_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in (2).msg
E01115	19-Apr-21	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning Benefits/Capacity Agreement	Sidney (Tr'ondëk Hwëch'in) indicated that Hemmera would need to add an item on the April 27 meeting agenda for the next wave of Capacity Funding according to the Engagement Plan.	N/A	E01112_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in (2).msg
E01093	23-Apr-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Josee Tremblay	Meeting Coordination/Planning Engagement/Consultation	Hemmera attached and sent out the April 27 agenda.	210414_TH-Chance_MeetingAgenda_April27_DRAFT_v0.2.docx	E01093_Placeholder for Chance and TH Meeting re Eagle Plains Exploration Project (ExCom).msg
E01116	23-Apr-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning Engagement/Consultation	Hemmera attached the updated agenda for the April 27 meeting and noted they would also add it to the meeting invitation. Hemmera noted that changes to the agenda could be made on the day of the meeting as well.	N/A	E01112_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in (2).msg
E01063	26-Apr-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in),	Meeting Coordination/Planning	Hemmera sent out a meeting invitation for Chance and Tr'ondëk Hwëch'in to meet and discuss Chance's proposed Eagle Plains Exploration Project. Hemmera said that Sidney (Tr'ondëk Hwëch'in) could feel free to forward the invitation to anyone else from the Tr'ondëk Hwëch'in team that would like to attend.	210414_TH-Chance_MeetingAgenda_April27_DRAFT_v0.2.docx	E01063_Chance and TH Meeting re Eagle Plains Exploration Project (ExCom).msg
E01072	27-Apr-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	Project Description/Activities	Hemmera sent Sidney (Tr'ondëk Hwëch'in) a message stating "Here you go!"	210414_Chance_ProjectDescription_April2021.pdf	E01072_draft Project description.msg
E01117	27-Apr-21	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Hemmera	Project Description/Activities Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) asked Hemmera and Chance is they had a Draft of the EXComm proposal they could look at.	N/A	E01112_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in (2).msg
E01118	27-Apr-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Project Description/Activities Meeting Coordination/Planning	Hemmera sent out the attached Draft Project Description for Chance's Eagle Plains Exploration Project. Hemmera noted to Tr'ondëk Hwëch'in that it was the same document that Tr'ondëk Hwëch'in would have received a long time ago in 2019. Hemmera explained they were in the process of updating the document, but they could talk about that more on the call at 2:00 PM.	190605_Chance Oil and Gas Eagle Plains Project Description_V3.pdf	E01118_RE_ Chance Eagle Plains Exploration Project (ExCom) - Meeting request with Tr'ondëk Hwëch'in .msg
E01192	27-Apr-21	Meeting		Tr'ondëk Hwëch'in	N/A	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Project Description/Activities Fracking Water - Ground Well Location Water - Surface Dempster Highway Caribou	The purpose of this meeting was for Chance to present a Draft Project Description of exploration activities proposed for the Eagle Plains Basin. Chance provided recent information and updates regarding baseline information gathered by consultants (Environmental Dynamics Inc (EDI), Peer Solutions, Palmer) and parties discussed next steps with community engagement and consultation schedules for Tr'ondëk Hwëch'in.	See Meeting summary for details.	E01192_210512_April27_TH-Chance_Meetingsummary_Draft_v0.3.docx

E01148	12-May-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Engagement/Consultation Meeting Coordination/Planning	Hemmera sent out and attached the April 27 Tr'ondëk Hwëch'in / Chance meeting summary Draft for review. They also attached Chance's 2021 Engagement Schedule memo that was identified as an action item. Hemmera asked Sidney (Tr'ondëk Hwëch'in) if they were interested in starting to schedule the meeting for the second week of June.	210512_Chance_ScheduleMemo_for_TH_v0.2.docx 210512_April27_TH-Chance_Meetingsummary_Draft_v0.3.docx	E01148_April 27_ Meeting summary Review & .msg
E01149	17-May-21	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) stated that they were good with the meeting notes. Sidney asked if June 8 would work to meet and follow up.	N/A	E01149_RE_ April 27_ Meeting summary Review & 1 .msg
E01150	17-May-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera stated that June 8 would work for Hemmera for the follow-up meeting. Hemmera asked if June 8 at 2:00pm Yukon time would work for everyone.	N/A	E01150_RE_ April 27_ Meeting summary Review & .msg
E01152	17-May-21	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Richard (Chance) stated that the timing on June 8 would work for him too.	N/A	E01152_RE_ April 27_ Meeting summary Review & .msg
E01153	17-May-21	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Sidney (Tr'ondëk Hwëch'in) said they were okay with the timing on June 8.	N/A	E01153_RE_ April 27_ Meeting summary Review & (2).msg
E01154	17-May-21	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Greg (Chance) said they were okay with the timing on June 8.	N/A	E01154_RE_ April 27_ Meeting summary Review & (1).msg
E01159	18-May-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Information Sharing Project Description/Activities Engagement/Consultation	Hemmera shared a recently received report and accompanying appendices from Palmer Environmental who worked on permafrost/terrain studies as well as suitability mapping. Hemmera also attached the main memo/report from Palmer.	Palmer_RPT_Eagle Plains Terrain Permafrost_DRAFT_25January2021.pdf	E01159_Chance Eagle Plains Exploration Project - Baseline information on terrain_ permafrost_ and suitability maps.msg
E01151	21-May-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera sent the meeting invitation for the June 8 Tr'ondëk Hwëch'in / Chance meeting. The purpose of this meeting was to focus on the permafrost baseline and suitability information collected by Palmer. Hemmera said that a Draft agenda would be sent out prior to the meeting.	N/A	E01151_June 8th Tr'ondëk Hwëch'in _ Chance Meeting .msg
E01173	21-May-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	Information Sharing Meeting Coordination/Planning	Hememra wanted to check-in and see if Tr'ondëk Hwëch'in had any issues with downloading the maps. Additionally, Hemmera wanted to propose that an agenda item for the June 8 meeting be a presentation from Palmer. Hemmera suggested this presentation could include an overview of Palmer's work and an opportunity for questions/discussion. Hemmera noted that Chance was fine with this idea and if Tr'ondëk Hwëch'in was too, then Hemmera could Draft an agenda and send it out to the parties.	N/A	E01173_RE_ Chance Eagle Plains Exploration Project - Baseline information on terrain_ permafrost_ and suitability maps (1TH).msg
E01224	7-Jun-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance), Robin McKillop, Shirley McCuaig, Cory Mcgregor	Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning	Hemmera sent the meeting invitation for the June 8 Tr'ondëk Hwëch'in / Chance meeting. The purpose of this meeting would be to focus on the permafrost baseline and suitability information collected by Palmer. Hemmera said that a Draft agenda would be sent out prior to the meeting.	210607_June8_TH-Chance_MeetingAgenda.docx	E01224_June 8th Tr'ondëk Hwëch'in _ Chance Meeting (5).msg
E01225	7-Jun-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance), Robin McKillop, Shirley McCuaig, Cory Mcgregor	Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Meeting Coordination/Planning Engagement/Consultation	Hemmera sent out and attached June 8 meeting materials including Palmer's PDF Presentation and a Draft Meeting Agenda.	210607_June8_TH-Chance_MeetingAgenda.docx Palmer_Chance_EaglePlains_summary.pdf	E01225_June 8th Tr'ondëk Hwëch'in _ Chance Meeting .msg
E01239	7-Jun-21	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in), Hemmera	Information Sharing	Sidney (Tr'ondëk Hwëch'in) thanked Hemmera for their note and stated they were reading it now since they were on vacation. Sidney stated they did receive the maps and a presentation from Palmer would be acceptable for the June 8 meeting.	N/A	E01239_RE_ Chance Eagle Plains Exploration Project - Baseline information on terrain_ permafrost_ and suitability maps (1).msg
E01240	7-Jun-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	N/A	Sidney Schafrik (Tr'ondëk Hwëch'in)	Information Sharing	Hemmera said that they had remembered Sidney (Tr'ondëk Hwëch'in) was away when they proposed this idea, so Hemmera had reserved Palmer in the hopes that Tr'ondëk Hwëch'in would support a presentation. Hemmera said that Mary would be sending out a Draft agenda later in the morning for everyone's review.	N/A	E01240_RE_ Chance Eagle Plains Exploration Project - Baseline information on terrain_ permafrost_ and suitability maps.msg
E01351	7-Jun-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Robin McKillop, Shirley McCuaig, Cory McGregor, Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Calista Morrison (Hemmera), Mary Kelly, Shena Shaw (Hemmera)	Information Sharing	Hemmera sent Tr'ondëk Hwëch'in Palmer's PDF version of their presentation for tomorrow. Hemmera noted that a few slides had been duplicated to simulate the 'appear' animation, so the presentation would be a little shorter than its page count suggests.	E01351_Palmer_Chance_EaglePlains_summary.pdf	E01351_RE_ Draft Meeting Agenda - June 8th.msg
E01215	8-Jun-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Engagement/Consultation	Hemmera sent a Draft agenda for the Chance and Tr'ondëk Hwëch'in meeting on June 8. Hemmera indicated to please let them kno if anyone had any changes they would like them to make.	210607_June8_TH-Chance_MeetingAgenda.docx	E01215_Draft Meeting Agenda - June 8th.msg
TH0100	8-Jun-21	Meeting	N/A	Tr'ondëk Hwëch'in	N/A	Cindy Dickson (Chance), Richard Wyman (Chance)	Chief Roberta Joseph (Tr'ondëk Hwëch'in) Sidney Schafrik (Tr'ondëk Hwëch'in) Robin McKillop Shirley McCuaig Cory McGregor Calista Morrison (Hemmera) Mary Kelly	Meeting	Chance met with Tr'ondëk Hwëch'in to present baseline information on Permafrost studies in Chance's Project Area, and to provide an opportunity for parties to discuss engagement preferences, planning, and upcoming engagement reports.	N/A	N/A
E01202	17-Jun-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance), Robin McKillop (Palmer), Cory McGregor (Palmer), Shirley McCuaig	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in)	Engagement/Consultation	Hemmera attached the June 8 Chance and Tr'ondëk Hwëch'in Draft Meeting Summary for review. Hemmera indicated they were happy to revise if needed.	210617_June8_TH-Chance_Meetingsummary_v0.4.docx	E01202_Chance - Tr'ondëk Hwëch'in June 8th Draft Meeting summary.msg E01261_210617_June8_TH-Chance_Meetingsummary_v0.5
E01247	19-Jun-21	Email	Incoming	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera sent Tr'ondëk Hwëch'in a copy of Chance's Engagement Log which will serve as Appendix D. Sidney indicated they were looking forward to Tr'ondëk Hwëch'in's comments on the Draft Annual Report.	210714_ChanceCommunicationLog_v7TH.pdf 210716_EngagementPlan_2021ImplementationReport_TH_v0.5.docx	E01247_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (2).msg
E01233	22-Jun-21	Email	Outgoing	Tr'ondëk Hwëch'in	Robin McKillop (Palmer)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Robin McKillop (Palmer), Shirley McCuaig (Palmer) Cory Mcgregor (Palmer), Hemmera	Engagement/Consultation	Robin (Palmer) said that all of their contributions seemed to have been captured well. Robin commented it was hard to dispute things with nearly a word-for-word account of the discussion.	N/A	E01233_Re_ Chance - Tr'ondëk Hwëch'in June 8th Draft Meeting summary (1).msg

E01235	22-Jun-21	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Robin McKillop (Palmer), Shirley McCuaig (Palmer) Cory Mcgregor (Palmer)	Engagement/Consultation	Sidney (Tr'ondëk Hwëch'in) stated they were fine with the notes and awaited any changes to the Project description and as well as any further baseline data.	N/A	E01235_RE_ Chance - Tr'ondëk Hwëch'in June 8th Draft Meeting summary.msg
E01212	16-Jul-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Greg Charlie (Chance), Cindy Dickson (Chance), Richard Wyman (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera sent out and attached the Draft report on the implementation of the Tr'ondëk Hwëch'in and Chance Engagement and Communications Plan for Tr'ondëk Hwëch'in and Chance to review. This report summarized meetings/correspondence that occurred between Tr'ondëk Hwëch'in and Chance since completing the 2020 Annual Report. Hemmera indicated that they had attached the Draft as a word document. Hemmera requested that both Tr'ondëk Hwëch'in and Chance make revisions to that document in tracked changes, which would assist them in creating a final version. Hemmera stated that if there were any issues that arose between the parties' revisions, they could address them via email and/or a quick call. Once revisions had been incorporated and the document was considered final by Tr'ondëk Hwëch'in and Chance, Hemmera would send the final version to both parties to sign. Hemmera stated that either later today, or, they would send a follow-up email with a Draft of Tr'ondëk Hwëch'in and Chance's Engagement Log which would serve as Appendix D.	210716_EngagementPlan_2021ImplementationReports_TH_v0.5.docx	E01212_DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review.msg
E01218	19-Jul-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera stated as referred to in their email on July 16 they had attached a copy of Chance's Engagement Log which would serve as Appendix D. Hemmera said they looked forward to Tr'ondëk Hwëch'in and Chance's comments on the Draft 2021 Annual Report on the Implementation of the Tr'ondëk Hwëch'in and Chance Engagement and Communications Plan.	210714_ChanceCommunicationLog_v7TH.pdf	E01218_FW_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review.msg
E01219	21-Jul-21	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Richard (Chance) said the Draft 2021 Annual Report on the Implementation of the Tr'ondëk Hwëch'in and Chance Engagement and Communications Plan looked good.	Note - typo in title of document and email - report is for 2021 not 2020	E01219_FW_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review.msg
E01306	27-Jul-21	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Hemmera	Engagement Reports/OIC Requirements	Sidney (Tr'ondëk Hwëch'in) sent Hemmera one correction on the Draft 2021 Annual Report on the Implementation of the Tr'ondëk Hwëch'in and Chance Engagement and Communications Plan which was about Brenda Butterworth-Carr (Tr'ondëk Hwëch'in)'s appointment to Charles Pugh's former position.	E01306_210714_ChanceCommunicationLog_v7TH.pdf E01306_210716_EngagementPlan_2021ImplementationReport_TH_v0.5.docx	E01306_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (7).msg
E01307	27-Jul-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Shena Shaw (Hemmera)	Engagement Reports/OIC Requirements	Hemmera thanked Tr'ondëk Hwëch'in for their review of the Draft 2021 Annual Report on the Implementation of the Tr'ondëk Hwëch'in and Chance Engagement and Communications Plan. Hemmera attached an updated version with the revision you've provided below. They also removed Draft from the title of the document and the Draft watermark. Hemmera asked if Sidney (Tr'ondëk Hwëch'in) could sign on their end (once they had finished Tr'ondëk Hwëch'in's approval process) and send a copy to Hemmera. Hemmera noted that Greg (Chance) and Richard (Chance) were actually in Eagle Plains right now, but that Greg (Chance) was scheduled to stop by the Hemmera Office to sign on once he's returned. Hemmera confirmed with Derek (Yukon Government) that submitting the report on August 2 was acceptable.	E01304_210727_EngagementPlan_2021ImplementationReport_TH_v0.6	E01304_FW_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review.msg
E01282	2-Aug-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Derek Fraser (Yukon Government) (Yukon Government), Sidney Schafrik (Tr'ondëk Hwëch'in) (TH), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in) (TH)	Engagement Reports/OIC Requirements	Hemmera sent Derek (Yukon Government) the attached Draft 2021 Annual Report on the Implementation of the Tr'ondëk Hwëch'i and Chance Engagement and Communications Plan. Hemmera noted that this report was prepared using meeting agendas and summaries Drafted by Hemmera and subsequently reviewed and agreed to by the parties. This report had been reviewed and approved by Chance. Tr'ondëk Hwëch'in reviewed the report and provided revisions to Hemmera. Hemmera noted that those revisions were incorporated into the report attached, however, Hemmera was unable to secure approval and a signature from Tr'ondëk Hwëch'in. To that end, the signature lines had been removed and the Draft watermark remained in place. Hemmera stated that if Tr'ondëk Hwëch'in provided a signature at a date, Hemmera would be happy to prepare a final version of the report for submission to Yukon Government.	E01282_210802_EngagementPlan_DRAFT2021ImplementationReport_TH_v0.7wAppD.pdf	E01282_2021 Annual Report - Tr'ondëk Hwëch'in and Chance Oil and Gas Engagement and Communication Plan.msg
E01308	2-Aug-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in)	Engagement Reports/OIC Requirements	Hemmera asked Tr'ondëk Hwëch'in if they would be able to send a signed copy of the signature page of the Draft 2021 Annual Report on the Implementation of the Tr'ondëk Hwëch'in and Chance Engagement and Communications Plan on that same day. Hemmera explained that then Chance could sign on their end and Hemmera could submit the engagement report to Yukon Government.	E01304_210727_EngagementPlan_2021ImplementationReport_TH_v0.6.docx	E01304_FW_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review.msg
E01322	2-Aug-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (Tr'ondëk Hwëch'in), Hemmera	Engagement Reports/OIC Requirements	Hemmera explained that since Chance must submit their engagement reports to Yukon Government today, Hemmera would submit the report as a Draft. They were going to remove the signing page, keep Draft in the title, and keep the Draft watermark on the report. Additionally, in their email to Yukon Government, Hemmera explained they could cc Tr'ondëk Hwëch'in and indicate that while the Draft report does incorporate revisions from Tr'ondëk Hwëch'in the parties were unable to sign it. Hemmera stated if they didn't hear from Tr'ondëk Hwëch'in before 2:30 pm, they would proceed as outlined above	E01322_210727_EngagementPlan_2021ImplementationReport_TH_v0.6.docx	E01322_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (5).msg
E01315	4-Aug-21	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	N/A	Engagement Reports/OIC Requirements	Greg (Chance) signed the Draft 2021 Annual Report on the Implementation of the Tr'ondëk Hwëch'in and Chance Engagement and Communications Plan.	E01315_img-210804121653-0001.pdf	E01315_FW_ Scan Data from _XRX9C934E2E3310_.msg
E01323	4-Aug-21	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Roberta Joseph (Tr'ondëk Hwëch'in), Shena Shaw (Hemmera), Calista Morrison (Hemmera)	Engagement Reports/OIC Requirements	Sidney (Tr'ondëk Hwëch'in) said they had been on site for the past couple of days and was unable to sign the Draft 2021 Annual Report on the Implementation of the Tr'ondëk Hwëch'in and Chance Engagement and Communications Plan. Sidney sent the attached a signed version for this year.	E01323_Chance Engagement Plan Signed (August 4 2021).pdf	E01323_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (3).msg
E01324	4-Aug-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Roberta Joseph (Tr'ondëk Hwëch'in), Shena Shaw (Hemmera), Calista Morrison (Hemmera)	Engagement Reports/OIC Requirements	Hemmera thanked Sidney (Tr'ondëk Hwëch'in) for their signature of the Draft 2021 Annual Report on the Implementation of the Tr'ondëk Hwëch'in and Chance Engagement and Communications Plan. Hemmera asked Greg (Chance) to please sign page 5 and send a scanned copy back to them. Hemmera stated then they would provide an updated version to Derek (Yukon Government).	N/A	E01321_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (2).msg
E01325	4-Aug-21	Email	Outgoing	Tr'ondëk Hwëch'in	Richard Wyman (Chance)	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Roberta Joseph (Tr'ondëk Hwëch'in), Hemmera	Engagement Reports/OIC Requirements	Richard (Chance) thanked Sidney (Tr'ondëk Hwëch'in) on the Draft 2021 Annual Report on the Implementation of the Tr'ondëk Hwëch'in and Chance Engagement and Communications Plan.	N/A	E01325_Re_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review (4).msg
E01326	4-Aug-21	Email	Outgoing	Tr'ondëk Hwëch'in	Hemmera	Richard Wyman (Chance), Greg Charlie (Chance), Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in), Roberta Joseph (Tr'ondëk Hwëch'in), Hemmera	Engagement Reports/OIC Requirements	Calista (Hemmera) attached the final version of the 2021 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities.	E01326_210804_EngagementPlan_FINAL2021ImplementationReport_TH_v0.6_SIGNEDwAppD.pdf	E01326_RE_ DRAFT 2020 Annual Report of Tr'ondëk Hwëch'in and Chance Engagement Activities - For Review.msg
E01364	17-Dec-21	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	Mike Chernoff, Greg Charlie (Chance), Richard Wyman (Chance), Cindy Dickson (Chance)	Chief Dana Tizya-Tramm (Vuntut Gwitchin First Nation), Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), Chief Roberta Joseph (Tr'ondëk Hwëch'in) (First Nation of Na-cho Nyäk Dun)	Engagement/Consultation	Greg (Chance) sent a formal letter to Minister Streicker and cc'ed Chief Tizya Tramm (Vuntut Gwitchin First Nation), Grand Chief Kyikavichik (Gwich'in Tribal Council), and Chief Roberta Joseph (Tr'ondëk Hwëch'in) (First Nation of Na-Cho Nyäk). Greg (Chance) stated if anyone had any questions, to contact them via email or cell.	E01363_Government of Yukon Land Tenure Extension Request.pdf	E01364_FW_ Land Tenure Request (2).msg
E01418	29-Jul-22	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Cindy Dickson (Chance), Greg Charlie (Chance), Richard Wyman (Chance)	Brenda Butterworth-Carr (Tr'ondëk Hwëch'in), Calista Morrison (Hemmera), Chief Roberta Joseph (Tr'ondëk Hwëch'in), Jeffrey McLean (Hemmera)	Engagement	Sidney (Tr'ondëk Hwëch'in) sent Calista (Ausenco) the signed copy of the Chance Tr'ondëk Hwëch'in Engagement Plan Implementation 2022 Report, in three separate documents.	N/A	E01419 - Chance TH Engagement Plan Implementation 2022-Signed_CompleteDocument
E01420	7-Mar-23	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	Cindy Dickson (Chance), Richard Wyman (Chance)	Aparna Verma, Chief Pauline Frost (Vuntut Gwitchin First Nation), Chief Roberta Joseph (Tr'ondëk Hwëch'in), Derek Fraser, Grand Chief Ken Kyikavichik (Gwich'in Tribal Council), John Strecker, Mike Chernoff, Simon Mervyn	Engagement	Greg (Chance) emailed Honorable John S. and cc'd Chance and Yukon Government representatives as well as Chief Pauline Frost (Vuntut Gwitchin First Nation), Grand Chief Ken Kyiachivik, Chief Simon Mervyn (First Nation of Na-cho Nyäk Dun), and Chief Roberta Joseph (Tr'ondëk Hwëch'in) providing the Land Tenure extension request. Chance confirmed their availability to answer any questions.	N/A	E01411860 - Land Tenure Extension Request
TH0078	14-Jun-23	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	Cindy Dickson (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Community Engagement	Greg (Chance) emailed Sidney (Tr'ondëk Hwëch'in) and stated that they would like to set up time with Sidney to discuss what Tr'ondëk Hwëch'in would like Chance to do in terms of community engagement. Greg (Chance) stated they had the week of July 10 free. Greg (Chance) requested a call to discuss engagement.	N/A	20230614-TH0001

TH0079	26-Jun-23	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	Greg Charlie (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Community Engagement	Greg (Chance) emailed Sidney (Tr'ondëk Hwëch'in) stating they had left a voice message as well. Greg (Chance) had confirmed First Nation of Na-Cho Nyäk on July 10th and Greg (Chance) stated Chance was hoping to have a meeting on July 11 in the morning with Sidney (Tr'ondëk Hwëch'in) and then do an open house at Tr'ondëk Hwëch'in for afternoon/early evening. Greg (Chance) requested confirmation if Tr'ondëk Hwëch'in is interested in meeting.	N/A	20230626-TH0002
TH0080	27-Jun-23	Email	Incoming	Tr'ondëk Hwëch'in	Richard Wyman (Chan	Cindy Dickson (Chance), Richard Wyman (Chance), Greg Charlie (Chance)	Chief Darron Taylor (Tr'ondëk Hwëch'in)	Congratulatory Letter	Richard (Chance) emailed Chief Darren Taylor and attached a letter. In the letter, Richard (Chance) congratulated Chief Darren Taylor on their election to become Chief of Tr'ondëk Hwëch'in. Richard (Chance) updated Chief Darren Taylor on the progress of the Project so far and the different parties involved. Richard (Chance) stated Chance would be interested in meeting Chief Darren Taylor as well as Tr'ondëk Hwëch'in Council and Citizens to discuss the Project in more detail going forward.	N/A	20230627-TH0003 20230627-TH0003A
TH0081	30-Jun-23	Email	Incoming	Tr'ondëk Hwëch'in	Sidney Schafrik (Tr'ondëk Hwëch'in)	Greg Charlie (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Community Engagement	Sidney (Tr'ondëk Hwëch'in) emailed Greg (Chance) stating they were out of the country and could not respond until now. Sidney (Tr'ondëk Hwëch'in) stated that at this time Tr'ondëk Hwëch'in was not prepared enough to be able to host a community consultation or have a direct meeting. Sidney (Tr'ondëk Hwëch'in) stated that Chance was free to conduct a community consultation to the Dawson City, but Tr'ondëk Hwëch'in would not be able to endorse or participate at this moment. Sidney (Tr'ondëk Hwëch'in) stated they would be able to provide more information once it is available.	N/A	20230630-TH0004
TH0082	30-Jun-23	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	Greg Charlie (Chance)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Community Engagement	Greg (Chance) emailed Sidney (Tr'ondëk Hwëch'in) stating Chance respects their wishes and will be prepared when Tr'ondëk Hwëch'in is ready. Greg (Chance) noted that they could suggest sometime in early fall to give them time. Greg (Chance) stated they will send Draft Project Description for Tr'ondëk Hwëch'in's review.	N/A	20230630-TH0005
TH0083	13-Jul-23	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	Jennifer Shalagan (Environmental Dynamics Inc.)	Sidney Schafrik (Tr'ondëk Hwëch'in)	Engagement	Greg (Chance) emailed Sidney (Tr'ondëk Hwëch'in) and Jennifer (EDI) and provided a Draft Project Description. Chance requested that Sidney (Tr'ondëk Hwëch'in) share with the Tr'ondëk Hwëch'in team. Chance stated they can discuss next steps when they meet and invited Tr'ondëk Hwëch'in to the August 3, 2023 meeting in Whitehorse. Chance noted that they are preparing community engagement meetings in Old Crow, Inuvik, Tsiigehtchic, and Teetl'it Zheh (Fort McPherson) during the August 22, 2023 week. Chance stated they look forward to hearing from Tr'ondëk Hwëch'in on dates for community engagement in Dawson City. Chance said to not hesitate to contact Greg (Chance) or Jennifer (EDI) if there were any questions.	N/A	20230713-TH0006
TH0084	28-Jul-23	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	N/A	Derek Fraser, Eliza Bethune (Two Worlds Consulting)	Engagement	Greg (Chance) emailed Derek (Tr'ondëk Hwëch'in) and cc'd Eliza (Two Worlds Consulting), providing a presentation Chance was planning to share on August 3, 2023 at 9:00 am. Chance stated they will meet in their boardroom and asked if Derek (Tr'ondëk Hwëch'in) could provide the location and list of people to attend. Chance requested feedback should there be anything additional to add to the meeting agenda.	N/A	20230713-TH0007 20230713-TH0007A
TH0085	3-Aug-23	Meeting - In Person	N/A	Tr'ondëk Hwëch'in	N/A	Cindy Dickson (Chance), Greg Charlie (Chance), Jennifer Shalagan (Environmental Dynamics Inc.), Pat Tobler (Environmental Dynamics Inc.)	Eliza Bethune (Two Worlds Consulting), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Engagement	Chance hosted an in-person meeting with advisors from behalf of both First Nation of Na-Cho Nyäk Dun and Tr'ondëk Hwëch'in in Whitehorse. The purpose of the meeting was to discuss engagement, socioeconomic and baseline data, primary data, and abandonment wells.	N/A	20230713-TH0007A
TH0095	05-Sep-23	Email	Outgoing	Tr'ondëk Hwëch'in	Eliza Bethune (Two Worlds Consulting)	Cindy Dickson (Chance), Richard Wyman (Chance), Greg Charlie (Chance)	Josee Tremblay, Adrienne Hill, Kevin Simpson (Two Worlds Consulting), Jennifer Shalagan (Environmental Dynamics Inc.), Eliza Bethune (Two Worlds Consulting), Skeeter Wright (First Nation of Na-cho Nyäk Dun)	YESAB Meeting Summary & Follow Up Aug Action Items	Eliza (Two Worlds Consulting) emailed Skeeter (First Nation of Na-Cho Nyäk Dun) and cc'd Josee (First Nation of Na-Cho Nyäk Dun), Adrienne (First Nation of Na-Cho Nyäk Dun), Kevin (Two Worlds Consulting), Jennifer (EDI), Cindy (Chance), Richard (Chance), and Greg (Chance) stating that the meeting minutes had been updated with the feedback from First Nation of Na-Cho Nyäk and attached them to the email. Eliza (Two Worlds Consulting) also provided the presentation from the August 3rd meeting, a Draft project overview video, a plain language 2D and 3D seismic definition, linear feature baseline data, wildlife baseline data, socioeconomic baseline data, socioeconomic baseline data, Andrea Wilson (Yukon Government) contact details. Eliza (Two Worlds Consulting) stated that Chance would like to receive direction from the leaderships of First Nation of Na-Cho Nyäk Dunand Tr'ondëk Hwëch'in around interest in meeting with Chance (in person or virtually), support for community open house events, community-based research protocols to inform primary socio-economic baseline data collection, Project Proposal review period, and preferences around the incorporation of Indigenous Knowledge in the draft Project Proposal.	N/A	20230905-TH0095A 20230905-TH0095B 20230905-TH0095C 20230905-TH0095D
TH0102	19-Sep-23	Email	Incoming	Tr'ondëk Hwëch'in	John Bailey (Vuntut Gwitchin First Nation)	Greg Charlie (Chance) Cindy Dickson (Chance)	John Bailey (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) Bailey, Andrea Wilson (Yukon Government), Brian Macdonald (Yukon Government), Keith Maguire (Yukon Government), Katie Fraser (Tr'ondëk Hwëch'in), executivedirector@First Nation of Na-Cho Nyäk Dunfn.com, lands.director@First Nation of Na-Cho Nyäk Dunfn.com, Jim Taggart (Unknown), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Bryony Mcintyre (Yukon Government), Laura Melvin (Yukon Environmental Socio-economic Assessment Board), Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council), Brandon Roebuck (Government of Canada), Elizabeth Staples (Vuntut Gwitchin First Nation), McGarry Selbee (First Nation of Na-cho Nyäk Dun), Jennifer Shalagan (Environmental Dynamics Inc.), Eliza Bethune (Two Worlds Consulting)	Executive Committee Screening	John (Vuntut Gwitchin First Nation) invited Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, and Gwich'in Tribal Council to a meeting with the Yukon Government, Chance, and Yukon Environmental Socio-economic Assessment Board regarding the Yukon Environmental Socio-economic Assessment Board Executive Committee screening for the Project. John (Vuntut Gwitchin First Nation) requested individuals RSVP if they were available for a virtual meeting at 10:30AM on , October 13th.	N/A	N/A

TH0103	21-Sep-23	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	Greg Charlie (Chance) Cindy Dickson (Chance)	John Bailey (Vuntut Gwitchin First Nation) (Vuntut Gwitchin First Nation) Bailey, Andrea Wilson (Yukon Government), Brian Macdonald (Yukon Government), Keith Maguire (Yukon Government), Katie Fraser (Tr'ondëk Hwëch'in), executivedirector@First Nation of Na-Cho Nyäk Dunfn.com; lands.director@First Nation of Na-Cho Nyäk Dunfn.com; Jim Taggart (Unknown), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Bryony Mcintyre (Yukon Government), Laura Melvin (Yukon Environmental Socio-economic Assessment Board), Kanda Gnama (Gwich'in Tribal Council), Peter Csicsai (Gwich'in Tribal Council), Brandon Roebuck (Government of Canada), Elizabeth Staples (Vuntut Gwitchin First Nation), McGarry Selbee (First Nation of Na-cho Nyäk Dun), Jennifer Shalagan (Environmental Dynamics Inc.), Eliza Bethune (Two Worlds Consulting)	Executive Committee Screening	Greg (Chance) emailed and stated thanks for organizing a meeting with the parties. Chance stated their team will be available for this meeting and will send out a presentation ahead of time.	N/A	N/A
TH0087	10-Oct-23	Email	Incoming	Tr'ondëk Hwëch'in	Elizabeth Staples	Greg Charlie (Chance) Cindy Dickson (Chance)	Shane Kilpatrick (Government of Canada), Kim Pawley (Government of Canada), Carey Sibbald (Government of Canada), Krista Magee (Government of Canada), Jennifer Walsh (Government of Canada), Alicia McKae (Gwich'in Tribal Council), Maggie Crump, Kanda Gnama (Gwich'in Tribal Council), Brian MacDonald, Keith Maguire (Yukon Government) (Yukon Government), Andrea Wilson (Yukon Government), Tiffani Fraser (Yukon Government), Jim Taggart (Unknown) (Yukon Government), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), and John Bailey (Vuntut Gwitchin First Nation)	Meeting	Elizabeth Staples (Vuntut Gwitchin First Nation)emailed Vuntut Gwitchin First Nation, Gwich'in Tribal Council, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, Chance, and Two Worlds Consulting forwarding them a meeting invite for October 13, 2023. Elizabeth attached an agenda.	N/A	20231010-ALLNATIONS
TH0088	13-Oct-23	Meeting	N/A	Tr'ondëk Hwëch'in	Elizabeth Staples	Greg Charlie (Chance) Cindy Dickson (Chance)	Shane Staples (Government of Canada), Kim Pawley (Government of Canada), Carey Sibbald (Government of Canada), Krista Magee (Government of Canada), Jennifer Walsh (Government of Canada), Alicia McKae (Gwich'in Tribal Council), Maggie Crump, Kanda Gnama (Gwich'in Tribal Council) (Gwich'in Tribal Council), Brian MacDonald, Keith Maguire (Yukon Government) (Yukon Government), Andrea Wilson (Yukon Government), Tiffani Fraser (Yukon Government), Jim Taggart (Unknown) (Yukon Government), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting) (Two Worlds Consulting), Jennifer (Environmental Dynamics Inc.), and John Bailey (Vuntut Gwitchin First Nation)	October 13 Meeting	A meeting was had between Chance, Vuntut Gwitchin First Nation, Gwich'in Tribal Council, Tr'ondëk Hwëch'in, First Nation of Na-Cho Nyäk Dun, the Yukon Government, Crown-Indigenous Relations and Northern Affairs Canada, Environmental Dymanics Inc., and Two Worlds Consulting. They discussed consultation activities for the Project and capacity funding opportunities to support First Nations' involvement in the Project's regulatory process.	N/A	20231010-ALLNATIONS
TH0089	17-Oct-23	Email	Outgoing	Tr'ondëk Hwëch'in	Eliza Bethune (Two Worlds Consulting)	Greg Charlie (Chance) Cindy Dickson (Chance) Richard Wyman (Chance)	Eliza Bethune (Two Worlds Consulting) Kevin Simpson (Two Worlds Consulting) Skeeter Wright (First Nation of Na-cho Nyäk Dun), Jennifer Shalagan (Environmental Dynamics Inc.)	Traditional Knowledge Sources for TH's Review, Comment, and Permission for Use	Eliza (Two Worlds Consulting) shared that Two Worlds Consulting, on behalf of Chance, identified some existing secondary sources of Traditional Knowledge for Tr'ondëk Hwëch'in's review, comment, and permission for use. The table provided listed secondary sources related to Tr'ondëk Hwëch'in that, based on Two World's understanding, may contain Traditional Knowledge related to the Project area. Chance requested Tr'ondëk Hwëch'in's feedback including any protocols or guidance for the use of Traditional Knowledge and permission to use the listed secondary sources by, October 27, 2023. Chance also invited Tr'ondëk Hwëch'in to share any additional Traditional Knowledge sources that may not be listed to help inform the development of the socio-economic assessment and Project Proposal. Eliza stated that if Tr'ondëk Hwëch'in wanted to use alternative submission options for certain Traditional Knowledge sources, Chance would be happy to meet and discuss further.	N/A	20231023-TH0089
TH0090	23-Oct-23	Email	Outgoing	Tr'ondëk Hwëch'in	Eliza Bethune (Two Worlds Consulting)	Richard Wyman (Chance), Cindy Dickson (Chance), Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Jennfier Shalagan (Environmental Dynamics Inc.), Eliza Bethune (Two Worlds Consulting)	File Sharing Site Information and Access Instructions	Eliza (Two Worlds Consulting) provided the steps to access the Tr'ondëk Hwëch'in file sharing site.	N/A	N/A
TH0091	14-Nov-23	Email	Incoming	Tr'ondëk Hwëch'in	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Community Information Sessions	Skeeter (First Nation of Na-Cho Nyäk Dun) emailed Greg (Chance) stating they have reached out to Tr'ondëk Hwëch'in and First Nation of Na-Cho Nyäk regarding interest in meeting with Chance or an interest in Chance coming to the community for an information session with the Project, and to date, has received no response	N/A	N/A
TH0092	14-Nov-23	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun)	Community Information Sessions	Greg (Chance) emailed Skeeter (First Nation of Na-Cho Nyäk Dun) stating they are hopeful Tr'ondëk Hwëch'in or First Nation of Na-Cho Nyäk engage in the Project soon. Greg (Chance) requested updates going forward.	N/A	N/A
TH0094	22-Nov-23	Mail	Outgoing	Tr'ondëk Hwëch'in	Cindy Dickson (Chance	N/A	First Nation of Na-Cho Nyäk Chief and Council	November 2023 Letter	Cindy (Chance) mailed letters.	N/A	N/A

TH0093	23-Nov-23	Email	Outgoing	Tr'ondëk Hwëch'in	Greg Charlie (Chance)	Greg Charlie (Chance), Richard Wyman (Chance)	Chief Darren Taylor (Tr'ondëk Hwëch'in), Skeeter Wright (First Nation of Na-cho Nyäk Dun),Lauren Melvin (Yukon Government), Andrea Wilson (Yukon Government), Brenda Butterworth-Carr (Tr'ondëk Hwëch'in)	TH Chief Taylor Letter	Greg (Chance) emailed Chief Darren Taylor and cc'd Richard (Chance), Skeeter (First Nation of Na-Cho Nyäk Dun), Laura (Yukon Government), Andrea (Yukon Government), Brenda B., stating congratulations on Chief Darren Taylor's return to leadership for Tr'ondëk Hwëch'in. Greg (Chance) offered to provide a community update on the Project or also the staff of First Nation of Na-Cho Nyäk's Government. Greg (Chance) attached a letter.	N/A	20231123-TH0093A
TH0097	06-Dec-23	Email	Incoming	Tr'ondëk Hwëch'in	Eliza Bethune (Two Worlds Consulting)	Cindy Dickson (Chance), Richard Wyman (Chance), Greg Charlie (Chance)	Skeeter Wright (First Nation of Na-cho Nyäk Dun), Eliza Bethune (Two Worlds Consulting), Kevin Simpson (Two Worlds Consulting), Jennifer Shalagan (Environmental Dynamics Inc.)	Secondary TK Source Permission Request	Eliza (Two Worlds Consulting) emailed Skeeter (First Nation of Na-Cho Nyäk Dun) and cc'd Jennifer (EDI), Greg (Chance), Cindy (Chance), Richard (Chance), and Kevin (Two Worlds Consulting) providing a list of secondary TK sources for Tr'ondëk Hwëch'in and First Nation of Na-Cho Nyäk, and requested confirmation that Skeeter (First Nation of Na-Cho Nyäk Dun) had received direction from Tr'ondëk Hwëch'in or First Nation of Na-Cho Nyäk on preferences for use of publicly available secondary TK. Skeeter (First Nation of Na-Cho Nyäk Dun) emailed Eliza (Two Worlds Consulting) confirming Skeeter (First Nation of Na-Cho Nyäk Dun) would remind Tr'ondëk Hwëch'in and First Nation of Na-Cho Nyäk about the source lists.	N/A	N/A
TH0098	20-Dec-23	Meeting	N/A	Tr'ondëk Hwëch'in	N/A	Cindy Dickson (Chance), Greg Charlie (Chance)	Chris Albrecht (Environmental Dynamics Inc.) (Environmental Dynamics Inc.), Mike Setterington (Environmental Dynamics Inc.), Kerman Bajina (Environmental Dynamics Inc.), Skeeter Wright (First Nation of Na-cho Nyäk Dun), Deana Lemke (Porcupine Caribou Management Board), Joe Tetlichi (Porcupine Caribou Management Board), Matt Clarke, Eliza Bethune (Two Worlds Consulting), Haylee Dlouhy (Two Worlds Consulting), John Bailey (Vuntut Gwitchin First Nation), Mike Suitor (Yukon Government)	Technical Working Group	Chance met with Environmental Dynamics Inc., a technical advisor on behalf of First Nation of Na-Cho Nyäk Dun and Tr'ondëk Hwëch'in, a technical advisor on behalf of VGFN, the Porcupine Caribou Management Board, and Yukon Government to have a hybrid technical working group session. The purpose of this meeting was to discuss Project updates and Environmental Baseline Studies including potential effects and mitigation to Fish, Wildlife, Porcupine Caribou Herd, Linear Features, North Yukon Land Use Planning Conformity. The working group session also included and a question-and-answer period.	N/A	323-Chance_PCMB_Technical_Working_Group-December 20 2023_20240104

APPENDIX 2-D-38. Residents of Communities Record of Contact

Residents of Communities Record of Contact (January 1, 2014 - January 1, 2024)

Reference	Date	Communication Method	Location	Community Open House Attendees	Subject	Summary	Additional Comments	Attachments
VG0207	15-Jun-14	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 4:00 pm - 7:00 pm. Chance shared Project information by presentation. Chance provided dinner and door prizes.	N/A	210607_Chance_OldCrow_June15OpenHouseFlyer
VG0237	16-Jun-14	Community Event	Whitehorse	Residents of Whitehorse	Community Event	Chance held a community open house event in Whitehorse at the Yukon Inn from 4:30 pm - 6:00 pm. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided an open house survey to get feedback to improve future engagement with the community.	N/A	Open House Advertisement June 2014.pdf
VG0209	16-Jun-14	Community Event	Whitehorse	Residents of Whitehorse	Community Event	Chance held a community open house event from 1:00 PM to 2:00PM MST at the Vuntut Gwitchin First Nation Whitehorse Office at 3A-508 Hansen Street.	N/A	20140616-VG0209
NND0128	17-Jun-14	Community Event	Mayo	Residents of Mayo	Community Event	Chance held a community open house event in Mayo at the First Nation of Na cho Nyäk Dun Multi-Purpose Room from 10:00 am - 12:00 pm. Chance shared Project information by presentation and held a question-and-answer period after. Chance provided lunch to the residents of Mayo.	N/A	Mayo Open House Notice for June 17 2014.pdf Open House Advertisement June 2014.pdf
VG0210	17-Jun-14	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Old Crow Community Hall from 4:00 pm - 6:00 pm. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided dinner to the residents of Old Crow.	N/A	Old Crow Notice for June 17 2014.pdf Open House Advertisement June 2014.pdf
TH0099	18-Jun-14	Community Event	Dawson City	Residents of Dawson City	Community Event	Chance held a community open house event in Dawson City at the YOOP Hall from 4:00 pm - 6:00 pm. Chance shared Project information by presentation and had a question-and-answer period after.	N/A	Dawson City Open House Notice for June 18 2014
VG0238	03-Sep-14	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 3:30 pm - 7:30 pm. Chance shared Project information by presentation and had a question-and-answer period after. Chance provided juice boxes and packaged sandwiches to the residents of Old Crow.	N/A	200826_Chance_OldCrowOpenHouseFlyerRevised.pdf
E01252	06-Jun-19	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community dinner in Old Crow at the Community Hall. Chance presented the draft Project Description, as well as the transition from Northern Cross to Chance Oil and Gas Limited, seismic techniques, YESAB process, YESAB's Executive Committee, consultation and engagement, and the Porcupine Caribou Herd.	N/A	E01252_190606_Chance_OldCrowCommunity_June6_SignInSheet.pdf E01252_190620_Draft_June6_VGCommunity-ChanceMeetingsummary_v.0.3.docx
E01254	19-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01255	20-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01253	21-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01256	22-Aug-19	Community Event	Inuvik	Residents of Inuvik	Community Event	Meeting summary not available at time of submission.	N/A	Sign in sheet available
E01257	20-Apr-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Meeting summary not available at time of submission.	N/A	E01257_210430_Chance_OldCrowOpenHouse_April20_SignInSheet.pdf
E01258	21-Apr-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Meeting summary not available at time of submission.	N/A	E01258_210430_Chance_OldCrowOpenHouse_April21_SignInSheet.pdf
E01259	18-May-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Meeting summary not available at time of submission.	N/A	E01259_210521_Chance_OldCrowOpenHouse_May18_SignInSheet.pdf
E01260	13-Oct-21	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Chief Zzeh Gittlit School Gym from 4:30 pm - 7:30 pm. Chance shared Project information by presentation. Chance provided a dinner and door prizes.	N/A	E01260_211101_Chance_OldCrowOpenHouse_Oct13_SignInSheet.pdf E01260_211123_VGCommunity-Chance_Oct13OpenHouse_Metingsummary_v.0.4.docx

E01398	05-May-22	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Darius Elias Community Centre from 11:00 am – 7:00 pm MST. Chance shared information regarding the Project, heritage resources, permafrost, seismic testing, and wildlife studies.	N/A	E01397_220526_VGCommunity-Chance_May5OpenHouse_Meetingsummary_v.0.3.docx E01397_220505_VGCommunity-Chance_May5OpenHouse_Sign-inSheet.pd
E01384	26-May-22	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a community open house event in Old Crow at the Darius Elias Community Centre from 10:00 am – 8:00 pm MST. Chance shared information regarding the Project, drilling techniques and equipment, YESAA and YESAB's Pre-Submission Engagement Process, linear features and disturbance, and water bodies in the Project area.	N/A	E01384_220606_VGCommunity-Chance_May26OpenHouse_Meetingsummary_v.0.5.docx E01384_220525_VGCommunity-Chance_May25OpenHouse_sign-inSheet.pdf
VG0098	10-Jan-23	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance went to Old Crow to witness the Swearing In Ceremony of the newly elected Vuntut Gwitchin First Nation leadership.	N/A	E01485 - Air North Yukon's Airline-Confirmation 23163751
VG0142	15-May-23	Community Event	Old Crow	N/A	Community Event	The Project Team travelled to Old Crow and planned to conduct an in-person community open house event. This event was cancelled due to a potential flash flood. Chance, with approval from Chief Frost, provided a catered dinner for leadership and community members at the Old Crow Community Centre.	N/A	N/A
VG0143	15-May-23	Community Event	Old Crow	N/A	Community Event	The Chance team travelled to Old Crow and the meeting ended up being postponed due to potential flooding of the community.	N/A	N/A
E0141852	16-May-23	Community Event	Inuvik	Residents of Inuvik	Community Event	Chance held a community open house event in Inuvik at the Nihtat Gwich'in Council Board Room from 4:00 pm – 8:00 pm MST. Six community members attended this event. Open house attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to open house attendees. This presentation included a question-and-answer period as well as a draw for two Air North tickets.	N/A	Summary Report
E0141852	17-May-23	Community Event	Fort McPherson	N/A	Community Event	Chance planned to conduct an in-person community open house event in Teetł'it Zheh (Fort McPherson). This event was cancelled due to flash flooding in the Teetł'it Zheh (Fort McPherson) area.	N/A	N/A
E0141852	17-May-23	Community Event	Fort McPherson	N/A	Community Event	Chance planned to conduct an in-person community open house event in Teetł'it Zheh (Fort McPherson). This event was cancelled due to flash flooding in the Teetł'it Zheh (Fort McPherson) area.	N/A	N/A
VG0236	06-Dec-23	Community Event	Old Crow	Residents of Old Crow	Community Event	Chance held a World Cafe event in Old Crow at the Darius Elias Community Centre from 4:00 pm – 8:00 pm MST. World Cafe attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to World Cafe attendees. After dinner, technical experts from EDI, Ecofor, and Palmer were divided amongst the groups. Focus group #1 had a presentation from EDI on Wildlife and Fish and Fish Habitat. Focus group #2 had presentations from Ecofor and Palmer on Archaeology / Heritage Resources and Permafrost. Once presentations and comments/concerns were addressed, the technical experts switched tables and presented to the rest of the attendees. The World Cafe event had door prizes that were drawn throughout the event which included 2 Air North gift cards, 3 Co-op grocery gift cards, Ecofor packages, and a mug from Indigo.	N/A	Summary Report

GTC0220	07-Dec-23	Community Event	Fort McPherson	Residents of Fort McPherson	Community Event	Chance held a community open house event in Fort McPherson at the Tetlit' Zheh Fort McPherson Hamlet Chamber from 4:00 to 8:00 pm MST. Open house attendees were asked to sign in upon arrival and to complete a feedback form before leaving. Chance shared Project information on posterboards and a 1-page handout. Chance provided a catered dinner and presented Project information to the Open House attendees. The Open House event had door prizes that were drawn throughout the event which included 2 Air North gift cards, 2 Co-op grocery gift cards, and Ecofor packages.	N/A	Summary Report

APPENDIX 2-D-39. June 8, 2021 Meeting Summary

TR'ONDËK HWËCH'IN AND CHANCE OIL AND GAS MEETING

Date: June 8, 2021

Location: Microsoft Teams

Attendees:

Tr'ondëk Hwëch'in:
Chief [redacted]
[redacted], Senior Advisor, Mining & Strategic Initiatives

Chance Oil and Gas Limited:
[redacted], President
[redacted], Regulatory, Environmental and Community Relations Coordinator

Palmer:
[redacted], Principal, Geomorphologist
[redacted] Senior Geoscientist
[redacted], Geoscientist

Hemmera:
[redacted] Human Environment Specialist
[redacted], Human Environment Specialist

Purpose and Objectives

The purpose of this meeting was for Chance and Palmer to present baseline information on Permafrost studies in Chance's Project Area, and to provide an opportunity for parties to discuss engagement preferences, planning, and upcoming engagement reports.

Meeting Discussion:

Introductions of all attendees and overview of meeting agenda.

[redacted]: Chief [redacted], would you like to say anything before we get started?

Chief [redacted]: You can move along; I can speak at the end.

[redacted]: Quick review of the action items of our following meeting.

1. Hemmera to send Memo with tentative engagement schedule to TH. We sent this.
2. Hemmera/Chance to send revised project description to TH. We will send this as soon as it's done.

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3. Hemmera/Chance to send baseline information (Environmental Dynamics Inc. (EDI), Palmer, and Peer Solutions) to Tr'ondëk Hwëch'in (TH) as it becomes available. We have been able to send the Palmer maps and reports. We can later discuss sharing studies from other Chance consultants.

If there are no questions, then we'll just move right into the presentation.

[redacted]: Could you summarize what consultation is looking like with other First Nations?

[redacted]: Yes, here is a quick overview. In terms of the big picture we prepared and presented a project description in 2019 to various First Nation communities and Gwich'in communities in NWT. Chance then focused on their Well Maintenance Project for Designated Office for most of 2020. We are now re-engaging this project. We have revised the project description after feedback from communities and feedback from the Designated Office proposal currently in YESAB. I mentioned in our April meeting that we're working on revising the project description. This should be finished soon. In terms of re-engagement with First Nations, we have recently met with Skeeter Wright at Na-Cho Nyäk Dun (NND) and leadership at the Gwich'in Tribal Council (GTC). We're looking for guidance from First Nations on how we should proceed, either in-person or virtual events, and/or where we would share project descriptions and base findings. We've been having open houses in Old Crow for the community in order to collect feedback and concerns. The next open house will be with Environmental Dynamics Inc. (EDI) to present studies on wildlife and vegetation. Chance is working with the Vuntut Gwich'in (VG) Government, but those conversations are currently paused. That's a basic summary of the events since we've resumed engagement on the Executive Committee Project. Aiming for a YESAB submission this fall. Richard, anything to add?

[redacted]: No.

[redacted]: We've also been able to meet with Porcupine Caribou Management Board and the technical committee. This has helped work towards addressing issues with respect to the Porcupine Caribou Herd.

[redacted]: How far along are you from completing the Information Response for the DO project?

[redacted]: My understanding is that the Hemmera proposal management team is working on gathering information from various consultants. We can add this as an action item, to get the timeline for responding to the IR, for us.

[redacted]: Okay thank you. No questions on our end. I'll let you know as we go.

[redacted]: [Opens up presentation] Thanks everyone for taking the time to join us. We want to share our role in the project and how we are helping Chance to understand the grounds in the project area. We will do this in two parts. One, to understand the topography in the area and help inform the decision-making process. Two, to support the YESAB project proposal. We want to work with Hemmera and the other consultants to understand how permafrost is connected with other variables like vegetation and informing the assessment process. For understanding the topography in the region we will do this in two steps:

1. Physical setting: Understand the landscape, why it looks the way it does.
2. Mapping approach: Part of our job is to provide a better sense of the map and what's on the ground.

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The bedrock is the in the sedimentary basin. It was once a sea bed. Over time we start to see that the bedrock is cut into deep valleys and gullies. You can see that in the landscape like a network of channels and valleys. Another thing that is really cool about the area is that it escaped being covered by ice glaciers. This provided an opportunity for permafrost to develop. Permafrost from a technical perspective is defined by temperature. Some areas that are quite dry are not that sensitive and others that have more water and ice are quite sensitive. The valley bottoms get quite cold in the winter and warmer in the summer time. That [R. McKillop references presentation] picture of thermokarst, you see the surface pond as permafrost thaws. On the bottom left, you can see the patterned ground. This indicates that you have ice wedges underground which are sensitive. As the active layer thaws, and after rain or storms, you can have a landslide. It's something we want to pay attention to, especially with infrastructure. There could also be a concern for flooding. These are things we need to pay attention to.

Here are some slides from the Yukon Government. The uppermost centimetres of the permafrost is going to thaw with climate change. Precipitation patterns are changing which can also trigger some minor disturbances.

[redacted]: That shows a nice history of the landscape. For understanding the landscape, we use satellite or aerial views of the project area. We also use LiDAR to see through vegetation to get a true reflection of the surface. When it comes to documenting these things, we have a terrain map. We look at the geomorphological process, permafrost depth and ice content. These things are not always straight forward to map, but we get clues from the surface in which areas are permafrost sensitive. We create these exploratory suitability maps to tailor/make guides that provide an overview that shows how easy it will be to develop infrastructure and roads without mitigation measures in place. High suitability is in green and low is in red. Our reconnaissance study was done in July 2019. These green points are where data was collected. We completed terrain interpretations for more than 8,400 terrain polygons.

Interpreting these maps. You can use the colours for understanding what is there. The broad ridges are here [redacted referenced to presentation] the permafrost here is well drained. The field photo shows rocky areas. Moving down we have gentle valley slopes. Colluvial sediments are sediments moved down the slopes and ridges through gravity. Sometimes we may run into surface water constraints and more extreme cases active layer detachment. In these cases, we represent individual landslides as these small arrows [redacted referenced to presentation]. Generally, this will give you a clue of what you will see on the ground. Then on the valley bottoms you will see much more thick organics, ponds, and permafrost layers closer to the surface.

We created these exploration development suitability maps. The green shows well drained areas with permafrost at depths. At the opposite end of things, in red, you will see ice wedges exposed in the flood plain. Generally, these areas are where we would run into trouble. The implications are not a "yes" or "no", but more of an idea of what you are going to run into once you get there. In the green areas we predict Chance will have no issue. The oranges areas show the moderate to low. They give warning that mitigation methods may need to be considered.

[redacted]: There is a lot of information in the mapping. We are happy to help people and communities understand what the maps means and guide that information. Our next steps are a short field program to start getting some subsurface information and to see a little bit deeper. To understand the makeup of the materials. A lot of time we will hit bedrock. When we do hit thicker areas, we want to make sure we map it,

to record the areas that require more attention. We want to form a baseline report and wrap it up into an effects assessment. That was a quick version of what we have been up to.

[redacted]: Thank you, couple of questions. Will the subsurface work be done before Executive Committee project proposal?

[redacted]: It will be done in the late part of July 2021. We're advancing everything to build off the mapping done to date. We would like to collect that subsurface information to fine-tune the mapping information. This will really demonstrate what it is like and will feed into the YESAB submission this fall.

[redacted]: What was the methodology of the sampling and how did you conduct that to create the map and come up with the numbers for the areas?

[redacted]: The scale is 1 to 20,000 scale. We felt the need to sample representative areas of the landscape. The field sampling is representative of the different areas of the landscape. We tried to be sure that we saw everything on the property and touched down on areas of the landscape. Characterizing those materials and confidently re-assign these characteristics of these areas.

[redacted]: You mentioned climate change. How are you going to see if the project Chance is proposing will affect natural climate change or human driven climate change in the area?

[redacted]: We are hoping to install ground temperature surveyors to get baseline information for ground temperature. We are going off published information and trying to get specific project information from literature.

[redacted]: The well maintenance project going through YESAB right now is looking at the temperature change on the 8 wells. This will give us a modern measure on the permafrost where those 8 wells are.

[redacted]: How much information do you have on the hydrogeology on the existing 8 wells?

[redacted]: We will be going up with Chance to visit the well sites and try to get an idea of the thawing that has occurred over the years. The thawing is really just in the upper layers of the soil that sits above the permafrost. We can have some changes in the upper layer, but no reason to think that the water can get below that upper layer. Any questions?

[redacted]: That is okay, we're waiting to look at the information responses for the Designated Office project.

[redacted]: Any other questions?

[redacted]: No thank you, I'm satisfied with the technical side.

[redacted]: The way that we consider permafrost in the effects assessment can differ between projects. For example, having permafrost as value component or as a pathway of effects. Any opinions on how that is best addressed? Is it a concern itself or is the concern on its effect on other things?

[redacted]: Just on behalf of myself, I think the implications would be the pathways of effects as they relate to the Porcupine Caribou. As a value component that would be much more a question for VG.

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[redacted]: I think potentially as both. Especially with respect to the Porcupine Caribou. The VC's are not set in stone at the moment. Since we re-started engagement, the goal is to have meetings with all the technical staff and renewable resources councils. This will guide how we decide these things. As we are actively seek this information. I think the coming months will provide more guidance on those areas. Our selection of socio-economic components will be driven by guidance from First Nations.

It looks like we're all done for the permafrost information. Palmer you're welcome to remain on the call or log off. Chief [redacted], do you have any questions before they leave?

Chief [redacted]: No further questions.

[redacted]: Moving on to discuss the engagements reports.

[redacted]: I will stay on the rest are welcome to leave.

[redacted]: Chance needs to provide engagement reports in accordance with its Ministerial Orders. Usually it summarizes engagement up until May 31st. Pending any objections, we'll look at the communication log and summarize the meetings and emails that have occurred. General issues raised and key concerns that have been raised. We'll share the draft engagement report for review by TH and Chance, address key concerns and areas that have been raised, and, upon having a mutually agreed upon document, submit at the end of July. We will aim to get the draft report to you to early July – does that work for you?

Chief [redacted]: Yes, that's fine.

[redacted]: Engagement reports are usually associated with the Executive Committee Project, but will include DO project and associated engagement activities as well. That is it for the engagement reports. Those will be provided in early July to parties for review.

[redacted]: We are looking to you for your preferences for engagement with lands and wildlife staff and your citizens. It is also up to you, your preference, for our next meetings in general. This includes presenting information from EDI and Palmer.

Chief [redacted]: We will discuss and get back to you. We'll need the project description.

[redacted]: We will get that to you. With respect to concern related to best practices for safety during covid. We'd be happy to plan an open house in Dawson. If you want. If you are open to that. We're also waiting on other consultants out of the territory to get their second shots, but EDI can come at this point to present their findings. As they are based in Whitehorse.

[redacted]: I'll likely get my second shot by the end of the month.

[redacted]: [redacted], in the past you mentioned that Chance should send along technical materials. We can send along EDI's information if that's ok with you?

[redacted]: Yes, you can send that along.

DRAFT

[redacted]: We can also give a presentation of that later if you, or your, technical staff want. Questions or concerns? Closing statements?

Chief [redacted]: Thank you, I am happy to be a part of this presentation today. Our efforts in this project are limited with respect to Tr'ondëk Hwëch'in Traditional Territory and the Porcupine Caribou habitat and wellbeing. One of the things that you mentioned earlier in the overview of the project description and communication that has taken place. I was quite disturbed to learn about the communication breakdown with VG. Social responsibility is important. Our three First Nations work together in regard to our interests throughout the North Yukon area. We have key values that we must ensure are protected and ensure are sustainable. We collectively work together to support projects. I'm disturbed to hear that there isn't a strong dedication to social responsibility. That may have an impact on our three First Nations. Regarding the permafrost, there's always the concern of the project's impact on the Porcupine Caribou. The Porcupine Caribou is of high value for traditional food. They provide for our cultural and spiritual wellbeing. We will do all we can to protect the Porcupine Caribou. We're already having an impact on the Porcupine Caribou. We know that there has not been data collection on the Porcupine Caribou and that shows that there hasn't been respect for the Porcupine Caribou. Moving forward, we need to see that some changes are made with VG. Also, we do not support fracking. We are going to do all that we can to protect the water. You need to have respect – you need seek VG's permission before you move into their land. You need to be able to seek that permission from VG before you go onto their land or before you go present information. Ensure that there is social responsibility and approval from the VG. We look forward to the project description presentation again. We will get back to you at the end of this week on who you will be presenting for. There is nothing stopping you from providing a presentation here in the community since there is not much concern in the community for the project.

[redacted]: Thank you for comments and concerns.

Chief [redacted]: We would like to hear from Chance.

[redacted]: Thank you Chief [redacted], and thank you for your candid comments. It is our desire to have a good working relationship with all First Nations. We have been reaching out to VG. This is why we have hired consultants to reach and address these concerns. We are paused right now and hopefully we can get back on track.

Chief [redacted]: I'm hoping to hear news on this.

Action Items:

- Hemmera to send EDI baseline information to TH.
- Hemmera/Chance to send revised project description to TH as soon as it's done.
- TH to discuss internally preference for next round of meetings/presentations (e.g., with lands staff, citizens, etc.).

DRAFT

APPENDIX A. Terrain and Permafrost Baseline Report

470 Granville Street, Suite 630, Vancouver, BC V6C 1V5
Tel: 604-629-9075 | www.pecg.ca

Terrain & Permafrost Baseline Report

Eagle Plains Project

Palmer Project #
1903402

Prepared For
Chance Oil and Gas Limited

February 16, 2024

470 Granville Street, Suite 630, Vancouver, BC V6C 1V5
Tel: 604-629-9075 | www.pecg.ca

February 16, 2024

Richard Wyman
President
Chance Oil and Gas Limited
340 12th Avenue SW, Suite 1000
Calgary, AB T2R 1L5

Dear Richard Wyman:

Re: Terrain and Permafrost Baseline Report, Eagle Plains Project
Project #: 1903404

Palmer is pleased to submit the enclosed report to Chance Oil and Gas Limited (Chance) to accompany and explain the interpreted terrain and permafrost classification mapping and exploration development suitability mapping within its exploration property near Eagle Plains, northern Yukon. This report provides baseline characterizations of the surficial geology, terrain and permafrost in support of Chance's Project Proposal submission to the Yukon Environmental and Socio-Economic Assessment Board (YESAB).

This report, in combination with previous submissions and background information collected over several years, establishes the types, distribution, characteristics and sensitivities of terrain and permafrost within the project area. It enables proposed project components, such as seismic survey lines, well pads, winter access roads and mix-bury-cover disposal, to be planned and sited in such a way that minimizes their potential effects on permafrost and terrain stability and their potential exposure to associated terrain hazards.

Should you have any questions or require additional information, please do not hesitate to contact Robin McKillop (604-355-8788, robin.mckillop@pecg.ca).

Yours truly,

Robin McKillop, M.Sc., P.Geo.
Vice President, Principal Geomorphologist

Executive Summary

Since the 1950s, the Eagle Plains region has been explored for its petroleum resource potential. Chance Oil and Gas Limited (Chance), which drilled four exploration wells in 2012 and 2013, has retained Palmer to aid with its next phase of exploration, pending approval by Yukon Environmental and Socio-economic Assessment Board (YESAB). Palmer's role was to map and characterize baseline surficial geology and permafrost, thereby informing potential effects of the Project on permafrost and terrain stability as part of an environmental assessment.

This report details the physical setting of the Eagle Plains regions, reviews data sources and background information related to previous reports and mapping, describes the methods and limitations of the study, and presents the results of surficial geology and permafrost mapping within the Project Area. Exploration Development suitability mapping, which largely reflects permafrost-related terrain stability, guides exploration infrastructure planning. Considerations for exploration development, climate change, and future work conducted in the area are provided at the end.

Our approach began with a detailed investigation of the surficial geology and permafrost conditions within the Project Area, building off work done by Kyrotek Arctic Innovation (2015a,b). Based on this characterization, Palmer completed map sets for the entire 2,400 km^2 Project Area at a scale of 1:20,000, based on a combination of multiple stereo-imagery sources and high-resolution LiDAR derived elevation data.

The surficial geology of the Project Area consists of colluvial deposits, weathered bedrock, fluvial deposits, organic deposits, and anthropogenic features, with colluvial deposits being the most abundant in the area. The Project Area is located within the continuous permafrost zone. As such, ground temperature instruments were installed at 12 representative locations on ridge crests, on slopes of different aspects, and in valley bottoms to understand ground temperature variability. The focus was to assess which areas of the landscape are warmer (>-2°C) and cooler (<-2°C), improve definition of active layer thickness and seasonal dynamics, and identify what effects historical and recent wildfires have had on shallow permafrost.

Ice content variability and its relationship with different surficial deposits were incorporated into the mapping, considering that fine-grained deposits, such as colluvial and fluvial deposits, are typically ice-rich, while coarser-grained deposits, such as weathered bedrock, are typically ice-poor. This factored heavily into the determination of terrain stability, as permafrost-related processes such as cryoturbation, solifluction, active-layer detachments and thermokarst subsidence/gullying are dependent on ice content and drainage conditions.

Exploration development suitability mapping was completed to encompass all the above information into a map set. This map set provides guidance for future development of exploration infrastructure by identifying areas least likely to be affected by construction-related disturbance. Exploration development suitability was divided into two primary classifications: road and well pad suitability, which guides the establishment and maintenance of well pads and access roads (although the classification conservatively reflects all-season roadways, which are not proposed as part of the project), and mix-bury-cover (MBC) disposal suitability, which identifies areas of the landscape that are geomorphologically isolated and potentially

suitable for disposal of cuttings using MBC techniques. Road and well pad suitability classification also provides a conservative guied for proposed seismic surveys. The use of this map set in planning helps ensure that permafrost and terrain stability are protected during the exploration process. Recommendations for scenarios where development must occur on less suitable material are provided to aid with permafrost protection.

Lastly, this report acknowledges observed and projected increases in temperature and precipitation, more pronounced in northern regions, that are expected to continue to affect the permafrost and terrain stability in the Project Area. Thawing of permafrost, resulting in thermokarst subsidence, new and potentially larger active-layer detachments, and altered surface hydrology, is expected to occur gradually with time. Additionally, wildfires are expected to intensify with climate change, exacerbating localized instabilities.

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1. Introduction

This report documents the surficial geology and permafrost baseline assessment in support of Chance Oil and Gas Limited's (Chance's) Project Proposal submission to the Yukon Environmental and Socio-Economic Assessment Board (YESAB). 'Permafrost and terrain stability' have been selected as Valued Environmental and Socio-Economic Component (VESEC) for the Project Proposal. An understanding of their sensitivities to proposed project activities is founded on the mapping and characterizations of surficial geology included in this report.

Exploration development suitability is used throughout this report and accompanying mapping as a proxy for terrain stability – it is a reflection of expected terrain stability considering interdependent permafrost and terrain. Exploration development suitability classifications highlight areas more and less suitable for proposed project activities, thereby enabling optimization of routing and site selection and prioritization of mitigative measures where necessary.

Following a summary of background information collected over the last several years (Section 1.1), this report describes the physical setting in which the project is situated (Section 2), outlines the desktop- and field-based methods used to map and characterize surficial geology and permafrost (Section 3), characterizes dominant soils and permafrost-related terrain stability, with reference to associated project-wide mapping, as well as exploration development suitability and climate change implications (Section 4), and closes with a summary and key conclusions as map sets and text-based and illustrated characterizations showing the current surficial geology and permafrost conditions within the Project Area. Data was gathered via desktop study and field investigations from 2019 to 2023.

1.1 Program Overview

Chance's proposed exploration for oil and gas (the Project) is focused on the Eagle Plains Basin area of Yukon, covering an area of approx. 2396 km^2, and aligning with km 300 to 347 of the Dempster Highway. The Project aims to improve the understanding of oil and natural gas resources in the Eagle Plains basin, with the aim of identifying an economically viable resource that could potentially contribute to Yukon's long-term goal of energy independence and support numerous careers for decades.

The Project got underway in 2014, and has since then incorporated studies focused on surficial geology, permafrost and related terrain processes, water resources, fish and fish habitat, vegetation, wildlife, and linear disturbances. Palmer's role has been to improve understanding of the characteristics and implications of surficial geology and permafrost processes in the Eagle Plains Basin since original retention in 2015. Both desktop studies and field investigations have occurred from 2019 to 2023 to gather information on surficial geology, permafrost, and permafrost-related terrain processes, as a basis for evaluating terrain stability and associated exploration development suitability.

2. Project Setting

2.1 Physiography and Climate

The Project Area is within the Eagle Plains Ecoregion, an area of modest relief within the lowlands between the North Ogilvie and Richardson Mountain ranges (Yukon Ecoregions Working Group, 2004). Elevation ranges between about 350 m asl along the bottoms of the northernmost valleys to about 750 m asl at high points along the long ridge system followed by the Dempster Highway. Greaves and Ch'itr'ihkaiinjik rivers drain northward from the central northern portion of the Project Area, McParlon Creek drains westward from the southern part, and Dalglish and Enterprise creeks drain southeast toward Peel River in its southernmost portion (Figure 2-1). There are no mapped lakes within the Project Area, although some ponds have begun to form in broad valley bottoms.

The property is generally characterized by open black spruce woodlands interspersed with shrub tundra at higher elevations. Tussock tundra dominates the lower, more poorly drained, gentle slopes (Figure 2-2). Paper birch commonly colonizes burns, and aspen and balsam poplar locally occupy well-drained, south-facing slopes. Stream riparian zones are generally dominated by willow, alder and balsam poplar. Further detail on vegetation of the Project Area is available in the Vegetation Baseline Report (Environmental Dynamics Inc., 2024).

Climate is characterized by long, cold winters and short, warm summers. Based on the Ecoregions of the Yukon Territory volume (2004), mean annual air temperature (MAAT) for the area is -7.5˚C, with mean July air temperatures around 13˚C and mean January air temperatures slightly colder on the valley floors (-31˚C) than over higher terrain (-25˚C) due to strong temperature inversions associated with Arctic high-pressure systems. Based on data from the closest weather station to the Project Area (located in Old Crow (67°34'14" N, 139°50'21" W; Climate ID: 2100800)), MAAT is gradually increasing over time. Air temperatures have increased from -9.0˚C (1971-2000), to -8.3˚C (1981-2010), and most recently to -7.7˚C (1991-2020; Government of Canada, 2023). Annual precipitation in this semi-arid region is approximately 400 mm, falling mostly as rain during the summer months (Yukon Ecoregions Working Group, 2004).

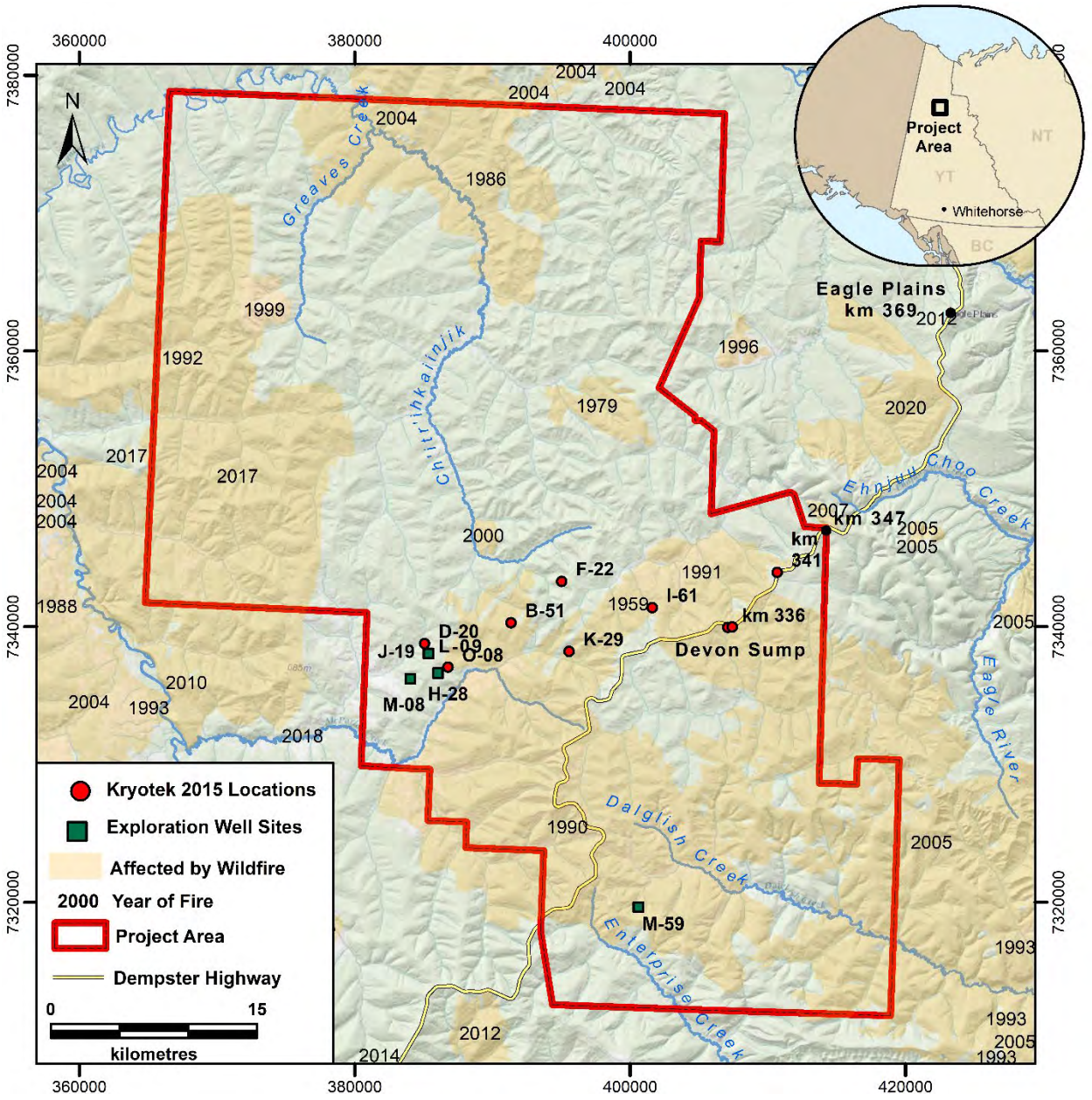

Figure 2-1. Eagle Plains Project Area, indicating wildfire history, existing Chance exploration well sites, and Kryotek Arctic Innovation's 2015 shallow-drilling investigation of proposed wellpad locations.



Figure 2-2. Modest relief, typical vegetation and recent wildfire burn within the Project Area. Note the conspicuous scarp in the left-centre of the photograph, indicative of an erosion-resistant stratum in roughly flat-lying sedimentary bedrock.

2.2 Bedrock Geology

The bedrock geology of the Project Area is dominated by Lower to Upper Cretaceous rocks of the Cody Creek, Burnthill Creek, and Eagle Plain formations (Yukon Geological Survey, 2020). These rocks comprise fine- to medium-grained sedimentary sequences including sandstone, shale, siltstone, bituminous shale, mudstone, and coal. The easternmost edges of the Project Area intersect mixed carbonate and clastic rocks of the Hart River and Ford Lake formations (cherty spiculite and packstone with minor sandstone, siltstone, and shale).

Differential weathering of the various bedrock units has contributed to the unique landscape in the Project Area. Broad ridges are formed by comparatively erosion-resistant sandstone beds. The Dempster Highway and Chance Road generally follow a network of these more resistant ridges. Isolated knolls along the ridge crests are likely remnants of the more competent bedrock in the area.

2.3 Landscape Evolution, Surficial Geology, and Soils

The Project Area escaped direct effects of multiple late Pleistocene glaciations that otherwise covered much of Yukon (Duk-Rodkin, 1999). Indirect effects include a lowering of the base level of the Eagle River and a consequential acceleration of incision of its tributaries (include some reaches within the Project Area) and the widespread deposition of loess – windblow silt and very fine sand – sourced from unvegetated proglacial areas to the south and east. Much of this loess has since been redistributed into valley bottoms through colluviation and slopewash.

The lack of glacial erosion in the Project Area has resulted in broad, rolling uplands that are typically covered by veneers of relatively fine-grained colluvium or weathered bedrock. These uplands commonly bounded by comparatively steep scarps, where more resistant bedrock transitions into fluvially incised, V-shaped valleys. The valley sides are covered by thicker, fine-grained colluvium, locally overlain by organic material. Thick, silty to gravelly fluvial deposits occupy the valley bottoms (Hughes, 1972). Organic-rich soil and peat are found in depressions and along valley bottoms (Hughes, 1972).

The unglaciated history of the Project Area has subjected the soils to long periods of weathering, resulting in heavy oxidation (Yukon Ecoregions Working Group, 2004). Soils in the area have previously been described as Dystric Brunisols in well-drained upper slope and ridge crest positions, and Turbic Cryosols in other upland locations. The latter are commonly found just above treeline, commonly in areas of patterned ground (Yukon Ecoregions Working Group, 2004). The pH of Eagle Plains soils can be as low as 4 in upland areas underlain by weathered sandstone (Yukon Ecoregions Working Group, 2004).

2.4 Permafrost

Permafrost is ground, including both unconsolidated sediments and bedrock, that remains below 0˚C for at least two consecutive years. Locally, permafrost distribution is related to slope aspect, angle and shape, sediment texture, and the presence, thickness, and type of organic cover (Williams 1995; Williams and Burn, 1996). Ice content within permafrost in the Eagle Plains area is variable and generally lower on topographic highs and convexities and higher on gentle slopes and in valleys Permafrost within the Eagle Plains Ecoregion is up to 200 m thick (Yukon Ecoregions Working Group, 2004).

Snowpack, vegetation, substrate, moisture regime and topography are important influences on permafrost temperatures (Zhang et al., 2021). The Project Area is located entirely within the zone of continuous permafrost, and ground temperatures were expected to be in the -1˚C to -2˚C range in 2015 (at 10 m depth) (Burn et al., 2015). A mean annual ground temperature (MAGT) of -1.2 ˚C was measured south of the Eagle Plains Hotel at km 347 on the Dempster Highway by Burn et al. (2015). The average temperature of the permafrost in the J-19 well area (Figure 2-1) in 1998 was about -2˚C (Northern Cross Yukon, 1998).

The active layer is the surface layer, overlying permafrost, that freezes and thaws each year. Its thickness depends on elevation, aspect, slope position/shape, sediment texture/drainage, snowpack and vegetation cover (Williams and Burn, 1996; Bonnaventure et al., 2012; Zhang et al., 2021). The active layer ranges from about 0.2 to 2 m thick within the region encompassing the Project Area (Yukon Ecoregions Working Group, 2004), except in areas where vegetation had been stripped (i.e., in road cuts, as per Heijmans et al., 2022). Well drained, coarse-grained soils tend to have a thicker active layer than poorly drained, fine-grained soils (Li et al., 2012). Active layers may be thicker, locally reaching bedrock at depths of 3-4 m,

following wildfire (Coates, 2008; Kryotek Arctic Innovation, 2015a). Burn et al. (2015) determined that the active layer was 1.5 m thick at km 347 on the Dempster Highway in late summer. Shallow borehole data were acquired at several historical well pad sites and at a few locations along the Dempster Highway (Kryotek Arctic Innovation, 2015a,b). Data from these studies are summarized in Section 3.1.1, and site locations are shown in FigureFigure 2-1. Areas affected by wildfire show locally thicker active layers.

Ice-rich permafrost is common in fine-grained deposits along the Dempster Highway, but the portion of the highway traversing Eagle Plains is relatively unaffected by permafrost "due to the shallow soils and absence of water courses" (Burn et al., 2015). Burn et al. (2015) identified thaw subsidence (i.e., thawing permafrost) as the primary risk factor for infrastructure damage along the length of the Dempster Highway, followed by the effects of freeze/thaw cycles in water-logged soils overlying impermeable permafrost layers. Organic-rich soil and peat are found in depressions and valley bottoms within the Project Area (Hughes, 1972). The lower permeability of these sediments results in the preservation of ice-rich permafrost that is more susceptible to thaw subsidence.

Ice-wedge polygons with slight depressions (furrows) above the wedges were observed at tundra sites along the Dempster Highway (Burn et al., 2015) and are similarly visible on some flat-topped ridges in the Project Area.

2.4.1 Terrain Stability

Terrain stability within the Eagle Plains region, which is typified by modest relief and slope steepness, largely reflects the local ice content, depth, and thaw sensitivity of permafrost. Steeper topography merely compounds permafrost-related instabilities. The principal manifestations of permafrost-related instability are active-layer detachments or thermokarst. Active-layer detachments occur naturally on slopes shallowly underlain by permafrost, whether or not ice-rich, commonly in response to intense or prolonged rainfall/snowmelt and/or warm air temperatures. Active-layer detachments are uncommon, but mainly occur on south- to southeast-facing slopes of 25 to 45% gradient (Haseldine, 2021). The number of active-layer detachments has been increasing in the Eagle Plains region since 1992 (Haseldine, 2021), presumably in association with climate change.

Active-layer detachments commonly occur in response to wildfires, following sudden thickening and saturation of the active layer (Coates, 2008).

Thermokarst is the process, and consequential landforms, of differential subsidence in response to the degradation (thaw) of ice-rich permafrost. It is most common in poorly drained, level or gentle topography, but it can also occur through fluvio-thermal erosion on ice-rich slopes subject to concentrated surface runoff. Retrogressive thaw slumps are a unique form of thermokarst, although their rarity in the Eagle Plains region is likely explained by the absence of buried glacial ice (Haseldine, 2021).

3. Methods

3.1 Historical Data Compilation

Initial understanding of permafrost and terrain within the 2,400 km^2 Project Area and the encompassing 20,400 km^2 Eagle Plains region was gained through compilation and review of a diverse range of information. Accounts of historical petroleum exploration activity, which began in the late 1950s, were documented by Martin (1973) and Hamblin (1990). An excellent overview of the Eagle Plains Ecoregion by the Yukon Ecoregions Working Group (2004) was reviewed for background context on regional physiography, bedrock geology, surficial geology, glacial history, climate, hydrology, permafrost, soils, vegetation, and wildlife. Surficial geology mapping was completed by Hughes (1972) for Northern Yukon and Northwestern-Northwest Territories at a scale of 1:500,000, and by Thomas and Rampton (1982) for Moose Lake. Detailed surficial geology and geomorphology mapping had not been completed for the Project prior to Palmer's involvement. Several permafrost studies have been completed along the Dempster Highway (e.g., Burn et al., 2015; Idrees et al., 2015); however, these studies are limited to the highway corridor and are not broadly applicable to most of the Project Area.

Geotechnical and permafrost investigations were previously carried out in the Project Area by Kryotek Arctic Innovation Inc. (2015a, 2015b), where drilling and geophysics were used to assess ground conditions at existing well pads and several proposed sites.

3.1.1 Palmer's Previous Studies of Permafrost and Terrain Stability

Palmer completed the terrain mapping, terrain stability mapping and fieldwork that is summarized herein. Prior to this submission, derivative maps were created from the surficial geology maps for Chance's use. These included memoranda on exploration development suitability mapping (Palmer, 2015; 2021a), borrow source mapping (Palmer, 2015) and terrain sensitivity mapping reclassification for seismic survey planning (Palmer, 2021b). The latter report also provided initial potential locations for cuttings disposal and best practices for seismic exploration.

Table 3-1. Permafrost data from selected locations within the Project Area (adapted from Kryotek Arctic Innovation, 2015a,b). Site locations are shown in Figure 2-1.

Well Pad/ Site Location	Easting	Northing	Avg active layer thickness (m)	Average Ice Content (%)	Ice type	Material Type	Data Acquisition Date
K-29*	395569	7338191	0.2	25	Vx[1], Vs[2]	Silt, some clay, some sand	Late August/early September 2015
B-51*	391347	7340277	2.8	-	Vs	Silty clay, rock chips	Late August/early September 2015
F-22	395030	7343279	0.2	30	Vx	Silt, trace clay, trace sand	Late August/early September 2015
I-61*	401607	7341376	3.5	-	Vs	Silt, clay, silty sand	Late August/early September 2015
O-08*	386774	7337053	2.2	20	Vs	Sand, silty, trace clay	Late August/early September 2015
D-20	385065	7338767	0.1	50	Vx, Vs	Silt, clay	Late August/early September 2015
L-09	385922	7338180	0.1	50	Vx, Vs	Silt, clay	Late August/early September 2015
km 336*	407095	7339942	0.6	-			Early August 2015
km 341	410682	7343934	0.6	-	Vs	Sand, silt, clay	Early August 2015
Devon Sump*	407423	7339970	0.6	-		Clay, silt, sand	Early August 2015

[1] ice crystals

[2] ice lenses and layers

*Site affected by wildfire

3.2 Terrain and Permafrost Field Investigations

Field investigations were completed to ground truth terrain and permafrost mapping, collect preliminary permafrost information, and to establish permafrost (ground temperature) monitoring instrumentation within the Project Area. Field site data were used to update terrain and permafrost mapping as well as exploration development suitability classifications.

3.2.1 Field Reconnaissance

A one-week field reconnaissance program was completed between July 1 and 7, 2019. The program focussed on characterizing the diversity of landforms, surficial materials, and permafrost conditions across the Project Area. Field measurements and observations were acquired at 103 ground-based sites, and helicopter-based observations of landforms (e.g., colluvial aprons, fluvial fans) and permafrost features (e.g., patterned ground, active layer detachment failures) were acquired opportunistically. Ground-based field observations were made through a series of foot traverses commencing at helicopter drop-off locations. Field assessment involved examining sediments and visible ice in hand-dug soil pits and natural exposures (e.g., landslide scarps, gullies, stream cut banks); measuring depth to permafrost with a permafrost probe (which provides apparent depth to permafrost due to fieldwork being completed before the late-summer maximum thaw period); determining material textures, origins, and expressions; and describing geomorphological processes. Field photographs were taken at each site and additional observations were made from helicopter where possible. The program was completed in parallel with an ecological field program undertaken by EDI. Where possible, terrain interpretations were supplemented by opportunistic field observations made and shared by EDI's ecologists as part of their field program.

Additionally, from July 28 to August 6, 2021, helicopter-supported fieldwork in the Project Area was completed to expand coverage and to examine and document representative soils within the Project Area. Soil horizons were examined and described in hand-dug test pits. Additional examination and sampling of soils is warranted once well pad locations are determined.

3.2.2 Permafrost Investigation, Instrumentation and Monitoring

A six-day, helicopter-supported field program was completed from July 28 to August 6, 2021 to investigate and install ground temperature sensors in the active layer and uppermost permafrost at widely distributed sites representative of the diversity of permafrost and terrain settings. Shallow subsurface ground conditions were investigated using a helicopter-portable Talon drill and hand-dug pits at 15 locations (test pits were dug at all borehole locations; FiguresFigure 3-1, Figure 3-2). The Talon drill uses a combination of percussive augering and/or coring to penetrate through the active layer into permafrost and collect representative core samples. Boreholes were drilled to approximately 2.5 m depth or to refusal. FrostLink ground temperature sensor instruments were installed at four of these sites (FiguresFigure 3-1, Figure 3-2). FrostLink sensors record ground temperatures and phase state (i.e., thawed versus frozen) at 5 cm and 1 m depths and are useful for understanding active layer dynamics and the evolving susceptibility of underlying permafrost to thaw.

A second, three-day, helicopter-supported field program was completed from July 24 to 27, 2022 to download ground temperature data from the four FrostLinks installed during 2021 and examine and sample permafrost using a Talon in advance of installation of two additional FrostLinks (Figure 3-1).

A third, three-day, helicopter and truck-supported field program was completed from July 21 to 23, 2023 to download ground temperature data and examine and sample permafrost using a Talon in advance of installation of six more FrostLink instruments (Figure 3-1). Shallow subsurface ground conditions were also examined in hand-dug testpits at eight locations. Boreholes were drilled to approximately 1.5 m depth or to refusal.

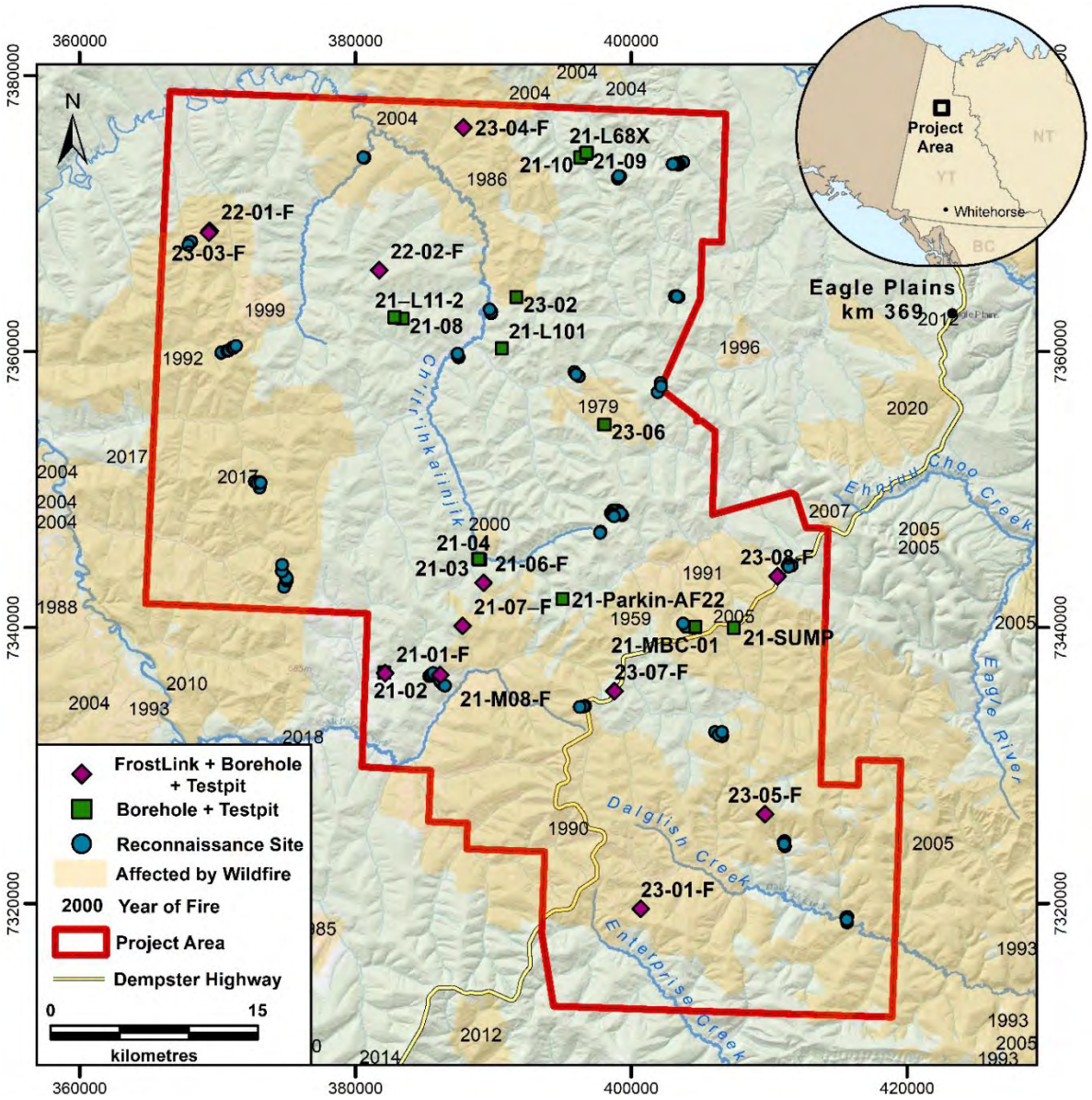

Figure 3-1. Locations of FrostLink sensors, Talon borehole locations, and reconnaissance sites within the Project Area. FrostLink sites beginning with the two-digit year of installation i.e. sites with '21' were installed in 2021.

Permafrost probing was done at each field site to identify the best locations for soil pits and boreholes (i.e., areas without boulders or cobbles near surface and with representative depths to permafrost). Permafrost probing was also completed at historical well sites H28 and M08 (Figure 2-1), in early August 2021, to gain insight into the extent of permafrost degradation (thaw) and any associated ground settlement at former well pad sites. Depth measurements were likely shallower than true active layer thickness, which is generally not achieved until early September.

A spade was used to dig testpits at each field site to inform drill sites, examine and describe soil characteristics and to obtain near-surface soil samples for analysis (Figure 3-2). Soils were preliminarily classified according to the Canadian System of Soil Classification (Soil Classification Working Group, 1998) prior to subsequent refinement based on the results of laboratory analyses. Representative samples of near-surface soils were acquired from the active layer at select testpits. These were analyzed in a laboratory for background geochemistry (e.g., trace metals, hydrocarbons, organic carbon content, etc.).

Talon-drilled boreholes were initiated with auger tooling to condition the holes. Because auger samples are disturbed, the adjacent soil pit was used to log the uppermost portion of the boreholes. A side-smear sampler was used to acquire core segments in 10 or 30 cm sections. Each core section was extracted, split in half lengthwise using a hatchet, logged, and photographed prior to thaw caused by exposure to ambient air. Boreholes were drilled to bedrock, to refusal, or to a point where sloughing or squeezing of the material at depth precluded further penetration. Depth to permafrost (apparent active layer thickness) was recorded at each borehole and in adjacent soil pits to document local variability (generally <20 cm).

Samples of frozen material at the bottom of the boreholes, likely within permafrost, were collected for grain size and moisture content analysis. Where ice content was high, samples were acquired from a greater depth range to achieve the required sample size. Ice content in the cores was estimated visually by volume and later confirmed by moisture content analysis of selected samples. Ice type, percentage and clarity were recorded. The volume of nonvisible ice was determined in the field by beaker analysis.



Figure 3-2. Clockwise from upper left: Helicopter after dropping off drill as a sling load at field site 21-L68X; Drilling with the Talon at field site 21-08; Soil pit at field site 21-02; Surface housing of FrostLink ground temperature/phase sensor installed at field site 21-07-F.

3.3 Mapping of Surficial Geology and Permafrost

Palmer completed surficial geology and permafrost mapping within the Project Area. Surficial geology and permafrost interpretations were based on a combination of multiple high-resolution stereo-imagery sources and high-resolution LiDAR-derived elevation data (rendered as a 2 m-resolution hillshade model), with calibratory reference to background regional surficial geology mapping and seismic shothole logs compiled by the Geological Survey of Canada from historical oil and gas exploration (Smith and Lesk-Winfield, 2010). Aerial photographs were acquired by Chance in 2019 within the northern and southern regions of the Project Area, but smoke from wildfires precluded acquisition within the central portion. Satellite images acquired between 2014 and 2019 were obtained and overlain onto a digital elevation model to generate pseudo-stereo imagery, and these were used as a substitute for stereo aerial photographs in the central portion of the Project Area. Delineations and attributions were applied in DATEM's Summit 3D mapping software linked to an ArcGIS platform.

Surficial geology mapping was completed at a scale of 1:20,000, using the standardized Yukon surficial geology mapping protocols (Lipovsky and Bond, 2014), which are an adaptation of the *Terrain Classification System for British Columbia* (Howes and Kenk, 1997). Minor modifications were made to the mapping protocols to ensure local features and variability were captured. Map units (polygons) were delineated based on internally homogenous combinations of surficial materials, textures, surface expressions, drainage classes, and geomorphological processes. Under this system, up to two surficial materials are identified in each polygon as either a primary or secondary material, or in stratigraphic relation to each other. Map units were symbolized based on the primary surficial material. Discrete terrain features and geomorphic processes too small to be mapped as individual polygons, such as thermokarst subsidence and active-layer detachments, have been identified using point and line features, respectively. All codes used in the mapping are defined in the map legend.

Relative depth to permafrost (active layer thickness) and relative ice content of permafrost were interpreted for each map polygon based on surface indicators and calibration and extrapolation (based on landform associations) from field observations. Relative depth to permafrost refers to the approximate maximum (end of summer) thickness of the active layer (Table 3-2). Relative ice content of permafrost is an inference of the relative amount of excess ice within permafrost, whether in pores, segregated seams and lenses, or massive bodies (e.g., wedges) (Table 3-3). Terrain and permafrost interpretations are limited by the mapping scale and represent the average conditions within each map unit. Ground ice may be more or less extensive than mapped due to the necessary generalization of terrain characteristics or geomorphological processes within the map unit.

Table 3-2. Permafrost classification for inferred relative depth to permafrost.

Depth Classification	Definition	Description
Near-surface	Permafrost table likely less than 0.4 m below the ground surface.	Permafrost is typically found within or at the base of surface organics. Includes map units overlain by organic blankets and veneers; very poorly to imperfectly drained fluvial fans, terraces, and veneers; and inactive floodplains.
Shallow	Permafrost table likely between 0.4 and 1.0 m below the ground surface.	Considered the typical depth-to-permafrost class in the Project Area. Common in relatively fine-grained sediments; includes most imperfectly to moderately well drained deposits, active floodplains and most deposits containing evidence of ice-wedge polygons or thermokarst subsidence.
Deep	Permafrost table likely more than 1 m below the ground surface.	Most common in relatively coarse-grained and clast-supported deposits; includes bedrock and most moderately to well drained colluvium and weathered bedrock along convex ridges, spurs, and scarps.

Table 3-3. Permafrost classification for inferred relative ice content.

Ice Content	Pore Ice	Segregated Ice	Massive Ice	Excess Ice	Description
Ice-rich	Continuous	Extensive	Indicated, inferred, or likely; widespread	Major	Typically includes sediments overlain by organic blankets and veneers; poorly to very poorly drained, inactive fluvial deposits; and map units affected by ice-wedge polygons and/or thermokarst subsidence.
Ice-moderate	Continuous	Widespread, in seams and lenses	Possible, locally	Moderate	Includes fluvial deposits not classified as ice-rich; fine-grained colluvial aprons and blankets; imperfectly to poorly drained matrix-supported colluvial blankets; and map units affected by sheetwash or solifluction.
Ice-poor	Discontinuous to continuous	Local, mostly in seams	Unlikely, except in isolated areas	None to minor	Applies to most moderately to well drained terrain, commonly convexities, throughout the rolling uplands and colluvial slopes.

3.4 Classification of Exploration Development Suitability

Exploration development suitability is a reclassification of the surficial geology and permafrost mapping (Section 3.3) that reflects permafrost-related terrain stability and areal differences in sensitivity to disturbance. The classification was developed to inform planning for oil and gas exploration and serve as a basis for avoidance or mitigation of areas most sensitive to disturbance. Exploration development suitability has been divided into two primary classifications:

- Road and well pad suitability:
  - Guides the establishment and maintenance of access roads[1] and well pads.
- Mix-bury-cover (MBC) disposal suitability:
  - Identifies areas of the landscape that are geomorphologically isolated and potentially suitable for disposal of cuttings using MBC techniques, if pre-existing areas of disturbance cannot be used.

The two classifications were derived from the 1:20,000-scale, field-checked surficial geology interpretations and are specific to the Project Area. Map units (polygons) were categorized into five road and well pad suitability classes, ranging from Very High to Very Low, and two MBC disposal suitability classes, Potentially Suitable and Probably Unsuitable. The exploration development suitability classifications were aided by professional experience in unglaciated Yukon (e.g., McKillop et al., 2013; McKillop et al., 2016). Definitions, explanations, and implications of each class are outlined in Section 4.3.

For both classifications, a lower suitability rating does not necessarily mean suitable terrain is absent within the map unit; localized portions of such map units may be suitable for exploration development or MBC disposal based on site-specific terrain characteristics. Similarly, a higher rating does not necessarily mean the entire polygon is suitable for exploration development. Field investigations remain important for final evaluation of suitability classifications at the site-specific scale.

3.5 Quality Assurance and Quality Control

A number of quality assurance/quality control (QA/QC) techniques and procedures were adopted over the course of the work described above. Surficial geology and permafrost field investigations were always completed with a minimum of 2 qualified and experience staff, thereby ensuring agreement in the interpretation and appropriate documentation of permafrost and terrain.

Permafrost investigations involved multiple approaches, including frost probing, shallow drilling and coring, hand-dug testpitting, and installation and monitoring of FrostLink temperature/phase sensors, which strengthen understanding of the shallow permafrost environment and enable detection of any outlier results. Additionally, the ground temperature results were shared with a third party (Kryotek Arctic Innovation Inc.) to confirm interpretations of results.

Soil samples for the Project Area were sent to the accredited Whitehorse laboratory of ALS Environmental for analysis, where they were analyzed for background geochemistry and grain size distribution. Preliminary, field-based classifications were updated, as needed, based on the results.

[1] *This classification conservatively considers all-weather access roads, although only winter roads are proposed.*

4. Results

4.1 Surficial Geology and Soils

The surficial deposits and the character of the landscape reflect the structure and lithologies of underlying bedrock and the unglaciated history of the region. Overall, the Project Area exhibits a dendritic drainage pattern that has dissected a plateau comprising gently dipping sedimentary bedrock beds (mostly shale and sandstone). The surficial geology mapping completed within the Project Area reveals broad, rounded complexes of ridges and spurs are divided by valleys with colluvium-mantled walls locally interrupted by concentric scarps of relatively erosion-resistant weathered bedrock (Figure 4-1) (Appendix A). Streams are found in the valley bottoms and fluvial fans are locally present (Figure 4-1). Most landforms and materials in the Project Area are interpreted to have originated prior to the last glaciation. The landscape is dominated by deeply weathered colluvium and unconsolidated weathered bedrock units that have developed on slopes and ridges over many millennia (Table 4-1).

Table 4-1. Areal distribution of surficial materials and landforms by primary surface material.

Surficial Material and Landform	Terrain Code	Areal Extent	Areal Percentage
Colluvial Veneer	Cv	810.5 km^2	33.8%
Weathered Bedrock Veneer	Dv	413.6 km^2	17.3%
Colluvial Blanket	Cb	397.4 km^2	16.6%
Colluvial Mantle of Variable Thickness	Cw	324.8 km^2	13.6%
Colluvial Apron	Ca	188.5 km^2	7.9%
Fluvial Plain (active and inactive)	FAp; Fp	111.8 km^2	4.7%
Fluvial Veneer (active)	FAv	49.5 km^2	2.1%
Fluvial Fan (active and inactive)	FAf; Ff	36.6 km^2	1.5%
Organic Veneer	Ov	10.2 km^2	0.4%
Organic Blanket	Ob	28.9 km^2	1.2%
Bedrock	R	20.5 km^2	0.9%
Fluvial Terrace	Ft	2.9 km^2	0.2%
Anthropogenic	A	1.4 km^2	< 0.1%
Total		**2,396.6 km^2**	**100%**

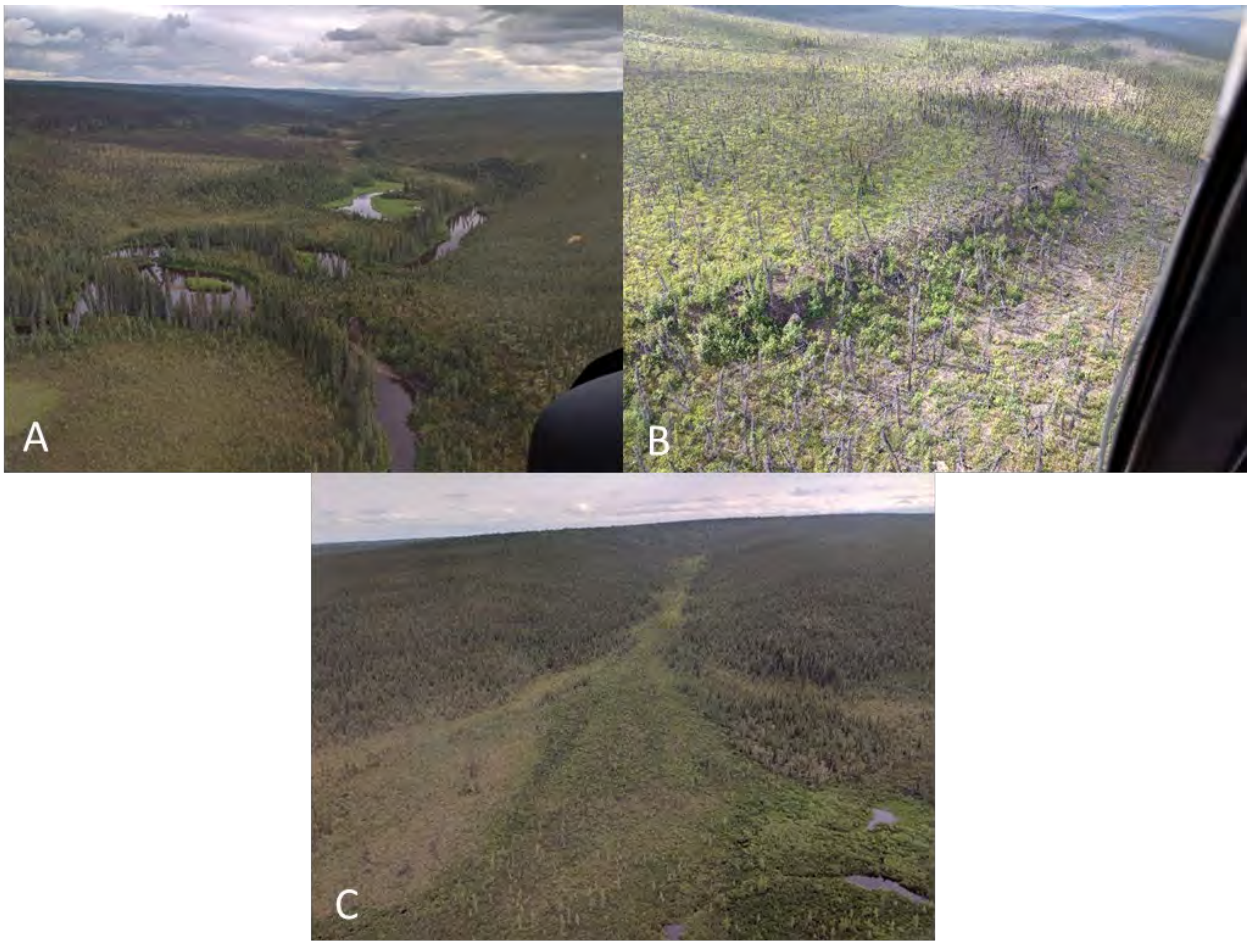

Figure 4-1. Field photographs representative of the landscape and geomorphological processes within the Project Area: A) Dalglish Creek valley, showing an irregularly meandering channel and several areas of lateral erosion where the creek has cut into the gently sloping valley walls; B) Convex, mid-slope ridge comprising erosion-resistant bedrock mantled by a veneer of weathered bedrock and colluvium; C) Gently sloping fluvial fan exhibiting a typical wedge shape and transitioning into a modern stream valley on lower right.

Geomorphological processes related to permafrost include ice-wedge polygons, thermokarst subsidence and mass movement, including a few active-layer detachments (Figure 4-2). Permafrost features are touched upon below but are discussed in more detail in Section 4.2.

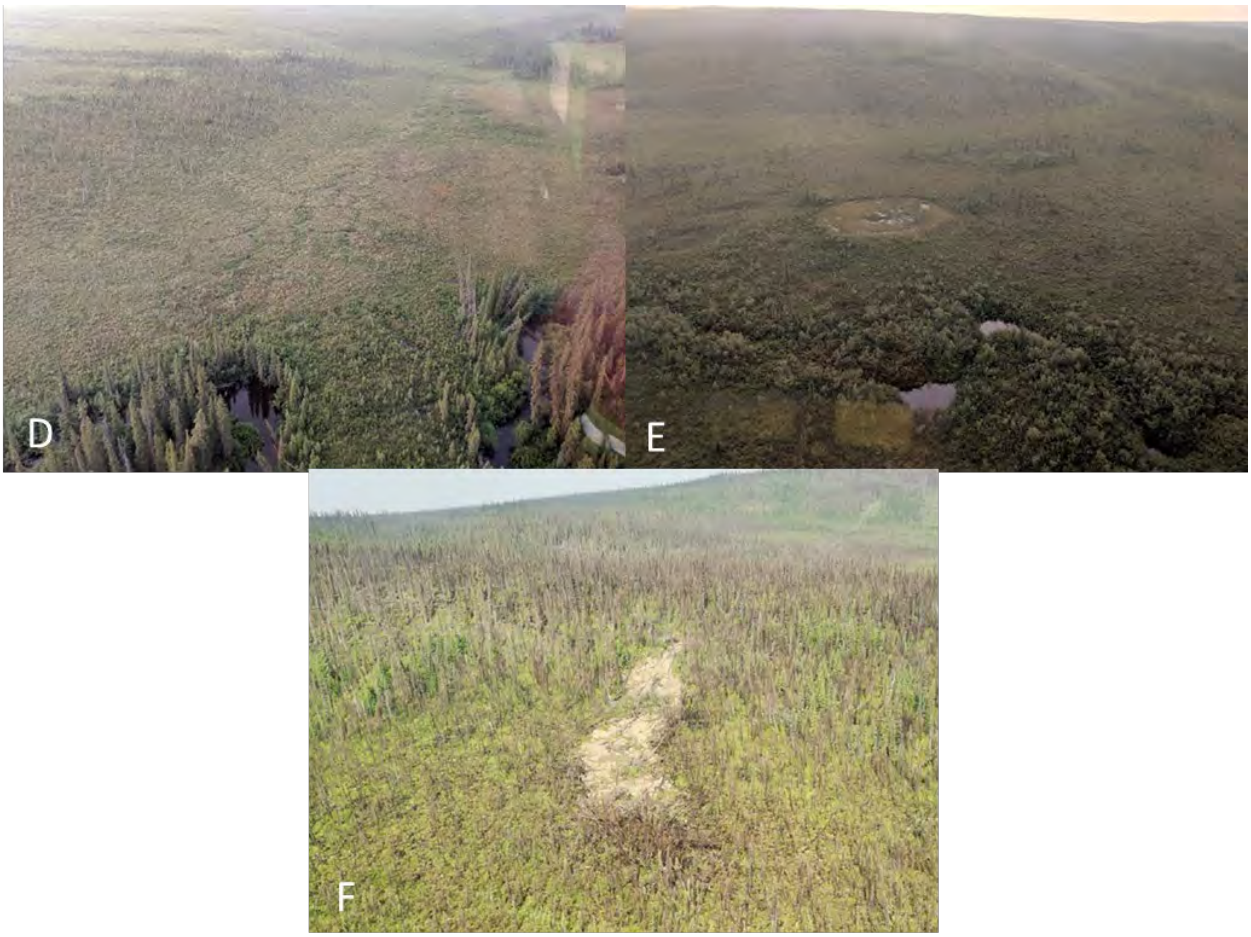

Figure 4-2. Field photographs representative of common landforms and permafrost-related geomorphological processes within the Project Area: D) Surface expression of ice-wedge polygons within an inactive floodplain; E) Thermokarst depression within an inactive floodplain; and F) Recent active-layer detachment initiated at the crest of a gentle colluvial slope.

The following subsections characterize the terrain conditions within the Project Area, by dominant surficial material, and acknowledge the nature of anthropogenic features and near-surface soils.

4.1.1 Colluvial Deposits (C)

Colluvial deposits (C) are the most extensive surficial material. They are found on slopes and sloping ridges, covering 71.9% of the Project Area (Table 4-1). Colluvial deposits are typically fine-grained (mainly silt and clay), locally overlain by or intermixed with loess, with imperfect to poor drainage. Locally sandier deposits, with 10-40% pebbles, cobbles and less commonly, boulders, are moderate to well drained. Sandy deposits are more common in areas of sandstone bedrock. Locally, colluvial deposits can include disseminated organics, in layers and lenses, with or without fragments of wood.

Colluvium is typically thin on upper slopes, thickening toward the base of slopes (ranging from veneer (Cv) to blanket (Cb) deposits). In some areas, colluvium is thick enough to form an apron covering the base of

a slope (Ca). These areas tend to be rich in silt (including resedimented loess), organics and ice, especially on north-facing slopes, so they are particularly sensitive to disturbance.

North-facing colluvial slopes are cooler and may display different vegetation than warmer, south-facing slopes. The active layer is expected to be thinner on cooler slopes than on warmer slopes. A few active-layer detachments, sheetwash, and solifluction have been identified on some colluvial slopes, with instances of ice-wedge polygons in medium to fine-grained material. Their locations are shown on the maps in Appendix A.

4.1.2 Weathered Bedrock (D) and Bedrock (R)

Bedrock within the Project Area is commonly fissile and deeply weathered, forming veneers of material overlying competent bedrock (Figure 4-3). Weathered bedrock (D) is found on ridge tops and convex slope breaks along valley walls, typically moderately to well drained, and covers 17.3% of the Project Area (Table 4-1-1). Weathered bedrock commonly consists of silt and/or clay, similar to colluvium (or sand in areas of sandstone). However, it is denser and harder to drill than colluvium and contains sand or pebbles/cobbles derived from the underlying more solid bedrock. It commonly grades downward to more solid bedrock. Competent bedrock (R) is rare at surface and is limited to exposures in steep scarps adjacent to ridge tops; it covers only 0.9% of the Project Area (Table 4-1-1). Examples include several conspicuous outcrops of sandstone and conglomerate near the Dempster Highway (Figure 4-3).

Some instances of ice-wedge polygons are present within weathered bedrock material, potentially by exploiting existing bedrock fractures, and is further discussed in Section 4.2.



Figure 4-3. Field photographs representative of typical surficial material characteristics: G) Outcrop of competent conglomerate exposed in a bluff near the Dempster Highway; H) Sandy veneer of weathered bedrock, typical of deposits found on ridge crests.

4.1.3 Fluvial Deposits (F)

Fluvial deposits (F) comprise 8.5% of the Project Area (Table 4-1-1; Figure 4-4). They generally have poor drainage and are found along the bottoms of broad valleys, as active (FAp) or inactive (Fp) plains, although fans (Ff or Faf) and veneers (Fv or Fav) of fluvial sediments are mapped at confluences and within narrow ravines, respectively. Fluvial sediments comprise silt and clay with some sand and are interbedded with organic-rich layers and peat. The peat may include pieces of wood.

A number of geomorphological processes are present within fluvial deposits, such as irregularly sinuous channels, and permafrost features, such as ice-wedge polygons and thermokarst that are typically present due to their poor drainage and fine-grained materials.

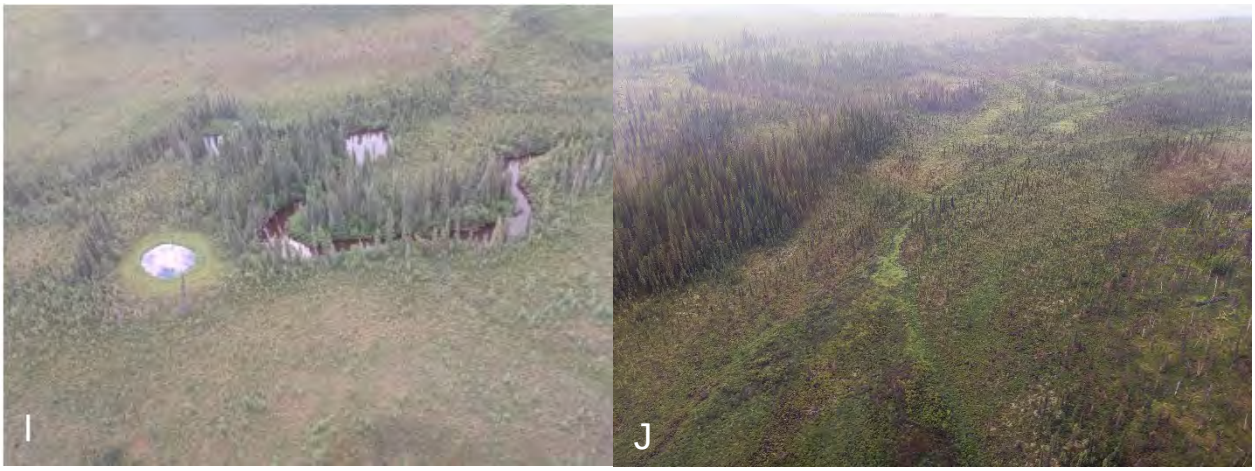

Figure 4-4. Field photographs representative of fluvial deposits within the Project Area: I) Active fluvial plain with irregularly meandering channel; J) Active fluvial fan, especially the areas with brighter green vegetation.

4.1.4 Organic Deposits (O)

Organic material (O) accumulates on most imperfectly to very poorly drained deposits throughout the Project Area (Figure 4-5), but it is only identified in the terrain code (map label) when its thickness is interpreted to exceed about 0.5 m, mainly in valley bottoms. Organic veneers (Ov) and blankets (Ob) are generally mapped in low valley positions near active streams and comprise 1.6% of the Project Area (Table 4-1-1).

Typical geomorphological processes in organic deposits are thermokarst and ice-wedge polygons due to the poorly-drained and fine-grained materials that are often dominated by ice-rich permafrost.

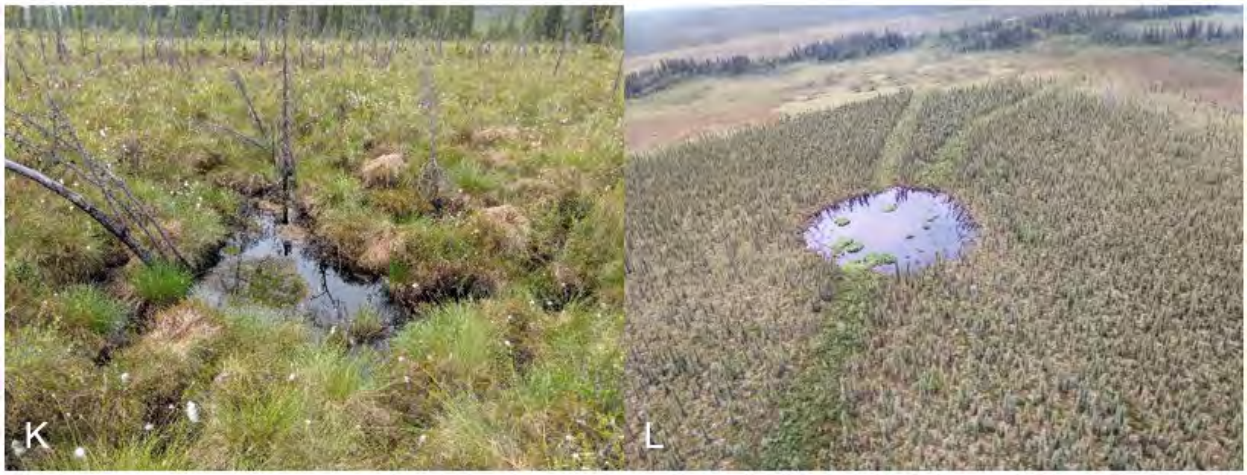

Figure 4-5. Field photographs representative of organic deposits within the Project Area: K) Organic veneer with poor to very poor drainage; L) Organic blanket with poor to very poor drainage and an actively expanding thermokarst pond along a former winter trail.

4.1.5 Anthropogenic Features (A)

Areas significantly disturbed by human activity (excluding trail/road networks, which are unmapped linear features) have been mapped as anthropogenic landforms (A), and cover <0.1% of the Project Area (Table 4-1-1). They mainly include camp areas and borrow pits near the Dempster Highway.

4.1.6 Soils

All soils identified within the Project Area are Cryosols, as expected for an area within the zone of continuous permafrost. Static Cryosols are found in areas of fine-grained colluvium or weathered bedrock veneer and fine-grained fluvial sediment. Twelve of the sixteen soils specifically examined and classified within the Project Area (Figure 4-6) are static, due to no clear evidence of cryoturbation, especially within saturated pits. Turbic Cryosols exhibit lenses or layers of organic material, incorporated wood pieces, and/or inverse grading. These cryoturbated soils are found in fluvial, weathered bedrock, or colluvial material that is also fine-grained. Coarser-grained colluvium and weathered bedrock on upper slopes and ridges tends to develop Orthic Static Cryosols.

Gleysolic Crysols are gleyed (due to saturation) and/or contain rusty mottles (due to periodic wetting). Soils at low elevations are either Gleysolic or Regosolic, and can be either Turbic or Static. Soils on slopes at higher elevations can be Brunisolic, Orthic, or Gleysolic and the sites investigated in this study were all Static. Ridge-top soils are Regosolic, Gleysolic, or Orthic and are most commonly Static.

Samples were not analyzed for pH; soils are assumed to be dystric as noted in Yukon Ecoregions Working Group (2004). Each testpit ended on permafrost, except for field site 21-09, which ended on cobbles.

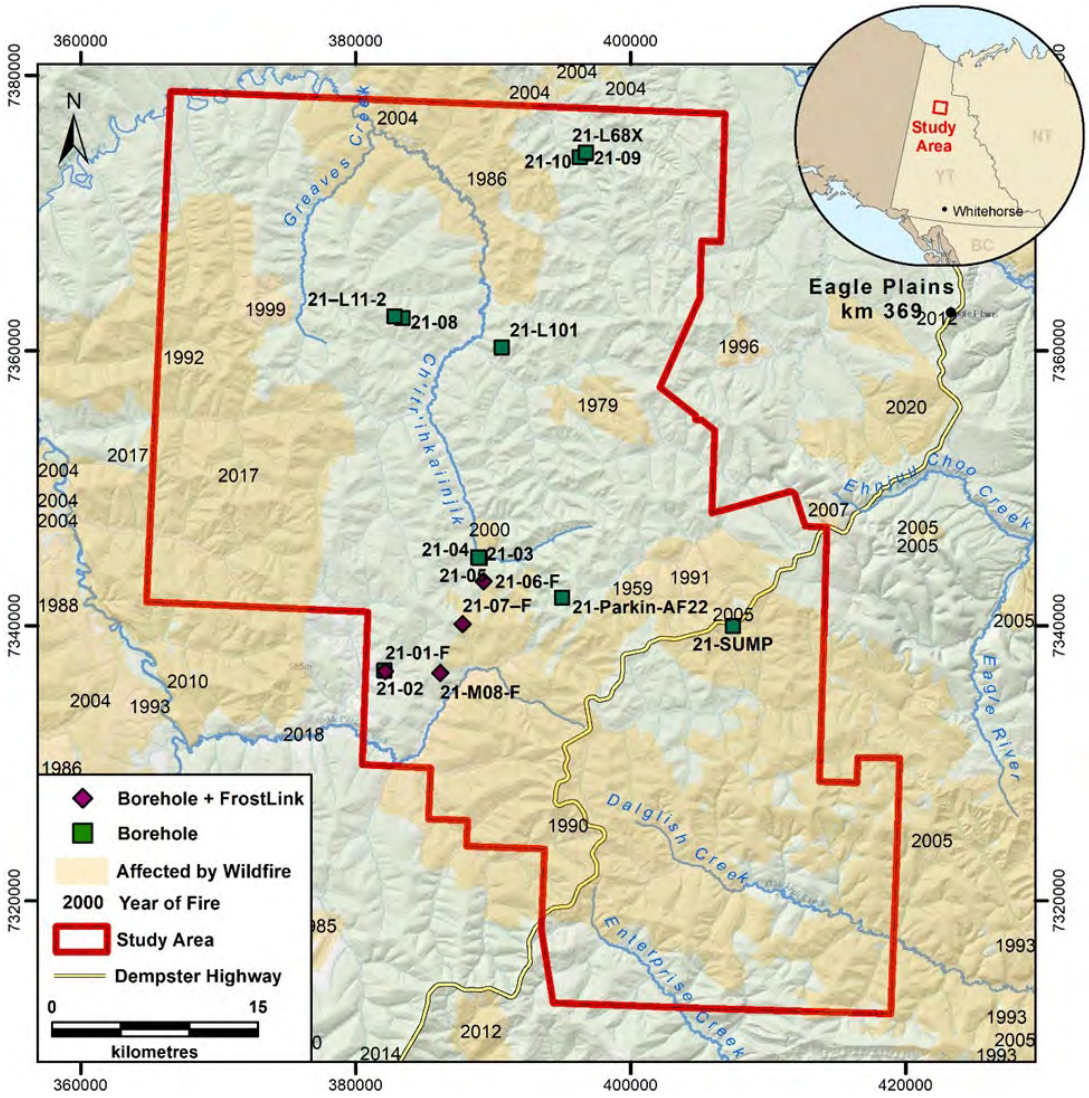

Figure 4-6. Locations of 2021 soil examination and classification sites.

4.2 Permafrost

Permafrost has a strong influence on drainage conditions, the rates, and mechanisms of colluvial (mass movement) processes, and overall hillslope and valley bottom morphology. An appreciation of permafrost characteristics and processes is therefore important for the planning of exploration projects in the region.

Permafrost is ubiquitous across the Project Area. The active layer is thicker in areas of weathered bedrock and areas affected by recent forest fires and thinner in valley bottoms and on lower slopes. Ground ice expression ranges from nonvisible (Nb) to tiny crystals (Vx) to lenses and layers of segregated ice (Vs) (Appendix C, borehole logs); massive ice is also inferred to underlie portions of the ground, based on local surface expressions of ice-wedge polygons and observation of a buried ice wedge in a recent erosion scar along a creek bank.

Relative active layer thickness and ice content were interpreted, field-calibrated, and mapped across the Project Area as described in Section 4.2.1. The borehole data (Appendix C) provide additional information on active layer thickness (shown as “permafrost depth” on borehole logs), ice content and permafrost sensitivity to disturbance.

4.2.1 Active Layer Thickness

The active layer thickness (the bottom of which is referred to in borehole logs as the permafrost table depth) varies spatially at regional and local scales, and over time in association with climate change and/or anthropogenic disturbance. The depth to thaw can fluctuate seasonally, increasing following snowmelt in the spring and peaking to total active layer thickness in late summer. The relative thinness of snow cover in the semi-arid environment of the Project Area allows cold temperatures to penetrate the ground and refreeze the active layer in most years. Observations of incomplete active layer refreezing have been reported in areas where the active layer is anomalously thick due to wildfire (this study; Kryotek Arctic Innovation, 2015a,b).

Well-drained ground insulated by thick annual snow cover tends to have thicker active layers than wind-swept or poorly drained areas.

In areas of thick, mossy organic cover or in poorly drained valley bottoms, permafrost may be encountered at depths as shallow as 22 cm below the surface. North-facing colluvial aprons are also expected to have thin active layers. These “near-surface” active layers are rare, however, interpreted to represent only 3.9% of the Project Area Table 4-2.

Active layers are interpreted to be moderately thick (0.4-1.0 m) across the majority of the Project Area (85.9%, Table 4-2). These areas of “shallow” permafrost are most common on poorly drained valley bottoms, including fluvial terraces and inactive floodplains, in fine-grained colluvium, in fine-grained weathered bedrock and beneath insulating organic deposits.

Active layers appear to be thicker (>1.0 m) in areas of coarser-grained colluvial or weathered bedrock deposits typically found on bedrock scarps and ridges (10.2%, Table 4-2). Ridgetops, when exposed, sparsely vegetated, and well drained, also have such “deep” active layers, regardless of grain size, with thicknesses that may exceed the borehole depth (for example site 23-05-F; Appendix C).

Additionally, active layers can thicken in response to wildfire. An example of this can be observed at site 22-01-F, in contrast to active layer thickness at site 22-02-F. While the material and ice content are the same at both sites, a thicker active layer of 0.9 m is evident at site 22-01-F, compared to an active layer of 0.35 m at site 22-02-F (Appendix C). This difference in active layer thickness was likely caused by the 2017 wildfire that affected site 22-01-F. Based on borehole information from sites affected by older wildfires (Figure 3-1; Appendix C), recovery of permafrost occurs with time and re-establishment of insulating vegetation cover.

Table 4-2. Areal distribution of field-calibrated, interpreted permafrost conditions by relative depth and ice content.

Permafrost Condition Classification		Estimated Relative Ice Content			
		Ice-poor (<10% ice)	Ice-moderate (10-20% ice)	Ice-rich (>20% ice)	Total
Estimated Active Layer Thickness	Near surface (<0.4 m)	0% (0 km^2)	0.1% (2.2 km^2)	3.8% (91.9 km^2)	3.9% (94.1 km^2)
	Shallow (0.4 – 1 m)	33.2% (794.6 km^2)	43.0% (1029.8 km^2)	9.8% (234.1 km^2)	85.9% (2,058.5 km^2)
	Deep (>1 m)	9.3% (222.5 km^2)	0.9% (21.6 km^2)	0% (0 km^2)	10.2% (244.0 km^2)
	Total	42.5% (1,017.1 km^2)	44% (1053.6 km^2)	13.6% (326 km^2)	100% (2396.6 km^2)

4.2.2 Ice Content

Permafrost may or may not contain ice, depending primarily on material composition and moisture regime. Data collected from FrostLink sensors (21-06-F, 21-M08-F, 22-02-F) installed within the Project Area in 2021 and 2022 confirm that in areas of undisturbed vegetation, cold, stable permafrost with relatively thin active layers are present (Figure 3-1).

Permafrost ice content varies significantly with depth but without any obvious trends (Appendix C: borehole logs). Ice content ranges from 5 to 95%, commonly within the same borehole, but on average is 10-50%.

Permafrost is interpreted to be ice-rich (>20% ice; Heginbottom et al., 1995) across 13.6% of the Project Area (Table 4-2), as ice content varies with depth, grain size, and drainage. Segregated ice forms lenses and layers; ice crystals are also common. Massive ice may be present locally. Ice-rich areas may be present along some ridges where the surface expression of ice-wedge polygons is visible in LiDAR data and/or aerial imagery. Here, it appears that ice wedges may have exploited existing bedrock fractures and it is uncertain if these features are relict or active. Ice-rich/ice-moderate permafrost is common in valley bottoms below imperfectly to poorly drained, fluvial deposits or poorly drained organic deposits, but is also abundant in thick, fine-grained colluvial deposits and even in some ridge-top weathered bedrock deposits.

Ice-moderate permafrost contains 10-20% ice by volume (Heginbottom et al., 1995) and is found where textures are sandy and ground moisture is moderate. Thin seams or lenses of ice are common. Ice-moderate terrain is interpreted to comprise 44% of the Project Area (Table 4-2) and is commonly found below imperfectly drained fluvial deposits and thick, fine-grained colluvial deposits. Ice-moderate permafrost is also inferred in regions affected by sheetwash or solifluction. Ice-moderate deposits were found at boreholes 21-02, 21-07-F, 21-10, and 23-01-F (Appendix C). Boreholes 21-07-F and 21-10 were only drilled to 0.8 m; their fine-grained material suggests that these deposits are likely ice-moderate to ice-rich at greater depth. Borehole 21-10 is a fluvial deposit of clay and silt that was expected to be ice-rich

given its valley bottom location. Borehole 23-01-F is a thick, fine-grained colluvial deposit that was ice-moderate to the drilled depth of 1.3 m.

Ice-poor permafrost is considered to have volumetric ice contents of less than 10% (Heginbottom et al., 1995) and is interpreted to comprise 42.5% of the Project Area (Table 4-2). It is commonly only found in areas (or layers) of coarse-grained material, often with sparser vegetation and better drainage, such as exposed ridgetops. Ice-poor permafrost was identified at boreholes 21-SUMP, 23-05-F, and 23-06.

Ground ice content in permafrost is highly variable, both laterally and vertically. While sandier, well drained deposits are expected to be ice-poor, this is not always the case. Similarly, not all valley floor deposits are ice-rich. As such, site-specific investigation of confirmed well pad and MBC disposal areas will be important prior to establishment.

4.2.3 Permafrost-related Features

As permafrost acts as an impenetrable barrier to water flow, the active layer above permafrost can become quite saturated during the summer months. As such, freeze and thaw of this saturated material commonly results in differential frost heave, resulting in irregular micro-topography and the formation of earth hummocks. Additionally, this terrain is favourable for the formation of ice-wedge polygons, as continuous freeze and thaw cycles can cause contraction cracks, which are then infilled by water retained in the active layer, and lead to the development of ice wedges (Figure 4-7). Ice-wedge polygons occur in many gentle valley bottoms and on some of the broad, near-level ridge crests, although some upper-elevation occurrences may be relict features and more so a reflection of underlying bedrock fracturing and are considered ice-rich permafrost terrain (Table 4-2).

Massive ice may be present in some low-lying areas. It grows and shrinks in response to changing climatic conditions and ground thermal regime (e.g., organic cover thickness, local drainage conditions; Burn et al., 2015; Watanabe et al., 2017).

Geomorphological processes related to permafrost are indicated by cryoturbation, solifluction, active-layer detachments (Figure 4-2), ice-wedge polygons (FiguresFigure 4-2 andFigure 4-6), thermokarst subsidence (Figure 4-2) drunken forest (Figure 4-8) and earth hummocks.



Figure 4-7. Ice wedge exposed in freshly eroded stream bank within the Project Area (1.9 m-tall person for scale).



Figure 4-8. Drunken and burnt forest at field site 21-SUMP.

4.2.3.1 Permafrost-related Mass Movement

On slopes, summertime saturation reduces the shear strength of surface deposits overlying permafrost and promotes solifluction and active-layer detachments (Figure 4-2). Solifluction is best recognized at surface by conspicuous lobes of material with steep, rounded fronts, and tapering tails. Areas of active solifluction

can gradually destabilize roads, in the long-term, through irregular settlement and mounding. Some slopes appear more prone to active-layer detachments than others within the Project Area; most occur on south- to southeast-facing slopes of 25 to 45% gradient. Evidence of past failures can be seen in aerial photography, where conspicuous downslope-oriented stripes of deciduous trees have recolonized the landslide scars. Both solifluction and active-layer detachments increase in frequency and magnitude shortly after wildfire, mainly due to loss of rooting strength and insulating organic cover (Coates, 2008). This is consistent within observations within the Project Area: active layer detachments are most common on previously burnt slopes.

In areas of ice-rich permafrost, even minor ground disturbances may trigger thermokarst activity (e.g., natural windthrow of trees that tears the surface organic mat and exposes underlying sediments). When this occurs, the ground subsides or, if on a slope, fails in response to the melting of buried ice bodies. Thermokarst commonly continues for years to decades once initiated, through a positive feedback cycle caused by increases in thaw leading to increases in water ponding, which leads to increases in thaw.

Slopewash is a widespread and important process on slopes underlain by permafrost. Material is transported downslope through a combination of sheetwash (entrainment of sediment grains in surface runoff; Appendix A) and piping (entrainment of grains in water percolating through the active layer). Shallow runnels, also known as water tracks, are the surface manifestation of slopewash, formed by the repeated and preferential downslope transport of sediments along natural drainage paths. As slopewash runnels deepen, they concentrate and prolong the conveyance of surface runoff and shallow groundwater, resulting in local depression of the permafrost table (thickening of the active layer). The interception of slopewash runnels by roads necessitates cross-ditching or drainage culvert installation; still, such sites may form ‘icings’ during the winter and spring months, which increase maintenance requirements on road surfaces and embankments.

4.2.4 Ground Temperatures

Ground temperatures from three distinct sites within the Project Area were recorded from summer 2021 to summer 2022. Sensor 21-06-F (Figure 3-1), located on a gentle, south-facing slope within a forested area, recorded a mean near-surface (5 cm depth) temperature of -2.1°C (Palmer, 2023; Table 4-3). Battery malfunction prevented 1-m depth ground temperature data from being recorded. Sensor 21-07-F (Figure 3-1), located in a wildfire-affected area, recorded a mean annual near-surface temperature of 0.9°C and a mean annual 1-m depth temperature of -0.2°C (Palmer, 2023; Table 4-3). This area is consistent with expected wildfire effects and the potential for incomplete freeze-back of the active layer, indicating degrading permafrost. Lastly, sensor 21-M08-F (Figure 3-1; Table 4-3), located on a northeast-facing slope, recorded a near-surface (5 cm depth) MAGT of -1.3°C and a MAGT of -3.8 °C at 1 m-depth, representing an area of colder, more stable permafrost (Palmer, 2023).

From the summer of 2022 to the summer of 2023, sites 21-07-F and 21-M08-F continued to record ground temperatures, with negligible change in ground temperatures at depth for both sites across the 2-year recording period (Figure 4-8 to

Figure 4-11). Two additional FrostLinks were installed at sites 22-01-F and 22-02-F in the summer of 2022 (Figure 3-1). However, the FrostLink at site 22-01-F was destroyed by wildlife and no data could be

recovered. Site 22-02-F recorded ground temperatures from 2022 to 2023, but this data is several days short of a full year (August 3rd, 2022, to July 20th, 2023) and should be recalculated when a full year of data is available. A 1 m-depth temperature was not recorded due to grounding issues, but a mean near-surface (5 cm depth) temperature of -2.3°C was recorded (Figure 4-13; Table 4-3). This site is on a north- to northeast-facing slope in colluvium and represents an area of colder, more stable permafrost, as temperatures at the 1 m depth are expected to be colder than those near surface.

Thawing degree days (TDD), or thawing index, are calculated from the mean daily temperatures by taking the sum of all the surface housing air temperature values above 0°C during the thawing season. Freezing degree days (FDD), or freezing index, are calculated in the same manner, but use mean daily temperatures below 0°C during the freezing season. A higher FDD than TDD value means permafrost can aggrade (or re-aggrade following disturbance). This situation is evident at sites 21-06-F, 21-M08-F, and 22-02-F (Table 4-3). At site 21-07-F, TDD is higher, indicating that permafrost is not likely to recover if the vegetation is disturbed or burnt.

Table 4-3. FrostLink Data Summary by Site for 2021-2022 and 2022-2023.

FrostLink Sensor	Location	Mean Annual Temp, 5 cm depth (°C)	Mean Annual Temp, 1 m depth (°C)	Thawing Degree Days[2] (TDD)	Freezing Degree Days[1] (FDD)	Record Start Date	Record End Date
21-01-F	Valley bottom fluvial deposit affected by icing (aufeis).	N/A	N/A	N/A	2175	2021-08-03	2022-05-11
21-06-F	South-facing slope in colluvium, with sphagnum, forested.	-2.1	N/A	1299	2063	2021-08-03	2022-08-08
21-07-F	Northwest-facing slope in colluvium, affected by wildfire in 1990.	0.9	-0.2	1702	1313	2021-08-03	2022-07-27
		N/A	-0.2	N/A[3]	N/A[2]	2022-07-20	2023-07-19
21-M08-F	Northeast-facing slope in colluvium, with sphagnum and stunted black spruce.	-1.3	-3.8	2195	2775	2021-08-03	2022-08-08
		N/A	-3.8	2127	2470	2022-07-19	2023-07-18
22-02-F	North to northeast-facing slope in colluvium.	-2.3	N/A	1692	2200	2022-08-03	2023-07-20
23-01-F	Anthropogenic area around well pad M-59, northwest-facing slope in colluvium, affected by wildfire in 1990.	Data to be collected in 2024				2023-07-22	TBD
23-03-F	Northwest-facing slope in colluvium, affected by wildfire in 2017.	Data to be collected in 2024				2023-07-22	TBD
23-04-F	At slope break between valley bottom and south-facing colluvium slope, affected by wildfire in 1986 and 2004.	Data to be collected in 2024				2023-07-22	TBD
23-05-F	East-facing ridgetop in weathered bedrock.	Data to be collected in 2024				2023-07-22	TBD
23-07-F	Southeast-facing ridgetop in weathered bedrock, affected by wildfire in 2005, forested.	Data to be collected in 2024				2023-07-23	TBD
23-08-F	Ridgetop in weathered bedrock, forested.	Data to be collected in 2024				2023-07-23	TBD

[2] TDD and FDD values are based on air temperatures recorded in the enclosed FrostLink housings, so they are not directly comparable to values from climate stations with a Stevenson screen.

[3] TDD and FDD could not be determined for 21-07-F due to too much daily fluctuation around 0°C during the thawing and freezing seasons.

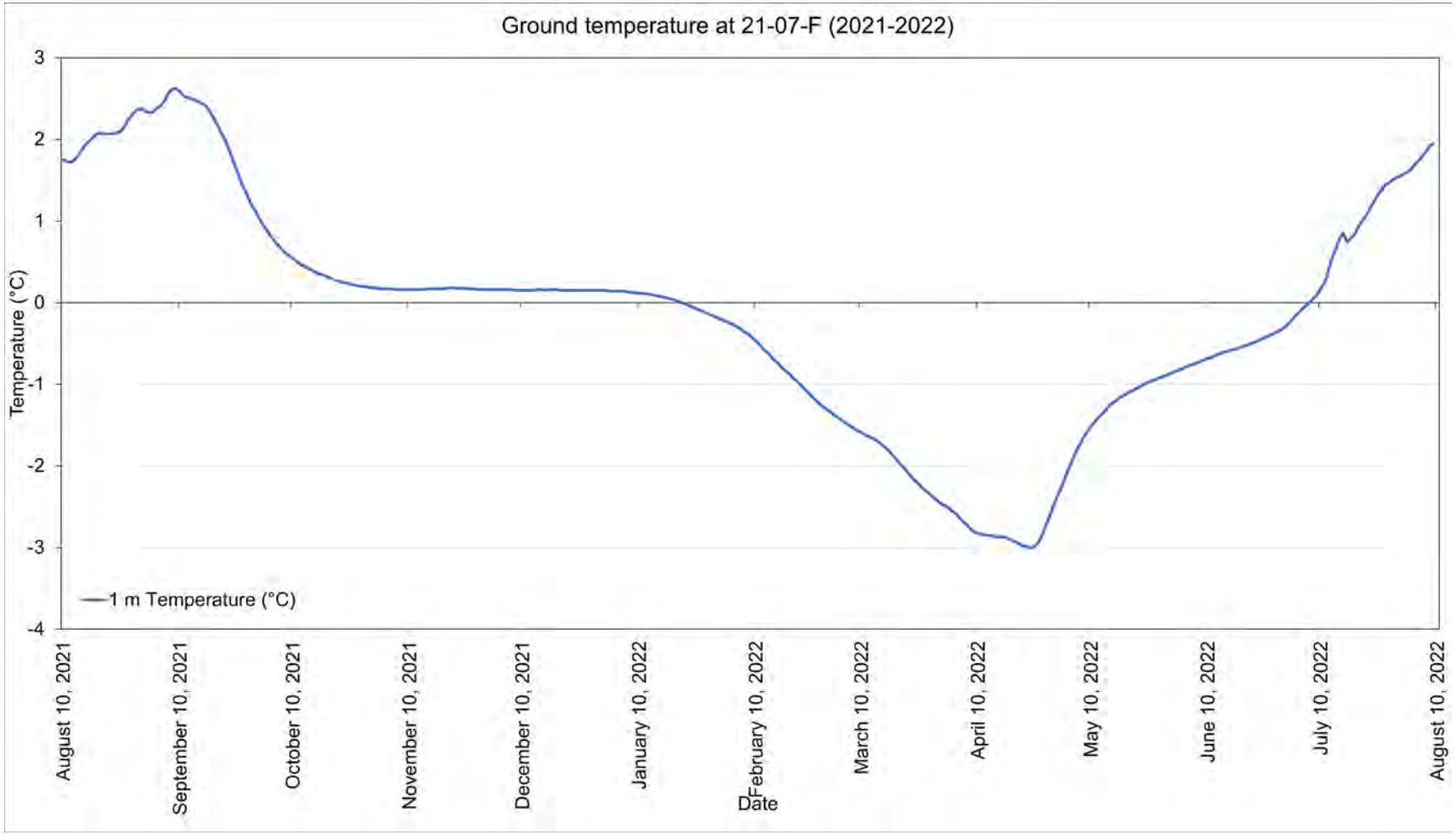

Figure 4-9. One year of ground temperatures at a depth of 1 m for site 21-07-F. Permafrost is deeper than the 1 m sensor.

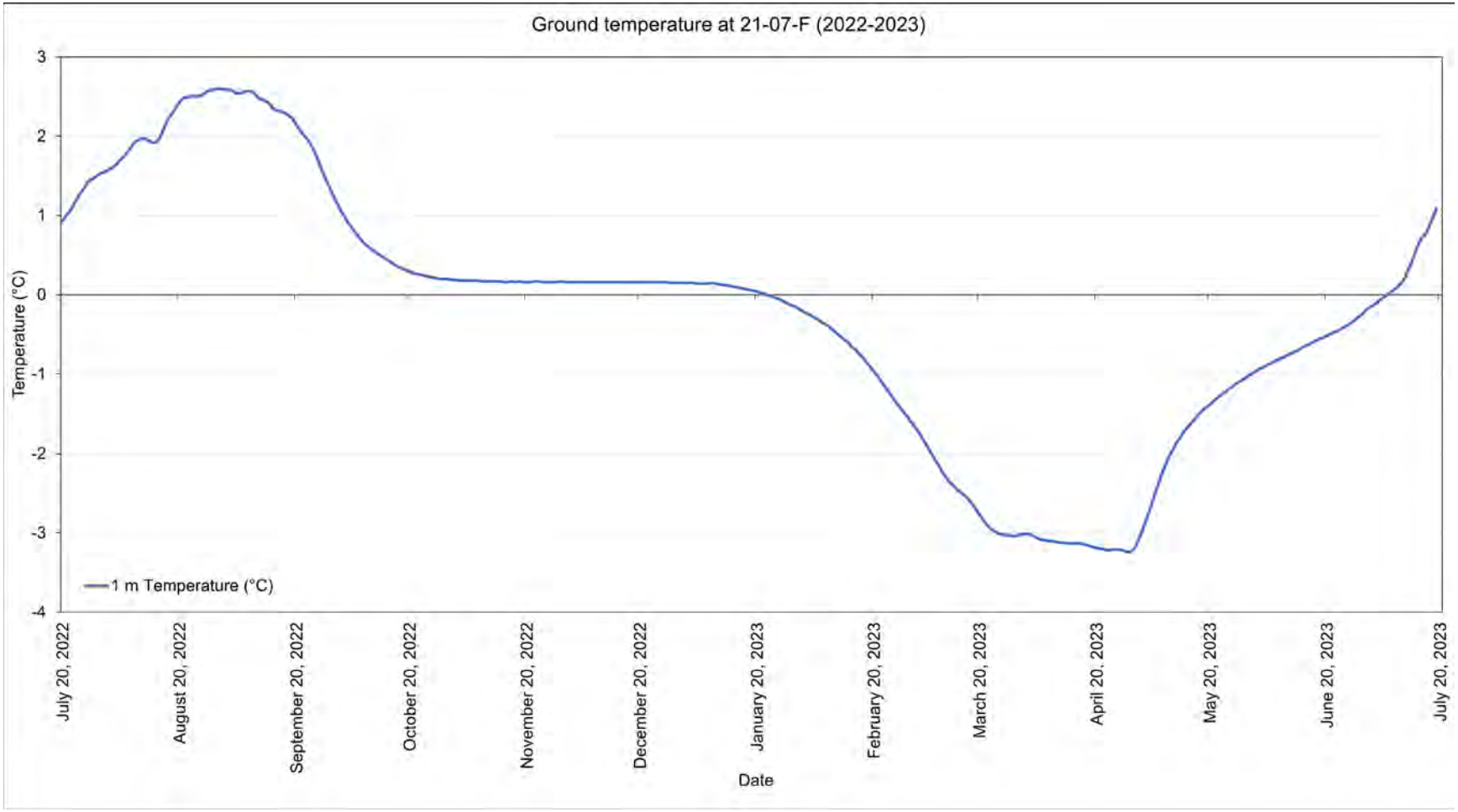

Figure 4-10. One year of ground temperatures at a depth of 1 m for site 21-07-F. Permafrost is deeper than the 1 m sensor.

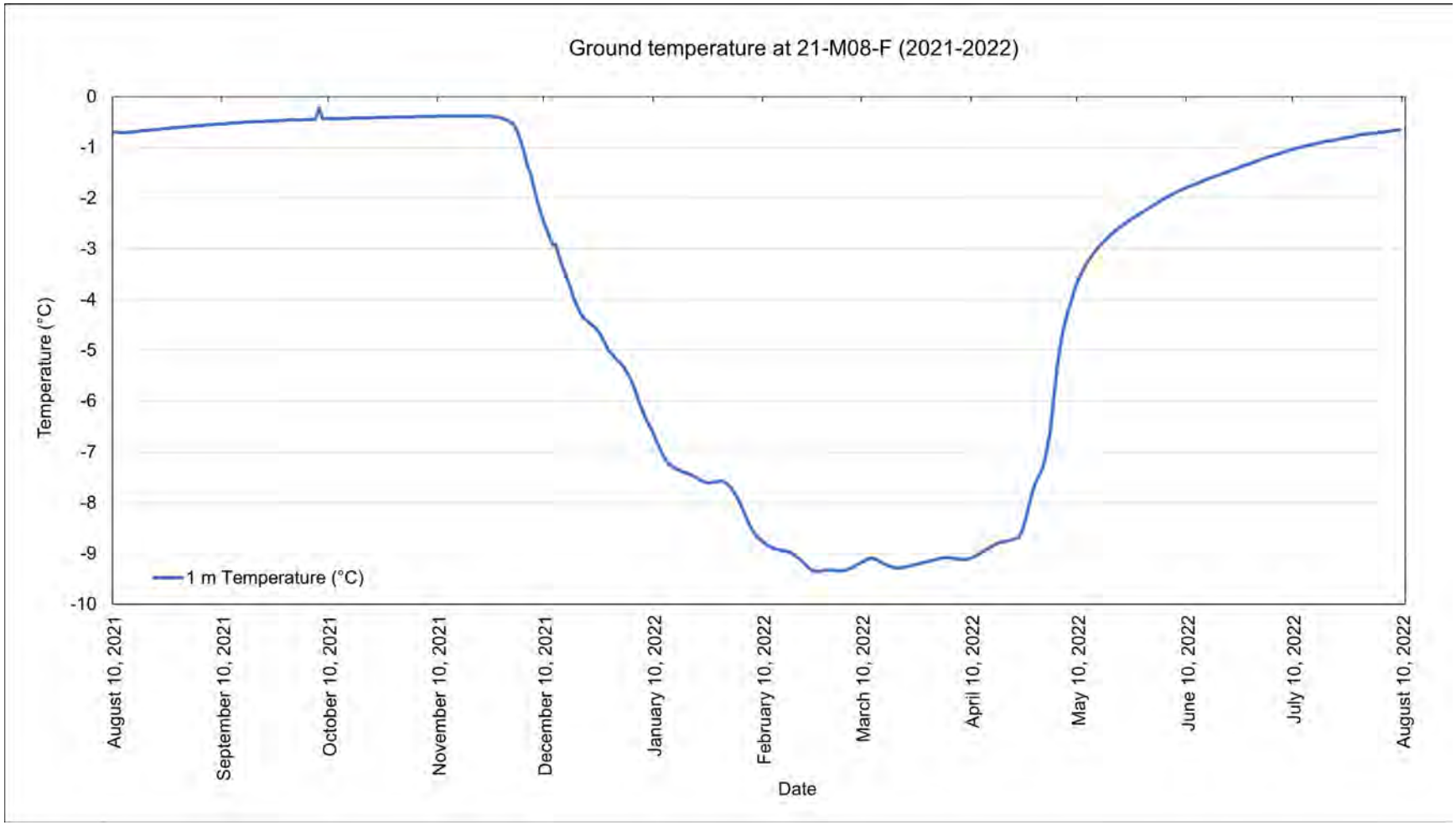

Figure 4-11. One year of ground temperatures at a depth of 1 m for site 21-M08-F.

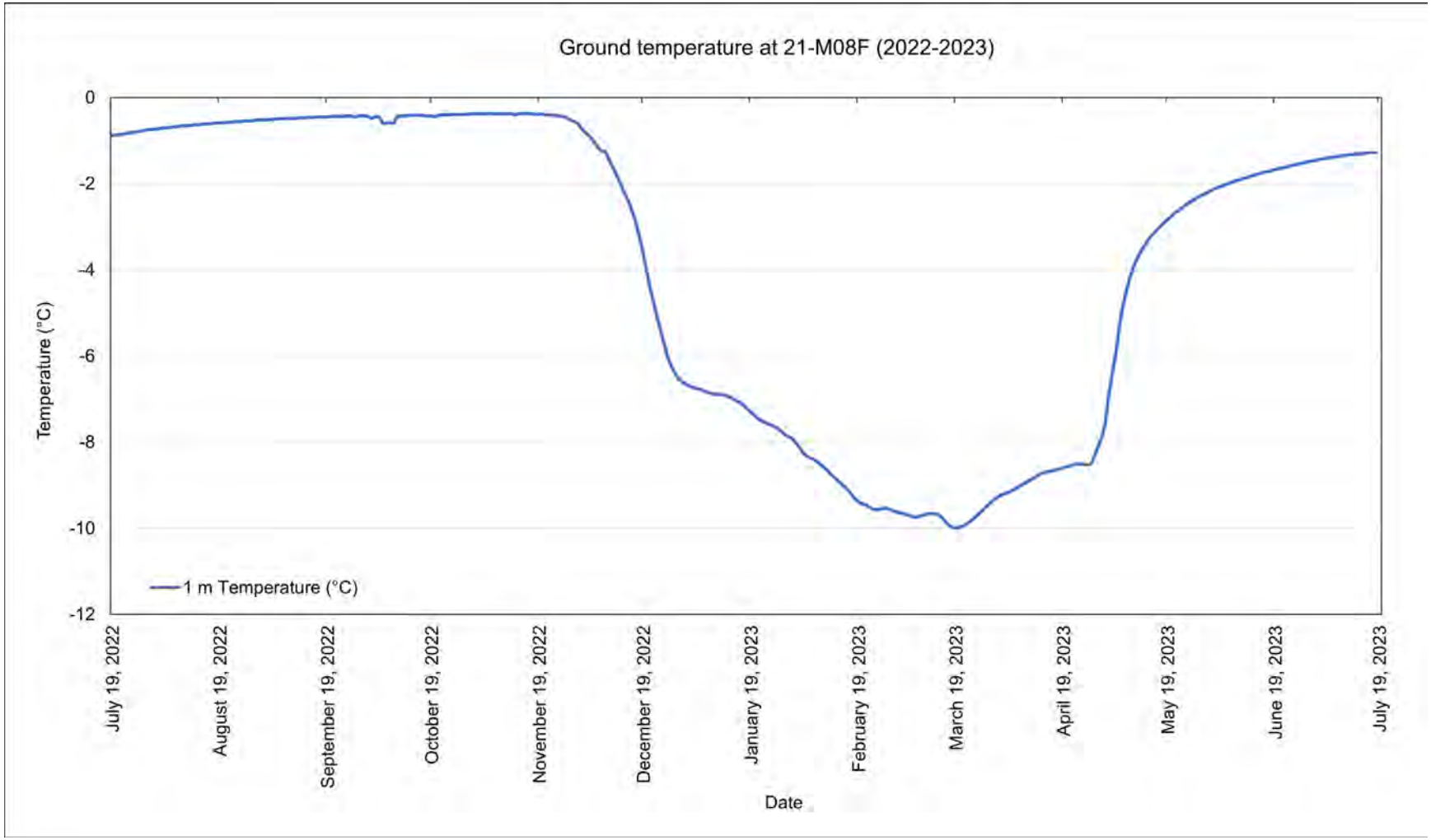

Figure 4-12. One year of ground temperatures at a depth of 1 m for site 21-M08-F.

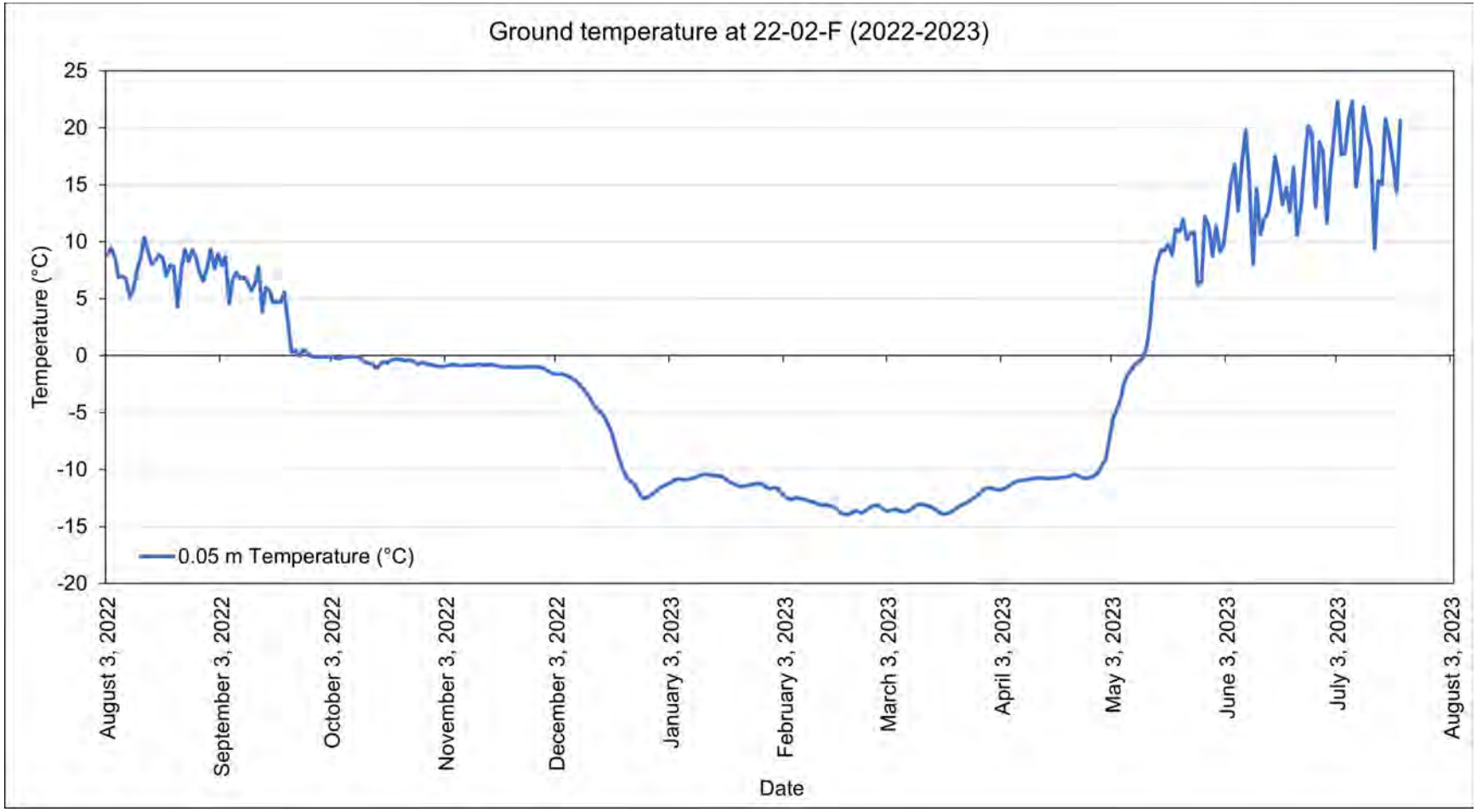

Figure 4-13. Near-surface (0.05 m) ground temperature from August 3rd, 2022, to July 20th, 2023 for site 22-02-F. Permafrost is deeper than the 0.05 m sensor.

4.2.5 Sensitivity to Disturbance

The sensitivity of permafrost to disturbance depends on a variety of factors, including its temperature, ice content, insulating ground cover (e.g., organics) and material texture. Relatively warm permafrost (i.e., warmer than -2°C) is more susceptible to thaw due to localized and even minor disturbances to the ground surface, whereas cooler permafrost is able to withstand minor disturbances without appreciable effect. Ice-rich permafrost is more sensitive to ground disturbance (e.g., stripping or compaction of organics). Ice-rich permafrost within fine-grained materials is more likely to contain discrete bodies of ice (Figure 4-14) and, thus, is more sensitive than that within weathered bedrock or coarse-grained colluvium.



Figure 4-14. Ice lens within fine-grained, colluvial sediment.

4.2.6 Permafrost Probe Analysis

4.2.6.1 Former Well Site H28

Apparent active layer thicknesses (depth of thaw) were measured between July 28 to August 6, 2021, in the area surrounding Former Well Site H28, which was drilled in the winter of 2012. In Figure 4-15, it is apparent that active layer thicknesses are greatest (60-70 cm) close to the well and thin toward the edges of the disturbed area. Undisturbed areas have notably thinner active layers (11-21 cm). On the south side of the well, an imperfectly drained gentle slope directs surface and near-surface runoff towards the well. The well was drilled in the winter when snow was relatively deep. As a result, its corrugated steel cellar is approximately 75 cm above ground surface and its surrounding rig matting has settled (Figure 4-16). It is apparent that some permafrost thaw has occurred within the disturbed zone immediately surrounding the well, mainly at and near the well, but relatively little and without broader effect on surroundings. Permafrost thaw is accompanied by subsidence because water has 10% less volume than ice, and on slopes, the excess meltwater is able to freely drain away. The disturbed area has active layer thicknesses of 43 to 69 cm. Our borehole data show that similar but undisturbed northwest-facing or northeast-facing colluvial slopes have active layers ranging from 26 to 53 cm thick at this time of year (no time of year depth

adjustment applied) (Boreholes 21-06-F, 21-07-F and 21-M08-F, Appendix C). In time, natural revegetation should help restore shallow permafrost at the site despite ongoing climate change. However, wetting caused by the slope to the south may slow this process and may have caused more thaw in the area immediately north of it. Any future site restoration initiatives must account for local surface drainage patterns, material properties and vegetation resilience.

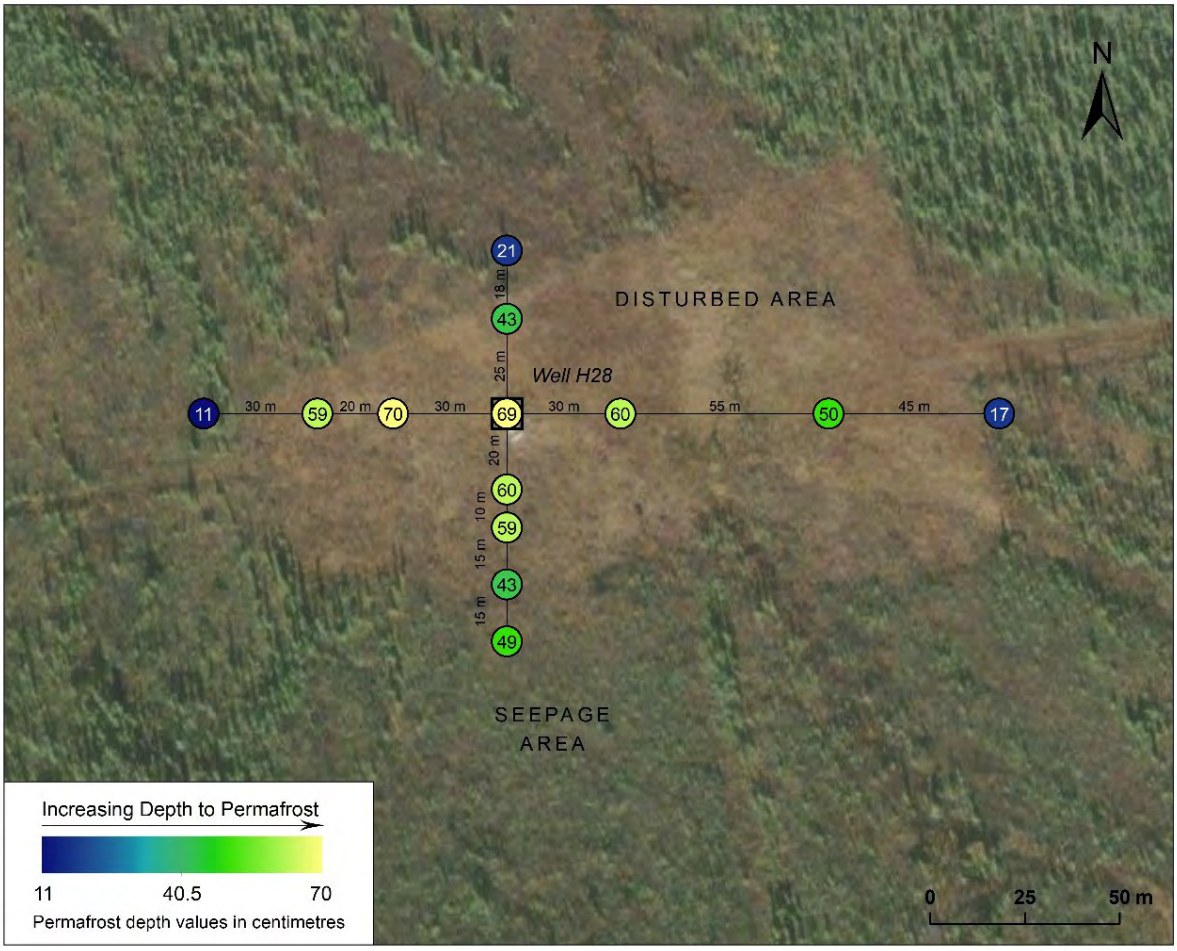

Figure 4-15. Apparent active layer thicknesses (in cm) at former well site H28, measured with a frost probe between July 28 to August 6, 2021. Ground generally slopes downhill from south (bottom) to north (top).



Figure 4-16. Former Well Site H28. Above-ground cellar and apparent settlement of rig mats is due to wintertime installation when snow was relatively deep.

4.2.6.2 Former Well Site M08

A similar localized, minor disturbance to permafrost occurred at Former Well M08 (Figure 4-17). The site was drilled in the winter of 1959 and has a wood frame cellar made of wood piles. Some clearing occurred in January to March 1998, in preparation for flow testing work that was cancelled (older disturbance area). An area 10 m in radius is cleared around the well head approximately every five years to meet Yukon oil and gas regulations (recent disturbance area).

The well is located on a gentle, northeast-facing, ice-rich colluvial slope. Here, the active layer is thicker, both in the recently disturbed area and in the adjacent older disturbed areas that are now forested with young deciduous trees (Figure 4-18). Cracks in the soil around the base of the well and the slow exposure of the wood piles, which have mostly occurred in the last 10 to 12 years (pers. comm., Richard Wyman), show that the well has either heaved or that the land around it has subsided.

Apparent active layer thicknesses are greatest near and at the well (70-82 cm) in the recently disturbed zone and thin toward the older disturbed zone. The older disturbed areas have thicknesses ranging from 53-80 cm (Figure 4-17). These active layer thicknesses are greater than that observed on a nearby undisturbed slope (26 cm thick, Borehole 21-M08-F, Appendix C). It is apparent that the permafrost table is more depressed in the recently disturbed zone, as would be expected due to the removal of vegetation.

The older disturbed zone has naturally revegetated with pioneer species of trees over the past 63 years. Here, permafrost is slowly recovering. The recovery may be more noticeable if a wider area is examined in future. Our data provide baseline information as of July 30, 2021. Active layer thicknesses near the well head are expected to remain the same due to the periodic clearing that is required by Yukon oil and gas regulations.

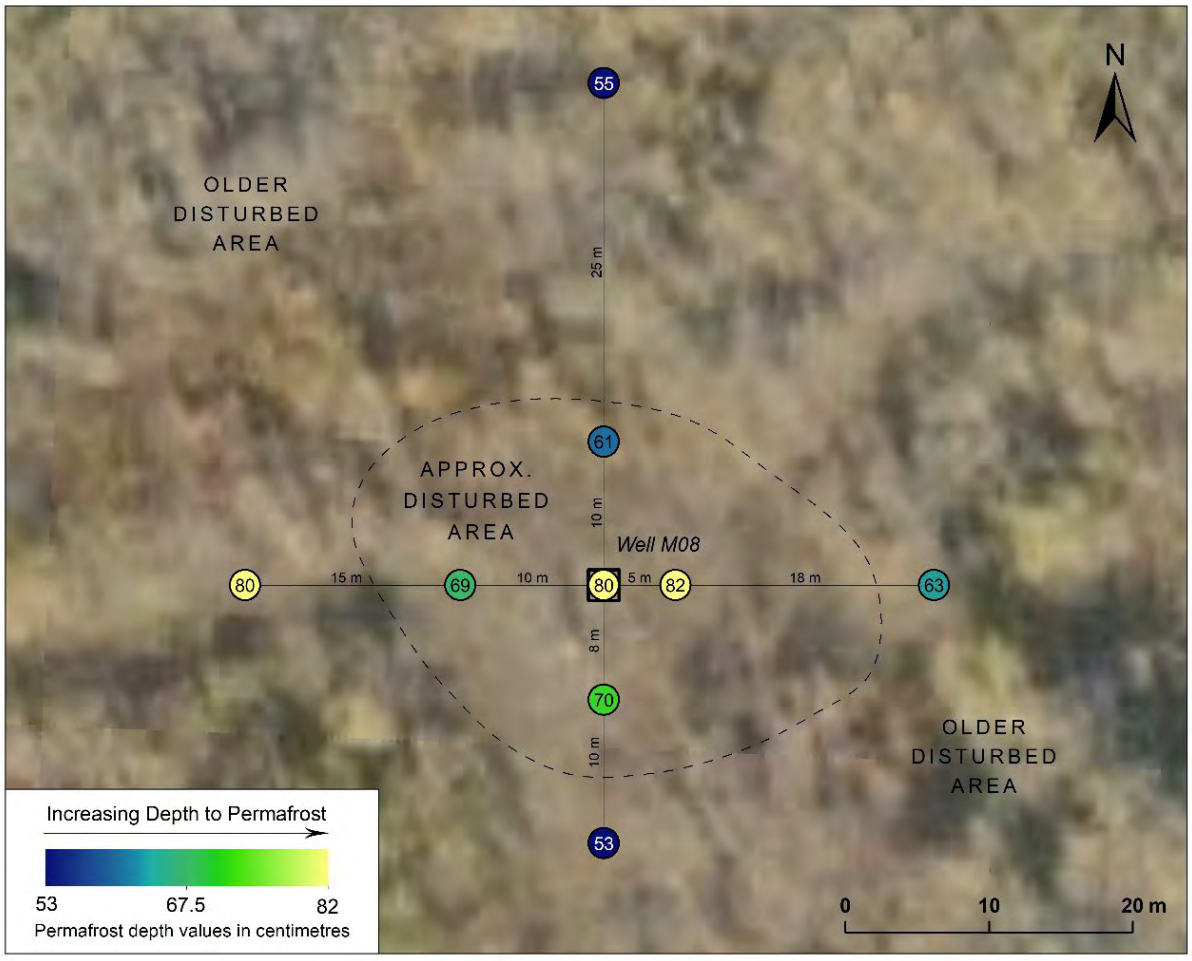

Figure 4-17. Active layer thicknesses (in cm) at former well site M08, measured with a frost probe on July 30, 2021. Slope dips gently to the northeast.



Figure 4-18. Former Well Site M08. Note exposed wood pile in foreground and young forest growth in older disturbed area in background.

4.3 Exploration Development Suitability

Exploration development suitability mapping, which builds on the characterizations of surficial geology (Section 4.1) and permafrost (Section 4.2) and reflects on permafrost-related terrain stability and areal differences in sensitivity to disturbance (Section 4.2), is presented for the Project Area in Appendix B. The mapping combines the results of the road and well pad suitability classifications (Table 4-4) with the MBC disposal suitability classifications (Table 4-5). Road and well pad suitability classification also provides a conservative guide for proposed seismic surveys.

Nearly all existing and potential instability within the Project Area is related to permafrost, given the ancient, rolling, relatively low-relief terrain and thinly covered slopes of the Eagle Plains region. Our exploration development suitability maps (Appendix B) show the extent of most (very high classification) to least (very low classification) suitable terrain for exploration activities (Table 4-4)

Areas of high to very high suitability are generally found on wide, rounded ridge tops, commonly with either exposed bedrock and boulders or shallow bedrock, and where shallow colluvium overlies convex topography. They are generally ice-poor and well drained and occupy the least amount of the Project Area, ranging from 9.4% (high suitability) to 7% (very high suitability; Table 4-4).

Areas of moderate suitability are found on imperfectly to moderately drained colluvial slopes, fine-grained ridge tops, and fluvial terraces. These areas have moderate slope gradients, varying permafrost depths, moderate ice contents, and occupy 28.7% of the Project Area (Table 4-4).

Areas of low and very low suitability generally include ice-rich areas, which are most commonly found in valley bottoms, frequently associated with floodplains and fluvial or organic material. These ice-rich areas may exhibit ice-wedge polygons and are particularly susceptible to thermokarst. Steeper slopes with lower suitability are also more commonly associated with active-layer detachments and solifluction, or the potential for localized rock fragment ravelling on scarps. Low and very low suitability areas represent 33.5% and 21.4% of the Project Area, respectively (Table 4-4).

High and very high suitability areas require minimal maintenance requirements and have favourable conditions for access road and well pad establishment when best management practices are applied. Very low suitability areas, by comparison, require comprehensive mitigations to protect thaw-sensitive permafrost and control surface runoff. Required maintenance is likely high and field reconnaissance is critical to make informed route and site selections and mitigation decisions.

The MBC disposal suitability serves to highlight ice-poor, gently-sloping, and relatively stable regions of the landscape set back from significant watercourses as potentially suitable for MBC disposal (Table 4-5). These criteria were generally met along broad ridge systems and isolated knolls. A total of 13.2% of the study area has been classified as potentially suitable for MBC drill cuttings disposal, most commonly in association with areas classified as High or Very High suitability for road and well pad suitability (Appendix B). Runoff may be variable at the mapped scale such that different areas within a polygon may have less or more interaction with surface water. For example, polygons affected by slope wash may show discrete runnels where runoff is concentrated. As a result, field investigations are suggested to refine the MBC

disposal suitability classifications at a site-specific scale which would better determine target areas for cuttings disposal within each mapped polygon unit.

Table 4-4. Road and well pad suitability classifications and implications for construction and maintenance.

Road and Well pad Suitability	Description	Implications for Construction and Maintenance	Percent of Project Area
Very High	Moderately well to well drained, isolated topographic highs with deep or shallow, ice poor permafrost. Generally considered to be stable terrain, and typically located along wide, rounded ridge crests, commonly with shallow bedrock.	Favourable conditions for access road and well pad establishment through standard best management practices. Minimal expectation for maintenance requirements.	7.0%
High	Generally, moderately well to well drained areas with deep or shallow, ice-poor permafrost. Typically associated with ridges of weathered bedrock or shallow colluvium over convex topography.	Generally favourable conditions for access road and well pad establishment through standard best management practices. Low to moderate expectation for maintenance requirements.	9.4%
Moderate	Imperfectly to moderately well drained colluvial slopes with deep to shallow permafrost, commonly with moderate ice content; convex weathered bedrock bluffs, typically at moderate slope gradients; and fluvial terraces above the influence of modern stream processes.	Generally reasonable conditions for access road and well pad establishment. Where necessary, employment of mitigations may be to proactively manage natural concentrations of surface runoff and to protect thaw-sensitive permafrost. Moderate expectation for maintenance requirements. Field reconnaissance would help inform route/site selection and mitigation requirements.	28.7%
Low	Poorly to imperfectly drained, thick colluvial slopes with shallow permafrost, commonly with moderate to rich ice content; imperfectly drained fluvial fans and veneers. Regions affected by sheetwash, gully erosion, and ice-wedge polygons are typically included in this category. Surface runoff becomes concentrated.	Generally unfavourable conditions for access road and well pad establishment, except through mitigations to proactively manage natural concentrations of surface runoff and to protect thaw-sensitive permafrost. Moderate to high expectation for maintenance requirements. Field reconnaissance is necessary to inform route/site selection and mitigation requirements.	33.5%
Very Low	Very poorly to imperfectly drained areas with shallow or near-surface permafrost, commonly with rich to moderate ice content. Includes most floodplains and steep bedrock scarps. Thermokarst subsidence and ice-wedge polygons are common on level to gently sloping ground, and slopes may be subjected to mass movements including solifluction and active-layer detachments.	Unfavourable conditions for access road and well pad establishment. Any necessary crossings will require comprehensive mitigations to protect thaw-sensitive permafrost and manage surface runoff and compressible, fine-grained sediments. Road construction through steep bedrock scarps would require earthworks and potentially localized blasting. Maintenance expectations are high. Field reconnaissance is critical to inform route/site selection and mitigation requirements.	21.4%

Table 4-5. Mix-bury-cover (MBC) disposal suitability classifications and descriptions.

MBC Disposal Suitability	Description	Percent of Project Area
Potentially Suitable	Generally geomorphologically isolated regions on level or near-level, elevated areas with minimal or no receipt of surface runoff (i.e., 'shedding sites'). Areas are typically located along broad to rounded ridge crests and knolls that are set back from significant watercourses.	13.2%
Probably Unsuitable	Includes moderate to steeply sloping regions; areas with ice-rich permafrost; and areas exhibiting evidence of geomorphological instability such as fluvial erosion, thermokarst subsidence, solifluction, and active-layer detachments	86.8%

4.4 Potential Effects of Climate Change on Baseline Conditions

Climate change, which is occurring more rapidly in Yukon than in southern Canada (Perrin and Jolkowski, 2022; BNQ, 2023), is expected to have locally significant impacts on the terrain and permafrost conditions in the Project Area, as it will in many other northern regions. However, permafrost has a high thermal inertia, meaning it does not respond quickly to temperature changes. Permafrost thaw is therefore expected to be a gradual process.

As temperatures rise due to climate change, permafrost is expected to thaw. This thawing can lead to increases in thermokarst subsidence and initiation of new active-layer detachments (and potentially retrogressive thaw flow slides, locally). Thawing permafrost can also lead to changes in the flow of rivers and streams, affecting fish habitat and water quality. The release of previously frozen organic matter from permafrost can also contribute to increased nutrient loading in water bodies and loss of permafrost can accelerate erosion along riverbanks and coastlines.

Climate change is associated with increased frequency and intensity of wildfires. This can have an important impact on terrain and permafrost, as wildfires can accelerate permafrost thaw by removing insulating vegetation and depositing ash that darkens the surface, causing it to absorb more heat. The active layer responds by becoming thicker and thaw subsidence may occur in ice-rich areas.

The exploration development suitability mapping can be used to forecast which areas of the landscape are most likely to respond to climate change, based on the implicit representation of terrain stability. Depending on what climate change scenario occurs (low, moderate or high greenhouse gas emissions scenarios), we expect that the Very Low suitability areas will remain the same and that the Low Suitability areas will eventually become areas of Very Low suitability, although the timing of this is dependent on the actual climate change scenario. Areas of Moderate Suitability are highly variable in terms of terrain and permafrost, so it is more difficult to predict what will happen in those locations. Areas of High and Very High suitability are expected to remain unchanged, as they are stable both in terms of landscape position and low permafrost content. It is possible that some areas of High Suitability could become Moderate Suitability areas, depending on local permafrost conditions in those locations, but these should be very localized.

5. Summary and Conclusions

This report describes the Eagle Plains Project Area's surficial geology and permafrost baseline conditions for the purposes of evaluating potential effects of the Project on permafrost and terrain stability as part of the Project Proposal to YESAB. Detailed (1:20,000) mapping of surficial geology and permafrost was completed for the 2,400 km^2 Project Area and combined to produce exploration development suitability maps, which reflect permafrost-related terrain stability (Appendix B). The mapping was based on interpretation of high-resolution stereo-imagery and LiDAR-derived topographic data, calibrated through reference to pertinent background information and the findings of several field investigations involving the examination, sampling and documentation of soils and surficial materials in hand-dug testpits and shallow (~2 m) Talon-drilled boreholes, installation and monitoring of FrostLink ground temperature/phase sensors, and helicopter overview flights.

The unglaciated landscape of the Eagle Plains region consists of rounded ridges separated by deep, V-shaped valleys. Climate is characterized by long, cold winters and short, warm summers. Bedrock comprises sandstone, shale, bituminous shale, siltstone, mudstone, coal, spiculite and packstone of Cretaceous age.

Surficial materials within the Project Area include weathered bedrock and colluvial, fluvial and organic deposits. Many of these deposits are affected by gullying, solifluction, permafrost processes and active-layer detachments. The abundant colluvial deposits are generally fine-grained (mainly silt and clay), although they are sandier and may include some gravel-sized fragments in areas of sandstone bedrock. They are locally intermixed with organics. Intact bedrock is uncommon, typically limited to erosion-resistant scarps, but weathered bedrock also is widespread on ridges and spurs. Weathered bedrock comprises silt/clay or sand with pebbles or cobbles of the underlying bedrock (if overlying more competent sandstone). Fluvial deposits found in valley bottoms consist of silt and clay with some sand, interfingered with organic layers. Areas disturbed by human activity are rare.

The Project Area is located within the zone of continuous permafrost. As part of the work completed for this report, ground temperature sensors (FrostLinks) were installed at 12 locations on ridge crests, on slopes of different aspect, and in valley bottoms to improve understanding of ground temperatures across the Project Area and in different terrain settings. Mean annual ground temperatures generally range from -0.2°C to -2.3°C near surface to -3.8°C at 1 m depth. Temperatures are warmer in wildfire-affected areas. Permafrost that is warm (warmer than -2°C) is more susceptible to thaw subsidence in response to climate change or disturbance. Continued monitoring of ground temperatures, including the 2023 FrostLink installations, is recommended to monitor ground temperatures, especially in areas of disturbance.

Apparent active layer thicknesses (depth to thaw during the summer months) range from 0.2 to 3.5 m, with the thickest active layers occurring in areas of recent wildfire and the thinnest on poorly drained valley floors, in areas of thick moss or organic material cover, and in areas of fine-grained deposits. Active layer thicknesses of more than 0.6 m are found in areas of coarse-grained colluvium or weathered bedrock (upland areas).

Ice content within permafrost is highly variable. Ice-rich deposits include fine-grained colluvial or fluvial deposits and weathered bedrock, but these deposits can also be ice-moderate. Ice-rich/ice-moderate

permafrost underlies poorly drained, inactive fluvial deposits or organic deposits in valley bottoms. Ice content is lowest in association with coarse-grained weathered sandstone bedrock.

Permafrost-related processes include cryoturbation, solifluction, active-layer detachments and thermokarst subsidence/gullying. Permafrost features include ice-wedge polygons, earth hummocks and drunken forest. Minor, localized degradation of permafrost has occurred at former well sites H28 and M08 but appears to be recovering in areas where the vegetation is regenerating.

The exploration development suitability maps reflect findings of both the desktop- and field-based assessment and provide guidance for the development of exploration infrastructure by identifying those areas least likely to be affected by construction-related disturbance. Areas of potentially suitable MDC disposal have been identified, generally along broad ridge systems and isolated knolls and typically aligning with high to very high road and well pad suitability areas. Chance has located its access roads and well sites using these maps to ensure that permafrost and terrain stability are appropriately protected during the exploration process. Where lower suitability areas are unavoidable, mitigation measures are available to ensure protection of permafrost and address any concerns regarding associated terrain stability.

Finally, climate change is affecting, and will continue to affect, permafrost and terrain stability within the Project Area. The slow response of permafrost to warming air temperature means thawing will occur gradually, ultimately contributing to initiation and expansion of thermokarst subsidence, more widespread and potentially larger active-layer detachments, and altered surface hydrology. Wildfires, intensified by climate change, can expedite permafrost thaw and terrain instability. Exploration development suitability is expected to change as permafrost thaws, with low suitability areas likely transitioning to very low suitability. High and very high suitability areas are expected to remain stable, but some may shift to moderate suitability based on local permafrost conditions. Prioritizing high suitability areas for infrastructure, and incorporating adaptation measures where necessary, can mitigate impacts from such natural processes.

6. Statement of Limitations

The observations and results provided are limited to the scope of work for which Palmer was retained. The information and data provided by the Client or any secondary sources was assumed to be factual and accurate, and any deficiency, misstatement or inaccuracy contained in this report as a result of omissions, misinterpretations or negligent acts from relied-upon data are not Palmer's responsibility. Judgment has been used by Palmer in interpreting permafrost and terrain stability and associated hazards based on desktop interpretation calibrated by first- and second-hand field observations at sites representative of the diversity of conditions within the study area. Ground conditions may differ from those interpreted at a map unit (polygon) scale, even where investigated in the field, due to inherent variability in terrain characteristics.

Palmer is not a guarantor of the terrain, permafrost, or hazard conditions within each of the mapped polygons, but warrants only that its work was undertaken and its report prepared in a manner consistent with the level of skill and diligence normally exercised by competent geoscience professionals practicing in Yukon. Our findings, conclusions and recommendations should be evaluated in light of the limited scope of work.

7. Certification

This report was prepared, reviewed, and approved by the undersigned:

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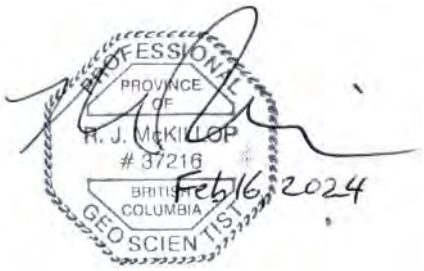

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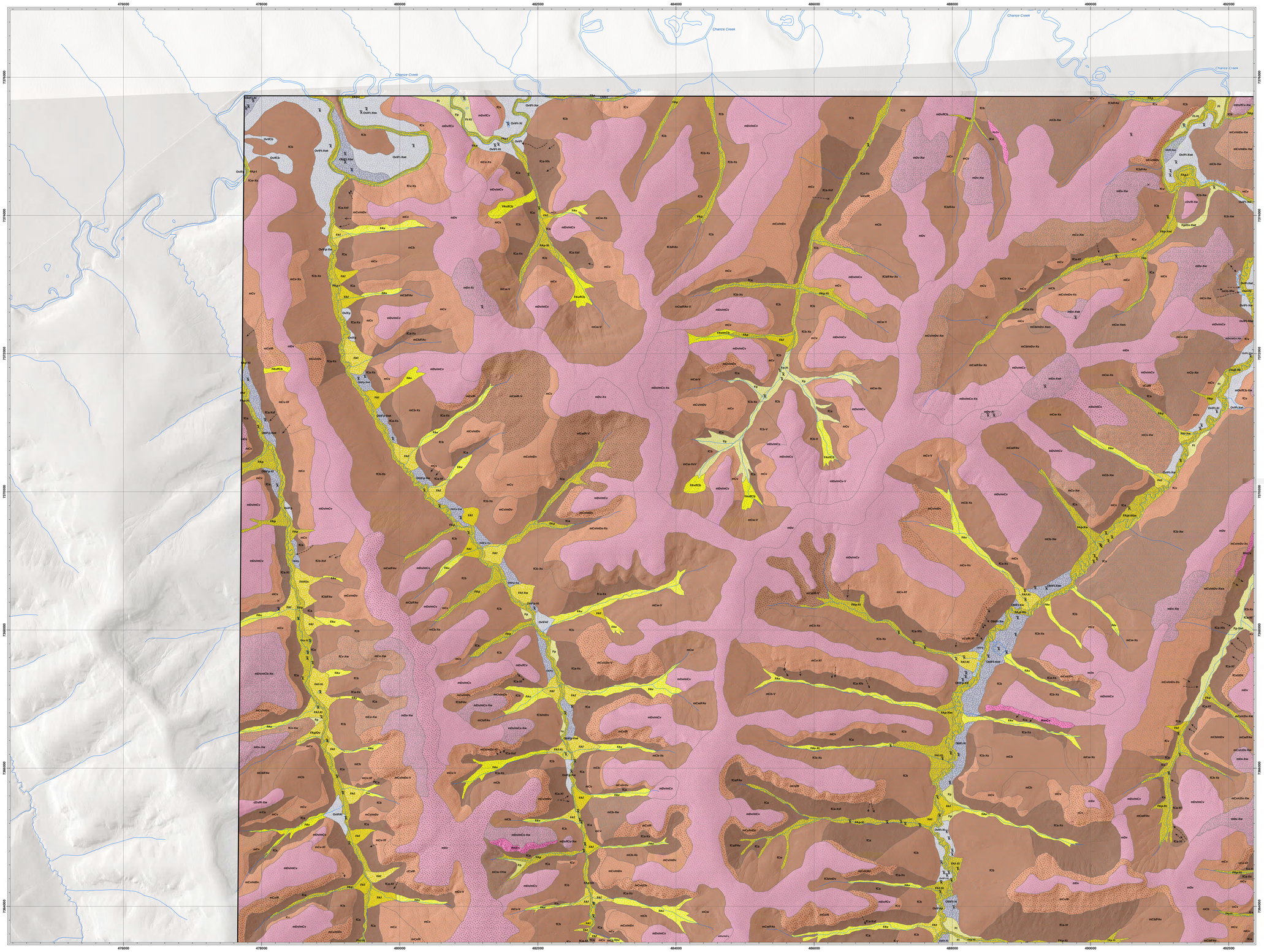
Appendix A

Surficial Geology and Permafrost Classification

Eagle Plains, Yukon



SURFICIAL MATERIAL AND LANDFORM DEFINITIONS

A — **Anthropogenic deposits:** surficial materials modified by human activities such that their original physical properties have been significantly altered, applied to areas modified by excavation and construction activities; not applied to road networks.

Ov — **Organic deposits; veneer:** < 1 m thick; material ider ived fr om the accumulation of plant matter , generally consisting of peat (typically bog or fen) ; occur s on p oor ly dr ained, level to gently slop ing areas; shallow dep r essions; only included in map labels wher e accumulation is thicker than 2 0 cm.

Ob — **Organic deposits; blanket:** > 1 m thick; material ider ived fr om the accumulation of plant matter , generally consisting of peat (typically bog or fen) ; occur s on p oor ly dr ained, level to gently slop ing areas; shallow dep r essions.

FAv — **Fluvial sediments; active veneer:** < 1 m thick; material lai d ar ansp or ted and dep osited by str eams typically exhibiting inter mittent or p er ennial flow; mainly occur s on gentle slop es within gullies at the headwaters of moder n str eams; gener ally comp osed of silt, or ganics, and minor sands.

FAf — **Fluvial sediments; active fan:** mater ials tr ansp or ted and dep osited by str eams; typically occur s where tr ibutar y str eams meet lar ger , lower angle r iver systems and dep osit mater ials; longitudinal profiles fr om slightly concave to slightly convex; gener ally comp osed of silt, sands, and or ganics.

FAp — **Fluvial sediments; active plain:** mater ials tr ansp or ted and dep osited by moder n str eams; typically plains to gently slop ing landfor ms along valley bottoms; gener ally comp osed of silt and sand on flooding lain and gr avels along active channels and bar s.

Fp — **Fluvial sediments; active plain:** mater ials tr ansp or ted and dep osited by str eams in the floodp lain above moder n channels; typically p lanar to gently slop ing landfor ms along valley bottoms; gener ally composed of silts, sands, and or ganics.

Ft — **Fluvial sediments; terrace:** mater ials tr ansp or ted and dep osited by str eams and usually located adjacent to moder n str eams; typically occur s as a p lanar landfor m with a consp icuous scar p along its edge; gener ally comp osed of silts, sands, and or ganics.

Cv — **Colluvial sediments; veneer:** < 1 m thick; mater ials that have been tr ansp or ted downslop e thr ough gr avitational p r ocesses including fr eeze- thaw cycles, cr eep , solifluction, slop ewash and active-layer detachments; dep osit r oughly follows the sur face of the under lying bedr ock and is too thin to mask r r egular ities; gener ally comp osed of silts, sands, and gr avels; may locally include lar ger clasts.

Cb — **Colluvial sediments; blanket:** > 1 m thick; mater ials that have been tr ansp or ted downslop e thr ough gr avitational p r ocesses including fr eeze- thaw cycles, cr eep , solifluction, slop ewash and active-layer detachments; dep osit r oughly follows the sur face of the under lying bedr ock and is thick enough to mask minor ir r egular ities; gener ally comp osed of silts, sands, and gr avels; may locally include lar ger clasts.

Cw — **Colluvial sediments; mantle of variable thickness:** typically 0 - 3 m thick; mater ials that have been tr ansp or ted downslop e thr ough gr avitational p r ocesses including fr eeze- thaw cycles, cr eep , solifluction, slop ewash and active- layer detachments; a layer or discontinuous layer that r oughly follows the sur face of exp r ession of under lying bedr ock and fills or p ar tly fills dep r essions in an ir r egular substrate; comp osed of silts, sands, and gr avels; may locally include lar ger clasts.

Ca — **Colluvial sediments; apron:** < 1 m thick; mater ials that have been tr ansp or ted downslop e thr ough gr avitational p r ocesses including fr eeze- thaw cycles, cr eep , solifluction, slop ewash and active-layer detachments; wedge- shap ed landfor ms occur r ing on lower slop e p ositions wher e sediments accumulate; may be locally inter mixed with fluvial dep osits; gener ally comp osed of silts, sands, and gr avels; locally include lar ger clasts and or ganics.

Dv — **Bedrock, undifferentiated, weathered:** extensively weather ed mater ials der ived dir ectly fr om under lying bedr ock without significant tr ansp or tation; typically occur s on r ounded summits and along br oad and sp ur s; gener ally comp osed of silt, sand, and gr avel- sized r egolith.

R — **Bedrock, undifferentiated:** moder ate- to high- r elief sur face exp r ession; typically exp osed in bluffs along r idges and in up p er slop e p ositions, in association with differential er osion of differ ent sedimentary typically gr adational to weather ed bedr ock.

TEXTURE*

f - Matr ix- dominated: dep osit is comp osed near ly entir ely of silts and clays, with minor sand.

m - Matr ix- sup p or ted: dep osit is a matr ix- sup p or ted mixtur e of gr avels, sands, silts, and minor clay.

c - Clast- sup p or ted: dep osit is a clast- r ich mixtur e of gr avels, sands, and minor silts.

**Texture classes are applied to colluvium and weathered bedrock. Textures for other materials are characterized above in association with the landform definitions.*

GEOMORPHOLOGICAL PROCESSES

I - Ir r egular ly sinuous channel: a clear ly defined main channel disp laying ir r egular meander bends.

S - Solifluction: slow, downslop e gr avitational movement of wet soil acr oss a fr ozen (e. g. p er maf ost) or impe r meable substr ate.

G - Gully er osion: for mation of sub- p ar allel, nar r ow r avines by concentr ated sur face r unoff and mass movement exacer bated by fluvio- ther mal er osion in ar eas of ice- r ich p er maf ost.

X - Permafrost Processes:

-s - Sheetwash: ar eas wher e sur face r unoff flows as diffuse sheetflow, or in concentr ated r unnels (watershallow p er maf ost.

-f - Active- layer detachment: tr anslational landslides along a shallow failur e p lane (also r efer r ed to as the typ ically r esult fr om the loss of str ength at the contact between thawed (above) and fr ozen (below) mp lane may be within or at base of active layer over lying p er maf ost.

-t - Ther mokar st subsidence: gr ound- sur face dep r essions cr eated by the thawing of ice- r ich p er maf ost soil subsidence; dep r essions commonly contain water (thaw p ond) ; may be map p ed as a lake in the base map p ing.

-w - P atter ned gr ound: p olygonal sur face exp r ession of ice wedges in p er maf ost ter r ain; commonly ther mokar st.

TERRAIN LABEL

TERRAIN COMPONENT DELIMITER

TERRAIN COMPONENT 1 / TERRAIN COMPONENT 2

mCv / cDv-Xf ← GEOMORPHOLOGICAL PROCESS(ES) (- X = per maf ost)

SUBCLASS(ES) (k = sheetwash, f = active- layer detachment)

TEXTURE 1 (m = matr ix- sup p or ted) / TEXTURE 2 (m = matr ix- sup p or ted)

SURFICIAL MATERIAL 1 (C = colluvial) / SURFICIAL MATERIAL 2 (D = Weather ed Bedr

SURFACE EXPRESSION 1 (v = veneer) / SURFACE EXPRESSION 2 (v = veneer)

COMPOSITE SYMBOL DELIMETERS:

/ Primary unit is more extensive than secondary unit

// Primary unit is much more extensive than secondary unit

\ Primary unit overlies secondary unit

ONSITE SYMBOLS

- × Bedrock outcrop ; minor
- Thermokarst subsidence
- ---→ Active- layer detachment
- Highway / Road
- Water course
- Water body
- Air strip
- Study area boundary

PERMAFROST CLASSIFICATION OVERLAY		ESTIMATED RELATIVE ICE CONTENT		
		Ice-poor: little to no excess ice; discontinuous to continuous pore ice; locally include segregated ice in thin seams; most ice unlikely; most common condition in the study area	**Ice-moderate:** moderate amount of excess ice; continuous to continuous pore ice; locally included segregated ice widespread in seams and lenses; massive ice possible locally.	**Ice-rich:** large amount of excess ice; continuous segregated ice; extensive in seams and lenses; massive ice indicated (Xm) , or likely.
ESTIMATED RELATIVE DEPTH	**Near-surface:** < 0 . 4 m; within or at the base of organics.	Typically at surface		
	Shallow: 0 . 4 - 1 m; relatively fine- grained, sup p or ted to matr ix- dominated sediments; most common condition in the study area.	Commonly in matr ix- dominated sediments		
	Deep: > 1 m; typically relatively coar se- gr ained, sup p or ted sediments.	Within Ubds		

** Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.*
*** Depth to permafrost and ice content classes are relative and inferred based on landform association with reference to limited field observations and secondary source information.*

Mapping Notes

Surficial geology mapping was completed at a scale of 1:20,000 using DAT/EM Summit software in combination with ESRI's ArcGIS. Interpretations were made based on continuous coverage of satellite imagery (2019) and aerial photographs, and further refined using 1 m- resolution, LiDAR-derived (2019). Map units (polygons) were delineated based on surficial materials, expressions, active processes, and surface or ainage in accordance with the Terrain Classification System for British Columbia (Howes and Kenk, 1997), with modifications for use in Yukon (Lipovsky and Bond, 2014) and to accommodate objectives. Under this system, up to two surficial materials may be identified in each polygon as either secondary material, or in strat igraphic relation to each other. Polygons have been symbolized based on surficial material, Discrete terrain features and geomorphic processes too small to be mapped as polygons (either mokarst depressions and active- layer detachments, have been identified using point and line features. Interpretations were calibrated, in part, based on one week of helicopter- supported field reconnaissance in July, 2015.

Refer ences:

Howes, D. E. and Kenk, E., 1997. Terrain Classification System for British Columbia (Version 2). Columbia, Resource Inventory Branch, Ministry of Environment, Lands and Parks; Recreational Fisheries Branch, Ministry of Environment; and Surveys and Resources Mapping Branch, Ministry of Crown Lands, 102 p.

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C 1	C 2	C 3
D 1	D 2	D 3
	E 1	E 2

Surficial Geology and Permafrost Classification

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2
kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

Geology by: C. McGregor, D. Cronmiller, R. McKillop, C. Knox, and B. Janzen
Cartography by: B. Elder

Print size is 32 x 45 inches
January 2021

LiDAR-derived hillshade basemapping (2019) provided by Chance Oil and Gas Limited.

Additional surrounding hillshade provided by Esri basemap service.

1:50 000 scale topographic base data produced by CENTRE FOR TOPOGRAPHIC INFORMATION, NATURAL RESOURCES CANADA

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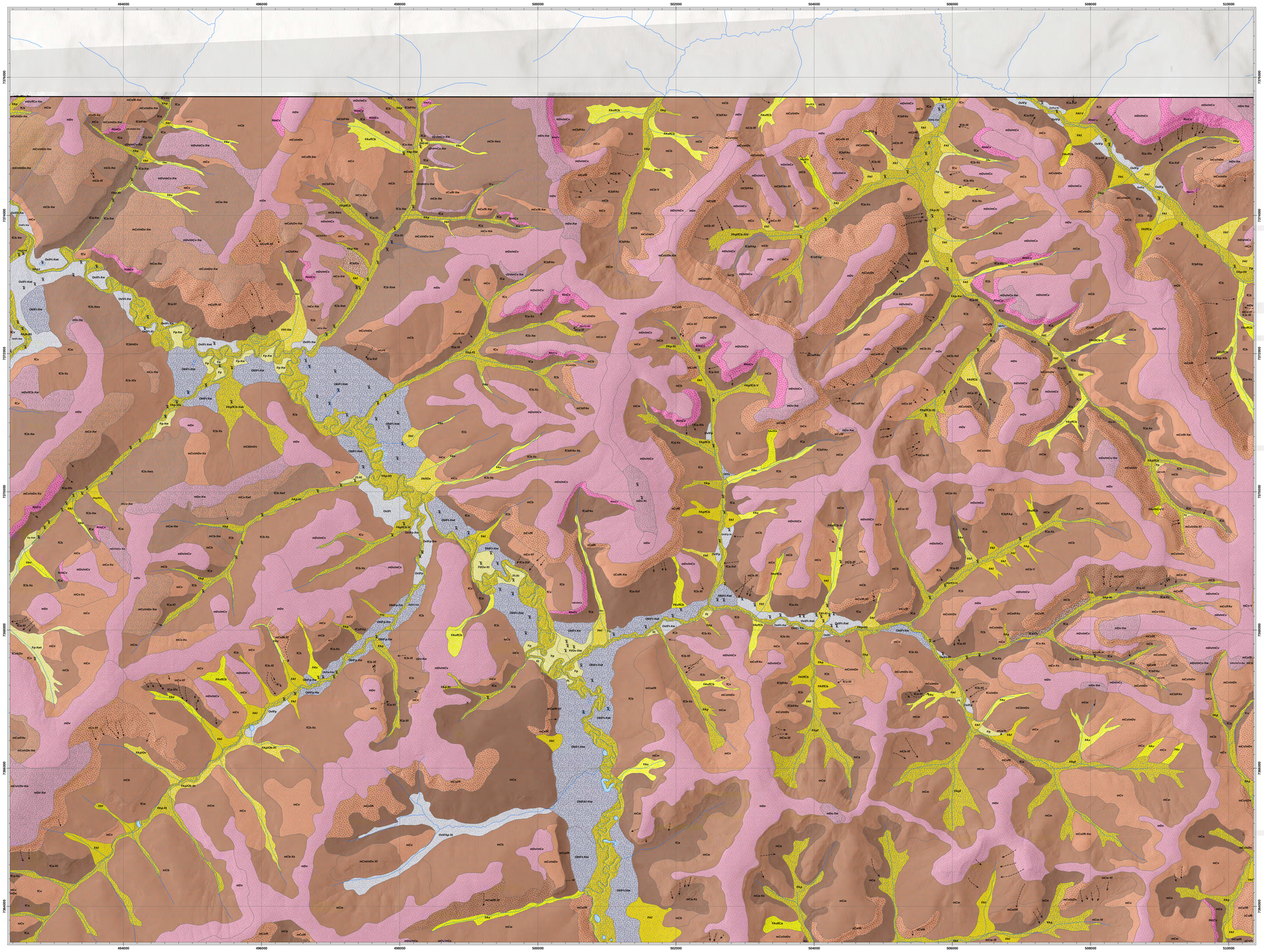

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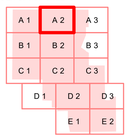

Surficial Geology and Permafrost Classification

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

SURFICIAL MATERIAL AND LANDFORM DEFINITIONS

A — **Anthropogenic deposits:** surficial materials modified by human activities such that their original physical properties have been significantly altered, applied to areas modified by excavation and construction activities; not applied to road networks.

Ov — **Organic deposits; veneer:** < 1 m thick; material ldeived from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions; only included in map labels where accumulation is thicker than 20 cm.

Ob — **Organic deposits; blanket:** > 1 m thick; material lderived from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions.

FAv — **Fluvial sediments; active veneer:** < 1 m thick; material lal transported and deposited by streams typically exhibiting intermittent or perennial flow; mainly occurs on gentle slopes within gullies at the headwaters of moderate streams; generally composed of silt, organics, and minor sands.

FAf — **Fluvial sediments; active fan:** material lal transported and deposited by streams; typically occurs where fluvial systems meet lal gentle, lower angle river systems and deposited material lals; longitudinal profile of slightly concave to slightly convex; generally composed of silt, sands, and organics.

FAp — **Fluvial sediments; active plain:** material lals transported and deposited by moderate streams; typically planar to gently sloping landforms along valley bottoms; generally composed of silt and sand on floodplains and gravels along active channels and bars.

Fp — **Fluvial sediments; active plain:** material lals transported and deposited by streams in the floodplains above moderate channels; typically planar to gently sloping landforms along valley bottoms; generally composed of silts, sands, and organics.

Ft — **Fluvial sediments; terrace:** material lals transported and deposited by streams and usually located adjacent to moderate streams; typically occurs as a planar landform with a conspicuous scarp along edge; generally composed of silts, sands, and organics.

Cv — **Colluvial sediments; veneer:** < 1 m thick; material lals that have been transported and deposited by gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; deposits roughly follows the surface of the underlying bedrock and is too thin to mask irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.

Cb — **Colluvial sediments; blanket:** > 1 m thick; material lals that have been transported and deposited by gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; deposits roughly follows the surface of the underlying bedrock and is too thick enough to mask irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.

Cw — **Colluvial sediments; mantle of variable thickness:** typically 0 - 3 m thick; material lals that have been transported and deposited by gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; a layer or discontinuous layer that roughly follows the expression of underlying bedrock and fills or partly fills depressions in an irregular substrate; composed of silts, sands, and gravels; may locally include larger clasts.

Ca — **Colluvial sediments; apron:** < 1 m thick; material lals that have been transported and deposited by gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; wedge-shaped landforms occurring on lower slopes positions where sediments accumulate; may be locally intermixed with fluvial deposits; generally composed of silts, sands, and gravels; locally include larger clasts and organics.

Dv — **Bedrock, undifferentiated, weathered:** extensively weathered materials deformed by tectonic forces; typically exposed in bluffs along ridges and in upper slopepositions, in association with differential erosion of different sedimentary units; typically gravitational to weathered bedrock.

R — **Bedrock, undifferentiated:** moderate-to high-relief surface exposition; typically exposed in bluffs along ridges and in upper slopepositions, in association with differential erosion of different sedimentary units; typically gravitational to weathered bedrock.

TEXTURE*

f - Matrix-dominated: deposit is composed nearly entirely of silts and clays, with minor sand.

m - Matrix-supported: deposit is a matrix-supported mixture of gravels, sands, silts, and minor clay.

c - Clast-supported: deposit is a clast-rich mixture of gravels, sands, and minor silts.

*Texture classes are applied to colluvium and weathered bedrock. Textures for other materials are characterized above in association with the landform definitions.

GEOMORPHOLOGICAL PROCESSES

I - Irregularly sinuous channel: a clearly defined main channel displaying irregular meanders bends.

S - Solifluction: slow, downslope gravitational movement of wet soil across a frozen (e.g. permafrost) impermeable substrate.

G - Gully erosion: formation of sub-parallel, narrow ravines by concentrated surface runoff and mass wasting exacerbated by fluvio-thermal erosion in areas of ice-rich permafrost.

X - Permafrost Processes:

-s - Sheetwash: areas where surface runoff flows as diffuse sheetflow, or in concentrated runnels (watertracks) shallow permafrost.

-f - Active-layer detachment: translational landslides along a shallow failure plane (also referred to as the typically result from the loss of strength at the contact between thawed (above) and frozen (below) material; plane may be within or at base of active layer overlying permafrost.

-t - Thermokarst subsidence: ground-surface depressions created by the thawing of ice-rich permafrost soil subsidence; depressions commonly contain water (thaw pond); may be mapped as a lake in the base mapping.

-w - Patterned ground: polygonal surface expression of ice wedges in permafrost terrain; commonly thermokarst.

TERRAIN LABEL

TERRAIN COMPONENT DELIMITER

TERRAIN COMPONENT 1 / TERRAIN COMPONENT 2

mCv / cDv-Xf ← GEOMORPHOLOGICAL PROCESS(ES) (- X = permafrost)

SUBCLASS(ES) (s = sheetwash, f = active-layer detachment)

TEXTURE 1 (m = matrix-supported or clast) SURFICIAL MATERIAL 1 (C = colluvial) SURFACE EXPRESSION 1 (v = veneer)

TEXTURE 2 (m = matrix-supported) SURFICIAL MATERIAL 2 (D = Weathered Bedrock) SURFACE EXPRESSION 2 (v = veneer)

COMPOSITE SYMBOL DELIMETERS:

/ Primary unit is more extensive than secondary unit

// Primary unit is much more extensive than secondary unit

\ Primary unit overlies secondary unit

ONSITE SYMBOLS

× Bedrock outcrop; minor

Thermokarst subsidence

A ctive-layer detachment

Highway / Road

Water course

Water body

Airstrip

Study area boundary

PERMAFROST CLASSIFICATION OVERLAY		ESTIMATED RELATIVE ICE CONTENT		
		Ice-poor: little to no excess ice; discontinuous continuous pore ice; locally include segregated ice in thin seams, ice unlikely; most common condition in the study area	**Ice-moderate:** moderate amount of excess continuous pore ice; segregated ice widespread in seams and lenses; massive ice (e.g.) possible locally	**Ice-rich:** large amount of excess ice; continuous ice; segregated ice extensive in seams and lenses; massive indicated (Xw), or likely (Xi), or likely
ESTIMATED RELATIVE DEPTH	**Near-surface:** < 0.4 m; within or at the base of organics.	typically surface		
	Shallow: 0.4 - 1 m; relatively fine-grained, supported to matrix-dominated sediments; massive ice common	commonly in matrix-dominated sediments		
	Deep: > 1 m, typically relatively coarse-grained, supported sediments.	within Upland		

* Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.
** Depth to permafrost and ice content classes are relative and inferred based on landform association with reference to limited field observations and secondary source information.

Mapping Notes

Surficial geology mapping was completed at a scale of 1:20,000 using DAT/EM Summit software in combination with ESRI's ArcGIS. Interpretations were made based on continuous coverage of satellite imagery (2019) and aerial photographs, and further refined using LiDAR-derived (2019). Map units (polygons) were delineated based on surficial materials, exposures, active processes, and surface drainage in accordance with the Terrain Classification System for British Columbia (Howes and Kenk, 1997), with modifications for use in Yukon (Lipovsky and Bond, 2014) and to accommodate objectives. Under this system, up to two surficial material ials may be identified in each polygon as either secondary material, or in stratigraphic relation to each other. Polygons have been symbolized based on surficial material. Discrete terrain features and geomorphic processes too small to be mapped as polygons, ther mokarst depressions and active-layer detachments, have been identified using point and line features. Imagery were calibrated, in part, based on one week of helicopter-supported field reconnaissance in July, 2019.

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1:50 000 scale topographic base data produced by CENTRE FOR TOPOGRAPHIC INFORMATION, NATURAL RESOURCES CANADA

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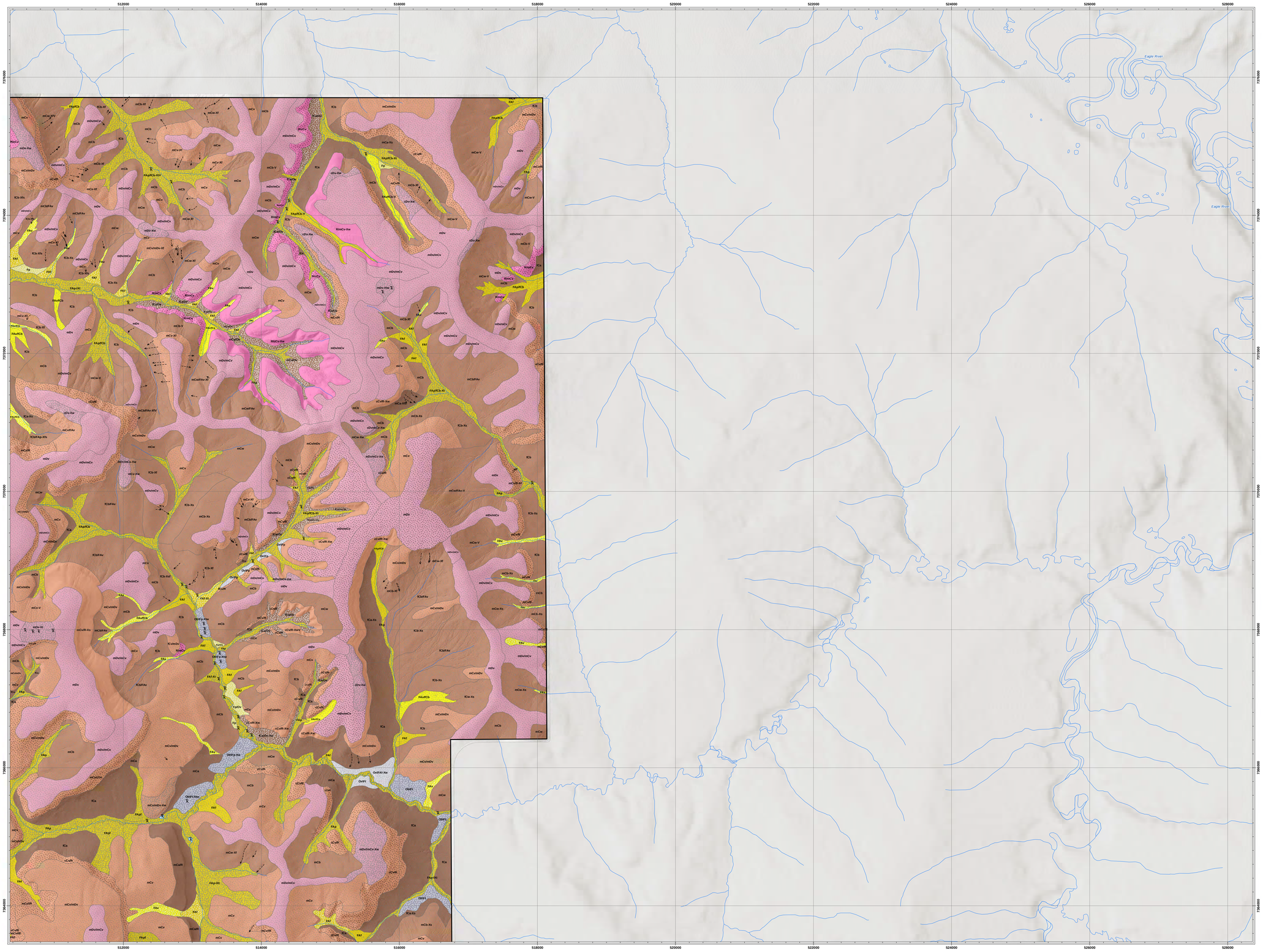

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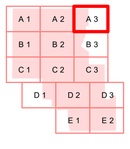

Surficial Geology and Permafrost Classification

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

SURFICIAL MATERIAL AND LANDFORM DEFINITIONS

A — **Anthropogenic deposits:** surficial materials modified by human activities such that their original physical properties have been significantly altered, applied to areas modified by excavation and construction activities; not applied to road network.

Ov — **Organic deposits; veneer:** < 1 m thick; material ldeveloped from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions; only included in map labels where accumulation is thicker than 20 cm.

Ob — **Organic deposits; blanket:** > 1 m thick; material ldeveloped from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions.

FAv — **Fluvial sediments; active veneer:** < 1 m thick; material ltransported and deposited by streams typically exhibiting intermittent or perennial flow; mainly occurs on gentle slopes within gullies at the headwall moderate streams; generally composed of silt, organics, and minor sands.

FAf — **Fluvial sediments; active fan:** material lstransported and deposited by streams; typically occurs where fluvial streams meet larger, lower angle rivers systems and deposited material lsis longitudinal fluvial from slightly concave to slightly convex; generally composed of silt, sands, and organics.

FAp — **Fluvial sediments; active plain:** material lstransported and deposited by modern streams; typically a planar to gently sloping landform mainly along valley bottoms; generally composed of silt and sand on floodplains gravels along active channels and bars.

Fp — **Fluvial sediments; active plain:** material lstransported and deposited by streams in the floodplain above modern channels; typically a planar to gently sloping landform mainly along valley bottoms; generally composed of silts, sands, and organics.

Ft — **Fluvial sediments; terrace:** material lstransported and deposited by streams and usually located adjacent to modern streams; typically occurs as a planar landform with a conspicuous scarp along edge; generally composed of silts, sands, and organics.

Cv — **Colluvial sediments; veneer:** < 1 m thick; material lthat have been transported and deposited by downslope gravitational processes including freeze-thaw cycles, creep, solifluction, slope wash and active-layer detachments; deposits roughly follows the surface of the underlying bedrock and is too thin to irregularities; generally composed of silts, sands, and gravels; may locally include large clasts.

Cb — **Colluvial sediments; blanket:** > 1 m thick; material lthat have been transported and deposited by downslope gravitational processes including freeze-thaw cycles, creep, solifluction, slope wash and active-layer detachments; deposits roughly follows the surface of the underlying bedrock and is thick enough to minor irregularities; generally composed of silts, sands, and gravels; may locally include large clasts.

Cw — **Colluvial sediments; mantle of variable thickness:** typically 0 - 3 m thick; material lthat have been transported and deposited by downslope gravitational processes including freeze-thaw cycles, creep, solifluction, slope wash and active-layer detachments; a layer or discontinuous layer that roughly follows the surface expression of underlying bedrock and fills or partially fills depressions in an irregular substrate; composed of silts, sands, and gravels; may locally include large clasts.

Ca — **Colluvial sediments; apron:** < 1 m thick; material lthat have been transported and deposited by downslope gravitational processes including freeze-thaw cycles, creep, solifluction, slope wash and active-layer detachments; wedge-shaped landforms occurring on lower slope positions where sediments accumulate; may be locally inter mixed with fluvial deposits; generally composed of silts, sands, and gravels; locally include large clasts and organics.

Dv — **Bedrock, undifferentiated, weathered:** extensively weathered material lsderived directly from underlying bedrock without significant transportation; typically occurs on rounded summits and along broad and subdued; generally composed of silt, sand, and gravel-sized fragments.

R — **Bedrock, undifferentiated:** moderate- to high-relief surface exposition; typically exposed in bluffs along ridges and in upper slope positions, in association with different erosion of different sedimentary typically gravitational to weather bedrock.

TEXTURE*

f - Matrix-dominated: deposits composed nearly entirely of silts and clays, with minor sand.

m - Matrix-supported: deposits is a matrix-supported mixture of gravels, sands, silts, and minor clay

c - Clast-supported: deposits is a clast-rich mixture of gravels, sands, and minor silts.

*Texture classes are applied to colluvium and weathered bedrock. Textures for other materials are characterized above in association with the landform definitions.

GEOMORPHOLOGICAL PROCESSES

I - Irregularly sinuous channel: a clearly defined main channel displaying irregular meander bends.

S - Solifluction: slow, downslope gravitational movement of wet soil across a frozen (e.g. permafrost) impermeable substrate.

G - Gully erosion: formation of sub-parallel, narrow ravines by concentrated surface runoff and mass exacerbated by fluvio-thermal erosion in areas of ice-rich permafrost.

X - Permafrost Processes:

-s - Sheetwash: areas where surface runoff flows as diffuse sheetflow, or in concentrated runnels (watershallow permafrost.

-f - Active-layer detachment: translational landslides along a shallow failure plane (also referred to as thetypically resulting from the loss of strength at the contact between thawed (above) and frozen (belowplane may be within or at base of active layer overlying permafrost.

-t - Thermokarst subsidence: ground-surface depressions created by the thawing of ice-rich permafrost orsoil subsidence; depressions commonly contain water (thaw pond); may be mapped as a lake in thebase mapping.

-w - Patterned ground: polygonal surface expression of ice wedges in permafrost terrain; commonlythermokarst.

TERRAIN LABEL

TERRAIN COMPONENT DELIMITER

TERRAIN COMPONENT 1 / TERRAIN COMPONENT 2

mCv / cDv-Xf ← GEOMORPHOLOGICAL PROCESS(ES) (- X = permafrost)

↑↑↑↑ SUBCLASS(ES) (k = sheetwash, f = active-layer detachment)

TEXTURE 1 (m = matrix-sup p or ted) ← TEXTURE 2 (m = matrix-sup p or ted)

SURFICIAL MATERIAL 1 (C = colluvial) ← SURFICIAL MATERIAL 2 (D = Weathered Bedrock)

SURFACE EXPRESSION 1 (v = veneer) ← SURFACE EXPRESSION 2 (v = veneer)

COMPOSITE SYMBOL DELIMETERS:

/ Primary unit is more extensive than secondary unit

// Primary unit is much more extensive than secondary unit

\ Primary unit overlies secondary unit

ONSITE SYMBOLS

- × Bedrock outcrop; minor
- Thermokarst subsidence
- ---→ Active-layer detachment
- Highway / Road
- Water course
- Water body
- Air strip
- Study area boundary

PERMAFROST CLASSIFICATION OVERLAY

ESTIMATED RELATIVE DEPTH	ESTIMATED RELATIVE ICE CONTENT		
	Ice-poor: little to no excess ice; discontinuous to continuous pore ice; locally include segregated ice in thin seams; ice unlikely; most condition in the study area	**Ice-moderate:** moderately amount of excess ice; continuous pore ice segregated ice widespread; massive ice (i.e. ice wedges) locally.	**Ice-rich:** large amount of excess ice; continuous to discontinuous segregated ice; extensive in seams and lenses; massive ice indicated (Xm), otherwise likely.
Near-surface: < 0.4 m; within or at the base of organics.	typically at surface		
Shallow: 0.4 - 1 m; relatively fine-grained, supported by matrix-dominated sediments; most common condition in the study area	commonly in matrix-supported		
Deep: > 1 m; typically relatively coarse-grained, supported sediments.	within clasts		

* Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.
** Depth to permafrost and ice content classes are relative and inferred based on landform association with reference to limited field observations and secondary source information.

Mapping Notes

Surficial geology mapping was completed at a scale of 1:20,000 using DAT/EM Summit software in combination with ESRI's ArcGIS. Interpretations were made based on continuous cover aspects of satellite imagery (2019) and aerial photographs, and further refined using 1m-resolution, LiDAR-(2019). Map units (polygons) were delineated based on surficial materials, expressions, active processes, and surface drainage in accordance with the Terrain Classification System for British Columbia Kenk, 1997), with modifications for use in Yukon (Lipovsky and Bond, 2014) and to accommodate objectives. Under this system, up to two surficial materials may be identified in each polygon as either secondary material, or in staligraphic relation to each other. Polygons have been symbolized based on surficial material and landform features and geomorphic processes too small to be mapped as polygons (thermokarst depressions and active-layer detachments, have been identified using point and line features. Information were calibrated, in part, based on one week of helicopter-supported field reconnaissance in July, 2019.

References

Howes, D.E. and Kenk, E., 1997. Terrain Classification System for British Columbia (Version 2). Columbia, Resource Inventory Branch, Ministry of Environment, Lands and Parks; Resource Evaluation Ministry of Environment; and Surveys and Resources Mapping Branch, Ministry of Crown Lands, 102

Lipovsky, P.S. and Bond, J.D. (compiler(s)), 2014. Yukon digital surficial geology compilation, 2014. Yukon Geological Survey.



Geology by: C. McGregor, D. Cronmiller, R. McKillop, C. Knox, and B. Janzen
Cartography by: B. Elder

Print size is 32 x 45 inches
January 2021

LiDAR-derived hillshade basemapping (2019) provided by Chance Oil and Gas Limited.

Additional surrounding hillshade provided by Esri basemap service.

1:50 000 scale topographic base data produced by CENTRE FOR TOPOGRAPHIC INFORMATION, NATURAL RESOURCES CANADA

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Surficial Geology and Permafrost Classification

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

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SURFICIAL MATERIAL AND LANDFORM DEFINITIONS

A — **Anthropogenic deposits:** surficial materials modified by human activities such that their original physical properties have been significantly altered, and applied to areas modified by excavation and construction activities; not applied to road network.

Ov — **Organic deposits; veneer:** < 1 m thick; material lderived from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions; only included in map labels where accumulation is thicker than 20 cm.

Ob — **Organic deposits; blanket:** > 1 m thick; material lderived from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions.

FAv — **Fluvial sediments; active veneer:** < 1 m thick; material ltransported and deposited by streams typically exhibiting intermittent or perennial flow; mainly occurs on gentle slopes within gullies at the headwaters of modern streams; generally composed of silt, organics, and minor sands.

FAf — **Fluvial sediments; active fan:** materials transported and deposited by streams; typically occurs where fluvial systems meet lar ger, lower angle river systems and deposit material as; longitudinal piles from slightly concave to slightly convex; generally composed of silt, sands, and organics.

FAp — **Fluvial sediments; active plain:** materials transported and deposited by modern streams; typically plains to gently sloping landforms along valley bottoms; generally composed of silt and sand on floodplains and gravels along active channels and bars.

Fp — **Fluvial sediments; active plain:** materials transported and deposited by streams in the floodplain above modern channels; typically planar to gently sloping landforms along valley bottoms; generally composed of silts, sands, and organics.

Ft — **Fluvial sediments; terrace:** materials transported and deposited by streams and usually located adjacent to modern streams; typically occurs as a planar landform with a conspicuous scarp along edge; generally composed of silts, sands, and organics.

Cv — **Colluvial sediments; veneer:** < 1 m thick; material that have been transported and deposited by gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; deposit roughly follows the surface of the underlying bedrock and is too thin to mirror irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.

Cb — **Colluvial sediments; blanket:** > 1 m thick; material that have been transported and deposited by gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; deposit roughly follows the surface of the underlying bedrock and is thick enough to mirror irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.

Cw — **Colluvial sediments; mantle of variable thickness:** typically 0 - 3 m thick; material that have been transported and deposited by gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; a layer or discontinuous layer that roughly follows the expression of underlying bedrock and fills or partly fills depressions in an irregular substrate; composed of silts, sands, and gravels; may locally include larger clasts.

Ca — **Colluvial sediments; apron:** < 1 m thick; material that have been transported and deposited by gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; wedge-shaped landforms occurring on lower slope positions where sediments accumulate; may be locally inter mixed with fluvial deposits; generally composed of silts, sands, and gravels; locally include larger clasts and organics.

Dv — **Bedrock, undifferentiated, weathered:** extensively weathered materials derived directly from underlying bedrock without significant transportation; typically occurs on rounded summits and along broad and upland slopes; generally composed of silt, sand, and gravel- sized fragments.

R — **Bedrock, undifferentiated:** moderate- to high-relief surface exposition; typically exposed in bluffs along ridges and in upper slope positions, in association with differential erosion of different sedimentary and typically gradational to weather red bedrock.

TEXTURE*

f - Matrix- dominated: deposits composed nearly entirely of silts and clays, with minor sand.

m - Matrix- supported: deposits is a matrix- supported mixture of gravels, sands, silts, and minor clays.

c - Clast- supported: deposits is a clast- rich mixture of gravels, sands, and minor silts.

*Texture classes are applied to colluvium and weathered bedrock. Textures for other materials are characterized above in association with the landform definitions.

GEOMORPHOLOGICAL PROCESSES

I - Irregularly sinuous channel: a clearly defined main channel displaying irregular meanders bends.

S - Solifluction: slow, downslope gravitational movement of wet soil across a frozen (e.g. permafrost) impermeable substrate.

G - Gully erosion: formation of sub-parallel, narrow ravines by concentrated surface runoff and mass exacerbated by fluvio- thermal erosion in areas of ice- rich permafrost.

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-t - Thermokarst subsidence: ground- surface depressions created by the thawing of ice- rich permafrost soil subsidence; depressions commonly contain water (thaw ponds); may be mapped as a lake in the base mapping.

-w - Patterned ground: polygonal surface expression of ice wedges in permafrost terrain; commonly thermokarst.

TERRAIN LABEL

TERRAIN COMPONENT DELIMITER

TERRAIN COMPONENT 1 — TERRAIN COMPONENT 2

mCv / cDv-Xf ← GEOMORPHOLOGICAL PROCESS(ES) (- X = permafrost)

SUBCLASS(ES) (s = sheetwash, f = active- layer detachment)

TEXTURE 1 (m = matrix- supported) — TEXTURE 2 (m = matrix- supported)

SURFICIAL MATERIAL 1 (C = colluvial) — SURFICIAL MATERIAL 2 (D = Weathered Bedrock)

SURFACE EXPRESSION 1 (v = veneer) — SURFACE EXPRESSION 2 (v = veneer)

COMPOSITE SYMBOL DELIMETERS:

/ Primary unit is more extensive than secondary unit

// Primary unit is much more extensive than secondary unit

\ Primary unit overlies secondary unit

ONSITE SYMBOLS

- Bedrock outcrop; minor
- Thermokarst subsidence
- Active- layer detachment
- Highway / Road
- Water course
- Water body
- Aerstrip
- Study area boundary

PERMAFROST CLASSIFICATION OVERLAY		ESTIMATED RELATIVE ICE CONTENT		
		Ice-poor: little to no excess ice; discontinuous to continuous pore ice; locally include segregated ice within seams; condition in the study area possible locally.	**Ice-moderate:** moderate amount of excess continuous pore ice; segregated ice widespread and seams; moderate ice potential.	**Ice-rich:** large amount of excess ice; continuous pore ice; segregated ice extensive in seams and lenses; massive ice identified (> 10 m thick).
ESTIMATED RELATIVE DEPTH	**Near-surface:** < 0.4 m; within or at the base of organics.	typically at surface		
	Shallow: 0.4 - 1 m; relatively fine- grained, sup ported to matrix- dominated sediments; most common condition in the study area.	commonly in matrix dominated sediments		
	Deep: > 1 m; typically relatively coarse- grained, sup ported sediments.	subsurface units		

*Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.

**Depth to permafrost and ice content classes are relative and inferred based on landform association with reference to limited field observations and secondary source information.

Mapping Notes

Surficial geology mapping was compiled at a scale of 1:20,000 using DAT/EM Summit software e in combination with ESRI's ArcGIS. Interpretations were made based on continuous coverage of satellite imagery (2019) and aerial photographs, and further refined using 1m- resolution, LiDAR-(2019). Mapunits (polygons) were delineated based on surficial material ids, exposures, active processes, and surface drainage in accordance with the Terrain Classification System for British Columbia Kenk, 1997, with modifications for use in Yukon (Lipovsky and Bond, 2014) and to accommodate objectives. Under this system, up to two surficial materials may be identified in each polygon as either secondary material, or in strigaphic relation to each other. Polygons have been symbolized based on surficial material, disconnected terrain features and geomorphic processes too small to be mapped as polygons, ther mokarst depressions and active- layer detachments, have been identified using point and line features. In were calibrated, in part, based on one week of helicopter- supported field reconnaissance in July, 2018

Refer ences:

Howes, D.E. and Kenk, E., 1997. Terrain Classification System for British Columbia (Version Columbia, Resource Inventory Branch, Ministry of Environment, Lands and Parks; Recreational Fish Ministry of Environment; and Surveys and Resources Mapping Branch, Ministry of Crown Lands, 102

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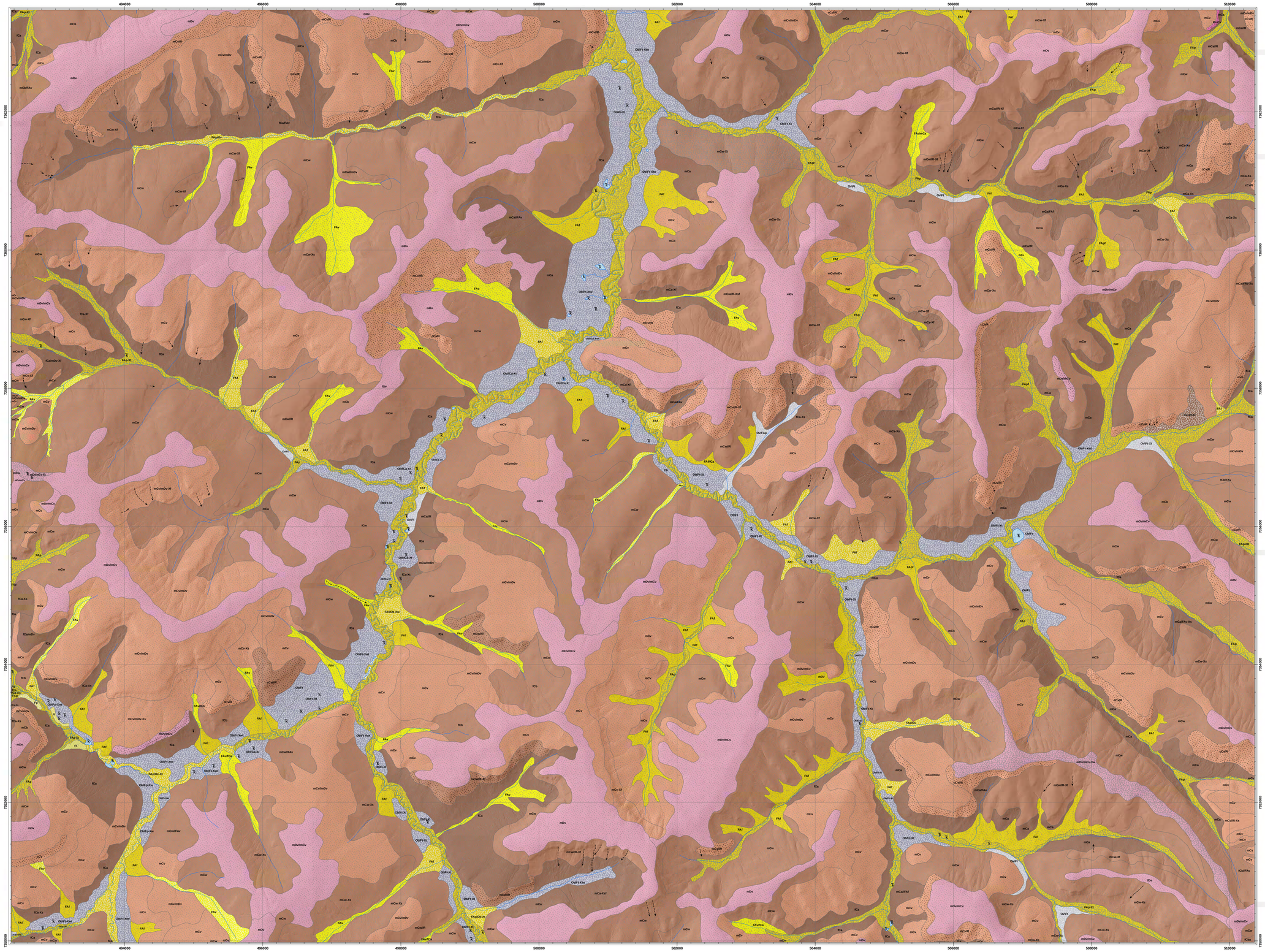

SURFICIAL MATERIAL AND LANDFORM DEFINITIONS

A	**Anthropogenic deposits:** sur ficial mater ials modified by human activities such that their or iginal p hysical p r op er ties have been significantly alter ed; ap p lied to ar eas modified by excavation and const activities; not ap p lied to r oad networ ks.
Ov	**Organic deposits; veneer:** < 1 m thick; mater ial der ived fr om the accumulation of p lant matter ... gen consisting of p eat (typ ically bog or fen) ; occur s on p oor ly dr ained, level to gently slop ing shallow dep r essions; only included in map labels wher e accumulation is thicker than 2 0 cm.
Ob	**Organic deposits; blanket:** > 1 m thick; mater ial der ived fr om the accumulation of p lant matter ... gen consisting of (typ ically bog or fen) ; occur s on p oor ly dr ained, level to gently slop ing shallow dep r essions.
FAv	**Fluvial sediments; active veneer:** < 1 m thick; mater ial tr ansp or ted and dep osited by str eams typ ica exhibiting inter mittent or p er ennial flow; mainly occur s on gentle slop es within gullies at the heade moder n str eams; gener ally comp osed of silt, or ganics, and minor sands.
FAf	**Fluvial sediments; active fan:** mater ials tr ansp or ted and dep osited by str eams; typ ically occur s wher tr ibutar y str eams meet lar ger, lower angle r iver systems and dep osit mater ials; longitudinal p fr om slightly concave to slightly convex; gener ally comp osed of silt, sands, and or ganics.
FAp	**Fluvial sediments; active plain:** mater ials tr ansp or ted and dep osited by moder n str eams; typ ically p lana to gently slop ing landfor ms along valley bottoms; gener ally comp osed of silt and sand on flood plain gr avels along active channels and bar s.
Fp	**Fluvial sediments; active plain:** mater ials tr ansp or ted and dep osited by str eams in the floodp lain above moder n channels; typ ically p lanar to gently slop ing landfor ms along valley bottoms; gener ally comp silts, sands, and or ganics.
Ft	**Fluvial sediments; terrace:** mater ials tr ansp or ted and dep osited by str eams and usually located adjacent to moder n str eams; typ ically occur s as a p lanar landfor m with a consp icuous scar p along edge; gener ally comp osed of silts, sands, and or ganics.
Cv	**Colluvial sediments; veneer:** < 1 m thick; mater ials that have been tr ansp or ted downslop e thr oug gr avitational p r ocesses including fr eeze- thaw cycles, cr eep, solifluction, slop ewash and active detachments; dep osit r oughly follows the sur face of the under lying bedr ock and is too thin ir r egular dies; gener ally comp osed of silts, sands, and gr avels; may locally include lar ger clasts.
Cb	**Colluvial sediments; blanket:** > 1 m thick; mater ials that have been tr ansp or ted downslop e thr oug gr avitational p r ocesses including fr eeze- thaw cycles, cr eep, solifluction, slop ewash and active detachments; dep osit r oughly follows the sur face of the under lying bedr ock and is too thick enough to mirr ir r egular dies; gener ally comp osed of silts, sands, and gr avels; may locally include lar ger clasts.
Cw	**Colluvial sediments; mantle of variable thickness:** typ ically 0 - 3 m thick; mater ials that have been tr ansp or ted downslop e thr ough gr avitational p r ocesses including fr eeze- thaw cycles, cr eep, so slop ewash and active- layer detachments; a layer or discontinuous layer that r oughly follows exp r ession of under lying bedr ock and fills or p ar tly fills dep r essions in an ir r egular substr comp osed of silts, sands, and gr avels; may locally include lar ger clasts.
Ca	**Colluvial sediments; apron:** < 1 m thick; mater ials that have been tr ansp or ted downslop e thr oug gr avitational p r ocesses including fr eeze- thaw cycles, cr eep, solifluction, slop ewash and active detachments; wedge- shap ed landfor ms occur r ing on lower slop e p ositions wher e sediments accumu may be locally inter mixed with fluvial dep osits; gener ally comp osed of silts, sands, and gr ave locally include lar ger clasts and or ganics.
Dv	**Bedrock, undifferentiated, weathered:** extensively weather ed mater ials der ived dir ectly fr om under lying bedr ock without significant tr ansp or tation; typ ically occur s on r ounded summits and along br oad and sp ur s; gener ally comp osed of silt, sand, and gr avel- sized f ragm ents.
R	**Bedrock, undifferentiated:** moder ate- to high- r elief sur face exp r ession; typ ically exp osed in bluffs all r idges and in up p er slop e p ositions, in association with differ ential er osion of differ ent sedimentary typ ically gr adational to weather ed bedr ock.

TEXTURE*

f - Matr ix- dominated: dep osit is comp osed near ly entir ely of silts and clays, with minor sand.

m - Matr ix- sup p or ted: dep osit is a matr ix- sup p or ted mixtur e of gr avels, sands, silts, and minor cla

c - Clast- sup p or ted: dep osit is a clast- r ich mixtur e of gr avels, sands, and minor silts.

**Texture classes are applied to colluvium and weathered bedrock. Textures for other materials are characterized above in association with the landform definitions.*

GEOMORPHOLOGICAL PROCESSES

I - Ir r egular ly sinuous channel: a clear ly defined main channel disp laying ir r egular meander bends.

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G - Gully er osion: for mation of sub- p ar allel, nar r ow r avines by concentr ated sur face r unoff and mass exacer bated by fluvio- ther mal er osion in ar eas of ice- r ich p er maft ost.

X - Permafrost Processes:

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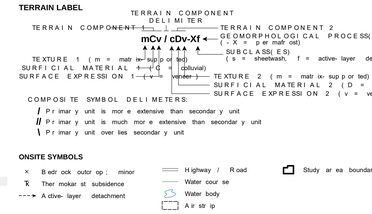
-t - Ther mokar st subsidence: gr ound- sur face dep r essions cr eated by the thawing of ice- r ich p er maft ost soil subsidence; dep r essions commonly contain water (thaw p ond) ; may be map p ed as a lake in the base map p ing.

-w - P atter ned gr ound: p olygonal sur face exp r ession of ice wedges in p er maft ost ter r ain; comm ther mokar st.

TERRAIN LABEL



COMPOSITE SYMBOL DELIMETERS:

/ Pr imar y unit is mor e extensive than secondar y unit

// Pr imar y unit is much mor e extensive than secondar y unit

\ Pr imar y unit over lies secondar y unit

ONSITE SYMBOLS

- × Bedr ock outcr op ; minor
- Ther mokar st subsidence
- A ctive- layer detachment
- Highway / Road
- Water cour se
- Water body
- Air str ip
- Study ar ea boundar y

PERMAFROST CLASSIFICATION OVERLAY		ESTIMATED RELATIVE ICE CONTENT		
		Ice-poor: little to no exc ice, discontinuous, continuous p or e spac ice in thin seams; ice unlikely; most con ice (e. g. condition in the study ar ea	**Ice-moderate:** moder ate amount of excess continuous p or e spac ice in thick seams; massive ice is p ossible locally.	**Ice-rich:** lar ge amount of excess ice, continuous p or e spac egated ice extensive seams in lenses, massive ice indicated (Xw) , inter r ed (Xi) ... or likely.
ESTIMATED RELATIVE DEPTH	**Near-surface:** < 0 . 4 m; within or at the base of or ganics.	no scally sur face		
	Shallow: 0 . 4 - 1 m; r elatively fine- gr ained, sup p or ted to matr ix- dominated sediments; most common condition in the study ar ea.	commonly en matr ix- dominated		
	Deep: > 1 m; typ ically r elatively coar se- gr ained, sup p or ted sediments.	subsur clast-		

** Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.*

*** Depth to permafrost and ice content classes are relative and inferred based on landform association with reference to limited field observations and secondary source information.*

Mapping Notes

Sur ficial geology map p ing was comp leted at a scale of 1 : 2 0 , 0 0 0 using DAT/ E M Summit soft cop y 3 - 0 softwar e in combination with E SR I 's Ar cGI S. I nter p r etations wer e made based on continuous cover age of satellite imager y (2 0 1 9) and aer ial p hotogr ap hs, and fur ther r efined using 1 m- r esolution, L I DA R - (2 0 1 9) . Map units (p olygons) wer e delineated based on sur ficial mater ials, exp r essions, active p r ocesses, and sur face dr ainage in accor dance with the Ter r ain Classification System for Br itish Columbia K enk, 1 9 9 7) , with modifications for use in Yukon (L ip ovsky and B ond, 2 0 1 4) and to accommod objectives. Under this system, up to two sur ficial mater ials may be identified in each p olygon as either secondar y mater ial, or in str atigr ap hic r elation to each other. P olygons have been symbolized based on sur ficial mater ial, dep osi tional ter r ain featur es and geomor p hic p r ocesses too small to be map p ed as p o ther mokar st dep r essions and active- layer detachments, have been identified using p oint and line featur es. I n wer e calibr ated, in p ar t, based on one week of helicop ter - sup p or ted field r econnaissance in July, 2 0 1 9

Refer ences:

Howes, D. E. and K enk, E. , 1 9 9 7 . Ter r ain Classification System for Br itish Columbia (Ver sio Columbia, Resour ce I nventor y Br anch, Ministr y of Envir onment, L ands and Par ks; Recr eational F Ministr y of Envir onment; and Sur veys and Resour ces Map p ing Br anch, Ministr y of Cr own Lands, 1 0 2

Lip ovsky, P. S. and B ond, J. D. (comp iler s) , 2 0 1 4 . Yukon digital sur ficial geology comp ilation, 2 0 1 4 , Yukon Geological Sur vey.



Geology by: C. McGr egor , D. Cr onmiller , R. McK illop , C. K nox, and B. Janzen
Car togr ap hy by: B. E ller

Pr int size is 3 2 x 4 5 inches
Januar t 2 0 2 1

LiDAR-derived hillshade basemapping (2019) provided by Chance Oil and Gas Limited.

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Surficial Geology and Permafrost Classification

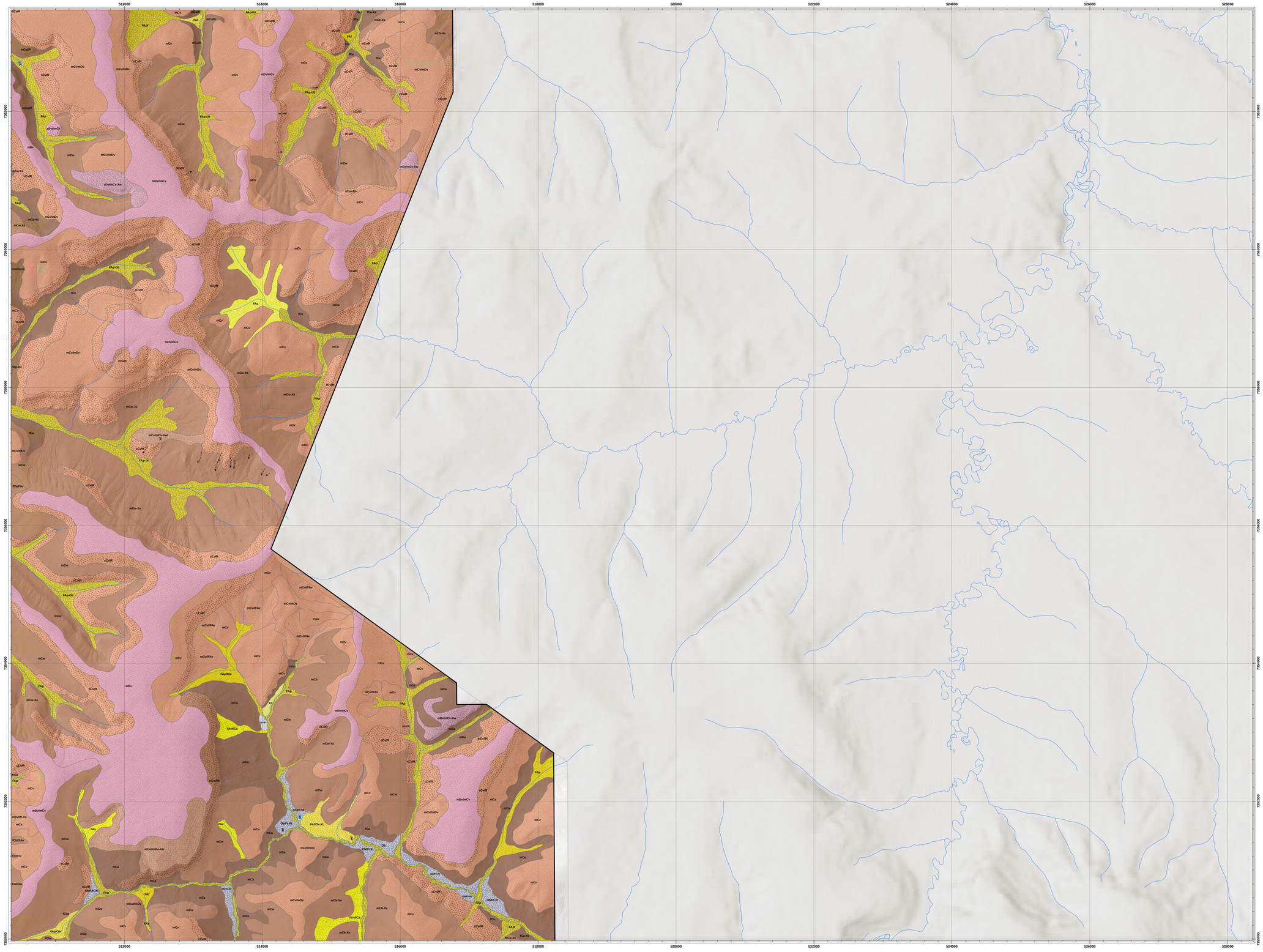
EAGLE PLAINS, YUKON

1:20 000 scale

0 0 . 5 1 1 . 5 2

kilometr es

TWO THOUSAND METRE GRID
Univer sal Tr ansver se Mer cator Pr ojection
N or th A mer ican Datum 1 9 8 3
Zone 8



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Surficial Geology and Permafrost Classification

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
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Ob — **Organic deposits; blanket:** > 1 m thick; material derived from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions.

FAv — **Fluvial sediments; active veneer:** < 1 m thick; material that transports and deposited by streams typically exhibiting intermittent or perennial flow; mainly occurs on gentle slopes within gullies at the headwaters of moderate streams; generally composed of silt, organics, and minor sands.

FAf — **Fluvial sediments; active fan:** material laid transported and deposited by streams; typically occurs where a tributary stream meets larger, lower angle river systems and deposited material; longitudinal profile of slightly concave to slightly convex; generally composed of silt, sands, and organics.

FAp — **Fluvial sediments; active plain:** material laid transported and deposited by moderate streams; typically planar to gently sloping landforms mainly along valley bottoms; generally composed of silt and sand on floodplains and gravels along active channels and bars.

Fp — **Fluvial sediments; active plain:** material laid transported and deposited by streams in the floodplain above moderate channels; typically planar to gently sloping landforms mainly along valley bottoms; generally composed of silts, sands, and organics.

Ft — **Fluvial sediments; terrace:** material laid transported and deposited by streams and usually located adjacent to moderate streams; typically occurs as a planar landform with a conspicuous scarp along edge; generally composed of silts, sands, and organics.

Cv — **Colluvial sediments; veneer:** < 1 m thick; material that have been transported downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, sloped wash and active-layer detachments; deposit roughly follows the surface of the underlying bedrock and is too thin to mask irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.

Cb — **Colluvial sediments; blanket:** > 1 m thick; material that have been transported downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, sloped wash and active-layer detachments; deposit roughly follows the surface of the underlying bedrock and is thick enough to mask minor irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.

Cw — **Colluvial sediments; mantle of variable thickness:** typically 0 - 3 m thick; material that have been transported downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, sloped wash and active-layer detachments; a layer or discontinuous layer that roughly follows the surface; may locally include larger clasts and gravels; may be locally inter mixed with fluvial deposits; generally composed of silts, sands, and gravels.

Ca — **Colluvial sediments; apron:** < 1 m thick; material that have been transported downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, sloped wash and active-layer detachments; wedge-shaped landforms occurring on lower slope positions where sediments accumulate; may be locally inter mixed with fluvial deposits; generally composed of silts, sands, and gravels; may locally include larger clasts and organics.

Dv — **Bedrock, undifferentiated, weathered:** extensively weathered material laid derived directly from underlying bedrock without significant transportation; typically occurs on rounded summits and along broad and upland surfaces; generally composed of silt, sand, and gravel-sized regolith.

R — **Bedrock, undifferentiated:** moderate- to high-relief surface exposition; typically exposed in bluffs along ridges and in upper slope positions, in association with differential erosion of different sedimentary types typically gradational to weathered bedrock.

TEXTURE*

f - Matrix-dominated: deposit is composed nearly entirely of silts and clays, with minor sand.

m - Matrix-supported: deposit is a matrix-supported mixture of gravels, sands, silts, and minor clay.

c - Clast-supported: deposit is a clast-rich mixture of gravels, sands, and minor silts.

*Texture classes are applied to colluvium and weathered bedrock. Textures for other materials are characterized above in association with the landform definitions.

GEOMORPHOLOGICAL PROCESSES

I - Irregularly sinuous channel: a clearly defined main channel displaying irregular meanders bends.

S - Solifluction: slow, downslope gravitational movement of wet soil across a frozen (e.g. permafrost) impermeable substrate.

G - Gully erosion: formation of sub-parallel, narrow rarvines by concentrated surface runoff and mass exacerbated by fluvio-thermal erosion in areas of ice-rich permafrost.

X - Permafrost Processes:

-s - Sheetwash: areas where surface runoff flows as diffuse sheetflow, or in concentrated rrunnels (watershallow permafrost.

-f - Active-layer detachment: translational landslides along a shallow failure plane (also referred to as the typically result from the loss of strength at the contact between thawed (above) and frozen (below) rplane may be within or at base of active layer overlying permafrost.

-t - Thermokarst subsidence: ground-surface depressions created by the thawing of ice-rich permafrost soil subsidence; depressions commonly contain water (thaw pond); may be mapped as a lake in the base mapping.

-w - Patterned ground: polygonal surface expression of ice wedges in permafrost terrain; commonly thermokarst.

TERRAIN LABEL

TERRAIN COMPONENT DELIMITER

TERRAIN COMPONENT 1 / TERRAIN COMPONENT 2

mCv / cDv-Xf ← GEOMORPHOLOGICAL PROCESS(ES) (-X = permafrost)

SUBCLASS(ES) (k = sheetwash, f = active-layer detachment)

TEXTURE 1 (m = matrix-supported) / TEXTURE 2 (m = matrix-supported)

SURFICIAL MATERIAL 1 (C = colluvial) / SURFICIAL MATERIAL 2 (D = Weathered Bedrock)

SURFACE EXPRESSION 1 (v = veneer) / SURFACE EXPRESSION 2 (v = veneer)

COMPOSITE SYMBOL DELIMETERS:

/ Primary unit is more extensive than secondary unit

// Primary unit is much more extensive than secondary unit

\ Primary unit overlies secondary unit

ONSITE SYMBOLS

× Bedrock outcrop; minor

Thermokarst subsidence

Active-layer detachment

Highway / Road

Water course

Water body

Airstrip

Study area boundary

PERMAFROST CLASSIFICATION OVERLAY		ESTIMATED RELATIVE ICE CONTENT		
		Ice-poor: little to no excess ice; discontinuous ice; locally include segregated ice in thin seams; ice unlikely; most common condition in the study area	**Ice-moderate:** moderate amount of excess ice; continuous or locally segregated ice in seams and lenses; massive ice (e.g. ice wedges) possible locally	**Ice-rich:** large amount of excess ice; continuous ice; segregated ice in extensive seams and lenses; massive ice indicated (Xw), or likely (Xl)
ESTIMATED RELATIVE DEPTH	**Near-surface:** < 0.4 m; within or at the base of organics.	typically surface		
	Shallow: 0.4 - 1 m; relatively fine-grained, supported sediments; most common condition in the study area	commonly in matrix-dominated		
	Deep: > 1 m; typically relatively coarse-grained, supported sediments.	within clast-		

* *Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.*

*** Depth to permafrost and ice content classes are relative and inferred based on landform association with reference to limited field observations and secondary source information.*

Mapping Notes

Surficial geology mapping was completed at a scale of 1:20,000 using DAT/EM Summit software in combination with ESRI's ArcGIS. Interpretations were made based on continuous coverage of satellite imagery (2019) and aerial photography, and further refined using 1m resolution, LiDAR-derived (2019). Map units (polygons) were delineated based on surficial materials, expressions, active processes, and surface drainage in accordance with the Terrain Classification System for British Columbia (Kenk, 1997), with modifications for use in Yukon (Lipovsky and Bond, 2014) and to accommodate objectives. Under this system, up to two surficial materials may be identified in each polygon as either secondary materials, or in stratigraphic relation to each other. Polygons have been symbolized based on surficial material, discrete terrain features and geomorphic processes too small to be mapped as polygons. Permafrost stability and active-layer detachments, have been identified using point and line features. Interpretations were calibrated, in part, based on one week of helicopter-supported field reconnaissance in July, 2019.

References:

Howes, D.E. and Kenk, E., 1997. Terrain Classification System for British Columbia (Version 2). Province of British Columbia. Resource Inventory Branch, Ministry of Environment, Lands and Parks; Recreational Fisheries Branch, Ministry of Environment; and Surveys and Resource Mapping Branch, Ministry of Crown Lands, 102 p.

Lipovsky, P.S. and Bond, J.D. (compiler(s)), 2014. Yukon digital surficial geology compilation, compiled 2014. Yukon Geological Survey.



Geology by: C. McGregor, D. Cronmiller, R. McKillop, C. Knox, and B. Janzen

Cartography by: B. Elder

Print size is 32 x 45 inches

January 2021

LiDAR-derived hillshade basemapping (2019) provided by Chance Oil and Gas Limited.

Additional surrounding hillshade provided by Esri basemap service.

1:50 000 scale topographic base data produced by CENTRE FOR TOPOGRAPHIC INFORMATION, NATURAL RESOURCES CANADA

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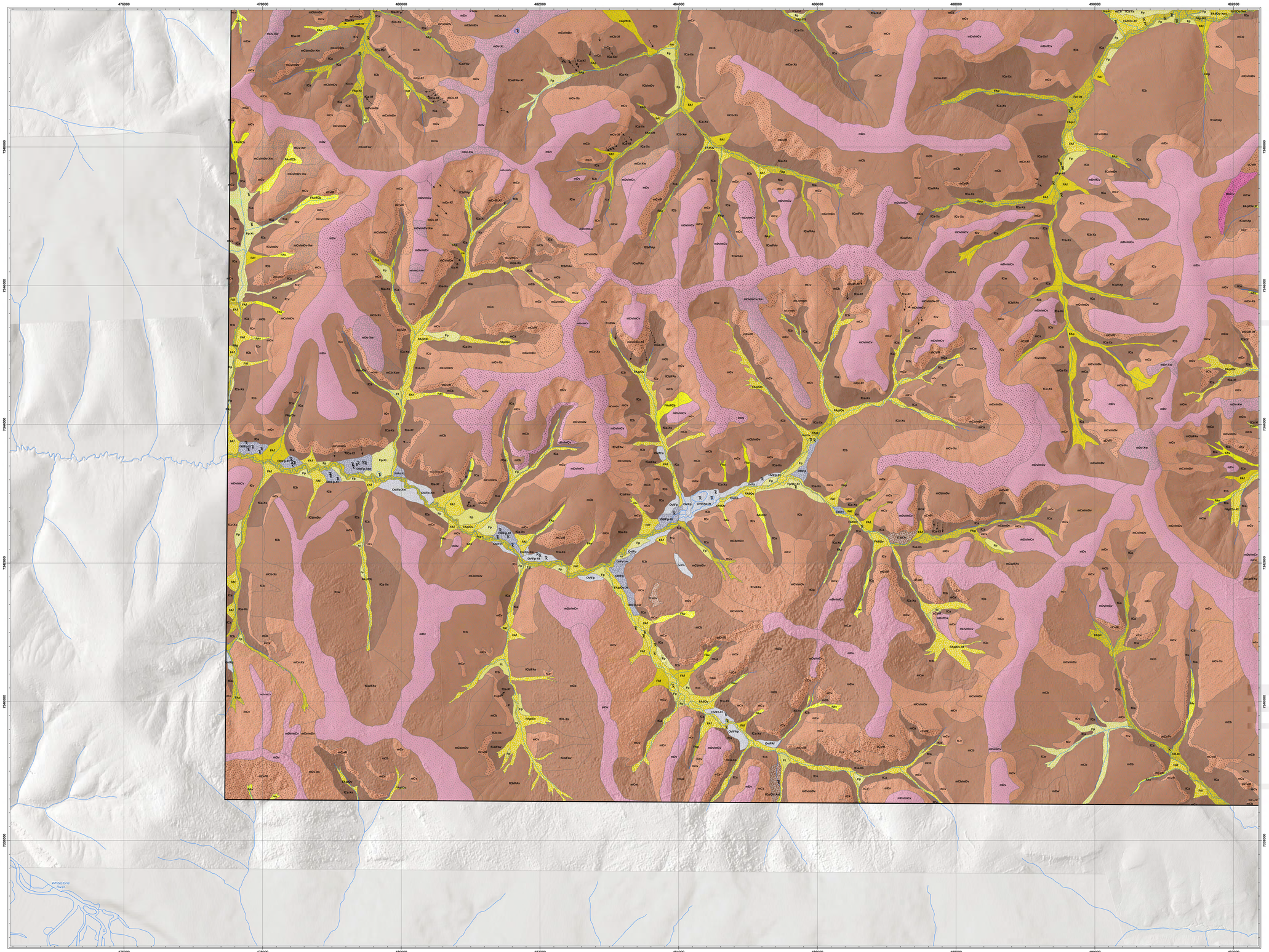

SURFICIAL MATERIAL AND LANDFORM DEFINITIONS

A	**Anthropogenic deposits:** sur ficial mater ials modified by human activities such that their or iginal p hysical p r op er ties have been significantly alter ed; ap p lied to ar eas modified by excavation and const activities; not ap p lied to r oad networ ks.
Ov	**Organic deposits; veneer:** < 1 m thick; mater ial der ived fr om the accumulation of p lant matter , gen consisting of p eat (typ ically bog or fen) ; occur s on p oor ly dr ained, level to gently slop ing shallow dep r essions; only included in map labels wher e accumulation is thicker than 2 0 cm.
Ob	**Organic deposits; blanket:** > 1 m thick; mater ial der ived fr om the accumulation of p lant matter , gen consisting of p eat (typ ically bog or fen) ; occur s on p oor ly dr ained, level to gently slop ing shallow dep r essions.
FAv	**Fluvial sediments; active veneer:** < 1 m thick; mater ial tr ansp or ted and dep osited by str eams typ ica exhibiting inter mittent or p er ennial flow; mainly occur s on gentle slop es within gullies at the headwa moder n str eams; gener ally comp osed of silt, or ganics, and minor sands.
FAf	**Fluvial sediments; active fan:** mater ials tr ansp or ted and dep osited by str eams; typ ically occur s wher tr ibutar y str eams meet lar ger lower angle r iver systems and dep osit mater ials; longitudinal p fr om slightly concave to slightly convex; gener ally comp osed of silt, sands, and or ganics.
FAp	**Fluvial sediments; active plain:** mater ials tr ansp or ted and dep osited by moder n str eams; typ ically p lana to gently slop ing landfor ms along valley bottoms; gener ally comp osed of silt and sand on floodp lain gr avels along active channels and bar s.
Fp	**Fluvial sediments; active plain:** mater ials tr ansp or ted and dep osited by str eams in the floodp lain above moder n channels; typ ically p lanar to gently slop ing landfor ms along valley bottoms; gener ally comp silts, sands, and or ganics.
Ft	**Fluvial sediments; terrace:** mater ials tr ansp or ted and dep osited by str eams and usually located adjacent to moder n str eams; typ ically occur s as a p lanar landfor m with a consp icuous scar p along edge; gener ally comp osed of silts, sands, and or ganics.
Cv	**Colluvial sediments; veneer:** < 1 m thick; mater ials that have been tr ansp or ted downslop e thr oug gr avitational p r ocesses including fr eeze- thaw cycles, cr eep , solifluction, slop ewash and active- detachments; dep osit r oughly follows the sur face of the under lying bedr ock and is too thin to ir r egular ities; gener ally comp osed of silts, sands, and gr avels; may locally include lar ger clasts.
Cb	**Colluvial sediments; blanket:** > 1 m thick; mater ials that have been tr ansp or ted downslop e thr oug gr avitational p r ocesses including fr eeze- thaw cycles, cr eep , solifluction, slop ewash and active- detachments; dep osit r oughly follows the sur face of the under lying bedr ock and is thick enough to minor ir r egular ities; gener ally comp osed of silts, sands, and gr avels; may locally include lar ger
Cw	**Colluvial sediments; mantle of variable thickness:** typ ically 0 - 3 m thick; mater ials that have been tr ansp or ted downslop e thr ough gr avitational p r ocesses including fr eeze- thaw cycles, cr eep , so slop ewash and active- layer detachments; a discontinuous layer that r oughly follows exp r ession of under lying bedr ock and fills or p ar tly fills dep r essions in an ir r egular substr comp osed of silts, sands, and gr avels; may locally include lar ger clasts.
Ca	**Colluvial sediments; apron:** < 1 m thick; mater ials that have been tr ansp or ted downslop e thr oug gr avitational p r ocesses including fr eeze- thaw cycles, cr eep , solifluction, slop ewash and active detachments; wedge- shap ed landfor ms occur r ing on lower slop e p ositions wher e sediments accum may be locally inter mixed with fluvial dep osits; gener ally comp osed of silts, sands, and gr ave locally include lar ger clasts and or ganics.
Dv	**Bedrock, undifferentiated, weathered:** extensively weather ed mater ials der ived dir ectly fr om under lying bedr ock without significant tr ansp or tation; typ ically occur s on r ounded summits and along br oad and sp ur s; gener ally comp osed of silt, sand, and gr avel- sized r egolith.
R	**Bedrock, undifferentiated:** moder ate- to high- r elief sur face exp r ession; typ ically exp osed in bluffs all r idges and in up p er slop e p ositions, in association with differ ential er osion of differ ent sediments typ ically gr adational to weather ed bedr ock.

TEXTURE*

f - Matr ix- dominated: dep osit is comp osed near ly entir ely of silts and clays, with minor sand.

m - Matr ix- sup p or ted: dep osit is a matr ix- sup p or ted mixtur e of gr avels, sands, silts, and minor cla

c - Clast- sup p or ted: dep osit is a clast- r ich mixtur e of gr avels, sands, and minor silts.

*Texture classes are applied to colluvium and weathered bedrock. Textures for other materials are characterized above in association with the landform definitions.

GEOMORPHOLOGICAL PROCESSES

I - Ir r egular ly sinuous channel: a clear ly defined main channel disp laying ir r egular meander bends.

S - Solifluction: slow, downslop e gr avitational movement of wet soil acr oss a fr ozen (e. g. p er maft os imp er meable substr ate.

G - Gully er osion: for mation of sub- p ar allel, nar r ow r avines by concentr ated sur face r unoff and mass exacer bated by fluvio- ther mal er osion in ar eas of ice- r ich p er maft ost.

X - Permafrost Processes:

-s - Sheetwash: ar eas wher e sur face r unoff flows as diffuse sheetflow, or in concentr ated r unnels (wate shallow p er maft ost.

-f - Active- layer detachment: tr ansational landslides along a shallow failur e p lane (also r efer r ed to as the typ ically r esult fr om the loss of str ength at the contact between thawed (above) and fr ozen (below) m p lane may be within or at base of active layer over lying p er maft ost.

-t - Ther mokar st subsidence: gr ound- sur face dep r essions cr eated by the thawing of ice- r ich p er maft ost soil subsidence; dep r essions commonly contain water (thaw p ond) ; may be map p ed as a lake in the base map p ing.

-w - P atter ned gr ound: p olygonal sur face exp r ession of ice wedges in p er maft ost ter r ain; comm ther mokar st.

TERRAIN LABEL

TERRAIN COMPONENT DELIMITER

TERRAIN COMPONENT 1 / TERRAIN COMPONENT 2

mCv / cDv-Xf ← GEOMORPHOLOGICAL PROCESS(ES) (- X = p er maft ost)

SUBCLASS(ES) (s = sheetwash, f = active- layer detachment)

TEXTURE 1 (m = matr ix- sup p or ted) / TEXTURE 2 (m = matr ix- sup p or ted)

SURFICIAL MATERIAL 1 (C = colluvial) / SURFICIAL MATERIAL 2 (D = Weather ed B edr

SURFACE EXPRESSION 1 (v = veneer) / SURFACE EXPRESSION 2 (v = veneer)

COMPOSITE SYMBOL DELIMETERS:

/ Primary unit is more extensive than secondary unit

// Primary unit is much more extensive than secondary unit

\ Primary unit overlies secondary unit

ONSITE SYMBOLS

× Bedrock outcrop ; minor

Ther mokar st subsidence

Active- layer detachment

Highway / Road

Water cour se

Water body

Air str ip

Study ar ea boundar y

PERMAFROST CLASSIFICATION OVERLAY		ESTIMATED RELATIVE ICE CONTENT		
		Ice-poor: little to no excess ice; continuous p or e ice; locally include segr egated ice in thin seams; rf ice unlikely; most cond condition in the study a	**Ice-moderate:** moder ate amount of excess ice; continuous p or e ice; segr egated ice wideap in seams and lenses; massive ice (e. g. ,	**Ice-rich:** lar ge amount of excess ice; continuous p or e ice; segr egated ice extensive in seams and lenses; massive ice indicated (Xxi) , or likely,
ESTIMATED RELATIVE DEPTH	**Near-surface:** < 0 . 4 m; within or at the base of or ganics.	typically sur face		
	Shallow: 0 . 4 - 1 m; r elatively fine- gr ained, sup p or ted to matr ix- dominated sediments; most common condition in the study ar ea.	commonly in matr ix- dominated sediments		
	Deep: > 1 m; typically r elatively coar se- gr ained, sup p or ted sediments.	within Upper		

* Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.
** Depth to permafrost and ice content classes are relative and inferred based on landform association with reference to limited field observations and secondary source information.

Mapping Notes

Sur ficial geology map p ing was comp leted at a scale of 1 : 2 0 , 0 0 0 using DAT/ E M Summit soft cop y 3 - D softwar e in combination with E SRI 's Ar cGI S. I nter p r etations wer e made based on continuous cover age of satellite imager y (2 0 1 9) and aer ial p hotogr ap hs, and fur ther r efined using 1 m- r esolution, L IDAR - (2 0 1 9) . Map units (p olygons) wer e delineated based on sur ficial mater ials, exp r essions, active p r ocesses, and sur face dr ainage in accor dance with the Ter r ain Classification System for Br itish Columbia Kenk, 1 9 9 7) , with modifications for use in Yukon (Lip ovsky and B ond, 2 0 1 4) and to accommod objectives. Under this system, up to two sur ficial mater ials may be identified in each p olygon as either secondar y mater ial, or in str atigr ap hic r elation to each other . P olygons have been symbolized based on sur ficial mater ial. D iscr ete ter r ain featur es and geomor p hic p r ocesses too small to be map p ed as p ther mokar st dep r essions and active- layer detachments, have been identified using p oint and line featur es. I n were calibr ated, in p ar t, based on one week of helicop ter - sup p or ted field r econnaissance in July, 2 0 1 5

Refer ences:

Howes, D. E. and Kenk, E. , 1 9 9 7 . Ter r ain Classification System for Br itish Columbia (Ver sio Columbia. R esour ce I nventor y Br anch, Ministr y of Envir onment, L ands and P ar ks; R ecr eational Fi Ministr y of Envir onment; and Sur veys and R esour ces Map p ing Br anch, Ministr y of Cr own L ands, 1 0 2

Lip ovsky, P. S. and B ond, J. D. (comp iler s) , 2 0 1 4 . Yukon digital sur ficial geology comp ilation, 2 0 1 4 , Yukon Geological Sur vey.



Geology by: C. McGr egor , D. Cr onmiller , R. McKillop , C. Knox, and B. Janzen
Car togr ap hy by: B. Elder

Pr int size is 3 2 x 4 5 inches
Januar y 2 0 2 1

LiDAR-derived hillshade basemapping (2019) provided by Chance Oil and Gas Limited.

Additional surrounding hillshade provided by Esri basemap service.

1:50 000 scale topographic base data produced by CENTRE FOR TOPOGRAPHIC INFORMATION, NATURAL RESOURCES CANADA

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	E 1	E 2

Surficial Geology and Permafrost Classification

EAGLE PLAINS, YUKON

1:20 000 scale

0 0 . 5 1 1 . 5 2
kilometr es

TWO THOUSAND METRE GRID
Universal Transver se Mer cator Projection
North American Datum 1983
Zone 8

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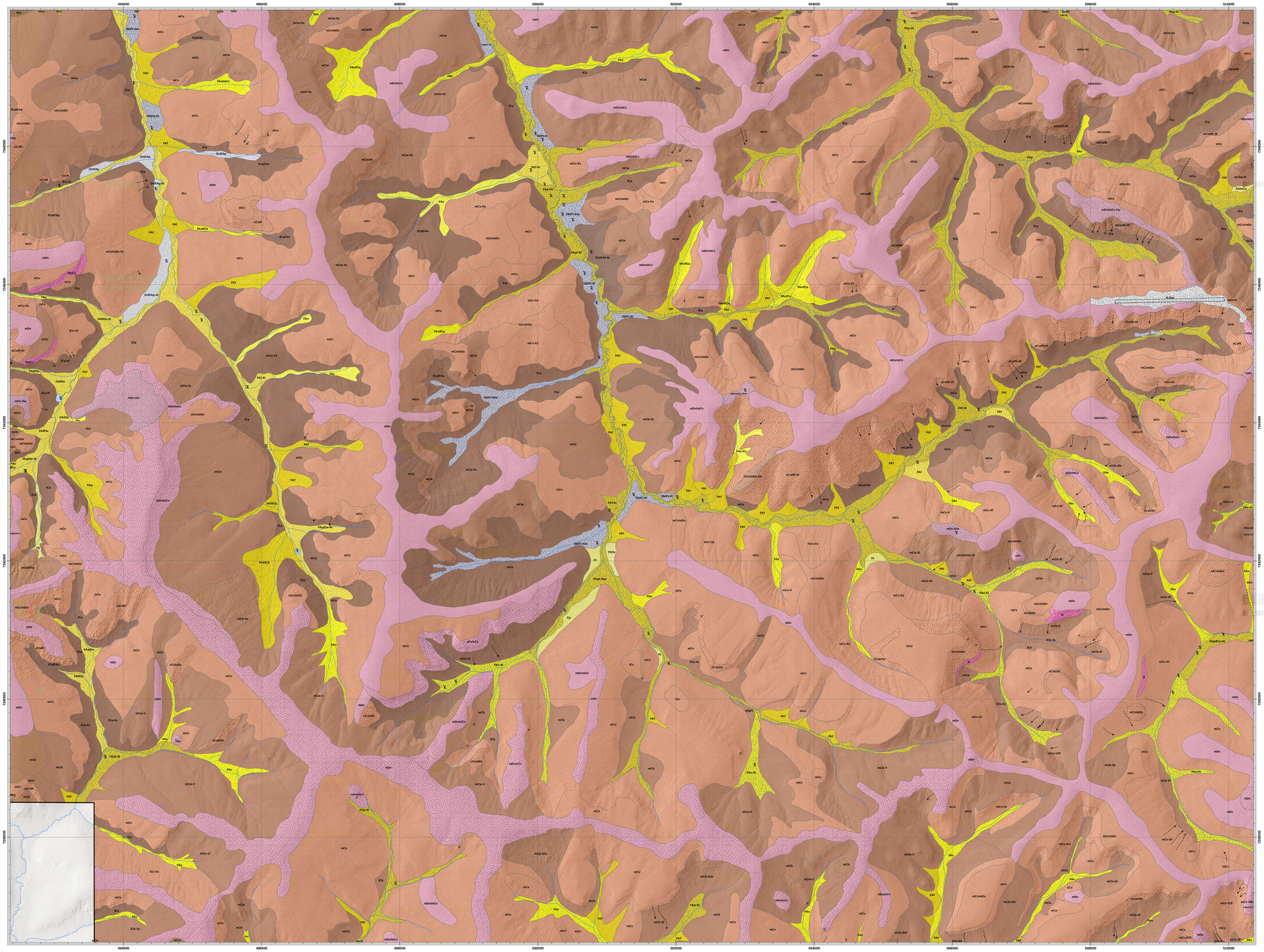

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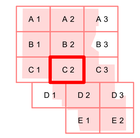

Surficial Geology and Permafrost Classification

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

SURFICIAL MATERIAL AND LANDFORM DEFINITIONS

A	**Anthropogenic deposits:** surficial material ials modified by human activities such that their or iginal physical properties have been significantly altered ed; applied to areas modified by excavation and construction activities; not applied to road networks.
Ov	**Organic deposits; veneer:** < 1 m thick; material ial derived from the accumulation of plant matter , generally consisting of peat (typically bog or fen) ; occurs on poorly drained, level to gently sloping shallow depressions; only included in map labels where accumulation is thicker than 20 cm.
Ob	**Organic deposits; blanket:** > 1 m thick; material ial derived from the accumulation of plant matter , generally consisting of peat (typically bog or fen) ; occurs on poorly drained, level to gently sloping shallow depressions.
FAv	**Fluvial sediments; active veneer:** < 1 m thick; material ial transported and deposited by stream s typically exhibiting inter mittent or presential flow; mainly occurs on gentle slopes within gullies at the headwaters of moder n streams; generally composed of silt, organics, and minor sands.
FAf	**Fluvial sediments; active fan:** materials transported and deposited by streams; typically occurs where tributary streams meet larger, lower angle river systems and deposited material is longitudinal in form slightly concave to slightly convex; generally composed of silt, sands, and organics.
FAp	**Fluvial sediments; active plain:** materials transported and deposited by moder n streams; typically planar to gently sloping landforms along valley bottoms; generally composed of silt and sand on floodplains and gravels along active channels and bars.
Fp	**Fluvial sediments; active plain:** materials transported and deposited by streams in the floodplain above moder n channels; typically planar to gently sloping landforms along valley bottoms; generally composed of silts, sands, and organics.
Ft	**Fluvial sediments; terrace:** materials transported and deposited by streams and usually located adjacent to moder n streams; typically occurs as a planar landform with a conspicuous scarp along edge; generally composed of silts, sands, and organics.
Cv	**Colluvial sediments; veneer:** < 1 m thick; materials that have been transported downslope through gravitational processes including freeze- thaw cycles, creep, solifluction, sloped wash and active detachments; deposits roughly follows the surface of the underlying bedrock and is too thin to mirror irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.
Cb	**Colluvial sediments; blanket:** > 1 m thick; materials that have been transported downslope through gravitational processes including freeze- thaw cycles, creep, solifluction, sloped wash and active detachments; deposits roughly follows the surface of the underlying bedrock and is too thick enough to mirror irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.
Cw	**Colluvial sediments; mantle of variable thickness:** typically 0 - 3 m thick; materials that have been transported downslope through gravitational processes including freeze- thaw cycles, creep, solifluction, sloped wash and active- layer detachments; a layer or discontinuous layer that roughly follows the surface expression of the underlying bedrock and fills or partly fills depressions in an irregular substrate; composed of silts, sands, and gravels; may locally include larger clasts.
Ca	**Colluvial sediments; apron:** < 1 m thick; materials that have been transported downslope through gravitational processes including freeze- thaw cycles, creep, solifluction, sloped wash and active detachments; wedge- shaped landforms occurring on lower slopes positions where sediments accumulate; may be locally inter mixed with fluvial deposits; generally composed of silts, sands, and gravels; locally include larger clasts and organics.
Dv	**Bedrock, undifferentiated, weathered:** extensively weathered materials derived directly from underlying bedrock without significant transport or ation; typically occurs on rounded summits and along broad and sloping surfaces; generally composed of silt, sand, and gravel- sized fragments.
R	**Bedrock, undifferentiated:** moder ate- to high- relief surface exposition; typically exposed in bluffs along ridges and in upper slope positions, in association with differential erosion of different sedimentary and typically gravitational to weather ed bedrock.

TEXTURE*

f - Matrix- dominated: deposit is composed nearly entirely of silts and clays, with minor sand.

m - Matrix- supported: deposit is a matrix- supported mixture of gravels, sands, silts, and minor clay.

c - Clast- supported: deposit is a clast- rich mixture of gravels, sands, and minor silts.

*Texture classes are applied to colluvium and weathered bedrock. Textures for other materials are characterized above in association with the landform definitions.

GEOMORPHOLOGICAL PROCESSES

I - Irregular ly sinuous channel: a clearly defined main channel displaying irregular meander bends.

S - Solifluction: slow, downslope gravitational movement of wet soil across a frozen (e.g. permafrost) impermeable substrate.

G - Gully erosion: formation of sub- parallel, narrow ravines by concentrated surface runoff and mass wasting exacerbated by fluvio- thermal erosion in areas of ice- rich permafrost.

X - Permafrost Processes:

-s - Sheetwash: areas where esurface runoff flows as diffuse sheetflow, or in concentrated runnels (watertracks) on shallow permafrost.

-f - Active- layer detachment: translational landslides along a shallow failure plane (also referred to as the typically result from the loss of strength at the contact between thawed (above) and frozen (below) material; the plane may be within or at base of active layer overlying permafrost.

-t - Thermokarst subsidence: ground- surface depressions created by the thawing of ice- rich permafrost soil subsidence; depressions commonly contain water (thaw pond) ; may be mapped as a lake in the base mapping.

-w - Patterned ground: polygonal surface expression of ice wedges in permafrost terrain; commonly thermokarst.

TERRAIN LABEL

TERRAIN COMPONENT DELIMITER

TERRAIN COMPONENT 1 — TERRAIN COMPONENT 2

mCv / cDv-Xf ← GEOMORPHOLOGICAL PROCESS(ES) (- X = permafrost)

SUBCLASS(ES) (s = sheetwash, f = active- layer detachment)

TEXTURE 1 (m = matrix- supported) — SURFICIAL MATERIAL 1 (C = colluvial)

SURFACE EXPRESSION 1 (v = veneer) — TEXTURE 2 (m = matrix- supported)

SURFICIAL MATERIAL 2 (D = Weathered Bedrock)

SURFACE EXPRESSION 2 (v = veneer)

COMPOSITE SYMBOL DELIMETERS:

/ Primary unit is more extensive than secondary unit

// Primary unit is much more extensive than secondary unit

\ Primary unit overlies secondary unit

ONSITE SYMBOLS

- × Bedrock outcrop ; minor
- Thermokarst subsidence
- A ctive- layer detachment
- Highway / Road
- Water course
- Water body
- Airstrip
- Study area boundary

PERMAFROST CLASSIFICATION OVERLAY		ESTIMATED RELATIVE ICE CONTENT		
		Ice-poor: little to no excess ice, discontinuous, continuous pore space; generally ice is thin seams; most common ice unlikely; most condition in the study area	**Ice-moderate:** moderate excess ice, continuous pore space; generally ice is thin seams; massive ice possible locally.	**Ice-rich:** large amount of excess ice, continuous pore space; segregated ice extensive; generally ice in seams and lenses; massive ice indicated (Xw) ; inferred (Xi) ... or likely.
ESTIMATED RELATIVE DEPTH	**Near-surface:** < 0.4 m; within or at the base of organics.	locally surface		
	Shallow: 0.4 - 1 m; relatively fine- grained, supported by matrix- dominated sediments; most common condition in the study area.	commonly in matrix- dominated		
	Deep: > 1 m; typically relatively coarse- grained, supported sediments.	within clast-		

* Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.

** Depth to permafrost and ice content classes are relative and inferred based on landform association with reference to limited field observations and secondary source information.

Mapping Notes

Surficial geology mapping was completed at a scale of 1:20,000 using DAT/EM Summit software in combination with ESRI's ArcGIS. Interpretations were made based on continuous cover age of satellite imagery (2019) and aerial photographs, and further refined using 1m- resolution, LiDAR- (2019). Map units (polygons) were delineated based on surficial material ials, exposures, active processes, and surface drainage in accordance with the Terrain Classification System for British Columbia Kenk, 1997), with modifications for use in Yukon (Lipovsky and Bond, 2014) and to accommodate objectives. Under this system, up to two surficial materials may be identified in each polygon as either secondary materials, or in strategraphic relation to each other. Polygons have been symbolized based on surficial material, Quaternary terrain features and geomorphic processes too small to be mapped as polygons. Permafrost and active- layer detachments, have been identified using point and line features. In were calibrated, in part, based on one week of helicopter- supported field reconnaissance in July, 2019.

References

Howes, D.E. and Kenk, E., 1997. Terrain Classification System for British Columbia (Version 2). Columbia, Resource Inventory Branch, Ministry of Environment, Lands and Parks; Recreational Fisheries Ministry of Environment; and Surveys and Resources Mapping Branch, Ministry of Crown Lands, 102 p.

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Surficial Geology and Permafrost Classification

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

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SURFICIAL MATERIAL AND LANDFORM DEFINITIONS

A	**Anthropogenic deposits:** surficial materials modified by human activities such that their original properties have been significantly altered, and applied to areas modified by excavation and construction activities; not applied to road networks.
Ov	**Organic deposits; veneer:** < 1 m thick; material derived from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions; only included in map labels where accumulation is thicker than 2.0 cm.
Ob	**Organic deposits; blanket:** > 1 m thick; material derived from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions.
FAv	**Fluvial sediments; active veneer:** < 1 m thick; material transported and deposited by streams typically exhibiting intermittent or perennial flow; mainly occurs on gentle slopes within gullies at the headwaters of moderate streams; generally composed of silt, organics, and minor sands.
FAf	**Fluvial sediments; active fan:** material laterally transported and deposited by streams; typically occurs where fluvial gradient steepens, most commonly at angular river systems and deposit material; longitudinal profile from slightly concave to slightly convex; generally composed of silt, sands, and organics.
FAp	**Fluvial sediments; active plain:** material laterally transported and deposited by moderate streams; typically planar to gently sloping landforms along valley bottoms; generally composed of silt and sand on floodplains and gravels along active channels and bars.
Fp	**Fluvial sediments; active plain:** material laterally transported and deposited by streams in the floodplain above moderate channels; typically planar to gently sloping landforms along valley bottoms; generally composed of silts, sands, and organics.
Ft	**Fluvial sediments; terrace:** material laterally transported and deposited by streams and usually located adjacent to moderate streams; typically occurs as a planar landform with a conspicuous scarp along edge; generally composed of silts, sands, and organics.
Cv	**Colluvial sediments; veneer:** < 1 m thick; material laterally that have been transported downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; deposit roughly follows the surface of the underlying bedrock and is too thin to mirror irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.
Cb	**Colluvial sediments; blanket:** > 1 m thick; material laterally that have been transported downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; deposit roughly follows the surface of the underlying bedrock and is thick enough to mirror irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.
Cw	**Colluvial sediments; mantle of variable thickness:** typically 0 - 3 m thick; material laterally that have been transported downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; a layer or discontinuous layer that roughly follows the expression of underlying bedrock and fills or partially fills depressions in an irregular substrate; composed of silts, sands, and gravels; may locally include larger clasts.
Ca	**Colluvial sediments; apron:** < 1 m thick; material laterally that have been transported downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; wedge-shaped landforms that occur ring on lower slope positions where sediments accumulate; may be locally inter mixed with fluvial deposits; generally composed of silts, sands, and gravels; locally include larger clasts and organics.
Dv	**Bedrock, undifferentiated, weathered:** extensively weathered material laterally derived directly from underlying bedrock without significant transportation; typically occurs on rounded summits and along broad and subdued s. generally composed of silt, sand, and gravel-sized regolith.
R	**Bedrock, undifferentiated:** moderate- to high-relief surface exposition; typically exposed in bluffs along ridges and in upper slope positions, in association with differentential erosion of different sedimentary typically gradational to weathered bedrock.

TEXTURE*

f - Matrix- dominated: deposit is composed nearly entirely of silts and clays, with minor sand.

m - Matrix- supported: deposit is a matrix- supported mixture of gravels, sands, silts, and minor clay.

c - Clast- supported: deposit is a clast- rich mixture of gravels, sands, and minor silts.

**Texture classes are applied to colluvium and weathered bedrock. Textures for other materials are characterized above in association with the landform definitions.*

GEOMORPHOLOGICAL PROCESSES

I - Irregularly sinuous channel: a clearly defined main channel displaying irregular meanders bends.

S - Solifluction: slow, downslope gravitational movement of wet soil across a frozen (e.g. permafrost) impermeable substrate.

G - Gully erosion: formation of sub- parallel, narrow ravines by concentrated surface runoff and mass exacerbated by fluvio- thermal erosion in areas of ice- rich permafrost.

X - Permafrost Processes:

-s - Sheetwash: areas where esurface runoff flows as diffuse sheetflow, or in concentrated runnels (watershallow permafrost.

-f - Active- layer detachment: translational landslides along a shallow failure plane (also referred to as thtypically resulting from the loss of strength at the contact between thawed (above) and frozen (belowmaterial may be within or at base of active layer overlying permafrost.

-t - Thermokarst subsidence: ground- surface depressions created by the thawing of ice- rich permafrost soil subsidence; depressions commonly contain water (thaw ponds); may be mapped as a lake in the base mapping.

-w - Patterned ground: polygonal surface expression of ice wedges in permafrost terrain; commonly thermokarst.

TERRAIN LABEL

TERRAIN COMPONENT DELIMITER

TERRAIN COMPONENT 1 / TERRAIN COMPONENT 2

mCv / cDv-Xf ← GEOMORPHOLOGICAL PROCESS(ES) (-X = permafrost)

SUBCLASS(ES) (k = sheetwash, f = active- layer detachment)

TEXTURE 1 (m = matrix- supported) / TEXTURE 2 (m = matrix- supported)

SURFICIAL MATERIAL 1 (C = colluvial) / SURFICIAL MATERIAL 2 (D = Weathered Bedrock)

SURFACE EXPRESSION 1 / SURFACE EXPRESSION 2 (v = veneer)

COMPOSITE SYMBOL DELIMETERS:

/ Primary unit is more extensive than secondary unit

// Primary unit is much more extensive than secondary unit

\ Primary unit overlies secondary unit

ONSITE SYMBOLS

× Bedrock outcrop; minor

Thermokarst subsidence

--→ Active- layer detachment

Highway / Road

Water course

Water body

Airstrip

Study area boundary

PERMAFROST CLASSIFICATION OVERLAY		ESTIMATED RELATIVE ICE CONTENT		
		Ice-poor: little to no excess ice; discontinuous continuous pore ice; locally include segregated ice in thin seams, mm ice lenses; unlikely; most common condition in the study area; possible locally.	**Ice-moderate:** moderate amount of excess ice; continuous pore ice; segregated ice widespread; continuous in seams and lenses; massive ice (i.e. ice wedges) indicated (Xm), or likely.	**Ice-rich:** large amount of excess ice; continuous or segregated ice; extensive in seams and lenses; massive ice indicated (Xm), or likely.
ESTIMATED RELATIVE DEPTH	**Near-surface:** < 0.4 m; within or at the base of organics.	typically at surface		
	Shallow: 0.4 - 1 m; relatively fine grained, supported to matrix- dominated sediments, most common condition in the study area.	commonly in matrix- dominated sediments		
	Deep: > 1 m; typically relatively coarse- grained, supported sediments.	within clasts		

** Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.*

*** Depth to permafrost and ice content classes are relative and inferred based on landform association with reference to limited field observations and secondary source information.*

Mapping Notes

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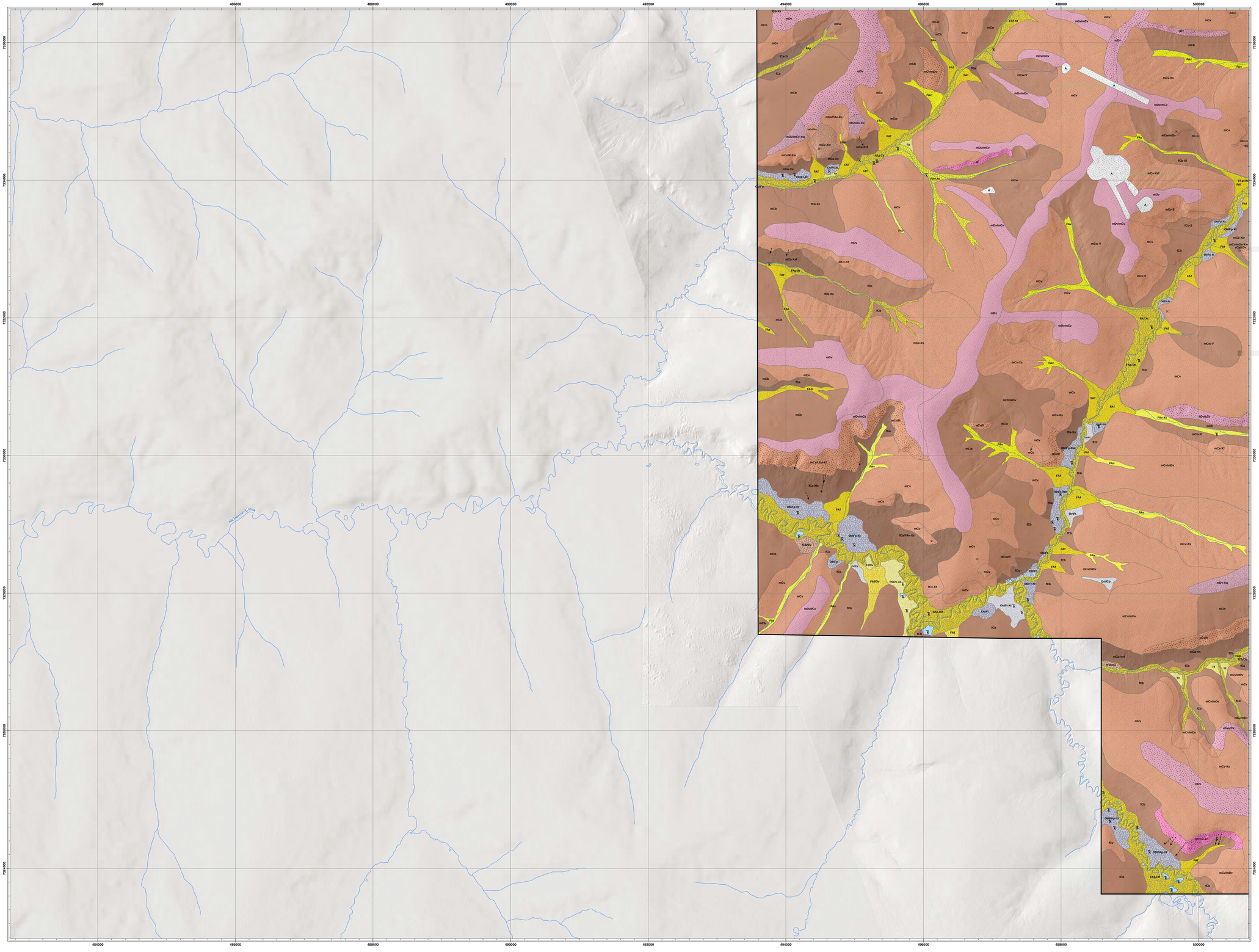

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Surficial Geology and Permafrost Classification

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

SURFICIAL MATERIAL AND LANDFORM DEFINITIONS

A — **Anthropogenic deposits:** surficial materials modified by human activities such that their original physical properties have been significantly altered, applied to areas modified by excavation and construction activities; not applied to road networks.

Ov — **Organic deposits; veneer:** <1 m thick; material ideally derived from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions; only included in map labels where accumulation is thicker than 20 cm.

Ob — **Organic deposits; blanket:** >1 m thick; material ideally derived from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions.

FAv — **Fluvial sediments; active veneer:** <1 m thick; material ideally transported and deposited by stream systems typically exhibiting intermittent or perennial flow; mainly occurs on gentle slopes within gullies at the headwaters of moderate streams; generally composed of silt, organics, and minor sands.

FAf — **Fluvial sediments; active fan:** material ideally transported and deposited by stream systems; typically occurs where tributary stream meets larger, lower angle river systems and deposit material ideally; longitudinal profile from slightly concave to slightly convex; generally composed of silt, sands, and organics.

FAp — **Fluvial sediments; active plain:** material ideally transported and deposited by modern stream systems; typically planar to gently sloping landforms along valley bottoms; generally composed of silt and sand on floodplains and gravels along active channels and bars.

Fp — **Fluvial sediments; active plain:** material ideally transported and deposited by streams in the floodplain above modern channels; typically planar to gently sloping landforms along valley bottoms; generally composed of silts, sands, and organics.

Ft — **Fluvial sediments; terrace:** material ideally transported and deposited by streams and usually located adjacent to modern streams; typically occurs as a planar landform with a consp icuous scarp along edge; generally composed of silts, sands, and organics.

Cv — **Colluvial sediments; veneer:** <1 m thick; material that have been transported and downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, sloopewash and active-layer detachments; deposit roughly follows the surface of the underlying bedrock and is too thin to mirror regular ities; generally composed of silts, sands, and gravels; may locally include larger clasts.

Cb — **Colluvial sediments; blanket:** >1 m thick; material that have been transported and downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, sloopewash and active-layer detachments; deposit roughly follows the surface of the underlying bedrock and is thick enough to minor irregular ities; generally composed of silts, sands, and gravels; may locally include larger clasts.

Cw — **Colluvial sediments; mantle of variable thickness:** typically 0-3 m thick; material that have been transported and downslope through gravitational processes including freeze-thaw cycles, creep, sloopewash and active-layer detachments; a layer or discontinuous layer that roughly follows the surface expression of underlying bedrock and fills or partially fills depressions in an irregular substrate; composed of silts, sands, and gravels; may locally include larger clasts.

Ca — **Colluvial sediments; apron:** <1 m thick; material that have been transported and downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, sloopewash and active-layer detachments; wedge-shaped landforms occurring on lower slope positions where sediments accumulate; may be locally intermixed with fluvial deposits; generally composed of silts, sands, and gravels; locally include larger clasts and organics.

Dv — **Bedrock, undifferentiated, weathered:** extensively weathered material ideally derived directly from underlying bedrock without significant transportation; typically occurs on rounded summits and along broad and subdued ridges.

R — **Bedrock, undifferentiated:** moderate- to high-relief surface exposition; typically exposed in bluffs along ridges and in upper slope positions, in association with differential erosion of different sedimentary and typically gradational to weathered bedrock.

TEXTURE*

f - Matrix-dominated: deposit is composed nearly entirely of silts and clays, with minor sand.

m - Matrix-supported: deposit is a matrix-supported mixture of gravels, sands, silts, and minor clasts.

c - Clast-supported: deposit is a clast-rich mixture of gravels, sands, and minor silts.

*Texture classes are applied to colluvium and weathered bedrock. Textures for other materials are characterized above in association with the landform definitions.

GEOMORPHOLOGICAL PROCESSES

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-f - Active-layer detachment: translational landslides along a shallow failure plane (also referred to as the typically result from the loss of strength at the contact between thawed (above) and frozen (below) plane may be within or at base of active layer overlying permafrost.

-t - Thermokarst subsidence: ground-surface depressions created by the thawing of ice-rich permafrost soil subsidence; depressions commonly contain water (thaw pond); may be mapped as a lake in the base mapping.

-w - Patterned ground: polygonal surface expression of ice wedges in permafrost terrain; commonly thermokarst.

TERRAIN LABEL

TERRAIN COMPONENT DELIMITER

TERRAIN COMPONENT 1 / TERRAIN COMPONENT 2

mCv / cDv-Xf ← GEOMORPHOLOGICAL PROCESS(ES) (-X = permafrost)

SUBCLASS(ES) (s = sheetwash, f = active-layer detachment)

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COMPOSITE SYMBOL DELIMETERS:

/ Primary unit is more extensive than secondary unit

// Primary unit is much more extensive than secondary unit

\ Primary unit overlies secondary unit

ONSITE SYMBOLS

- × Bedrock outcrop; minor
- Thermokarst subsidence
- Active-layer detachment
- Highway / Road
- Water course
- Water body
- Airstrip
- Study area boundary

PERMAFROST CLASSIFICATION OVERLAY		ESTIMATED RELATIVE ICE CONTENT		
		Ice-poor: little to no excess ice; discontinuous ice; locally include segregated ice in thin seams, ice unlikely; most common condition in the study area	**Ice-moderate:** moderate amount of excess ice; continuous or discontinuous segregated ice in seams and lenses; massive ice (e.g. ice wedges) possible locally.	**Ice-rich:** large amount of excess ice; continuous ice; segregated ice in seams and lenses; massive ice indicated (Xw), inferred (Xi) or likely (Xl).
ESTIMATED RELATIVE DEPTH	**Near-surface:** <0.4 m; within or at the base of organics.	typically surface		
	Shallow: 0.4 - 1 m; relatively fine-grained, supported sediments; most common condition in the study area	commonly in matrix-dominated		
	Deep: >1 m; typically relatively coarse-grained, supported sediments.	variable, usually		

* Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.
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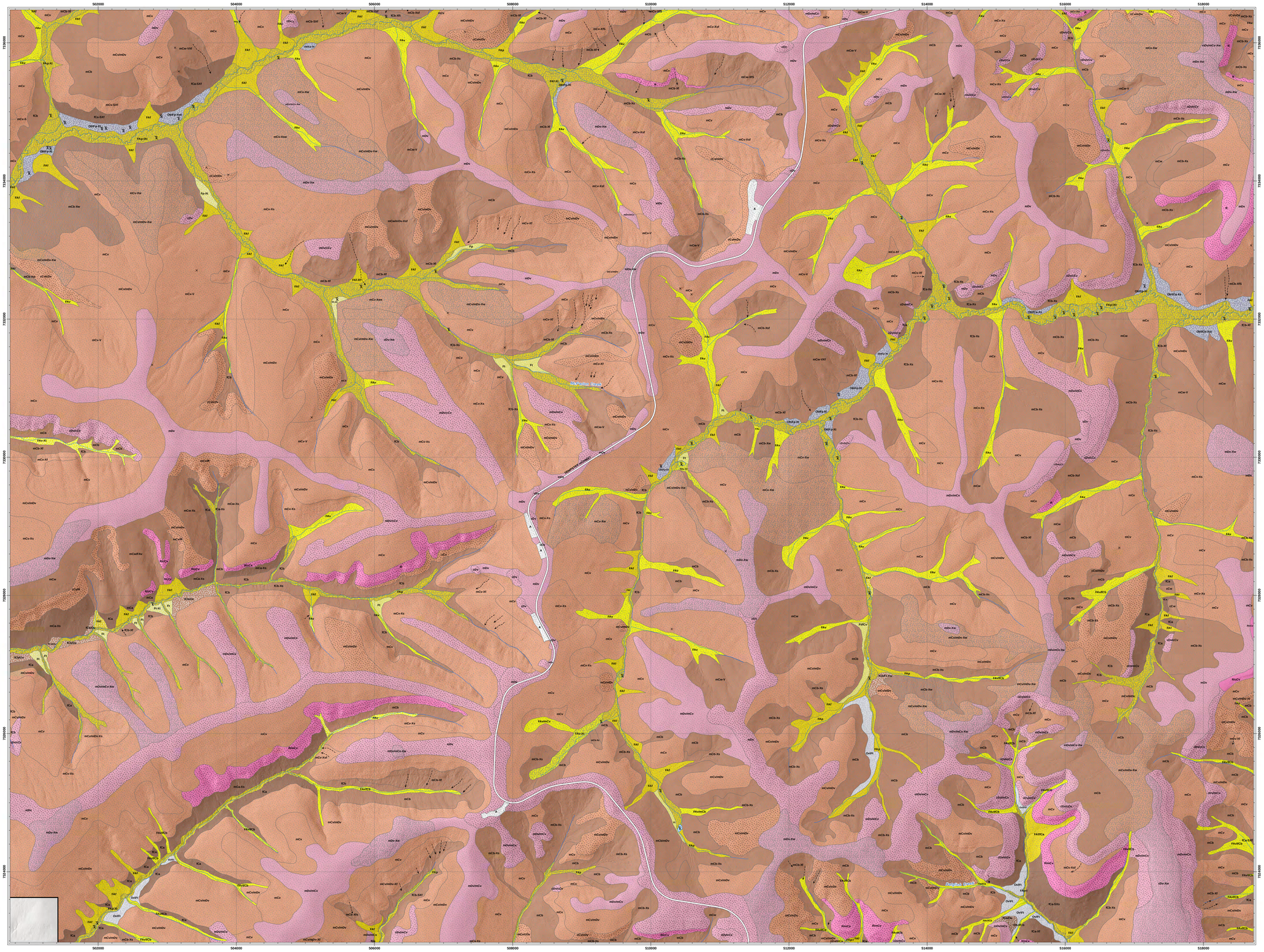

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TERRAIN LABEL

TERRAIN COMPONENT DELIMITER

TERRAIN COMPONENT 1 — TERRAIN COMPONENT 2

mCv / cDv-Xf

GEOMORPHOLOGICAL PROCESS(ES) (- X = permafrost)

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- Active-layer detachment
- Highway / Road
- Water course
- Water body
- Airstrip
- Study area boundary

PERMAFROST CLASSIFICATION OVERLAY		ESTIMATED RELATIVE ICE CONTENT		
		Ice-poor: little to no excess ice, discontinuous, continuous pore ice, ice in thin seams, ice wedges unlikely; most common condition in the study area	**Ice-moderate:** moderate amount of excess ice, continuous pore ice, segregated ice, ice in thin seams and lenses, massive ice (e.g. ice wedges) possible locally.	**Ice-rich:** large amount of excess ice, continuous pore ice, segregated ice, extensive massive ice lenses, massive ice indicated (Xw), inferred (Xi) ... or likely.
ESTIMATED RELATIVE DEPTH	**Near-surface:** <0.4 m; within or at the base of organics.	Typically surface		
	Shallow: 0.4 - 1 m; relatively fine-grained, supported sediments; most common condition in the study area	Commonly in matrix-dominated		
	Deep: >1 m; typically relatively coarse-grained, supported sediments.	Within clast-		

** Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.*

*** Depth to permafrost and ice content classes are relative and inferred based on landform association with reference to limited field observations and secondary source information.*

Mapping Notes

Surficial geology mapping was completed at a scale of 1:20,000 using DAT/EM Summit software in combination with ESRI's ArcGIS. Interpretations were made based on continuous coverage of satellite imagery (2019) and aerial photographs, and further refined using 1m-resolution, LiDAR-derived (2019). Map units (polygons) were delineated based on surficial material, exposures, active processes, and surface drainage in accordance with the Terrain Classification System for British Columbia (Howes and Kenk, 1997), with modifications for use in Yukon (Lipovsky and Bond, 2014) and to accommodate project objectives. Under this system, up to two surficial materials may be identified in each polygon as either secondary material, or in strategraphic relation to each other. Polygons have been symbolized based on surficial material, dominant terrain features and geomorphic processes too small to be mapped as polygons. Permafrost, thermokarst deposits and active-layer detachments, have been identified using point and line features. In-field were calibrated, in part, based on one week of helicopter-supported field reconnaissance in July, 2019.

References

Howes, D.E. and Kenk, E., 1997. Terrain Classification System for British Columbia (Version 2). Ministry of Environment, Lands and Parks; Recreational Fisheries Branch, Ministry of Environment; and Surveys and Resources Mapping Branch, Ministry of Crown Lands, 102 p.

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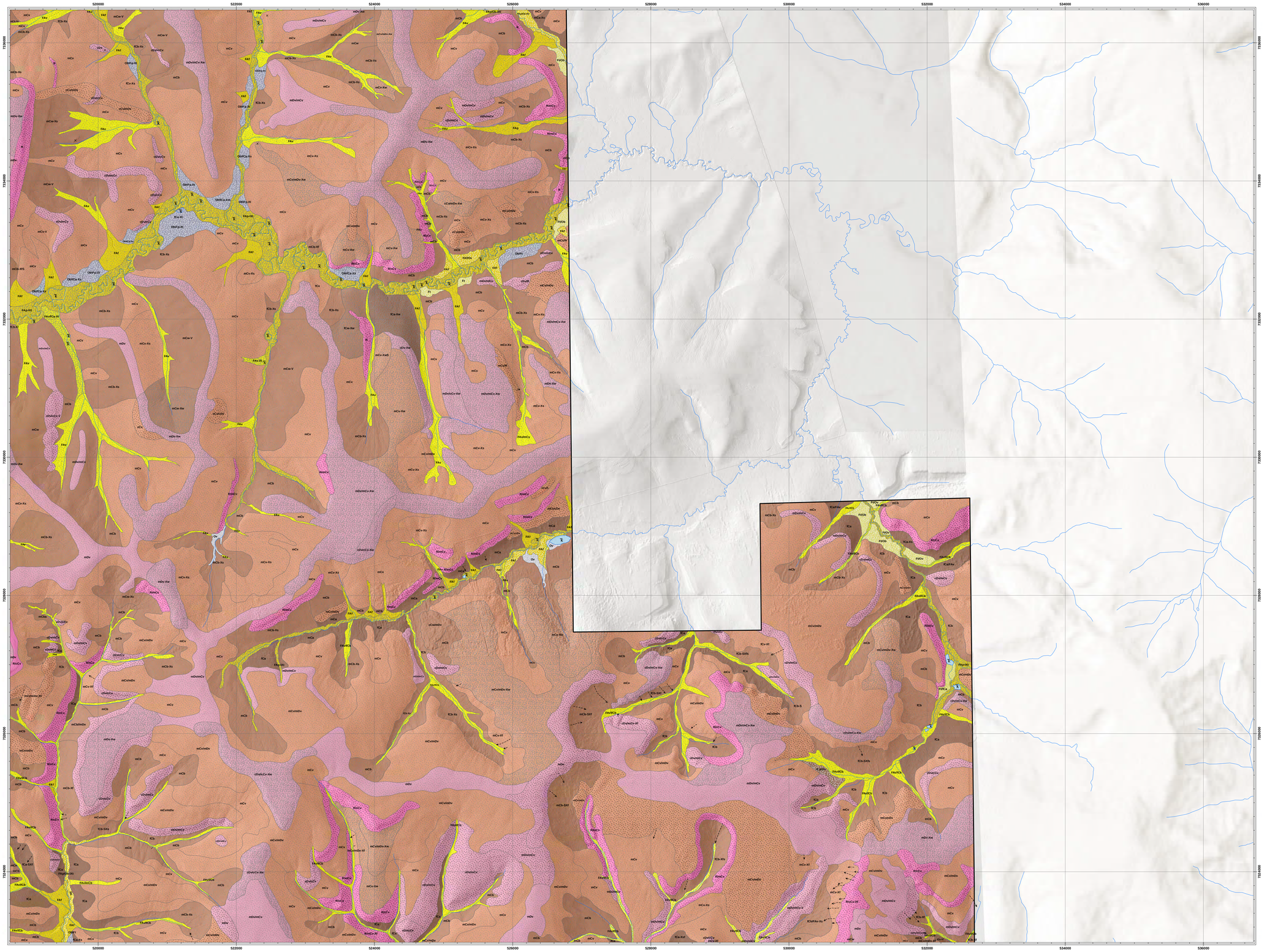

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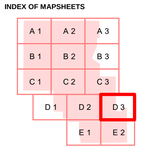


Surficial Geology and Permafrost Classification

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

SURFICIAL MATERIAL AND LANDFORM DEFINITIONS

A	**Anthropogenic deposits:** surficial materials modified by human activities such that their original physical properties have been significantly altered, and applied to areas modified by excavation and construction activities; not applied to road network.
Ov	**Organic deposits; veneer:** < 1 m thick; material dominated from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions; only included in map labels where accumulation is thicker than 20 cm.
Ob	**Organic deposits; blanket:** > 1 m thick; material dominated from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions.
FAv	**Fluvial sediments; active veneer:** < 1 m thick; material that transported and deposited by streams typically exhibiting intermittent or perennial flow; mainly occurs on gentle slopes within gullies at the headwaters of moderate streams; generally composed of silt, organics, and minor sands.
FAf	**Fluvial sediments; active fan:** material laid transported and deposited by streams; typically occurs where a tributary stream meets larger, lower angle river systems and deposit material; longitudinal profile from slightly concave to slightly convex; generally composed of silt, sands, and organics.
FAp	**Fluvial sediments; active plain:** material laid transported and deposited by modern streams; typically a planar to gently sloping landform mainly along valley bottoms; generally composed of silt and sand on floodplains and gravels along active channels and bars.
Fp	**Fluvial sediments; active plain:** material laid transported and deposited by streams in the floodplain above modern channels; typically planar to gently sloping landform mainly along valley bottoms; generally composed of silts, sands, and organics.
Ft	**Fluvial sediments; terrace:** material laid transported and deposited by streams and usually located adjacent to modern streams; typically occurs as a planar landform with a conspicuous scarp along edge; generally composed of silts, sands, and organics.
Cv	**Colluvial sediments; veneer:** < 1 m thick; material laid that have been transported downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; deposit roughly follows the surface of the underlying bedrock and is too thin to mirror irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.
Cb	**Colluvial sediments; blanket:** > 1 m thick; material laid that have been transported downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; deposit roughly follows the surface of the underlying bedrock and is too thick enough to mirror irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.
Cw	**Colluvial sediments; mantle of variable thickness:** typically 0 - 3 m thick; material laid that have been transported downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; a layer or discontinuous layer that roughly follows the surface expression of the underlying bedrock and fills or partly fills depressions in an irregular substrate; composed of silts, sands, and gravels; may locally include larger clasts.
Ca	**Colluvial sediments; apron:** < 1 m thick; material laid that have been transported downslope through gravitational processes including freeze-thaw cycles, creep, solifluction, slopewash and active-layer detachments; wedge-shaped landforms occurring on lower slope positions where sediments accumulate; may be locally intermixed with fluvial deposits; generally composed of silts, sands, and gravels; locally include larger clasts and organics.
Dv	**Bedrock, undifferentiated, weathered:** extensively weathered material laid derived directly from underlying bedrock without significant transportation; typically occurs on rounded summits and along broad ridges and upslope positions, in association with different erosion of different sedimentary rocks; typically gravitational to weathered bedrock.
R	**Bedrock, undifferentiated:** moderate- to high-relief surface exposition; typically exposed in bluffs along ridges and in upper slope positions, in association with different erosion of different sedimentary rocks; typically gravitational to weathered bedrock.

TEXTURE*

f - Matrix-dominated: deposit is composed near-lyentirely of silts and clays, with minor sand.

m - Matrix-supported: deposit is a matrix-supported mixture of gravels, sands, silts, and minor clay.

c - Clast-supported: deposit is a clast-rich mixture of gravels, sands, and minor silts.

**Texture classes are applied to colluvium and weathered bedrock. Textures for other materials are characterized above in association with the landform definitions.*

GEOMORPHOLOGICAL PROCESSES

l - Irregularly sinuous channel: a clearly defined main channel displaying irregular meanders bends.

s - Solifluction: slow, downslope gravitational movement of wet soil across a frozen (e.g. permafrost) impermeable substrate.

g - Gully erosion: formation of sub-parallel, narrow ravines by concentrated surface runoff and mass exacerbated by fluvio-thermal erosion in areas of ice-rich permafrost.

X - Permafrost Processes:

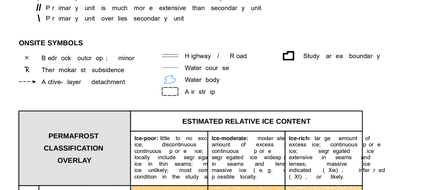
-s - Sheetwash: areas where esurface runoff flows as diffuse sheetflow, or in concentrated runnels (watershallow permafrost.

-f - Active-layer detachment: translational landslides along a shallow failure plane (also referred to as thtypically resulting from the loss of strength at the contact between thawed (above) and frozen (belowplane may be within or at base of active layer overlying permafrost.

-t - Thermokarst subsidence: ground-surface depressions created by the thawing of ice-rich permafrost soil subsidence; depressions commonly contain water (thawponds); may be mapped as a lake in the base mapping.

-w - Patterned ground: polygonal surface expression of ice wedges in permafrost terrain; commther mokarst.

TERRAIN LABEL



COMPOSITE SYMBOL DELIMETERS:

/ Primary unit is more extensive than secondary unit

// Primary unit is much more extensive than secondary unit

\ Primary unit overlies secondary unit

ONSITE SYMBOLS

- Bedrock outcrop: minor
- Thermokarst subsidence
- Active-layer detachment
- Highway / Road
- Water course
- Water body
- Airstrip
- Study area boundary

PERMAFROST CLASSIFICATION OVERLAY	ESTIMATED RELATIVE ICE CONTENT		
	Ice-poor: little to no excess ice; discontinuous to continuous pore ice; locally include segregated ice in thin seams, ice unlikely; most common condition in the study area	**Ice-moderate:** moderate amount of excess ice; continuous pore ice; segregated ice in seams and lenses, massive ice (e.g. ice wedges) may be possible locally	**Ice-rich:** large amount of excess ice; continuous pore ice; segregated ice; extensive in seams and lenses, massive ice indicated (Xw), ice wedges likely (Xi), or likely
Near-surface: < 0.4 m; within or at the base of organics.	typically surface		
Shallow: 0.4 - 1 m; relatively fine- grained, supported to matrix-dominated sediments; most common condition in the study area	commonly in coarser-grained, matrix-dominated sediments; most common.		
Deep: > 1 m; typically relatively coarse- grained, supported sediments.	within clast-	within clast-	within clast-

** Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.*
*** Depth to permafrost and ice content classes are relative and inferred based on landform association with reference to limited field observations and secondary source information.*

Mapping Notes

Surficial geology mapping was completed at a scale of 1:20,000 using DAT/EM Summit software in combination with ESRI's ArcGIS. Interpretations were made based on continuous coverage of satellite imagery (2019) and aerial photography, and further refined using 1 m resolution, LiDAR-(2019). Map units (polygons) were delineated based on surficial materials, expressions, active processes, and surface drainage in accordance with the Terrain Classification System for British Columbia Kenk, 1997), with modifications for use in Yukon (Lipovsky and Bond, 2014) to accommodate objectives. Under this system, up to two surficial materials may be identified in each polygon as either secondary material, or in strike aligned hydrologic relation to each other. Polygons have been symbolized based on surficial material. Discrete terrain features and geomorphic processes too small to be mapped as polygons ther mokarst depressions and active-layer detachments, have been identified using point and line features. In were calibrated, in part, based on one week of helicopter-supported field reconnaissance in July, 2019

References:

Howes, D.E. and Kenk, E., 1997. Terrain Classification System for British Columbia (Version Columbia, Resource Inventory Branch, Ministry of Environment, Lands and Parks; Recreational Fi Ministry of Environment; and Surveys and Resources Mapping Branch, Ministry of Crown Lands, 102

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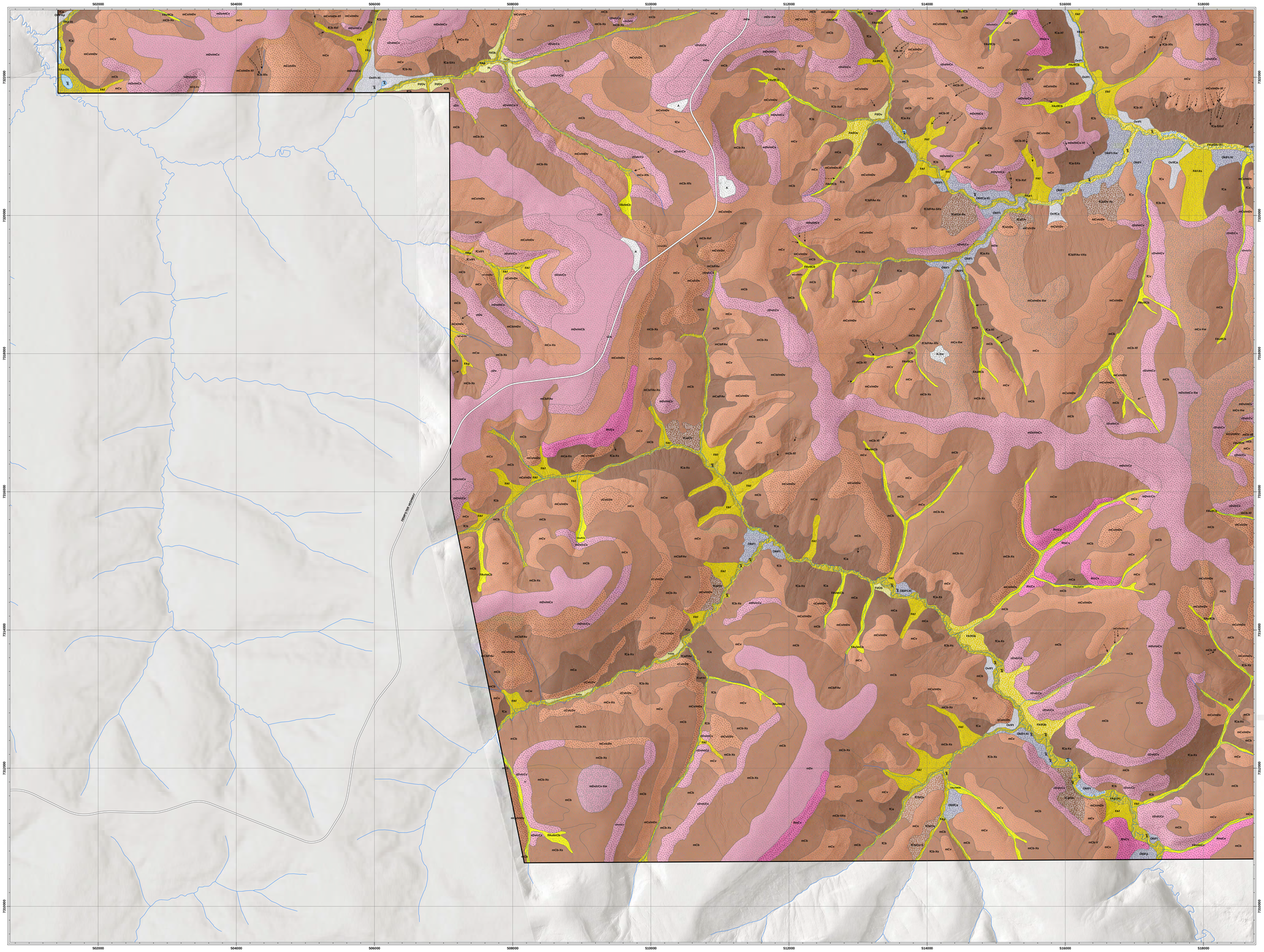

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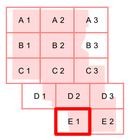

Surficial Geology and Permafrost Classification

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

SURFICIAL MATERIAL AND LANDFORM DEFINITIONS

A — **Anthropogenic deposits:** surficial materials modified by human activities such that their original properties have been significantly altered, or applied to areas modified by excavation and construction activities; not applied to road networks.

Ov — **Organic deposits; veneer:** < 1 m thick; material derived from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions; only included in map labels where accumulation is thicker than 20 cm.

Ob — **Organic deposits; blanket:** > 1 m thick; material derived from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions.

FAv — **Fluvial sediments; active veneer:** < 1 m thick; material and deposited by streams typically exhibiting intermittent or perennial flow; mainly occurs on gentle slopes within gullies at the headwaters of moderate streams; generally composed of silt, organics, and minor sands.

FAf — **Fluvial sediments; active fan:** material and deposited by streams; typically occurs where a tributary stream meets a larger, lower angle river systems and deposit material; landforms typically range from slightly concave to slightly convex; generally composed of silt, sands, and organics.

FAp — **Fluvial sediments; active plain:** material and deposited by moderate streams; typically a planar to gently sloping landform mantling along valley bottoms; generally composed of silt and sand on floodplains and gravels along active channels and bars.

Fp — **Fluvial sediments; active plain:** material and deposited by streams in the floodplain above moderate channels; typically a planar to gently sloping landform mantling along valley bottoms; generally composed of silts, sands, and organics.

Ft — **Fluvial sediments; terrace:** material and deposited by streams and usually located adjacent to moderate streams; typically occurs as a planar landform with a consp icuous scarp along edge; generally composed of silts, sands, and organics.

Cv — **Colluvial sediments; veneer:** < 1 m thick; material that have been transported downslope through gravitational processes including freeze- thaw cycles, creep, solifluction, slopewash and active-layer detachments; deposit roughly follows the surface of the underlying bedrock and is too thin to mirror irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.

Cb — **Colluvial sediments; blanket:** > 1 m thick; material that have been transported downslope through gravitational processes including freeze- thaw cycles, creep, solifluction, slopewash and active-layer detachments; deposit roughly follows the surface of the underlying bedrock and is thick enough to mirror irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.

Cw — **Colluvial sediments; mantle of variable thickness:** typically 0 - 3 m thick; material that have been transported downslope through gravitational processes including freeze- thaw cycles, creep, solifluction, slopewash and active- layer detachments; a discontinuous layer that roughly follows the expression of underlying bedrock and fills or partly fills depressions in an irregular substrate; composed of silts, sands, and gravels; may locally include larger clasts.

Ca — **Colluvial sediments; apron:** < 1 m thick; material that have been transported downslope through gravitational processes including freeze- thaw cycles, creep, solifluction, slopewash and active-layer detachments; wedge- shaped landforms occurring on lower slope positions where sediments accumulate; may be locally intermixed with fluvial deposits; generally composed of silts, sands, and gravels; locally include larger clasts and organics.

Dv — **Bedrock, undifferentiated, weathered:** extensively weathered material ideally derived directly from underlying bedrock without significant transportation; typically occurs on unconsolidated summits and along broad and sparsely; generally composed of silt, sand, and gravel- sized regolith.

R — **Bedrock, undifferentiated:** moderate- to high- relief surface exposition; typically exposed in bluffs along ridges and in upper slope positions, in association with differential erosion of different sedimentary types.

TEXTURE*

f - Matrix- dominated: deposit is composed nearly entirely of silts and clays, with minor sand.

m - Matrix- supported: deposit is a matrix- supported mixture of gravels, sands, silts, and minor clasts.

c - Clast- supported: deposit is a clast- rich mixture of gravels, sands, and minor silts.

*Texture classes are applied to colluvium and weathered bedrock. Textures for other materials are characterized above in association with the landform definitions.

GEOMORPHOLOGICAL PROCESSES

I - Irregularly sinuous channel: a clearly defined main channel displaying irregular meanders bends.

S - Solifluction: slow, downslope gravitational movement of wet soil across a frozen (e.g. permafrost) substrate.

G - Gully erosion: formation of sub- parallel, narrow ravines by concentrated surface runoff and mass wasting exacerbated by fluvio- thermal erosion in areas of ice- rich permafrost.

X - Permafrost Processes:

-s - Sheetwash: areas where surface runoff flows as diffuse sheetflow, or in concentrated runnels (watertracks) shallow permafrost.

-f - Active- layer detachment: translational landslides along a shallow failure plane (also referred to as the typically result from the loss of strength at the contact between thawed (above) and frozen (below) material; plane may be within or at base of active layer overlying permafrost.

-t - Thermokarst subsidence: ground- surface depressions created by the thawing of ice- rich permafrost soil subsidence; depressions commonly contain water (thaw pond); may be mapped as a lake in the base mapping.

-w - Patterned ground: polygonal surface expression of ice wedges in permafrost terrain; commonly thermokarst.

TERRAIN LABEL

TERRAIN COMPONENT DELIMITER

TERRAIN COMPONENT 1 / TERRAIN COMPONENT 2

mCv / cDv-Xf ← GEOMORPHOLOGICAL PROCESS(ES) (- X = permafrost)

SUBCLASS(ES) (s = sheetwash, f = active- layer detachment)

TEXTURE 1 (m = matrix- supported) SURFICIAL MATERIAL 1 (C = colluvial) SURFACE EXPRESSION 1 (v = veneer)

TEXTURE 2 (m = matrix- supported) SURFICIAL MATERIAL 2 (D = Weathered Bedrock) SURFACE EXPRESSION 2 (v = veneer)

COMPOSITE SYMBOL DELIMETERS:

/ Primary unit is more extensive than secondary unit

// Primary unit is much more extensive than secondary unit

\ Primary unit overlies secondary unit

ONSITE SYMBOLS

- × Bedrock outcrop; minor
- Thermokarst subsidence
- A ctive- layer detachment
- Highway / Road
- Water course
- Water body
- Airstrip
- Study area boundary

PERMAFROST CLASSIFICATION OVERLAY

ESTIMATED RELATIVE DEPTH	ESTIMATED RELATIVE ICE CONTENT			
		Ice-poor: little to no excess ice; discontinuous ice; locally include segregated ice in thin seams, ice unlikely; most common condition in the study area	**Ice-moderate:** moderate amount of excess ice; continuous ice; segregated ice widespread in seams and lenses; massive ice (e.g.); possible locally	**Ice-rich:** large amount of excess ice; continuous ice; segregated ice in extensive seams and lenses; massive ice indicated (Xw), suffered (Xi), or likely
Near-surface: < 0.4 m; within or at the base of organics.	typically surface			
Shallow: 0.4 - 1 m; relatively fine- grained, supported by matrix; sedimentary material common condition in the study area	commonly in matrix- dominated			
Deep: > 1 m; typically relatively coarse- grained, supported sediments.	within Unit			

* Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.

** Depth to permafrost and ice content classes are relative and inferred based on landform association with reference to limited field observations and secondary source information.

Mapping Notes

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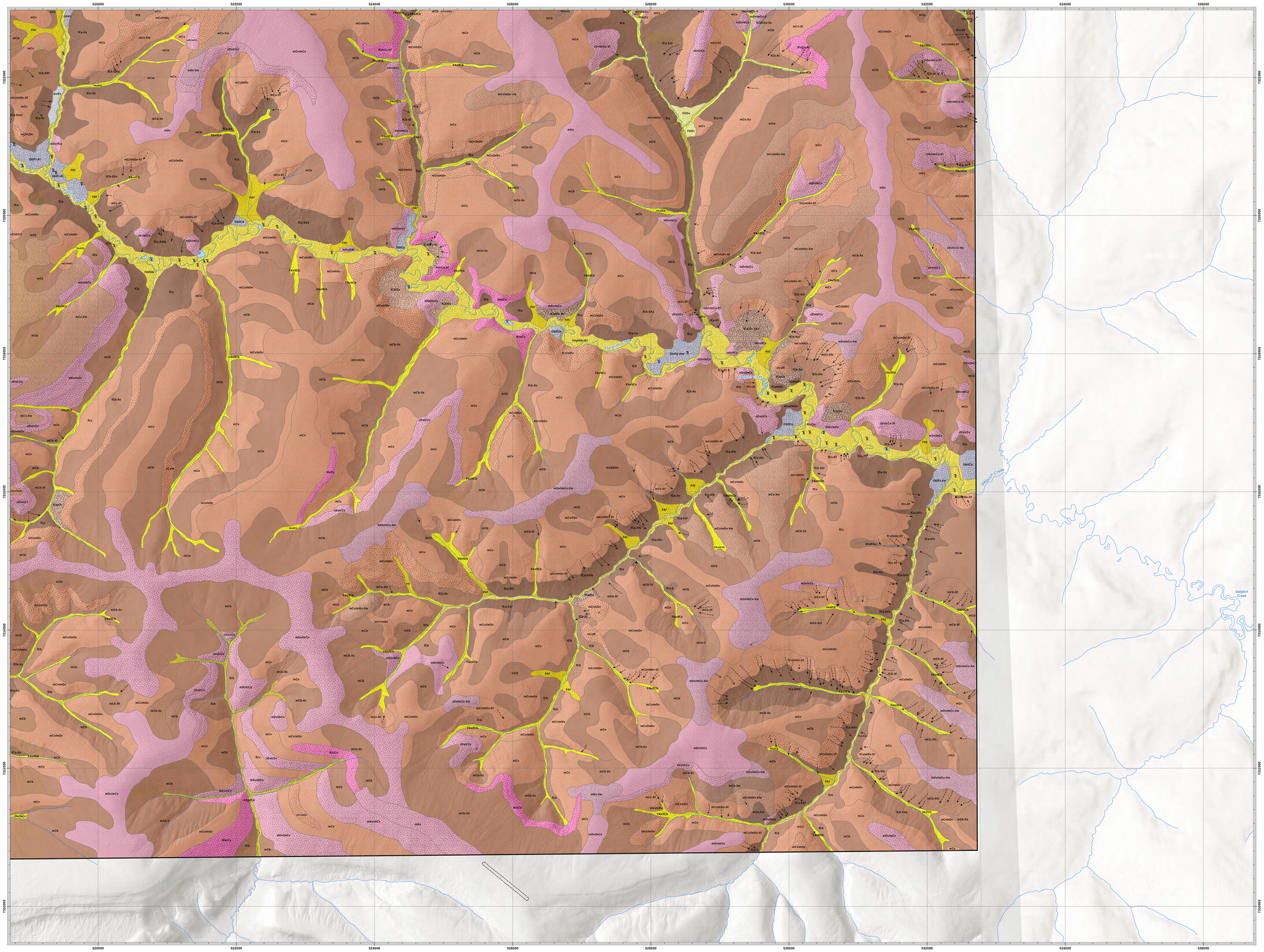

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Surficial Geology and Permafrost Classification

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

SURFICIAL MATERIAL AND LANDFORM DEFINITIONS

A	**Anthropogenic deposits:** surficial materials modified by human activities such that their original physical properties have been significantly altered, applied to areas modified by excavation and construction activities; not applied to road network.
Ov	**Organic deposits; veneer:** < 1 m thick; material derived from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions; only included in map labels where accumulation is thicker than 2.0 cm.
Ob	**Organic deposits; blanket:** > 1 m thick; material derived from the accumulation of plant matter, generally consisting of peat (typically bog or fen); occurs on poorly drained, level to gently sloping shallow depressions.
FAv	**Fluvial sediments; active veneer:** < 1 m thick; material transported and deposited by streams typically exhibiting inter mittent or perennial flow; mainly occurs on gentle slopes within gullies at the headwaters of moderate streams; generally composed of silt, organics, and minor sands.
FAf	**Fluvial sediments; active fan:** material transported and deposited by streams; typically occurs where fluvial systems meet lar ger, lower angle river systems and deposit material; longitudinal profile from slightly concave to slightly convex; generally composed of silt, sands, and organics.
FAg	**Fluvial sediments; active plain:** material transported and deposited by moderate streams; typically planar to gently sloping landform ms along valley bottoms; generally composed of silt and sand on floodplains, gravels along active channels and bars.
Fp	**Fluvial sediments; active plain:** material transported and deposited by streams in the floodplain above moderate channels; typically planar to gently sloping landform ms along valley bottoms; generally composed of silts, sands, and organics.
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Cv	**Colluvial sediments; veneer:** < 1 m thick; material that have been transported downslope through gravitational processes including freeze- thaw cycles, creep, solifluction, slopewash and active-layer detachments; deposit roughly follows the surface of the underlying bedrock and is too thin to mirror irregularities; generally composed of silts, sands, and gravels; may locally include larger clasts.
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Ca	**Colluvial sediments; apron:** < 1 m thick; material that have been transported downslope through gravitational processes including freeze- thaw cycles, creep, solifluction, slopewash and active-layer detachments; wedge- shaped landforms occurring on lower slopes positions where sediments accumulate; may be locally inter mixed with fluvial deposits; generally composed of silts, sands, and gravels; locally include larger clasts and organics.
Dv	**Bedrock, undifferentiated, weathered:** extensively weathered material identified by bedrock outcrops; material derived directly from underlying bedrock without significant transportation; typically occurs on rounded summits and along broad and sloped surfaces; generally composed of silt, sand, and gravel- sized fragments.
R	**Bedrock, undifferentiated:** moderate- to high- relief surface exposition; typically exposed in bluffs along ridges and in upper slopes positions, in association with different erosion of different sedimentary; typically gradational to weathered bedrock.

TEXTURE*

f - Matrix- dominated: deposit is composed nearly entirely of silts and clays, with minor sand.

m - Matrix- supported: deposit is a matrix supported mixture of gravels, sands, silts, and minor clay.

c - Clast- supported: deposit is a clast- rich mixture of gravels, sands, and minor silts.

**Texture classes are applied to colluvium and weathered bedrock. Textures for other materials are characterized above in association with the landform definitions.*

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-t - Thermokarst subsidence: ground- surface depressions created by the thawing of ice- rich permafrost osoil subsidence; depressions commonly contain water (thaw pond); may be mapped as a lake in the base mapping.

-w - Patterned ground: polygonal surface expression of ice wedges in permafrost terrain; commonthermokarst.

TERRAIN LABEL

TERRAIN COMPONENT DELIMITER

TERRAIN COMPONENT 1 | TERRAIN COMPONENT 2

mCv / cDv-Xf ← GEOMORPHOLOGICAL PROCESS(ES) (- X = permafrost)

SUBCLASS(ES) (s = sheetwash, f = active- layer detachment)

TEXTURE 1 (m = matrix- supported) | TEXTURE 2 (m = matrix- supported)

SURFICIAL MATERIAL 1 (C = colluvial) | SURFICIAL MATERIAL 2 (D = Weathered Bedrock)

SURFACE EXPRESSION 1 (v = veneer) | SURFACE EXPRESSION 2 (v = veneer)

COMPOSITE SYMBOL DELIMETERS:

/ Primary unit is more extensive than secondary unit

// Primary unit is much more extensive than secondary unit

\ Primary unit overlies secondary unit

ONSITE SYMBOLS

- × Bedrock outcrop; minor
- Thermokarst subsidence
- ---→ Active- layer detachment
- Highway / Road
- Water course
- Water body
- Airstrip
- Study area boundary

PERMAFROST CLASSIFICATION OVERLAY	ESTIMATED RELATIVE ICE CONTENT		
	Ice-poor: little to no excess ice; discontinuous to continuous pore ice; locally include segregated ice in thin seams; massive ice unlikely; most common condition in the study area	**Ice-moderate:** moderate amount of excess ice; continuous pore ice; segregated ice in seams and lenses; massive ice (e.g. wedges) possible locally.	**Ice-rich:** large amount of excess ice; continuous pore ice; segregated ice; extensive in seams and lenses; massive ice indicated (Xw), otherwise inferred (Xi), or likely.
ESTIMATED RELATIVE DEPTH — **Near-surface:** < 0.4 m; within or at the base of organics.	typically sur face		
Shallow: 0.4 - 1 m; relatively fine- grained, sup porting sediments; most common condition in the study area	commonly in matrix- dominated		
Deep: > 1 m; typically relatively coarse- grained, sup porting sediments.	within clast-		

** Excess ice refers to the volume of ice that exceeds the total voids (e.g. pore space) that would be present under natural, unfrozen conditions.*

*** Depth to permafrost and ice content classes are relative and inferred based on landform association with reference to limited field observations and secondary source information.*

Mapping Notes

Surficial geology mapping was completed at a scale of 1:20,000 using DAT/EM Summit software e in combination with ESRI's ArcGIS. Interpretations were made based on continuous coverage of satellite imagery (2019) and aerial photography hs, and further refined using 1 m- resolution, LiDAR- (2019). Map units (polygons) were delineated based on surficial materials, exposures, active processes, and surface morphology in accordance with the Terrain Classification System for British Columbia Kenk, 1997), with modifications for use in Yukon (Lipovsky and Bond, 2014) and to accommodate objectives. Under this system, up to two surficial materials may be identified in each polygon as either secondary materials, or in strati graphic relation to each other. Polygons have been symbolized based on surficial material, Discrete terrain features and geomorphic processes too small to be mapped as polygons ther mokarst depressions and active- layer detachments have been identified using point and line features. were calibrated, in part, based on one week of helicopter- supported field reconnaissance in July, 2015

Refer ences:

Howes, D.E. and Kenk, E., 1997. Terrain Classification System for British Columbia (Version Columbia. Resource Inventory Branch, Ministry of Environment, Lands and Parks; Recreational Fish Ministry of Environment; and Surveys and Resources Mapping Branch, Ministry of Crown Lands, 102

Lipovsky, P.S. and Bond, J.D. (compiler s). 2014. Yukon digital surficial geology compilation, 2014, Yukon Geological Survey.



Geology by: C. McGregor, D. Cronmiller, R. McKillop, C. Knox, and B. Janzen
Cartography by: B. Elder

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January 2021

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Appendix B

Exploration Development Suitability

Eagle Plains, Yukon



Road and Wellpad Suitability Classification

	Typical Description	Typical Implications
Very High	Moderately well to well drained, isolated topographic highs with deep or shallow, ice-poor permafrost. Generally considered to be stable terrain, and typically located along wide, rounded ridge crests.	Favourable conditions for access road and wellpad establishment through standard best management practices, with minimal expectation for maintenance requirements.
High	Generally moderately well to well drained areas with deep or shallow, ice-poor permafrost. Typically associated with ridges of weathered bedrock or shallow colluvium over convex topography.	Generally favourable conditions for access road and wellpad establishment through standard best management practices, with low to moderate expectation for maintenance requirements.
Moderate	Imperfectly to moderately well drained, colluvial slopes with deep to shallow permafrost, commonly with poor to moderate ice content; convex weathered bedrock bluffs, typically at moderate slope gradients; and fluvial terraces above the influence of modern stream processes.	Generally reasonable conditions for access road and wellpad establishment, where necessary employing mitigations to proactively manage natural concentrations of surface runoff and protect thaw-sensitive permafrost, with moderate expectation for maintenance requirements. Field reconnaissance would help inform route/site selection and mitigation requirements.
Low	Poorly to imperfectly drained, thick colluvial slopes with shallow, ice-rich or ice-moderate permafrost; and imperfectly drained fluvial fans and veneers. Sheetwash, gully erosion, and ice-wedge polygons are common; surface runoff becomes concentrated.	Generally unfavourable conditions for access road and wellpad establishment, except through mitigations to proactively manage natural concentrations of surface runoff and protect thaw-sensitive permafrost, with moderate to high expectation for maintenance requirements. Field reconnaissance necessary to inform route/site selection and mitigation requirements.
Very Low	Very poorly to imperfectly drained areas with shallow or near-surface, ice-rich or ice-moderate permafrost, commonly in association with floodplains, as well as steep bedrock scarps. Thermokarst subsidence and ice-wedge polygons are common; surface runoff and slopes may be subjected to mass movements including solifluction and active-layer detachments.	Unfavourable conditions for access road and wellpad establishment. Any necessary crossings will require comprehensive mitigations to protect thaw-sensitive permafrost and manage surface runoff and fine-grained sediments. Widespread shallow or near-surface of permafrost within overburden. Road construction through steep bedrock scarps would require earthworks and potentially localized blasting. Regardless, maintenance expectations would be high. Field reconnaissance critical to inform route/site selection and mitigation requirements.

Mix-Bury-Cover Disposal Suitability Classification*

Potentially Suitable: level or near-level, elevated areas with minimal or no receipt of surface runoff (i.e., 'shedding sites'). Generally areas are located along broad to rounded ridge crests and knolls that are set back from significant watercourses.

Probably Unsuitable: moderate to steep slopes, areas with ice-rich permafrost, and/or areas exhibiting evidence of instability (e.g, fluvial erosion, thermokarst subsidence, solifluction, active-layer detachments).

**Field investigations necessary to evaluate suitability at a site-specific level.*

Topgraphic Features

- Highway / Road
- Watercourse
- Waterbody
- Airstrip
- Study area boundary

Mapping Notes

The exploration development suitability (EDS) maps represent the general suitability of distinct areas for the construction and maintenance of access roads and wellpads, as well as the suitability for disposal of drill cuttings using mix-bury-cover (MBC) techniques. The EDS classification was derived from the 1:20,000-scale surficial geology interpretations and is specific to the project area. Map units (polygons) were categorized into five road and wellpad suitability classes and two MBC disposal suitability classes based on interpretations of texture, material genesis, geomorphological processes, drainage, and permafrost characteristics. A lower rating does not necessarily mean suitable terrain is not present in the map unit; localized portions of these polygons may be found to be suitable for exploration development or MBC disposal based on site-specific terrain characteristics. Similarly, a higher rating does not necessarily mean the entire polygon is suitable for exploration development or MBC disposal.

Road and wellpad suitability has been primarily classified based on terrain characteristics, site drainage, and permafrost conditions. Isolated topographic highs and moderately to well drained ridges are generally ice poor and favourable for development of exploration infrastructure. Conversely, lower valley terrain such as floodplains and fine grained colluvial aprons are generally prone to higher ice content, and active permafrost and periglacial processes, including active-layer detachments, solifluction, thermokarst, and sheetwash. Construction and maintenance of exploration infrastructure typically requires greater effort and more complex management solutions as road and wellpad suitability decreases. The MBC disposal suitability serves to highlight regions of the study area potentially suitable for MBC disposal of drill cuttings. This classification highlights ice poor, gently sloping, and geomorphologically isolated regions of the landscape set back from significant watercourses as potentially suitable for MBC disposal. Site specific investigations are recommended to confirm the suitability classifications.

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Exploration Development Suitability

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8



Geology by: C. McGregor, D. Cronmiller, R. McKillop, C. Knox, and B. Janzen
Cartography by: B. Elder

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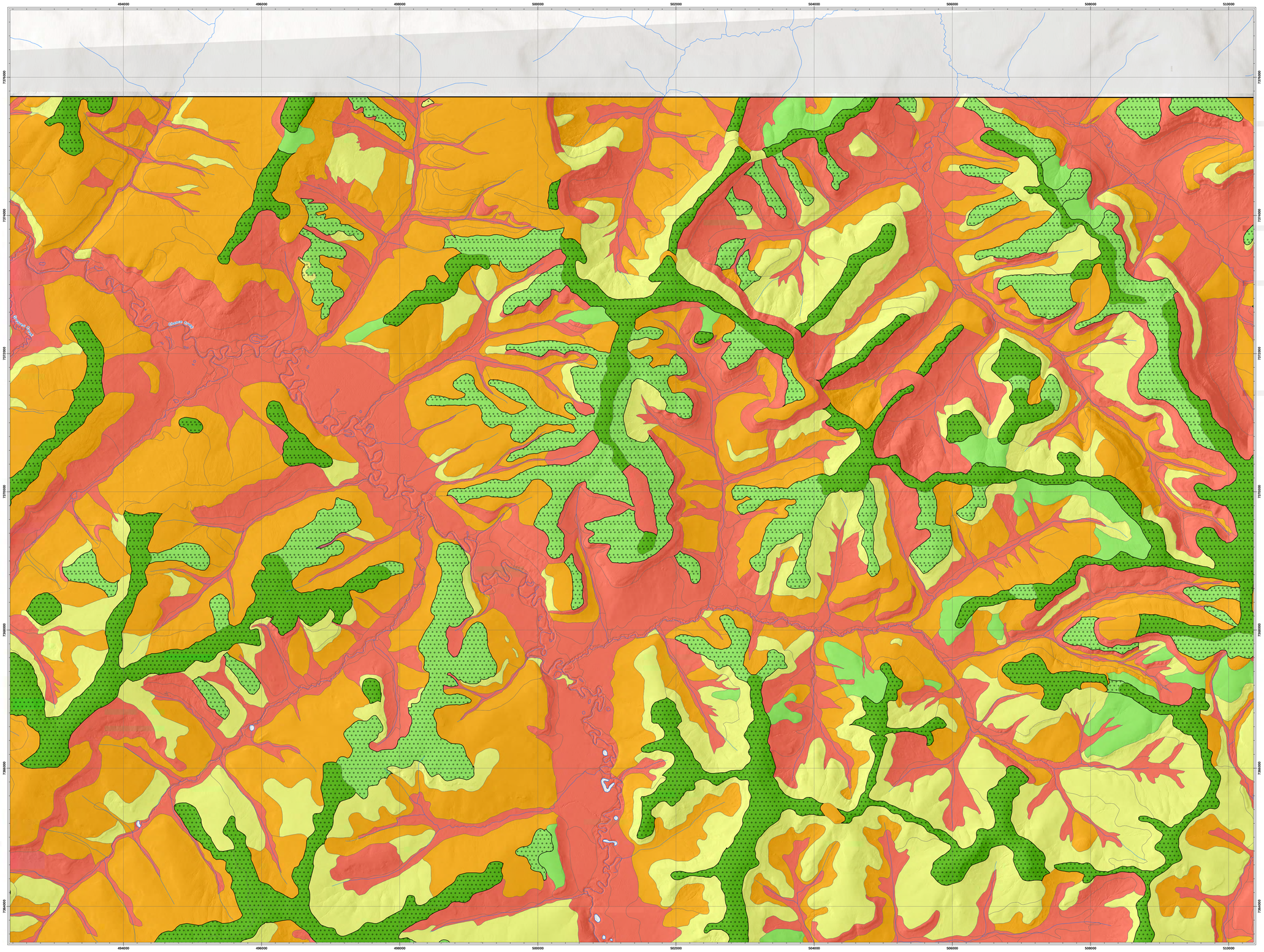

Road and Wellpad Suitability Classification

	Typical Description	Typical Implications
Very High	Moderately well to well drained, isolated topographic highs with deep or shallow, ice-poor permafrost. Generally considered to be stable terrain, and typically located along wide, rounded ridge crests.	Favourable conditions for access road and wellpad establishment through standard best management practices, with minimal expectation for maintenance requirements.
High	Generally moderately well to well drained areas with deep or shallow, ice-poor permafrost. Typically associated with ridges of weathered bedrock or shallow colluvium over convex topography.	Generally favourable conditions for access road and wellpad establishment through standard best management practices, with low to moderate expectation for maintenance requirements.
Moderate	Imperfectly to moderately well drained, colluvial slopes with deep to shallow permafrost, commonly with poor to moderate ice content; convex weathered bedrock bluffs, typically at moderate slope gradients; and fluvial terraces above the influence of modern stream processes.	Generally reasonable conditions for access road and wellpad establishment, where necessary employing mitigations to proactively manage natural concentrations of surface runoff and protect thaw-sensitive permafrost, with moderate expectation for maintenance requirements. Field reconnaissance would help inform route/site selection and mitigation requirements.
Low	Poorly to imperfectly drained, thick colluvial slopes with shallow, ice-rich or ice-moderate permafrost; and imperfectly drained fluvial fans and veneers. Sheetwash, gully erosion, and ice-wedge polygons are common; surface runoff becomes concentrated.	Generally unfavourable conditions for access road and wellpad establishment, except through mitigations to proactively manage natural concentrations of surface runoff and protect thaw-sensitive permafrost, with moderate to high expectation for maintenance requirements. Field reconnaissance necessary to inform route/site selection and mitigation requirements.
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Probably Unsuitable: moderate to steep slopes, areas with ice-rich permafrost, and/or areas exhibiting evidence of instability (e.g. fluvial erosion, thermokarst subsidence, solifluction, active-layer detachments).

**Field investigations necessary to evaluate suitability at a site-specific level.*

Topgraphic Features

- Highway / Road
- Watercourse
- Waterbody
- Airstrip
- Study area boundary

Mapping Notes

The exploration development suitability (EDS) maps represent the general suitability of distinct areas for the construction and maintenance of access roads and wellpads, as well as the suitability for disposal of drill cuttings using mix-bury-cover (MBC) techniques. The EDS classification was derived from the 1:20,000-scale surficial geology interpretations and is specific to the project area. Map units (polygons) were categorized into five road and wellpad suitability classes and two MBC disposal suitability classes based on interpretations of texture, material genesis, geomorphological processes, drainage, and permafrost characteristics. A lower rating does not necessarily mean suitable terrain is not present in the map unit; localized portions of these polygons may be found to be suitable for exploration development or MBC disposal based on site-specific terrain characteristics. Similarly, a higher rating does not necessarily mean the entire polygon is suitable for exploration development or MBC disposal.

Road and wellpad suitability has been primarily classified based on terrain characteristics, site drainage, and permafrost conditions. Isolated topographic highs and moderately to well drained ridges are generally ice poor and favourable for development of exploration infrastructure. Conversely, lower valley terrain such as floodplains and fine grained colluvial aprons are generally prone to higher ice content, and active permafrost and periglacial processes, including active-layer detachments, solifluction, thermokarst, and sheetwash. Construction and maintenance of exploration infrastructure typically requires greater effort and more complex management solutions as road and wellpad suitability decreases. The MBC disposal suitability serves to highlight regions of the study area potentially suitable for MBC disposal of drill cuttings. This classification highlights ice poor, gently sloping, and geomorphologically isolated regions of the landscape set back from significant watercourses as potentially suitable for MBC disposal. Site specific investigations are recommended to confirm the suitability classifications.

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EAGLE PLAINS, YUKON
1:20 000 scale

0 0.5 1 1.5 2
kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8



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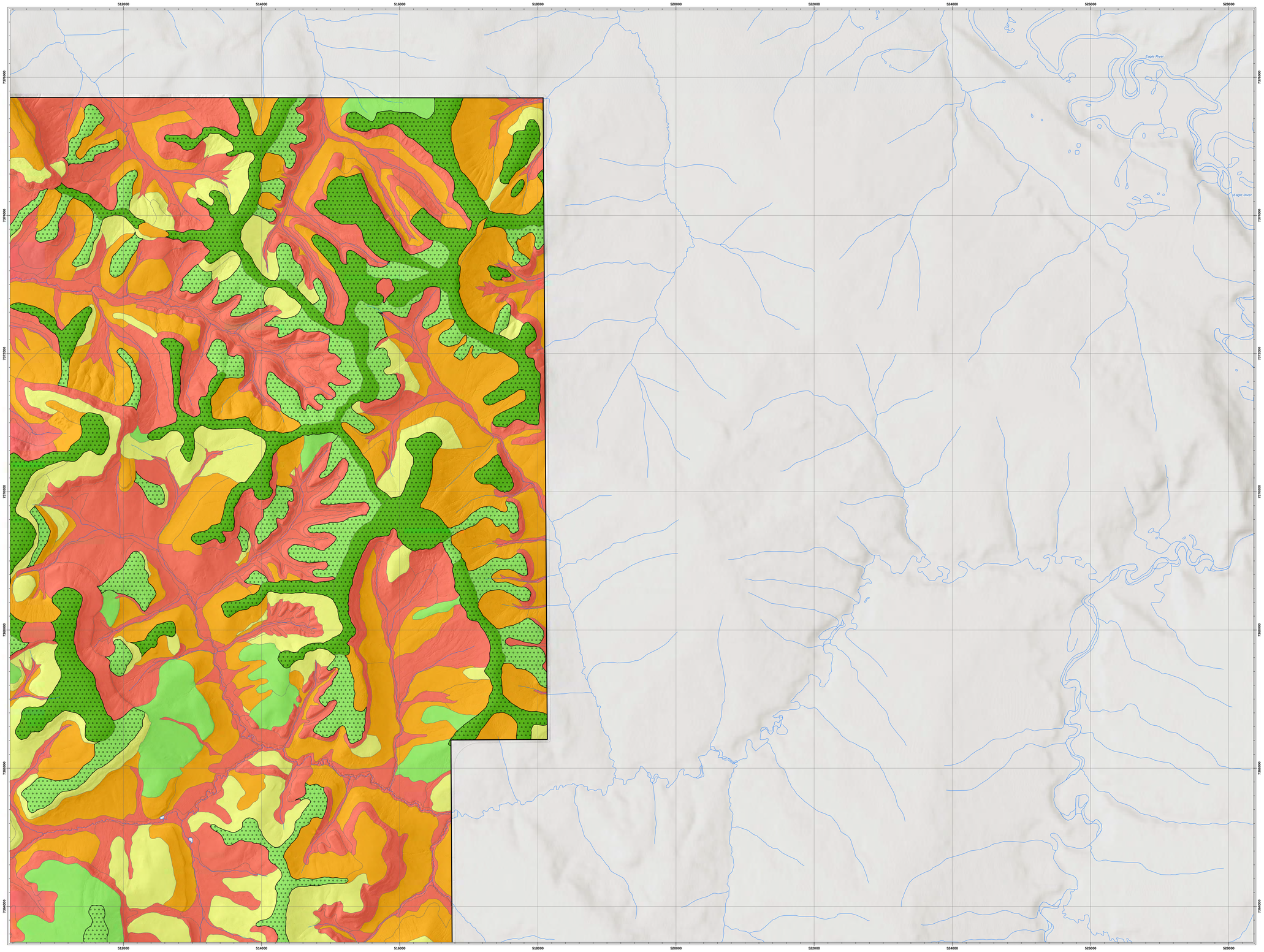

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1:20 000 scale

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Very Low	Very poorly to imperfectly drained areas with shallow or near-surface, ice-rich or ice-moderate permafrost, commonly in association with floodplains, as well as steep bedrock scarps. Thermokarst subsidence and ice-wedge polygons are common on level ground, and slopes may be impacted by ground movements including solifluction and active-layer detachments.	Unfavourable conditions for access road and wellpad establishment. Any necessary crossings will require comprehensive mitigations to protect thaw-sensitive permafrost and manage surface runoff and fine-grained sediment. Where permafrost is within overburden of permafrost within overburden. Road construction through steep bedrock scarps would require earthworks and potentially localized blasting. Regardless, maintenance expectations would be high. Field reconnaissance critical to inform route/site selection and mitigation requirements.

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- Highway / Road
- Watercourse
- Waterbody
- Airstrip
- Study area boundary

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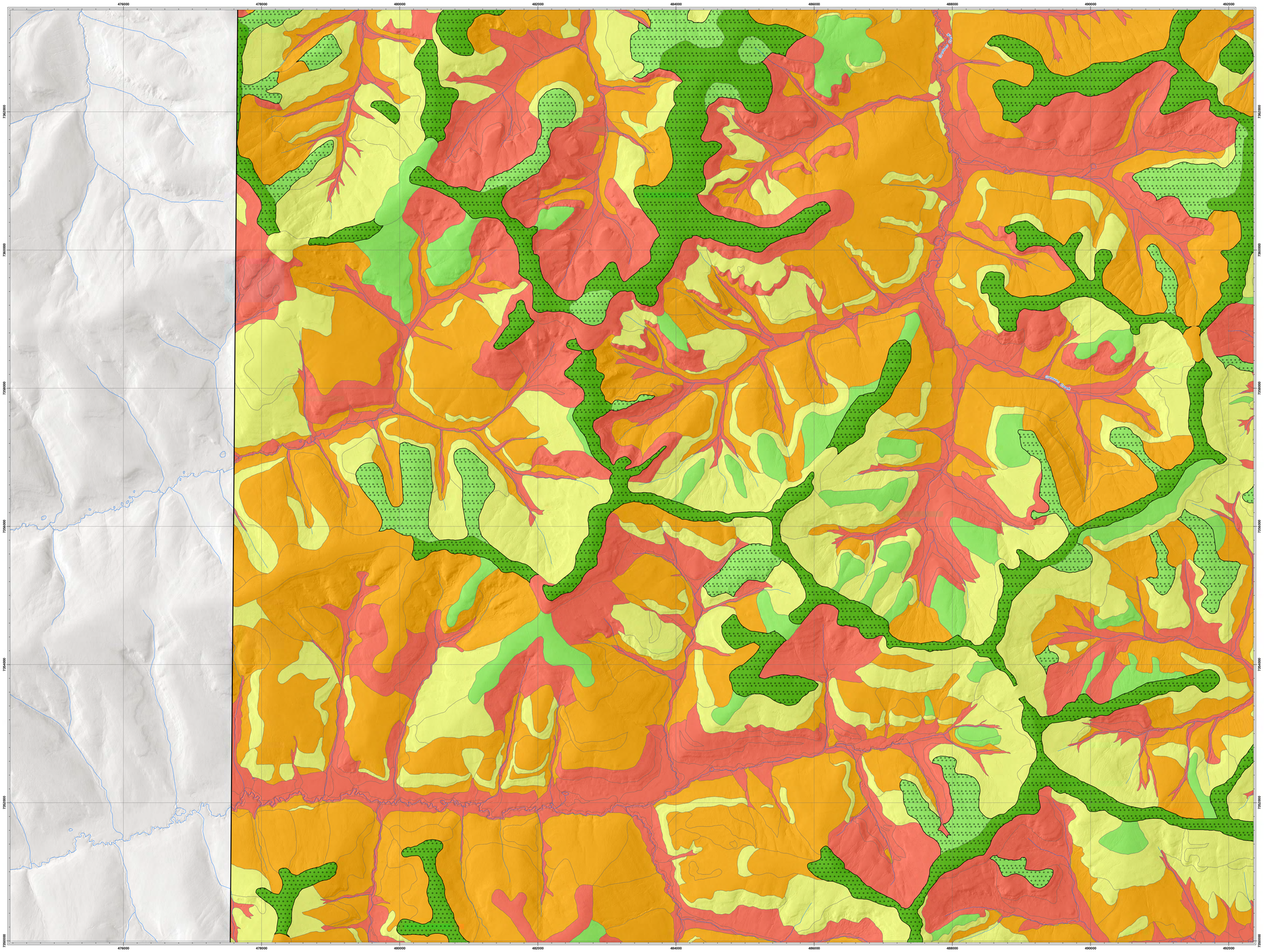

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1:20 000 scale

0 0.5 1 1.5 2
kilometres

TWO THOUSAND METRE GRID
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North American Datum 1983
Zone 8

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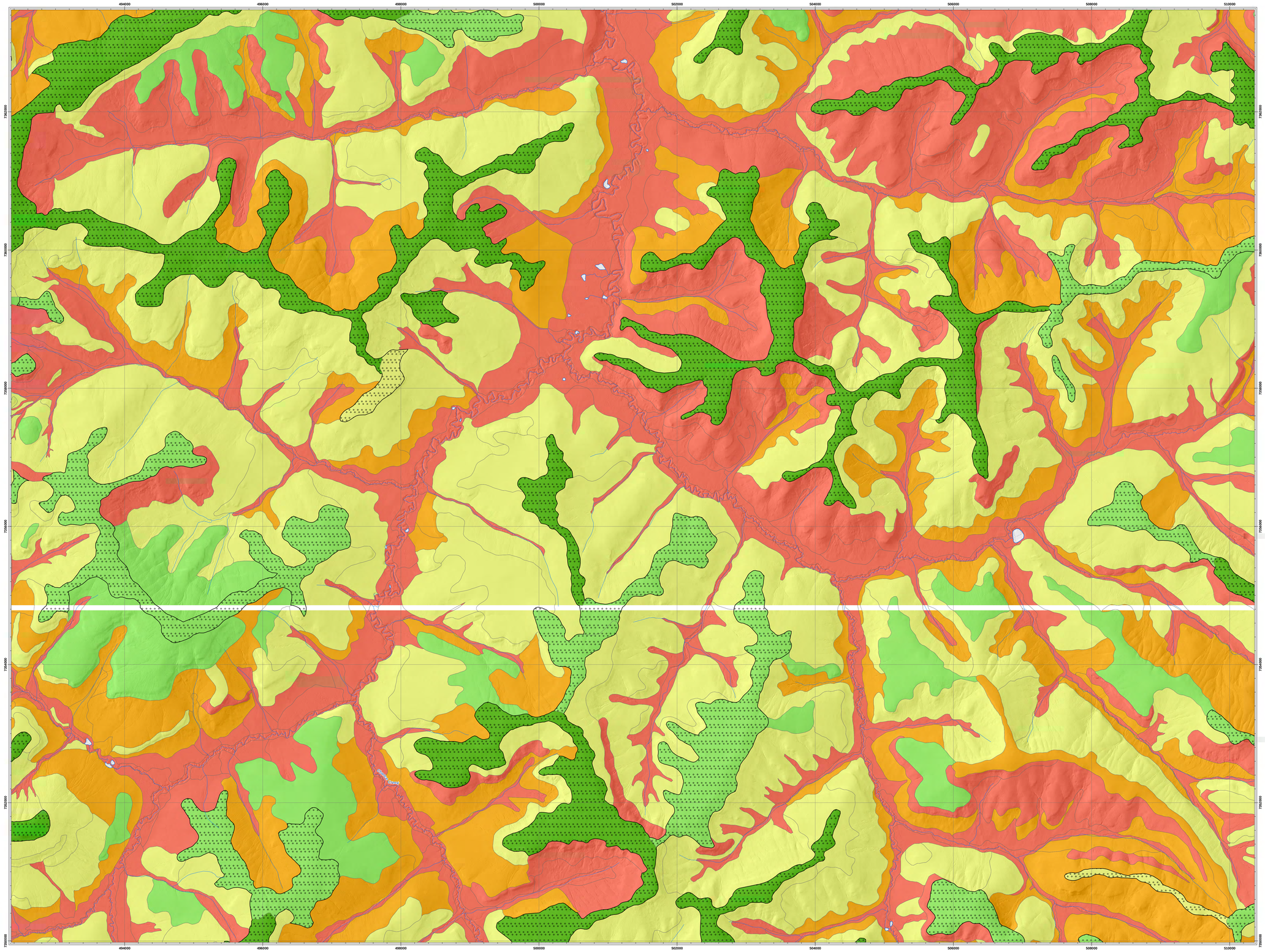

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Mix-Bury-Cover Disposal Suitability Classification*

Potentially Suitable: level or near-level, elevated areas with minimal or no receipt of surface runoff (i.e., 'shedding sites'). Generally areas are located along broad to rounded ridge crests and knolls that are set back from significant watercourses.

Probably Unsuitable: moderate to steep slopes, areas with ice-rich permafrost, and/or areas exhibiting evidence of instability (e.g. fluvial erosion, thermokarst subsidence, solifluction, active-layer detachments).

**Field investigations necessary to evaluate suitability at a site-specific level.*

Topgraphic Features

- Highway / Road
- Watercourse
- Waterbody
- Airstrip
- Study area boundary

Mapping Notes

The exploration development suitability (EDS) maps represent the general suitability of distinct areas for the construction and maintenance of access roads and wellpads, as well as the suitability for disposal of drill cuttings using mix-bury-cover (MBC) techniques. The EDS classification was derived from the 1:20,000-scale surficial geology interpretations and is specific to the project area. Map units (polygons) were categorized into five road and wellpad suitability classes and two MBC disposal suitability classes based on interpretations of texture, material genesis, geomorphological processes, drainage, and permafrost characteristics. A lower rating does not necessarily mean suitable terrain is not present in the map unit; localized portions of these polygons may be found to be suitable for exploration development or MBC disposal based on site-specific terrain characteristics. Similarly, a higher rating does not necessarily mean the entire polygon is suitable for exploration development or MBC disposal.

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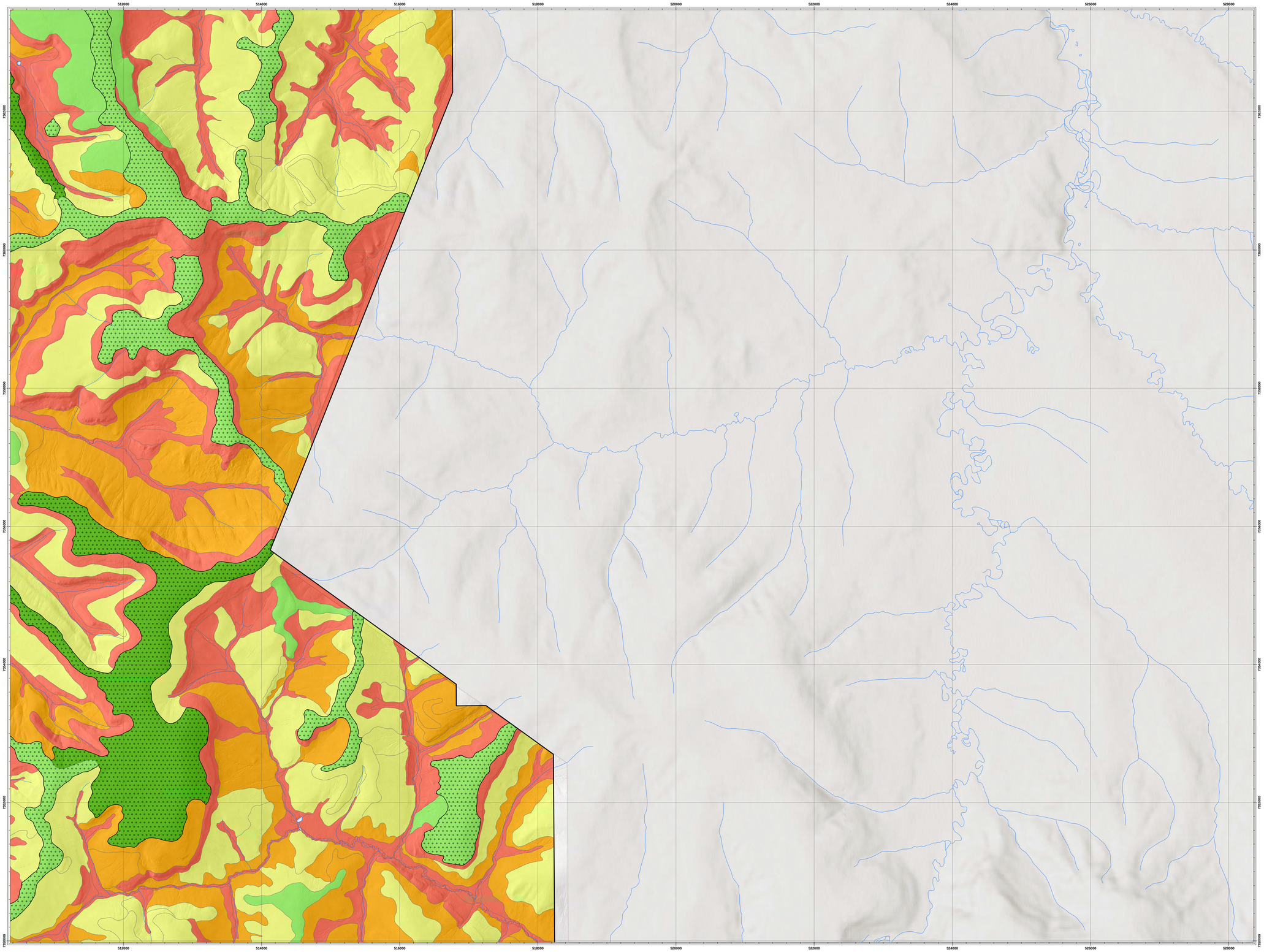

Road and Wellpad Suitability Classification

	Typical Description	Typical Implications
Very High	Moderately well to well drained, isolated topographic highs with deep or shallow, ice-poor permafrost. Generally considered to be stable terrain, and typically located along wide, rounded ridge crests.	Favourable conditions for access road and wellpad establishment through standard best management practices, with minimal expectation for maintenance requirements.
High	Generally moderately well to well drained areas with deep or shallow, ice-poor permafrost. Typically associated with ridges of weathered bedrock or shallow colluvium over convex topography.	Generally favourable conditions for access road and wellpad establishment through standard best management practices, with low to moderate expectation for maintenance requirements.
Moderate	Imperfectly to moderately well drained, colluvial slopes with deep to shallow permafrost, commonly with poor to moderate ice content; convex weathered bedrock bluffs, typically at moderate slope gradients; and fluvial terraces above the influence of modern stream processes.	Generally reasonable conditions for access road and wellpad establishment, where necessary employing mitigations to proactively manage natural concentrations of surface runoff and protect thaw-sensitive permafrost, with moderate expectation for maintenance requirements. Field reconnaissance would help inform route/site selection and mitigation requirements.
Low	Poorly to imperfectly drained, thick colluvial slopes with shallow, ice-rich or ice-moderate permafrost; and imperfectly drained fluvial fans and veneers. Sheetwash, gully erosion, and ice-wedge polygons are common; surface runoff becomes concentrated.	Generally unfavourable conditions for access road and wellpad establishment, except through mitigations to proactively manage natural concentrations of surface runoff and protect thaw-sensitive permafrost, with moderate to high expectation for maintenance requirements. Field reconnaissance necessary to inform route/site selection and mitigation requirements.
Very Low	Very poorly to imperfectly drained areas with shallow or near-surface, ice-rich or ice-moderate permafrost, commonly in association with floodplains, as well as steep bedrock scarps. Thermokarst subsidence and ice-wedge polygons are common on level ground, and slopes may be subjected to mass movements including solifluction and active-layer detachments.	Unfavourable conditions for access road and wellpad establishment. Any necessary crossings will require comprehensive mitigations to protect thaw-sensitive permafrost and manage surface runoff and fine-grained sediments. Where unavoidable, the presence of permafrost within overburden. Road construction through steep bedrock scarps would require earthworks and potentially localized blasting. Regardless, maintenance expectations would be high. Field reconnaissance critical to inform route/site selection and mitigation requirements.

Mix-Bury-Cover Disposal Suitability Classification*

Potentially Suitable: level or near-level, elevated areas with minimal or no receipt of surface runoff (i.e., 'shedding sites'). Generally areas are located along broad to rounded ridge crests and knolls that are set back from significant watercourses.

Probably Unsuitable: moderate to steep slopes, areas with ice-rich permafrost, and/or areas exhibiting evidence of instability (e.g. fluvial erosion, thermokarst subsidence, solifluction, active-layer detachments).

**Field investigations necessary to evaluate suitability at a site-specific level.*

Topgraphic Features

- Highway / Road
- Watercourse
- Waterbody
- Airstrip
- Study area boundary

Mapping Notes

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Exploration Development Suitability

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8



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1:20 000 scale

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High	Generally moderately well to well drained areas with deep or shallow, ice-poor permafrost. Typically associated with ridges of weathered bedrock or shallow colluvium over convex topography.	Generally favourable conditions for access road and wellpad establishment through standard best management practices, with low to moderate expectation for maintenance requirements.
Moderate	Imperfectly to moderately well drained, colluvial slopes with deep to shallow permafrost, commonly with poor to moderate ice content; convex weathered bedrock bluffs, typically at moderate slope gradients; and fluvial terraces above the influence of modern stream processes.	Generally reasonable conditions for access road and wellpad establishment, where necessary employing mitigations to proactively manage natural concentrations of surface runoff and protect thaw-sensitive permafrost, with moderate expectation for maintenance requirements. Field reconnaissance would help inform route/site selection and mitigation requirements.
Low	Poorly to imperfectly drained, thick colluvial slopes with shallow, ice-rich or ice-moderate permafrost; and imperfectly drained fluvial fans and veneers. Sheetwash, gully erosion, and ice-wedge polygons are common; surface runoff becomes concentrated.	Generally unfavourable conditions for access road and wellpad establishment, except through mitigations to proactively manage and vehicles. Thaw-sensitive permafrost and slopes may be subjected to mass movements including solifluction and active-layer detachments.
Very Low	Very poorly to imperfectly drained areas with shallow or near-surface, ice-rich or ice-moderate permafrost, commonly in association with floodplains, as well as steep bedrock scarps. Thermokarst subsidence and ice-wedge polygons are common; surface runoff and slopes may be subjected to mass movements including solifluction and active-layer detachments.	Unfavourable conditions for access road and wellpad establishment. Any necessary crossings will require comprehensive mitigations to protect thaw-sensitive permafrost and manage surface runoff and fine-grained sediments. Road construction in areas underlain by permafrost within overburden. Road construction through steep bedrock scarps would require earthworks and potentially localized blasting. Regardless, maintenance expectations would be high. Field reconnaissance critical to inform route/site selection and mitigation requirements.

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- Watercourse
- Waterbody
- Airstrip
- Study area boundary

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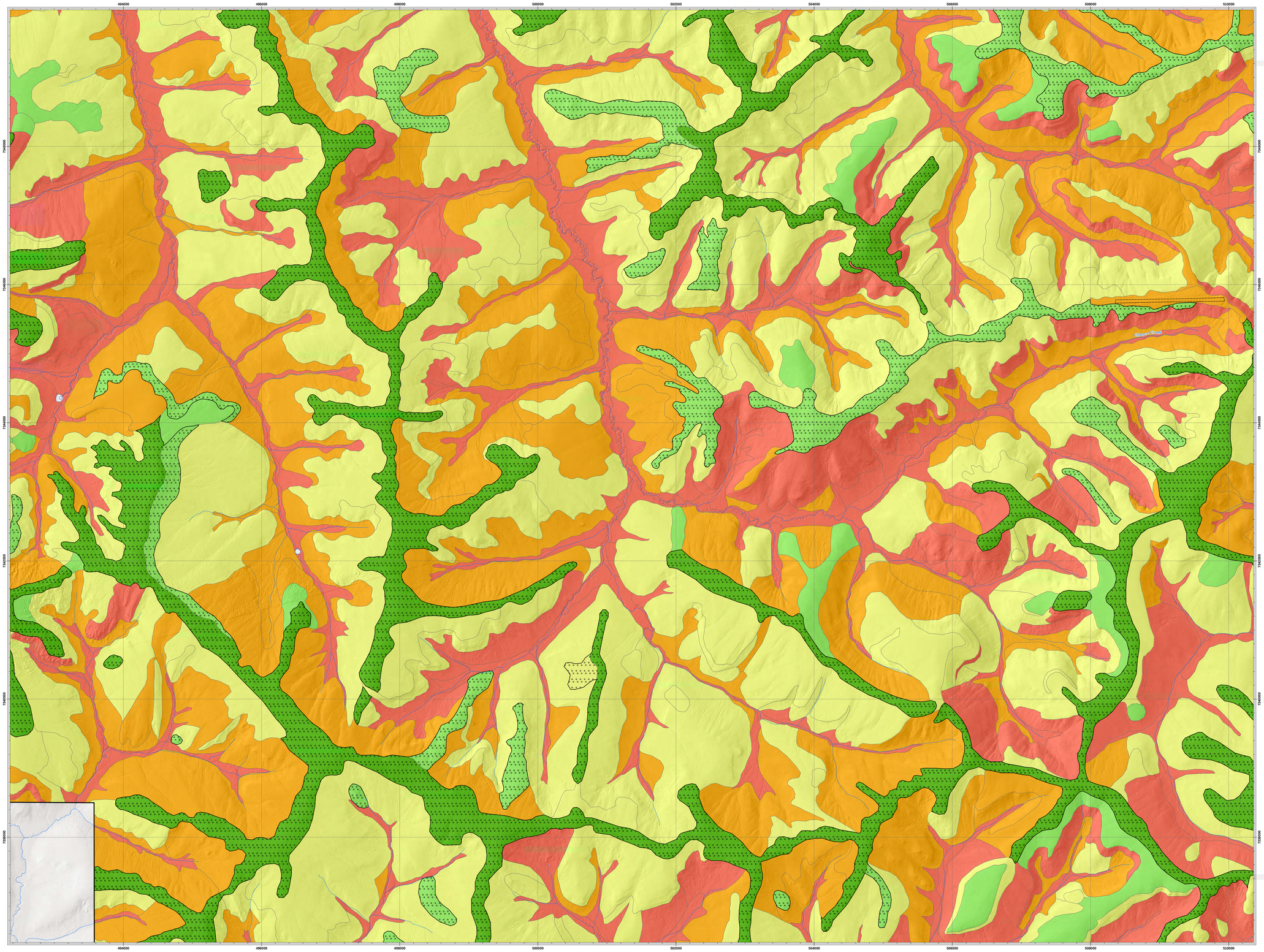

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Exploration Development Suitability

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

Road and Wellpad Suitability Classification

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Mix-Bury-Cover Disposal Suitability Classification*

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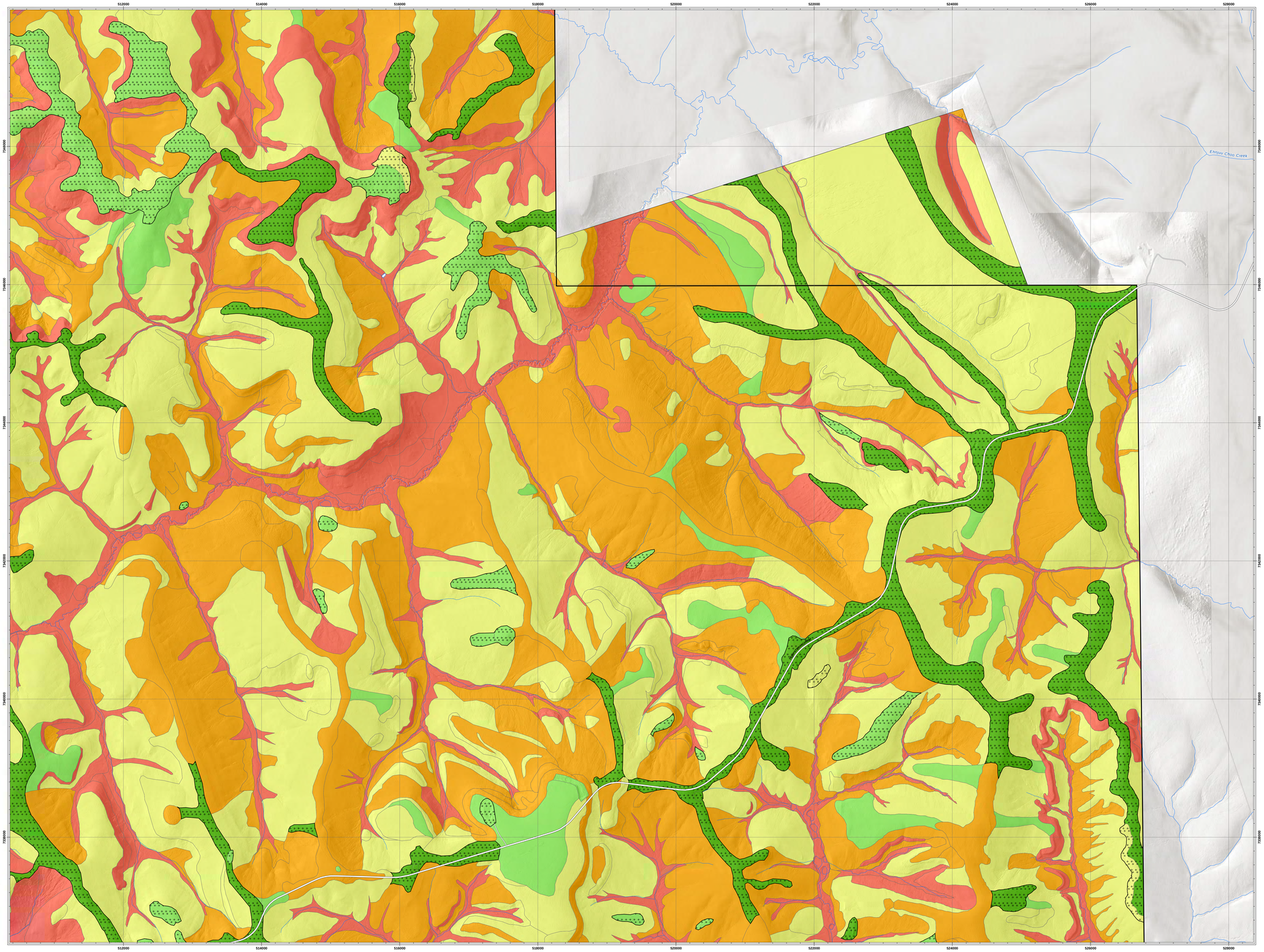

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Exploration Development Suitability

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8



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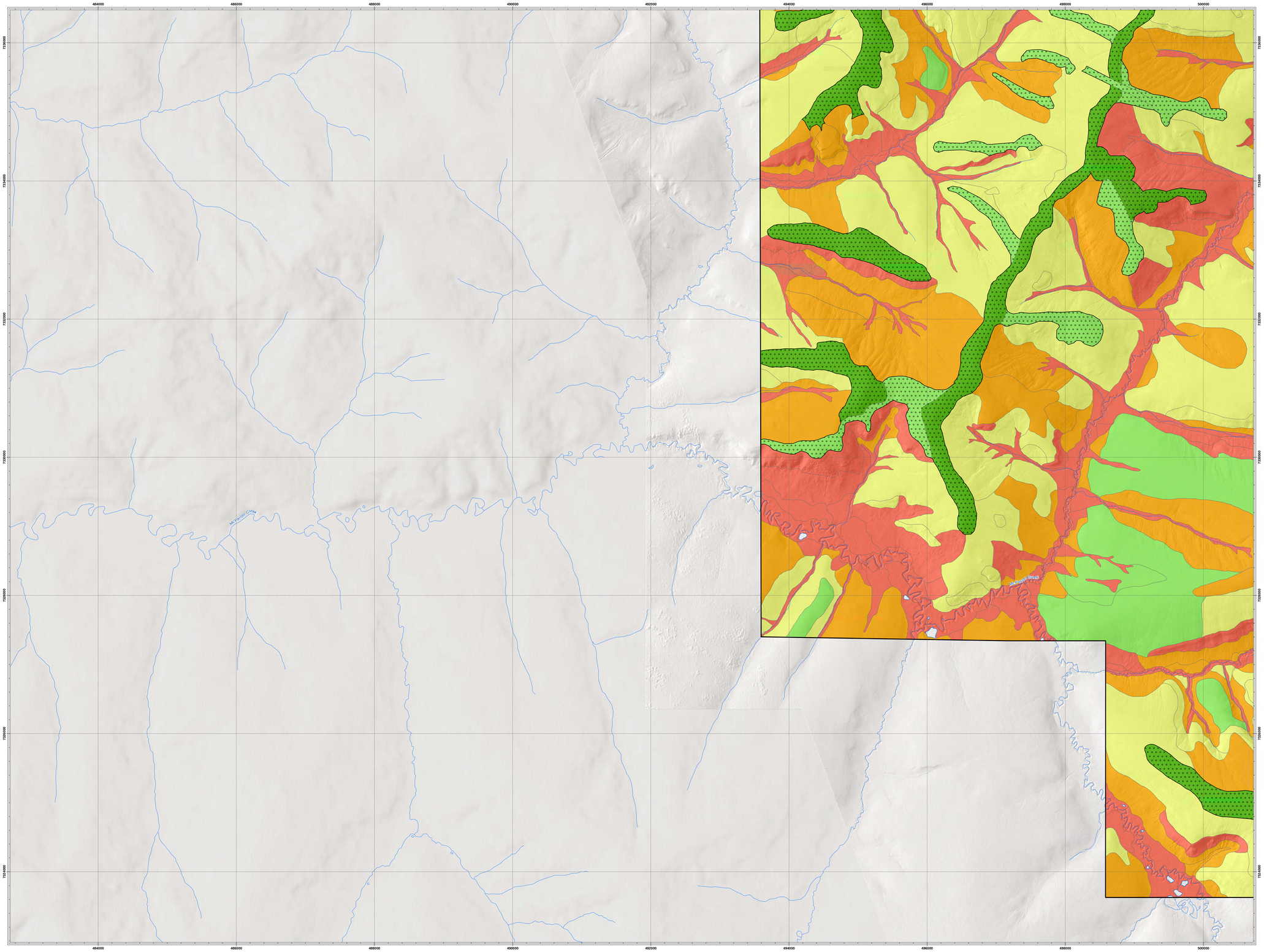

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Very Low	Very poorly to imperfectly drained areas with shallow or near-surface, ice-rich or ice-moderate permafrost, commonly in association with floodplains, as well as steep bedrock scarps. Thermokarst subsidence and ice-wedge polygons are common on low-level ground, and slopes may be impacted by ground movements including solifluction and active-layer detachments.	Unfavourable conditions for access road and wellpad establishment. Any necessary crossings will require comprehensive mitigations to protect thaw-sensitive permafrost and manage surface runoff and fine-grained sediments. Where permafrost is near-surface or of permafrost within overburden, Road construction through steep bedrock scarps would require earthworks and potentially localized blasting. Regardless, maintenance expectations would be high. Field reconnaissance critical to inform route/site selection and mitigation requirements.

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Cartography by: B. Elder

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Road and Wellpad Suitability Classification

	Typical Description	Typical Implications
Very High	Moderately well to well drained, isolated topographic highs with deep or shallow, ice-poor permafrost. Generally considered to be stable terrain, and typically located along wide, rounded ridge crests.	Favourable conditions for access road and wellpad establishment through standard best management practices, with minimal expectation for maintenance requirements.
High	Generally moderately well to well drained areas with deep or shallow, ice-poor permafrost. Typically associated with ridges of weathered bedrock or shallow colluvium over convex topography.	Generally favourable conditions for access road and wellpad establishment through standard best management practices, with low to moderate expectation for maintenance requirements.
Moderate	Imperfectly to moderately well drained, colluvial slopes with deep to shallow permafrost, commonly with poor to moderate ice content; convex weathered bedrock bluffs, typically at moderate slope gradients; and fluvial terraces above the influence of modern stream processes.	Generally reasonable conditions for access road and wellpad establishment, where necessary employing mitigations to proactively manage natural concentrations of surface runoff and protect thaw-sensitive permafrost, with moderate expectation for maintenance requirements. Field reconnaissance would help inform route/site selection and mitigation requirements.
Low	Poorly to imperfectly drained, thick colluvial slopes with shallow, ice-rich or ice-moderate permafrost; and imperfectly drained fluvial fans and veneers. Sheetwash, gully erosion, and ice-wedge polygons are common; surface runoff becomes concentrated.	Generally unfavourable conditions for access road and wellpad establishment, except through mitigations to proactively manage natural concentrations of surface runoff and protect thaw-sensitive permafrost, with moderate to high expectation for maintenance requirements. Field reconnaissance necessary to inform route/site selection and mitigation requirements.
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Mix-Bury-Cover Disposal Suitability Classification*

Potentially Suitable: level or near-level, elevated areas with minimal or no receipt of surface runoff (i.e., 'shedding sites'). Generally areas are located along broad to rounded ridge crests and knolls that are set back from significant watercourses.

Probably Unsuitable: moderate to steep slopes, areas with ice-rich permafrost, and/or areas exhibiting evidence of instability (e.g. fluvial erosion, thermokarst subsidence, solifluction, active-layer detachments).

**Field investigations necessary to evaluate suitability at a site-specific level.*

Topgraphic Features

- Highway / Road
- Watercourse
- Waterbody
- Airstrip
- Study area boundary

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Exploration Development Suitability

EAGLE PLAINS, YUKON

1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8



Geology by: C. McGregor, D. Cronmiller, R. McKillop, C. Knox, and B. Janzen
Cartography by: B. Elder

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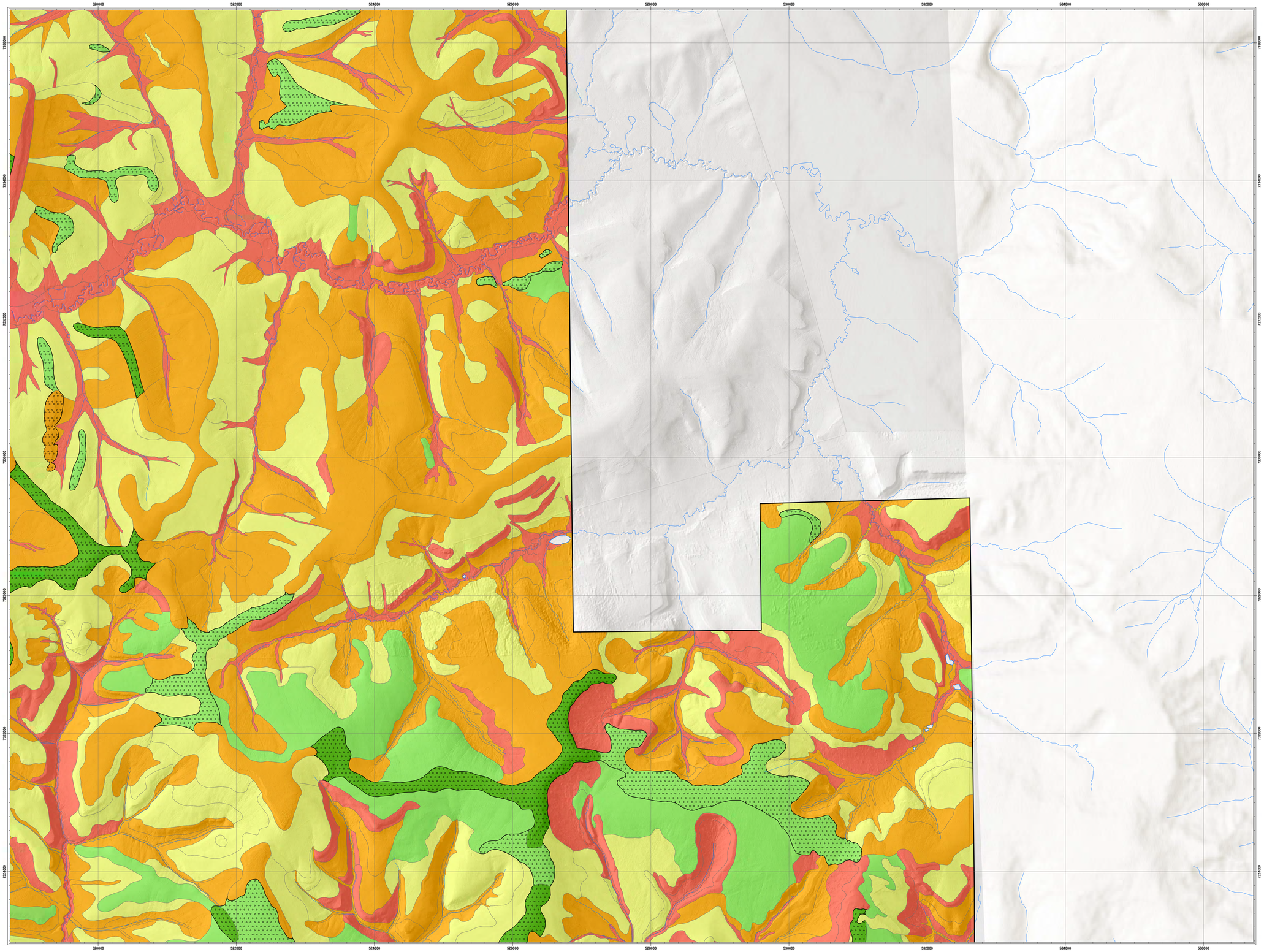

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1:20 000 scale

0 0.5 1 1.5 2

kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8

Road and Wellpad Suitability Classification

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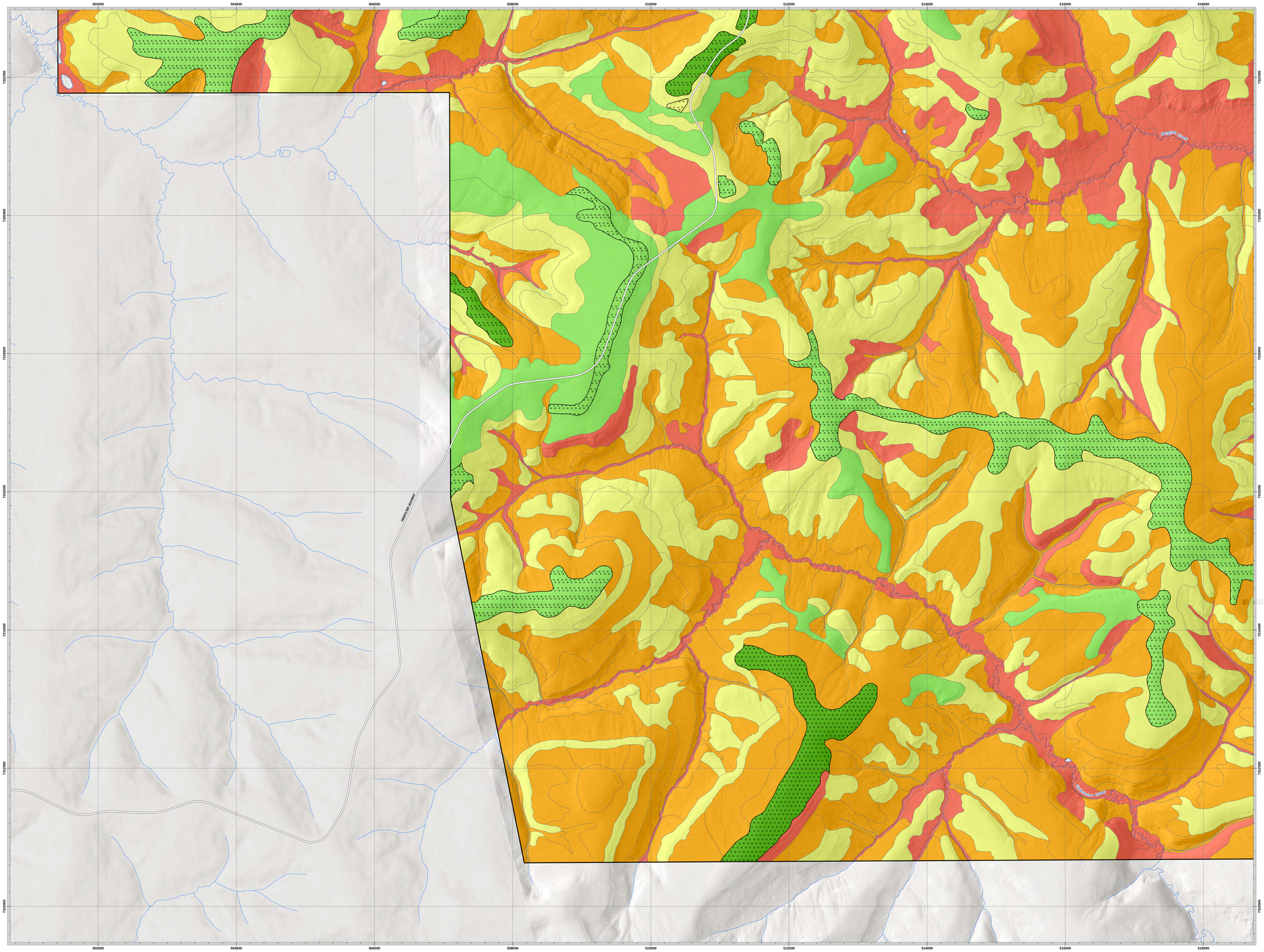

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Exploration Development Suitability
EAGLE PLAINS, YUKON
1:20 000 scale

0 0.5 1 1.5 2
kilometres

TWO THOUSAND METRE GRID
Universal Transverse Mercator Projection
North American Datum 1983
Zone 8



Geology by: C. McGregor, D. Cronmiller, R. McKillop, C. Knox, and B. Janzen
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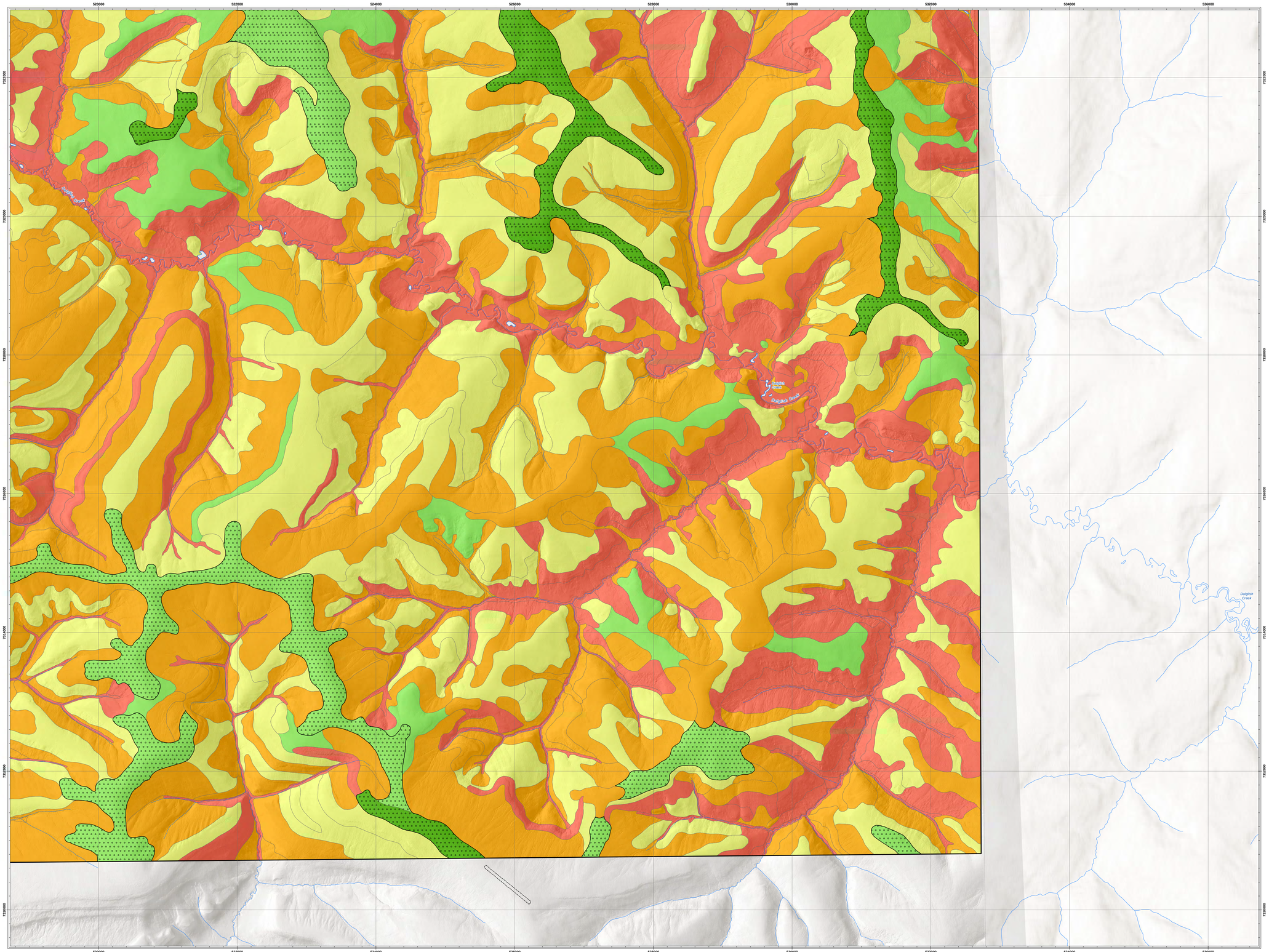

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Appendix C

Borehole Logs

LOG OF BOREHOLE 21-01-F

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-01-2021

BH LOCATION: 66°07'42.8" N, 137°36'38.0" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
Ground Surface					
0.00	CLAYEY SILT (FLUVIAL); some sand, dark grey; very wet, organic-rich layers; water table at 0.28 m, permafrost table at 0.34 m				Cored
			21-01-F; 0.20 to 0.23 m		
	W. L. 0.28 mBGL				
	P.T. 0.34 mBGL				
0.40	No recovery				
0.55				Vs 30%; micro-lenticular layers <1 mm apart	
0.60	Trace sand		21-01-F; 0.60 to 0.80 m	Vs 10-30%; 1 mm layers 4 mm apart	Clay 24%, silt 68%, sand 8%
0.90	Organic-rich layers 1-5 mm thick, with wood			Vs, Vr 10%; 1 mm layers and <1 mm vertical veins	
1				Vs 60%, micro-lenticular	
1.14	ICE				
1.18	CLAYEY SILT (FLUVIAL)			Vs 60%	
1.22	Organic-rich			Vs 20%	
1.40	ICE + CLAYEY SILT (FLUVIAL)			Vs 70%; clear, granular ice	
1.74	CLAYEY SILT (FLUVIAL)			Vs 30%	
1.80	PEAT			Vx 10%	
1.86	CLAYEY SILT (FLUVIAL)			Vs 40%	
1.96	PEAT				
2					

Continued Next Page

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE ▼

SURFICIAL GEOLOGY BOREHOLES 1-02SEP_2022_BOREHOLES_GS.GLB
SURFICIAL GEOLOGY BOREHOLES 1-02SEP_SURFICIAL GEOLOGY BOREHOLES (GINT 2 GPJ 23-9-25

LOG OF BOREHOLE 21-01-F

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-01-2021

BH LOCATION: 66°07'42.8" N, 137°36'38.0" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Continued				
	PEAT(Continued)			Vx 10%	
2.16	Wood pieces up to 5 cm long + 2 cm wide			Vc 5%	Refusal at 2.2 m on wood; Frostlink sensor installed
2.20	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

LOG OF BOREHOLE 21-02

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-01-2021

BH LOCATION: 66°07'44.2" N, 137°36'43.8" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	SILTY CLAY (FLUVIAL); medium brown, medium-grey gleyed patches with 20% rusty mottles				Hand-dug to 0.60 m
0.30	CLAYEY SANDY SILT (FLUVIAL); permafrost at 0.60 m		21-02-F; 0.40 to 0.46 m		Clay 27%, silt 48%, sand 25%, moisture 39%
0.60	P.T. 0.60 mBGL CLAYEY SILT (FLUVIAL)			Vs 20%; clear ice layers, <1 mm to 10 mm	Cored
0.90	SILTY CLAY (FLUVIAL)			Nf	
1.28	SILT (FLUVIAL)			Vc 20%	
1.30	CLAYEY SILT (FLUVIAL); sparse mottles; fine roots, rare organics			Nb	
1.58	Peat inclusion				
1.70	Rusty mottles 20%			Nb	Ended hole due to sloughing and squeezing
1.80	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE ▼

LOG OF BOREHOLE 21-03

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-01-2021

BH LOCATION: 66°12'19.1" N, 137°28'05.5" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	CLAYEY SILT (COLLUVIUM); some sand; dark grey; gleyed, 30% rusty mottles; a few wood pieces up to 25 cm; a few clasts up to 1.5				Cored
0.08	P.T. 0.08 mBGL				
	ICE + CLAYEY SILT (COLLUVIUM); clayey silt forms layers within ice; permafrost at 0.08 m			Vs 70%	
				Ice >95%; clear, granular	
0.30	A few organic lenses			Ice 80%	
				Ice 95%	
			21-03-F; 0.50 to 0.56 m	Ice 80%	Clay 19%, silt 68%, sand 13%
				Clear, granular, friable ice	
0.80	CLAYEY SILT (COLLUVIUM)			Vs 30%, wavy lenticular, 1 mm lenses, 3 mm apart	
0.86	ICE + CLAYEY SILT (COLLUVIUM); clayey silt forms layers			Ice 80%	
1					
1.00	CLAYEY SILT (COLLUVIUM)		21-03-F; 1.00 to 1.04 m		
				Vs 60%, microlenticular	
1.25	5 mm soil and ice layers				
				Vs 40%, wavy lenticular, minor micro-lenticular	
1.55	SILT (WEATHERED BEDROCK); some sand and clay; yellow-brown			Vs 5%, <1 mm thick ice layers	
					Refusal on weathered bedrock at 1.70 m
1.70	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

LOG OF BOREHOLE 21-04

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd.

Method: Hand-Dug Test Pit

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic

Date: Aug-01-2021

BH LOCATION: 66°12'17.0" N, 137°27'56.2" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
Ground Surface					
0.00	SILT (COLLUVIUM); some sand; medium brown; 40% boulders/cobbles, fining to pebbles with depth; platy boulders up to 35 cm long near surface			Cryoturbation evidence	Hand-dug
	P.T. 0.22 mBGL				
0.26	SANDY SILT (COLLUVIUM); medium brown; 20% pebbles				
0.38	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

LOG OF BOREHOLE 21-05

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-01-2021

BH LOCATION: 66°12'18.6" N, 137°28'02.7" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	SILTY CLAY (COLLUVIUM); dark yellow-brown; B horizon				Cored
0.08	Medium brown; C horizon				
	P.T. 0.26 mBGL				
0.30	Gleyed with rusty mottles			Vs 40%	
					Abandoned at 0.48 m due to high ice content and poor recovery
0.48	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

LOG OF BOREHOLE 21-06-F

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd.

Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic

Date: Aug-01-2021

BH LOCATION: 66°11'23.3" N, 137°27'30.1" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	SILTY CLAY (COLLUVIUM); dark brown, organic-rich, A horizon lens on north side of soil pit				Hand dug to 0.40 m
0.08	CLAYEY SILT (COLLUVIUM); a few specks of dark organics and rusty sand				
0.20	Medium brown				
	P.T. 0.35 mBGL				
				Vs 5%	Cored
0.42	ICE + CLAYEY SILT (COLLUVIUM)			Vs 80%; clear to cloudy ice; thinly layered	
0.60	CLAYEY SANDY SILT (COLLUVIUM)			Vs 30%	
0.65	Medium brown		21-06-F		Clay 26%, silt 50%, sand 24%
				Vs 10%; layers 2-10 mm thick, 10-20 mm apart	
0.78	Grey brown				
				Nb	
				Vs 40%; clear, granular ice	
1					
					Drill stuck at 1.0 m, augered separate hole to 1.1 m to install Frostlink
1.10	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

LOG OF BOREHOLE 21-07-F

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd.

Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic

Date:

BH LOCATION: 66°09'40.9" N, 137°29'21.2" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	CLAYEY SILT (COLLUVIUM); some sand; light yellow brown; dry; massive				Cored
0.42	P.T. 0.42 mBGL Medium brown				
0.46	SANDY SILT (COLLUVIUM); some clay; flecks of black organics				
			21-07-F; 0.50 to 0.54 m		Clay 22%, silt 40%, sand 38%
				Vx 5-15%; very small ice crystals	
0.64	Sandstone clast, 4cm wide				
0.66	CLAY (WEATHERED BEDROCK); some silt and sand; some pebbles				Augered
				Vx <1% Nb	
					Refusal on weathered bedrock at 0.66 m; augered to 1 m for Frostlink installation
0.80	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

LOG OF BOREHOLE 21-08

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-02-2021

BH LOCATION: 66°21'33.4" N, 137°36'23.0" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
Ground Surface					
0.00	SILT (WEATHERED BEDROCK); light brown-grey; Ae horizon; organic-rich				Cored
0.15	Dark brown; Ah horizon; very organic-rich				
0.20	CLAYEY SILT (WEATHERED BEDROCK); medium grey; C horizon; gleyed; rusty mottles; permafrost at 0.55 m		21-08-F; 0.36 to 0.38 m		
0.55	P.T. 0.55 mBGL Medium brown			Vx <1%	
0.68	ICE + CLAYEY SILT (WEATHERED BEDROCK)			Ice 95%; clear and cloudy layers of granular ice Ice 80%	
1.04	SILT (WEATHERED BEDROCK); some clay, some sand; medium brown		21-08-F; 1.08 to 1.10 m	Vx, Vs 5%	
1.12	ICE + SILT (WEATHERED BEDROCK); some clay, some sand			Vs; ice 60-70%; clear, granular	
1.30	SILT (WEATHERED BEDROCK); some clay, some sand		21-08-F; 1.30 to 1.34 m	Vs 30%	Clay 17%, silt 71%, sand 12%
1.36	Darker brown				
1.40				Vs, Vx 30%; wavy lenticular	
1.46	Platy mudstone clasts				
1.50	Dark brown; platy mudstone clasts			Vs, 20%	Refusal on harder weathered bedrock at 1.6 m
1.60	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

LOG OF BOREHOLE 21-09

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd.

Method: Hand-Dug Test Pit

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic

Date: Aug-04-2021

BH LOCATION: 66°28'15.8" N, 137°19'8.1" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
Ground Surface					
0.00	SANDY SILT (COLLUVIUM); medium brown			No permafrost encountered	Hand-dug
0.02	Yellow-brown				
0.20	30% pebbles and cobbles				
0.39	SAND (COLLUVIUM); fine to coarse-grained; medium grey-brown; 40% cobbles/pebbles				
0.77	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

LOG OF BOREHOLE 21-10

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-04-2021

BH LOCATION: 66°28'6.9" N, 137°19'40.7" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
Ground Surface					
0.00	CLAYEY SILT (COLLUVIUM); some sand; medium brown, a few disseminated organics; 1 pebble at 0.4 m				Cored
			21-10; 0.20 to 0.26 m		Clay 33%, silt 51%, sand 16%, moisture 32%
0.44	P.T. 0.44 mBGL CLAY (COLLUVIUM); some silt, medium brown			Vs 10%; clear, granular ice	
0.60	10-20% angular pebbles of rusty sandstone			Ice lens; 2 cm	
0.70	ICE			Massive, granular ice	
0.76	ICE + CLAY (COLLUVIUM)			Vs	Refusal at 0.8 m
0.80	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

LOG OF BOREHOLE 21-AF22

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-05-2021

BH LOCATION: 66°10'52.3" N, 137°19'49.9" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	SILT (WEATHERED BEDROCK); some clay; medium brown; 5% angular pebbles/cobbles; wet				Cored
0.15	SANDY SILT (WEATHERED BEDROCK); medium brown; pebbles and cobbles				
0.24	SILT (WEATHERED BEDROCK); some clay; 5% angular pebbles and cobbles		21-AF22; 0.24 to 0.28 m		
0.40	P.T. 0.40 mBGL Dark yellow brown; few organic flecks			Nb	
0.50	CLAYEY SILT (WEATHERED BEDROCK); medium brown-grey; some angular pebbles			Vs 10%; clear ice lenses	
0.60	SILTY SAND (WEATHERED BEDROCK); some clay; some angular pebbles		21-AF22; 0.60 to 0.69 m	Vs 20%	Clay 11%, silt 45%, sand 44%
0.69	ICE + CLAYEY SILT (WEATHERED BEDROCK); some angular pebbles			Vs 80%; clear and cloudy ice	
0.75	CLAYEY SILT (WEATHERED BEDROCK); medium brown; some angular pebbles			Vs, Vx 40%; ataxitic, crystals up to 7 mm long	
0.88	SANDSTONE (WEATHERED)			Vx 3%	
0.98	SILTSTONE (WEATHERED)			Vs 5%; lenses <1 mm thick	
1.05	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

LOG OF BOREHOLE 21-L11-2

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-06-2021

BH LOCATION: 66°21'35.9" N, 137°37'9.1" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	CLAYEY SILT (WEATHERED BEDROCK); blue-grey; 50% rustly mottles; upper 20 cm springy (slightly wetter); a few organic lenses and pieces of wood				Cored
0.33	P.T. 0.35 mBGL				
	Medium brown			Vs 15%; clear, granular ice; 1 mm layers 5 mm apart	
0.55	Wood pieces up to 1.5 cm long		21-L11-2; 0.60 to 0.64 m	Vx 5%	Clay 20%, silt 71%, sand 9%
				Vx, Vs 40%	
0.79	Wood pieces up to 3 cm long			Vs 5%	
0.83	CLAY (WEATHERED BEDROCK); medium yellow brown			Vs, Vx 40%	
1.00				Vs 20%	
1.14	Medium brown			Vs 50%; clear, granular ice	
1.24	SILTY CLAY (WEATHERED BEDROCK); medium brown; wood pieces up to 1 cm			Vs 40%	
1.34	ICE + SILTY CLAY (WEATHERED BEDROCK)			Massive ice, 80%; cloudy to clear, granular	
1.38	SILTY CLAY (WEATHERED BEDROCK)			Vs 40%	
1.40	ICE + SILTY CLAY (WEATHERED BEDROCK)			Ice 60%; cloudy to clear granular	
1.50	CLAY (WEATHERED BEDROCK); dark brown-grey				
1.68	Small wood pieces			Vs 40%	
1.82	Small wood pieces			Vs 30%	
				Vs 10%	
				Vs 50%	

Continued Next Page

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE ▼

SURFICIAL GEOLOGY BOREHOLES 21-L11-2.GPJ 2022-8-30 PDF: 22-8-30
SURFICIAL GEOLOGY BOREHOLES 21-L11-2.GPJ GDP_BOREHOLES.GDT 7-DEC-21 9:25

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-06-2021

BH LOCATION: 66°21'35.9" N, 137°37'9.1" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION Continued	LITHOLOGY			
2.00	Small wood pieces			Vs 30%	
2.10	ICE + SILTY CLAY (WEATHERED BEDROCK)			Ice 70%; clear and cloudy layers	
2.20	SILTY CLAY (WEATHERED BEDROCK)			Vs 50% Vs 30%; a few rusty to dark brown areas	Ended due to time constraints
2.50	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

SURFICIAL GROUP BOREHOLES_CASING_2022_BOREHOLES.GLB
SURFICIAL GROUP BOREHOLES_2022\8 SURFICIAL GP BOREHOLES.GINT 2.GPJ 23-5-25

Palmer

LOG OF BOREHOLE 21-L68X

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-04-2021

BH LOCATION: 66°28'18.1" N, 137°19'5.5" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	SANDY SILT (WEATHERED BEDROCK); light yellow brown; B horizon; pebbles/cobbles/boulders 30%, angular to subangular				Cored
0.20	Dark yellow-brown				
			21-L68X; 0.34 to 0.38 m		Clay 19%, silt 43%, sand 38%, moisture 14%
0.60	P.T. 0.60 mBGL Some pebbles			Vx 1%	
0.68	SAND (WEATHERED BEDROCK); fine to medium-grained; medium brown, some pebbles			Vx 5%	
			21-L68X; 0.80 to 0.90 m		
				Vx 10%	
0.98	Fine to medium-grained, medium brown			Vs 20-30%; ice lenses	
1.15	ICE + SAND (WEATHERED BEDROCK); ice 90%; sand lenses				
1.20	SILTY SAND (WEATHERED BEDROCK)			Vx 5%	
1.26	SAND (WEATHERED BEDROCK); fine to medium-grained			Vx 20%	
1.38	Some rusty, weathered sandstone pebbles			Vx, Vs 10%	
1.54	SANDSTONE (BEDROCK); medium brown, rusty layers			Vs 5%	
1.60	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

LOG OF BOREHOLE 21-L101

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-05-2021

BH LOCATION: 66°20'33.6" N, 137°26'37.7" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	PEAT				Cored
0.22	P.T. 0.22 mBGL CLAYEY SILT (WEATHERED BEDROCK); medium grey		21-L101; 0.20 to 0.24 m	Vx 5%	
0.60	ICE + CLAYEY SILT (WEATHERED BEDROCK); medium brown		21-L101; 0.60 to 0.64 m	Vs 80%; clear, granular ice	
0.70	CLAYEY SILT (COLLUVIUM)			Vs 40%	
0.74	ICE + CLAYEY SILT (WEATHERED BEDROCK)		21-L101; 0.70 to 0.80 m	Vs 80%; cloudy to clear ice	Clay 29%, silt 62%, sand 9%
0.80	CLAYEY SILT (COLLUVIUM)			Nb Vs 30% Vs 40%; cloudy, granular ice layers 5-10 mm thick, 5-20 mm apart	
1.04	ICE + CLAYEY SILT (COLLUVIUM)			Vs 70%-90%; cloudy to clear, granular ice	
1.20	CLAYEY SILT (COLLUVIUM); dark yellow-brown			Vs 5%	
1.32	ICE + CLAYEY SILT (COLLUVIUM)			Vs 70%	
1.38	CLAYEY SILT (COLLUVIUM); dark grey-brown; a few dark, rusty patches			Vs 20%	
1.44	ICE + CLAYEY SILT (COLLUVIUM)			Vs 70%	
1.48	CLAY (WEATHERED BEDROCK); some silt; dark yellow-brown			Vs 50%, clear to cloudy, granular ice Vs 30% Vs 50% Vs 15% Vs 15%; some 1-5 mm layers,	

Continued Next Page

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE ▼

SURFICIAL GEOLOGY BOREHOLES 21-L101.GPJ 2022-03-25 SURFICIAL GEOLOGY BOREHOLES GINT 2.GDT 22-3-25

LOG OF BOREHOLE 21-L101

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-05-2021

BH LOCATION: 66°20'33.6" N, 137°26'37.7" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Continued				
	CLAY (WEATHERED BEDROCK); some silt; dark yellow-brown(Continued)			3-8 mm apart	
2.15	Yellow-grey			Vs 5%; 1 mm layers, 5-30 mm apart	
2.28	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

LOG OF BOREHOLE 21-M08-F

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Jul-30-2021

BH LOCATION: 66°07'43.9" N, 137°31'19.2" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	PEAT				Hand-dug to 0.27 m
0.12	P.T. 0.15 mBGL SILTY CLAY (COLLUVIUM); medium-grey; rusty-brown mottles			Vs; 1-3 mm lenses, 5-20 mm apart	Cored
0.40	ICE + CLAYEY SILT (COLLUVIUM); ice with clayey silt inclusions			Vs 70%; cloudy and clear ice	
0.60	Ice with clayey silt layers, 5-15 mm thick			Cloudy, granular ice with clear crystals up to 12 mm diameter	
0.75	Ice with clayey silt lenses			Vs 50%; cloudy, granular ice lenses	
0.90	SILT (WEATHERED BEDROCK); dense		21-M08-F; 0.90 to 0.96 m		Clay 17%, silt 71%, sand 12%; 35% volumetric ice content determined by becker analysis; difficult drilling
1.00	CLAYEY SILT (COLLUVIUM)			Vs 35%; 1 mm ice lenses, 5 mm long, 1 mm apart One ice lens 2 cm thick	
					Refusal on bedrock at 1.15 m; Frostlink installed
1.15	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE ▼

LOG OF BOREHOLE 21-MBC-01

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd.

Method: Hand-Dug Test Pit

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic

Date:

BH LOCATION: 66°9'58.2" N, 137°6'54.9" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	SAND (WEATHERED BEDROCK); light brown; fine to medium-grained; 40% angular to subangular sandstone clasts; pebbles, cobbles, and occasional boulders; dry			No permafrost encountered	Cored
0.40	Medium brown				
0.50	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

LOG OF BOREHOLE 21-SUMP

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Aug-04-2021

BH LOCATION: 66°9'59.1" N, 137°3'12.0" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	CLAYEY SILT (WEATHERED BEDROCK); medium brown; a few dark organic flecks				Cored
0.26	SANDY SILT (WEATHERED BEDROCK); medium brown				
	P.T. 0.34 mBGL				
0.35	CLAYEY SILT (WEATHERED BEDROCK); medium brown			Vx 3%	
0.50	FINE SAND (WEATHERED BEDROCK); trace silt; medium brown; a few rootlets			Vx 3%	
0.95	Siltstone granules			Vx 3%	
1.14	SILTY FINE SAND (WEATHERED BEDROCK)				
1.18	FINE SAND (WEATHERED BEDROCK)			Vx 5%	
1.26	No recovery				
1.40	SILTY FINE SAND (WEATHERED BEDROCK); medium brown			Vx 5%	
1.55	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE ▼

LOG OF BOREHOLE 22-01-F

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Jul-26-2022

BH LOCATION: 66°24'38.8" N, 137°55'29.9" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	SILTY CLAY; dark grey to brown, inclusions of wood				Cored
0.15	SILTY CLAY; dark grey to brown, slight mottling				
0.90	P.T. 0.90 mBGL				
1	CLAYEY SILT; brown to dark brown			Vr 25%, frozen, ice crystals visible	Lost recovery after 1.05 m, augered to install Frostlink
1.05	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

Palmer

LOG OF BOREHOLE 22-02-F

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Jul-26-2022

BH LOCATION: 66°23'24.3" N, 137°38'50.5" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	CLAYEY SILT; dark grey to brown, minor root inclusions				Cored
0.35	P.T. 0.35 mBGL				
	Ice laminations			Vs 20-40%	
0.45				Vs 40-70%	
0.60	ICE + 10% CLAYEY SILT				
0.75	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

Palmer

LOG OF BOREHOLE 23-01-F

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd.

Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic

Date: Jul-21-2023

BH LOCATION: 65°58'54.65" N, 137°11'14.21" W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	PEAT				Augered
0.30	SILTY CLAY; 40% organics, brown				
0.80	P.T. 0.80 mBGL SILTY CLAY; 30% organics, brown				
1				Vx 20%	Installed Frostlink
1.30	EOH				

GROUNDWATER LEVEL

Measurement

PERMAFROST TABLE

SURFICIAL GROUP BOREHOLES CASING 2022 BOREHOLES.GLB
SURFICIAL GROUP BOREHOLES 2023/8 SURFICIAL GP BOREHOLES GINT 2.GPJ 23-8-25

LOG OF BOREHOLE 23-02

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Jul-21-2023

BH LOCATION: 66°22'34.07"N, 137°25'24.66"W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
Ground Surface					
0.00	PEAT				Augered
	P.T. 0.30 mBGL			Nb	
1					
					Ended due to stuck tooling.
1.50	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

Palmer

LOG OF BOREHOLE 23-03-F

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd.

Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic

Date: Jul-22-2023

BH LOCATION: 66°24'34.23"N, 137°55'34.05"W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	PEAT			No permafrost encountered	Augered
0.10	CLAYEY SILT (COLLUVIUM); grey to brown, 40% subangular cobbles up to 12 cm				
1					Installed Frostlink
1.20	EOH				

GROUNDWATER LEVEL

Measurement

PERMAFROST TABLE

SURFICIAL GROUP BOREHOLES CASING 2022 BOREHOLES.GLB
SURFICIAL GROUP BOREHOLES 2023/8 SURFICIAL GP BOREHOLES GINT 2.GPJ 23-8-25

Palmer

LOG OF BOREHOLE 23-04-F

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd.

Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic

Date: Jul-22-2023

BH LOCATION: 66°29'6.12"N, 137°31'12.47"W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	PEAT			No permafrost encountered	Augered
0.10	CLAY; grey, 30% organics, angular cobbles up to 15 cm				
1					Installed Frostlink
1.30	EOH				

GROUNDWATER LEVEL

Measurement

PERMAFROST TABLE

SURFICIAL GROUP BOREHOLES CASING 2022 BOREHOLES.GLB
SURFICIAL GROUP BOREHOLES 2023/8 SURFICIAL GP BOREHOLES GINT 2.GPJ 23-8-25

Palmer

LOG OF BOREHOLE 23-05-F

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd.

Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic

Date: Jul-22-2023

BH LOCATION: 66° 2'45.76"N, 136°59'36.26"W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	PEAT			No permafrost encountered	Augered
0.10	CLAY (WEATHERED BEDROCK); grey to brown, 10% organics, 10% subangular clasts up to 5 cm				
1					Installed Frostlink
1.30	EOH				

GROUNDWATER LEVEL

Measurement

PERMAFROST TABLE

SURFICIAL GROUP BOREHOLES CASING 2022 BOREHOLES.GLB
SURFICIAL GROUP BOREHOLES 2023/8 SURFICIAL GP BOREHOLES.GINT 2.GPJ 23-5-25

Palmer

LOG OF BOREHOLE 23-06

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd.

Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic

Date: Jul-23-2023

BH LOCATION: 66°17'44.07"N, 137°16'23.67"W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	SILTY CLAY (WEATHERED BEDROCK); brown			No permafrost encountered	Augered Refusal on bedrock at 0.8 m
0.80	EOH				

GROUNDWATER LEVEL

Measurement

PERMAFROST TABLE

SURFICIAL GROUP BOREHOLES CASING 2022 BOREHOLES.GLB
SURFICIAL GROUP BOREHOLES 2023/8 SURFICIAL GP BOREHOLES GINT 2.GPJ 23-8-25

Palmer

LOG OF BOREHOLE 23-07-F

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd.

Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic

Date: Jul-23-2023

BH LOCATION: 66° 7'21.41"N, 137°14'29.28"W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
	Ground Surface				
0.00	PEAT				Augered
0.25	P.T. 0.25 mBGL ICE + SILTY CLAY (WEATHERED BEDROCK); brown			Vx 70%; cloudy ice cystals distrubuted throughout, up to 10 mm	
0.50	SILTY CLAY (WEATHERED BEDROCK); brown			Vx 30%; cloudy ice cystals distrubuted throughout, up to 10 mm	
0.80	CLAY (WEATHERED BEDROCK); brown			Nb	
1					Installed Frostlink
1.10	EOH				

GROUNDWATER LEVEL

Measurement

PERMAFROST TABLE

SURFICIAL GROUP BOREHOLES_CASING_2022_BOREHOLES.GLB
SURFICIAL GROUP BOREHOLES_2022B SURFICIAL GP BOREHOLES.GINT 2.GPJ 23-8-25

LOG OF BOREHOLE 23-08-F

PROJECT: Eagle Plains Permafrost Investigation

CLIENT: Chance Oil and Gas Ltd. Method: Talon Drill

PROJECT LOCATION: Eagle Plains, YT

DATUM: Geodetic Date: Jul-23-2023

BH LOCATION: 66°12'2.93"N, 136°59'8.81"W

SURFICIAL GEOLOGY			SAMPLES	PERMAFROST DESCRIPTION	SAMPLE ANALYSIS AND REMARKS
(m) ELEV / DEPTH	DESCRIPTION	LITHOLOGY			
Ground Surface					
0.00	PEAT				Augered
0.20	CLAY (WEATHERED BEDROCK); grey				
0.60	P.T. 0.60 mBGL CLAY (WEATHERED BEDROCK); grey			Vx 40%; cloudy, infrequent granular ice lenses Nb	
1					Installed Frostlink
1.10	EOH				

GROUNDWATER LEVEL

Measurement ▽

PERMAFROST TABLE

▼

Appendix D

Glossary

D1. Glossary of Terms
D2. Acronyms & Abbreviations

Glossary of Terms

Term	Definition
Active Layer	The top layer of ground above the permafrost table that is subject to annual thawing and freezing.
Active Layer Detachment	Shallow slope failure in which the thawed or thawing active layer and vegetation mat detach from the underlying frozen material. Common on colluvial slopes in areas of fine-grained, ice-rich deposits.
Apron	Coalesced fans which occur at foot of bluffs, escarpments, or steep slopes. They are formed by materials transported from the steeper slope and form wedge-shaped deposits with concave to planar surfaces. Deposition of materials typically occurs during extreme storm or runoff events.
Blanket	A mantle of surficial materials thicker than about one metre, which reflects the topography of the bedrock or older surficial materials upon which it rests, although minor details of the topography may be masked.
Colluvial Deposits/Colluvium	Materials deposited by downslope movements due to gravity, such as rockfall, soil creep, and debris flows, including talus slopes and mantles of weathered bedrock. Colluvial deposits are composed of rock fragments of all sizes derived from the local bedrock and reworked loess, as well as finer textured material derived from in place weathering of the rock fragments. These deposits are generally poorly sorted and poorly consolidated.
Creep	The imperceptibly slow downward movement of soil or rock on slopes or slow deformation of frozen ground; caused by gravity or long-term application of a stress too small to produce failure in the frozen material.
Cryoturbation	Heaving, churning, and sorting of soil and surficial materials due to repeated freezing and thawing; results in the development of convoluted and flame- like structures in the soil and patterned ground.
Debris Flow	A sudden and destructive landslide where loose material on a slope, with more than 50% of particles larger than sand size, is mobilized by saturation and flows down a channel or canyon. The flow contains a combination of or all of the following: soil, surficial materials, bedrock, and plant material. Whether saturated or dry, a debris flow behaves much like a viscous fluid when moving.
Dendritic	Surface drainage pattern where streams branch out in an irregular tree-like fashion.
Drunken Forest	A stand of trees rotated from their normal vertical alignment due to frost heaving
Earth Hummocks	A hummock having a core of silty and clayey mineral soil which may show evidence of cryoturbation. Earth hummocks are a type of non-sorted circle (see patterned ground) commonly found in the zone of continuous permafrost. They develop in materials of a high silt and clay content and/or of high ice content.
Excess Ice	The volume of ice in the ground that exceeds the total pore volume that the ground would have under natural unfrozen conditions.
Fluvial Deposits	Sediments transported and deposited by streams and rivers, including floodplain deposits, river terraces, and fluvial fans. “Alluvial” is an older term meaning the same.
Fluvial Fan	A fan-shaped deposit built by streams, usually located at the mouth of a tributary valley. The sediment flows start at the apex of the fan, and over time move to occupy many positions on the

Term	Definition
	fan surface. Sediments generally consist of sand and gravel, and are formed by a combination of stream flood and debris flow activity. Fluvial fans typically have gradients of less than 10%.
Frost Heave	The upward or outward movement of the ground surface (or objects on, or in, the ground) caused by the formation of ice in the soil.
Glaciofluvial Deposits	Sediments formed by meltwater issuing from, or within, a glacier. The deposits are stratified and may form outwash plains, or terraces.
Ground Ice	Ice in pores, cracks, and other openings in surface sediments or rock, which forms in permafrost terrain. A general term referring to all types of ice formed in freezing or frozen ground.
Gully	A channel caused by erosion and the concentrated but intermittent flow of water during and immediately after heavy rains or ice/snow melt; generally V-shaped; larger than a rill and smaller than a ravine.
Ice Wedge	A massive, generally wedge-shaped body of ground ice with its apex pointing downward, composed of foliated or vertically banded, commonly white, ice; forms in permafrost environments.
Massive Ice	Large masses of ground ice, including ice wedges, pingo ice, buried ice, and large ice lenses, with a minimum thickness of 0.3 m. Ice layers less than 0.3 m in thickness are better termed ice lenses.
Packstone	A grain-supported carbonate rock with a muddy matrix.
Patterned Ground	Any ground surface exhibiting a discernibly ordered, more or less symmetrical, morphological pattern and, where present, vegetation, including non-sorted and sorted circles, nets, polygons, steps, and stripes, and solifluction features. In permafrost regions, ice-wedge polygon and non-sorted circles are most common.
Peat	Unconsolidated compressible material consisting largely of undecomposed, or slightly decomposed, organic matter accumulated under water-saturated conditions. Peat is commonly formed by the slow decay of successive layers of aquatic and semi-aquatic plants in swampy or water-logged areas, where oxygen is absent.
Permafrost	Ground (soil or rock) that remains at or below 0ºC for at least two consecutive years.
Physiography	The physical nature of the land; it includes topography (the relief and contours of the land), elevation, aspect, slope, surface pattern of landforms, and drainage.
Retrogressive Thaw Flow Slide	A slope failure resulting from thawing of ice-rich permafrost. The head scarp commonly continues to grow in a headward direction as new permafrost is exposed to thaw.
Segregated Ice	Ice in discrete layers or ice lenses, formed by ice segregation; commonly occurs in alternating layers of ice and soil. Segregated ice layers can range from hairline to more than 10 m in thickness.
Slopewash	Fine sediments on or at the foot of hillsides that have been moved by downslope by water saturation, groundwater flow and freeze/thaw processes.
Soil	The upper portion of a surficial deposit that has been affected by soil-forming processes such as eluviation
Solifluction	Slow downslope movement of saturated unfrozen (in non-permafrost regions) or thawed (associated with frozen ground) earth materials across a frozen substrate.
Spiculite	A siliceous rock composed predominantly of sponge spicules, with a porosity greater than 50%.

Term	Definition
Thermokarst	The process by which characteristic landforms result from the thawing of ice rich permafrost or the melting of massive ice.
Terrain	The surficial geology and landforms that make up a particular region
Veneer	A cover of surficial material with a thickness less than 1 meter.

Acronyms & Abbreviations

A	Anthropogenic features/landforms
C	Colluvial deposit/material
Ca	Colluvial apron
Cb	Colluvial blanket
Chance	Chance Oil and Gas Limited
cm	Centimeters
Cv	Colluvial veneer
D	Weathered bedrock
EDI	Environmental Dynamics Inc.
EDS	Exploration Development Suitability
F	Fluvial deposit/material
Fap	Fluvial active plain
Fav	Fluvial active veneer
FDD	Freezing degree days
Ff	Fluvial fan
Fp	Fluvial plain
Fv	Fluvial veneer
km	Kilometers
m asl	Metres above sea level
m	Metres
MAAT	Mean annual air temperature
MAGT	Mean annual ground temperature
MBC	Mix-bury-cover
Nb	Well bonded nonvisible ice within frozen ground
O	Organic deposit/material
Ob	Organic blanket
Ov	Organic veneer
Project	Eagle Plains Project
R	Bedrock
TDD	Thawing degree days
VESEC	Valued Environmental and Socio-Economic Component
Vs	Ice lenses and layers within frozen ground
Vx	Ice crystals within frozen ground
YESAB	Yukon Environmental and Socio-Economic Assessment Board
%	Percent
°C	Degrees Celsius

APPENDIX A. Surface Water Quality and Hydrology Baseline

Chance Oil and Gas, Eagle Plains Project: Surface Water Quality and Hydrology Baseline



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EDI Project
22Y0505
May 2023

EDI
ENVIRONMENTAL DYNAMICS INC.
Down to Earth Biology

EXECUTIVE SUMMARY

The Eagle Plains Project (the Project) is an oil and gas exploration program in north-central Yukon, approximately 605 km north of Whitehorse along the Dempster Highway. Chance Oil and Gas Ltd. intends to conduct exploratory activities over a 10-year period to confirm the quality, quantity, and areal extent of hydrocarbons. Project activities will include seismic exploration and exploratory wells supported by an expanded winter road network. The Project's Regional Study Area (RSA) is approximately 2,386 km² (238,566 ha) and is spatially bounded by the Peel River and Ogilvie River to the south and the northern reaches of Chance Creek to the north. The Project is within the Eagle Plains ecoregion, an intermontane basin underlain by sedimentary rock. The regional land cover comprises subarctic coniferous forest with mixed forest and arctic/alpine tundra while also lying within a continuous permafrost zone.

EDI Environmental Dynamics Inc. (EDI) was retained by Chance Oil and Gas in 2019 to provide a surface water quality and hydrology baseline report to inform background characteristics of surface water within the RSA. This report is intended to support the Chance Oil and Gas submission to the Yukon Environmental Socio-Economic Board for Executive Committee screening and guide any of their anticipated or intended water resource requirements.

This report was developed using historical data available from Environment and Climate Change Canada (ECCC), Yukon Government Water Resources Branch (YG WRB) and the Water Survey of Canada (WSC). In August 2019 and March 2020, EDI collected additional water quality data from the RSA and the broader adjacent area to support this baseline water quality assessment.

Water quality data are framed within the Canadian Council of Ministers of the Environment (CCME) guidelines for protecting freshwater 'aquatic life.' Key characteristics including general chemistry, major ions, nutrients, trace metals and hydrocarbons are analyzed to understand water quality as it exists within the RSA.

Water quality was similar across the RSA, with neutral to slightly acidic, brown stained water. Variable turbidity and total suspended sediment concentrations were likely associated with melting permafrost and resulting slumping banks that continuously deposit material into the water columns. The dominant ions reflect local geology and included bicarbonate, calcium, and sulphate. Nutrient concentrations were generally low to moderate, and total phosphorus concentrations indicated that streams were oligotrophic to mesotrophic. Metals including aluminum, cadmium, copper, iron, and manganese were present throughout the RSA at concentrations that exceeded the CCME guidelines for protecting freshwater aquatic life (CCME-FAL) guidelines.

Additionally, some other metals were present at concentrations above the CCME-FAL in isolated samples from each watershed area, including arsenic from Chance and Dalglish creek sites, and selenium from McParlon, Eagle and Dalglish creek sites. Volatile organic carbons were not present at or above laboratory detection limits at any of the sample locations. Common polycyclic aromatic hydrocarbons in the RSA included naphthalene, biphenyl, phenanthrene, and retene; these compounds are associated with naturally occurring oil and gas deposits and by-products of forest fires.

The hydrometric conditions in the RSA and surrounding region are snowmelt-dominated annual discharges, representative of a hydrologic regime of a northern climate. The highest flows occur in spring, driven by warming events and rainfall, which release water stored in the snowpack. The magnitude of the peak discharge during freshet is generally proportional to the contributing area of the snowpack. Over the summer, as snowmelt volume declines, stream discharge decreases, and flows are sustained by rainfall inputs, characterized by short-term peaks in discharge. Tributary watercourses, including first to third-order streams that originate within the RSA, are also snowmelt driven, but have flashier responses to precipitation events relative to watercourses with larger catchment areas. Stream discharges continue to decline into the fall as precipitation begins to be stored as snowpack and the active permafrost layer begins to refreeze. With no inputs to support baseflow during the winter, tributary channels tend to de-water or freeze to the bed over winter between October and November and do not resume discharge until the following freshet, typically beginning in April or early May. Thick continuous permafrost prevents interaction between aquifers and surface water, and limits groundwater interactions to perched seasonal suprapermafrost groundwater in the thin active layer. Watercourses with larger catchment areas (i.e., higher-order streams and rivers) do not reach zero flow winter conditions due to larger contributing areas and shorter periods where the active layer is frozen. In the larger watercourses, flows continue to decline through the winter, with the lowest discharge reported in February and March. In some third and fourth-order streams, water was found in residual pools in March. However, the water contained low dissolved oxygen. These conditions indicate zero or very low flow rates and are lower than minimum levels to support overwintering fish.

AUTHORSHIP

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
$CaCO_3$	calcium carbonate
CCME	Canadian Council Ministers of the Environment
CCME-FAL	CCME guidelines for the protection of freshwater aquatic life
DO	dissolved oxygen
°C	degree Celsius
ECCC	Environment and Climate Change Canada
mg/L	milligrams per litre
mV	Millivolts
µS/cm	microSiemens per centimetre
NND	Na cho Nyäk Dun
NTU	Nephelometric Turbidity Units (turbidity)
ORP	oxidation reduction potential
PAHs	Polycyclic aromatic hydrocarbons
QA/QC	Quality Assurance/Quality Control
RSA	Regional Study Area
SPC	Specific conductivity
TGC	Tetlit Gwich'in Council
TSS	total suspended sediment
TKN	total Kjeldahl nitrogen
VG	Vuntut Gwitchin
VH	volatile hydrocarbons
VOC	volatile organic carbons
VPH	volatile petroleum hydrocarbons
WSC	Water Survey of Canada
YESAA	Yukon Environmental and Socio-Economic Assessment Act
YGS	Yukon Geological Survey
YG WRB	Yukon Government Water Resources Branch

1 INTRODUCTION

The Eagle Plains Project (the Project) is a proposed oil and gas exploration operation spanning approximately 2,500 km² in the Eagle Plains region in northern Yukon. The Project will consist of seismic exploration and up to 30 test wells; both supported via a winter road network. All exploration activities will occur in winter; however, year-round monitoring may be conducted at a subset of the well sites depending on exploration results.

The Regional Study Area (RSA) overlaps three Yukon First Nations Traditional Territories; these are the Na-cho Nyäk Dun (NND), Vuntut Gwitchin (VG), and the Tetlit Gwich'in Council (Secondary Use Area; TGC). The proposed Project is also within the boundaries of the North Yukon and Peel Planning Regions and is subject to Land Use Plans developed for both regions.

The Eagle Plains Ecoregion is in the Taiga Cordillera Ecozone, characterized by subarctic coniferous forest (90 %) and mixed forest and Arctic/alpine tundra (5% each; Yukon Ecoregions Working Group 2004). Black spruce woodlands dominate this Ecoregion, with black spruce-tussock tundra at lower elevations and shrub-tundra above 800 m (Yukon Ecoregions Working Group 2004). The area is characterized by long winters, generally extending from October to May, with a mean annual temperature of −7.5°C (average −28°C in January and 13°C in July). The Eagle Plains Ecoregion has extensive permafrost throughout the whole Ecoregion, approximately 89 m in depth, with the active layer in the top one metre (i.e., thaws in summer and refreezes in the winter). However, as was previously noted in the water quality baseline developed for this area in 2018, permafrost monitoring along the Dempster Highway since 2013 indicated that permafrost degradation is actively occurring in the Eagle Plains area (Idrees et al. 2015, Golder Associates Ltd. 2018).

Watercourses in active permafrost regions range from permanent to intermittent flow, which are seasonally timed. The annual discharge in streams in watersheds like those in the RSA are snowmelt driven, with peak flows during the spring and low flows during the winter. The lower order streams are more likely to be seasonally intermittent as inputs from precipitation decrease and permafrost re-freezes. Ice build-up in watercourses alters flow behaviour in all these watercourses from the beginning of freeze-up until spring thaw is complete. In the case of the smaller streams, the channel may fully freeze in early winter. There are four Water Survey of Canada (WSC) and two Yukon Geological Survey (YGS) hydrometric stations collecting discharge data on watercourses relevant to the RSA, collecting discharge data over variable periods of record from 2004, and all stations are currently operating. The Yukon Government Water Resources Branch (YG WRB) received funding via the Yukon Environmental and Socio-Economic Assessment Act (YESAA) to collect seasonal water quality samples in the Eagle Plains area in anticipation of further funding resource development in the area. They collected water quality data from 2012 through 2017; data relevant to this Project was collected from 2013 to 2016. These data were used to develop a water quality and sediment baseline for the Eagle Plains area in 2018 (Golder Associates Ltd. 2018) and their findings are reflected in this report.

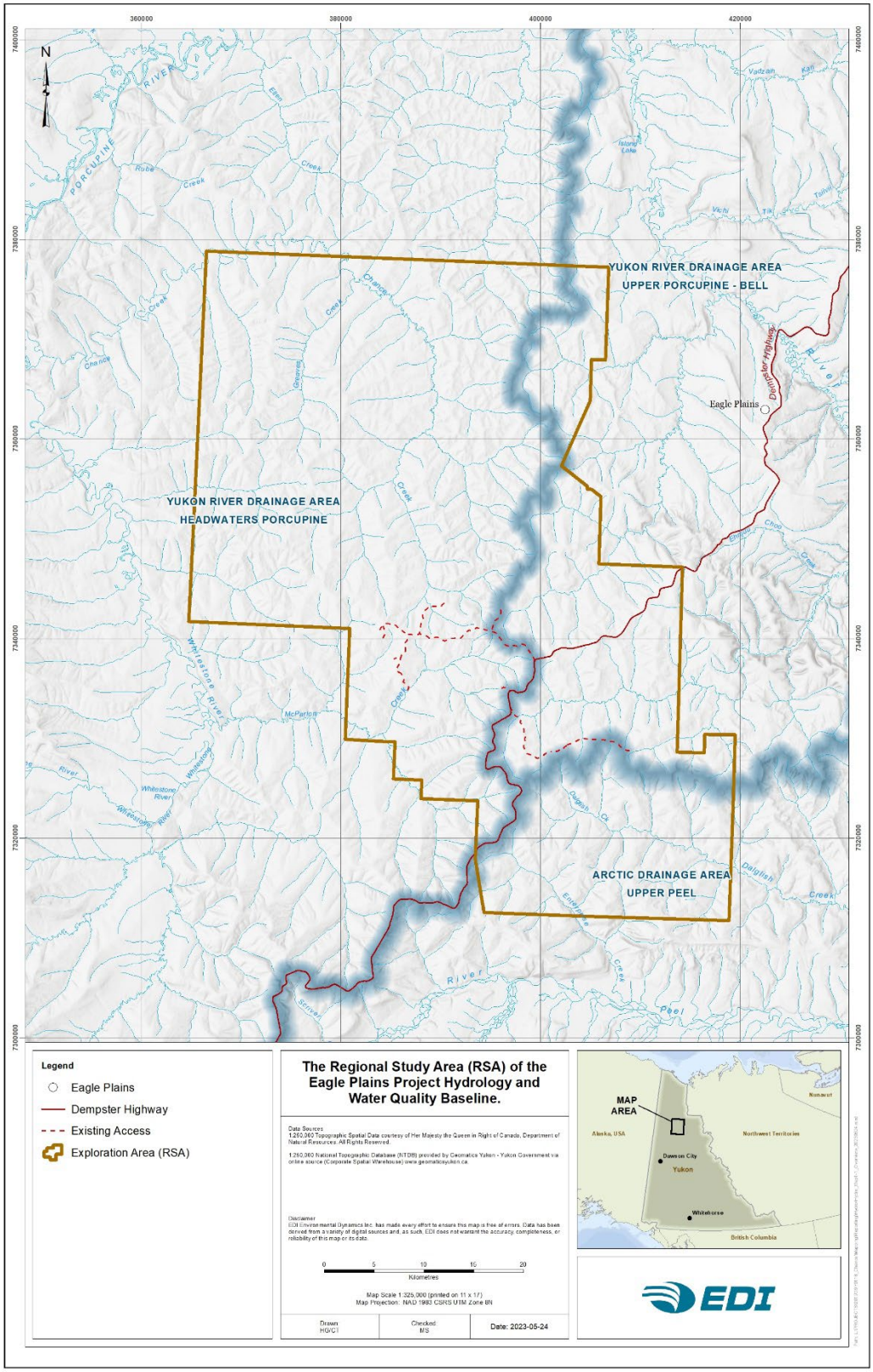
The major drainages within and adjacent to the RSA include the Porcupine and Peel river watersheds, with the subdrainages of the Eagle and Whitestone rivers entering the Porcupine drainage and the Ogilvie River

entering the Peel drainage (Map 1-1). The largest drainages within the RSA include Chance (Porcupine), McParlon (Porcupine), Dalglish (Peel), and Enterprise (Peel) creeks. The proposed Project would use winter roads that may include stream crossings. Thus, there was a need to understand the RSA's water quality and hydrology values, including seasonal and temporal trends. This report describes the baseline surface water resources conditions throughout the RSA.

1.1 PROGRAM OVERVIEW AND OBJECTIVES

This study aimed to document baseline information on surface water quality and hydrology within the RSA. This information could then be used to assess the Project's potential effects on water in the permit proposal to Yukon Environmental Socio-Economic Board and support management measures to mitigate potential effects.

Historical surface water quality and hydrology data, collected by various government and industry organizations are available for the RSA. EDI Environmental Dynamics Inc. (EDI) also conducted a modest surface water quality data collection program during the summer 2019 and winter 2020 to supplement the available water quality data with broader geographic sampling across the RSA, focusing on lower-order tributary streams, which were poorly represented in the historical data. This combination of historical and recent data was used to define the baseline surface water quality and quantity in the RSA.



Map 1-1. The Regional Study Area (RSA) of the Eagle Plains Project Hydrology and Water Quality Baseline.

2 METHODS

2.1 WATER QUALITY

The RSA was divided into four catchments to describe baseline water quality: McParlon, Chance, Eagle River Tributaries to the north and south, and Dalglish. Within each micro watershed, multiple sampling locations were established, including data historical collected by YG WRB from 2013 to 2016 (Section 2.1.1) and new surveys by EDI in August 2019 and March 2020 (Section 2.1.2; both summarized in Table 2-1). Water quality data at these sites represent water quality within and downstream of the RSA.

Table 2-1. Water quality monitoring sites, organized by catchment, moving from upstream to downstream.

Site Code	Site Name	YG WRB Data Collection Range	YG WRB Sample Frequency	EDI Sampling
McParlon				
McPL-002	McParlon Creek, upstream reach	2013, 2014, 2015, 2016	Quarterly	August 2019
McPL-001	McParlon Creek, just upstream from Whitestone River	2013, 2014, 2015	Quarterly	August 2019 March 2020
Chance				
CHNC-003	Chance Creek, upstream of inputs from CHNC-t-002	2013, 2014, 2015, 2016	Periodically	August 2019 March 2020
CHNC-t-002	Tributary to Chance Creek	2013, 2014, 2015, 2016	Periodically	August 2019
CHNC-001	Chance Creek, just upstream from Whitestone River	2013, 2014, 2015	Quarterly	August 2019 March 2020
Eaglet North and South				
NCY-PT19	Unnamed tributary to Eagle River	2013, 2014, 2015, 2016	Quarterly	August 2019 March 2020
EAGL-t-002	Unnamed tributary to Eagle River	2013, 2014, 2015	-	-
EAGL-t-003	Tributary to Eagle River	2013, 2014, 2015	Quarterly	August 2019 March 2020
EAGL-t-004	Tributary to Eagle River	-	-	August 2019 March 2020
Dalglish				
DALG-003	Dalglish Creek, upstream reach	-	-	August 2019
DALG-002	Dalglish Creek, just upstream from Ogilvie River	2014, 2015	Quarterly	August 2019 March 2020

2.1.1 HISTORICAL DATA COMPILATION

The Yukon Government Water Resources Branch collected water quality data in the area surrounding the RSA between 2013 and 2016; this sampling was funded by the Yukon Environmental and Socio-Economic Assessment Act implementation funding in anticipation of further resource development in the area (Table 2-1). The frequency of data collection was quarterly (seasonal) at most sites, but only periodically at upper Chance Creek (CHNC-003) and in the small tributary to Chance Creek (CHNC-t-002), generally owing to winter conditions. Winter samples were not regularly collected at all sites as many small streams were dry or frozen to the substrate through the winter season.

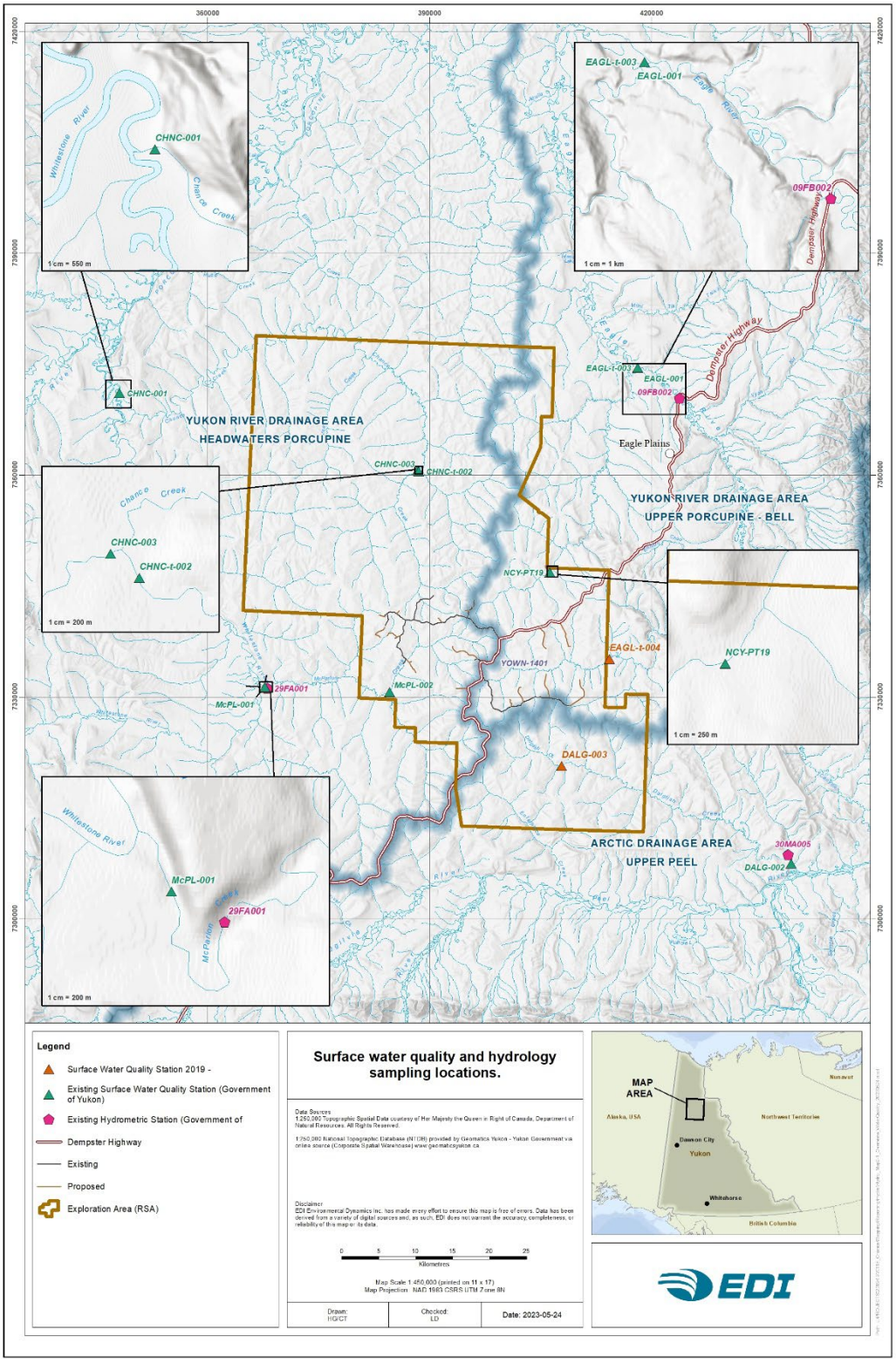
Water quality samples were collected and analyzed for inorganics, metals, nutrients, organics, and physical parameters. These historical data are publicly available from the Yukon Environment website (www.env.gov.yk.ca/air-water-waste/hydrogeology.php). EDI accessed and downloaded this data to review for the development of this baseline (A-1). These data were reviewed and described in a baseline data report drafted for the Yukon Government (Golder Associates Ltd. 2018).

2.1.2 PROJECT-SPECIFIC FIELD SAMPLING

After reviewing the existing data, additional water quality data were collected from ten sites; five sites within the RSA and the other five sites downstream of streams and rivers contained within the RSA (Table 2-1, Table 2-2, Map 2-1). Eight of these sites fall within or downstream of the RSA and were previously sampled by YG WRB; these were resampled to such that more recent data could be added to evaluate any recent changes to water quality in the RSA. Two sites were added to expand coverage of the RSA and downstream areas; these included EAGL-t-003, a tributary to the Eagle River that drains the RSA to the northeast, and DALG-003, located on the upstream reaches of Dalglish Creek, within the Project footprint (Table 2-1, Table 2-2, Map 2-1). All water quality samples were analyzed for inorganics, metals, nutrients, organics, and physical parameters.

Table 2-2. Record of EDI sampling conducted for the Project in August 2019 and March 2020.

Site Code	August 2019	March 2020
McParlon		
McPL-002	August 1, 2019	No sample. Stream frozen to substrate
McPL-001	August 1, 2019	March 8, 2020
Chance		
CHNC-003	August 1, 2019	March 10, 2020
CHNC-t-002	August 1, 2019	No sample. Stream frozen to substrate
CHNC-001	August 1, 2019	March 9, 2020
Eaglet North and South		
EAGL-t-004	August 1, 2019	March 12, 2020
NCY-PT19	August 1, 2019	March 8, 2020
EAGL-t-003	August 1, 2019	March 9, 2020
Dalglish		
DALG-003	August 1, 2019	No sample. Stream frozen to substrate
DALG-002	August 1, 2019	March 12, 2020



Map 2-1. Surface water quality and hydrology sampling locations.

2.1.3 FIELD SAMPLING METHODS

Field staff used a YSI ProPlus multi-meter to measure in-situ water temperature (degrees Celsius [°C]), pH (pH units), specific conductivity (SPC; microSiemens per centimetre [µS/cm]), oxidation-reduction potential (ORP; millivolts [mV]) and dissolved oxygen (DO; milligrams per litre [mg/L]). The YSI meter was calibrated on the first day of each trip, performed a 'bump test' to verify data at the end of each field sampling day and re-calibrated as required in the field. Staff used an Oakton T100 turbidity meter to collect in-situ turbidity (nephelometric turbidity units [NTU]) calibrated monthly in the office, according to instrument specifications and bump-tested pre- and post-trip.

Field staff recorded data on standard field data forms (either on an iPad tablet or hard copy datasheets). This information included station name, sample date and time, location (GPS coordinates), water temperature, SPC, pH, DO, ORP, turbidity, and photo numbers. Site conditions were also recorded, including flow stage (low, moderate, high), turbidity (clear, light, moderate, high), and any other qualitative observations.

In addition to in-situ data, water samples were collected from each monitoring site. Staff filled laboratory-cleaned bottles using clean techniques (i.e., nitrile gloves, appropriate bottle handling) and samples were filtered and preserved on site, as per instructions from the accredited lab. Samples were stored in coolers, with lab-supplied ice packs, when necessary, to maintain sample temperatures at approximately 4°C. On the final day of each sampling event, staff delivered the samples with laboratory Chain of Custody forms to Air North in Whitehorse for delivery to an analytical laboratory. Efforts were made to meet all sample holding times despite the remote location of the Project site.

2.1.4 LABORATORY ANALYSIS

Laboratory analysis consisted of routine physical chemistry, anions, nutrients, dissolved organic carbon, total and dissolved metals, extractable hydrocarbons, and volatile organic carbons.

2.1.5 QUALITY ASSURANCE / QUALITY CONTROL

The water quality field program included collecting quality assurance/quality control (QA/QC) samples, including replicate samples, field blanks, and travel blanks. Replicate samples are sample duplicates collected at the same date, time, and location as the regular sample. Sampling methodology is the same for the collection of both regular and replicate samples. Field staff collected replicates from randomly selected sites during each trip. The total number of replicates represented approximately 10% of the total sites sampled. The replicate samples determine the accuracy and precision of the laboratory analysis; they also provide a measure of variability in water quality at a site for a given time.

Field blank samples comprised one complete bottle set filled on-site with deionized water during the sampling trip. Sampling methodology is the same as if sampling from a stream, with filtering and preserving as required. Field blanks assist in identifying any contamination introduced to the sample during the act of field sampling (i.e., sample filling/handling, exposure to questionable air quality) or via the supplies (filter, syringe, bottle, or preservative). The analytical lab supplied the travel blank, which EDI field crews carry to and from the site

during the fieldwork. Field staff do not open the travel blank at any time during the trip. Travel blanks assist in the identification of any sample contamination caused during transportation or storage.

2.1.6 DATA MANAGEMENT AND ANALYSIS

Once field crews returned from the field, they reviewed and entered all in-situ data and site condition notes recorded on the field data forms (either a table export file or hard copy datasheets) into a Microsoft Excel template and updated the project water quality database (data available in Attachment B).

Upon receipt, laboratory data were reviewed and appended to the project database. As part of the data review, we compare the results with the Canadian Council of Ministers of the Environment (CCME) guidelines to protect freshwater 'aquatic life' (CCME-FAL; CCME 2015; Table 2-3). Water quality characteristics such as hardness and nutrient concentrations will be evaluated against accepted scales (Table 2-4 and Table 2-5).

Table 2-3. Canadian Council of the Ministers of the Environment Guidelines for the Protection of Freshwater Aquatic Life (CCME-FAL) guidelines (CCME 2015).

Water Quality Parameter	CCME FAL Guideline	Comments
Aluminum	0.1 mg/L	Guideline is 0.1 at pH ≥ 6.5; if pH is lower than 6.5, guideline is set at 0.005 mg/L.
Ammonia	Variable	Guideline is temperature and pH dependent. Guidelines are for pH ranging from 6 to 10. For pH below 6, guideline is set as if pH was 6.
Arsenic	0.005 mg/L	-
Boron	1.5 mg/L	-
Cadmium	Variable	Guideline is hardness dependent; the guideline is 0.04 µg/L when water hardness is >0 to <17 mg/L. At hardness >280 mg/L, the guideline is 0.37 µg/L. At hardness ≥17 to ≤280 mg/L, the guideline in µg/L is calculated using the following equation: Hardness Adjusted Guideline = $10^{[0.83(\log[\text{hardness}])-2.46]}$
Chloride	120 mg/L	-
Chromium – trivalent	0.0089 mg/L	Interim guideline
Copper	Variable	Guideline is hardness dependent; the guideline is 2 µg/L for water hardness between 0 to <82 mg/L. At hardness >180 mg/L, the guideline is 4 µg/L. At hardness ≥82 to ≤180 mg/L, the guideline in µg/L is calculated using the following equation: Hardness Adjusted Guideline = $e^{0.8545\ (\text{LN}[\text{hardness}]-1.465*0.2}$
Dissolved oxygen	9.5 mg/L	Lowest acceptable dissolved oxygen concentration for cold water biota in early life stages.
Fluoride	0.120 mg/L	Interim guideline
Iron	0.3 mg/L	-
Lead	Variable	Guideline is hardness dependent; the guideline is 0.003 mg/L for a hardness of 100 mg/L. When hardness is 0 to ≤60 mg/L, the guideline is 0.001 mg/L. At hardness >180 mg/L, the guideline is 0.007 mg/L. At hardness >60 to ≤180 mg/L, the guideline in µg/L is calculated using the following equation: Hardness Adjusted Guideline = $e^{[1.273\ (\text{LN}[\text{hardness}]-4.705]}$

Water Quality Parameter	CCME FAL Guideline	Comments
Manganese	Variable	Guideline is pH and hardness dependent. Resulting guideline can be determined using a look up table/Canadian Water Quality Guideline (CWQG) calculator available at: http://ceqg-rcqe.ccme.ca/download/en/361
Mercury	0.000026 mg/L	-
Molybdenum	0.073 mg/L	-
Nickel	Variable	Guideline is hardness dependent; the guideline is 0.1 mg/L for a hardness of 100 mg/L. When hardness is 0 to ≤60 mg/L, the guideline is 25 µg/L. At hardness >180 mg/L, the guideline is 150 µg/L. At hardness >60 to ≤180 mg/L, the guideline in µg/L is calculated using the following equation: Hardness Adjusted Guideline = $e^{[0.76\ (LN[hardness]+1.06]}$
Nitrate (as NO_3-N)	13 mg/L	-
Nitrite (as NO_2-N)	0.06 mg/L	-
pH	6.5 - 9.0	-
Selenium	0.001 mg/L	-
Silver	0.00025 mg/L	-
Thallium	0.0008 mg/L	-
Uranium	0.015 mg/L	-
Zinc (dissolved)	Variable	Guideline is hardness and dissolved organic carbon (DOC) dependent; the short-term benchmark is for dissolved zinc in mg/L and is calculated using the following equation: Hardness and DOC Adjusted Guideline = $\exp^{(0.833[\ln(\text{hardness mg/L})] + 0.240[\ln(\text{DOC mg/L})] + 0.526)}$ At hardness (as $CaCO_3$) of 50 mg/L and DOC of 0.5 mg/L, the guideline value is 0.037 mg/L. The benchmark equation is valid for hardness between 13.8 and 250.5 mg/L and DOC between 0.3 and 17.3 mg/L. When hardness or DOC values are outside these limits, the nearest applicable limit is used in the equation.

Table 2-4. Qualitative scale of water hardness adapted from McNeely et al. 1979.

Hardness Category	Hardness (mg/L as $CaCO_3$)
Very soft	0 – 30
Soft	31 – 75
Moderately soft	76 – 120
Hard	121 – 180
Very Hard	>180

Table 2-5. General relationship of surface water productivity to total phosphorus.

Trophic Status	Total Phosphorus (mg/L)	
	Waterbodies [1]	Watercourses [2]
Ultra-oligotrophic (very nutrient-poor)	<0.004	N/A
Oligotrophic (nutrient-poor)	0.004 – 0.01	<0.025
Mesotrophic (containing a moderate concentration of nutrients)	0.01 – 0.02	0.025 – 0.075
Meso-eutrophic (containing moderate to high concentration of nutrients)	0.02 – 0.035	N/A
Eutrophic (nutrient rich)	0.035 – 0.1	>0.075
Hypereutrophic (very nutrient rich)	>0.1	N/A

[1] (CCME Canadian Council of Ministers of the Environment 2007)
[2] (Dodds et al. 1998)

2.1.7 RISKS AND LIMITATIONS

Due to the number of streams within the RSA (n = 1,467), the length of time needed to access and sample sites, and the cost associated with laboratory analysis of samples, only a very small proportion of streams were sampled as part of this program (~2.5%). However, past data are available, including a recent baseline water quality program administered by the YG WRB. The YG WRB program was designed to characterize the baseline water quality of the area, including that encompassed by the Project. This report incorporated that data, combined with the additional sampling in 2019 and 2020, to provide adequate, current baseline water quality conditions. In some historical data collected by YG WRB it appears that for some metals, including iron and manganese, the dissolved fraction is higher than the total fraction; given that only some metals exhibit this pattern, it is unlikely that this is a sampling error. Instead, it is an indication that most of the total metals are present in the dissolved form. Differences in concentrations are a result of laboratory methods.

2.2 HYDROLOGY

Hydrological data in this report are based solely on historical information. EDI did not collect supplemental hydrological data as part of this study.

2.2.1 ENVIRONMENT AND CLIMATE CHANGE CANADA HYDRO-CLIMATE DATA

Environment and Climate Change Canada (ECCC) operates a meteorological station near the Eagle Plains hotel (Table 2-6). The historical climate data collected at that station are available from the ECCC website (https://climate.weather.gc.ca/historical_data/search_historic_data_e.html). Rainfall and snowpack data recorded by this station were used to analyze precipitation and snowmelt trends and support flow regime data.

Table 2-6. Environment and Climate Change Canada meteorological records used for baseline analysis.

Station Code	Site Name/ID	Record Date Range	Coordinates
2100468	Eagle Plains – 2100468	1998–2005, 2007–2008	66° 22' 10" N 136° 43' 03" W

2.2.2 WATER SURVEY OF CANADA REGIONAL DATA

Surface water in the RSA flows into four major watercourses in the region: Eagle, Peel, Ogilvie, and Porcupine Rivers. The Water Survey of Canada (WSC) operates and maintains continuous hydrometric monitoring stations on these watercourses and provides real-time and historic discharge records to the public. The WSC discharge data are developed using rating curves maintained by WSC using regular field discharge measurements, stage elevation surveys, and continuous water level logger data. These records are computed based on active rating curves and revised by WSC for final publication following a detailed review of water level and discharge field measurement records. These data are available on-demand from the WSC website (https://wateroffice.ec.gc.ca/index_e.html). Table 2-7 outlines the discharge records used to establish regional baseline flow trends. The rationale for the records chosen was based on the destination of outgoing flow from the RSA, geographic proximity to the RSA and completeness of records.

Table 2-7. Water Survey of Canada discharge records used for baseline analysis.

Station Code	Site Name	Record Date Range	Coordinates
09FB002	Eagle River at Dempster Highway Bridge	2013–2020	66° 26’ 36” N 136° 42’ 33” W
10MA001	Peel River Above Canyon Creek	2006–2020	65° 53’ 33” N 136° 02’ 17” W
10MA002	Ogilvie River at Kilometre 197.9 Dempster Highway	2016–2020	65° 21’ 45” N 138° 17’ 50” W
09FD003	Porcupine River Below Old Crow River	2004–2020	67° 34’ 05” N 139° 50’ 03” W

2.2.3 YUKON GOVERNMENT WATER RESOURCES BRANCH DATA

Yukon Government Water Resource Branch operates two continuous hydrometric monitoring stations on McParlon and Dalglish Creeks (Map 2-1). These tributaries originate within the RSA and feed into the Porcupine and Peel Rivers, respectively. The flow data are available upon request from YG WRB (water.resources@gov.yk.ca) and the YG WRB data catalogue is available at the YG WRB website (http://yukonwater.ca/monitoring-yukon-water/water-data-catalogue). The YG-WRB discharge data are developed using rating curves maintained by YG WRB using regular field discharge measurements, stage elevation surveys and continuous water level logger data. Table 2-8 outlines the discharge records used to analyze site-specific flow trends. The McParlon and Dalglish Creek flow records were the only records available for watercourses originating within the RSA.

Table 2-8. Yukon Government Water Resources Branch discharge records used for baseline analysis.

Station Code	Site Name	Record Date Range	Coordinates
30MA004	Dalglish Creek - Lower	2013–2014	65° 52' 56" N 136° 20' 15" W
29FA001	McParlon Creek	2013–2017	66° 4' 24" N 137° 54' 57" W

2.2.4 QUALITY ASSURANCE / QUALITY CONTROL

EDI performed independent QA/QC on all data used for hydrology and meteorological baseline analysis. Data records averaged across the complete annual and partial year records were not included in the analysis. As such, annual averages are calculated across different year ranges based on the records available.

ECCC performs data review before incorporation into their database and retroactively updates historical data records. Data include quality flags defined by ECCC in each data file, and where data was flagged as "Missing," data points are displayed as gaps in this report. No other data flags were present in the date ranges used for this report. The "Missing" flag is about data that were never collected due to power outages, equipment failure, or station maintenance. All meteorological data are subject to a disclaimer for meteorological information, which can be viewed at the ECCC website (https://climate.weather.gc.ca/climate_data/data_quality_e.html).

Historical data records for watercourses originating from within the RSA are incomplete, with varying degrees of data quality. The YG WRB grades and approves all hydrometric data and provides grade and approval descriptions upon request. Where data were graded as "Unusable," "Water Level Below Sensor," or "Ice," data points were rejected and displayed as gaps in this report. Data graded at these levels were primarily found to occur between September and April. The remaining gaps present in the data were blank cells in raw data files provided by YG WRB and were rejected during the internal approval process. The YG WRB monitoring stations on McParlon Creek and Dalglish Creek are subject to overwinter de-watering, adversely impacting water level logger data and low flow rating curve development. The review of the data records, data gaps and flags, suggests that the McParlon and Dalglish Creeks reach zero-flow levels during mid to late October. Additionally, these creeks experience more rapid hydromorphic change, such as banks caving in or sediment transport due to their small size and drastic flow fluctuations. Thus, long-term data are incomplete where stations have been required to be relocated or discontinued.

The WSC data records for regional watercourses were complete and of moderate to high quality. No provisional data were included in this analysis. The WSC monitoring stations on the Eagle, Peel, Ogilvie, and Porcupine Rivers are in watercourses that exhibit some flow year-round and do not de-water or freeze to bed during winter months. For these reasons, WSC records cover a greater period with complete over-winter flow data. Gaps present in the data were blank cells in raw data files provided by WSC and were rejected during the WSC internal approval process. All flow data provided by WSC are subject to a disclaimer for hydrometric information, which can be viewed at the WSC website (https://wateroffice.ec.gc.ca/disclaimer_info_e.html).

3 RESULTS

3.1 WATER QUALITY

3.1.1 MCPARLON CREEK

McParlon Creek drains the RSA to the west, emptying into the Whitestone River (Map 2-1). Available water quality data are from two sites in the McParlon watershed:

1. McPL-002, which lies in the upstream reaches of McParlon Creek (Photo 3-1); and,
2. McPL-001, which is located just upstream of the Whitestone River (Photo 3-2).

Water quality data were collected from McPL-001 periodically starting in July 2013, in spring and fall 2014, 2015 and 2016, in winter, spring and fall in 2017, and later winter 2018. Data were collected from McPL-002 from 2013 through 2016. EDI collected samples from both sites in the summer of 2019. While a sample was collected from McPL-001 in March 2020, McPL-002 was frozen to the substrate. McParlon Creek is a wide, shallow, slow-moving stream that freezes to substrate in the winter months. The YG WRB attempts to sample in March during all sampling years found either no water (as EDI also found in 2020), or only standing water, as was found in 2016.



Photo 3-1 Overview of site McPL-002.



Photo 3-2 Upstream view from site McPL-001.

3.1.1.1 General Chemistry and Major Ions

Water in McParlon Creek was circumneutral to slightly acidic. Conductivity ranged widely with the seasons from between 50 to 100 µS/cm in early summer during freshet to a high of 1,200 µS/cm recorded in later winter when the water is dominated by basal, groundwater-sourced flow. Water was generally characterized as 'very to moderately soft' during the open water season with available hardness data ranging from 25 to

63 mg/L (as $CaCO_3$), and 'hard to very hard' during the under-ice months, with hardness as high as 270 mg/L (Table 2-4).

Water was brown stained in colour, and turbidity ranged from very low during the under-ice period, to close to 100 NTUs at other times of the year. Aside from low turbidity under ice, turbidity showed no seasonal pattern and may have been influenced by precipitation events and bank material periodically entering the water column as melting permafrost resulting in slumping banks. The suspended sediment load was generally low, ranging from <1 mg/L (below detection) to 23 mg/L; however, like turbidity, there were some spikes to approximately 100 mg/L in samples collected at various open water times of the which were likely associated with precipitation events year, and melting permafrost. Major ions were predominantly comprised of bicarbonate, calcium and sulphate (Figure 3-1) and showed no variation with seasons and little difference among the two sites.

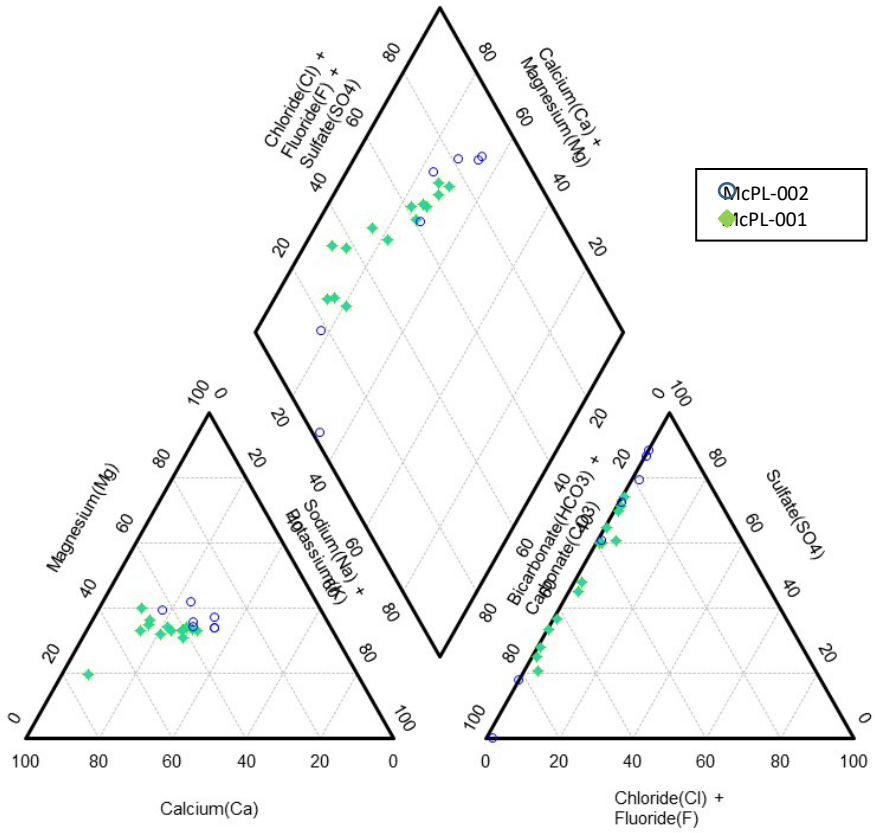


Figure 3-1. Piper plot showing major ion composition of waters in the McParlon watershed in % meq/kg.

3.1.1.2 Nutrients

Nutrient concentrations in McParlon Creek at both sampling sites were low. Concentrations of nitrate, nitrite, nitrate+nitrite, and total ammonia were below applicable guidelines for surface water. Total Kjeldahl Nitrogen (TKN), which is the total concentration of organic nitrogen and ammonia, ranged from 0.85 to 1.19 mg/L. Total phosphorus concentrations ranged from <0.050 (March 2020 at McPL-001) through 0.086 (July 2013 at McPL-001) mg/L, indicating oligotrophic to mesotrophic trophic status (Table 2-5).

3.1.1.3 Trace Metals

Aluminum, cadmium, copper, iron, manganese, and selenium in the McParlon Creek watershed occurred at concentrations that regularly exceeded the CCME-FAL concentrations (Table 2-3). Total aluminum exceeded the CCME-FAL guideline in nearly all samples from both sites; however, the dissolved fraction of aluminum in nearly all samples was below the CCME-FAL guideline (Figure 3-2 and Figure 3-3). Therefore, most of the aluminum in the water column was bound to suspended sediment. Total and dissolved cadmium, copper, iron, and manganese regularly exceeded their respective CCME-FAL guidelines (Figure 3-4 through Figure 3-11). Total selenium exceeded the CCME-FAL in three samples associated with under-ice sampling; dissolved fractions were below the guideline (Figure 3-12 and Figure 3-13).

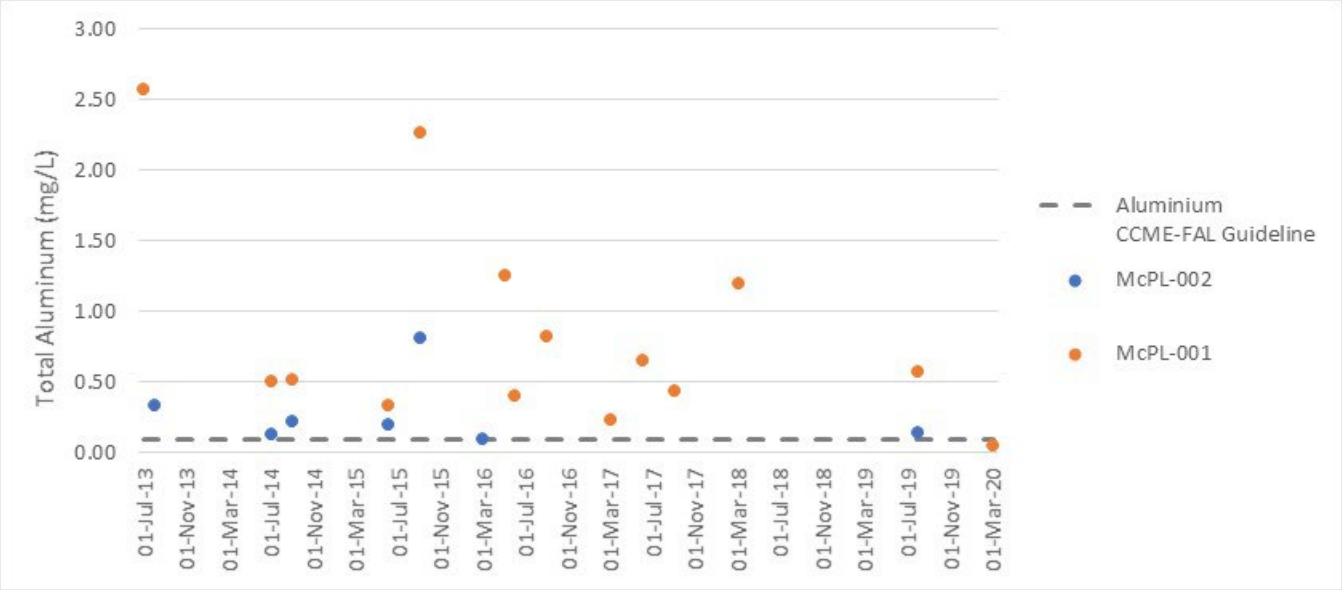


Figure 3-2. Total aluminum concentrations in McParlon Creek sites between July 2013 and March 2020.

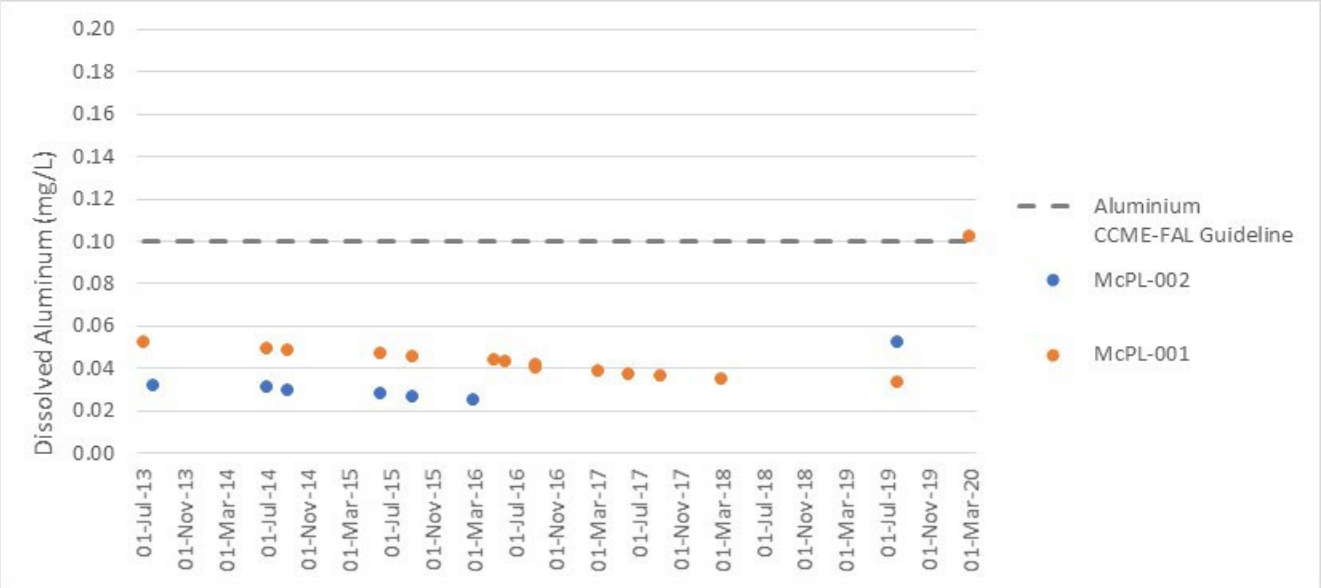


Figure 3-3. Dissolved aluminum concentrations in McParlon Creek sites between July 2013 and March 2020.

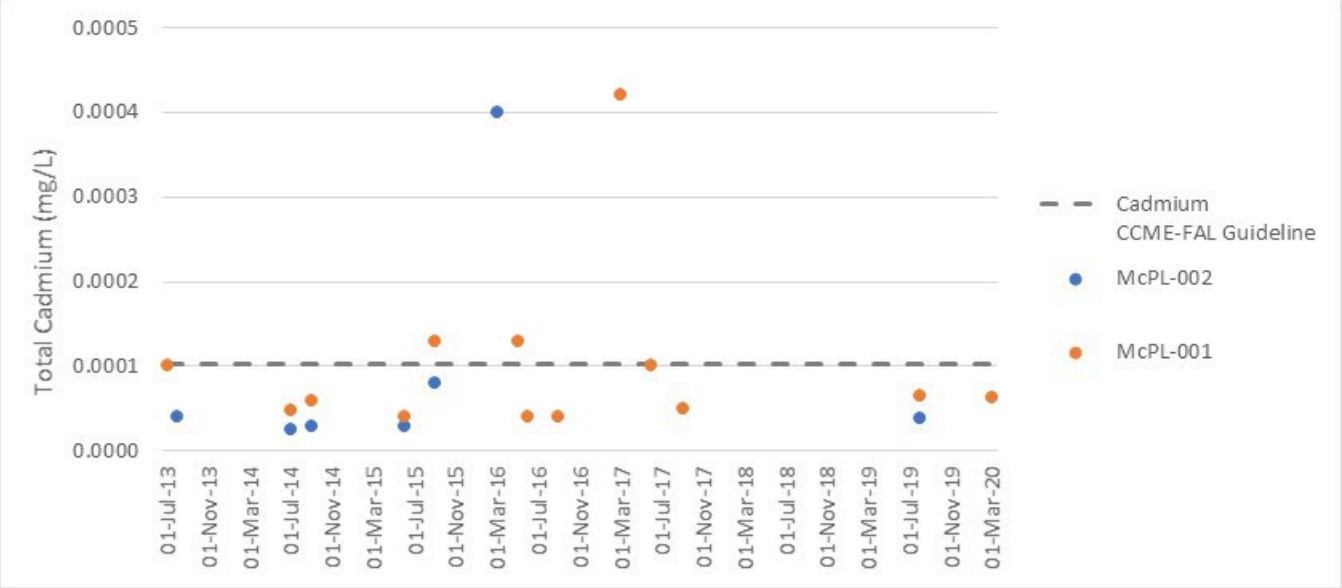


Figure 3-4. Total cadmium concentrations in McParlon Creek sites between July 2013 and March 2020.

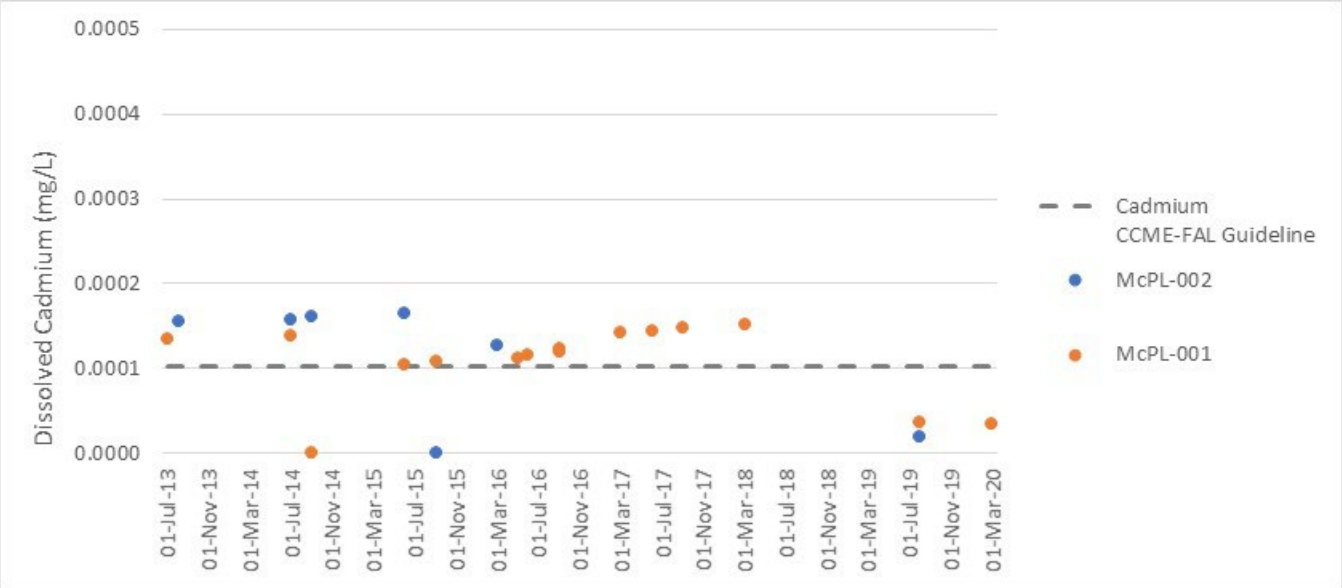


Figure 3-5. Dissolved cadmium concentrations in McParlon Creek sites between July 2013 and March 2020.

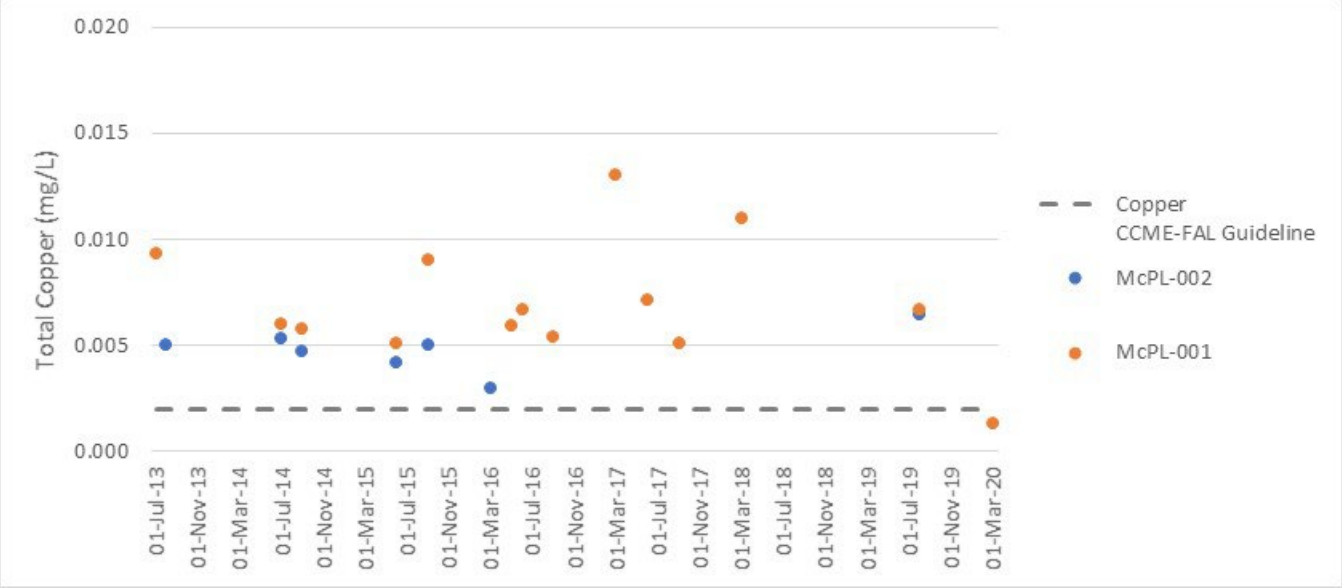


Figure 3-6. Total copper concentrations in McParlon Creek sites between July 2013 and March 2020.

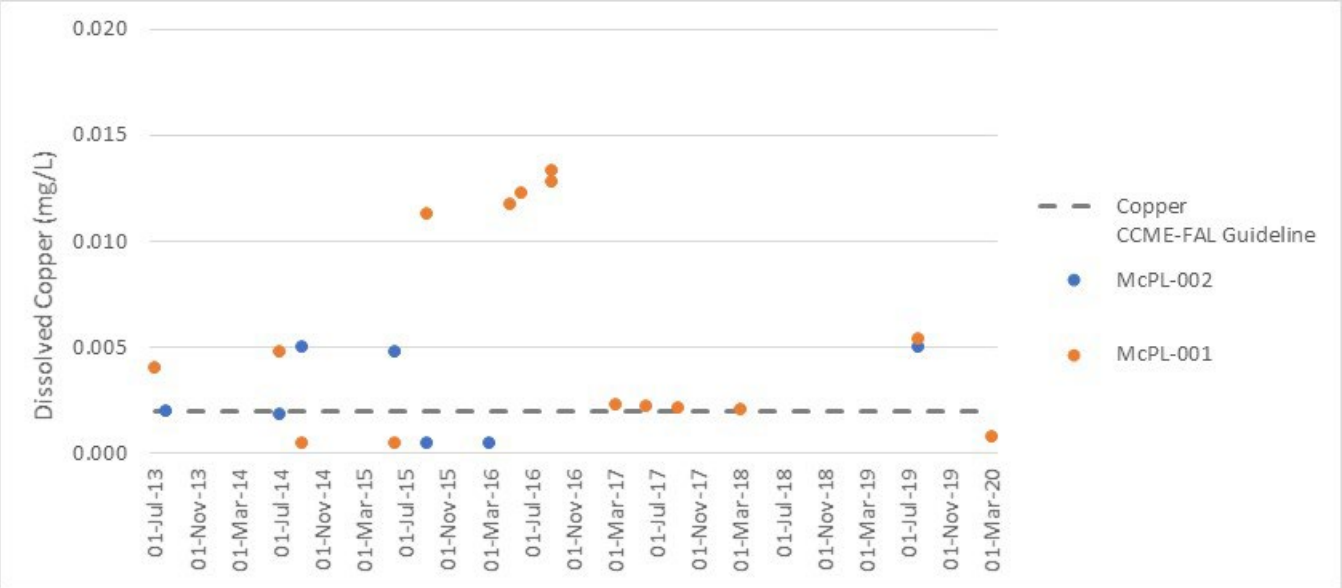


Figure 3-7. Dissolved copper concentrations in McParlon Creek sites between July 2013 and March 2020.

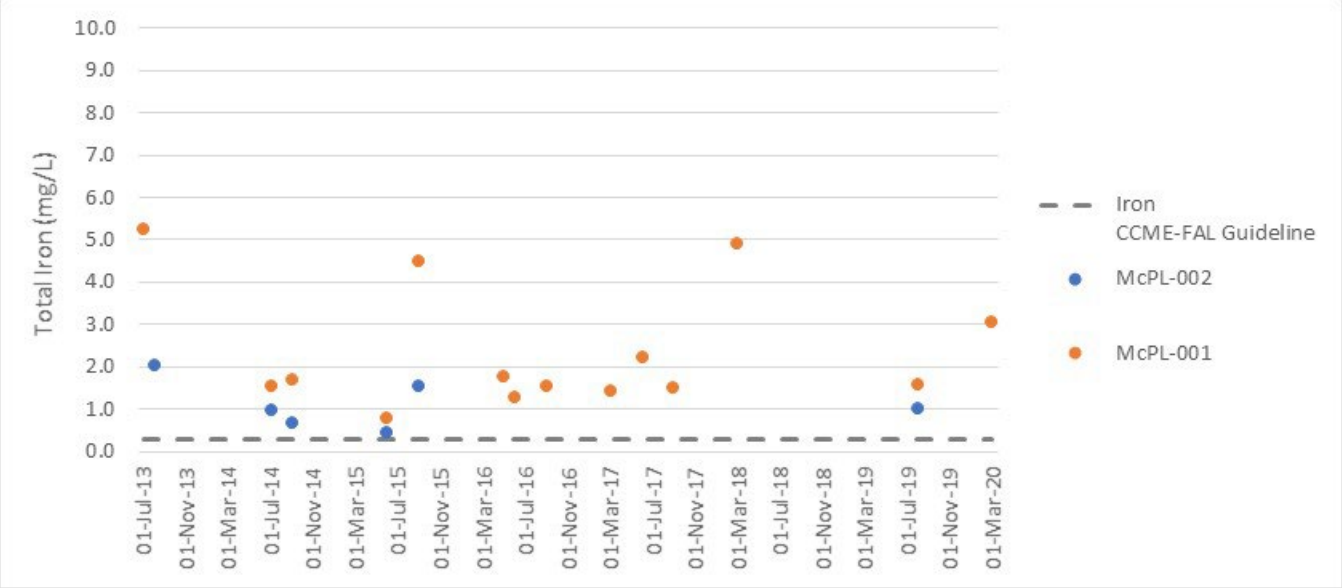


Figure 3-8. Total iron concentrations in McParlon Creek sites between July 2013 and March 2020.

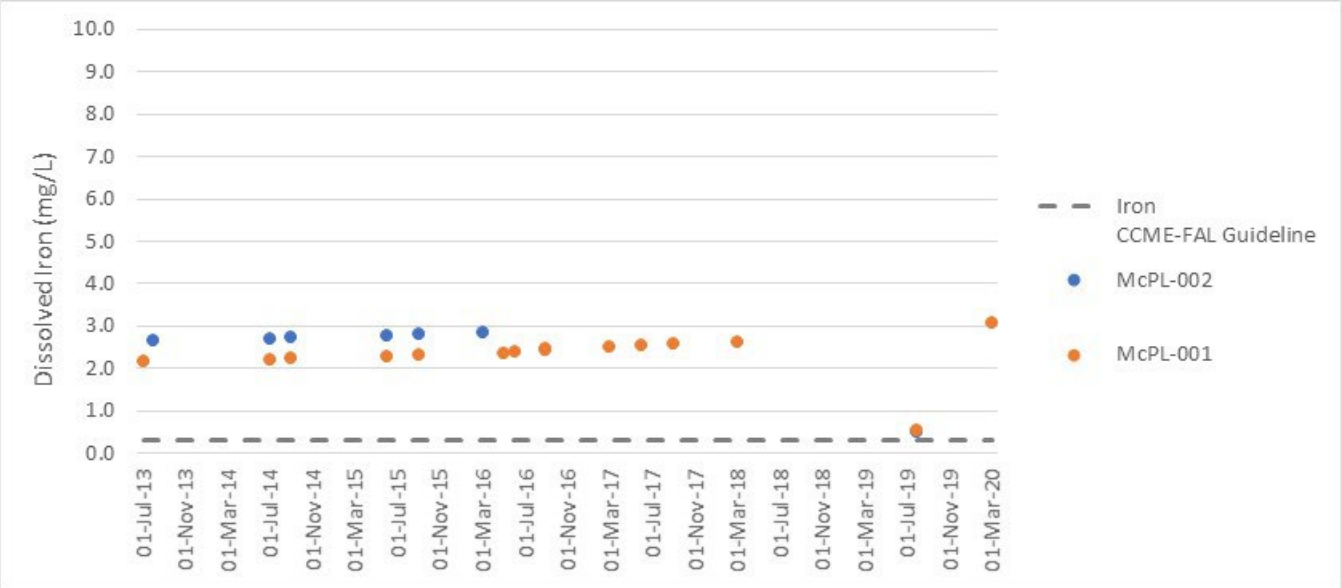


Figure 3-9. Dissolved iron concentrations in McParlon Creek sites between July 2013 and March 2020.

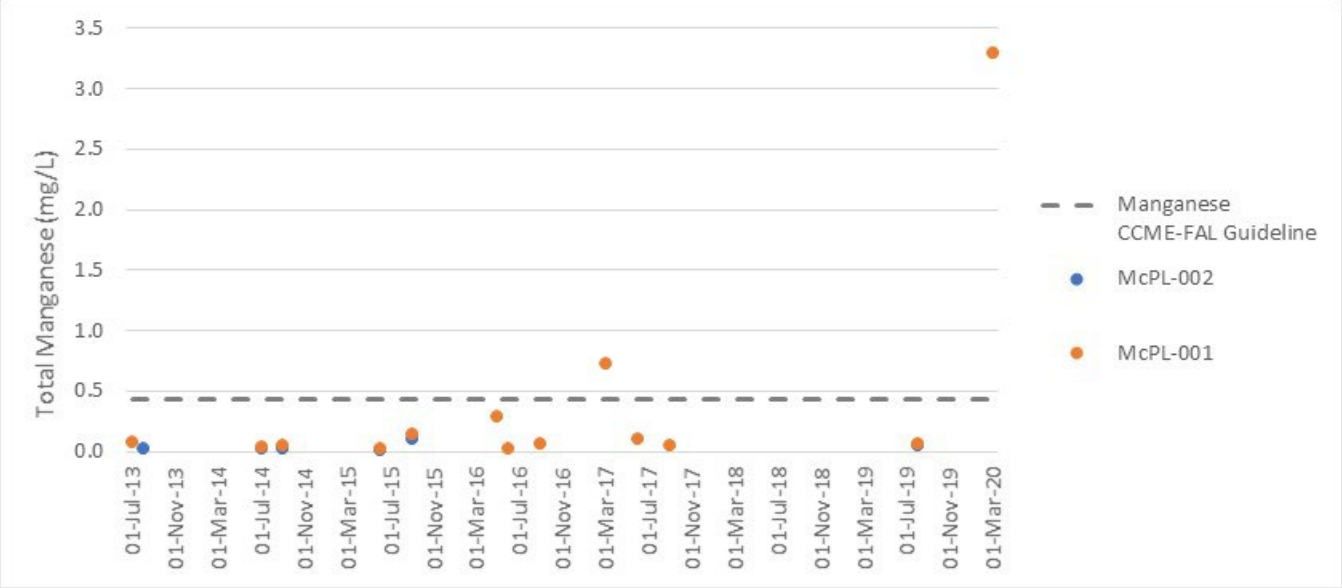


Figure 3-10. Total manganese concentrations in McParlon Creek sites between July 2013 and March 2020.

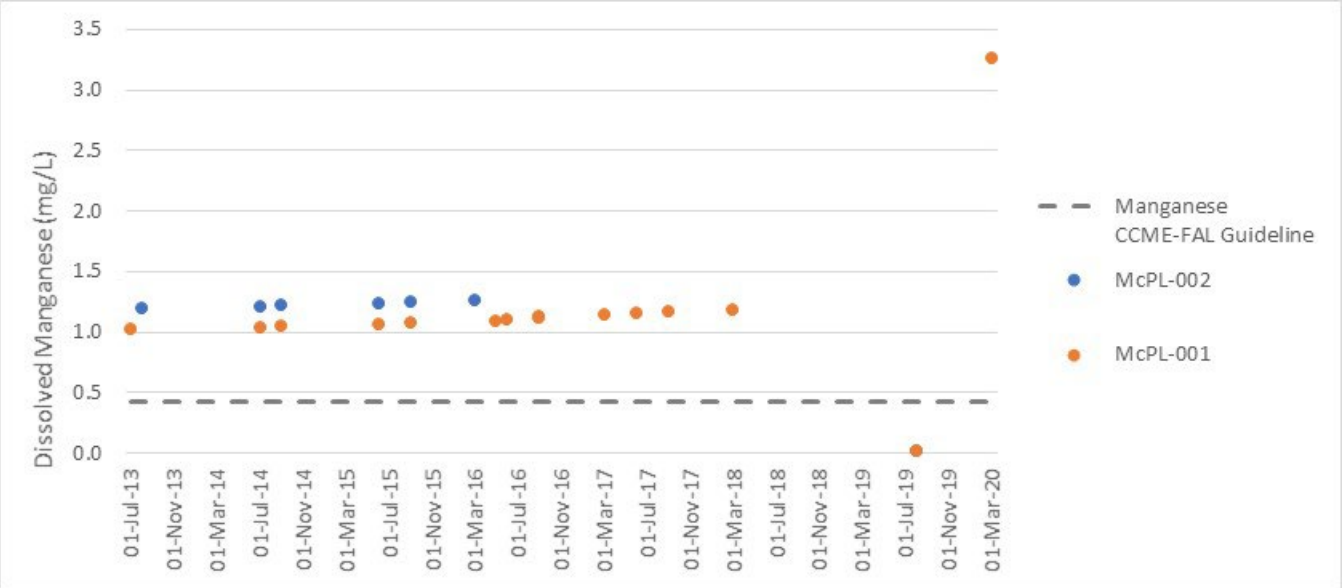


Figure 3-11. Dissolved manganese concentrations in McParlon Creek sites between July 2013 and March 2020.

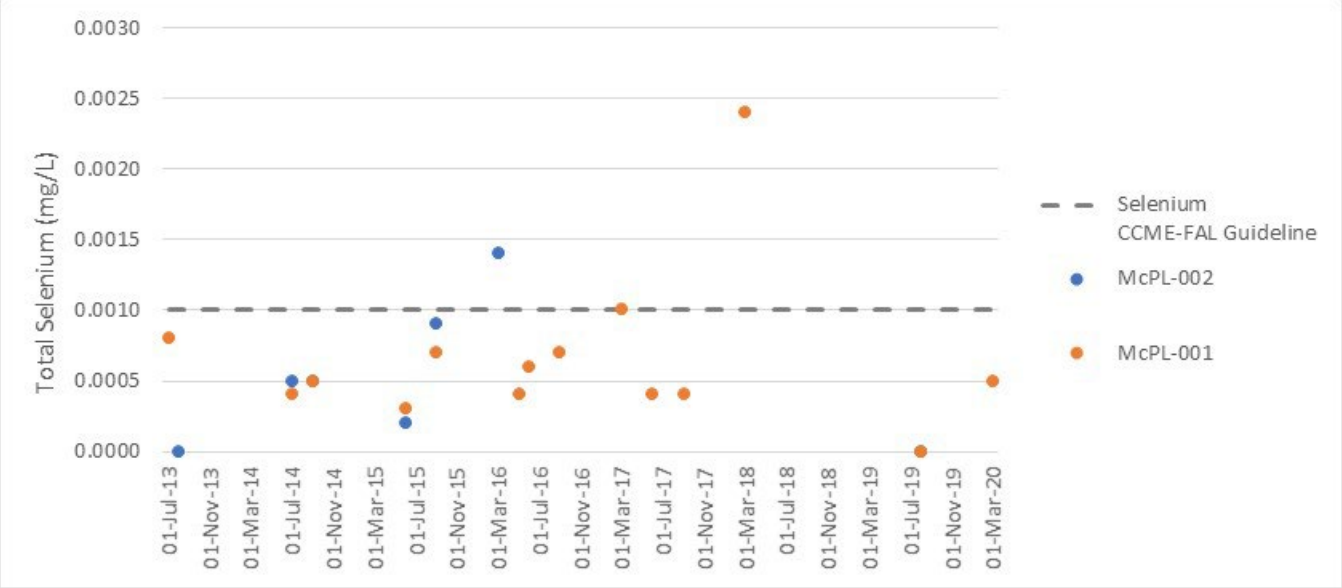


Figure 3-12. Total selenium concentrations in McParlon Creek sites between July 2013 and March 2020.

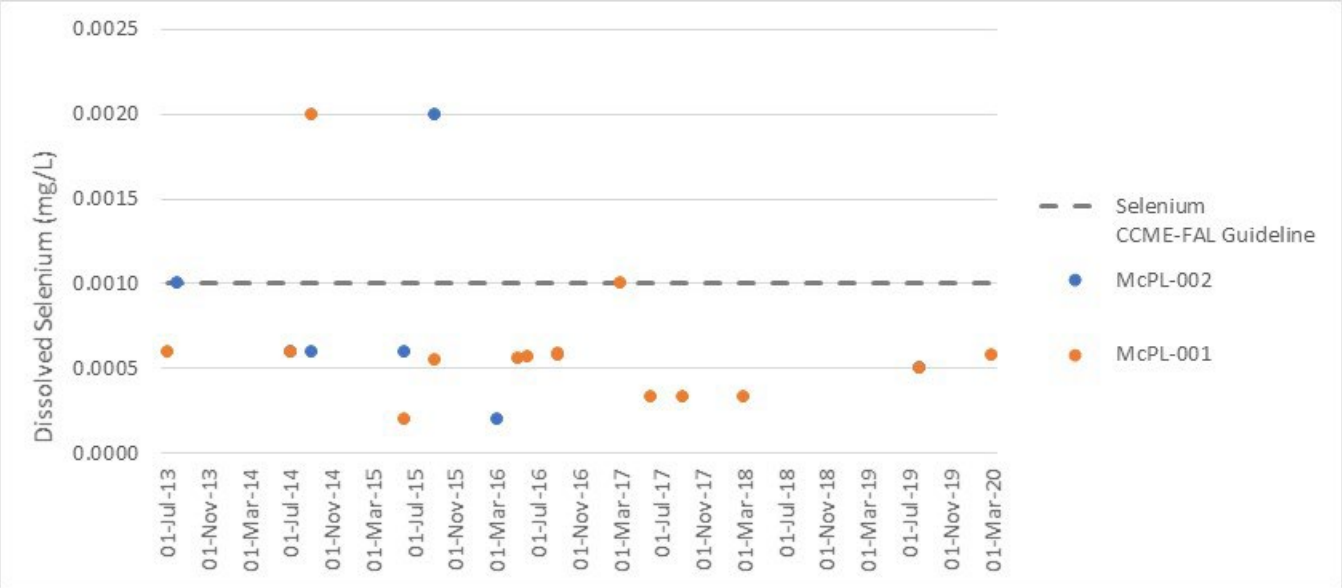


Figure 3-13. Dissolved selenium concentrations in McParlon Creek sites between July 2013 and March 2020.

3.1.1.4 Hydrocarbons

Hydrocarbons in the McParlon Creek sites were the lowest in the RSA. Hydrocarbons including volatile hydrocarbons (VHs), volatile petroleum hydrocarbons (VPHs), and volatile organic carbons (VOCs) were undetectable throughout the McParlon Creek sample sites. In general, naphthalene, biphenyl, phenanthrene, and retene were the major polycyclic aromatic hydrocarbons (PAHs) found at the McParlon Creek sites (Figure 3-14 and Figure 3-15).

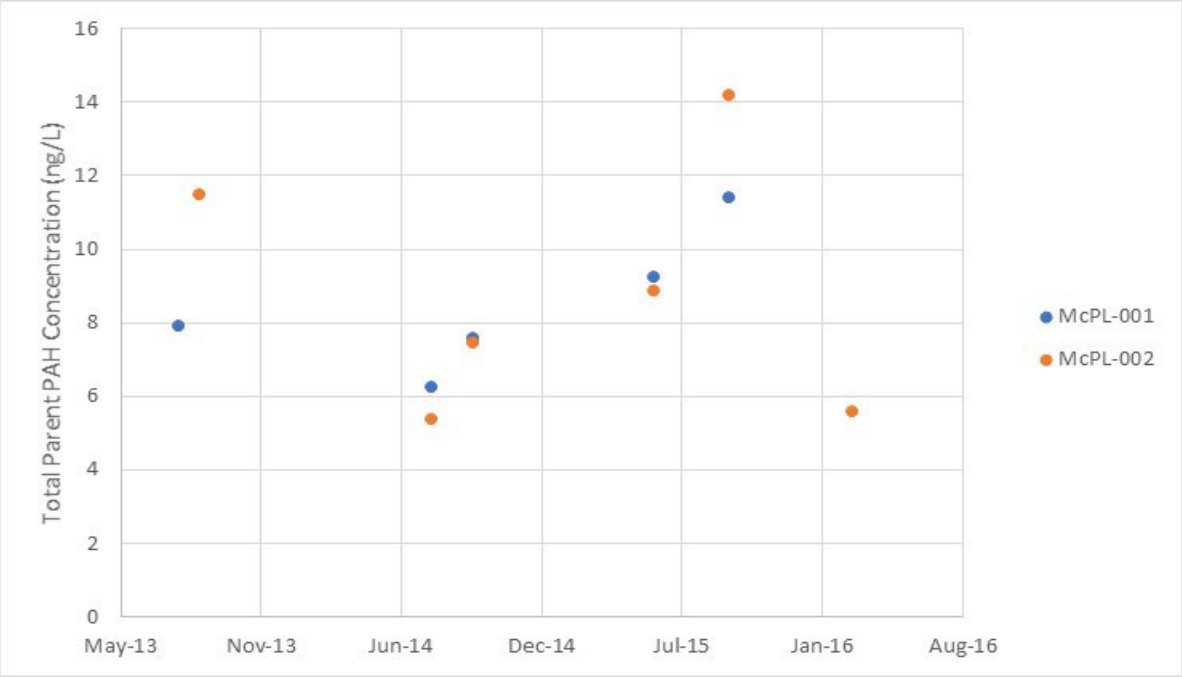


Figure 3-14. Total parent PAH concentrations in McParlon Creek sites from July 2013 through March 2016.

Note: Results that were below detection were treated as 0 ng/L.

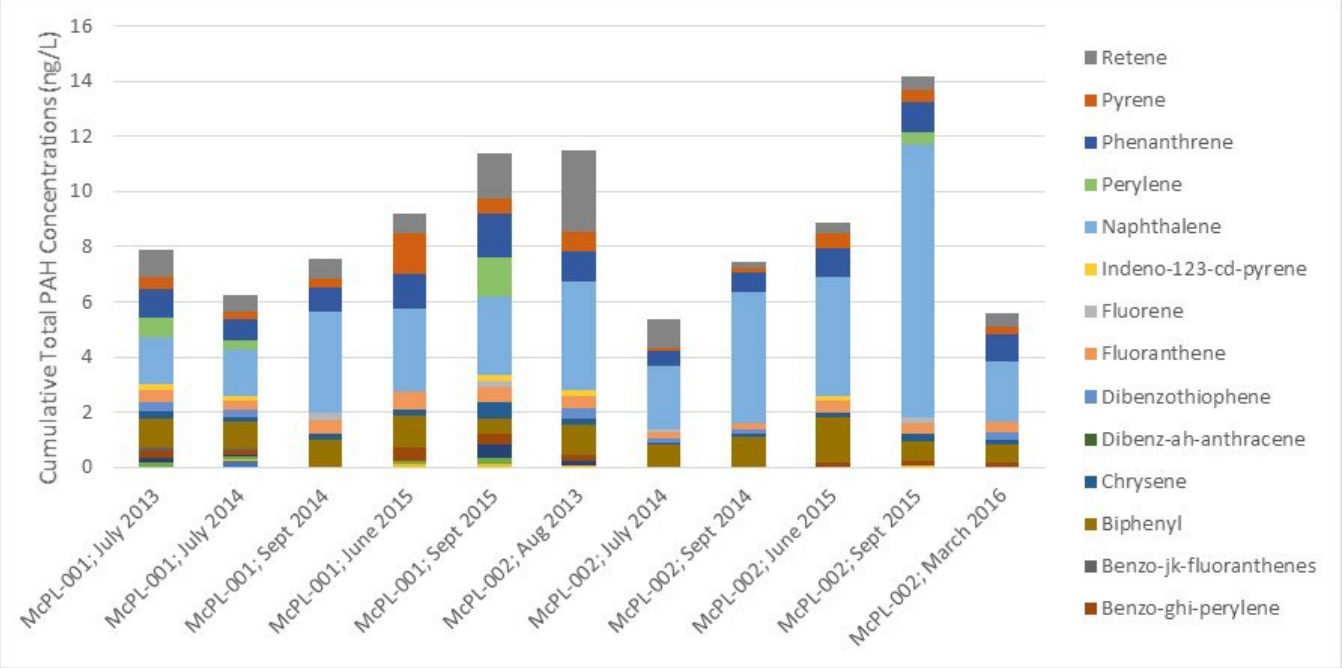


Figure 3-15. Cumulative parent PAH compounds in McParlon Creek sites from July 2013 through March 2016.

Note: Results that were below detection were treated as 0 ng/L.

3.1.2 CHANCE CREEK

The Chance Creek system is in the north of the RSA. It drains to the west, flowing first into the Whitestone River, and ultimately the headwaters of the Porcupine River. Data are available from three sites in the Chance Creek watershed:

1. CHNC-003, located in the upper reaches of Chance Creek, upstream of CHNC-t-002 (Photo 3-3);
2. CHNC-t-002, which is a small tributary to Chance Creek (Photo 3-4); and,
3. CHNC-001, which is just upstream from the Whitestone River (Photo 3-5).

Water quality data were collected from all sites periodically from July/August 2013 through March 2016 at CHNC-t-002, June 2017 at CHNC-003, and through March 2018 at CHNC-001. Chance Creek, which has brown stained water, is a wide, slow-moving stream. While some year-to-year variability is expected, many section of this stream and its tributaries within the RSA freeze to substrate during the winter months.



Photo 3-3. Downstream view from CHNC-003.



Photo 3-4. Upstream view from site CHNC-t-002.



Photo 3-5. Downstream view from CHNC-001.

3.1.2.1 General Chemistry and Major Ions

Water in Chance Creek and its tributary was circumneutral to slightly acidic. The headwaters of Chance Creek and the tributary sampled at CHNC-t-002 were more acidic and pH moved toward neutral by the CHNC-001 sample site. Conductivity in the Chance headwaters ranged from 28.5 to 58 µS/cm at CHNC-003 and from 24.5 to 50 µS/cm at CHNC-t-002, with one outlier at 285 µS/cm, collected in March 2016. At CHNC-001, the conductivity range was greater at 28 to 507 µS/cm. Water can be generally characterized as 'very to moderately soft' during the open water season and 'hard to very hard' during the under-ice months (Table 2-4).

Water was brown stained in colour, and turbidity ranged from very low during the under-ice period, to close to 100 NTUs at other times of the year. Aside from low turbidity under ice, turbidity showed no seasonal pattern and may be influenced by precipitation events. The suspended sediment load is generally low, ranging from <1 mg/L (below detection) to 88 mg/L; however, like turbidity, there are some spikes to approximately 245 mg/L in samples collected at various open water times of the year that were likely associated with precipitation events. Major ions were predominantly comprised of bicarbonate, calcium, and sulphate (Figure 3-16); the headwaters had higher proportions of magnesium in comparison with CHNC-001, and the sulfate increased with distance downstream.

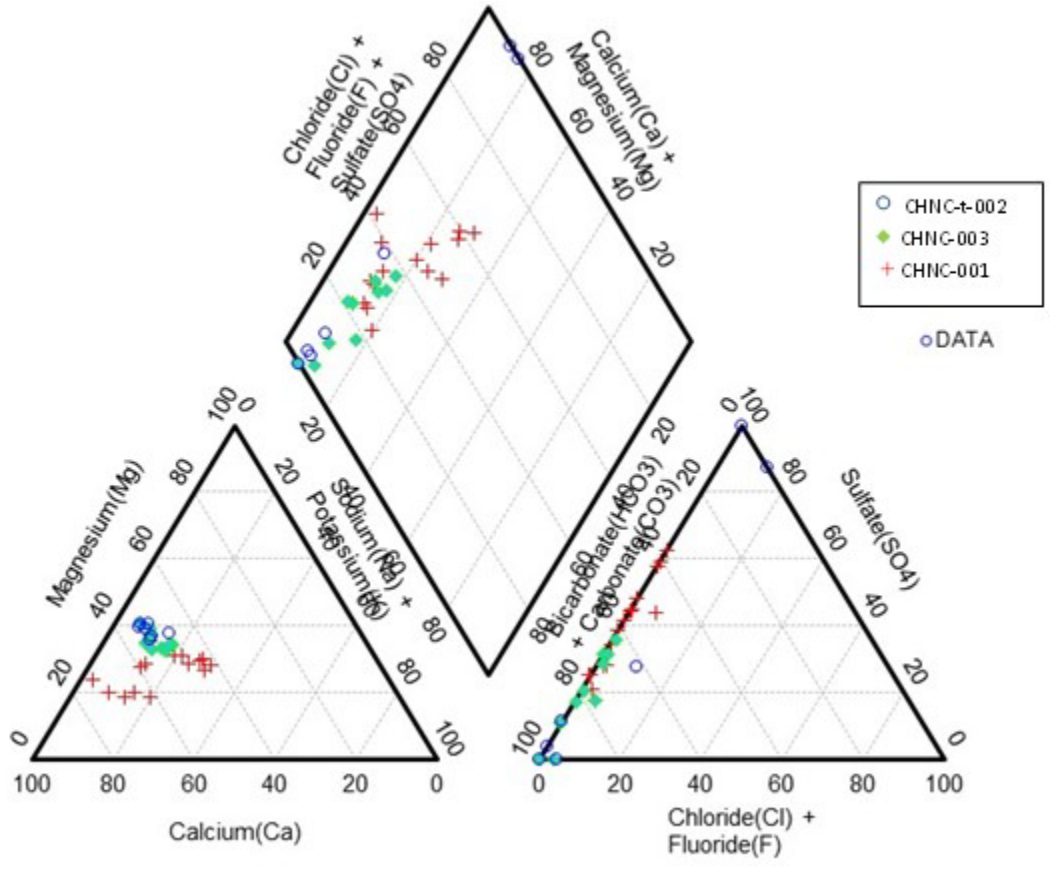


Figure 3-16. Piper plot showing major ion composition of waters in the C hance Creek watershed in % meq/kg.

3.1.2.2 Nutrients

Nutrient concentrations in the Chance Creek sites were low. Concentrations of nitrate, nitrate+nitrite, and total ammonia were below applicable guidelines in surface water. One nitrite sample, collected from CHNC-001 in March 2016, had a concentration of 0.11 mg/L, which exceeded the CCME-FAL of 0.06 mg/L; all other nitrite concentrations ranged from <0.010 mg/L (below detection) to 0.06 mg/L. Total Kjeldahl Nitrogen ranged from 0.85 to 1.19 mg/L.

Total phosphorus concentrations generally ranged from 0.020 through 0.085 mg/L, indicating that the trophic status generally ranged from oligotrophic to mesotrophic (Table 2-5); one sample, collected from CHNC-003 in March 2020, had a concentration of 0.218 mg/L.

3.1.2.3 Trace Metals

Aluminum, arsenic, copper, iron, and manganese in the Chance Creek watershed occurred in concentrations that regularly exceeded the CCME-FAL guideline. Total aluminum exceeded the CCME-FAL guideline in nearly all samples from both sites; however, most of the aluminum in the water column is likely bound to suspended sediment as the dissolved fraction of aluminum in nearly all samples was below the CCME-FAL guideline (Figure 3-17 and Figure 3-18). Total arsenic exceeded the CCME-FAL in two samples, both associated with under-ice sampling; dissolved fractions were below the guideline (Figure 3-19 and Figure 3-20). Total and dissolved copper, iron, and manganese regularly exceeded their respective CCME-FAL guidelines (Figure 3-21 through Figure 3-26).

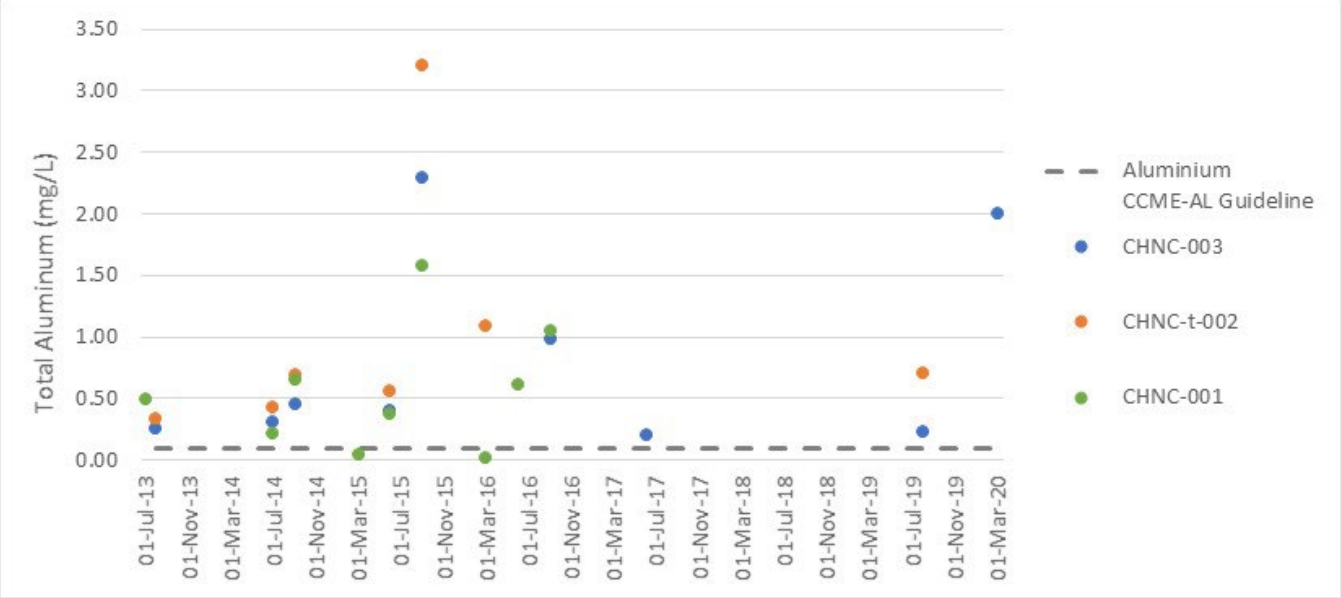


Figure 3-17. Total aluminum concentrations in Chance Creek sites between July 2013 and March 2020.

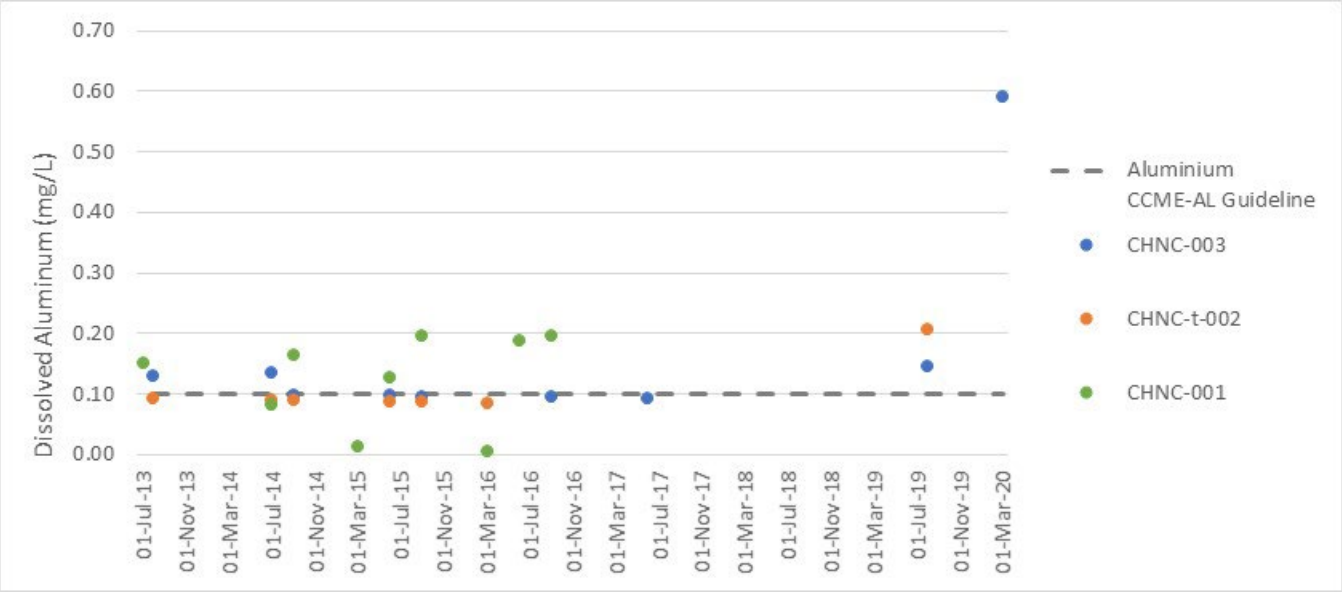


Figure 3-18. Dissolved aluminum concentrations in Chance Creek sites between July 2013 and March 2020.

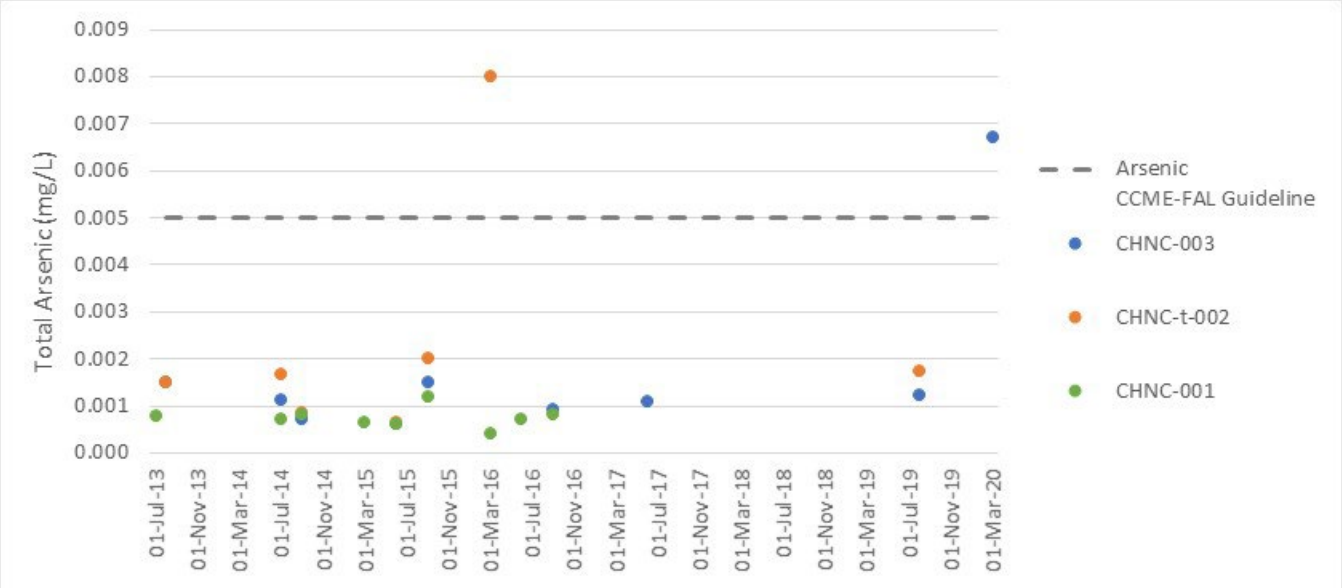


Figure 3-19. Total arsenic concentrations in Chance Creek sites between July 2013 and March 2020.

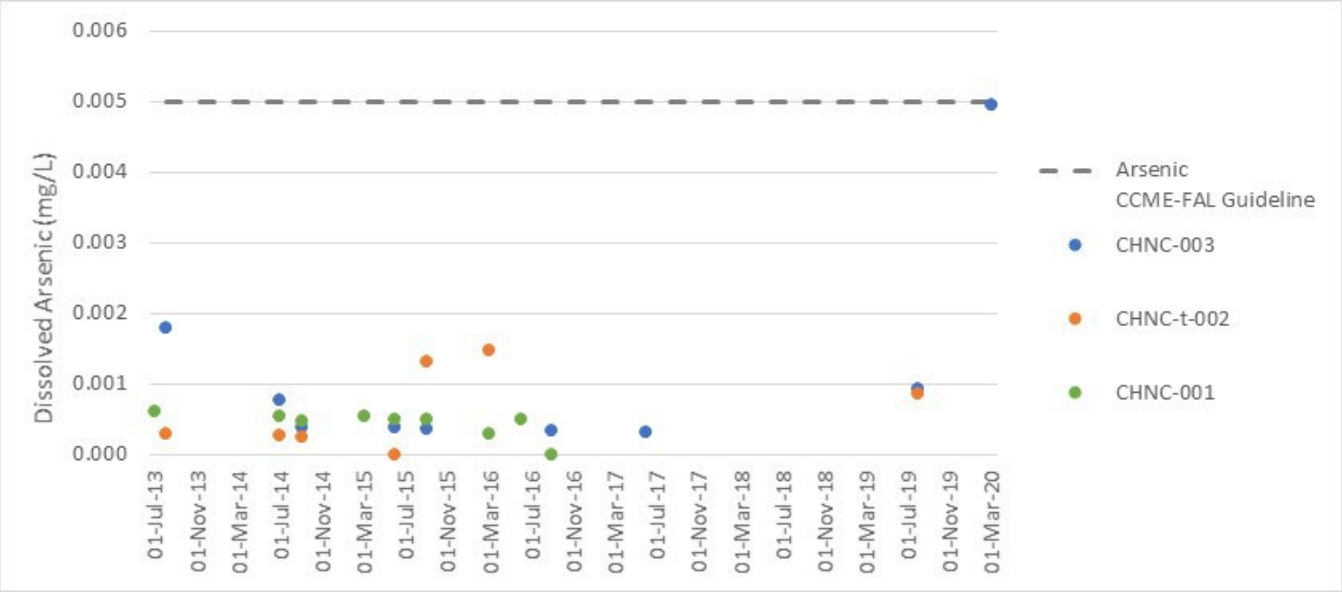


Figure 3-20. Dissolved arsenic concentrations in Chance Creek sites between July 2013 and March 2020.

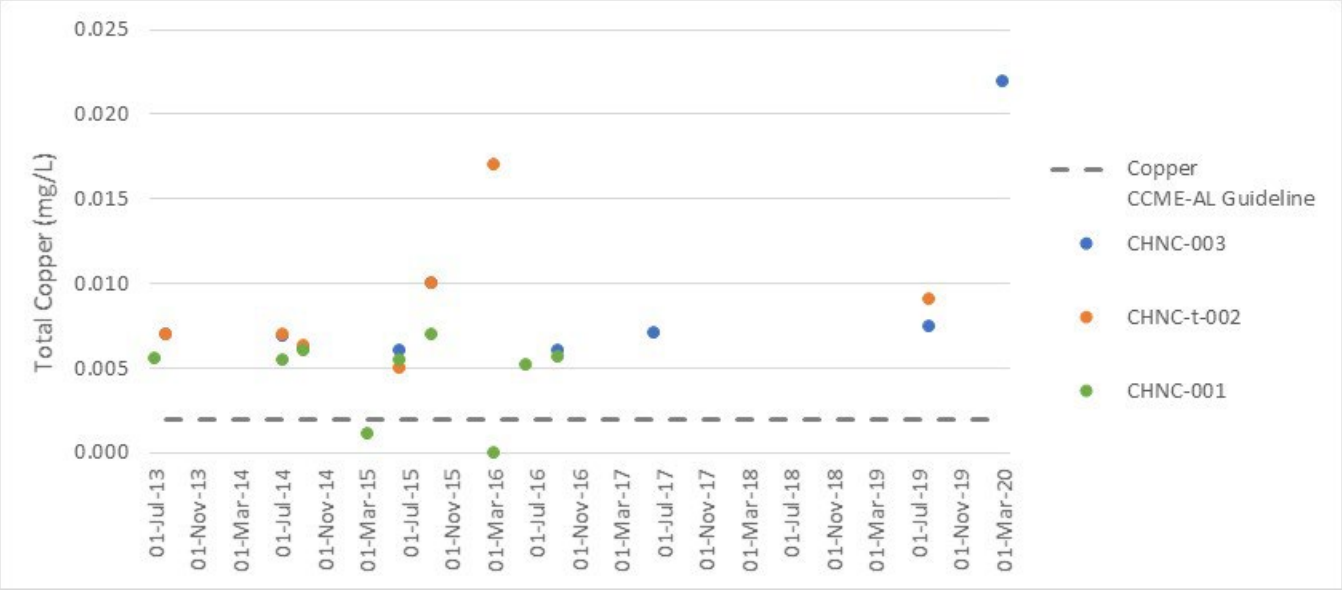


Figure 3-21. Total copper concentrations in Chance Creek sites between July 2013 and March 2020.

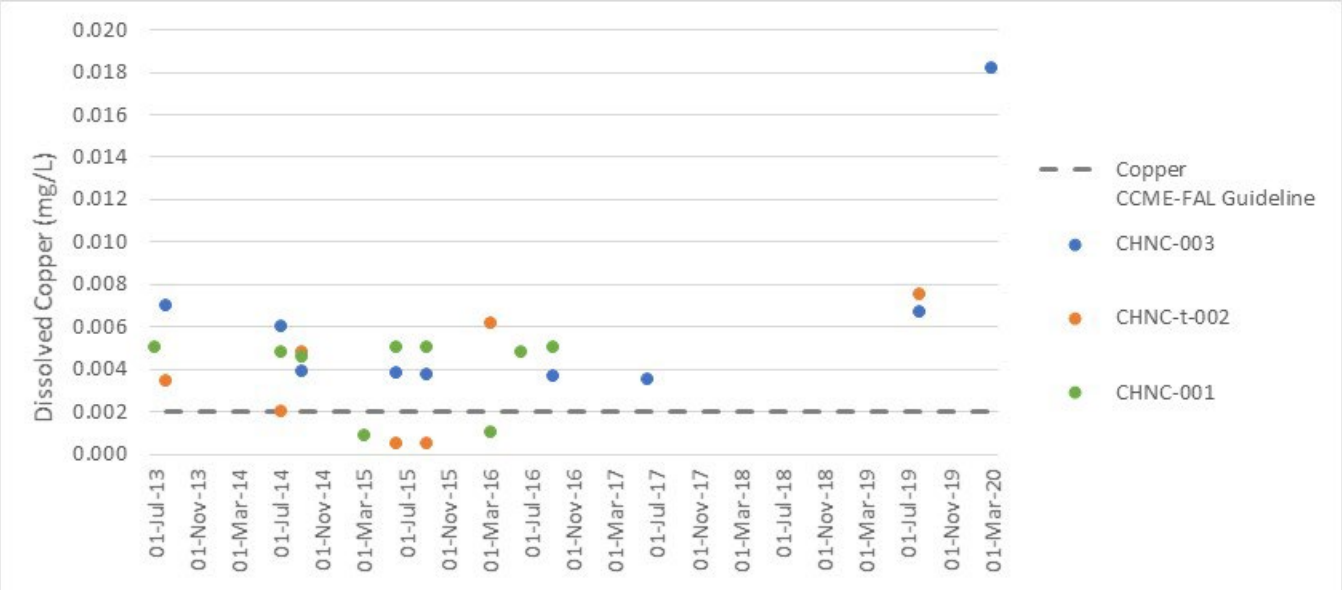


Figure 3-22. Dissolved copper concentrations in Chance Creek sites between July 2013 and March 2020.

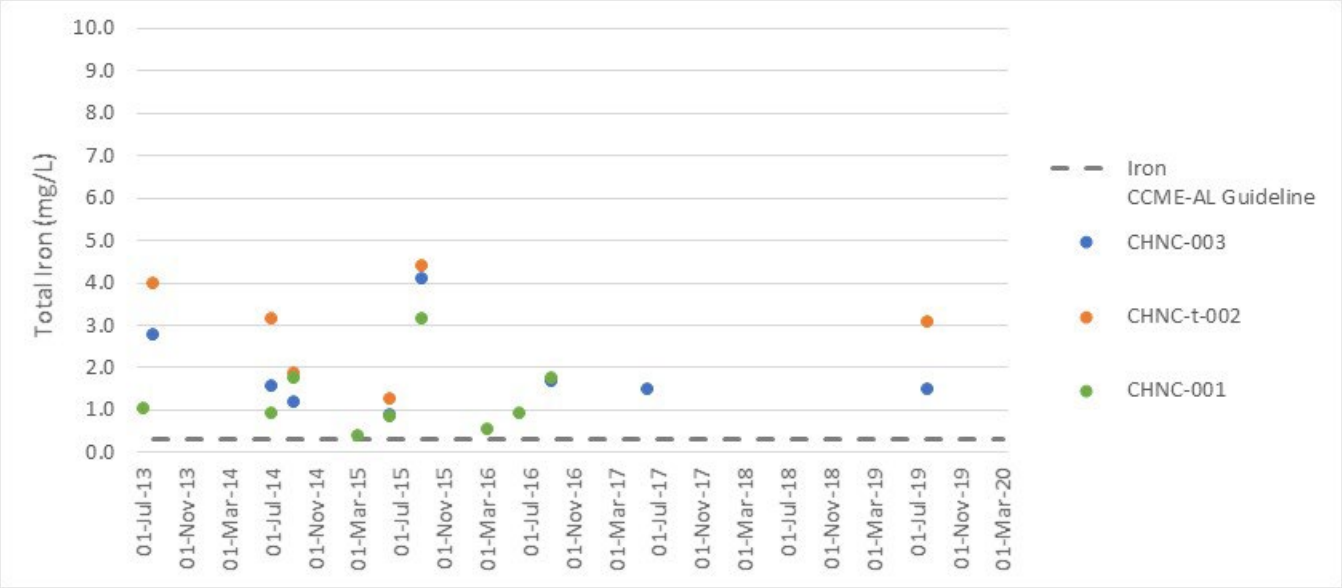


Figure 3-23. Total iron concentrations in Chance Creek sites between July 2013 and March 2020.

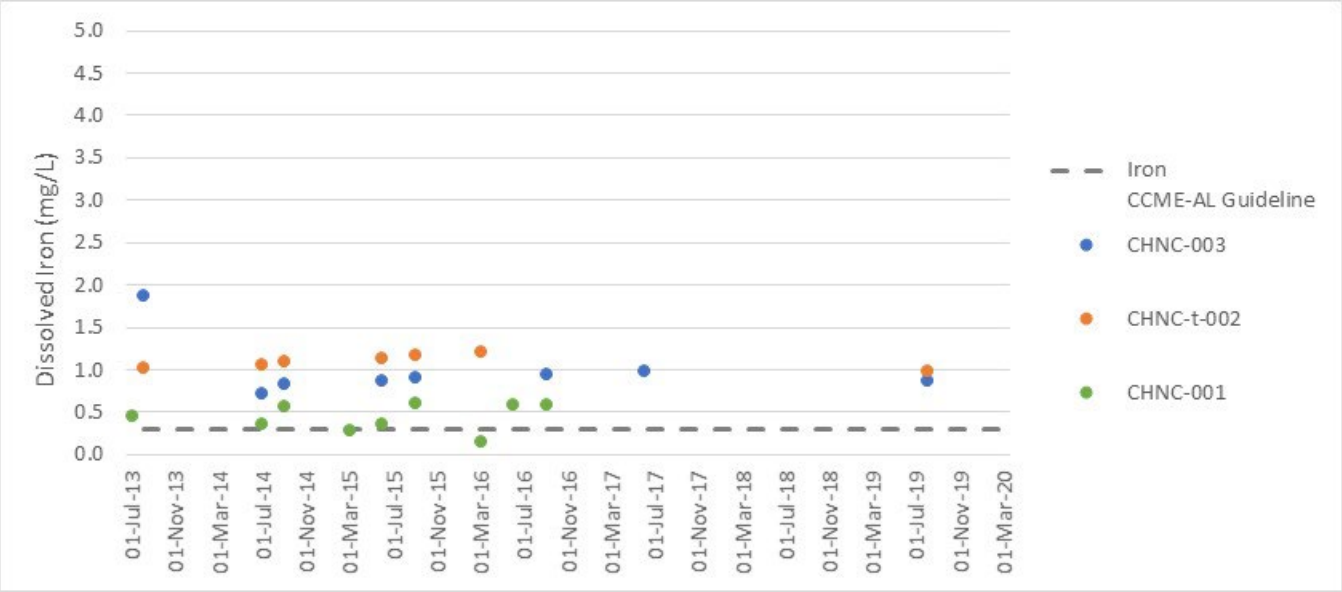


Figure 3-24. Dissolved iron concentrations in Chance Creek sites between July 2013 and March 2020.

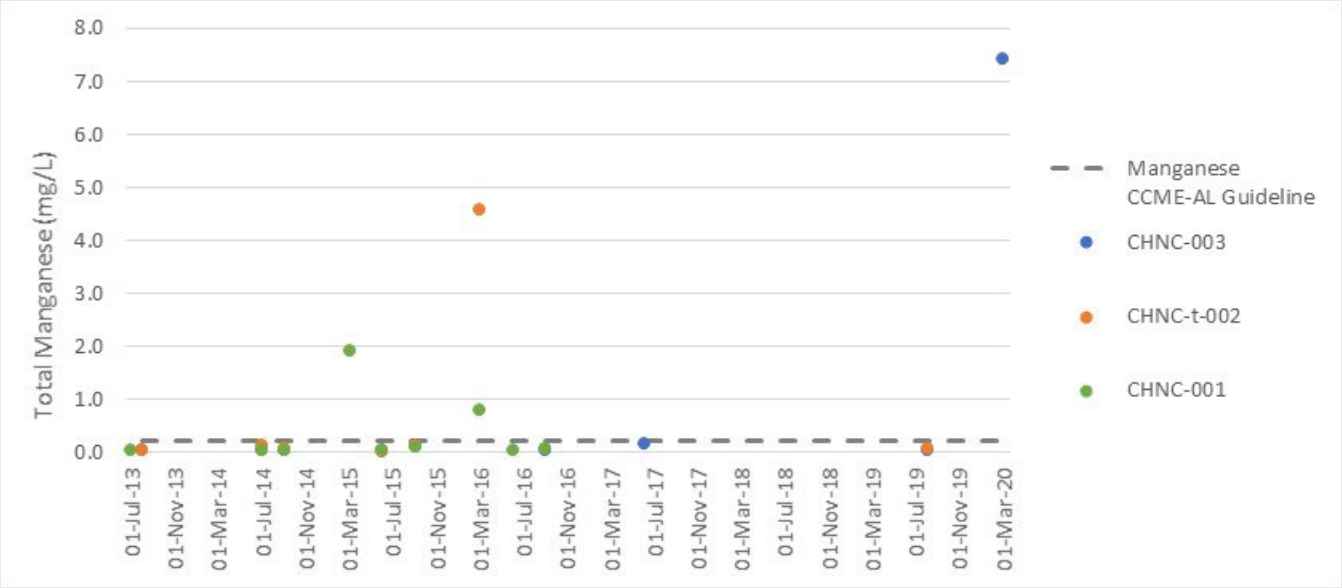


Figure 3-25. Total manganese concentrations in Chance Creek sites between July 2013 and March 2020.

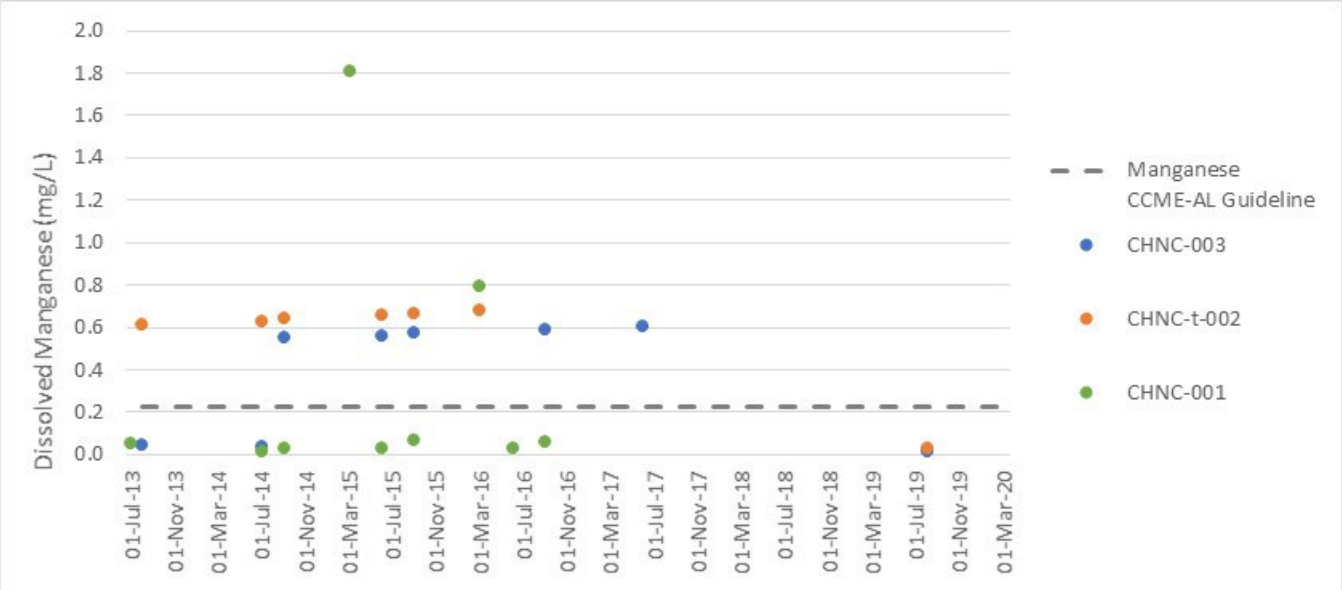


Figure 3-26. Dissolved manganese concentrations in Chance Creek sites between July 2013 and March 2020.

3.1.2.4 Hydrocarbons

Hydrocarbon concentrations in water from the Chance Creek sites including VHs, VPHs, and VOCs were undetectable throughout the Chance Creek sample sites. In general, PAH concentrations were higher in Chance Creek than in McParlon Creek. No pattern in total PAH concentration was identified among the Chance Creek sample sites (Figure 3-27). The PAHs that comprised most total parent PAHs at the Chance Creek sites included naphthalene and retene (Figure 3-28). The sample collected from CHNC-001 in March 2015 had significantly higher PAH concentrations, particularly naphthalene, than all other samples from all sites, indicating that this sample may have been contaminated (Figure 3-27).

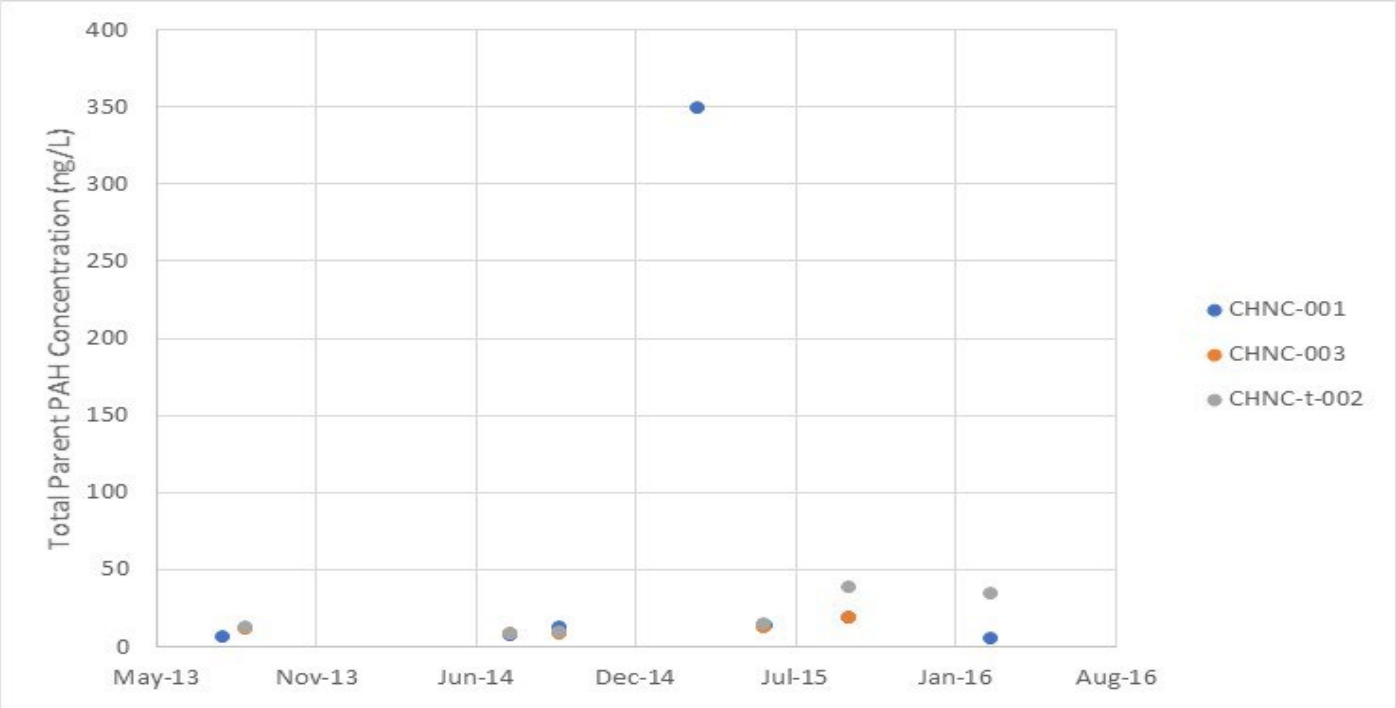


Figure 3-27. Total parent PAH concentrations in Chance Creek sites from July 2013 through March 2016.

Note: Results that were below detection were treated as 0 ng/L.

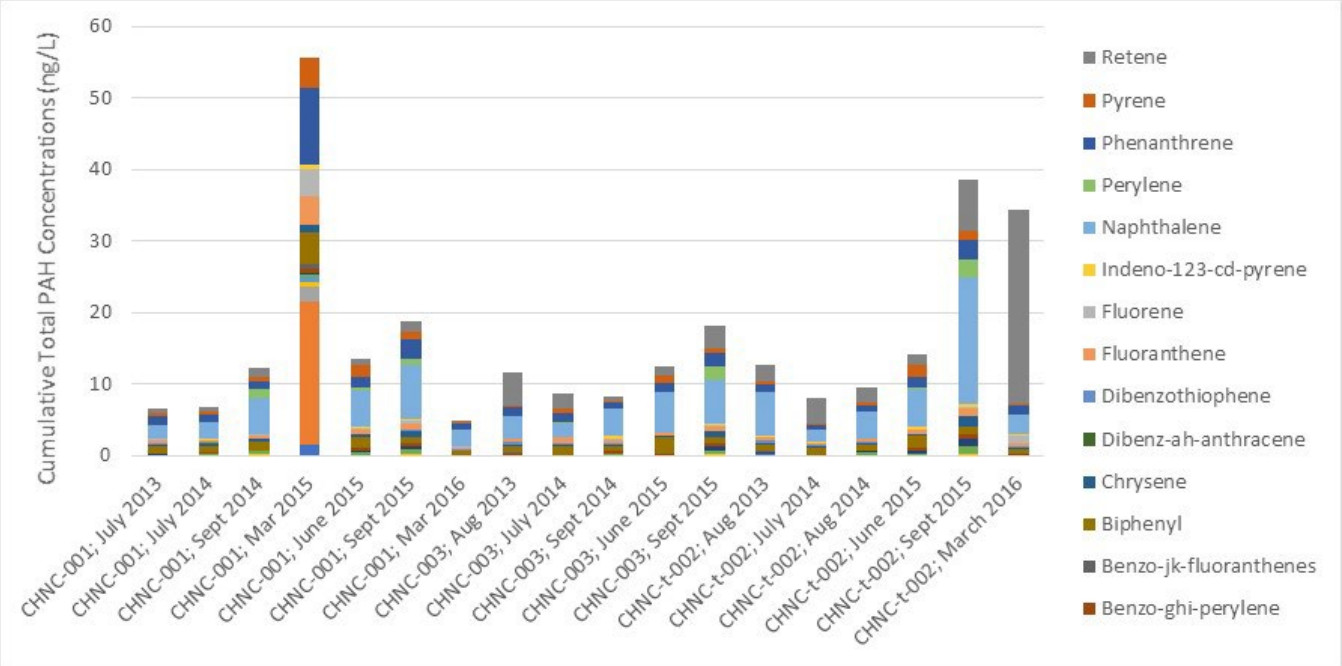


Figure 3-28. Cumulative parent PAH compounds in Chance Creek sites from July 2013 through March 2016.

Note: Results that were below detection were treated as 0 ng/L. The naphthalene at CNHC-001 in March 2015 result was removed from the bar chart due to suspected contamination error (294 ng/L).

3.1.3 EAGLE RIVER TRIBUTARIES, NORTH AND SOUTH

Water quality sampling took place in three tributaries to Eagle River, which ultimately drains into the headwaters of Porcupine River (Map 2-1):

1. NCY-PT19, an unnamed tributary that drains north from the RSA to the Eagle River (Photo 3-6);
2. EAGL-t-003, located in a tributary to the Eagle River, downstream of NCY-PT19 and EAGLE-t-002, and just upstream from the Eagle River (Photo 3-7); and,
3. EAGL-t-004, a tributary that drains the RSA south, to the Eagle River (Photo 3-8).

Water quality data were collected by YG WRB periodically at NCY-PT19 from August 2013 through September 2015. The longest sampling record in this catchment comes from EAGL-t-003, which YG WRB sampled from August 2013 through March 2018. EDI collected samples from all three sites in August 2019 and March 2020.



Photo 3-6. Upstream view from NCY-PT19.



Photo 3-7. Upstream view from site EAGL-t-003.



Photo 3-8. Downstream view from EAGL-t-004.

3.1.3.1 General Chemistry and Major Ions

Water in Eagle River tributaries (Eaglet north and south drainage) was circumneutral to slightly acidic. Conductivity was higher than noted in other RSAs, ranging from 142 to 626 µS/cm. Water hardness can be generally characterized as 'moderately hard' during the open water season and 'hard to very hard' during the under-ice months, with hardness concentrations generally greater than 60 mg/L (as $CaCO_3$).

Water was brown stained in colour, and turbidity was generally low. Turbidity showed no seasonal pattern and may be influenced by precipitation events and sampling. The suspended sediment load was generally low, ranging from <1 mg/L (below detection) to 39 mg/L; however, like turbidity, there are some spikes to approximately 182 mg/L in samples collected at various open water times of the year, which were likely associated with precipitation events or permafrost melt-related bank slumping. Major ions predominantly included bicarbonate, calcium, sodium, and sulphate (Figure 3-29); the furthest downstream site, EAGL-t-003 showed lower amounts of magnesium and higher amounts of calcium when compared with NCY-PT19.

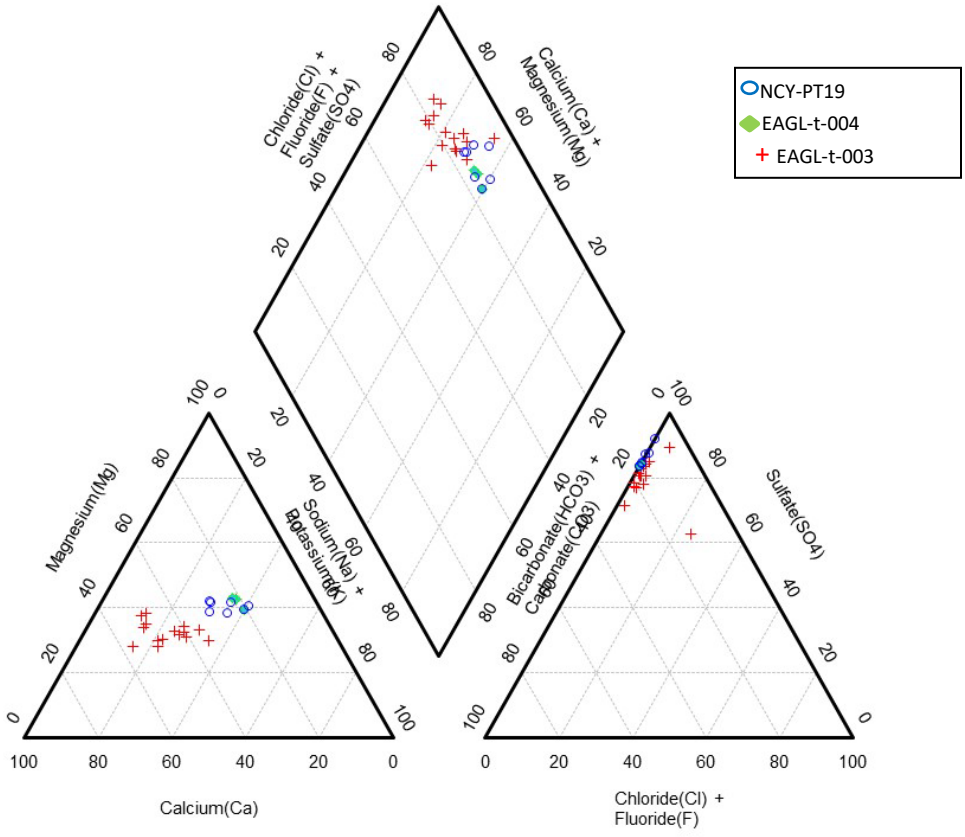


Figure 3-29. Piper plot showing major ion composition of waters in the Eaglet north and south watersheds in % meq/kg.

3.1.3.2 Nutrients

Nutrient concentrations in the Eagle Creek tributary sites were low; nitrate, nitrite, nitrate+nitrite, and total ammonia were below applicable guidelines in surface water. Total Kjeldahl Nitrogen ranged from 0.48 to 1.00 mg/L (NCY-PT19 in July 2014). Total phosphorus concentrations ranged from 0.014 to 0.05 mg/L, indicating mesotrophic trophic status (Table 2-5).

3.1.3.3 Trace Metals

Aluminum, cadmium, copper, iron, manganese, and selenium in the Eagle Creek tributary sites occurred in concentrations that regularly exceeded the CCME-FAL guideline. Total aluminum exceeded the CCME-FAL guideline in nearly all samples from all sites; however, the dissolved fraction of aluminum was below the CCME-FAL guideline in all but one sample (Figure 3-30 and Figure 3-31). Total and dissolved cadmium and selenium exceeded the CCME-FAL, a small number of samples associated with under-ice sampling (Figure 3-32, Figure 3-33, Figure 3-40, and Figure 3-41). Total and dissolved copper, iron, and manganese regularly exceeded their respective CCME-FAL guidelines (Figure 3-34 to Figure 3-38).

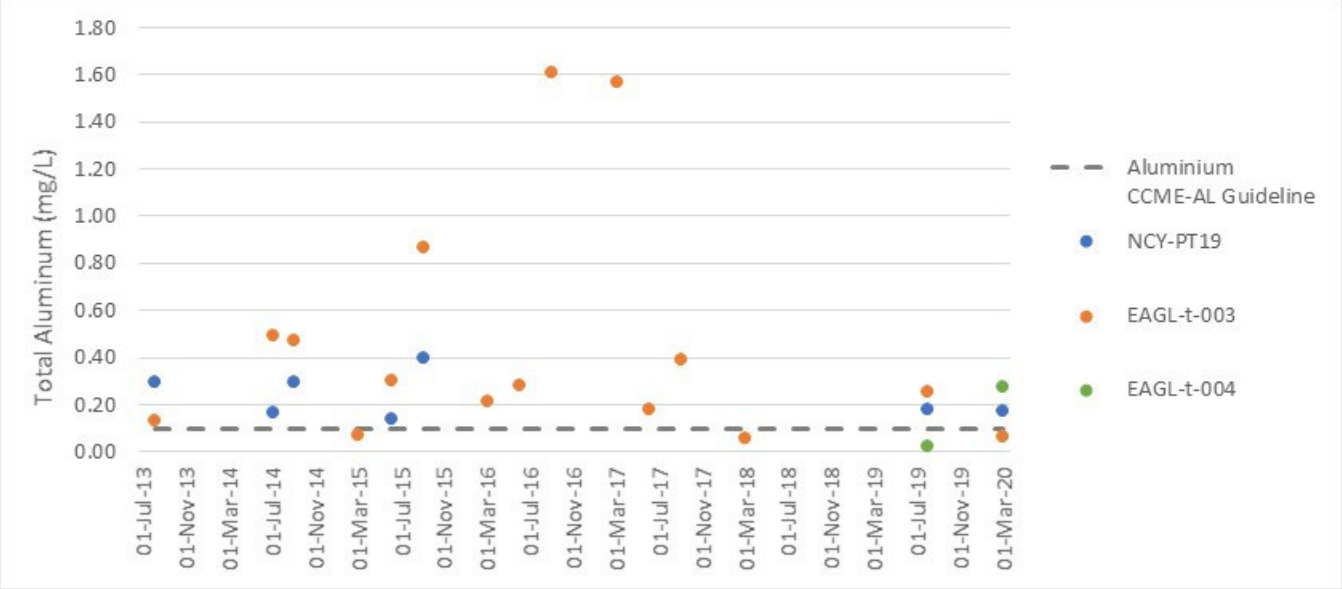


Figure 3-30. Total aluminum concentrations in Eagle Creek tributary sites between July 2013 and March 2020.

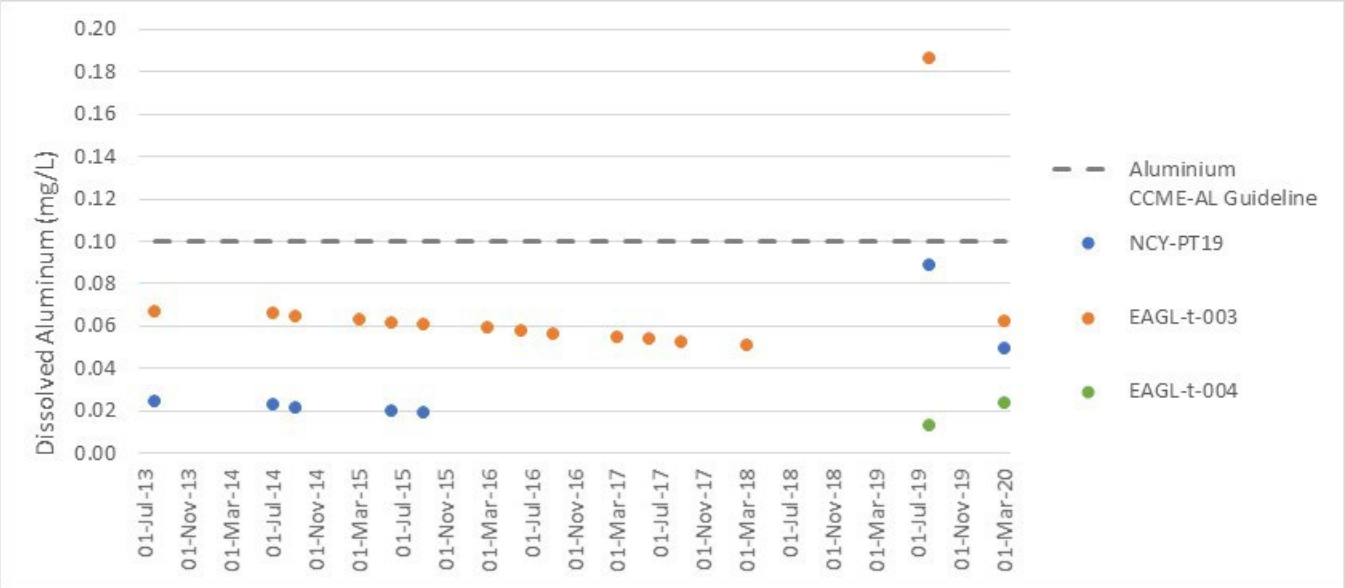


Figure 3-31. Dissolved aluminum concentrations in Eagle Creek tributary sites between July 2013 and March 2020.

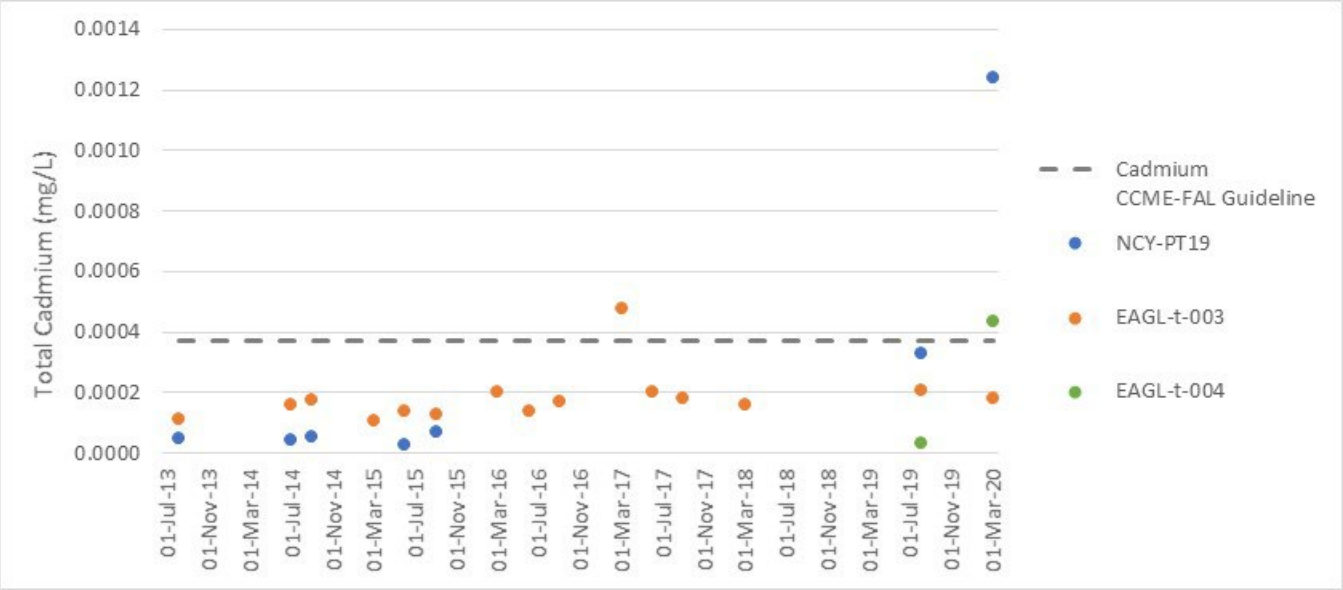


Figure 3-32. Total cadmium concentrations in Eagle Creek tributary sites between July 2013 and March 2020.

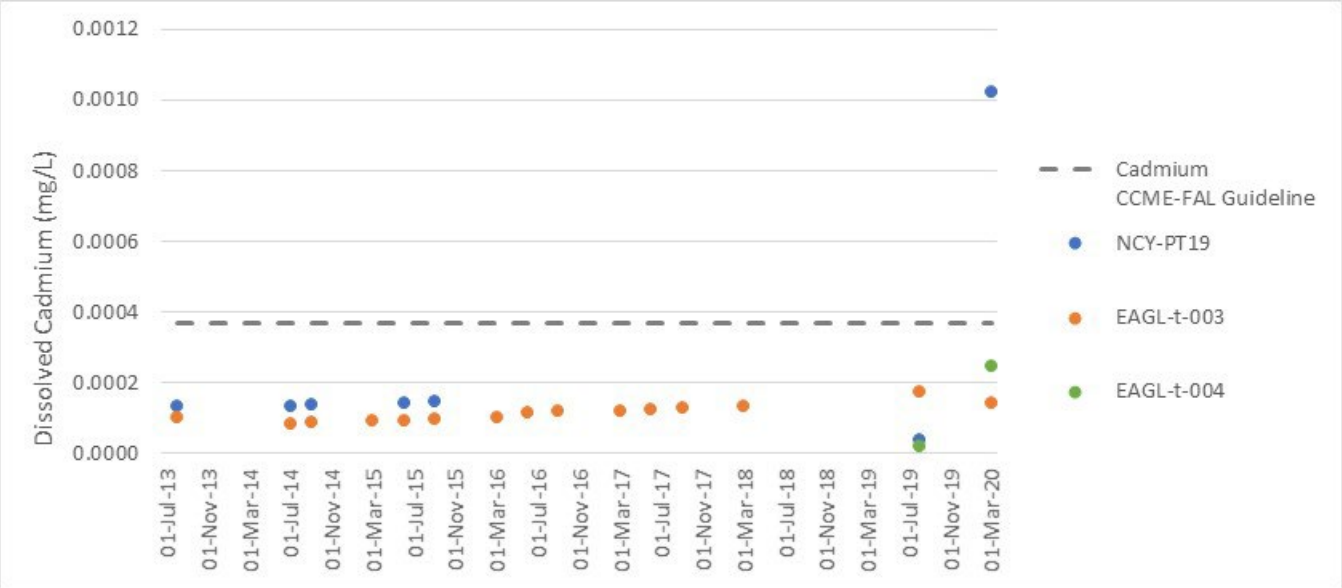


Figure 3-33. Dissolved cadmium concentrations in Eagle Creek tributary sites between July 2013 and March 2020.

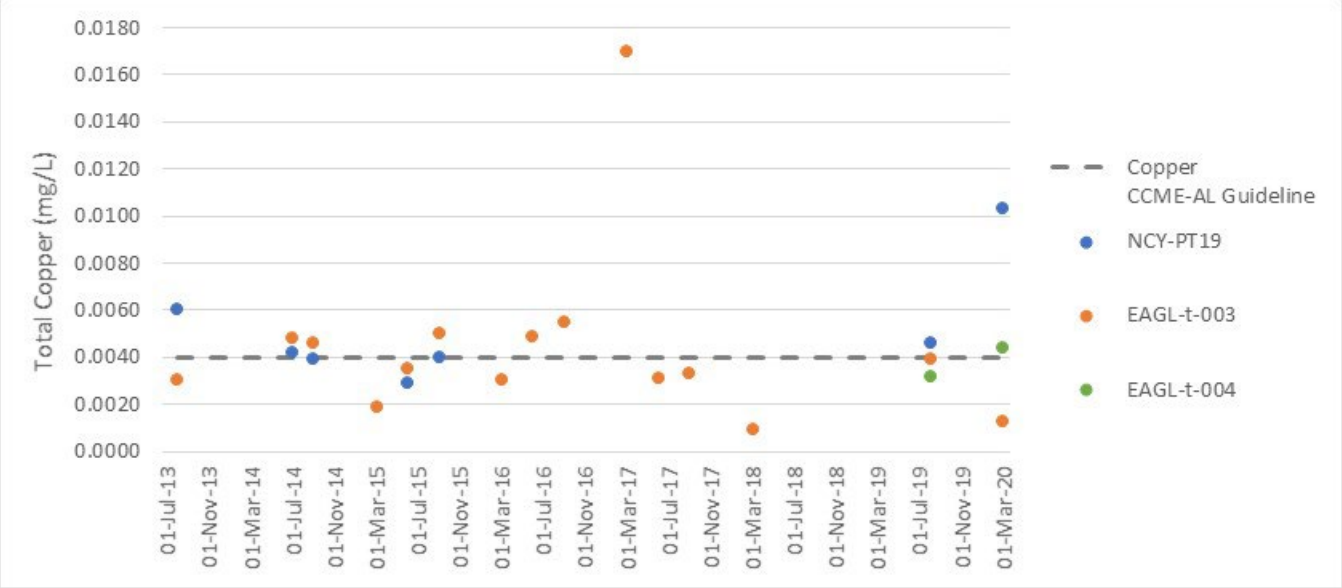


Figure 3-34. Total copper concentrations in Eagle Creek tributary sites between July 2013 and March 2020.

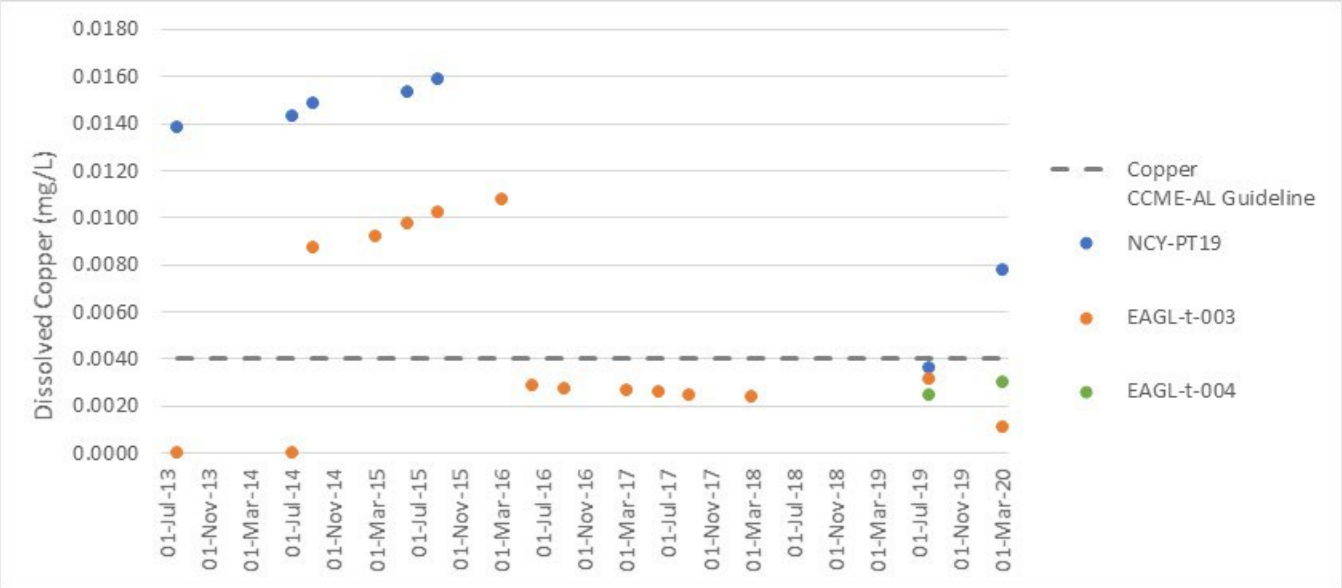


Figure 3-35. Dissolved copper concentrations in Eagle Creek tributary sites between July 2013 and March 2020.

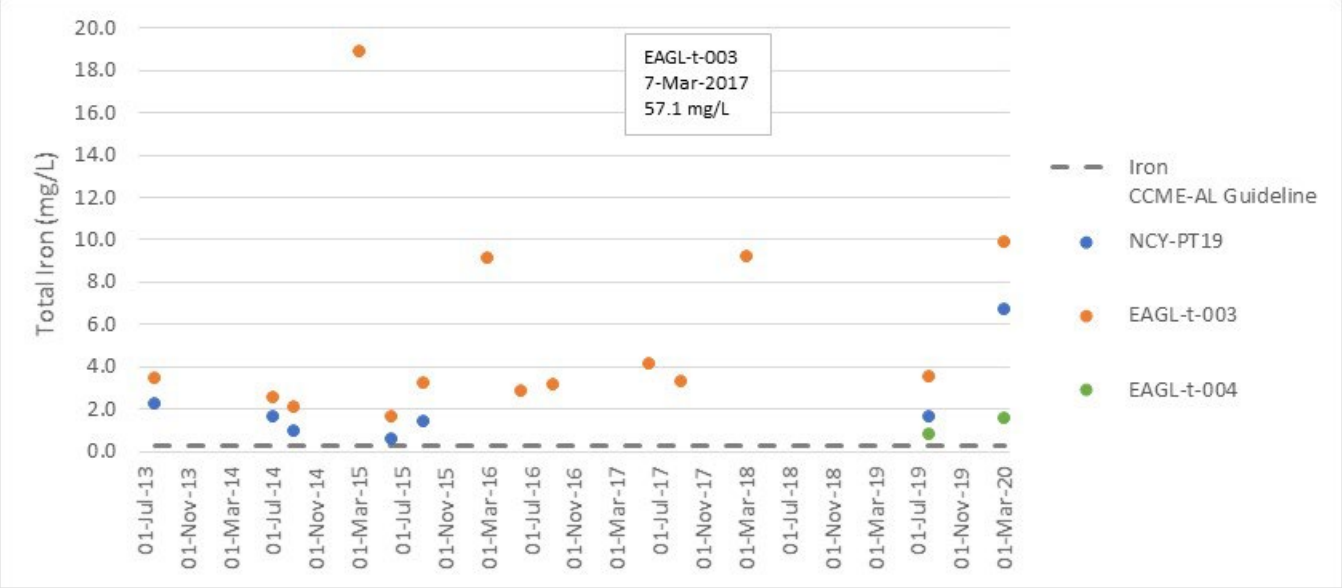


Figure 3-36. Total iron concentrations in Eagle Creek tributary sites between July 2013 and March 2020.

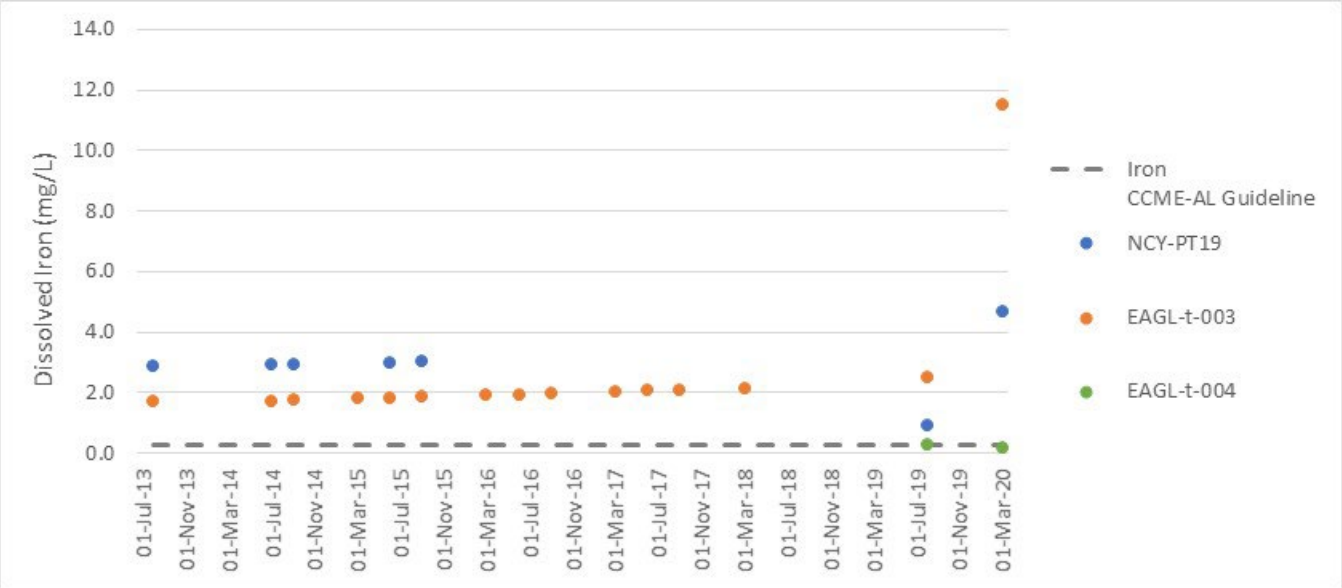


Figure 3-37. Dissolved iron concentrations in Eagle Creek tributary sites between July 2013 and March 2020.

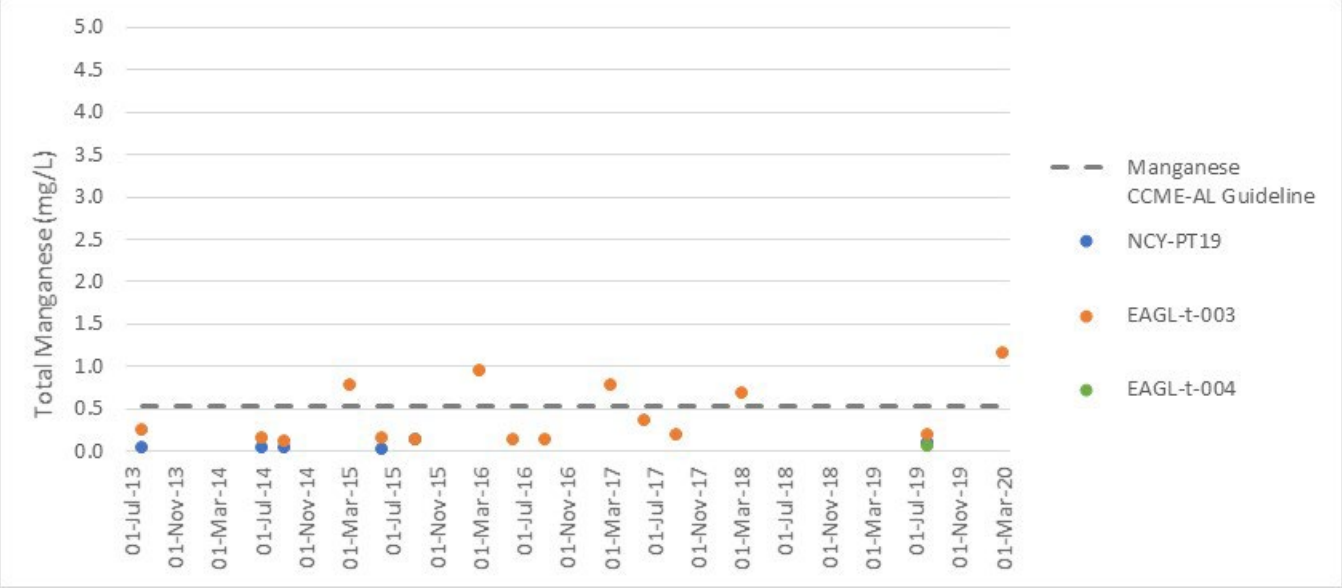


Figure 3-38. Total manganese concentrations in Eagle Creek tributary sites between July 2013 and March 2020.

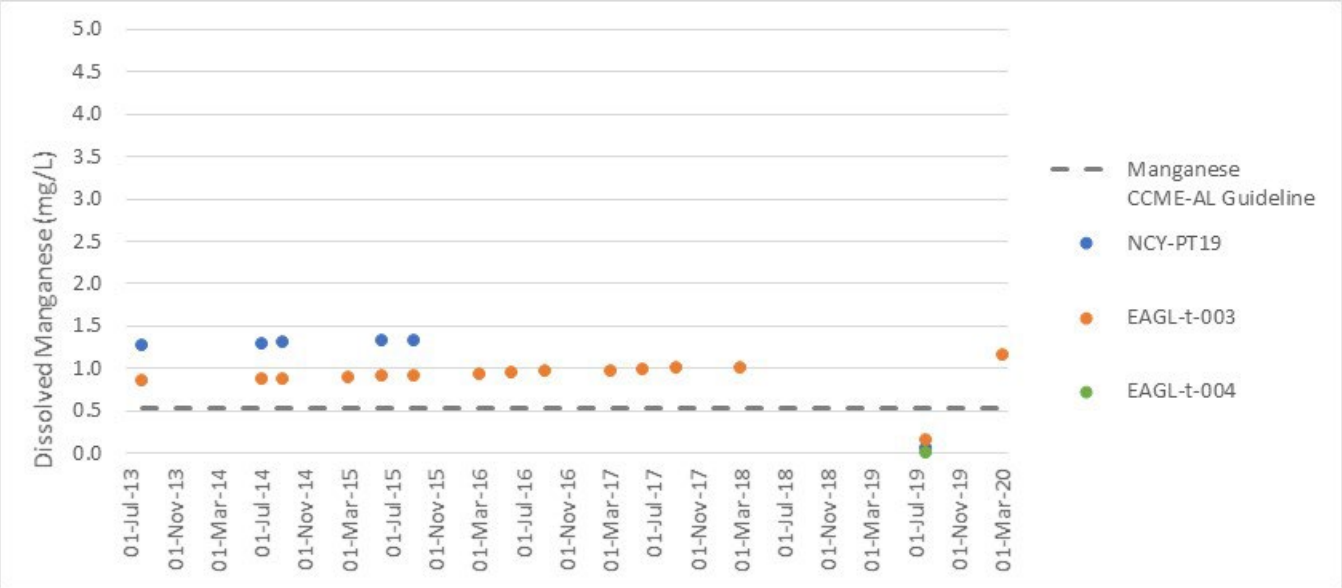


Figure 3-39. Dissolved manganese concentrations in Eagle Creek tributary sites between July 2013 and March 2020.

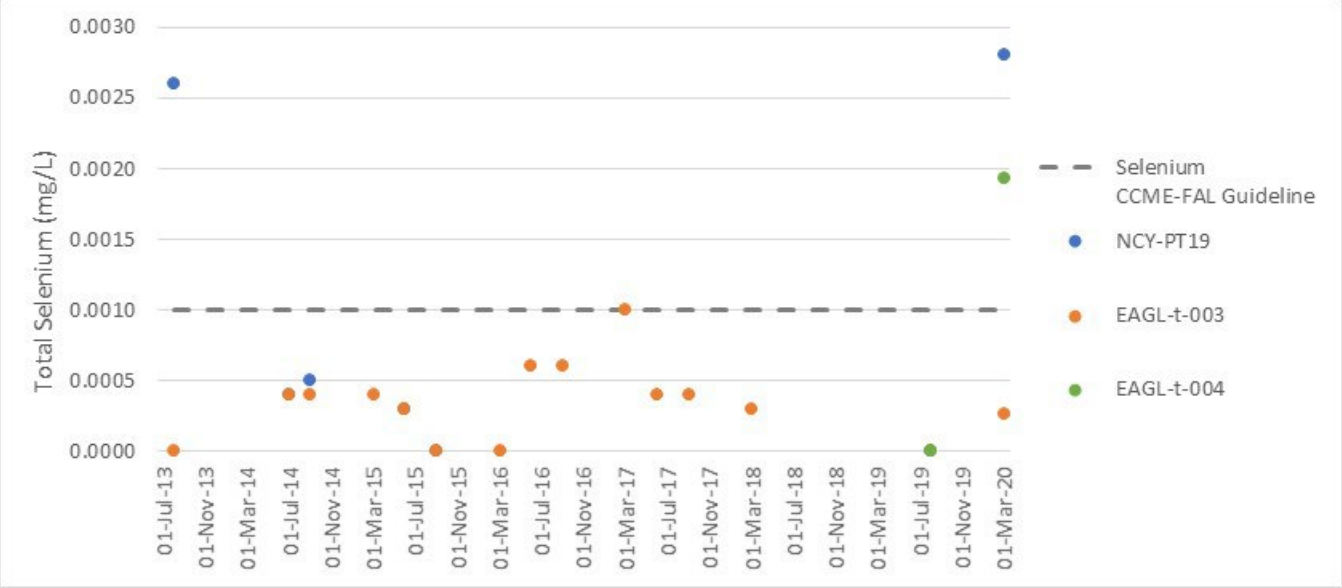


Figure 3-40. Total selenium concentrations in Eagle Creek tributary sites between July 2013 and March 2020.

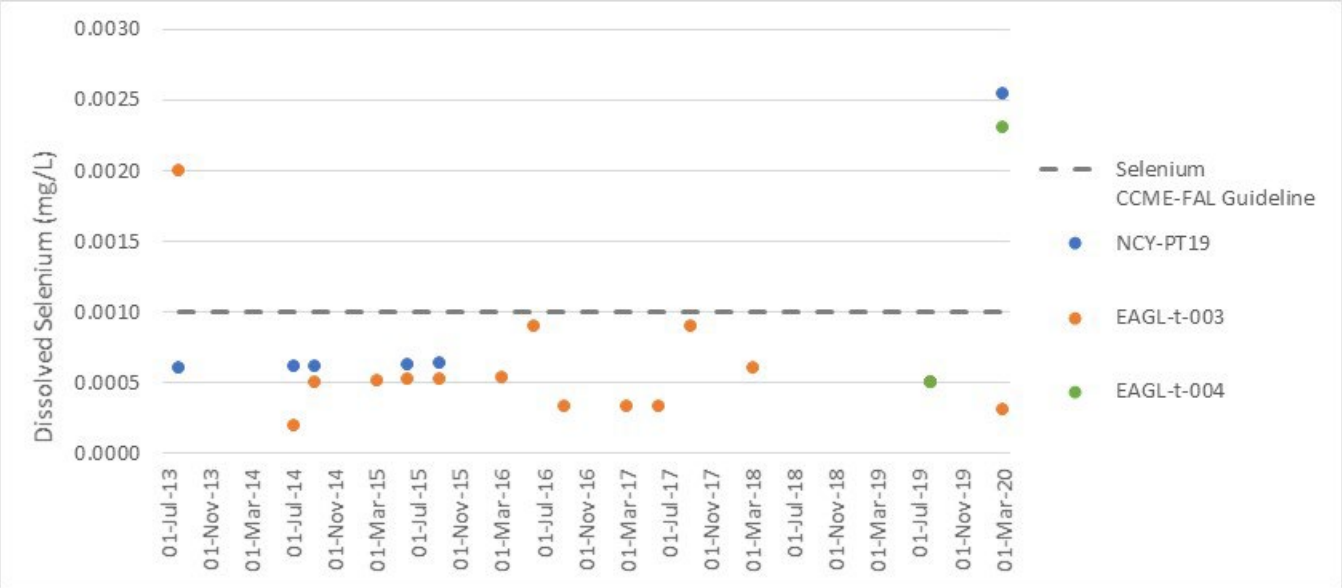


Figure 3-41. Dissolved selenium concentrations in Eagle Creek tributary sites between July 2013 and March 2020.

3.1.3.4 Hydrocarbons

As in McParlon Creek, hydrocarbons including VHs, VPHs, and (VOCs were undetectable throughout the Eagle Creek sample sites. The PAH concentrations were higher at EAGL-t-003 than at NCY-PT19 (Figure 3-42). The PAHs that comprised the majority of total parent PAHs at the Eagle Creek tributary included naphthalene, phenanthrene, and biphenyl (Figure 3-43).

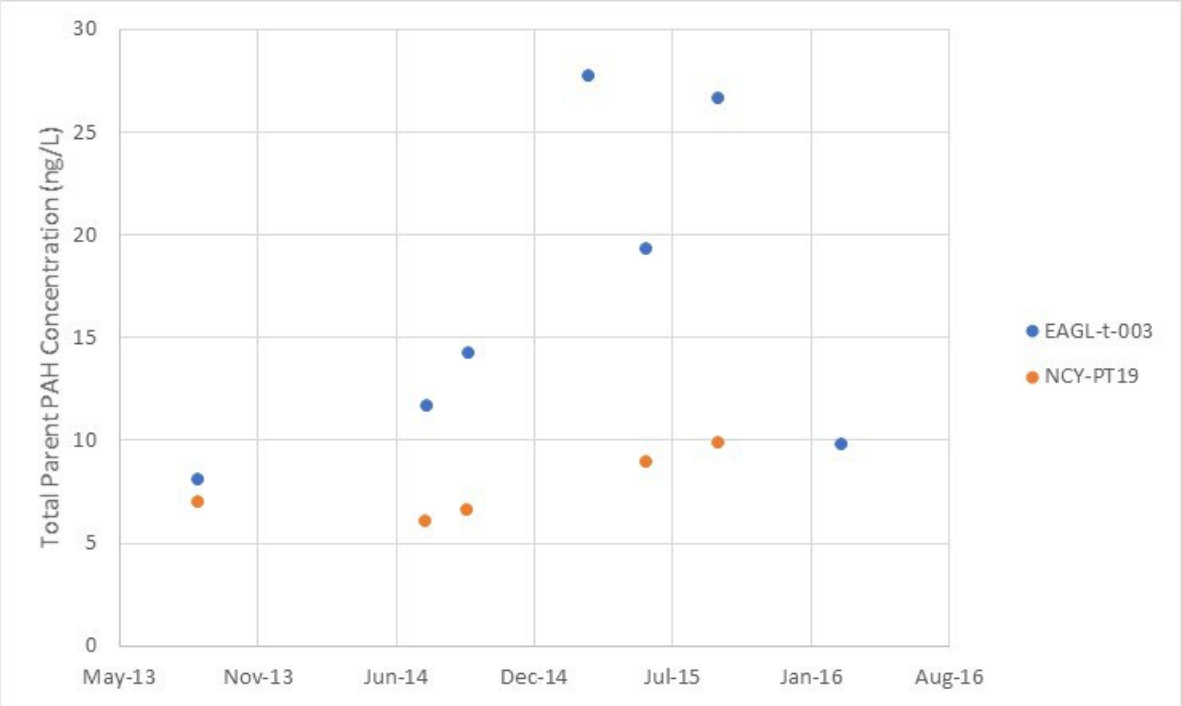


Figure 3-42. Total parent PAH concentrations in Eagle Creek tributaries from August 2013 through March 2016.

Note: Results that were below detection were treated as 0 ng/L.

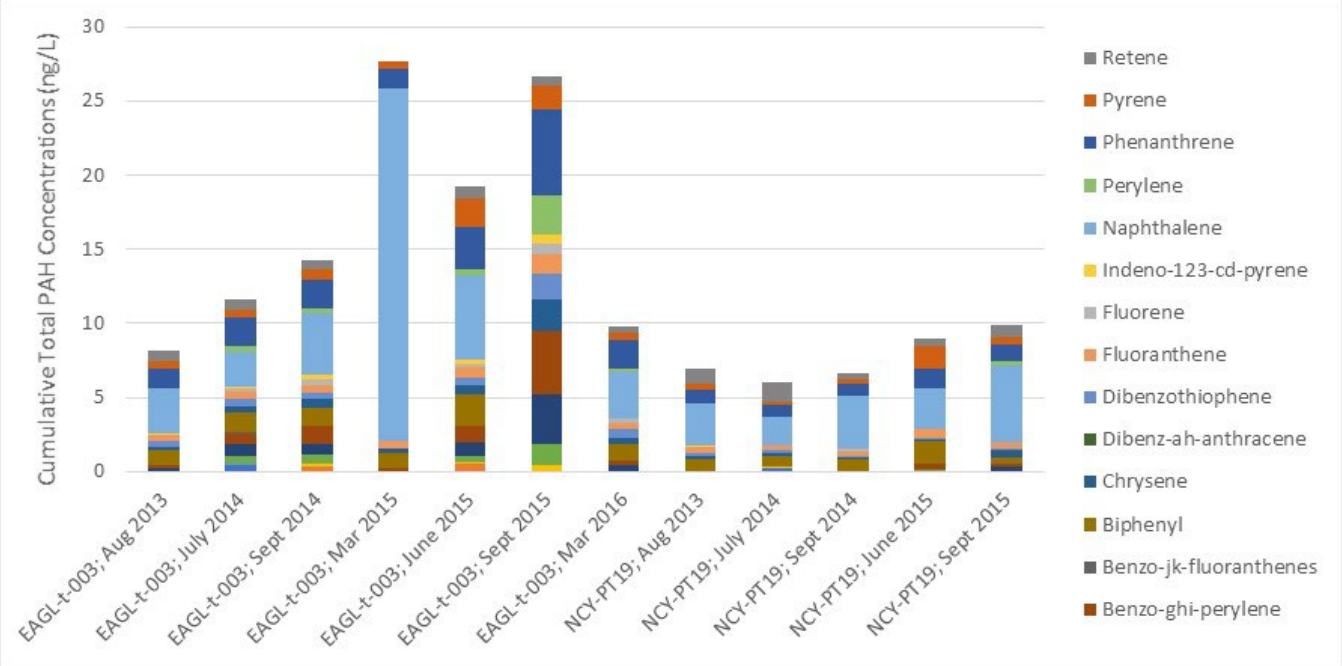


Figure 3-43. Cumulative parent PAH compounds in Eagle Creek tributaries from August 2013 through March 2016.

Note: Results that were below detection were treated as 0 ng/L.

3.1.4 DALGLISH CREEK

Dalglish Creek drains the RSA to the south, emptying into the Peel River. Water quality data were collected from two locations:

1. DALG-003, located on Dalglish Creek, in the upper reaches of the tributary (Photo 3-9); and,
2. DALG-002, located on Dalglish Creek, just upstream of the Peel River (Photo 3-10).

Water quality data were collected by YG WRB periodically at DALG-002 from September 2014 through March 2018. DALG-003 was sampled by EDI in August 2019 but was frozen to bed in March 2020.



Photo 3-9. Upstream view from DALG-003.



Photo 3-10. Upstream view from site DALG-002.

3.1.4.1 General Chemistry and Major Ions

Water in Dalglish Creek was circumneutral to slightly acidic. Conductivity was higher than noted in other areas, ranging from 61 to 886 µS/cm. Water hardness can be generally characterized as 'soft to moderately soft' during the open water season and 'very hard' during the under-ice months (Table 2-4).

Water was brown stained in colour, and turbidity was generally low. The suspended sediment load was variable throughout the year, with higher total suspended solids (TSS) samples likely associated with freshet and other rainfall events; it is suspected that elevated TSS in under-ice samples was associated with the sampling event itself, as the augur may have disturbed bottom sediments. Major ions predominantly comprised bicarbonate, calcium, magnesium, and sulphate (Figure 3-44).

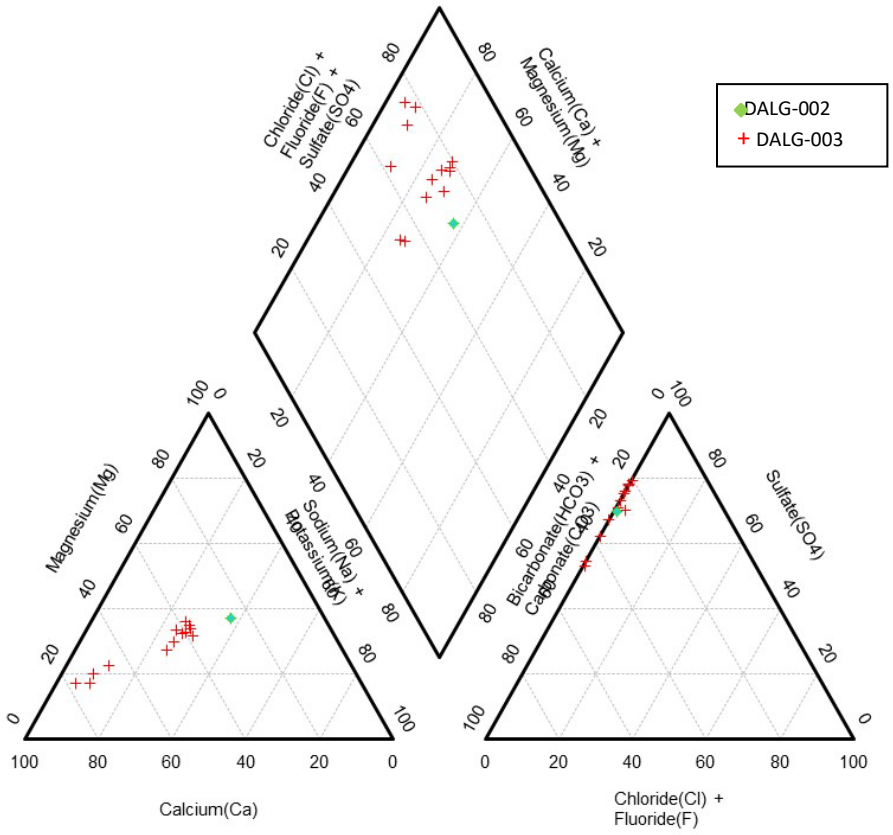


Figure 3-44. Piper plot showing major ion composition of waters in the Dalglish watershed in % meq/kg.

3.1.4.2 Nutrients

Nutrient concentrations in the Dalglish Creek sites were low; nitrate, nitrite, nitrate+nitrite, and total ammonia were below applicable guidelines in surface water. Total phosphorus concentrations ranged from 0.017 to 0.11 mg/L, indicating mesotrophic to oligotrophic trophic status (Table 2-5).

3.1.4.3 Trace Metals

Aluminum, copper, iron, and manganese in the Dalglish Creek sites occurred at concentrations that regularly exceeded the CCME-FAL guideline. Total aluminum exceeded the CCME-FAL guideline in nearly all samples from both sites; however, the dissolved fraction of aluminum was below the CCME-FAL guideline in all samples (Figure 3-45 and Figure 3-46). Total and dissolved copper, iron, and manganese regularly exceeded their respective CCME-FAL guidelines (Figure 3-47 through Figure 3-52). Total arsenic, cadmium and selenium exceeded the hardness-specific guideline in only one sample, an under-ice sample from March 2017, when there was no visible flow at the sampling time.

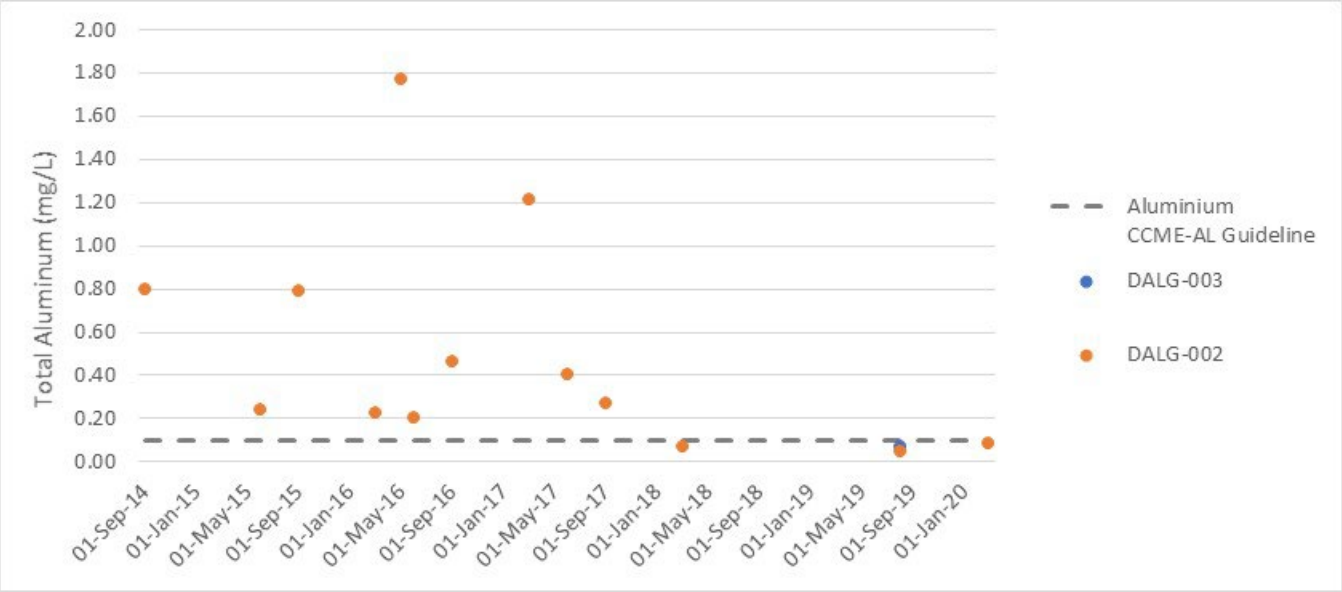


Figure 3-45. Total aluminum concentrations in Dalglish Creek sites between September 2014 and March 2020.

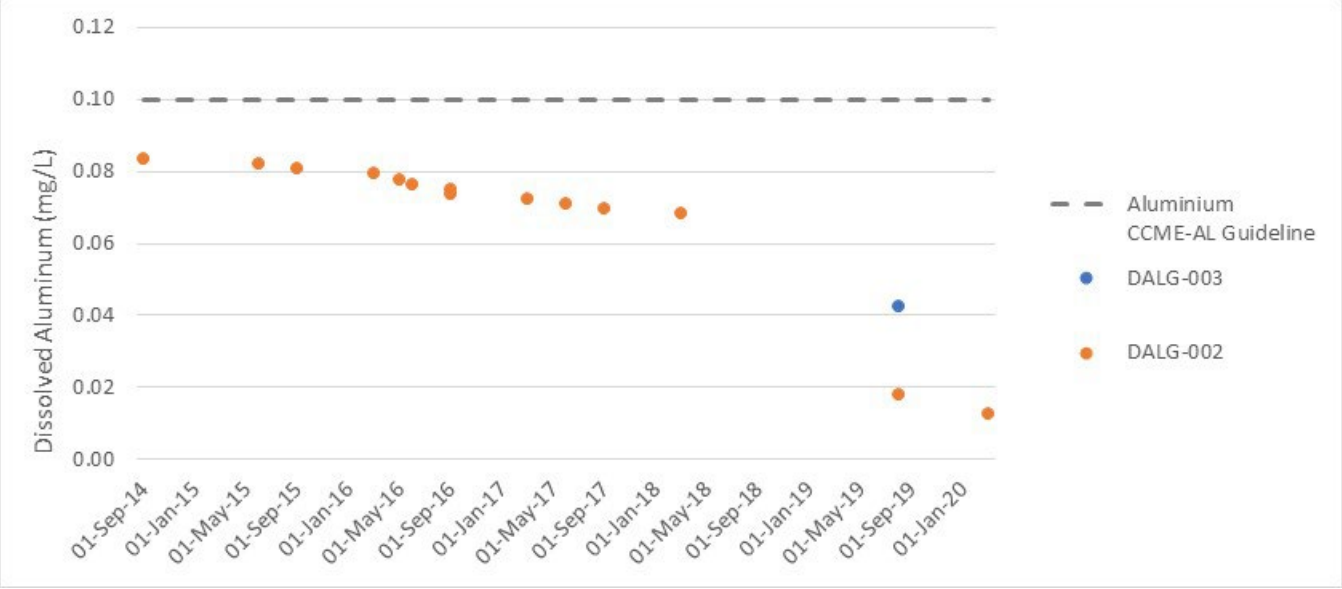


Figure 3-46. Dissolved aluminum concentrations in Dalglish Creek sites between September 2014 and March 2020.

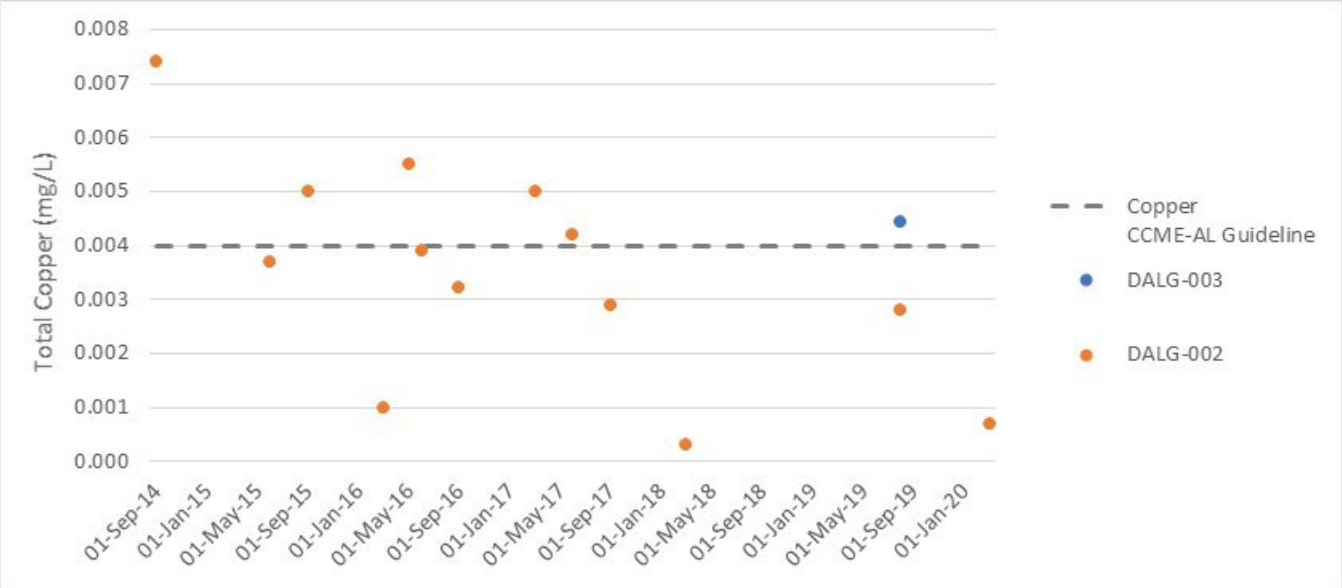


Figure 3-47. Total copper concentrations in Dalglish Creek sites between September 2014 and March 2020.

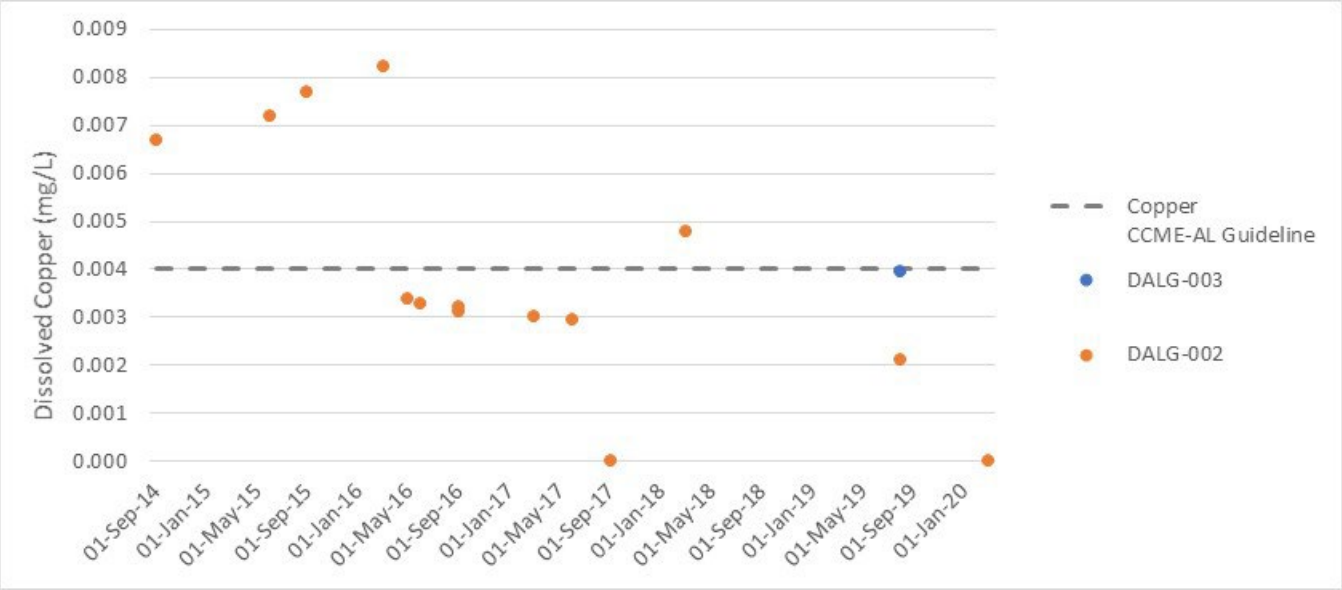


Figure 3-48. Dissolved copper concentrations in Dalglish Creek sites between September 2014 and March 2020.

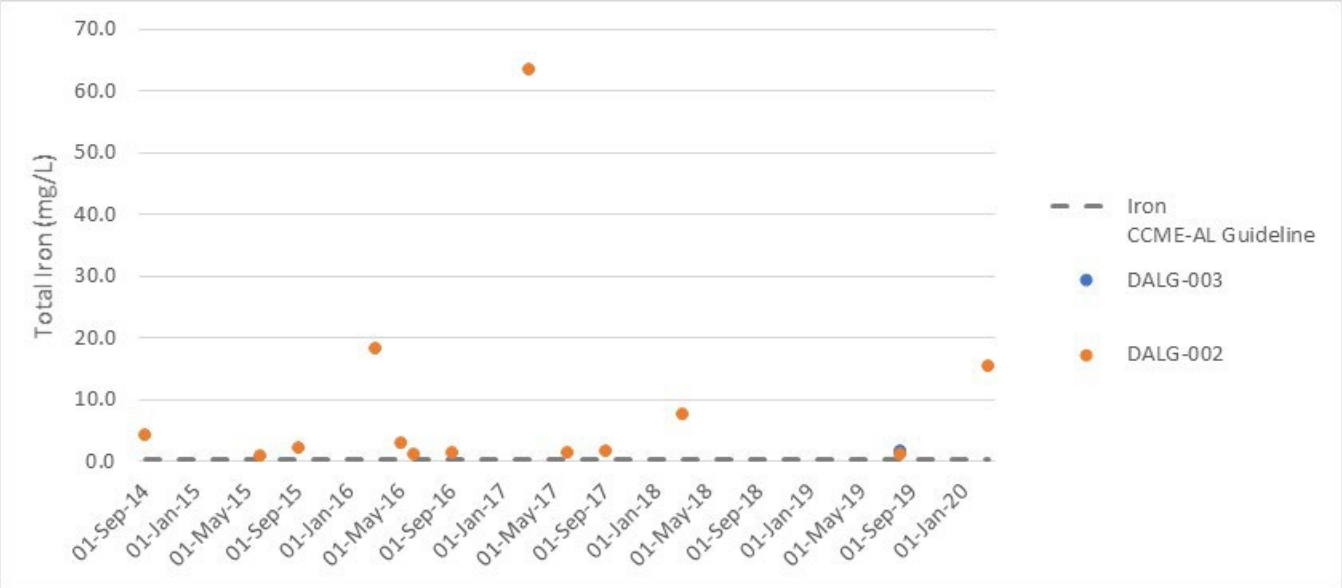


Figure 3-49. Total iron concentrations in Dalglish Creek sites between September 2014 and March 2020.

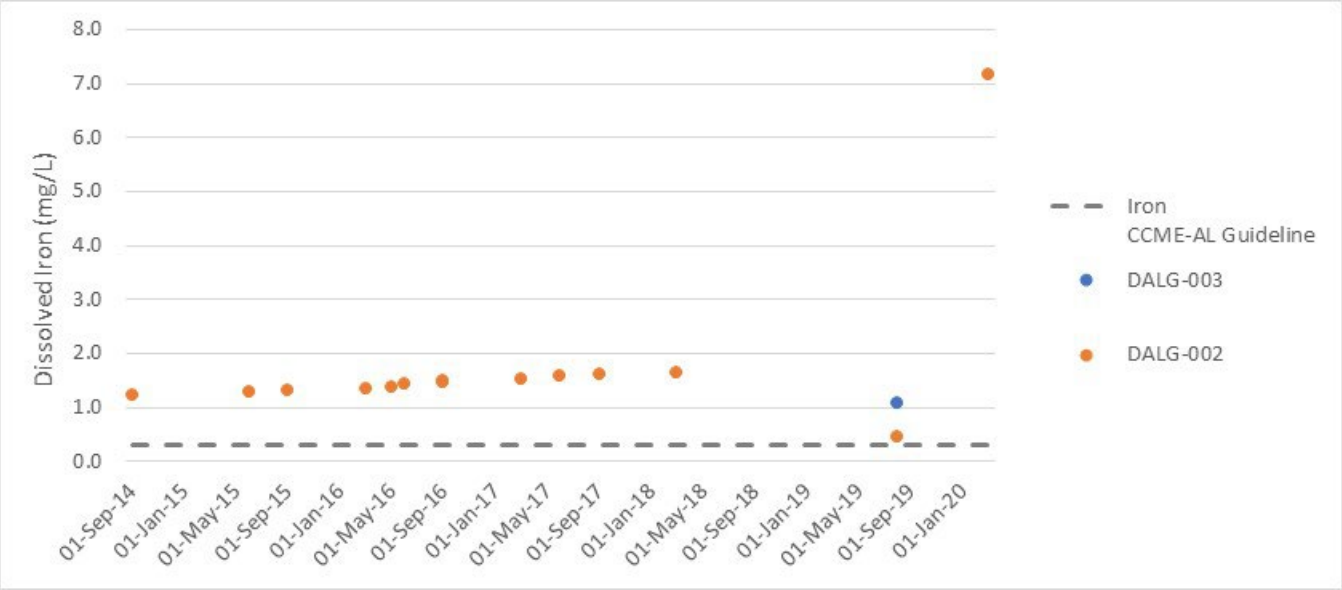


Figure 3-50. Dissolved iron concentrations in Dalglish Creek sites between September 2014 and March 2020.

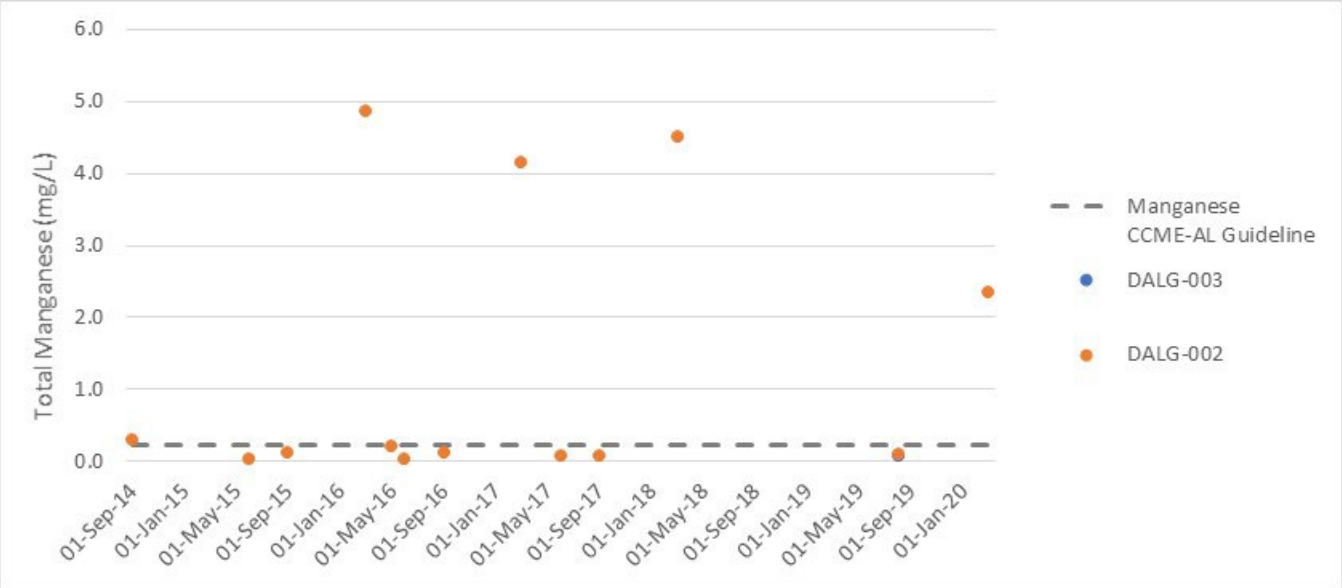


Figure 3-51. Total manganese concentrations in Dalglish Creek sites between September 2014 and March 2020.

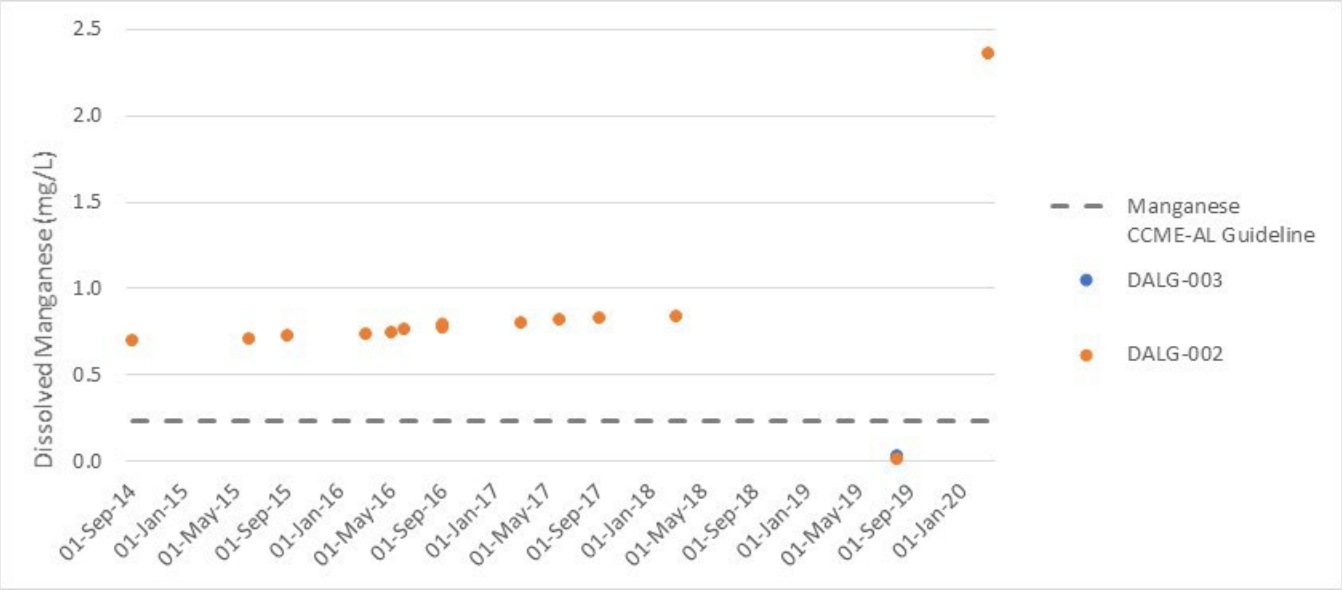


Figure 3-52. Dissolved manganese concentrations in Dalglish Creek sites between September 2014 and March 2020.

3.1.4.4 Hydrocarbons

As in the other Project sampling areas, VHs, VPHs, and VOCs were undetectable in Dalglish Creek. No seasonal/temporal pattern to PAH concentrations was identified in Dalglish Creek (Figure 3-53). The PAHs that comprised the majority of total parent PAHs in Dalglish Creek included naphthalene, phenanthrene, and retene (Figure 3-54).

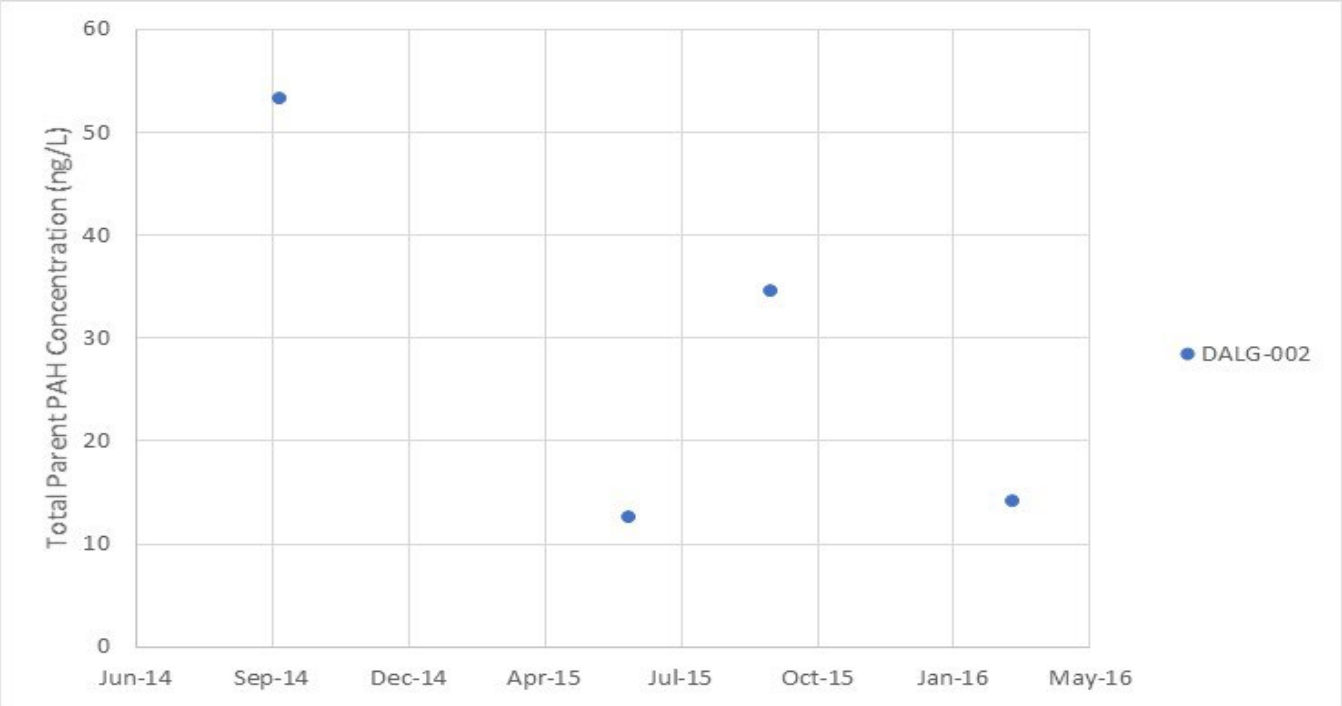


Figure 3-53. Total parent PAH concentrations in Dalglish Creek from September 2014 through March 2016.

Note: Results that were below detection were treated as 0 ng/L.

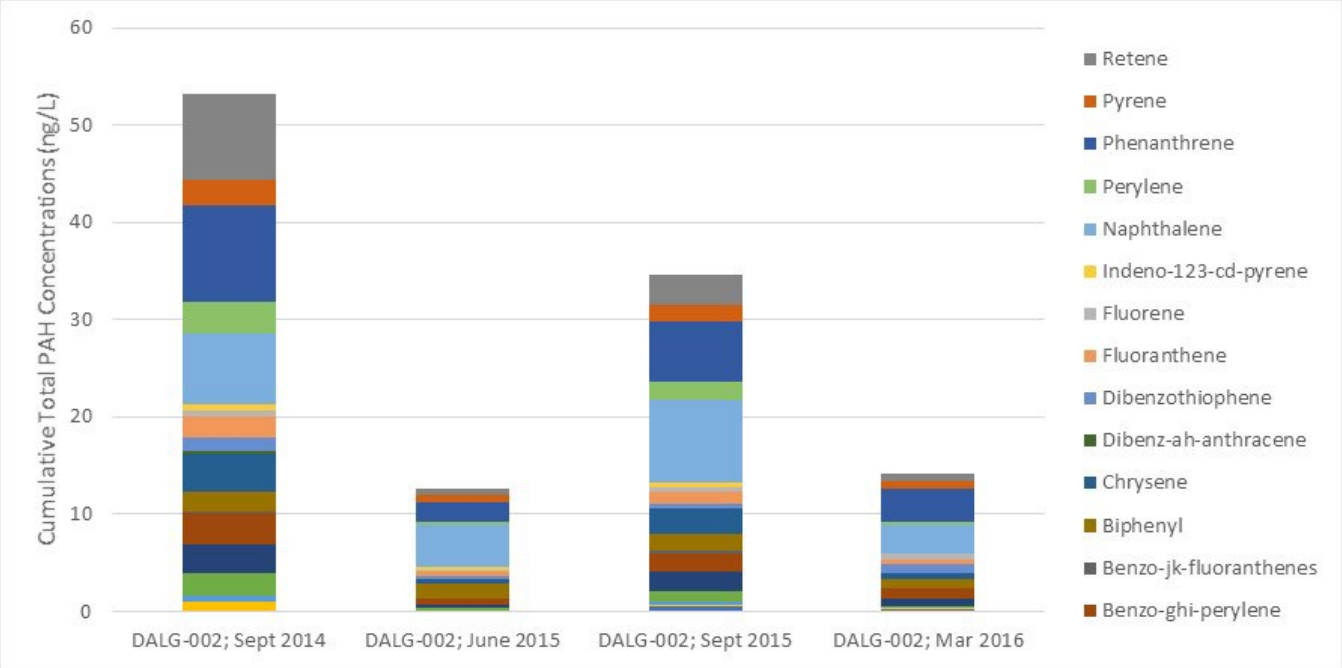


Figure 3-54. Cumulative parent PAH compounds in Dalglish Creek from September 2014 through March 2016.

Note: Results that were below detection were treated as 0 ng/L.

3.2 HYDROLOGY

3.2.1 HYDRO-CLIMATE

ECCC meteorological data were used to evaluate daily rainfall, snowpack and temperature trends and the relationship with local and regional flow regimes in and around the RSA. The mean daily rainfall and snowpack data were calculated through the period of record available (1998 – 2005, 2007 – 2008) and plotted to identify the seasonal trends in rainfall-driven snowmelt events, annual precipitation trends and their relationship (Figure 3-55). Precipitation in the region begins to accumulate as snowpack begins as early as mid-September. Water in the region is stored as snowpack and accumulates through the winter. Spring rainfall events begin to occur as early as mid-April, increasing snowpack melt and contributing to surface water discharge. Some snowpack can be retained as late as early June, when snow depths at the Eagle Plains meteorological station will decline rapidly with sustained positive temperatures and rainfall events.

Mean daily temperature approaches 0°C in mid-April, corresponding to the first annual rainfall events, increasing frequency and magnitude beginning in May (Figure 3-56). Rainfall events occur throughout the summer months with the maximum mean daily rainfall occurring in July. Mean daily rainfall remains high in August and gradually declines through late August into September. Mean daily air temperatures decrease and approach 0°C in September and October, corresponding to the decrease in rainfall magnitude. Sustained negative temperatures over the winter result in precipitation accumulating in snowpack and refreezing the active permafrost layer. This area is classed as semi-arid, and the combination of persistent low temperatures and low to moderate snowpack are considered insufficient to insulate the ground fully, and cold penetration contributes to a thin permafrost active layer (Palmer Environmental Consulting Group 2015). The continuous permafrost thickness is reported between 61 to 244 m, with an average active layer depth of 0.74 m.

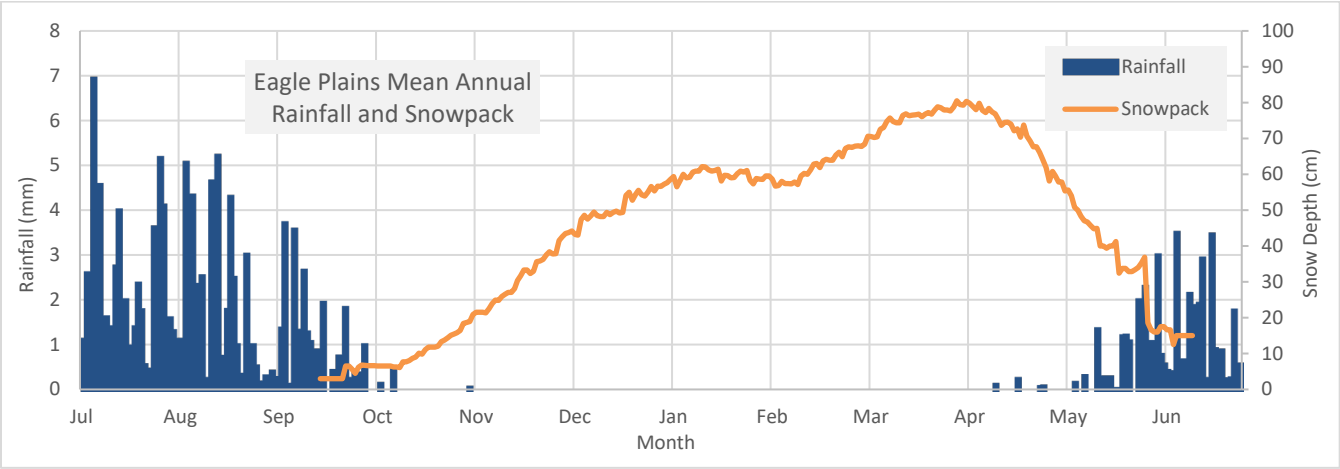


Figure 3-55. Mean daily rainfall and snowpack data averaged over the entire period on record from the Eagle Plains meteorological station (1998 – 2005, 2007 – 2008).

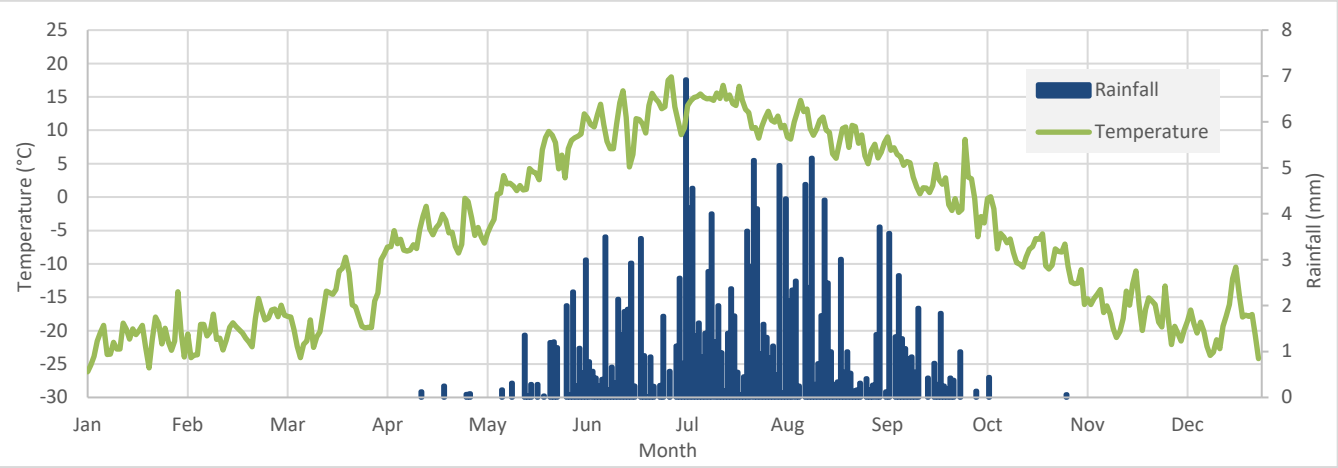


Figure 3-56. Rainfall and temperature data averaged over the entire period on record from the Eagle Plains meteorological station (1998 – 2005, 2007 – 2008).

3.2.2 REGIONAL SURFACE FLOW TRENDS

The WSC data were used to evaluate annual discharge trends in the region and inform a surface water flow regime baseline. Mean daily discharge data for each station's entire period of record was plotted (Figure 3-57) to identify the timing and magnitude of peak events such as spring freshet and compare the trends with the regional flow regimes to better inform site-specific baseline flow regimes. Regional flow trends are consistent with a northern climate where flows are primarily driven by spring snowpack melt (freshet). This is evident in the high peak flows during late April to late May, with a rapid recession following freshet events. Flows are generally stable over the summer months and sustained by baseflow contributed by inter-flow in surficial material or suprapermafrost water. Rainfall events drive peaks in the summer discharge. During late September through early October discharge decreases regionally as precipitation accumulates as snowpack and the active layer refreezes. Flows continue to decline over the winter, with low flow or zero-flow periods occurring annually from February into April.

Flows continue to decline from October into the winter period, and WSC data indicate these higher-order watercourses do not tend to exhibit zero-flow levels (Figure 3-58). The lowest flow period in the region is typically observed between late February and early April, with some occurrences observed as early as February 9 and as late as May 1.

Peak flows in the region are commonly observed between early and mid-May. Some precipitation-driven maximum discharge outliers occur after freshet as late as August 12. Table 3-1 indicates the three most extreme minimum and maximum flow values on record and the date on which the values were observed. Most maximum discharge values occurred in May, and most minimum discharge values occurred in April, and the timing of both are characteristic of snowmelt-driven flow regimes.

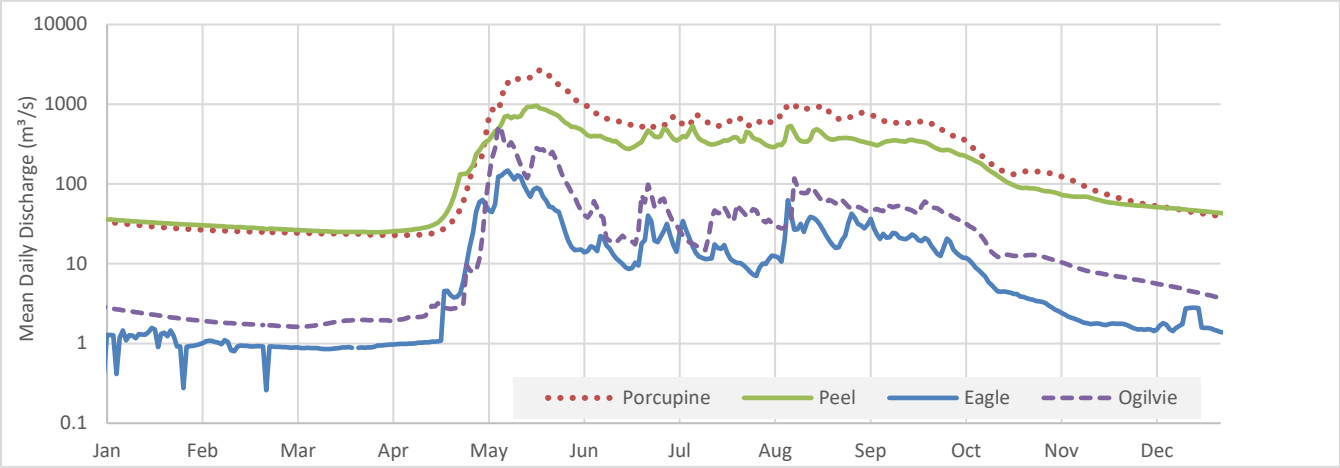


Figure 3-57. Mean daily discharge over available periods of record for the Eagle, Ogilvie, Porcupine and Peel Rivers. Note: = discharge values are displayed on a logarithmic scale.

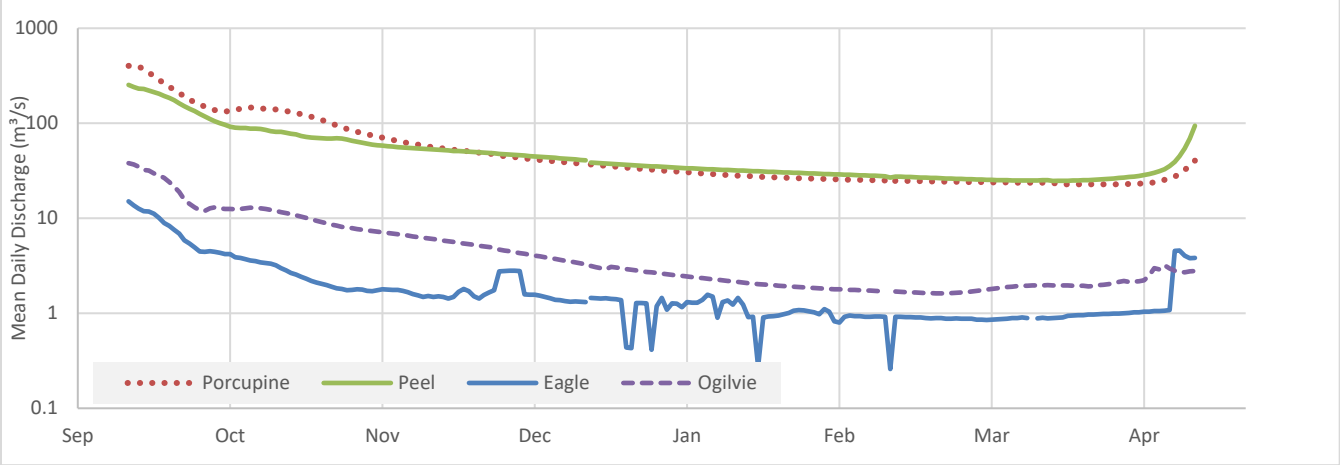


Figure 3-58. Fall and winter low flow mean daily discharges for the period on record for the Eagle, Ogilvie, Porcupine and Peel Rivers. Note: discharge values are displayed on a logarithmic scale.

Table 3-1. The minimum and maximum recorded mean daily discharge values for the entire period on record for Eagle, Peel, Ogilvie, and Porcupine rivers.

Watercourse	Minimum Recorded Discharge		Maximum Recorded Discharge	
Eagle River	0.152 m^3/s	April 27, 2017	334 m^3/s	May 19, 2015
	0.164 m^3/s	April 13, 2014	294 m^3/s	May 15, 2019
	0.216 m^3/s	May 1, 2015	279 m^3/s	May 12, 2019
Peel River	21.2 m^3/s	April 6, 2012	3070 m^3/s	May 21, 2011
	22.8 m^3/s	April 17, 2014	2880 m^3/s	July 12, 2012
	23.0 m^3/s	March 30, 2015	2730 m^3/s	August 12, 2016
Ogilvie River	1.35 m^3/s	March 9, 2019	1160 m^3/s	August 12, 2016
	1.73 m^3/s	April 20, 2017	811 m^3/s	May 12, 2020
	2.41 m^3/s	April 1, 2020	510 m^3/s	May 16, 2017
Porcupine River	12.5 m^3/s	March 23, 2008	6320 m^3/s	May 25, 2011
	13.8 m^3/s	April 1, 2005	5770 m^3/s	May 16, 2015
	13.8 m^3/s	April 13, 2006	5600 m^3/s	May 18, 2019

3.2.3 TRIBUTARY SURFACE FLOW TRENDS

The WRB data for McParlon and Dalglish creeks were used to establish baseline flow trends for watercourses originating within the RSA. Mean daily discharge data for the period of record (Figure 3-59) were evaluated to identify timing and characteristics of peak flow events and compare the tributary and regional flow regimes. The peak flows are primarily snowmelt driven, tributary watercourses originating from the RSA exhibit high flow variability and flashiness between May and October. Precipitation events create short flashy discharge events followed by discharge returning to baseflow conditions (Figure 3-59). The two tributary watercourses exhibit similar flow regiments and discharge values, which is expected given their close geographical proximity. Both creeks either de-water or freeze to bed between early October and late April. No flow data are available for this period.

Discharge data for each tributary creek originating in the RSA were compared with the flow regime of each of the respective regional destination watercourse to compare the timing of peak flow events, low flow periods and the duration of these events (Figure 3-60 and Figure 3-61). The flow regimes in the destination watercourses have a lag relative to the tributary watercourses. However, the flow responses are similar. The regional watercourses respond to precipitation events more slowly. The peaks in discharge are longer duration than in the flashy tributaries, reflecting the cumulative inputs from tributaries over a larger contributing area.

McParlon Creek and Dalglish Creek exhibit zero-flow (defined as discharge < 1L/s) during the winter months. Data gaps exist between early October and late April where the channels freeze to bed, de-water, or channel ice inundates water level loggers and these channels are at zero-flow for most or all this period. Peak flows in the tributaries tend to occur in late April through early May, and in the regional watercourses in mid-May through early June. In the tributaries, flashy discharge is observed resulting from rainfall events throughout May to October. As indicated in Table 3-2, precipitation-driven peak flow outliers in the

tributaries may occur as late in the summer as August 11 in McParlon Creek and August 8 in Dalglish Creek and fluctuations in the discharge through the duration of the record also reflective of precipitation events.

The comparison between the tributary and regional watercourses shows similarities between the patterns and timing of the flow regimes. Lags between tributary and regional watercourses are variable related to the magnitude of the event driving the discharge fluctuation.

The regional and tributary watersheds are snowmelt driven, with seasonal inputs from rainfall, and little to no groundwater influxes to support the low flow winter periods after the active permafrost layer freezes seasonally. Groundwater – surface water interactions in these watersheds are limited to suprapermafrost perched groundwater within the shallow active layer of the permafrost. Water movement to surface flow is limited in these watersheds to direct runoff and interflow and lateral migration through the active layer, driven by precipitation or snowmelt, during the season of thaw in the active layer.

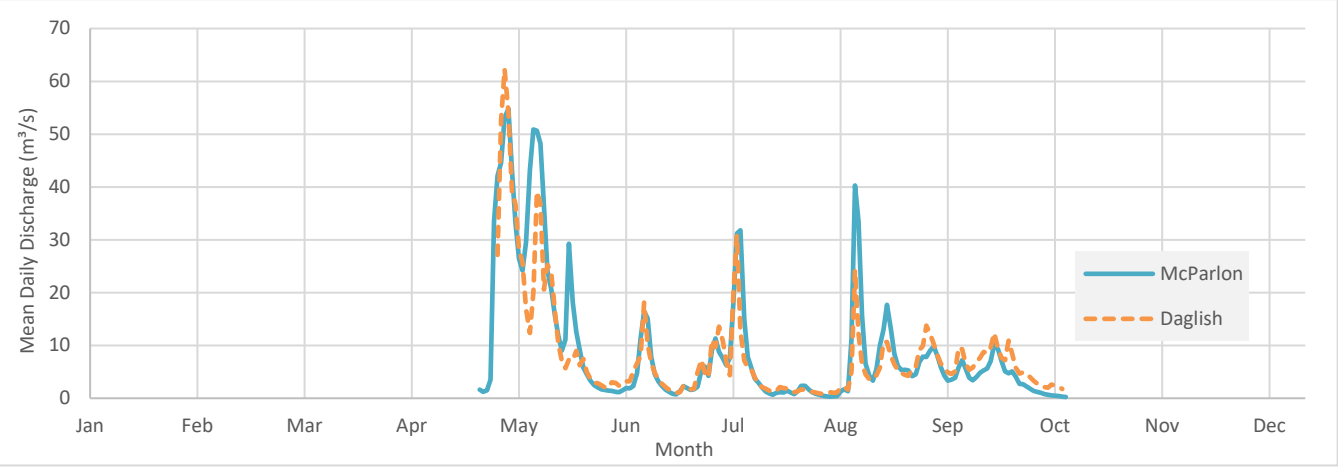


Figure 3-59. McParlon Creek and Dalglish Creek mean daily discharge rates over entire periods of record.

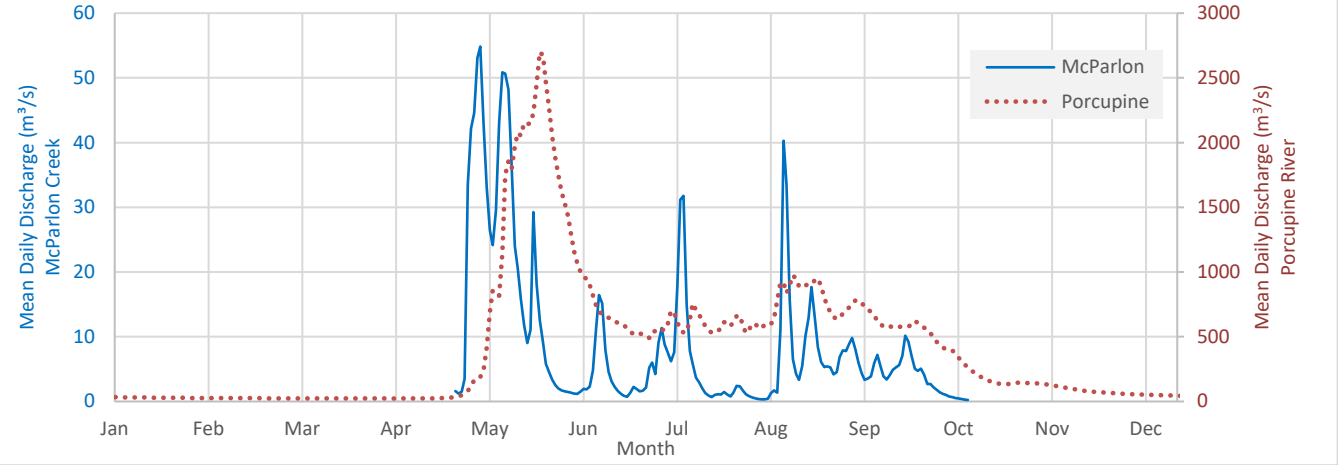


Figure 3-60. Comparative discharge plot for mean daily discharge for McParlon Creek and Porcupine River for the periods of record.

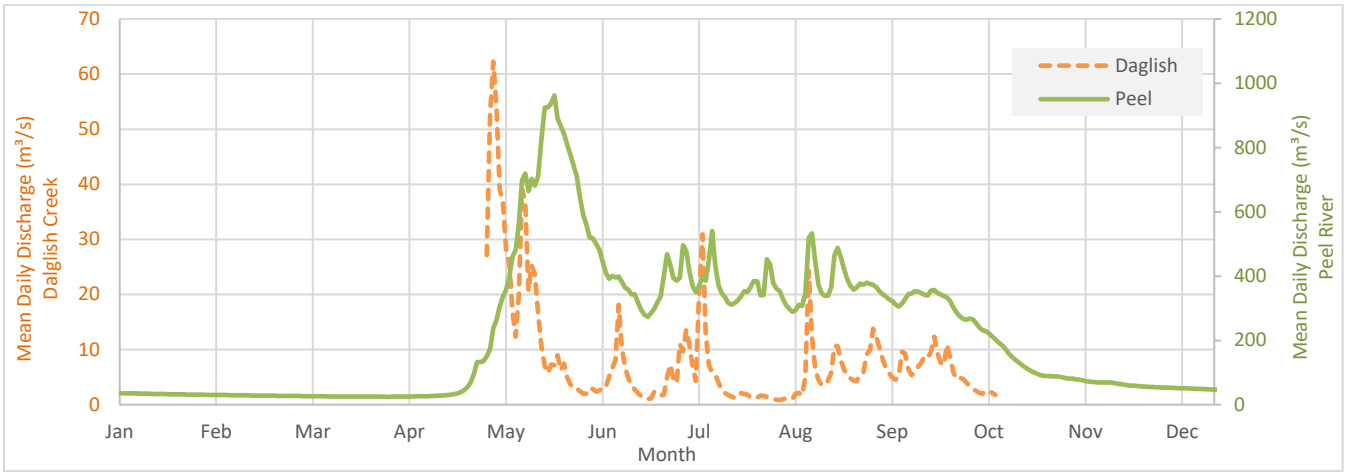


Figure 3-61. Comparative discharge plot for mean daily discharge for Dalglish Creek and Peel River for the periods record.

Table 3-2. Maximum discharge values for the entire period on record for tributary watercourses McParlon and Dalglish creeks.

Watercourse	Maximum Recorded Discharge	Date
McParlon	138.92 m³/s	May 14, 2015
	131.49 m³/s	August 11, 2016
	64.58 m³/s	May 5, 2014
Dalglish	106.75 m³/s	July 7, 2015
	82.10 m³/s	August 8, 2016
	70.85 m³/s	May 5, 2014

4 DISCUSSION AND SUMMARY

4.1 WATER QUALITY

Water quality was comparable across the RSA, with neutral to slightly acidic, brown-stained water due to tannic acids from surrounding sediments/soils. Variable turbidity and TSS concentrations were likely associated with melting permafrost and resulting slumping banks that continuously deposit material into the water columns. Water hardness ranged from soft to moderately soft in the open water season, changing to moderately hard to hard during the winter, under-ice season. Water hardness affects the toxicity of various metals in the water column; harder water can bind with more metals, rendering them less bioavailable to aquatic biota.

Dissolved oxygen concentrations were highest during freshet but decreased throughout the summer and were low throughout the RSA during the under-ice season. Most streams in the RSA are small and freeze to the substrate in the winter except for some isolated pools. These winter conditions result in minimal to no stream flow and, consequently, low dissolved oxygen concentrations that provide fish with little to no overwintering habitat.

The primary source of ions to natural surface waters is the weathering of rocks. Therefore the chemical composition of the water reflects the local geology. The dominant ions in all areas were bicarbonate, calcium, and sulphate.

Nutrient concentrations were generally low across the RSA. Concentrations of nitrogen compounds were low to below laboratory detection, and total phosphorus concentrations indicated that streams were oligotrophic to mesotrophic. Low nutrient concentrations combined with cold water temperatures and low dissolved oxygen concentrations result in low-productivity streams throughout the RSA.

Metals including aluminum, cadmium, copper, iron, and manganese were present throughout the RSA at concentrations that exceeded the CCME-FAL guidelines. Additionally, some other metals were present at concentrations above the CCME-FAL in isolated samples from each watershed area, including arsenic from Chance and Dalglish creek sites, and selenium from McParlon, Eagle and Dalglish creek sites. These metals are naturally present and enter the surface water environment through various processes, including the weathering of rocks, atmospheric deposition, permafrost melting, and the subsequent sediment introduction of the watercourses.

Volatile organic carbons were not present at or above laboratory detection limits at any of the sample locations. Common PAHs present in the RSA included naphthalene, biphenyl, phenanthrene, and retene. These PAHs are associated with natural processes, including forest fires (retene; Gabos et al. 2001) and naturally occurring oil and gas deposits in the area.

4.2 HYDROLOGY

Hydrological regimes observed in the study area are characteristic of snowmelt-dominated flow regimes of northern climates. Regional watercourses (i.e., stream orders 6 and greater) exhibit peak discharge in May when temperatures increase, rain melts the snowpack, and stored water is rapidly discharged as surface water flow. Over the summer, the flow in large watercourses is sustained by rainfall events, and to a lesser extent, shallow suprapermafrost lateral flows in the active layer. In the fall, when precipitation begins to be stored as snowpack and the active permafrost layer begins to refreeze, discharge trends downward from September and more rapidly through October when temperatures decrease below 0°C. Annual low flows occur over the winter, with the lowest discharge rates occurring during February, March, and April.

As stream order decreases, the relative response, both in time and magnitude, of discharge rates increases in response to precipitation events because of smaller contributing areas to the watercourse. As temperatures decrease below freezing between October and November, precipitation begins to become stored as snowpack, and the active layer begins to re-freeze and subsequently discharges decrease rapidly and most tributary streams either de-water or freeze to bed by March. Tributary watercourses within the RSA do not exhibit flow again until the following spring melt begins. Intermediate order watercourses like McParlon and Dalglish creeks may retain limited water in residual pools and water quality metrics, such as very low dissolved oxygen, were indicative of zero or very low flow.

The hydrology metrics within the RSA are consistent with hydrology for similar watercourses across northern Canada, and more specifically, within the Yukon River Basin (Brabets et al. 2000, Buttle et al. 2012). Studies on hydrology report similar hydrograph trends for snowmelt-dominated watersheds, both in current research and historically. The general trend describes minimal runoff and a corresponding decrease in streamflow, beginning in October and ending in late April. Regionally, runoff occurs from May to September, dependent on basin characteristics, including drainage area. In some watersheds, including the Porcupine, winter low flow periods approach zero flow, and this is attributed to continuous permafrost, which is effectively a barrier to groundwater influxes to the surface water. The thin active layer of the permafrost does not retain storage capacity for groundwater, and suprapermafrost groundwater perched on the permafrost is only seasonal lateral migration of interflow, or seasonal melt water. Zero flow conditions are not observed in the larger watercourses and mainstem channels because the discharge is a cumulation of the flows from large catchment areas. Locally there may be a thicker active layer that supports flows later into winter before the freeze is complete.

The literature reports that climatic conditions influence observed flows. These conditions drive channel freeze up and thaw, snowmelt, precipitation, runoff, and permafrost — all of which influence the timing and amount of groundwater influxes to suprapermafrost water within the active layer. The literature indicates that streams that reach or approach zero-flows seasonally are predominantly in headwater (lower order) catchments — supporting what the hydrology data show for the RSA.

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ATTACHMENTS

ATTACHMENT A YG WRB WATER QUALITY DATA; 2013 TO 2016

				O-DO-F	pH-F	Cond-F	TDS-F	ORP	Temp-F	Wlevel	Turb-F	Turb-F-FNU	PurgeVol	Alk-T	pH-L	Hard-T	Hard-D	Cond-L	TDS	TSS	N-NH4	N-NO3	N-NO23	N-NO2	N-TKN	P-PO4T	N-TN	N-NH3u(ca
				inorg	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	nutr	nutr	nutr	nutr	nutr	nutr	Nx nutr	nutr
				Oxygen, Dis	pH, Field	Specific Cor	Total Dissol	Oxidation -	Temperatur	Water Level	Turbidity, fi	Turbidity, fi	Volume of v	Alkalinity,	pH, Labora	Hardness (	Hardness (	Specific Co	Total Dissc	Total Susp	Ammoniur	Nitrate Nit	Nitrite and	Nitrite Nitr	Total Kjeld	Phosphoru	Nitrogen, '	Un-ionizec
				mg/L	pH units	uS/cm	mg/L	mV	C	m	NTU	FNU	L	mgCaCO3/	pH units	mgCaCO3/	mgCaCO3/	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
				6.5	6.5 - 9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*emp,pH-de*	13	-	0.06	-	-	-	-
Stn.Code	**Site Name**	**Group**	**Smpl Date**																									
CHNC-001	Chance Creek above confluence with	Chance	2013-07-29	8.8	7.3	54			16.9		8.3			16	6.81			52	86	4	0.04	<0.01		<0.01		0.02		0.000
CHNC-001	Chance Creek above confluence with	Chance	2014-07-22 10:47	-	**6.34**	89			16.38					29	7.32	47.7	40	89	102	3	<0.020	<0.010	<0.010	<0.010	0.7	0.017	0.7	0.000
CHNC-001	Chance Creek above confluence with	Chance	2014-09-22 19:00	11.9	6.8	61			4.8					13	6.84	27.1	25	62	88	15	0.026	0.04	0.04	<0.01	1.01	0.064	1.05	0.000
CHNC-001	Chance Creek above confluence with	Chance	2015-03-14 17:30	**2**	7.5	320			0.1					135	7.83	133	121	320	222	<2	0.156	0.02	0.02	<0.01	0.98	0.013	1	0.000
CHNC-001	Chance Creek above confluence with	Chance	2015-06-06 11:00	10.22	7.07	59.6			10.8			5.9		14	6.64			63	32	4	<0.01	0.08		0.06		0.039	0.69	0.000
CHNC-001	Chance Creek above confluence with	Chance	2015-09-18 18:05	12.34	7.02	116			3		45.8			23	6.7			116	12	81	0.01	0.03		0.04		0.063	0.75	0.000
CHNC-001	Chance Creek above confluence with	Chance	2016-03-16	**5.82**	8.18	28			0		3.1			201	7.56			542	202	<2	0.09	<0.01		0.11		<0.003	0.47	0.001
CHNC-001	Chance Creek above confluence with	Chance	2016-06-21 11:15	8.83	6.82	71.6			15.1		8.4			13	6.52			64	184	5	0.02	0.01		<0.01		0.016	0.59	0.000
CHNC-001	Chance Creek above confluence with	Chance	2016-09-20 12:00	13.75	7.44	136.6			1.4		16.8			26	6.94			135	146	11	<0.01	<0.01		<0.01		0.032	0.69	0.000
CHNC-001	Chance Creek above confluence with	Chance	2017-03-07 10:40	**0.93**	7.42	507			0		6.5			200	7.52		248	528	310	3	0.22	<0.1		<0.01		0.007	0.51	0.001
CHNC-001	Chance Creek above confluence with	Chance	2017-06-27 11:30	8.18	7.35	140.4			16.4		5.6			37	7.15		53	134	210	<2	0.03	<0.01		<0.01		0.024	0.72	0.000
CHNC-001	Chance Creek above confluence with	Chance	2017-09-20 10:21	11.91	7.6	71.4		105.9	5.1		16.5			17	7.14		31	70	98	2	<0.01	<0.01		<0.01		0.026	0.7	0.000
CHNC-001	Chance Creek above confluence with	Chance	2018-03-21 10:25	**3.91**	7.74	324.5		131.6	0		26.9			134	7.64		150	324	240	245	0.16	0.02		<0.01		0.164	0.58	0.001
CHNC-003	Chance Creek u/s tributary	Chance	2013-08-26 15:00	10.25	7	58			7.4		8.1			23	6.82			50	94	4	0.03	<0.01		<0.01		0.05		0.000
CHNC-003	Chance Creek u/s tributary	Chance	2014-07-22 18:30	-	**6.36**	42			15.93					11	6.69	22.7	21	41	86	4	<0.020	<0.010	<0.010	<0.010	0.88	0.071	0.878	0.000
CHNC-003	Chance Creek u/s tributary	Chance	2014-09-23 10:40	12.07	6.7	38			3.1					8	6.58	20.9	19	38	80	5	0.026	0.01	0.01	<0.01	0.83	0.04	0.84	0.000
CHNC-003	Chance Creek u/s tributary	Chance	2015-06-05 15:40	10.35	**6.36**	28.5			8.6			7.2		5	6.13			30	40	<3	0.01	0.01		0.05		0.035	0.63	0.000
CHNC-003	Chance Creek u/s tributary	Chance	2015-09-19 17:23	12.1	**6.2**	34			1.7		63.1			7	6.16			34	40	88	0.02	<0.01		0.04		0.092	0.68	0.000
CHNC-003	Chance Creek u/s tributary	Chance	2016-09-22 10:59	12.5	6.74	40.4	26.533	88.9	1.7		88.1			10	6.41		20	40	24	46	<0.01	0.01		<0.01		0.029	0.62	0.000
CHNC-003	Chance Creek u/s tributary	Chance	2017-06-27 9:30	6.76	**6.09**	51.8			13.9		7.5			17	6.51		24	47	86	11	0.04	<0.01		<0.01		0.039	1.53	0.000
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2013-08-26 14:02	10.7	6.8	50			5.9		0.8			16	6.69			42	88	4	0.03	<0.01		<0.01		0.056		0.000
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-07-22 18:50	-	6.91	46			15.59					13	6.54	24.6	23	42	111	8	<0.020	<0.010	<0.010	<0.010	1.12	0.112	1.12	0.000
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-09-21 15:10	12.1	**6.02**	31.6			2.7					6	6.39	18.2	16	32	86	19	<0.020	0.01	0.01	<0.01	1.01	0.062	1.02	0.000
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-06-05 16:10	10.27	**6.18**	24.5			8.3			12.5		<5	6.11			26	<5	<3	0.01	0.01		0.04		0.039	0.58	0.000
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-09-19 18:00	12.29	**5.93**	27			1.4		68.2			<5	5.77			28	<5	<5	0.05	<0.01		0.03		0.095	0.72	0.000
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2016-03-15	**1.8**	7.95	285			0		4.3			110	6.6			213	284	14	1.18	<0.01		<0.01		0.14	5.27	0.010
DALG-002	Dalglish Creek	Dalglish	2014-09-23 14:30	12.7	6.97	147			3.1					21	6.99	59.2	53	145	152	169	0.027	0.13	0.13	<0.01	1.35	0.289	1.47	0.000
DALG-002	Dalglish Creek	Dalglish	2015-06-06 17:40	10.61	7.33	131.2			11			5.7		17	6.73			135	<5	7	<0.01	0.02		0.05		0.029	0.63	0.000
DALG-002	Dalglish Creek	Dalglish	2015-09-18 13:45	12.48	7.3	228			3.1		30			29	7.01			225	118	46	0.08	0.08		0.03		0.054	1	0.000
DALG-002	Dalglish Creek	Dalglish	2016-03-15	**1.2**	7.72	148			0		26.3			141	7.13			886	578	83	0.44	<0.01		0.03		0.059	0.93	0.002
DALG-002	Dalglish Creek	Dalglish	2016-05-10	13.34	**6.46**	60.2			1.8		50.1			7	6.24			61	<5	75	0.04	<0.01		<0.01		0.111	0.78	0.000
DALG-002	Dalglish Creek	Dalglish	2016-06-21 17:43	9.33	7.32	199.7			17.1		3.8			34	6.88			183	250	3	0.02	<0.01		<0.01		0.02	0.75	0.000
DALG-002	Dalglish Creek	Dalglish	2016-09-20 15:30	14.13	7.42	280.6			1.9		12.8			31	7.07			272	246	4	<0.01	0.12		<0.01		0.022	0.75	0.000
DALG-002	Dalglish Creek	Dalglish	2016-09-22 14:50	13.01	7.53	301.8	196.135	42.8	2.7		10.4																	
DALG-002	Dalglish Creek	Dalglish	2017-03-07 15:00	7.03	7.94	380			-0.1		67.2			133	6.98		410	792	540	136	0.09	<0.01		<0.01		0.138	1.16	0.001
DALG-002	Dalglish Creek	Dalglish	2017-06-27 16:00	10.92	6.73	157.8			8.9		37.2			17	6.74		58	146	150	5	<0.01	0.03		<0.01		0.081	0.8	0.000
DALG-002	Dalglish Creek	Dalglish	2017-09-21 11:05	12.59	7.87	313		97.4	4.2		9.8			38	7.55		85	303	340	2	<0.01	0.2		<0.01		0.024	0.82	0.000
DALG-002	Dalglish Creek	Dalglish	2018-03-21 14:00	**2.43**	7.04	907		-44.3	0		39.4			127	7.31		450	875	660	60	0.45	<0.1		<0.1		0.013	0.73	0.000
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2013-08-26 15:45	10.7	7.31	352			7.9		7.2			52	7.21			296	268	<2	0.05	0.04		<0.01		0.012		0.000
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-07-23 11:55	-	6.68	1221			15.03					23	7.08	82.4	77	222	181	7	0.037	0.028	0.028	<0.010	0.48	0.053	0.509	0.000
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-09-23 11:15	12.4	7.02	156			3.5					14	6.85	58.9	55	156	135	6	0.034	0.03	0.03	<0.01	0.62	0.027	0.65	0.000
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-03-15 11:35	**3.1**	6.6	355			0.1					34	6.53	126	111	328	240	20	0.137	0.02	0.02	<0.01	0.56	0.007	0.57	0.000
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-06-05 17:50	10.07	6.95	239.9			11.2			6.2		17	6.66			251	142	6	0.03	0.03		0.05		0.016	0.66	0.000
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-09-18 18:55	12.53	7.06	182			3.2		29.3			16	6.5			186	68	34	0.04	0.03		0.03		0.042	0.63	0.000
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-03-16	**5.81**	7.76	38			0		1.5			36	6.42			396	320	39	0.11	<0.01		0.02		0.014	0.48	0.001
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-06-21 15:50	8.99	6.89	226.2			16.7		7.4			20	6.59			207	200	3	0.03	<0.01		<0.01		0.01	0.89	0.000
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-09-20 9:18	14.16	7.54	148.9			0.8		35.7			12	6.6			142	116	38	0.03	<0.01		<0.01		0.044	0.65	0.000
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-03-07 17:00	**6.24**	8	134.5			0		69			37	6.22		140	327	256	182	0.47	<0.01		<0.01		0.289	0.8	0.005
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-06-27 18:15	9.2	6.62	476.1			15.2		11.5			14	6.66		154	442	430	2	0.03	0.01		<0.01		0.013	0.39	0.000
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-09-20 17:30	11.9	7.22	246.1		60	5.6		6.4			23	7.19		85	239	220	<2	0.03	0.02		<0.01		0.012	0.47	0.000
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2018-03-20 17:38	**5.19**	6.89	871		18.5	0.1		15			81	6.91		270	626	440	9	0.14	<0.1		<0.1		<0.003	0.31	0.000
McPL-001	McParlon Creek above confluence wi	McParlon	2013-07-29	9.4	7.2	51			13.1		81.3			14	6.49			50	96	86	0.05	0.06		<0.01		0.086		0.000
McPL-001	McParlon Creek above confluence wi	McParlon	2014-07-22 16:55	-	6.5	47			13.33					13	6.82	25.8	23	47	112	8	<0.020	<0.010	<0.010	<0.010	0.85	0.049	0.846	0.000
McPL-001	McParlon Creek above confluence wi	McParlon	2014-09-21 13:10	11.8	7	81			3.9					14	6.95	33.9	32	82	109	11	0.023	0.03	0.03	<0.01	1.19	0.044	1.22	0.000
McPL-001	McParlon Creek above confluence wi	McParlon	2015-06-05 12:45	11.05	6.64	56.6			7.6			12		7	6.34			59	16	7	0.02	0.02		0.05		0.032	0.67	0.000
McPL-001	McParlon Creek above confluence wi	McParlon	2015-09-19 15:25	12.32	6.69	90			2.1		65.4			11	6.77			96	20	114	0.02	0.01		0.03		0.095	0.73	0.000
McPL-001	McParlon Creek above confluence wi	McParlon	2016-05-10	12.83	**6.12**	41.8			0.3		21.6			5	6.04			41	6	23	<0.01	<0.01		<0.01		0.058	1.01	0.000
McPL-001	McParlon Creek above confluence wi	McParlon	2016-06-21 12:55	9.36	6.63	67.7			14.8		7.2			12	6.4			61	166	3	0.01	<0.01		<0.01		0.017	0.79	0.000
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-20 13:16	13.79	7.33	115.2			1.2		17.4			14	6.98			111	126	8	<0.01	<0.01		<0.01		0.027	0.75	0.000
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-22 12:10	12.84	6.98	125		151	1.6		12.1																	
McPL-001	McParlon Creek above confluence wi	McParlon	2017-03-07 12:40	**1.88**	7.73	478			0		2.8			132	7.12		270	653	488	3	0.16	0.138		<0.01		0.023	1.6	0.001
McPL-001	McParlon Creek above confluence wi	McParlon	2017-06-27 12:55	9.91	**6.14**	39.8			9.3	0.55	39.5			10	6.32		21	36	70	5	0.01	<0.01		<0.01		0.102	0.94	0.000
McPL-001	McParlon Creek above confluence wi	McParlon	2017-09-20 14:05	12.22	7.8	74.1		105.2	3.6		13.5			16	7.09		31	74	160	2	<0.01	0.03		<0.01		0.023	0.72	0.000
McPL-001	McParlon Creek above confluence wi	McParlon	2018-03-21 12:48	**2.8**	6.62	933		-7.6	0		52.7			360	7.21		500	935	840	69.5	0.54	<0.1		<0.1		0.067	2.92	0.000

				O-DO-F	pH-F	Cond-F	TDS-F	ORP	Temp-F	Wlevel	Turb-F	Turb-F-FNU	PurgeVol	Alk-T	pH-L	Hard-T	Hard-D	Cond-L	TDS	TSS	N-NH4	N-NO3	N-NO23	N-NO2	N-TKN	P-PO4T	N-TN	N-NH3u(ca
				inorg	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	phy	nutr	nutr	nutr	nutr	nutr	nutr	Nx nutr	nutr
				Oxygen, Dis	pH, Field	Specific Cor	Total Dissol	Oxidation -	Temperatur	Water Level	Turbidity, fi	Turbidity, fi	Volume of v	Alkalinity,	pH, Labora	Hardness (	Hardness (	Specific Co	Total Dissc	Total Susp	Ammoniur	Nitrate Nit	Nitrite and	Nitrite Nitr	Total Kjeld	Phosphoru	Nitrogen, '	Un-ionizec
				mg/L	pH units	uS/cm	mg/L	mV	C	m	NTU	FNU	L	mgCaCO3/	pH units	mgCaCO3/	mgCaCO3/	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
				6.5	6.5 - 9.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	*emp,pH-de*	13	-	0.06	-	-	-	-
Stn.Code	**Site Name**	**Group**	**Smpl Date**																									
McPL-002	McParlon Creek headwaters	McParlon	2013-08-27 11:05	10.9	7.1	77			4.5		8.9			30	7.24			68	88	4	0.03	<0.01		<0.01		0.049		0.000
McPL-002	McParlon Creek headwaters	McParlon	2014-07-23 9:30	-	6.53	166			13.23					32	7.07	63.3	58	164	152	<1	<0.020	<0.010	<0.010	<0.010	0.92	0.029	0.925	0.000
McPL-002	McParlon Creek headwaters	McParlon	2014-09-21 16:00	11.8	7	150			3.6					14	6.91	52.9	48	150	126	<1	<0.020	<0.01	<0.01	<0.01	0.72	0.026	0.72	0.000
McPL-002	McParlon Creek headwaters	McParlon	2015-06-05 11:05	11.03	6.71	126.3			5.6				4.8	7	6.29			131	75200	5	<0.01	<0.01		0.05		0.021	0.64	0.000
McPL-002	McParlon Creek headwaters	McParlon	2015-09-19 14:30	11.93	6.67	256			1.8		23.4			16	6.47			256	84	24	0.01	0.01		0.02		0.037	0.72	0.000
McPL-002	McParlon Creek headwaters	McParlon	2016-03-15	12.27	7.75	1200			-0.1		1.6			238	6.81			4650	5180	104	1.49	<0.01		<0.01		<0.003	3.83	0.008
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2013-08-27 12:25	11.1	7.1	250			5.2		12.8			21	6.88			211	214	6	<0.01	0.04		<0.01		0.043		0.000
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-07-22 10:20	-	6.73	324			14.61					27	6.99	117	108	322	250	<1	<0.020	<0.010	<0.010	<0.010	1	0.035	0.997	0.000
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-09-21 14:20	11.5	6.8	198			4					12	6.77	66.1	62	198	173	<1	0.02	0.06	0.06	<0.01	0.72	0.03	0.78	0.000
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-06-06 15:00	10.35	6.83	315			9.3				3.3	13	6.54			311	130	5	0.02	0.12		0.04		0.021	0.66	0.000
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-09-18 14:51	11.92	7.15	413			2.2		10.2			36	6.82			411	146	11	0.02	0.05		0.01		0.025	0.83	0.000

Notes:
Sample classes included in query: All

				Bromide	Chlord	Fluord	SO4-D	Al-D	Sb-D	As-D	Ba-D	Be-D	Bi-D	B-D	Cd-D	Ca-D	Cr-D	Co-D	Cu-D	Fe-D	Pb-D	Li-D	Mg-D	Mn-D	Hg-D	Mo-D	Ni-D	P-D
				inorg	halo inorg	halo inorg	Sx inorg	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met
				Bromide	Chloride	Fluoride	Sulphate, D	Aluminum	Antimony,	Arsenic, di	Barium, di	Beryllium,	Bismuth, d	Boron, dis	Cadmium,	Calcium, d	Chromium	Cobalt, dis	Copper, di	Iron, disso	Lead, dissc	Lithium, di	Magnesiur	Manganes	Mercury, diss	Molybden	Nickel, dis	Phosphoru
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	-	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
				-	120	0.12	-	*pH-dep*	-	0.005	-	-	-	1.5	*Hardness-*	-	0.0089	-	*ardness-de*	0.3	*ardness-de*	-	-	-	0.000026	-	*ardness-de*	-
Stn.Code	**Site Name**	**Group**	**Smpl Date**																									
CHNC-001	Chance Creek above confluence with	Chance	2013-07-29		<0.05		4.2	0.152	<0.0002	0.0006	0.09	0.00005	<0.001	0.006	0.00003	7.54	0.0009	0.0002	0.005	**0.448**	0.0001	0.002	2.26	0.05	0.00001	0.00025	0.006	
CHNC-001	Chance Creek above confluence with	Chance	2014-07-22 10:47	<0.1	0.62		9.2	0.081	0.0002	0.00054	0.0933	0.00005	<0.00001	0.007	0.000017	10.8	0.0007	0.000078	0.0048	**0.349**	0.00026	0.00183	3.02	0.0147	<0.00001	0.00035	0.00438	0.01
CHNC-001	Chance Creek above confluence with	Chance	2014-09-22 19:00	<0.1	1.06		9.1	0.165	0.00016	0.00047	0.0672	0.00006	<0.00001	0.006	0.000034	6.09	0.0009	0.000262	0.0046	**0.569**	0.0001	0.0018	2.39	0.0334	<0.00001	0.00017	0.0056	0.01
CHNC-001	Chance Creek above confluence with	Chance	2015-03-14 17:30	<0.1	2.68		28.8	0.013	0.00009	0.00054	0.421	0.00001	<0.00001	0.013	0.000099	37.1	0.0003	0.000784	0.0009	**0.275**	<0.00005	0.00279	6.85	1.81	<0.000005	0.00138	0.00368	0.014
CHNC-001	Chance Creek above confluence with	Chance	2015-06-06 11:00	<0.02	0.08		9.09	0.127	<0.0002	0.0005	0.079	0.00007	<0.001	0.004	0.00002	5.91	0.0007	0.00011	0.005	**0.353**	0.0001	0.001	2.2	0.03	0.00001	0.00018	0.004	
CHNC-001	Chance Creek above confluence with	Chance	2015-09-18 18:05	<0.02	0.12		26.5	0.195	<0.0002	0.0005	0.086	0.00007	<0.001	0.008	0.00005	11.4	0.0007	0.00044	0.005	**0.596**	<0.0001	0.002	4.61	0.07	<0.00001	0.00021	0.005	
CHNC-001	Chance Creek above confluence with	Chance	2016-03-16	<0.02	0.46		99.4	0.006	<0.0002	0.0003	0.461	<0.00004	<0.0010	0.012	0.00008	89.5	<0.0004	0.00031	<0.001	**0.147**	<0.0001	0.005	15.3	0.792	<0.00001	0.0011	0.003	
CHNC-001	Chance Creek above confluence with	Chance	2016-06-21 11:15	<0.02	0.1		14.1	0.188	<0.0002	0.0005	0.065	0.00006	<0.001	0.005	0.00003	6.8	0.0007	0.00012	0.0048	**0.578**	<0.0001	0.001	2.9	0.03	<0.00001	0.0001	0.004	
CHNC-001	Chance Creek above confluence with	Chance	2016-09-20 12:00	<0.02	0.15		34.4	0.1956	<0.00020	<0.001	0.07	<0.00050	<0.001	<0.02	<0.0001	11.6	<0.00050	0.00041	<0.005	**0.58**	<0.0001	<0.005	4.7	0.06	<0.00001	0.00021	0.004	
CHNC-001	Chance Creek above confluence with	Chance	2017-03-07 10:40	<0.020	0.957		82.9	0.004424	0.00005	0.0004	0.6325	<0.000050	<0.0001	0.013	0.00005	77.8	0.000107	0.001102	<0.0005	**0.257**	<0.00001	0.0051	13	2.06	<0.00001	0.001112	0.003	
CHNC-001	Chance Creek above confluence with	Chance	2017-06-27 11:30	<0.02	0.09		27	0.078	0.00017	0.0006	0.1062	0.00006	<0.0001	0.012	0.00002	13	0.00082	0.000098	0.0047	**0.562**	0.00017	0.002	4.7	0.046	<0.00001	0.00037	0.005	
CHNC-001	Chance Creek above confluence with	Chance	2017-09-20 10:21	0.03	0.06		10.7	0.134	0.00013	0.0005	0.0751	<0.00005	<0.0001	0.005	0.00002	7.7	0.00084	0.00013	0.0045	**0.389**	0.00005	0.0015	2.9	0.025	0.00001	0.00023	0.005	
CHNC-001	Chance Creek above confluence with	Chance	2018-03-21 10:25	<0.02	0.39		35.5	0.027	0.0002	0.0005	0.3271	<0.00005	<0.0001	0.015	0.0001	46	0.00018	0.00095	0.001	**0.265**	0.0001	0.0037	8.6	1.53	<0.00001	0.00142	0.0038	
CHNC-003	Chance Creek u/s tributary	Chance	2013-08-26 15:00		<0.05		2.2	0.129	0.0002	0.0018	0.115	<0.00004	<0.001	<0.004	0.00005	7.82	0.0013	0.00032	0.007	**1.88**	0.0003	<0.001	3.36	0.044	<0.00001	0.00046	0.009	
CHNC-003	Chance Creek u/s tributary	Chance	2014-07-22 18:30	<0.1	0.24		<1.0	0.135	0.00018	0.00078	0.0843	0.00007	<0.00001	0.006	0.000042	5.14	0.0011	0.000253	0.006	**0.72**	0.00035	0.00097	1.98	0.0372	<0.00001	0.00037	0.00586	0.015
CHNC-003	Chance Creek u/s tributary	Chance	2014-09-23 10:40	<0.1	<0.10		2.9	0.202	0.00016	0.00048	0.0703	0.00007	<0.00001	0.006	0.000032	4.77	0.001	0.000226	0.005	**0.578**	0.00009	0.00143	1.75	0.0209	<0.00001	0.00019	0.00544	0.013
CHNC-003	Chance Creek u/s tributary	Chance	2015-06-05 15:40	<0.02	0.06		2.24	0.155	<0.0002	0.0006	0.064	0.00006	<0.001	<0.004	0.00003	3.07	0.0008	0.00017	0.005	**0.496**	0.0001	0.001	1.32	0.024	0.00001	0.00019	0.004	
CHNC-003	Chance Creek u/s tributary	Chance	2015-09-19 17:23	<0.02	0.1		2.26	0.283	<0.0002	0.0006	0.069	0.00007	<0.001	0.006	0.00006	4.5	0.0009	0.00057	0.006	**0.795**	0.0001	0.001	1.75	0.082	<0.00001	0.00015	0.005	
CHNC-003	Chance Creek u/s tributary	Chance	2016-09-22 10:59	<0.02	0.11		3.7	0.2447	0.000163	0.0006	0.0708	0.000104	<0.0001	0.005	0.000054	4.9	0.000886	0.000373	0.0057	**0.744**	<0.00001	0.0013	1.9	0.041	0.00001	0.00016	0.006	
CHNC-003	Chance Creek u/s tributary	Chance	2017-06-27 9:30	<0.02	0.06		2.8	0.102	0.00018	0.0008	0.0972	0.00006	<0.0001	0.006	0.00006	5.6	0.00099	0.00058	0.0064	**0.615**	0.00016	0.0009	2.4	0.122	<0.00001	0.00034	0.0061	
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2013-08-26 14:02		<0.05		1.6	0.192	0.0002	0.002	0.101	0.00004	<0.001	<0.004	0.00006	6.93	0.0015	0.00048	0.007	**2.54**	0.0002	0.001	3.31	0.037	<0.00001	0.00045	0.012	
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-07-22 18:50	<0.1	0.35		<1.0	0.152	0.00019	0.00093	0.0953	0.00006	<0.00001	0.006	0.000052	5.18	0.0012	0.000834	0.0058	**0.985**	0.00016	0.00102	2.33	0.0943	<0.00001	0.00049	0.00837	0.034
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-09-21 15:10	<0.1	0.57		2.1	0.218	0.00016	0.00056	0.0665	0.00006	<0.00001	0.008	0.000037	3.83	0.001	0.000568	0.0046	**0.757**	0.00012	0.00166	1.56	0.0428	<0.00001	0.00017	0.00631	0.013
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-06-05 16:10	<0.02	<0.05		1.71	0.173	<0.0002	0.0005	0.061	0.0001	<0.001	<0.004	0.00003	2.62	0.0009	0.00022	0.005	**0.694**	0.0001	0.001	1.27	0.02	0.00001	0.00017	0.005	
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-09-19 18:00	<0.02	0.09		0.84	0.301	<0.0002	0.0006	0.066	0.00006	<0.001	0.004	0.00006	3.71	0.0011	0.00083	0.006	**1.1**	0.0001	0.001	1.58	0.087	0.00001	0.00015	0.006	
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2016-03-15	<0.02	0.23		3.5	0.93	<0.002	**0.007**	0.475	<0.00040	<0.010	<0.04	0.00037	30.8	<0.004	0.0272	0.013	**36.9**	0.001	<0.010	13.7	4.52	0.00001	0.001	0.045	
DALG-002	Dalglish Creek	Dalglish	2014-09-23 14:30	<0.1	0.34		41.4	0.117	0.00015	0.00051	0.0741	0.00004	<0.00001	0.027	0.000046	11.8	0.0008	0.00106	0.0036	**0.673**	0.00008	0.00498	5.69	0.0994	<0.00001	0.00021	0.00747	0.016
DALG-002	Dalglish Creek	Dalglish	2015-06-06 17:40	<0.02	0.05		16.1	0.086	<0.0002	0.0005	0.068	0.00004	<0.001	0.024	0.00002	11	0.0006	0.00035	0.004	**0.542**	<0.0001	0.004	5.29	0.017	<0.00001	0.00025	0.006	
DALG-002	Dalglish Creek	Dalglish	2015-09-18 13:45	<0.02	0.14		70.1	0.117	<0.0002	0.0005	0.081	<0.00004	<0.001	0.031	0.00004	18.8	0.0005	0.00096	0.003	**0.678**	<0.0001	0.007	10.7	0.102	<0.00001	0.00023	0.007	
DALG-002	Dalglish Creek	Dalglish	2016-03-15	<0.02	0.18		356	0.006	<0.0002	0.0004	0.058	<0.00004	<0.0010	0.039	0.00006	177	<0.0004	0.0156	<0.001	**3.98**	<0.0001	0.008	23.8	4.96	<0.00001	0.0005	0.041	
DALG-002	Dalglish Creek	Dalglish	2016-05-10	<0.02	0.43		14.5	0.171	<0.0002	0.0005	0.044	<0.00004	<0.001	0.018	0.00006	4.8	0.0004	0.00154	0.0034	**0.815**	<0.0001	0.002	2.4	0.185	<0.00001	0.0001	0.005	
DALG-002	Dalglish Creek	Dalglish	2016-06-21 17:43	<0.02	<0.05		55.3	0.069	<0.0002	0.0005	0.059	<0.00004	<0.001	0.036	0.00002	18.1	0.0005	0.00025	0.0031	**0.665**	<0.0001	0.005	7.3	0.023	<0.00001	0.0003	0.005	
DALG-002	Dalglish Creek	Dalglish	2016-09-20 15:30	<0.02	0.4		95.7	0.07879	<0.00020	<0.001	0.076	<0.00050	<0.001	0.03	<0.0001	20.7	<0.00050	0.00087	<0.005	**0.56**	<0.0001	0.009	11.5	0.09	<0.00001	0.00021	0.005	
DALG-002	Dalglish Creek	Dalglish	2016-09-22 14:50																									
DALG-002	Dalglish Creek	Dalglish	2017-03-07 15:00	<0.020	0.187		287	0.003391	0.000117	0.0003	0.0658	<0.000050	<0.0001	0.036	0.000035	133	0.000119	0.01608	<0.0005	**1.06**	<0.00001	0.0077	18.6	4.04	<0.00001	0.000684	0.0326	
DALG-002	Dalglish Creek	Dalglish	2017-06-27 16:00	<0.02	<0.05		48.3	0.106	0.00013	0.0005	0.0622	<0.00005	<0.0001	0.025	0.00003	13	0.00067	0.00063	0.0035	**0.503**	0.000098	0.0044	6.5	0.045	<0.00001	0.00019	0.0054	
DALG-002	Dalglish Creek	Dalglish	2017-09-21 11:05	0.03	0.11		105	0.082	0.00012	0.0005	0.0821	<0.00005	<0.0001	0.035	0.00003	18	0.0006	0.00051	0.0023	**0.765**	0.00005	0.008	9.7	0.061	<0.00001	0.00028	0.0062	
DALG-002	Dalglish Creek	Dalglish	2018-03-21 14:00	<0.2	<0.5		359	0.003	0.00011	0.0003	0.074	<0.00005	<0.0001	0.04	0.00005	140	0.00009	0.01396	<0.0005	**1.78**	0.00004	0.0085	24	4.24	<0.00001	0.00042	0.029	
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2013-08-26 15:45		2.41		110	0.046	<0.0002	0.0007	0.058	<0.00004	<0.001	0.057	0.00008	35.3	0.0005	0.00545	0.002	**1.28**	<0.0001	0.008	12.2	0.249	<0.00001	0.00028	0.026	
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-07-23 11:55	<0.1	1.72		68.5	0.133	0.00013	0.00048	0.0496	0.00006	<0.00001	0.037	0.000122	18.8	0.0006	0.00351	0.0036	**1.02**	0.0002	0.00668	7.26	0.139	<0.00001	0.00017	0.0198	<0.01
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-09-23 11:15	<0.1	0.72		50	0.237	0.00011	0.00046	0.0456	0.00008	<0.00001	0.023	0.000141	13.7	0.0008	0.00369	0.0037	**1.23**	0.00007	0.00586	5.11	0.115	<0.00001	0.00014	0.0169	0.011
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-03-15 11:35	<0.1	4.3		115	0.041	0.00008	0.00076	0.0613	0.00001	<0.00001	0.019	0.000075	26.1	0.0004	0.0154	0.001	**16.1**	<0.00005	0.00469	11.2	0.711	<0.000005	0.00015	0.0221	<0.01
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-06-05 17:50	<0.02	1.5		87.9	0.149	<0.0002	0.0004	0.055	0.00006	<0.001	0.025	0.00012	19.8	0.0005	0.00389	0.003	**1.17**	<0.0001	0.007	9.12	0.156	<0.00001	0.00011	0.019	
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-09-18 18:55	<0.02	0.49		58	0.259	<0.0002	0.0006	0.053	0.00011	<0.001	0.018	0.00011	14.8	0.0007	0.00305	0.004	**1.34**	<0.0001	0.007	7.76	0.13	<0.00001	0.00018	0.013	
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-03-16	<0.02	1.52		153	0.083	<0.0002	0.0005	0.088	<0.00004	<0.0010	0.025	0.0001	40.5	0.0009	0.0143	0.002	**8.35**	<0.0001	0.006	18.6	0.921	<0.00001	<0.0001	0.03	
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-06-21 15:50	<0.02	21.8		75.7	0.134	<0.0002	0.0006	0.063	0.00007	<0.001	0.037	0.00012	17.8	0.0007	0.00278	0.0041	**1.49**	<0.0001	0.007	8.3	0.114	<0.00001	0.0001	0.018	
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-09-20 9:18	<0.02	0.45		48.2	0.3081	<0.00020	<0.001	0.048	<0.00050	<0.001	<0.02	0.00012	12.1	<0.00050	0.00365	<0.005	**1.4**	<0.0001	<0.005	5.6	0.12	<0.00001	<0.00020	0.014	
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-03-07 17:00	<0.020	1.69		107	0.06247	0.000086	0.0004	0.0784	<0.000050	<0.0001	0.021	0.000163	31.1	0.000368	0.01043	0.0021	**5.77**	0.000021	0.0048	15.2	0.775	<0.00001	0.000111	0.0225	
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-06-27 18:15	0.07	8.33		187	0.09	0.00009	0.0004	0.0739	0.00006	<0.0001	0.07	0.00014	33	0.0004	0.00633	0.0024	**1.33**	0.00015	0.0085	17	0.344	<0.00001	0.00007	0.025	
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-09-20 17:30	0.03	1.51		83	0.189	0.00008	0.0004	0.0524	<0.00005	<0.0001	0.033	0.00014	19	0.00057	0.00469	0.0027	**1.61**	0.00002	0.0076	9.2	0.17	<0.00001	0.00015	0.02	
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2018-03-20 17:38	<0.2	2.6		243	0.017	0.00019	0.0004	0.051	<0.00005	<0.0001	0.031	0.00012	73	0.00008	0.01188	0.0007	**8.61**	0.00006	0.0112	22	0.672	<0.00001	0.00033	0.0267	
McPL-001	McParlon Creek above confluence wi	McParlon	2013-07-29		0.1		4.3	0.147	<0.0002	0.0009	0.083	0.00004	<0.001	0.006	0.00003	6.26	0.0011	0.00033	0.006	**0.982**	0.0003	<0.001	2.56	0.032	0.00001	0.00045	0.006	
McPL-001	McParlon Creek above confluence wi	McParlon	2014-07-22 16:55	<0.1	0.41		2.8	0.145	0.00019	0.00067	0.0857	0.00006	<0.00001	0.005	0.000039	5.54	0.0009	0.000216	0.005	**0.636**	0.00012	0.00087	2.13	0.0288	<0.00001	0.00031	0.00519	0.013
McPL-001	McParlon Creek above confluence wi	McParlon	2014-09-21 13:10	<0.1	0.34		17.3	0.146	0.00019	0.00051	0.0964	0.00005	<0.00001	0.007	0.000033	7.35	0.001	0.000256	0.0047	**0.602**	0.00009	0.00144	3.35	0.0358	<0.00001	0.00026	0.00541	0.016
McPL-001	McParlon Creek above confluence wi	McParlon	2015-06-05 12:45	<0.02	0.15		13.2	0.126	<0.0002	0.0005	0.081	0.00005	<0.001	0.005	0.00003	4.51	0.0007	0.00011	0.005	**0.439**	<0.0001	0.001	2.43	0.014	0.00001	0.00019	0.004	
McPL-001	McParlon Creek above confluence wi	McParlon	2015-09-19 15:25	<0.02	0.27		22.6	0.207	<0.0002	0.0005	0.083	0.00005	<0.001	0.007	0.00005	7.7	0.0007	0.00051	0.005	**0.644**	<0.0010	0.001	4.07	0.081	<0.00001	0.00019	0.005	
McPL-001	McParlon Creek above confluence wi	McParlon	2016-05-10	<0.02	0.44		7	0.238	<0.0002	0.0005	0.079	0.00011	<0.001	0.006	0.00011	4	0.0005	0.00135	0.0052	**0.841**	<0.0001	<0.001	1.8	0.314	<0.00001	0.0001	0.005	
McPL-001	McParlon Creek above confluence wi	McParlon	2016-06-21 12:55	<0.02	0.17		14.5	0.138	<0.0002	0.0006	0.061	<0.00004	<0.001	0.006	0.00002	6	0.0008	0.0001	0.0048	**0.637**	<0.0001	<0.001	3	0.02	<0.00001	0.0002	0.003	
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-20 13:16	<0.02	0.24		32.7	0.1909	<0.00020	<0.001	0.086	<0.00050	<0.001	<0.02	<0.0001	8.4	<0.00050	0.0006	<0.005	**0.82**	0.00014	<0.005	4.6	0.09	<0.00001	<0.00020	0.005	
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-22 12:10																									
McPL-001	McParlon Creek above confluence wi	McParlon	2017-03-07 12:40	<0.020	1.29		193	0.1239	0.00039	0.001	0.387	<0.00050	<0.001	0.02	0.00012	60	0.00137	0.00061	0.011	**0.89**	0.00028	0.005	29.2	0.67	0.00001	0.00122	0.013	
McPL-001	McParlon Creek above confluence wi	McParlon	2017-06-27 12:55	0.04	0.12		2.7	0.139	0.00015	0.0007	0.0655	0.00005	<0.0001	0.006	0.00004	4.9	0.00085	0.00037	0.0055	**0.638**	0.00017	0.00098	2.1	0.052	<0.00001	0.00023	0.0042	
McPL-001	McParlon Creek above confluence wi	McParlon	2017-09-20 14:05	0.03	0.42		12.1	0.141	0.00013	0.0006	0.0987	<0.00005	<0.0001	0.005	0.00003	7	0.00097	0.00021	0.0045	**0.604**	0.00009	0.0013	3.3	0.037	0.00001	0.00028	0.0053	
McPL-001	McParlon Creek above confluence wi	McParlon	2018-03-21 12:48	<0.2	3.5		166	0.273	0.00063	0.0038	1.046	0.00017	<0.0001	0.025	0.00157	110	0.00195	0.03525	0.0062	**3.28**	0.00041	0.0051	55	21.4	<0.00001	0.00228	0.0755	

				Bromide	Chlord	Fluord	SO4-D	Al-D	Sb-D	As-D	Ba-D	Be-D	Bi-D	B-D	Cd-D	Ca-D	Cr-D	Co-D	Cu-D	Fe-D	Pb-D	Li-D	Mg-D	Mn-D	Hg-D	Mo-D	Ni-D	P-D
					halo	halo	Sx																					
				inorg	inorg	inorg	inorg	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met
				Bromide	Chloride	Fluoride	Sulphate, D	Aluminum	Antimony,	Arsenic, di	Barium, di	Beryllium,	Bismuth, d	Boron, dis	Cadmium,	Calcium, d	Chromium	Cobalt, dis	Copper, di	Iron, disso	Lead, dissc	Lithium, di	Magnesiur	Manganes	Mercury, diss	Molybden	Nickel, dis	Phosphoru
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
				-	120	0.12	-	*pH-dep*	-	0.005	-	-	-	1.5	*Hardness-*	-	0.0089	-	*ardness-de*	0.3	*ardness-de*	-	-	-	0.000026	-	*ardness-de*	-
Stn.Code	**Site Name**	**Group**	**Smpl Date**																									
McPL-002	McParlon Creek headwaters	McParlon	2013-08-27 11:05		0.09		5.1	0.1	0.0002	0.0017	0.072	<0.00004	<0.001	<0.004	0.00004	8.28	0.0011	0.00015	0.004	**1.19**	0.0001	<0.001	4.57	0.012	<0.00001	0.00038	0.007	
McPL-002	McParlon Creek headwaters	McParlon	2014-07-23 9:30	<0.1	0.58		40.2	0.051	0.00022	0.00069	0.106	0.00004	<0.00001	0.01	0.00002	11.8	0.0008	0.000125	0.0047	**0.568**	0.00009	0.00086	6.96	0.0148	<0.00001	0.00042	0.00554	0.038
McPL-002	McParlon Creek headwaters	McParlon	2014-09-21 16:00	<0.1	1.05		47.8	0.102	0.00017	0.0004	0.0936	0.00004	<0.00001	0.012	0.00002	10.1	0.0007	0.000126	0.004	**0.376**	0.00018	0.00165	5.6	0.0132	<0.00001	0.00018	0.00466	0.023
McPL-002	McParlon Creek headwaters	McParlon	2015-06-05 11:05	<0.02	0.14		43.6	0.093	<0.0002	0.0004	0.092	<0.00004	<0.001	0.008	0.00002	7.82	0.0006	0.0001	0.004	0.285	<0.0001	0.001	5.06	0.012	<0.00001	0.00018	0.004	
McPL-002	McParlon Creek headwaters	McParlon	2015-09-19 14:30	<0.02	0.36		85.5	0.132	<0.0002	0.0004	0.121	<0.00004	<0.001	0.012	0.00006	17.1	<0.0004	0.00041	0.004	**0.477**	<0.0001	0.002	11.1	0.089	<0.00001	0.00022	0.005	
McPL-002	McParlon Creek headwaters	McParlon	2016-03-15	<0.02	3.05		<0.5	0.062	0.0003	0.0019	0.066	<0.00004	<0.0010	0.037	0.00006	431	<0.0004	0.0706	0.002	**29.6**	<0.0001	0.018	325	35.3	<0.00001	0.0009	0.044	
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2013-08-27 12:25		0.35		90.5	0.113	<0.0002	0.002	0.071	<0.00004	<0.001	0.009	0.00003	14.8	0.001	0.00041	0.007	**1.17**	<0.0001	0.008	13.2	0.037	<0.00001	0.0002	0.008	
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-07-22 10:20	<0.1	0.46		121	0.089	0.00016	0.00074	0.0984	0.00004	<0.00001	0.018	0.000032	17.6	0.0009	0.000308	0.0038	**1.07**	0.00013	0.00933	15.6	0.0416	<0.00001	0.00028	0.00682	0.019
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-09-21 14:20	<0.1	0.49		70.3	0.151	0.00014	0.00041	0.0777	0.00005	<0.00001	0.014	0.000042	10.8	0.0009	0.000534	0.0034	**0.562**	0.00017	0.00702	8.44	0.0448	<0.00001	0.00013	0.00609	0.013
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-06-06 15:00	<0.02	0.2		122	0.084	<0.0002	0.0004	0.072	<0.00004	<0.001	0.015	0.00002	14.6	0.0006	0.00028	0.003	**0.388**	<0.0001	0.013	15.8	0.028	<0.00001	0.00011	0.004	
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-09-18 14:51	<0.02	0.48		145	0.144	<0.0002	0.0004	0.081	0.00005	<0.001	0.022	0.00006	23	<0.0004	0.00111	0.003	**0.695**	<0.0001	0.016	20.6	0.13	<0.00001	0.00022	0.008	

Notes:
Sample classes included in query: All

				K-D	Se-D	Si-D	Ag-D	Na-D	Sr-D	S-D	Te-D	Tl-D	Th-D	Sn-D	Ti-D	W-D	U-D	V-D	Zn-D	Zr-D	Al-T	Sb-T	As-T	Ba-T	Be-T	Bi-T	B-T	Cd-T	Ca-T
				met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met
				Potassium	Selenium,	Silicon, dis	Silver, diss	Sodium, di	Strontium,	Sulphur, D	Tellurium,	Thallium, (	Thorium, c	Tin, dissol	Titanium, (	Tungsten,	Uranium, (	Vanadium,	Zinc, disso	Zirconium,	Aluminum	Antimony,	Arsenic, to	Barium, to	Beryllium,	Bismuth, t	Boron, tot	Cadmium,	Calcium, t
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
				-	0.001	-	0.00025	-	-	-	-	0.0008	-	-	-	-	0.015	-	*Hardness,t*	-									
Stn.Code	**Site Name**	**Group**	**Smpl Date**																										
CHNC-001	Chance Creek above confluence with	Chance	2013-07-29	0.4	<0.0006	2.43	<0.00001	1.8	0.034	1.6		<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00054	0.004	0.00133	0.494	0.0001	0.00079	0.102	0.00009	<0.0001	0.007	0.00004	7.88
CHNC-001	Chance Creek above confluence with	Chance	2014-07-22 10:47	0.458	0.0003	1.52	<0.00001	2.44	0.0436	2.73	<0.00005	<0.000004	0.00011	<0.00005	0.0011		0.000126	0.0005	0.001	0.00121	0.218	0.00022	0.00071	0.109	0.00007	<0.00001	0.009	0.000027	13.7
CHNC-001	Chance Creek above confluence with	Chance	2014-09-22 19:00	0.313	0.0004	2.47	<0.00001	2.97	0.0299	2.41	<0.00005	<0.000004	0.00019	<0.00005	0.0017		0.000094	0.0004	0.004	0.00147	0.65	0.00019	0.00081	0.095	0.00009	0.00001	0.008	0.000061	6.61
CHNC-001	Chance Creek above confluence with	Chance	2015-03-14 17:30	0.817	0.0003	2.5	<0.00001	13.2	0.136	9.26	<0.00005	<0.000004	0.00002	<0.00005	0.0003		0.000233	0.0004	0.004	0.00046	0.039	0.0001	0.00064	0.471	0.00002	<0.00001	0.015	0.000128	41.5
CHNC-001	Chance Creek above confluence with	Chance	2015-06-06 11:00	0.4	<0.0006	1.67	<0.00001	3.3	0.03	3.3	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00049	0.004	0.00135	0.368	0.0001	0.00061	0.0926	0.00008	<0.0001	0.008	0.00004	7.36
CHNC-001	Chance Creek above confluence with	Chance	2015-09-18 18:05	0.3	0.0006	3.31	<0.00001	7.7	0.045	10.3	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00035	0.005	0.00175	1.58	<0.0002	0.0012	0.148	0.00008	<0.0010	0.009	0.0001	11.3
CHNC-001	Chance Creek above confluence with	Chance	2016-03-16	1	<0.0006	2.75	<0.00001	12.3	0.234	34.7	<0.0001	<0.00001	<0.0004	<0.0001	0.015		0.0009	<0.0001	0.003	0.0003	0.013	<0.0002	0.0004	0.471	<0.00005	<0.001	0.012	0.00008	93
CHNC-001	Chance Creek above confluence with	Chance	2016-06-21 11:15	0.3	<0.0006	2.15	<0.00001	4.8	0.026	4.9	<0.0001	<0.00001	<0.0004	<0.0001	<0.01		<0.0004	0.0004	0.003	0.0018	0.609	0.00013	0.0007	0.0791	0.00008	<0.0001	0.002	0.00003	7.3
CHNC-001	Chance Creek above confluence with	Chance	2016-09-20 12:00	0.4	<0.002	2.91	<0.0001	9.4	0.041	11.3	<0.00050	<0.0001	<0.00050	<0.001	0.004		0.00019	<0.00050	<0.005	<0.001	1.05	0.00016	0.0008	0.0985	0.00008	<0.0001	0.01	0.00006	12.2
CHNC-001	Chance Creek above confluence with	Chance	2017-03-07 10:40	1.1	<0.0002	2.72	<0.00001	17	0.2327	28.9	<0.000050	<0.00001	<0.000050	<0.0001	0.015		0.000388	0.000079	0.0021	0.0003	0.012	0.00012	0.0006	0.657	<0.00005	<0.0001	0.014	0.00007	78.4
CHNC-001	Chance Creek above confluence with	Chance	2017-06-27 11:30	0.71	0.0004	1.5	<0.00001	9.4	0.0487	9.5	<0.00005	<0.00001	0.00018	<0.0001	0.003		0.00013	0.00071	0.0069	0.0013	0.12	0.00018	0.0007	0.11	0.00006	<0.0001	0.011	0.00003	14
CHNC-001	Chance Creek above confluence with	Chance	2017-09-20 10:21	0.43	0.0004	2.8	<0.00001	3.3	0.0346	3.8	<0.00005	<0.00001	0.00023	<0.0001	0.002		0.00011	0.00027	0.0026	0.0016	0.64	0.00023	0.0008	0.094	0.00006	<0.0001	0.005	0.00004	8
CHNC-001	Chance Creek above confluence with	Chance	2018-03-21 10:25	0.87	0.0003	2.6	<0.00001	12	0.1422	12	<0.00005	<0.00001	0.00009	<0.0001	0.005		0.00032	0.00046	0.0053	0.0007	3	0.00028	0.0026	0.53	0.00019	<0.0001	0.015	0.00042	49
CHNC-003	Chance Creek u/s tributary	Chance	2013-08-26 15:00	0.5	0.0007	1.71	0.00002	1.6	0.042	0.9	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00163	0.006	0.00185	0.249	0.0002	0.0015	0.123	<0.00004	<0.001	<0.005	0.00006	7.66
CHNC-003	Chance Creek u/s tributary	Chance	2014-07-22 18:30	0.402	0.0003	1.58	<0.00001	0.899	0.0316	<0.5	<0.00005	<0.000004	0.00015	<0.00005	0.0022		0.000076	0.0009	0.004	0.00159	0.308	0.00022	0.00112	0.101	0.00008	0.00001	0.005	0.000055	5.65
CHNC-003	Chance Creek u/s tributary	Chance	2014-09-23 10:40	0.245	0.0003	2.65	<0.00001	1.18	0.0246	0.596	<0.00005	<0.000004	0.00021	<0.00005	0.0028		0.000075	0.0005	0.006	0.00165	0.445	0.00019	0.00071	0.0876	0.00007	<0.00001	0.008	0.000055	5.28
CHNC-003	Chance Creek u/s tributary	Chance	2015-06-05 15:40	0.3	<0.0006	1.69	<0.00001	1.1	0.019	1	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00064	0.006	0.00133	0.396	0.0002	0.00062	0.0734	0.00007	<0.0001	0.007	0.00005	3.67
CHNC-003	Chance Creek u/s tributary	Chance	2015-09-19 17:23	0.4	<0.0006	3.37	<0.00001	1.3	0.023	1.3	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00059	0.007	0.00186	2.29	<0.0002	0.0015	0.146	0.00023	<0.0010	0.007	0.00012	4.84
CHNC-003	Chance Creek u/s tributary	Chance	2016-09-22 10:59	0.2	0.0006	3.26	<0.00001	1.8	0.0239	1.6	0.000054	0.000011	<0.000050	<0.0001	0.002		0.000077	0.000053	0.0166	0.0015	0.982	0.00016	0.0009	0.091	0.00008	<0.0001	0.004	0.00009	5.48
CHNC-003	Chance Creek u/s tributary	Chance	2017-06-27 9:30	0.57	0.0004	1.4	0.00002	1.9	0.0308	1.2	<0.00005	<0.00001	0.00033	<0.0001	0.002		0.000099	0.00075	0.0049	0.0016	0.2	0.00021	0.0011	0.11	0.00011	<0.0001	0.006	0.00009	6.1
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2013-08-26 14:02	0.4	**0.0014**	2.34	0.00002	1.1	0.029	0.7	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00143	0.011	0.00196	0.33	<0.0002	0.0015	0.113	0.00005	<0.001	<0.005	0.00007	6.5
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-07-22 18:50	0.421	0.0004	1.27	<0.00001	0.722	0.0238	<0.5	<0.00005	<0.000004	0.00017	<0.00005	0.0028		0.000073	0.0009	0.006	0.00148	0.427	0.00023	0.00168	0.119	0.00008	0.00002	0.005	0.000084	5.79
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-09-21 15:10	0.174	0.0003	2.68	<0.00001	0.832	0.0157	<0.5	<0.00005	<0.000004	0.00022	<0.00005	0.0018		0.000068	0.0005	0.007	0.00141	0.684	0.00018	0.00086	0.1	0.00008	0.00001	0.009	0.000078	4.41
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-06-05 16:10	0.3	<0.0006	2	<0.00001	0.8	0.013	0.8	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00078	0.008	0.00127	0.552	0.0002	0.00064	0.0714	0.00006	<0.0001	0.007	0.00006	3.12
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-09-19 18:00	0.2	<0.0006	3.23	<0.00001	0.8	0.015	0.7	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00075	0.009	0.00193	3.21	<0.0004	0.002	0.17	0.00008	<0.0020	<0.01	0.00015	4.03
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2016-03-15	0.8	<0.006	12.1	<0.0001	4	0.121	2.9	<0.001	<0.0001	<0.004	<0.001	0.032		<0.004	0.018	0.032	0.01	1.09	0.0006	0.008	0.509	<0.00050	<0.001	<0.02	0.00059	32.5
DALG-002	Dalglish Creek	Dalglish	2014-09-23 14:30	0.687	0.0004	2.24	<0.00001	7.49	0.0354	11.7	<0.00005	<0.000004	0.00021	<0.00005	0.002		0.000089	0.0004	0.008	0.00112	0.798	0.0002	0.00159	0.158	0.00013	0.00002	0.032	0.000192	13.9
DALG-002	Dalglish Creek	Dalglish	2015-06-06 17:40	0.7	<0.0006	1.82	<0.00001	7.8	0.037	13.4	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00043	0.01	0.00086	0.24	0.0001	0.00059	0.0785	<0.00005	<0.0001	0.029	0.00003	12.5
DALG-002	Dalglish Creek	Dalglish	2015-09-18 13:45	0.8	0.0006	2.86	<0.00001	14	0.05	27.4	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00029	0.009	0.0011	0.788	<0.0002	0.0011	0.114	0.00005	<0.0010	0.031	0.00008	18.6
DALG-002	Dalglish Creek	Dalglish	2016-03-15	1.9	<0.0006	2.43	<0.00001	13.2	0.285	149	<0.0001	<0.00001	<0.0004	<0.0001	0.022		0.0014	0.0002	0.021	0.0004	0.226	<0.0002	0.0016	0.078	<0.00005	<0.001	0.04	0.00018	180
DALG-002	Dalglish Creek	Dalglish	2016-05-10	1.1	<0.0006	0.76	<0.00001	3.6	0.014	5.2	<0.0001	<0.00001	<0.0004	<0.0001	<0.01		<0.0004	0.0005	0.012	0.0006	1.77	0.0001	0.0014	0.11	0.00012	<0.0001	0.019	0.00011	5.66
DALG-002	Dalglish Creek	Dalglish	2016-06-21 17:43	0.9	<0.0006	1.31	<0.00001	11.5	0.043	19.5	<0.0001	<0.00001	<0.0004	<0.0001	<0.01		<0.0004	0.0004	0.0054	0.0007	0.203	0.00017	0.0008	0.0846	0.00007	<0.0001	0.045	0.00003	19.1
DALG-002	Dalglish Creek	Dalglish	2016-09-20 15:30	0.8	<0.002	2.39	<0.0001	16.7	0.05	30.6	<0.00050	<0.0001	<0.00050	<0.001	0.005		0.00012	<0.00050	<0.005	<0.001	0.464	0.00013	0.0008	0.0934	<0.00005	<0.0001	0.036	0.00006	21.9
DALG-002	Dalglish Creek	Dalglish	2016-09-22 14:50																										
DALG-002	Dalglish Creek	Dalglish	2017-03-07 15:00	1.6	0.0003	2.35	0.000064	18.6	0.2521	97	0.000265	0.000013	0.000387	0.0001	0.022		0.001081	0.000101	0.0206	0.0005	1.21	0.00042	0.0053	0.174	0.00029	<0.0005	0.04	0.00051	135
DALG-002	Dalglish Creek	Dalglish	2017-06-27 16:00	0.64	0.0004	1.9	<0.00001	10	0.0328	17	<0.00005	<0.00001	0.00021	<0.0001	0.004		0.0001	0.00039	0.0055	0.0011	0.4	0.00014	0.0009	0.097	0.00005	<0.0001	0.027	0.00007	13
DALG-002	Dalglish Creek	Dalglish	2017-09-21 11:05	0.66	0.0009	1.5	<0.00001	15	0.0673	32	<0.00005	<0.00001	0.00019	<0.0001	0.003		0.00013	0.0004	0.0049	0.0011	0.27	0.00014	0.0007	0.094	<0.00005	<0.0001	0.036	0.00004	24
DALG-002	Dalglish Creek	Dalglish	2018-03-21 14:00	1.7	0.0002	2.3	<0.00001	19	0.2922	120	<0.00005	0.00001	0.00008	0.0003	0.014		0.00096	0.00011	0.0162	0.0003	0.071	0.00012	0.0007	0.086	<0.00005	<0.0001	0.035	0.00008	150
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2013-08-26 15:45	1.1	<0.0006	2.35	<0.00001	17.5	0.121	35.7	<0.0001	0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00027	0.025	0.00029	0.13	<0.0002	0.0007	0.059	<0.00004	<0.001	0.057	0.00011	34.1
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-07-23 11:55	0.761	0.0003	2.31	<0.00001	9.62	0.0638	21.6	<0.00005	0.000011	0.00008	<0.00005	0.0008		0.0001	0.0003	0.023	0.00059	0.494	0.00015	0.00082	0.0616	0.0001	<0.00001	0.04	0.000161	20.5
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-09-23 11:15	0.434	0.0003	2.53	<0.00001	6.52	0.0447	13.1	<0.00005	0.000006	0.00016	<0.00005	0.0013		0.000113	0.0004	0.031	0.00096	0.474	0.00012	0.00071	0.0536	0.0001	<0.00001	0.026	0.000175	15
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-03-15 11:35	1.1	0.0003	2.81	<0.00001	8.8	0.0982	37.3	<0.00005	0.000008	0.00003	<0.00005	<0.0002		0.000052	0.0002	0.048	0.00042	0.069	0.00007	0.00103	0.0713	0.00002	<0.00001	0.024	0.000107	30.4
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-06-05 17:50	0.8	<0.0006	2.18	<0.00001	13.7	0.071	31.6	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00034	0.035	0.00044	0.302	<0.0001	0.00053	0.0596	0.00007	<0.0001	0.031	0.00014	22.8
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-09-18 18:55	0.6	<0.0006	3.32	<0.00001	10.9	0.04	23	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.0004	0.026	0.00127	0.864	<0.0002	0.0012	0.07	0.00014	<0.0010	0.018	0.00013	14.8
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-03-16	1	<0.0006	3.64	<0.00001	11.5	0.11	54.7	<0.0001	0.00001	<0.0004	<0.0001	<0.01		<0.0004	0.0002	0.077	0.0007	0.215	<0.0002	0.0008	0.098	0.00006	<0.001	0.026	0.0002	42.5
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-06-21 15:50	0.8	<0.0006	2.14	<0.00001	13.9	0.06	27.1	<0.0001	<0.00001	<0.0004	<0.0001	<0.01		<0.0004	0.0004	0.0296	0.0008	0.282	0.00011	0.0009	0.0791	0.00011	<0.0001	0.049	0.00014	19
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-09-20 9:18	0.5	<0.002	3	<0.0001	7.6	0.031	15.4	<0.00050	<0.0001	<0.00050	<0.001	0.005		0.00013	0.00066	0.034	<0.001	1.61	0.00014	0.0015	0.078	0.00013	<0.0001	0.017	0.00017	12.8
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-03-07 17:00	0.8	0.0003	3.76	0.000031	9.9	0.0936	39.9	0.000067	0.000012	0.000186	<0.0001	0.007		0.000089	0.00011	0.0583	0.0006	1.57	0.0003	0.005	0.174	<0.00025	<0.0005	0.03	0.00048	33.3
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-06-27 18:15	1.5	0.0003	2.7	<0.00001	37	0.1016	67	<0.00005	0.00002	0.00007	<0.0001	0.006		0.00005	0.00012	0.0317	0.0003	0.18	0.00009	0.0007	0.081	<0.00005	<0.0001	0.065	0.0002	34
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-09-20 17:30	0.7	0.0003	2.8	<0.00001	14	0.0591	28	<0.00005	<0.00001	0.00015	<0.0001	0.003		0.0001	0.00023	0.0336	0.0009	0.39	0.00012	0.0007	0.06	0.00011	<0.0001	0.029	0.00018	20
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2018-03-20 17:38	1.4	0.0002	2.7	<0.00001	22	0.2329	77	<0.00005	0.00002	0.00015	<0.0001	0.008		0.0003	0.00008	0.0512	0.0003	0.059	0.00019	0.0004	0.052	<0.00005	<0.0001	0.028	0.00016	81
McPL-001	McParlon Creek above confluence wi	McParlon	2013-07-29	0.3	<0.0006	2.53	<0.00001	3	0.036	1.6		<0.00001	<0.0004	<0.0001	0.015		<0.0004	0.00103	0.004	0.00156	2.57	0.0002	0.00231	0.179	0.00016	<0.0001	0.007	0.0001	7.06
McPL-001	McParlon Creek above confluence wi	McParlon	2014-07-22 16:55	0.287	0.0003	1.86	<0.00001	1.6	0.0345	0.636	<0.00005	0.000004	0.00013	<0.00005	0.0016		0.000073	0.0006	0.003	0.00146	0.507	0.00021	0.001	0.11	0.00009	0.00001	0.005	0.000048	6.44
McPL-001	McParlon Creek above confluence wi	McParlon	2014-09-21 13:10	0.443	0.0004	2.52	<0.00001	4.15	0.0366	4.97	<0.00005	<0.000004	0.00018	<0.00005	0.0019		0.000075	0.0004	0.004	0.00147	0.512	0.0002	0.00085	0.119	0.00007	0.00001	0.009	0.00006	7.93
McPL-001	McParlon Creek above confluence wi	McParlon	2015-06-05 12:45	0.4	<0.0006	1.84	<0.00001	3.7	0.025	4.7	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00049	0.005	0.00109	0.328	0.0002	0.00061	0.092	0.00005	<0.0001	0.008	0.00004	5.26
McPL-001	McParlon Creek above confluence wi	McParlon	2015-09-19 15:25	0.4	<0.0006	3.41	<0.00001	5.8	0.035	9.2	<0.0001	<0.00001	<0.0040	<0.0001	<0.010		<0.0004	0.00045	<0.010	0.00119	2.26	<0.0002	0.0016	0.173	0.00018	<0.0010	0.008	0.00013	7.99
McPL-001	McParlon Creek above confluence wi	McParlon	2016-05-10	1	<0.0006	0.86	0.00002	2.4	0.018	2.6	<0.0001	<0.00001	<0.0004	0.0001	<0.01		<0.0004	0.0006	0.0102	0.001	1.25	0.00008	0.0008	0.108	0.00007	<0.0001	0.007	0.00013	4.37
McPL-001	McParlon Creek above confluence wi	McParlon	2016-06-21 12:55	0.3	<0.0006	1.75	<0.00001	4.3	0.022	4.9	<0.0001	<0.00001	<0.0004	<0.0001	<0.01		<0.0004	0.0005	0.0024	0.0014	0.406	0.0002	0.001	0.1	0.00013	<0.0001	0.006	0.00004	6.43
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-20 13:16	0.4	<0.002	2.95	<0.0001	7.7	0.044	10.5	<0.00050	<0.0001	<0.00050	<0.001	0.004		0.00033	<0.00050	<0.005	<0.001	0.818	0.00017	0.0008	0.106	0.00011	<0.0001	0.006	0.00004	8.83
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-22 12:10																										
McPL-001	McParlon Creek above confluence wi	McParlon	2017-03-07 12:40	1.3	<0.002	6.44	<0.0001	42.8	0.24	71.3	<0.00050	<0.0001	<0.00050	0.027	0.013		0.00046	0.00056	0.049	0.002	0.23	0.00054	0.001	0.453	<0.00025	<0.0005	0.04	0.00042	68.1
McPL-001	McParlon Creek above confluence wi	McParlon	2017-06-27 12:55	0.41	0.0004	2.2	<0.00001	1.6	0.0237	1.3	<0.00005	<0.00001	0.00022	<0.0001	0.002		0.000095	0.0007	0.0033	0.0015	0.65	0.00017	0.0011	0.12	0.00007	<0.0001	0.006	0.0001	5.3
McPL-001	McParlon Creek above confluence wi	McParlon	2017-09-20 14:05	0.41	0.0004	3.1	<0.00001	3.7	0.0389	4.3	<0.00005	<0.00001	0.00023	<0.0001	0.003		0.00008	0.00042	0.0027	0.0017	0.43	0.00021	0.0009	0.11	0.00006	<0.0001	0.005	0.00005	7
McPL-001	McParlon Creek above confluence wi	McParlon	2018-03-21 12:48	2.1	**0.0022**	10	0.00002	29	0.5258	56	<0.00005	0.00009	0.00052	<0.0001	0.014		0.00204	0.00513	0.0831	0.0059	1.2	0.00071	0.0044	1.1	0.00015	<0.0001	0.024	0.0027	110

				K-D	Se-D	Si-D	Ag-D	Na-D	Sr-D	S-D	Te-D	Tl-D	Th-D	Sn-D	Ti-D	W-D	U-D	V-D	Zn-D	Zr-D	Al-T	Sb-T	As-T	Ba-T	Be-T	Bi-T	B-T	Cd-T	Ca-T
				met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met
				Potassium	Selenium,	Silicon, dis	Silver, diss	Sodium, di	Strontium,	Sulphur, D	Tellurium,	Thallium, (	Thorium, (	Tin, dissol	Titanium, (	Tungsten,	Uranium, (	Vanadium,	Zinc, disso	Zirconium,	Aluminum	Antimony,	Arsenic, to	Barium, to	Beryllium,	Bismuth, t	Boron, tot	Cadmium,	Calcium, t
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
				-	0.001	-	0.00025	-	-	-	-	0.0008	-	-	-	-	0.015	-	Hardness,t	-									
Stn.Code	**Site Name**	**Group**	**Smpl Date**																										
McPL-002	McParlon Creek headwaters	McParlon	2013-08-27 11:05	0.4	<0.0006	1.88	0.00002	3.7	0.034	2.4	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00083	0.005	0.00149	0.335	<0.0002	0.001	0.083	<0.00004	<0.0010	<0.005	0.00004	7.95
McPL-002	McParlon Creek headwaters	McParlon	2014-07-23 9:30	0.617	0.0005	0.479	<0.00001	10	0.0506	13.5	<0.00005	<0.000004	0.00008	<0.00005	0.0013		0.000052	0.0006	0.002	0.00087	0.133	0.00024	0.00089	0.122	0.00005	<0.00001	0.011	0.000026	13.4
McPL-002	McParlon Creek headwaters	McParlon	2014-09-21 16:00	0.448	0.0004	2.06	<0.00001	8.66	0.0418	13.1	<0.00005	<0.000004	0.00012	<0.00005	0.0019		0.00005	0.0003	0.003	0.00112	0.216	0.00018	0.0005	0.104	0.00004	<0.00001	0.016	0.00003	11.5
McPL-002	McParlon Creek headwaters	McParlon	2015-06-05 11:05	0.5	<0.0006	1.31	<0.00001	9.6	0.034	15.6	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00043	0.005	0.0009	0.199	0.0001	0.00044	0.101	<0.00005	<0.0001	0.011	0.00003	9.04
McPL-002	McParlon Creek headwaters	McParlon	2015-09-19 14:30	0.6	**0.0012**	2.89	<0.00001	21	0.057	34.7	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00021	0.007	0.00114	0.807	<0.0002	0.0007	0.146	0.00009	<0.0010	0.013	0.00008	16.2
McPL-002	McParlon Creek headwaters	McParlon	2016-03-15	4.6	**0.0018**	7.59	<0.00001	545	0.919	1190	<0.0001	<0.00001	0.0014	<0.0001	0.031		0.0024	0.0007	0.011	0.0024	0.099	0.0003	0.0021	0.067	0.00006	<0.001	0.038	0.0004	422
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2013-08-27 12:25	0.7	**0.0034**	1.99	0.00001	17.1	0.033	28.8	<0.0001	<0.00001	<0.0004	0.0001	<0.010		<0.0004	0.00071	0.008	0.0013	0.295	<0.0002	0.0022	0.085	<0.00004	<0.001	0.01	0.00005	15.4
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-07-22 10:20	0.761	0.0004	0.887	<0.00001	20.9	0.0398	38.2	<0.00005	<0.000004	0.00011	<0.00005	0.0021		0.000073	0.0009	0.005	0.0011	0.163	0.00018	0.00099	0.11	0.00005	<0.00001	0.019	0.000044	19.8
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-09-21 14:20	0.462	0.0004	2.4	<0.00001	12.5	0.0276	19.3	<0.00005	<0.000004	0.00017	<0.00005	0.0015		0.000116	0.0004	0.007	0.00114	0.298	0.00015	0.00054	0.0863	0.00005	<0.00001	0.017	0.000056	12.1
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-06-06 15:00	0.8	<0.0006	1.58	<0.00001	25	0.032	44.9	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00038	0.006	0.00075	0.14	0.0001	0.00042	0.0754	<0.00005	<0.0001	0.018	0.00003	17.1
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-09-18 14:51	1.1	<0.0006	2.89	0.00001	36.2	0.046	56.3	<0.0001	<0.00001	<0.0004	<0.0001	<0.010		<0.0004	0.00021	0.009	0.00127	0.398	<0.0002	0.0006	0.09	0.00004	<0.0010	0.023	0.00007	22

Notes:
Sample classes included in query: All

				Cr-T	Co-T	Cu-T	Fe-T	Pb-T	Li-T	Mg-T	Mn-T	Hg-T	Mo-T	Ni-T	P-T	K-T	Se-T	Si-T	Ag-T	Na-T	Sr-T	S-T	Te-T	Tl-T	Th-T	Sn-T	Ti-T	U-T	V-T
				met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met
				Chromium	Cobalt, tot	Copper, to	Iron, total	Lead, total	Lithium, to	Magnesiur	Manganes	Mercury, t	Molybden	Nickel, tot	Phosphoru	Potassium	Selenium,	Silicon, tot	Silver, tota	Sodium, to	Strontium,	Sulphur, T	Tellurium,	Thallium, t	Thorium, t	Tin, total	Titanium, t	Uranium, t	Vanadium
Stn.Code	Site Name	Group	Smpl Date	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
CHNC-001	Chance Creek above confluence with	Chance	2013-07-29	0.0014	0.0003	0.0056	1.02	0.0003	0.0018	2.41	0.0546	<0.00001	0.00028	0.0055	0.02	0.4	0.0004	3.46	<0.00005	2.7	0.0357			<0.00001	0.00023	<0.0001	0.0147	0.00013	0.0019
CHNC-001	Chance Creek above confluence with	Chance	2014-07-22 10:47	0.0011	0.000176	0.0055	0.902	0.00075	0.0026	3.26	0.0393	<0.00001	0.00039	0.00501	0.028	0.525	0.0005	1.8	0.00003	2.65	0.0469	3.3	<0.00005	0.000005	0.00015	<0.00005	0.0039	0.000185	0.0013
CHNC-001	Chance Creek above confluence with	Chance	2014-09-22 19:00	0.0018	0.000546	0.006	1.76	0.00053	0.00235	2.57	0.0476	<0.00001	0.00024	0.0069	0.033	0.389	0.0005	3.2	0.00002	3.06	0.0331	2.5	<0.00005	0.000012	0.00025	0.00005	0.013	0.000142	0.0023
CHNC-001	Chance Creek above confluence with	Chance	2015-03-14 17:30	0.0004	0.000892	0.0011	0.389	0.00005	0.00356	7.22	1.93	<0.000005	0.00161	0.00401	0.02	0.829	0.0003	2.6	<0.00001	13.9	0.144	8.8	<0.00005	<0.000004	0.00002	<0.00005	0.0011	0.000293	0.0006
CHNC-001	Chance Creek above confluence with	Chance	2015-06-06 11:00	0.0011	0.0002	0.0055	0.827	0.0003	0.0016	2.37	0.0466	<0.00001	0.00017	0.005		0.6	0.0003	2.32	<0.00005	3.5	0.0309			<0.00001	0.00019	<0.0001	0.0085	0.00013	0.0014
CHNC-001	Chance Creek above confluence with	Chance	2015-09-18 18:05	0.0032	0.00133	0.007	3.14	0.0012	0.004	4.78	0.109	0.00002	0.0003	0.009		0.67	0.0008	5.83	0.00003	7.36	0.046	9.7	<0.0001	0.00002	<0.0004	<0.0001	0.0382	<0.0004	0.0054
CHNC-001	Chance Creek above confluence with	Chance	2016-03-16	<0.0004	0.00033	<0.001	0.54	<0.0001	0.005	15.8	0.804	<0.00001	0.00112	0.003		1.1	<0.0006	2.79	<0.00001	12.9	0.236	35.9	<0.0001	<0.00001	<0.0004	<0.0001	0.007	0.0009	0.00019
CHNC-001	Chance Creek above confluence with	Chance	2016-06-21 11:15	0.00125	0.00023	0.0052	0.925	0.00016	0.0018	3.07	0.028	0.00002	0.00018	0.0053		0.5	0.0004	3.16	0.00002	5.02	0.029	5.2	<0.00005	<0.00001	0.00025	<0.0001	0.018	0.00012	0.00137
CHNC-001	Chance Creek above confluence with	Chance	2016-09-20 12:00	0.00218	0.00072	0.0057	1.76	0.000521	0.0038	5.3	0.082	<0.00001	0.000261	0.006		0.6	0.0008	5.6	0.000021	9.86	0.0476	12.1	<0.000050	0.000021	0.000089	<0.0001	0.042	0.000251	0.0031
CHNC-001	Chance Creek above confluence with	Chance	2017-03-07 10:40	0.0003	0.00112	0.0005	1.04	<0.00001	0.0048	13.1	1.96	<0.00001	0.00123	0.003		1.2	<0.0002	2.68	<0.00001	17.7	0.223	30.1	<0.000050	<0.00001	0.000082	<0.0001	0.013	0.000404	0.000177
CHNC-001	Chance Creek above confluence with	Chance	2017-06-27 11:30	0.00057	0.00015	0.0051	0.75	0.00027	0.0022	4.8	0.061	<0.00001	0.00039	0.0042		0.73	0.0004	1.6	<0.00001	9.6	0.05	9.4	<0.00005	<0.00001	0.00018	<0.0001	0.004	0.00015	0.00064
CHNC-001	Chance Creek above confluence with	Chance	2017-09-20 10:21	0.0016	0.00032	0.0052	1.5	0.00036	0.0021	3.1	0.035	<0.00001	0.0003	0.0059		0.69	0.0004	5.1	0.00002	3.3	0.04	3.9	<0.00005	0.00001	0.00078	<0.0001	0.042	0.00014	0.002
CHNC-001	Chance Creek above confluence with	Chance	2018-03-21 10:25	0.0054	0.0045	0.0057	6.9	0.0022	0.0069	9.8	2.7	<0.00001	0.0016	0.011		1.6	0.0008	8.4	0.00006	12	0.16	12	<0.00005	0.00005	0.00054	<0.0001	0.095	0.0005	0.011
CHNC-003	Chance Creek u/s tributary	Chance	2013-08-26 15:00	0.0018	0.00042	0.007	2.78	0.0004	0.001	3.24	0.0525	<0.00001	0.0005	0.01		0.46	0.0008	1.83	0.00003	1.71	0.045	0.9	<0.0001	<0.00001	<0.0004	<0.0001	0.0066	<0.0004	0.0026
CHNC-003	Chance Creek u/s tributary	Chance	2014-07-22 18:30	0.0015	0.000379	0.0069	1.56	0.00083	0.00121	2.09	0.0538	<0.00001	0.00044	0.00664	0.042	0.457	0.0004	1.8	0.00003	0.942	0.0341	<0.5	<0.00005	0.000004	0.00018	<0.00005	0.0055	0.000104	0.0019
CHNC-003	Chance Creek u/s tributary	Chance	2014-09-23 10:40	0.0015	0.000368	0.0061	1.18	0.00032	0.00167	1.88	0.0276	<0.00001	0.00027	0.00629	0.025	0.315	0.0003	3.1	0.00002	1.23	0.0274	0.57	<0.00005	0.000007	0.00022	<0.00005	0.006	0.000093	0.0016
CHNC-003	Chance Creek u/s tributary	Chance	2015-06-05 15:40	0.0012	0.0002	0.006	0.886	0.0002	0.0012	1.37	0.0269	<0.00001	0.00019	0.0045		0.5	0.0002	2.24	<0.00005	1.2	0.0202			<0.00001	0.00019	<0.0001	0.0074	0.00009	0.0016
CHNC-003	Chance Creek u/s tributary	Chance	2015-09-19 17:23	0.005	0.00189	0.01	4.1	0.0016	0.004	2.23	0.125	0.00002	0.0003	0.009		0.81	<0.0006	7.58	0.00005	1.32	0.027	1.2	<0.0001	0.00004	0.0005	<0.0001	0.0615	<0.0004	0.0066
CHNC-003	Chance Creek u/s tributary	Chance	2016-09-22 10:59	0.00223	0.00068	0.006	1.69	0.00051	0.0022	2.27	0.053	<0.00001	0.000259	0.0067		0.5	0.0005	5.5	0.00002	2.06	0.0267	1.7	<0.000050	0.000016	0.00036	<0.0001	0.036	0.000113	0.00298
CHNC-003	Chance Creek u/s tributary	Chance	2017-06-27 9:30	0.0011	0.00083	0.0071	1.5	0.00038	0.0011	2.6	0.17	<0.00001	0.00037	0.0073		0.66	0.0004	1.6	0.00001	2.1	0.033	1.3	<0.00005	<0.00001	0.00021	<0.0001	0.005	0.00011	0.0013
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2013-08-26 14:02	0.002	0.00061	0.007	3.97	0.0004	0.001	3.07	0.043	<0.00001	0.0005	0.013		0.39	0.0007	2.52	0.00003	1.06	0.03	0.7	<0.0001	<0.00001	<0.0004	<0.0001	0.0052	<0.0004	0.0029
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-07-22 18:50	0.002	0.00111	0.007	3.16	0.00062	0.00129	2.45	0.119	<0.00001	0.00062	0.00971	0.085	0.505	0.0005	1.7	0.00005	0.748	0.0256	<0.5	<0.00005	0.000005	0.00022	<0.00005	0.0099	0.000109	0.0034
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-09-21 15:10	0.0019	0.000922	0.0063	1.88	0.00058	0.00214	1.74	0.0613	<0.00001	0.00021	0.00799	0.034	0.274	0.0004	3.4	0.00002	0.859	0.0183	<0.5	<0.00005	0.000009	0.00027	<0.00005	0.0084	0.000105	0.0024
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-06-05 16:10	0.0013	0.0003	0.005	1.27	0.0003	0.0015	1.33	0.0231	<0.00001	0.00019	0.0052		0.5	0.0002	2.62	<0.00005	0.8	0.0131			<0.00001	0.0002	<0.0001	0.0112	0.00008	0.0021
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-09-19 18:00	0.007	0.00244	0.01	4.4	0.002	0.005	2.06	0.124	0.00002	0.0003	0.01		0.66	<0.001	7.21	0.00006	0.8	0.02	0.6	<0.0002	0.00006	<0.0008	<0.0002	0.0581	<0.0008	0.011
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2016-03-15	0.0036	0.0282	0.017	33.6	0.0016	<0.005	14.6	4.58	0.00002	0.00149	0.048		1	0.002	12.4	0.00016	4.25	0.125	3	<0.0005	<0.0001	0.0017	<0.001	0.03	0.0005	0.0177
DALG-002	Dalglish Creek	Dalglish	2014-09-23 14:30	0.0019	0.00343	0.0074	4.14	0.00174	0.00573	5.94	0.298	<0.00001	0.00026	0.0115	0.11	0.844	0.0006	2.9	0.00003	7.33	0.0414	11	<0.00005	0.00002	0.00046	<0.00005	0.012	0.00028	0.0047
DALG-002	Dalglish Creek	Dalglish	2015-06-06 17:40	0.0009	0.0004	0.0037	0.844	0.0002	0.0041	5.1	0.0172	<0.00001	0.00024	0.0067		0.9	0.0003	2.24	<0.00005	7.8	0.0367			<0.00001	0.00017	<0.0001	0.0076	0.00013	0.0012
DALG-002	Dalglish Creek	Dalglish	2015-09-18 13:45	0.0017	0.00162	0.005	2.19	0.0012	0.008	10.4	0.119	<0.00001	0.0003	0.009		0.92	0.0006	4	0.00005	13.1	0.051	25.7	<0.0001	0.00003	0.0008	<0.0001	0.0265	<0.0004	0.0032
DALG-002	Dalglish Creek	Dalglish	2016-03-15	0.0005	0.0167	0.001	18.2	0.0002	0.008	24.6	4.87	<0.00001	0.00072	0.046		2.1	<0.0006	2.9	0.00001	13.6	0.298	149	<0.0001	0.00002	0.0005	<0.0001	0.015	0.0017	0.00192
DALG-002	Dalglish Creek	Dalglish	2016-05-10	0.00338	0.00247	0.0055	2.92	0.00124	0.004	2.78	0.195	<0.00001	0.00022	0.0075		1.7	0.0006	5.55	0.00002	3.4	0.0179	5.2	<0.00005	0.00003	0.00039	<0.0001	0.086	0.00023	0.00659
DALG-002	Dalglish Creek	Dalglish	2016-06-21 17:43	0.0009	0.00043	0.0039	1.16	0.0001	0.0066	7.68	0.027	0.00002	0.00039	0.0063		0.9	0.0006	1.66	0.00001	11.9	0.0557	20.3	<0.00005	<0.00001	0.00017	<0.0001	0.01	0.00017	0.00113
DALG-002	Dalglish Creek	Dalglish	2016-09-20 15:30	0.00132	0.00107	0.0032	1.42	0.000265	0.0089	12.6	0.108	<0.00001	0.000254	0.0075		0.9	0.0007	3.66	0.000011	18.2	0.0538	33.7	<0.000050	0.00001	<0.000050	<0.0001	0.024	0.00017	0.00189
DALG-002	Dalglish Creek	Dalglish	2016-09-22 14:50																										
DALG-002	Dalglish Creek	Dalglish	2017-03-07 15:00	0.00186	0.0214	0.005	63.4	0.00158	0.0095	19.9	4.15	<0.00001	0.00166	0.059		2	0.001	4.95	<0.00005	19.5	0.264	104	<0.00025	<0.00005	0.000768	<0.0005	0.069	0.00174	0.0077
DALG-002	Dalglish Creek	Dalglish	2017-06-27 16:00	0.00076	0.00091	0.0042	1.4	0.00061	0.0047	6.6	0.063	<0.00001	0.00021	0.0077		0.69	0.0005	2.4	<0.00001	10	0.036	17	<0.00005	<0.00001	0.00025	<0.0001	0.012	0.00014	0.0015
DALG-002	Dalglish Creek	Dalglish	2017-09-21 11:05	0.00069	0.00064	0.0029	1.5	0.00018	0.0084	14	0.066	<0.00001	0.0003	0.0078		0.96	0.0009	2.8	<0.00001	19	0.073	36	<0.00005	<0.00001	0.00035	0.0001	0.017	0.00015	0.0011
DALG-002	Dalglish Creek	Dalglish	2018-03-21 14:00	0.00014	0.015	0.0003	7.7	0.00007	0.0085	25	4.5	<0.00001	0.00055	0.033		1.8	0.0003	2.4	<0.00001	20	0.31	120	<0.00005	<0.00001	0.00011	<0.0001	0.019	0.0011	0.00059
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2013-08-26 15:45	0.0006	0.00556	0.003	3.47	<0.0001	0.008	11.6	0.25	<0.00001	0.0002	0.026		1.08	<0.0006	2.44	<0.00001	17.2	0.121	35	<0.0001	<0.00001	<0.0004	<0.0001	0.004	<0.0004	0.0006
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-07-23 11:55	0.0012	0.00417	0.0048	2.51	0.00057	0.00763	7.58	0.152	<0.00001	0.00021	0.0229	0.025	0.887	0.0004	2.8	0.00002	10.1	0.0701	22	<0.00005	0.000017	0.00015	<0.00005	0.0106	0.000152	0.0018
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-09-23 11:15	0.0012	0.00406	0.0046	2.12	0.00028	0.00597	5.21	0.122	<0.00001	0.00018	0.0184	0.02	0.49	0.0004	2.8	0.00001	6.55	0.0476	13	<0.00005	0.00001	0.00021	<0.00005	0.0054	0.000141	0.0014
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-03-15 11:35	0.0006	0.0172	0.0019	18.9	<0.00005	0.00606	12.2	0.773	<0.000005	0.00019	0.0246	0.014	1.15	0.0004	2.9	<0.00001	9.55	0.107	37	<0.00005	0.000011	0.00009	<0.00005	0.0003	0.000079	0.0005
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-06-05 17:50	0.0007	0.0041	0.0035	1.61	0.0002	0.0067	8.99	0.153	<0.00001	0.0001	0.0214		1	0.0003	2.41	<0.00005	13.9	0.0698			0.00001	0.0001	<0.0001	0.0036	0.00012	0.0008
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-09-18 18:55	0.0018	0.00364	0.005	3.25	0.0007	0.007	7.69	0.136	<0.00001	0.0003	0.015		0.79	<0.0006	5.11	0.00002	10.5	0.04	21.1	<0.0001	0.00003	<0.0004	<0.0001	0.0362	<0.0004	0.0032
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-03-16	0.0007	0.0152	0.003	9.11	0.0002	0.006	19.5	0.943	<0.00001	<0.00010	0.032		1.2	<0.0006	3.9	0.00001	12.1	0.117	57.3	<0.0001	0.00002	<0.0004	<0.0001	0.006	<0.0004	0.00091
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-06-21 15:50	0.00099	0.00389	0.0049	2.83	0.00016	0.0089	8.76	0.136	0.00001	0.00018	0.0177		0.9	0.0006	2.53	0.00001	14.7	0.0718	28.4	<0.00005	<0.00001	0.00015	<0.0001	0.009	0.00015	0.00126
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-09-20 9:18	0.00336	0.00421	0.0055	3.18	0.000762	0.0076	6.29	0.145	<0.00001	0.000249	0.0167		0.8	0.0006	7.13	0.000023	8.13	0.035	16.6	<0.000050	0.000035	<0.000050	<0.0001	0.068	0.000212	0.00627
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-03-07 17:00	0.00246	0.0128	0.017	57.1	0.00148	0.0057	15.6	0.78	<0.00001	0.00069	0.037		1	0.001	6.5	<0.00005	10.7	0.101	40	<0.00025	0.00005	0.000974	<0.0005	0.04	0.000584	0.00693
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-06-27 18:15	0.00023	0.0073	0.0031	4.1	0.00018	0.0086	17	0.36	<0.00001	0.00009	0.029		1.5	0.0004	2.8	<0.00001	37	0.11	68	<0.00005	0.00002	0.00015	<0.0001	0.008	0.00008	0.00022
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-09-20 17:30	0.00056	0.0054	0.0033	3.3	0.0001	0.008	9.9	0.19	<0.00001	0.00017	0.024		0.83	0.0004	3.3	0.00001	14	0.067	29	<0.00005	0.00001	0.00043	<0.0001	0.008	0.00013	0.00067
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2018-03-20 17:38	0.00007	0.012	0.0009	9.2	0.00039	0.012	23	0.68	<0.00001	0.0004	0.03		1.5	0.0003	2.5	<0.00001	23	0.26	82	<0.00005	0.00002	0.00017	<0.0001	0.01	0.00036	<0.00005
McPL-001	McParlon Creek above confluence wi	McParlon	2013-07-29	0.0049	0.0017	0.0093	5.25	0.0022	0.0034	3.18	0.078	0.00002	0.0006	0.0092	0.086	0.6	0.0008	6.05	0.00008	3.1	0.0408			0.00005	0.00052	<0.0001	0.0309	0.00023	0.0087
McPL-001	McParlon Creek above confluence wi	McParlon	2014-07-22 16:55	0.0015	0.000388	0.006	1.55	0.0004	0.00138	2.36	0.0406	<0.00001	0.00035	0.00612	0.039	0.383	0.0004	2.5	0.00003	1.74	0.0378	1.1	<0.00005	0.000008	0.00017	<0.00005	0.0091	0.000105	0.002
McPL-001	McParlon Creek above confluence wi	McParlon	2014-09-21 13:10	0.0016	0.000454	0.0058	1.7	0.00044	0.00179	3.42	0.0462	<0.00001	0.00031	0.00617	0.034	0.512	0.0005	3	0.00003	4.14	0.0392	4.6	<0.00005	0.000008	0.00022	<0.00005	0.0087	0.000102	0.002
McPL-001	McParlon Creek above confluence wi	McParlon	2015-06-05 12:45	0.001	0.0002	0.0051	0.788	0.0002	0.0012	2.42	0.0162	<0.00001	0.00019	0.0046		0.6	0.0003	2.32	<0.00005	3.8	0.0251			<0.00001	0.00015	<0.0001	0.0081	0.00008	0.0013
McPL-001	McParlon Creek above confluence wi	McParlon	2015-09-19 15:25	0.0049	0.0019	0.009	4.5	0.0019	0.004	4.46	0.147	0.00001	0.0003	0.009		0.75	0.0007	7.27	0.00004	5.46	0.038	8.2	<0.0001	0.00003	<0.0004	<0.0001	0.0663	<0.0004	0.0073
McPL-001	McParlon Creek above confluence wi	McParlon	2016-05-10	0.0022	0.00171	0.0059	1.77	0.00067	0.0018	2.04	0.288	0.00001	0.00017	0.0062		1.2	0.0004	3.58	0.00001	2.3	0.0192	2.6	<0.00005	0.00002	0.00034	<0.0001	0.052	0.00016	0.00322
McPL-001	McParlon Creek above confluence wi	McParlon	2016-06-21 12:55	0.00151	0.00025	0.0067	1.29	0.00023	0.0017	3.14	0.026	0.00002	0.00031	0.0051		0.5	0.0006	2.42	0.00002	4.57	0.0337	5.3	<0.00005	<0.00001	0.00022	<0.0001	0.012	0.00012	0.00188
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-20 13:16	0.00193	0.00056	0.0054	1.54	0.000399	0.002	5.01	0.067	<0.00001	0.000245	0.0056		0.5	0.0007	4.97	0.000024	8.01	0.0354	11	<0.000050	0.000017	0.000127	0.0014	0.037	0.000115	0.00245
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-22 12:10																										
McPL-001	McParlon Creek above confluence wi	McParlon	2017-03-07 12:40	0.0013	0.00075	0.013	1.41	0.00017	0.0073	33.6	0.72	0.00001	0.00171	0.014		2	0.001	7.2	<0.00005	49.5	0.256	79	<0.00025	<0.00005	0.00035	<0.0005	0.02	0.00054	0.000879
McPL-001	McParlon Creek above confluence wi	McParlon	2017-06-27 12:55	0.0015	0.00077	0.0071	2.2	0.001	0.0013	2.3	0.099	<0.00001	0.00026	0.006		0.52	0.0004	2.9	0.00001	1.6	0.028	1.3	<0.00005	<0.00001	0.00025	0.0001	0.015	0.00016	0.0029
McPL-001	McParlon Creek above confluence wi	McParlon	2017-09-20 14:05	0.0013	0.00034	0.0051	1.5	0.00034	0.0015	3.5	0.043	<0.00001	0.00031	0.0058		0.56	0.0004	4.2	0.00002	3.7	0.043	4.3	<0.00005	0.00001	0.00052	<0.0001	0.021	0.0001	0.0016
McPL-001	McParlon Creek above confluence wi	McParlon	2018-03-21 12:48	0.0038	0.039	0.011	4.9	0.0011	0.0062	56	21	<0.00001	0.0025	0.084		2.4	0.0024	12	0.00005	29	0.56	57	<0.00005	0.00012	0.00062	<0.0001	0.054	0.0022	0.0082

				Cr-T	Co-T	Cu-T	Fe-T	Pb-T	Li-T	Mg-T	Mn-T	Hg-T	Mo-T	Ni-T	P-T	K-T	Se-T	Si-T	Ag-T	Na-T	Sr-T	S-T	Te-T	Tl-T	Th-T	Sn-T	Ti-T	U-T	V-T
				met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met	met
				Chromium	Cobalt, tot	Copper, to	Iron, total	Lead, total	Lithium, tc	Magnesiur	Manganes	Mercury, t	Molybden	Nickel, tot	Phosphoru	Potassium	Selenium,	Silicon, tot	Silver, tota	Sodium, tc	Strontium,	Sulphur, T	Tellurium,	Thallium, t	Thorium, t	Tin, total	Titanium, t	Uranium, t	Vanadium
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Stn.Code	**Site Name**	**Group**	**Smpl Date**																										
McPL-002	McParlon Creek headwaters	McParlon	2013-08-27 11:05	0.0015	0.00023	0.005	2.04	0.0003	0.001	4.37	0.0168	<0.00001	0.0004	0.007		0.49	<0.0006	2.26	0.00003	3.56	0.035	1.9	<0.0001	<0.00001	<0.0004	<0.0001	0.0079	<0.0004	0.002
McPL-002	McParlon Creek headwaters	McParlon	2014-07-23 9:30	0.001	0.000172	0.0053	0.966	0.00017	0.00102	7.26	0.0198	<0.00001	0.00048	0.00615	0.037	0.659	0.0005	0.66	0.00002	10.5	0.0539	14	<0.00005	<0.000004	0.00009	<0.00005	0.0041	0.000067	0.0022
McPL-002	McParlon Creek headwaters	McParlon	2014-09-21 16:00	0.001	0.000176	0.0047	0.667	0.00016	0.00186	5.88	0.0165	<0.00001	0.00021	0.00514	0.019	0.505	0.0005	2.3	0.00002	9.05	0.0456	14	<0.00005	<0.000004	0.00012	<0.00005	0.0042	0.000059	0.001
McPL-002	McParlon Creek headwaters	McParlon	2015-06-05 11:05	0.0008	0.0001	0.0042	0.44	0.0001	0.0012	4.99	0.0128	<0.00001	0.00014	0.004		0.6	0.0002	1.68	<0.00005	9.7	0.034			<0.00001	0.00011	<0.0001	0.0058	0.00005	0.0009
McPL-002	McParlon Creek headwaters	McParlon	2015-09-19 14:30	0.0014	0.00086	0.005	1.54	0.0006	0.003	10.5	0.105	<0.00001	0.0003	0.007		0.76	0.0009	4.27	0.00003	19.2	0.056	32.1	<0.0001	0.00002	<0.0004	<0.0001	0.0312	<0.0004	0.0022
McPL-002	McParlon Creek headwaters	McParlon	2016-03-15	0.0004	0.0721	0.003	26.1	<0.0001	0.018	318	29.1	<0.00001	0.00099	0.046		4.8	0.0014	7.69	<0.00001	539	0.964	1140	<0.0001	<0.00001	0.0014	<0.0001	0.016	0.0025	0.00119
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2013-08-27 12:25	0.0014	0.0005	0.006	2.28	0.0004	0.009	12.4	0.0456	<0.00001	0.0002	0.008		0.67	0.0026	2.56	0.00001	16.1	0.035	27.8	<0.0001	<0.00001	<0.0004	<0.0001	0.0114	<0.0004	0.0018
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-07-22 10:20	0.0012	0.000391	0.0042	1.61	0.00019	0.0105	16.3	0.0491	<0.00001	0.00032	0.00749	0.05	0.826	0.0004	1	0.00002	22.1	0.0421	40	<0.00005	<0.000004	0.00014	<0.00005	0.0037	0.000095	0.0025
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-09-21 14:20	0.0012	0.000629	0.0039	0.988	0.00017	0.00721	8.74	0.0502	<0.00001	0.00014	0.0066	0.021	0.512	0.0005	2.7	0.00002	13	0.0295	20	<0.00005	<0.000004	0.00018	<0.00005	0.0051	0.000136	0.0011
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-06-06 15:00	0.0007	0.0003	0.0029	0.568	<0.0001	0.0127	15.8	0.0283	<0.00001	0.00011	0.0045		0.9	0.0003	1.74	<0.00005	25.4	0.0313			<0.00001	0.00011	<0.0001	0.0023	0.00014	0.0008
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-09-18 14:51	0.001	0.00138	0.004	1.38	0.0002	0.017	19.6	0.132	<0.00001	0.0002	0.008		1.09	<0.0006	3.45	0.00001	33.9	0.046	53.6	<0.0001	<0.00001	<0.0004	<0.0001	0.0161	<0.0004	0.0011

Notes:
Sample classes included in query: All

				Zn-T	Zr-T	C-DOC	C-TIC	C-TOC	C-DIC	VH	VPH	sum range	sum range	C12H18O2	C12H20O2	C12H22O2	C12H24O2	C13H20O2	C13H22O2	C13H24O2	C13H26O2	C14H20O2	C14H22O2	C14H24O2	C14H26O2	C14H28O2	C15H18O2	C15H20O2	C15H22O2
										HC	HC	C12 to C16	C19 to C32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				met	met	org	org	org	org	org	org			org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org
				Zinc, total	Zirconium,	Carbon, Di	Carbon, Tc	Carbon, Tc	Carbon, Di	Volatile Hy	Volatile Pe	EPHw10-16	EPHw19-32	C12H18O2	C12H20O2	C12H22O2	C12H24O2	C13H20O2	C13H22O2	C13H24O2	C13H26O2	C14H20O2	C14H22O2	C14H24O2	C14H26O2	C14H28O2	C15H18O2	C15H20O2	C15H22O2
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Stn.Code	**Site Name**	**Group**	**Smpl Date**																										
CHNC-001	Chance Creek above confluence with	Chance	2013-07-29	0.0036	0.0016	26.1			3.4			3921.5	863.58	41.8	57.6	95.6	305	21.4	58.6	97.2	449	31.3	46.2	25	71.8	317	93.7	24.6	66.9
CHNC-001	Chance Creek above confluence with	Chance	2014-07-22 10:47	0.002	0.0013	50.9			5.8			817.9	506.3	54.6	26.4	<15.6	<15.6	24.3	25.1	<15.6	35.1	45.8	41.1	21.2	<15.6	<15.6	<15.6	24.9	100
CHNC-001	Chance Creek above confluence with	Chance	2014-09-22 19:00	0.008	0.0014	22.5	2.3	24.3	2.3	<0.1	<0.1	1157.37	282.13	59.4	36.9	<5.01	<5.01	32.3	27.4	<5.01	35	53	48.2	31.2	<5.01	<5.01	17.8	55.4	209
CHNC-001	Chance Creek above confluence with	Chance	2015-03-14 17:30	0.005	0.0005	18.2	29.3	19.4	29.3	<0.1	<0.1	1891.9	554.1	68.6	70.7	<30.7	43.2	70.4	94.9	35.5	56	52.5	97.7	106	<25	<15.2	19	58.5	137
CHNC-001	Chance Creek above confluence with	Chance	2015-06-06 11:00	0.0048	0.0014	24.1	3.6	23	3.2	<0.05	<0.05	0	0																
CHNC-001	Chance Creek above confluence with	Chance	2015-09-18 18:05	0.013	0.0016	25.4	4.7	24.4	4.4	<0.05	<0.05	0	0																
CHNC-001	Chance Creek above confluence with	Chance	2016-03-16	0.003	0.0005	9.6	46	10.4	45.2	<0.05	<0.05	0	0																
CHNC-001	Chance Creek above confluence with	Chance	2016-06-21 11:15	0.0042	0.002	24.6	2.7	25.1	2.5	<0.05	<0.05	0	0																
CHNC-001	Chance Creek above confluence with	Chance	2016-09-20 12:00	0.0109	0.0017	22.8	5.1	24.4	4.9	<0.05	<0.05	0	0																
CHNC-001	Chance Creek above confluence with	Chance	2017-03-07 10:40	0.0022	0.0004	9.3	48	9.7	48	<50	<50	0	0																
CHNC-001	Chance Creek above confluence with	Chance	2017-06-27 11:30	0.0019	0.0015	21.9	9.3	23.3	8.7	<0.05	<0.05	0	0																
CHNC-001	Chance Creek above confluence with	Chance	2017-09-20 10:21	0.0048	0.0025	22.3	3.4	22.8	3	<0.05	<0.05	0	0																
CHNC-001	Chance Creek above confluence with	Chance	2018-03-21 10:25	0.033	0.0012	18.8	30.1	19.8	29.4	<0.05	<0.05	0	0																
CHNC-003	Chance Creek u/s tributary	Chance	2013-08-26 15:00	0.008	0.0014	32			4.5			1256.2	190.2	106	60.5	8.8	<5.02	38.1	30.2	<5.02	<5.02	61.8	64.2	28.8	<5.02	<5.02	12	60	160
CHNC-003	Chance Creek u/s tributary	Chance	2014-07-22 18:30	0.004	0.0016	61.8			2.4			821.6	238	55	21.5	<15.7	<15.7	21.6	<24.3	<15.7	<24.9	46	43.7	18.1	<15.7	<15.7	<15.7	39.1	159
CHNC-003	Chance Creek u/s tributary	Chance	2014-09-23 10:40	0.007	0.0016	22.7	1.4	23.8	1.3	<0.1	<0.1	2601.9	636.02	134	68.7	<5.13	<5.13	80.6	64.2	<5.13	<5.13	157	114	65.5	<5.13	<5.13	32.4	152	559
CHNC-003	Chance Creek u/s tributary	Chance	2015-06-05 15:40	0.0066	0.0012	23.1	1.7	23.2	1.3	<0.05	<0.05	0	0																
CHNC-003	Chance Creek u/s tributary	Chance	2015-09-19 17:23	0.02	0.0014	28.5	1.8	29.6	1.4	<0.05	<0.05	0	0																
CHNC-003	Chance Creek u/s tributary	Chance	2016-09-22 10:59	0.0103	0.0017	24.9	2.4	24.9	2.2	<0.05	<0.05	0	0																
CHNC-003	Chance Creek u/s tributary	Chance	2017-06-27 9:30	0.0063	0.002	24.6	5.9	27.3	5	<0.05	<0.05	0	0																
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2013-08-26 14:02	0.009	0.0016	34.5			3.6			1566.5	935.44	157	83	27	<5.3	63.1	55.6	17.7	19.4	81.9	74.2	46.1	<5.3	<5.3	12.7	84.4	280
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-07-22 18:50	0.008	0.0014	66.3			1.4			1123.6	314.6	82.1	45.8	<15.6	<15.6	42.6	39.4	<15.6	<15.6	81.4	88.4	<24.6	<15.6	<15.6	<15.6	59.1	164
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-09-21 15:10	0.011	0.0014	23.8	0.7	24.3	0.6	<0.1	<0.1	1296.1	243.62	65.8	41.9	<4.93	<4.93	34.9	40.3	<13.6	34.2	90.4	42.5	39.1	<8.77	<4.93	17.3	62	217
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-06-05 16:10	0.0077	0.0011	22	1.5	21.3	1	<0.05	<0.05	0	0																
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-09-19 18:00	0.026	0.001	29	1.3	29.1	1	<0.05	<0.05	0	0																
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2016-03-15	0.047	0.009	119	25	120	19.8	<0.05	<0.05	0	0																
DALG-002	Dalglish Creek	Dalglish	2014-09-23 14:30	0.024	0.0014	21.3	4.2	22.1	3.8	<0.1	<0.1	2663.1	579.4	61.8	96.8	48.6	<5.16	76.1	175	46.6	28.7	57.5	133	167	27.4	<5.16	49.2	107	349
DALG-002	Dalglish Creek	Dalglish	2015-06-06 17:40	0.0109	0.001	18.6	4.4	18.6	4.2	<0.05	<0.05	0	0																
DALG-002	Dalglish Creek	Dalglish	2015-09-18 13:45	0.015	0.0011	20.6	6	21.9	5.7	<0.05	<0.05	0	0																
DALG-002	Dalglish Creek	Dalglish	2016-03-15	0.034	0.001	11	34	17.4	33.1	<0.05	<0.05	0	0																
DALG-002	Dalglish Creek	Dalglish	2016-05-10	0.0214	0.0013	17.9	2	24.4	1.6	<0.05	<0.05	0	0																
DALG-002	Dalglish Creek	Dalglish	2016-06-21 17:43	0.009	0.0009	18.1	6.6	18.8	6.1	<0.05	<0.05	0	0																
DALG-002	Dalglish Creek	Dalglish	2016-09-20 15:30	0.0102	0.001	19.9	6.8	21	6.4	<0.05	<0.05	0	0																
DALG-002	Dalglish Creek	Dalglish	2016-09-22 14:50									0	0																
DALG-002	Dalglish Creek	Dalglish	2017-03-07 15:00	0.0914	0.002	12.3	34.2	24.8	33.7	<50	<50	0	0																
DALG-002	Dalglish Creek	Dalglish	2017-06-27 16:00	0.0098	0.0017	21.8	5	23.3	4	<0.05	<0.05	0	0																
DALG-002	Dalglish Creek	Dalglish	2017-09-21 11:05	0.0074	0.0012	18.9	8.2	19.5	8.2	<0.05	<0.05	0	0																
DALG-002	Dalglish Creek	Dalglish	2018-03-21 14:00	0.02	0.0003	9.3	33	12.4	28.4	<0.05	<0.05	0	0																
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2013-08-26 15:45	0.035	0.0003	13.2			12			1695.27	292.85	58.7	106	49.9	<4.94	66.5	83.8	30	23.7	47.9	90	102	23.7	<4.94	20.7	53.3	88.2
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-07-23 11:55	0.036	0.00081	35.4			4.9			1291.3	226.85	36.5	59.9	27.7	<5.14	32.6	63.5	15.8	33.7	34.6	53.6	59.5	21.5	<5.14	16.8	34	81.5
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-09-23 11:15	0.038	0.00093	17.6	3.1	18.5	2.9	<0.1	<0.1	3754.1	756.3	105	183	83.6	<4.91	116	206	77.7	54.9	112	184	237	47.9	<4.91	41	120	330
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-03-15 11:35	0.05	0.00048	13.2	4.9	13.8	4.7	<0.1	<0.1	2029.06	135.59	104	167	56.8	33.8	105	119	31.2	<5.18	102	139	111	27.2	<5.18	31.2	72	137
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-06-05 17:50	0.0376	0.0005	13.3	4.5	13.3	4.2	<0.05	<0.05	0	0																
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-09-18 18:55	0.029	0.0011	21.2	3.8	22.2	3.4	<0.05	<0.05	0	0																
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-03-16	0.075	0.0008	11.7	12	15.9	7.8	<0.05	<0.05	0	0																
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-06-21 15:50	0.0424	0.0008	14.5	3.9	15.9	3.3	<0.05	<0.05	0	0																
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-09-20 9:18	0.0451	0.002	20.2	2.8	22.5	2.4	<0.05	<0.05	0	0																
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-03-07 17:00	0.101	0.002	14.4	11.8	28.2	9.9	<50	<50	0	0																
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-06-27 18:15	0.045	0.0004	10.7	4.9	11.9	4	<0.05	<0.05	0	0																
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-09-20 17:30	0.043	0.0012	13.8	5.2	15	5.1	<0.05	<0.05	0	0																
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2018-03-20 17:38	0.058	0.0003	5.1	17.3	7	17.6	<0.05	<0.05	0	0																
McPL-001	McParlon Creek above confluence wi	McParlon	2013-07-29	0.0165	0.0015	26.8			3			2109.7	482.06	46.9	28.5	20.6	78.1	18.3	31.6	18.8	111	21.2	26.1	14.1	14.8	84.3	17.8	34.5	143
McPL-001	McParlon Creek above confluence wi	McParlon	2014-07-22 16:55	0.005	0.0014	12.5			2.5			1342	563.6	89.3	39.2	<15.1	<15.1	34	29.7	<15.1	34.1	57.2	62	26.8	<15.1	<15.1	17.5	54	306
McPL-001	McParlon Creek above confluence wi	McParlon	2014-09-21 13:10	0.006	0.0014	21.5	2.4	21.6	2.6	<0.1	<0.1	1687.6	298.46	85	41.3	<5.12	<5.12	47.5	46	<5.12	37.7	62.1	70.6	43.1	<5.12	<5.12	26	86.1	419
McPL-001	McParlon Creek above confluence wi	McParlon	2015-06-05 12:45	0.0042	0.0011	20.5	1.9	20.3	1.6	<0.05	<0.05	0	0																
McPL-001	McParlon Creek above confluence wi	McParlon	2015-09-19 15:25	0.018	0.0019	25.6	2.6	25.4	3.6	<0.05	<0.05	0	0																
McPL-001	McParlon Creek above confluence wi	McParlon	2016-05-10	0.013	0.0011	26.4	1.6	32.3	1.1	<0.05	<0.05	0	0																
McPL-001	McParlon Creek above confluence wi	McParlon	2016-06-21 12:55	0.0042	0.0016	22.6	2.4	22.8	1.8	<0.05	<0.05	0	0																
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-20 13:16	0.0069	0.0018	22.3	3	24.1	2.8	<0.05	<0.05	0	0																
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-22 12:10									0	0																
McPL-001	McParlon Creek above confluence wi	McParlon	2017-03-07 12:40	0.019	0.003	46.5	32.9	46.5	31.3	<50	<50	0	0																
McPL-001	McParlon Creek above confluence wi	McParlon	2017-06-27 12:55	0.0081	0.0025	25.9	2.6	28.5	1.2	<0.05	<0.05	0	0																
McPL-001	McParlon Creek above confluence wi	McParlon	2017-09-20 14:05	0.0046	0.0021	22.9	3.5	23.1	2.9	<0.05	<0.05	0	0																
McPL-001	McParlon Creek above confluence wi	McParlon	2018-03-21 12:48	0.13	0.0055	89	90	102	80	<0.05	<0.05	0	0																

				Zn-T	Zr-T	C-DOC	C-TIC	C-TOC	C-DIC	VH	VPH	sum range	sum range	C12H18O2	C12H20O2	C12H22O2	C12H24O2	C13H20O2	C13H22O2	C13H24O2	C13H26O2	C14H20O2	C14H22O2	C14H24O2	C14H26O2	C14H28O2	C15H18O2	C15H20O2	C15H22O2
										HC	HC	C12 to C16	C19 to C32	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				met	met	org	org	org	org	org	org			org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org
				Zinc, total	Zirconium,	Carbon, Di	Carbon, Tc	Carbon, Tc	Carbon, Di	Volatile Hy	Volatile Pe	EPHw10-16	EPHw19-32	C12H18O2	C12H20O2	C12H22O2	C12H24O2	C13H20O2	C13H22O2	C13H24O2	C13H26O2	C14H20O2	C14H22O2	C14H24O2	C14H26O2	C14H28O2	C15H18O2	C15H20O2	C15H22O2
				mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L			ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Stn.Code	**Site Name**	**Group**	**Smpl Date**																										
McPL-002	McParlon Creek headwaters	McParlon	2013-08-27 11:05	0.005	0.0012	29.5			6			959.92	159.39	87.7	33.1	<5.05	<5.05	27.2	28.8	<5.05	16.9	31	43.4	<21	<5.05	<5.05	6.72	58.1	218
McPL-002	McParlon Creek headwaters	McParlon	2014-07-23 9:30	0.002	0.00097	54.9			6.2			1685.4	915.8	104	25.7	<15.1	<15.1	<28.3	40.4	<15.1	43.3	40.5	56.1	32.6	<15.1	<15.1	19.2	77.6	249
McPL-002	McParlon Creek headwaters	McParlon	2014-09-21 16:00	0.004	0.001	19.3	2.7	21.5	2.7	<0.1	<0.1	1041.2	289.04	52.1	24.5	<5.53	<5.53	27.4	29	<5.53	36.2	60.4	34.9	17.4	<5.53	<5.53	15.4	53.4	255
McPL-002	McParlon Creek headwaters	McParlon	2015-06-05 11:05	0.0045	0.0009	17.7	2	17.6	1.8	<0.05	<0.05	0	0																
McPL-002	McParlon Creek headwaters	McParlon	2015-09-19 14:30	0.01	0.0009	22.2	4.1	21.9	3.5	<0.05	<0.05	0	0																
McPL-002	McParlon Creek headwaters	McParlon	2016-03-15	0.012	0.0029	49.2	58	59.9	53.4	<0.05	<0.05	0	0																
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2013-08-27 12:25	0.013	0.0014	26.4			4.7			1949.03	142.18	110	138	50.8	<4.91	79.7	134	28.4	15.5	52.1	131	128	<14.1	<4.91	25.2	92.6	246
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-07-22 10:20	0.004	0.0012	56.8			5.3			1735.9	892.5	78.3	41.5	<26.4	<15.8	38	73.8	20.5	<19	48.5	81.9	78.2	<15.8	<15.8	22.5	70.5	157
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-09-21 14:20	0.008	0.0011	20.2	2.5	20.5	2.3	<0.1	<0.1	2606.6	297.7	88.5	148	73.7	<5.32	111	188	57.6	<5.32	95.5	178	186	<21.4	<5.32	23.7	107	332
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-06-06 15:00	0.0062	0.0007	16.8	3.6	16.6	3.3	<0.05	<0.05	0	0																
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-09-18 14:51	0.01	0.0011	21.9	7.9	22.3	7.4	<0.05	<0.05	0	0																

Notes:
Sample classes included in query: All

				C15H24O2	C15H26O2	C15H28O2	C15H30O2	C16H20O2	C16H22O2	C16H24O2	C16H26O2	C16H28O2	C16H30O2	C16H32O2	C17H22O2	C17H24O2	C17H26O2	C17H28O2	C17H30O2	C17H32O2	C17H34O2	C18H24O2	C18H26O2	C18H28O2	C18H30O2	C18H32O2	C18H34O2	C18H36O2	C19H26O2
				NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org
				C15H24O2	C15H26O2	C15H28O2	C15H30O2	C16H20O2	C16H22O2	C16H24O2	C16H26O2	C16H28O2	C16H30O2	C16H32O2	C17H22O2	C17H24O2	C17H26O2	C17H28O2	C17H30O2	C17H32O2	C17H34O2	C18H24O2	C18H26O2	C18H28O2	C18H30O2	C18H32O2	C18H34O2	C18H36O2	C19H26O2
				ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Stn.Code	**Site Name**	**Group**	**Smpl Date**																									
CHNC-001	Chance Creek above confluence with	Chance	2013-07-29	130	47.5	41.3	213	<4.9	<4.9	208	74.6	18.4	<4.9	<7.55	44.1	<4.9	15.9	16.8	17.1	29.2	160	316	39.1	568	14.8	<4.9	<4.9	165	71.9
CHNC-001	Chance Creek above confluence with	Chance	2014-07-22 10:47	234	28.3	<15.6	<15.6	<15.6	<15.6	<15.6	29.7	<29.7	<15.6	<15.6	<15.6	<15.6	<15.6	87.5	<15.6	<15.6	<15.6	39.9	<15.6	<15.6	<15.6	<15.6	<15.6	<15.6	33.3
CHNC-001	Chance Creek above confluence with	Chance	2014-09-22 19:00	314	29.4	<5.01	<5.01	21.2	<6.53	<5.01	32.1	<5.01	<5.01	<5.01	18.2	<5.01	7.47	71.8	<5.01	<5.01	<5.01	57.6	<5.01	<5.01	<5.01	<5.01	<5.01	<5.01	60.5
CHNC-001	Chance Creek above confluence with	Chance	2015-03-14 17:30	138	119	46.5	<15.2	32	<25.8	45	88.5	131	<15.2	<15.2	25	<15.2	41.6	119	68.1	<15.2	<15.2	60.1	27	41.1	<44.2	<15.2	<15.2	<15.2	<15.2
CHNC-001	Chance Creek above confluence with	Chance	2015-06-06 11:00																									
CHNC-001	Chance Creek above confluence with	Chance	2015-09-18 18:05																									
CHNC-001	Chance Creek above confluence with	Chance	2016-03-16																									
CHNC-001	Chance Creek above confluence with	Chance	2016-06-21 11:15																									
CHNC-001	Chance Creek above confluence with	Chance	2016-09-20 12:00																									
CHNC-001	Chance Creek above confluence with	Chance	2017-03-07 10:40																									
CHNC-001	Chance Creek above confluence with	Chance	2017-06-27 11:30																									
CHNC-001	Chance Creek above confluence with	Chance	2017-09-20 10:21																									
CHNC-001	Chance Creek above confluence with	Chance	2018-03-21 10:25																									
CHNC-003	Chance Creek u/s tributary	Chance	2013-08-26 15:00	254	44.1	<5.02	<46	23.9	16.3	26.1	50.6	<5.02	<5.02	<5.02	17.8	12.1	16.6	99.5	17.4	<5.02	<5.02	47.4	<5.02	<5.02	<5.02	<5.02	<5.02	<5.02	55.3
CHNC-003	Chance Creek u/s tributary	Chance	2014-07-22 18:30	186	19.3	<15.7	<15.7	18.1	<15.7	<15.7	26.2	<15.7	<15.7	<15.7	<16.3	<15.7	<15.7	65	<15.7	<15.7	<15.7	103	<15.7	<15.7	<15.7	<15.7	<15.7	<15.7	41
CHNC-003	Chance Creek u/s tributary	Chance	2014-09-23 10:40	500	94.4	<5.13	<5.13	51.2	<9.75	<7.32	92	<5.13	<5.36	<10.1	35.3	23.5	34.5	172	36.7	<5.13	<13	123	<5.13	11.9	<5.13	<5.13	<5.26	<5.13	104
CHNC-003	Chance Creek u/s tributary	Chance	2015-06-05 15:40																									
CHNC-003	Chance Creek u/s tributary	Chance	2015-09-19 17:23																									
CHNC-003	Chance Creek u/s tributary	Chance	2016-09-22 10:59																									
CHNC-003	Chance Creek u/s tributary	Chance	2017-06-27 9:30																									
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2013-08-26 14:02	255	47.5	<5.3	<5.3	17	22.4	29	61.4	<5.3	<5.3	<5.3	<5.3	<5.3	<12.1	73.4	17.2	<5.3	<5.3	41.5	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3	<5.3
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-07-22 18:50	209	29	<15.6	<15.6	18.3	<22.4	<15.6	44.6	<15.6	<15.6	<15.6	<15.6	<15.6	21.3	133	24.2	<15.6	<15.6	41.4	<15.6	<15.6	<15.6	<15.6	<15.6	<15.6	23.2
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-09-21 15:10	186	46.7	<4.93	45.2	27.1	<4.93	<4.93	36.9	<18.4	<4.93	125	<4.93	<4.93	<4.93	65.2	<4.93	<4.93	<6.74	78.6	<4.93	<4.93	<4.93	<4.93	<4.93	<4.93	38.8
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-06-05 16:10																									
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-09-19 18:00																									
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2016-03-15																									
DALG-002	Dalglish Creek	Dalglish	2014-09-23 14:30	261	109	<5.16	<5.16	80.7	70.9	58.8	110	66.6	<5.16	<5.16	70.4	59	43.4	82.3	23.5	<5.16	<5.16	133	34.3	22.9	13.6	<5.16	<5.16	<5.88	82.8
DALG-002	Dalglish Creek	Dalglish	2015-06-06 17:40																									
DALG-002	Dalglish Creek	Dalglish	2015-09-18 13:45																									
DALG-002	Dalglish Creek	Dalglish	2016-03-15																									
DALG-002	Dalglish Creek	Dalglish	2016-05-10																									
DALG-002	Dalglish Creek	Dalglish	2016-06-21 17:43																									
DALG-002	Dalglish Creek	Dalglish	2016-09-20 15:30																									
DALG-002	Dalglish Creek	Dalglish	2016-09-22 14:50																									
DALG-002	Dalglish Creek	Dalglish	2017-03-07 15:00																									
DALG-002	Dalglish Creek	Dalglish	2017-06-27 16:00																									
DALG-002	Dalglish Creek	Dalglish	2017-09-21 11:05																									
DALG-002	Dalglish Creek	Dalglish	2018-03-21 14:00																									
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2013-08-26 15:45	173	90.8	22.4	<4.94	29.9	32.1	45.1	81.9	36.5	<4.94	27.8	26.2	34.5	38.9	56.5	26.5	8.42	11.1	42.3	23.7	17.6	16.5	9.15	<4.94	<4.94	42.1
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-07-23 11:55	176	67.2	14.8	<5.14	23.1	24.7	30.2	61.6	38.4	<5.14	<5.14	22.3	23.2	31.9	61.3	25.3	<5.14	<5.14	61.1	18.4	21.3	19.3	<5.14	<5.14	<5.14	31.1
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-09-23 11:15	413	178	32.8	<6.72	65.6	75	74.9	170	130	<4.91	<4.91	52.1	60.6	86.7	195	75	<4.91	<4.91	94.8	47.7	59.1	45.7	<4.91	<5.22	<6.4	107
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-03-15 11:35	171	94.4	10	<5.18	37.3	38.4	57	70.3	29.5	<5.18	<5.18	33.3	34.6	66.6	42.7	11.9	<5.18	<5.18	51.6	24.4	10	9.86	<5.18	<5.18	<5.18	<5.18
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-06-05 17:50																									
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-09-18 18:55																									
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-03-16																									
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-06-21 15:50																									
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-09-20 9:18																									
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-03-07 17:00																									
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-06-27 18:15																									
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-09-20 17:30																									
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2018-03-20 17:38																									
McPL-001	McParlon Creek above confluence wi	McParlon	2013-07-29	266	29.2	12.4	66.4	<5.07	<5.07	64	121	<5.07	11.5	71.7	21.6	<5.07	14	36.7	8.4	13.5	<6.39	124	24.4	423	6.5	<5.07	<5.07	85.8	17.7
McPL-001	McParlon Creek above confluence wi	McParlon	2014-07-22 16:55	285	36.5	<15.1	<15.1	<15.1	<15.1	<15.1	38	<15.1	<15.1	<15.1	<15.1	<15.1	22.7	132	20	<15.1	<15.1	58	<15.1	<15.1	<15.1	<15.1	<15.1	<15.1	44
McPL-001	McParlon Creek above confluence wi	McParlon	2014-09-21 13:10	339	65	<5.12	<5.12	16.4	31.9	<5.12	61.5	<5.12	<5.12	<5.12	<5.12	<20.3	15.3	131	25.8	<5.12	<5.12	37.3	<5.12	<5.12	<5.12	<5.12	<5.12	<5.12	31.9
McPL-001	McParlon Creek above confluence wi	McParlon	2015-06-05 12:45																									
McPL-001	McParlon Creek above confluence wi	McParlon	2015-09-19 15:25																									
McPL-001	McParlon Creek above confluence wi	McParlon	2016-05-10																									
McPL-001	McParlon Creek above confluence wi	McParlon	2016-06-21 12:55																									
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-20 13:16																									
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-22 12:10																									
McPL-001	McParlon Creek above confluence wi	McParlon	2017-03-07 12:40																									
McPL-001	McParlon Creek above confluence wi	McParlon	2017-06-27 12:55																									
McPL-001	McParlon Creek above confluence wi	McParlon	2017-09-20 14:05																									
McPL-001	McParlon Creek above confluence wi	McParlon	2018-03-21 12:48																									

				C15H24O2	C15H26O2	C15H28O2	C15H30O2	C16H20O2	C16H22O2	C16H24O2	C16H26O2	C16H28O2	C16H30O2	C16H32O2	C17H22O2	C17H24O2	C17H26O2	C17H28O2	C17H30O2	C17H32O2	C17H34O2	C18H24O2	C18H26O2	C18H28O2	C18H30O2	C18H32O2	C18H34O2	C18H36O2	C19H26O2
				NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
				org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org
				C15H24O2	C15H26O2	C15H28O2	C15H30O2	C16H20O2	C16H22O2	C16H24O2	C16H26O2	C16H28O2	C16H30O2	C16H32O2	C17H22O2	C17H24O2	C17H26O2	C17H28O2	C17H30O2	C17H32O2	C17H34O2	C18H24O2	C18H26O2	C18H28O2	C18H30O2	C18H32O2	C18H34O2	C18H36O2	C19H26O2
				ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Stn.Code	**Site Name**	**Group**	**Smpl Date**																									
McPL-002	McParlon Creek headwaters	McParlon	2013-08-27 11:05	152	22.2	<5.05	<5.05	14.1	19.4	20.5	37	<5.05	<5.05	<5.05	<5.05	<5.05	14.6	101	<5.05	<5.05	<5.05	28.2	<5.05	<5.05	<5.05	<5.05	<5.05	<5.05	16.2
McPL-002	McParlon Creek headwaters	McParlon	2014-07-23 9:30	288	17.3	<15.1	<15.1	<21.5	<15.1	<34.9	58	<15.1	<15.1	<15.4	<15.1	<15.1	30.8	529	73.9	<15.1	<17.7	<40.1	<15.1	<32.5	<15.1	<15.1	<15.1	<15.1	38.5
McPL-002	McParlon Creek headwaters	McParlon	2014-09-21 16:00	169	30.4	<5.53	<5.53	22.2	18.3	<5.53	33.2	<5.53	<5.53	<13.3	<6.52	<5.53	<5.53	83.7	12.1	<5.53	<5.53	55.6	<5.53	11	<5.53	<5.53	<5.53	<5.53	63.4
McPL-002	McParlon Creek headwaters	McParlon	2015-06-05 11:05																									
McPL-002	McParlon Creek headwaters	McParlon	2015-09-19 14:30																									
McPL-002	McParlon Creek headwaters	McParlon	2016-03-15																									
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2013-08-27 12:25	213	88.7	<4.91	<4.91	33.2	49.6	45	75.4	20	<4.91	<4.91	19.3	22.8	26.4	59.3	13.3	<4.91	<4.91	36.4	<15.6	8.75	6.58	<4.91	<4.91	<4.91	23.8
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-07-22 10:20	236	61	<15.8	<15.8	38.4	36.7	<30.5	73.2	44.7	<15.8	<15.8	<26.9	29.1	34.7	290	60.6	<15.8	<15.8	68.4	21.6	30.8	<15.8	<15.8	<15.8	<15.8	40.5
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-09-21 14:20	311	119	<5.32	<5.32	43.3	56	59.9	112	40.5	<5.32	<5.32	26.9	39.8	41.4	73	17.7	<5.32	<76.6	61.8	<5.32	15.3	<5.32	<5.32	<5.32	<6.83	74.4
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-06-06 15:00																									
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-09-18 14:51																									

Notes:
Sample classes included in query: All

				C19H28O2	C19H30O2	C19H32O2	C19H34O2	C19H36O2	C19H38O2	C20H28O2	C20H30O2	C20H32O2	C20H34O2	C20H36O2	C20H38O2	C21H30O2	C21H32O2	C21H34O2	C21H36O2	C21H38O2	C21H40O2	126-Trime	12-Dimeth	1467-Tetra	17-Dimeth	17-Dimeth	18-Dimeth	1-Methylc	1-Methyln
				NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH
				org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org
				C19H28O2	C19H30O2	C19H32O2	C19H34O2	C19H36O2	C19H38O2	C20H28O2	C20H30O2	C20H32O2	C20H34O2	C20H36O2	C20H38O2	C21H30O2	C21H32O2	C21H34O2	C21H36O2	C21H38O2	C21H40O2	1,2,6-Trim	1,2-Dimeth	1,4,6,7-Tet	1,7-Dimeth	1,7-Dimeth	1,8-Dimeth	1-Methylcl	1-Methyln
				ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Stn.Code	**Site Name**	**Group**	**Smpl Date**																										
CHNC-001	Chance Creek above confluence with	Chance	2013-07-29	5.61	12.4	8.77	13.2	<13.2	<20.8	288	247	118	12.3	<4.9	10.3	76.1	<4.9	<4.9	<4.9	<4.9	<4.9	<0.0499	<0.236	<0.158	<0.193	<0.202	<0.203	<0.0486	0.646
CHNC-001	Chance Creek above confluence with	Chance	2014-07-22 10:47	<15.6	<15.6	<15.6	<29.7	19.1	71.7	<15.6	139	221	<15.6	<15.6	<15.6	22.2	<15.6	<15.6	<15.6	<15.6	<15.6	<0.0607	<0.561	<0.146	<0.444	<0.158	<0.161	<0.0954	0.706
CHNC-001	Chance Creek above confluence with	Chance	2014-09-22 19:00	<5.01	<5.01	<5.01	<5.01	7.33	25.8	12.8	117	47.4	<5.01	<5.01	<5.01	11.3	<5.01	<5.01	<5.01	<5.01	<5.01	<0.16	<1.24	<0.741	<0.484	0.146	<0.0854	<0.259	1.59
CHNC-001	Chance Creek above confluence with	Chance	2015-03-14 17:30	39.8	42.5	45.6	22.2	<15.2	<15.2	<15.2	247	79.5	44.9	<15.2	<15.2	32.6	<15.2	<15.2	<15.2	<15.2	<15.2	<0.27	7.72	1.54	<1.07	<0.281	<0.285	<0.103	129
CHNC-001	Chance Creek above confluence with	Chance	2015-06-06 11:00																			<0.0873	<0.6	<0.183	<0.223	<0.084	<0.0854	<0.0954	0.77
CHNC-001	Chance Creek above confluence with	Chance	2015-09-18 18:05																			<0.14	0.53	0.46	<0.277	0.196	<0.136	0.102	2.97
CHNC-001	Chance Creek above confluence with	Chance	2016-03-16																			<0.0922	<0.353	<0.162	<0.123	0.047	<0.0348	<0.0692	0.658
CHNC-001	Chance Creek above confluence with	Chance	2016-06-21 11:15																										
CHNC-001	Chance Creek above confluence with	Chance	2016-09-20 12:00																										
CHNC-001	Chance Creek above confluence with	Chance	2017-03-07 10:40																										
CHNC-001	Chance Creek above confluence with	Chance	2017-06-27 11:30																										
CHNC-001	Chance Creek above confluence with	Chance	2017-09-20 10:21																										
CHNC-001	Chance Creek above confluence with	Chance	2018-03-21 10:25																										
CHNC-003	Chance Creek u/s tributary	Chance	2013-08-26 15:00	<5.02	<5.02	<5.02	<5.02	<5.02	<5.02	73.9	47.6	13.4	<5.02	<5.02	<5.02	<5.02	<5.02	<6.16	<5.02	<5.02	<5.02	<0.139	0.651	<0.407	<0.217	0.194	0.141	<0.0419	0.841
CHNC-003	Chance Creek u/s tributary	Chance	2014-07-22 18:30	<15.7	<15.7	<15.7	<15.7	<15.7	21.7	<15.7	40.8	115	<15.7	<15.7	<15.7	19.5	<15.7	<15.7	<15.7	<15.7	<15.7	<0.0975	<0.473	<0.296	<0.383	0.14	<0.0647	<0.0775	0.577
CHNC-003	Chance Creek u/s tributary	Chance	2014-09-23 10:40	<5.13	12.7	<5.13	26.3	23	84.1	<14	253	73.6	16.5	7.72	17	18.1	<5.13	<7.6	<5.13	<5.13	<5.13	<0.117	<0.644	<0.265	<0.317	0.094	<0.0721	<0.0806	0.82
CHNC-003	Chance Creek u/s tributary	Chance	2015-06-05 15:40																			<0.077	<0.589	<0.258	<0.205	<0.0654	<0.0665	<0.0932	0.561
CHNC-003	Chance Creek u/s tributary	Chance	2015-09-19 17:23																			<0.0881	<0.531	<0.317	<0.2	0.183	<0.0616	<0.215	1.92
CHNC-003	Chance Creek u/s tributary	Chance	2016-09-22 10:59																										
CHNC-003	Chance Creek u/s tributary	Chance	2017-06-27 9:30																										
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2013-08-26 14:02	<5.3	<5.3	<5.3	<5.3	9.69	<5.3	810	95.2	11.4	<5.3	<5.3	<5.3	9.15	<5.3	<5.3	<5.3	<5.3	<5.3	<0.119	0.66	0.599	<0.22	0.14	0.157	<0.054	1.01
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-07-22 18:50	<15.6	<15.6	<15.6	17.2	31.9	33.3	<15.6	87	122	<15.6	<15.6	<15.6	<15.6	<15.6	<15.6	<15.6	<15.6	<15.6	<0.0587	<0.384	<0.141	<0.165	0.038	<0.0374	<0.0701	0.6
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-09-21 15:10	<4.93	<4.93	<4.93	<4.93	<4.93	27.5	<84.1	85.6	60	15.5	<4.93	<4.93	9.84	<4.93	<8.05	<4.93	<4.93	6.38	<0.124	1.08	<0.242	<0.437	0.078	0.087	<0.151	0.948
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-06-05 16:10																			<0.0824	<0.602	<0.176	<0.185	<0.07	<0.0712	<0.067	0.635
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-09-19 18:00																			<0.166	<0.431	<0.489	<0.605	0.394	<0.09	0.263	3.79
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2016-03-15																			<0.108	<0.432	<0.364	<0.409	0.111	<0.0923	<0.0799	0.984
DALG-002	Dalglish Creek	Dalglish	2014-09-23 14:30	15.1	20.7	16.3	<5.16	<5.16	24.2	16.6	300	72.1	15.8	<5.16	<5.16	15.8	<5.16	<5.16	<5.16	<5.16	<5.16	<0.604	2.72	2.95	<1.15	2.22	0.614	<1.18	5.69
DALG-002	Dalglish Creek	Dalglish	2015-06-06 17:40																			<0.125	<0.923	<0.343	<0.238	0.105	<0.0648	<0.107	1.32
DALG-002	Dalglish Creek	Dalglish	2015-09-18 13:45																			0.319	<0.832	1.22	<0.935	1.13	<0.414	0.364	4.13
DALG-002	Dalglish Creek	Dalglish	2016-03-15																			0.2	1.38	1.19	<0.478	0.618	0.203	0.119	3.5
DALG-002	Dalglish Creek	Dalglish	2016-05-10																										
DALG-002	Dalglish Creek	Dalglish	2016-06-21 17:43																										
DALG-002	Dalglish Creek	Dalglish	2016-09-20 15:30																										
DALG-002	Dalglish Creek	Dalglish	2016-09-22 14:50																										
DALG-002	Dalglish Creek	Dalglish	2017-03-07 15:00																										
DALG-002	Dalglish Creek	Dalglish	2017-06-27 16:00																										
DALG-002	Dalglish Creek	Dalglish	2017-09-21 11:05																										
DALG-002	Dalglish Creek	Dalglish	2018-03-21 14:00																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2013-08-26 15:45	13	16.4	10.4	7.03	<4.94	5.01	72.5	94	17.1	5.01	<4.94	<4.94	10.3	<4.94	<4.94	<4.94	<4.94	<4.94	<0.113	<0.601	<0.394	<0.316	0.203	<0.0807	<0.12	1.13
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-07-23 11:55	17.1	15	10.9	9.58	<5.14	18.8	<9.47	58.4	42.5	9.77	<5.14	<5.14	13.7	<5.14	<5.14	<5.14	<5.14	<5.14	<0.134	0.518	0.469	<0.199	0.177	<0.0705	<0.0911	1.72
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-09-23 11:15	43	46.7	42.4	29.4	12.1	55.5	21	275	66.1	12.6	<4.91	16.7	28.8	<5.81	<4.91	<4.91	<4.91	<4.91	<0.243	1.18	0.505	<0.499	0.229	<0.114	<0.258	2.03
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-03-15 11:35	8.77	7.15	<5.18	7.57	<5.18	<5.18	<5.18	91.5	20.6	<5.18	<5.18	<5.18	<5.18	<5.18	<5.18	<5.18	<5.18	<5.18	<0.266	<0.977	<0.319	<0.74	<0.263	<0.268	<0.121	8.57
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-06-05 17:50																			<0.119	<1.02	0.394	<0.318	0.21	<0.107	<0.1	2.46
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-09-18 18:55																			<0.315			<0.556	0.651	<0.317	0.415	
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-03-16																			0.104	0.52	<0.561	<0.227	0.368	0.127	<0.0839	2.13
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-06-21 15:50																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-09-20 9:18																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-03-07 17:00																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-06-27 18:15																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-09-20 17:30																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2018-03-20 17:38																										
McPL-001	McParlon Creek above confluence wi	McParlon	2013-07-29	14.2	12.8	9.17	10.1	6.66	<8.88	93.7	173	108	6.77	<5.07	<5.07	21.1	8.86	<5.07	<5.07	<5.07	<5.07	<0.0842	<0.178	<0.199	<0.223	<0.135	<0.136	<0.106	0.709
McPL-001	McParlon Creek above confluence wi	McParlon	2014-07-22 16:55	<15.1	<15.1	<15.1	27.6	17.6	106	<15.1	203	130	<23.9	<15.1	<15.1	35.4	<15.1	<15.1	<15.1	<15.1	<15.1	<0.0326	0.336	<0.129	<0.354	<0.239	<0.244	<0.0441	0.546
McPL-001	McParlon Creek above confluence wi	McParlon	2014-09-21 13:10	<5.12	<5.12	<5.12	<5.12	6.66	39	13.3	118	79.2	<5.12	<5.12	10.4	<9.61	<5.12	<5.12	<5.12	<5.12	<5.12	<0.0953	<0.496	<0.23	<0.237	<0.0804	<0.082	<0.193	0.808
McPL-001	McParlon Creek above confluence wi	McParlon	2015-06-05 12:45																			<0.0891	<0.418	<0.111	<0.233	<0.0662	<0.0673	<0.103	0.518
McPL-001	McParlon Creek above confluence wi	McParlon	2015-09-19 15:25																			<0.119	<0.477	<0.302	<0.168	<0.215	<0.217	<0.116	1.18
McPL-001	McParlon Creek above confluence wi	McParlon	2016-05-10																										
McPL-001	McParlon Creek above confluence wi	McParlon	2016-06-21 12:55																										
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-20 13:16																										
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-22 12:10																										
McPL-001	McParlon Creek above confluence wi	McParlon	2017-03-07 12:40																										
McPL-001	McParlon Creek above confluence wi	McParlon	2017-06-27 12:55																										
McPL-001	McParlon Creek above confluence wi	McParlon	2017-09-20 14:05																										
McPL-001	McParlon Creek above confluence wi	McParlon	2018-03-21 12:48																										

				C19H28O2	C19H30O2	C19H32O2	C19H34O2	C19H36O2	C19H38O2	C20H28O2	C20H30O2	C20H32O2	C20H34O2	C20H36O2	C20H38O2	C21H30O2	C21H32O2	C21H34O2	C21H36O2	C21H38O2	C21H40O2	126-Trime	12-Dimeth	1467-Tetra	17-Dimeth	17-Dimeth	18-Dimeth	1-Methylc	1-Methyln
				NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH
				org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org
				C19H28O2	C19H30O2	C19H32O2	C19H34O2	C19H36O2	C19H38O2	C20H28O2	C20H30O2	C20H32O2	C20H34O2	C20H36O2	C20H38O2	C21H30O2	C21H32O2	C21H34O2	C21H36O2	C21H38O2	C21H40O2	1,2,6-Trime	1,2-Dimeth	1,4,6,7-Tet	1,7-Dimeth	1,7-Dimeth	1,8-Dimeth	1-Methylcl	1-Methyln
				ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Stn.Code	**Site Name**	**Group**	**Smpl Date**																										
McPL-002	McParlon Creek headwaters	McParlon	2013-08-27 11:05	8.98	<5.05	<5.05	<5.05	<5.05	<5.05	54.8	58.3	14.9	6.21	<5.05	<5.05	<5.05	<5.05	<5.05	<5.05	<5.05	<5.05	<0.192	1.03	0.255	<0.354	0.15	<0.116	<0.0664	1.09
McPL-002	McParlon Creek headwaters	McParlon	2014-07-23 9:30	49.6	<15.1	<15.1	25.7	<15.1	101	<15.1	312	389	<41.9	<15.1	<15.1	<15.6	<15.1	<15.1	<15.1	<15.1	<15.1	<0.324	<0.379	<0.328	<0.224	<0.0492	<0.0501	<0.0418	0.505
McPL-002	McParlon Creek headwaters	McParlon	2014-09-21 16:00	<5.53	<5.53	<5.53	<5.53	<5.53	25.3	11.1	111	50.1	9.84	<5.53	<5.53	18.3	<5.53	<5.53	<5.53	<5.53	<5.53	<0.09	0.851	<0.267	<0.152	<0.0597	<0.0608	<0.11	0.836
McPL-002	McParlon Creek headwaters	McParlon	2015-06-05 11:05																			<0.067	<0.645	<0.21	<0.201	<0.061	<0.062	<0.0804	0.679
McPL-002	McParlon Creek headwaters	McParlon	2015-09-19 14:30																			<0.212	<0.394	<0.341	<0.443	<0.167	<0.169	<0.0808	1.5
McPL-002	McParlon Creek headwaters	McParlon	2016-03-15																			<0.0484	<0.448	<0.168	<0.132	0.068	<0.0445	<0.0534	0.589
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2013-08-27 12:25	7.02	7.78	<4.91	<4.91	<4.91	<4.91	27.2	57	13.8	<4.91	<4.91	<4.91	5.58	<4.91	<4.91	<4.91	<4.91	<4.91	<0.105	1.58	<0.343	<0.21	<0.127	<0.128	<0.0645	0.655
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-07-22 10:20	35	27.4	<15.8	57.1	35.5	113	<15.8	198	312	33.7	<15.8	<15.8	40.3	<15.8	<15.8	<15.8	<15.8	<15.8	<0.0574	<0.645	<0.211	<0.288	<0.15	<0.153	<0.0488	0.591
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-09-21 14:20	<5.32	<5.32	<5.32	<5.32	<5.32	27.4	<5.32	149	33	<5.32	<5.32	<5.32	13.9	<5.32	<5.32	<5.32	<5.32	<5.32	<0.108	0.856	<0.191	<0.231	<0.0748	0.087	<0.133	0.675
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-06-06 15:00																			<0.118	<0.64	<0.243	<0.322	<0.0564	<0.0574	<0.0792	0.61
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-09-18 14:51																			<0.124	<0.457	<0.22	<0.248	0.148	<0.0613	<0.0662	0.976

Notes:
Sample classes included in query: All

				1-Methylp	235-Trime	236-Trime	24-Dimeth	26-Dimeth	26-Dimeth	23-Methyl	2-Methyla	2-Methylfl	2-Methyln	2-Methylp	36-Dimeth	3-Methylfl	3-Methylp	59-Dimeth	56-Methyl	7-Methylb	94-Methyl	Acenaphth	Acenaphth	Anthracen	Benz-a-an	Benzo-a-p	Benzo-b-fl	Benzo-e-p	Benzo-ghi
				PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH
				org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org
				1-Methylp	2,3,5-Trim	2,3,6-Trim	2,4-Dimeth	2,6-Dimeth	2,6-Dimeth	2/3-Methy	2-Methyla	2-Methylfl	2-Methyln	2-Methylp	3,6-Dimeth	3-Methylfl	3-Methylp	5,9-Dimeth	5/6-Methy	7-Methylb	9/4-Methy	Acenaphth	Acenaphth	Anthracen	Benz[a]an	Benzo[a]p	Benzo[b]fl	Benzo[e]p	Benzo[ghi]
				ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Stn.Code	**Site Name**	**Group**	**Smpl Date**																										
CHNC-001	Chance Creek above confluence with	Chance	2013-07-29	<0.194	0.194	0.193	<0.0507	<0.192	<0.203	<0.163	<0.203	<0.347	1.07	<0.193	<0.205	0.238	<0.197	<0.114	<0.0533	<0.12	<0.197	<0.134	<0.0537	<0.031	<0.0748	<0.12	0.081	0.151	<0.107
CHNC-001	Chance Creek above confluence with	Chance	2014-07-22 10:47	0.14	0.255	0.206	<0.382	<0.469	<0.161	<0.137	<0.104	<0.273	1.09	0.239	<0.164	0.248	0.196	<0.122	<0.102	<0.112	0.121	<0.383	0.095	<0.0676	<0.0246	<0.12	0.132	<0.123	0.132
CHNC-001	Chance Creek above confluence with	Chance	2014-09-22 19:00	0.284	0.657	0.933	<0.415	<1.06	<0.0854	<0.24	<0.167	<0.193	2.22	0.267	<0.0871	0.628	0.314	<0.153	<0.269	<0.38	0.325	<0.654	<0.401	<0.212	0.165	<0.422	0.456	<0.413	<0.252
CHNC-001	Chance Creek above confluence with	Chance	2015-03-14 17:30	1.31	5.33	5.74	<0.357	23.2	0.604	<0.408	1.24	2.04	224	2.18	0.539	2.83	2.14	<0.301	<0.11	<0.278	1.91	1.54	20	1.99	0.785	0.566	0.363	0.322	0.678
CHNC-001	Chance Creek above confluence with	Chance	2015-06-06 11:00	0.183	0.395	0.471	<0.164	<0.507	<0.0854	<0.106	<0.132	<0.193	1.13	<0.128	<0.0869	0.43	0.212	<0.184	<0.101	<0.37	0.258	<0.231	<0.219	<0.09	0.096	<0.215	0.248	0.315	0.5
CHNC-001	Chance Creek above confluence with	Chance	2015-09-18 18:05	0.838	1.22	1.04	<0.4	0.832	<0.136	<0.33	<0.295	<0.575	3.74	0.652	0.153	1.29	0.722	<0.292	<0.0925	<0.174	0.929	<0.387	<0.302	<0.221	0.263	<0.257	0.497	0.489	0.423
CHNC-001	Chance Creek above confluence with	Chance	2016-03-16	0.125	<0.237	0.227	<0.155	<0.300	<0.0348	<0.170	<0.122	<0.174	0.892	<0.120	<0.0351	<0.187	0.148	<0.0898	<0.0711	<0.196	<0.120	<0.189	<0.131	<0.0702	<0.0373	<0.111	<0.0765	<0.112	<0.0859
CHNC-001	Chance Creek above confluence with	Chance	2016-06-21 11:15																										
CHNC-001	Chance Creek above confluence with	Chance	2016-09-20 12:00																										
CHNC-001	Chance Creek above confluence with	Chance	2017-03-07 10:40																										
CHNC-001	Chance Creek above confluence with	Chance	2017-06-27 11:30																										
CHNC-001	Chance Creek above confluence with	Chance	2017-09-20 10:21																										
CHNC-001	Chance Creek above confluence with	Chance	2018-03-21 10:25																										
CHNC-003	Chance Creek u/s tributary	Chance	2013-08-26 15:00	<0.287	<0.721	<0.725	<0.117	<0.379	<0.0918	<0.138	<0.301	<0.47	1.35	<0.286	<0.0925	0.437	<0.291	0.122	<0.0457	<0.222	<0.291	<0.363	<0.268	<0.23	<0.09	<0.189	<0.105	<0.173	0.246
CHNC-003	Chance Creek u/s tributary	Chance	2014-07-22 18:30	0.272	0.267	0.238	<0.269	<0.396	0.076	<0.134	<0.0975	<0.162	1.06	0.293	<0.0659	0.398	0.296	<0.086	<0.0825	<0.121	0.145	<0.354	<0.192	<0.0744	<0.041	<0.0608	<0.0407	0.077	<0.07
CHNC-003	Chance Creek u/s tributary	Chance	2014-09-23 10:40	<0.211	<0.258	0.374	<0.244	<0.547	<0.0721	<0.144	<0.21	<0.187	1.25	<0.21	<0.0735	0.262	<0.21	<0.11	<0.0836	<0.271	<0.21	<0.401	<0.147	<0.0923	0.089	<0.237	0.234	<0.232	0.267
CHNC-003	Chance Creek u/s tributary	Chance	2015-06-05 15:40	<0.102	0.323	0.292	<0.0787	<0.498	<0.0665	<0.138	<0.107	<0.157	1.13	<0.104	<0.0676	0.223	<0.104	<0.132	<0.0989	<0.317	<0.104	<0.247	<0.0879	<0.0806	<0.126	<0.261	<0.163	<0.264	0.324
CHNC-003	Chance Creek u/s tributary	Chance	2015-09-19 17:23	0.536	0.934	0.869	<0.513	0.489	0.066	<0.22	<0.151	<0.174	2.41	0.472	0.133	1.06	0.41	<0.236	<0.231	<0.333	0.643	<0.599	<0.153	<0.205	0.199	<0.281	0.559	0.533	0.36
CHNC-003	Chance Creek u/s tributary	Chance	2016-09-22 10:59																										
CHNC-003	Chance Creek u/s tributary	Chance	2017-06-27 9:30																										
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2013-08-26 14:02	<0.21	0.532	0.41	<0.145	0.475	<0.0738	<0.111	0.256	<0.359	1.48	<0.21	0.075	0.306	<0.213	<0.0602	<0.0589	<0.17	<0.213	0.238	<0.138	<0.18	<0.0589	<0.0951	<0.0507	0.159	0.119
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-07-22 18:50	0.166	0.306	0.243	<0.172	<0.321	<0.0374	<0.113	<0.0578	0.075	0.885	0.136	<0.0381	0.265	0.141	<0.0516	<0.0746	<0.128	0.088	<0.188	<0.0957	<0.0479	<0.0164	<0.0837	<0.0581	<0.0857	0.089
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-09-21 15:10	0.291	<0.425	0.427	<0.334	<0.598	<0.0677	<0.185	<0.213	<0.184	1.65	0.216	<0.069	0.397	0.317	<0.175	<0.156	<0.316	<0.214	<0.532	<0.336	<0.0975	0.091	<0.18	0.304	0.181	<0.166
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-06-05 16:10	<0.136	0.38	0.435	<0.0982	<0.509	<0.0712	<0.172	<0.143	<0.132	1.17	<0.138	<0.0724	0.36	<0.139	<0.123	<0.0711	<0.332	<0.139	<0.24	<0.135	<0.0715	0.077	<0.21	0.189	0.31	0.441
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-09-19 18:00	0.853	1.26	1.33	<0.732	0.995	0.147	0.318	<0.177	<0.736	4.95	0.836	0.248	1.91	0.769	<0.399	<0.168	<0.852	0.998	<0.514	<0.286	<0.368	0.273	<0.415	0.951	1.07	0.59
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2016-03-15	<0.250	<0.564	<0.519	<0.267	0.402	<0.0923	<0.275	<0.263	<0.157	1.11	<0.258	<0.0929	0.941	0.284	<0.0775	<0.0821	<0.195	<0.257	<0.462	<0.236	<0.117	<0.0626	<0.140	<0.0909	<0.141	0.248
DALG-002	Dalglish Creek	Dalglish	2014-09-23 14:30	4.44	6.6	6.76	<1.51	3.88	0.8	1.27	0.199	<0.532	6.56	3.44	0.977	6.39	3.34	<0.411	<1.22	<0.581	5.13	<0.595	<0.344	<0.236	1.06	0.539	2.41	2.84	3.22
DALG-002	Dalglish Creek	Dalglish	2015-06-06 17:40	0.285	0.816	0.86	<0.193	<0.781	<0.0648	<0.162	<0.234	<0.195	1.59	0.294	<0.0659	0.47	<0.228	<0.14	<0.113	<0.317	0.367	<0.463	<0.206	<0.0899	0.106	<0.135	0.295	0.366	0.504
DALG-002	Dalglish Creek	Dalglish	2015-09-18 13:45	2.62	3.16	3.94	<1.67	3.21	0.48	0.983	<0.37	<1.09	5.84	3	0.686	3.68	2.67	0.601	0.235	<0.288	3.42	0.47	<0.33	<0.133	0.278	0.265	1.14	2.02	1.71
DALG-002	Dalglish Creek	Dalglish	2016-03-15	1.57	3.23	3.28	<0.435	2.83	0.212	0.89	<0.188	<0.329	3.73	1.48	0.432	1.42	1.35	0.113	0.121	<0.198	1.97	0.216	<0.257	<0.0999	0.131	<0.250	0.234	0.805	0.962
DALG-002	Dalglish Creek	Dalglish	2016-05-10																										
DALG-002	Dalglish Creek	Dalglish	2016-06-21 17:43																										
DALG-002	Dalglish Creek	Dalglish	2016-09-20 15:30																										
DALG-002	Dalglish Creek	Dalglish	2016-09-22 14:50																										
DALG-002	Dalglish Creek	Dalglish	2017-03-07 15:00																										
DALG-002	Dalglish Creek	Dalglish	2017-06-27 16:00																										
DALG-002	Dalglish Creek	Dalglish	2017-09-21 11:05																										
DALG-002	Dalglish Creek	Dalglish	2018-03-21 14:00																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2013-08-26 15:45	<0.243	0.813	1.09	<0.236	<0.491	0.199	<0.152	<0.254	<0.293	1.73	0.505	0.092	0.373	0.334	<0.141	<0.131	<0.152	0.266	<0.401	<0.202	<0.204	<0.0611	<0.162	<0.0866	0.189	0.232
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-07-23 11:55	0.532	1.18	1.02	<0.165	1.33	<0.0705	0.4	<0.125	<0.175	2.15	0.598	0.148	0.6	0.681	<0.117	<0.097	<0.183	0.74	0.432	<0.18	<0.0668	0.095	0.056	0.496	0.738	0.771
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-09-23 11:15	0.557	0.928	1.31	<0.444	1.28	0.156	0.439	<0.292	<0.216	2.73	0.667	0.182	0.61	0.627	<0.224	<0.268	<0.314	0.762	<0.517	0.341	<0.218	0.159	<0.278	0.609	0.743	1.19
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-03-15 11:35	<0.317	<0.936	<0.864	<0.685	1.79	<0.268	<0.435	<0.331	<1.31	14.1	<0.321	<0.272	<0.417	<0.323	<0.2	<0.128	<0.33	<0.323	<0.696	<0.612	<0.238	<0.0822	<0.177	<0.118	<0.178	0.191
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-06-05 17:50	0.797	1.59	1.94	<0.225	1.84	<0.107	0.388	<0.232	<0.163	3.57	0.668	0.139	0.788	0.462	<0.0918	<0.106	<0.217	0.891	<0.479	0.546	<0.083	0.104	<0.192	0.385	0.876	1.13
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-09-18 18:55	2.56			<1.9		0.417	1.85	<0.37	<0.698		2.97	0.451	2.99	2.77	<0.343	0.353	<1.34	3.87			<0.475	0.384	<0.452	1.42	3.42	4.25
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-03-16	0.686	1.53	1.69	0.272	1.65	0.254	0.586	<0.171	0.202	2.96	0.891	0.217	0.686	0.795	<0.0632	<0.0862	<0.158	0.994	<0.227	<0.251	<0.0511	0.065	<0.157	<0.104	0.369	0.33
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-06-21 15:50																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-09-20 9:18																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-03-07 17:00																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-06-27 18:15																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-09-20 17:30																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2018-03-20 17:38																										
McPL-001	McParlon Creek above confluence wi	McParlon	2013-07-29	<0.229	<0.216	0.305	<0.0763	<0.145	<0.136	<0.202	<0.24	<0.209	1.12	<0.228	<0.137	0.161	<0.232	<0.0596	<0.116	<0.093	<0.232	<0.285	<0.107	<0.0928	<0.0902	<0.16	0.164	0.161	0.301
McPL-001	McParlon Creek above confluence wi	McParlon	2014-07-22 16:55	0.133	0.196	0.252	<0.314	0.355	<0.244	<0.133	<0.0759	<0.162	0.955	0.148	<0.248	0.222	0.136	<0.0689	<0.0469	<0.108	0.121	0.246	<0.077	<0.0504	0.025	0.044	0.099	0.064	0.155
McPL-001	McParlon Creek above confluence wi	McParlon	2014-09-21 13:10	<0.244	0.252	0.225	<0.29	<0.421	<0.082	<0.126	<0.242	<0.249	1.29	<0.242	<0.0836	0.372	<0.243	<0.126	<0.2	<0.469	<0.243	<0.397	<0.193	<0.1	<0.117	<0.587	<0.384	<0.575	<0.331
McPL-001	McParlon Creek above confluence wi	McParlon	2015-06-05 12:45	<0.143	0.202	0.184	<0.203	<0.353	<0.0673	<0.14	<0.149	<0.243	0.901	<0.145	<0.0684	<0.208	<0.146	<0.117	<0.109	<0.34	<0.146	<0.208	<0.0878	<0.0717	0.104	<0.186	0.148	<0.188	0.457
McPL-001	McParlon Creek above confluence wi	McParlon	2015-09-19 15:25	0.416	<0.805	<0.737	<0.306	<0.405	<0.217	<0.19	<0.137	<0.437	1.31	0.373	<0.219	0.753	0.317	<0.16	<0.124	<0.363	0.479	<0.409	<0.181	<0.099	0.118	<0.295	0.251	0.455	0.395
McPL-001	McParlon Creek above confluence wi	McParlon	2016-05-10																										
McPL-001	McParlon Creek above confluence wi	McParlon	2016-06-21 12:55																										
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-20 13:16																										
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-22 12:10																										
McPL-001	McParlon Creek above confluence wi	McParlon	2017-03-07 12:40																										
McPL-001	McParlon Creek above confluence wi	McParlon	2017-06-27 12:55																										
McPL-001	McParlon Creek above confluence wi	McParlon	2017-09-20 14:05																										
McPL-001	McParlon Creek above confluence wi	McParlon	2018-03-21 12:48																										

Stn.Code	Site Name	Group	Smpl Date	1-Methylp PAH org 1-Methylp ng/L	235-Trime PAH org 2,3,5-Trim ng/L	236-Trime PAH org 2,3,6-Trim ng/L	24-Dimeth PAH org 2,4-Dimetl ng/L	26-Dimeth PAH org 2,6-Dimetl ng/L	26-Dimeth PAH org 2,6-Dimetl ng/L	23-Methyl PAH org 2/3-Methy ng/L	2-Methyla PAH org 2-Methyla ng/L	2-Methylfl PAH org 2-Methylfl ng/L	2-Methyln PAH org 2-Methyln ng/L	2-Methylp PAH org 2-Methylp ng/L	36-Dimeth PAH org 3,6-Dimetl ng/L	3-Methylfl PAH org 3-Methylfl ng/L	3-Methylp PAH org 3-Methylp ng/L	59-Dimeth PAH org 5,9-Dimetl ng/L	56-Methyl PAH org 5/6-Methy ng/L	7-Methylb PAH org 7-Methylb ng/L	94-Methyl PAH org 9/4-Methy ng/L	Acenaphtl PAH org Acenaphtl ng/L	Acenaphtl PAH org Acenaphtl ng/L	Anthracen PAH org Anthracen ng/L	Benz-a-an PAH org Benz[a]an ng/L	Benzo-a-p PAH org Benzo[a]p ng/L	Benzo-b-fl PAH org Benzo[b]fl ng/L	Benzo-e-p PAH org Benzo[e]p ng/L	Benzo-ghi PAH org Benzo[ghi] ng/L
McPL-002	McParlon Creek headwaters	McParlon	2013-08-27 11:05	0.464	0.681	0.454	<0.22	0.824	<0.116	<0.235	<0.168	<0.497	1.78	0.176	<0.117	0.338	<0.163	<0.097	<0.0724	<0.166	<0.163	<0.273	<0.176	<0.165	0.081	<0.17	<0.0826	0.173	0.189
McPL-002	McParlon Creek headwaters	McParlon	2014-07-23 9:30	0.091	<0.198	0.253	<0.198	<0.317	<0.0501	<0.0992	<0.0671	<0.234	0.928	0.104	<0.051	<0.0747	0.111	<0.0475	<0.0445	<0.104	0.078	<0.248	<0.069	<0.0358	0.041	<0.144	<0.0983	<0.148	<0.05
McPL-002	McParlon Creek headwaters	McParlon	2014-09-21 16:00	<0.2	<0.291	0.326	<0.271	<0.523	<0.0608	<0.174	<0.199	<0.171	1.42	<0.199	<0.062	<0.223	<0.199	<0.111	<0.114	<0.715	<0.199	<0.412	<0.24	<0.136	<0.094	<0.514	<0.314	<0.503	<0.395
McPL-002	McParlon Creek headwaters	McParlon	2015-06-05 11:05	<0.234	0.33	0.259	<0.114	<0.545	<0.062	<0.13	<0.244	<0.155	1	<0.237	<0.063	<0.163	<0.239	<0.0774	<0.0853	<0.278	<0.239	<0.252	<0.115	<0.0844	<0.0546	<0.156	<0.101	<0.157	0.193
McPL-002	McParlon Creek headwaters	McParlon	2015-09-19 14:30	0.243	0.374	0.318	<0.393	<0.334	<0.169	<0.221	<0.151	<0.373	2.29	0.229	<0.171	0.281	0.267	<0.139	<0.087	<0.247	0.258	<0.399	<0.348	<0.177	0.065	<0.185	<0.125	<0.185	0.171
McPL-002	McParlon Creek headwaters	McParlon	2016-03-15	0.173	<0.340	<0.313	<0.102	<0.380	<0.0445	<0.164	<0.120	<0.267	0.925	0.218	0.055	<0.175	0.166	<0.119	<0.0549	<0.218	0.128	<0.295	<0.227	<0.122	0.04	<0.191	<0.122	<0.193	0.152
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2013-08-27 12:25	<0.381	0.254	0.447	<0.203	<0.492	<0.128	<0.145	<0.398	<0.403	0.991	<0.379	<0.129	0.31	<0.386	<0.0981	<0.0703	<0.163	<0.386	<0.24	<0.203	<0.166	<0.09	<0.256	<0.138	<0.234	<0.152
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-07-22 10:20	<0.231	<0.48	<0.438	<0.217	<0.539	<0.153	<0.123	<0.229	<0.14	0.988	<0.23	<0.156	<0.186	<0.23	<0.052	<0.0519	<0.193	<0.23	0.252	<0.105	<0.0369	0.045	<0.182	<0.112	<0.187	<0.0583
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-09-21 14:20	<0.195	0.15	0.204	<0.2	<0.357	<0.0762	<0.28	<0.193	<0.172	1.11	<0.193	<0.0777	<0.199	0.216	<0.191	<0.138	<0.473	<0.194	<0.32	<0.132	<0.148	<0.0958	<0.389	<0.248	<0.381	<0.325
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-06-06 15:00	<0.365	<0.302	<0.278	<0.245	<0.541	<0.0574	<0.127	<0.382	<0.173	0.901	<0.37	<0.0583	0.284	<0.373	<0.123	<0.084	<0.363	<0.373	<0.339	<0.139	<0.13	<0.0914	<0.175	0.124	<0.177	0.378
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-09-18 14:51	0.237	0.296	0.289	<0.599	<0.388	<0.0613	<0.351	<0.222	<0.332	1.4	<0.21	0.071	0.342	0.285	<0.176	<0.0712	<0.156	0.357	<0.231	<0.197	<0.201	0.056	<0.188	<0.125	0.244	0.194

Notes:
Sample classes included in query: All

Stn.Code	Site Name	Group	Smpl Date	Benzo-jk-f PAH org Benzo[j,k]f ng/L	Benzo-bjk- PAH org Benzo{b/j/ ng/L	Biphenyl PAH org Biphenyl ng/L	C1-Phenar PAH org C1 Phenan ng/L	C1-Acenap PAH org C1-Acenap ng/L	C1-Benzo- PAH org C1-Benzo[ng/L	C1-Benzof PAH org C1-Benzof ng/L	C1-Biphen PAH org C1-Biphen ng/L	C1-Dibenz PAH org C1-Dibenz ng/L	C1-Fluorar PAH org C1-Fluorar ng/L	C1-Fluorer PAH org C1-Fluorer ng/L	C1-Naphth PAH org C1-Naphth ng/L	C2-Phenar PAH org C2 Phenan ng/L	C2-Benzo- PAH org C2-Benzo[ng/L	C2-Benzof PAH org C2-Benzofl ng/L	C2-Biphen PAH org C2-Biphen ng/L	C2-Dibenz PAH org C2-Dibenz ng/L	C2-Fluorar PAH org C2-Fluorar ng/L	C2-Fluorer PAH org C2-Fluorer ng/L	C2-Naphth PAH org C2-Naphth ng/L	C3-Benzo- PAH org C3-Benzo[ng/L	C3-Dibenz PAH org C3-Dibenz ng/L	C3-Fluorar PAH org C3-Fluorar ng/L	C3-Fluorer PAH org C3-Fluorer ng/L	C3-Naphth PAH org C3-Naphth ng/L	C3-Phenar PAH org C3-Phenar ng/L
CHNC-001	Chance Creek above confluence with	Chance	2013-07-29	<0.0891		1	<0.194	<0.119	0.268	<0.12	1.82	<0.163	0.812	0.457	1.71	0.751	0.169	<0.108	8.56	0.686	1.14	0.841	2.85	0.195	0.497	0.81	2.05	2.42	0.608
CHNC-001	Chance Creek above confluence with	Chance	2014-07-22 10:47	<0.0848		1	0.575	<0.144	<0.0984	<0.112	3.08	<0.137	0.676	0.607	1.8	0.354	<0.122	0.156	14.8	<0.382	0.241	<0.444	0.799	<0.0497	<0.253	<0.204	0.458	2.13	0.512
CHNC-001	Chance Creek above confluence with	Chance	2014-09-22 19:00	<0.275		1.28	1.19	<0.46	0.541	<0.38	3.3	0.57	1.23	0.795	3.82	0.732	0.497	<0.317	16.4	0.662	1.36	<0.484	4.9	<0.16	1.54	0.708	1.48	7.07	0.897
CHNC-001	Chance Creek above confluence with	Chance	2015-03-14 17:30	0.439		4.47	8.78	<0.462	0.48	<0.278	5.85	<0.408	5.04	4.34	353	3.58	<0.301	<0.314	8.96	<0.357	3.49	6.64	95.8	<0.137	<0.14	<0.609	2.57	24.8	2.26
CHNC-001	Chance Creek above confluence with	Chance	2015-06-06 11:00	<0.154		1.48	<0.127	<0.221	0.235	<0.37	0.818	<0.106	0.934	0.792	1.9	0.58	<0.184	0.335	1.43	0.46	0.759	<0.223	1.78	0.24	0.406	<0.189	1.3	2.21	0.576
CHNC-001	Chance Creek above confluence with	Chance	2015-09-18 18:05	<0.187		0.849	3.14	<0.298	0.594	<0.174	0.953	0.366	2.67	0.863	6.71	1.04	<0.292	<0.305	0.279	0.662	2.45	<0.277	7.45	<0.135	0.888	<0.457	1.47	5.52	0.365
CHNC-001	Chance Creek above confluence with	Chance	2016-03-16	<0.0784		0.631	0.272	<0.314	<0.0702	<0.196	2.34	<0.170	<0.187	0.586	1.55	0.153	<0.0898	<0.0939	8.39	<0.155	<0.112	0.801	2.01	<0.0898	0.067	<0.131	0.818	1.15	0.109
CHNC-001	Chance Creek above confluence with	Chance	2016-06-21 11:15																										
CHNC-001	Chance Creek above confluence with	Chance	2016-09-20 12:00																										
CHNC-001	Chance Creek above confluence with	Chance	2017-03-07 10:40																										
CHNC-001	Chance Creek above confluence with	Chance	2017-06-27 11:30																										
CHNC-001	Chance Creek above confluence with	Chance	2017-09-20 10:21																										
CHNC-001	Chance Creek above confluence with	Chance	2018-03-21 10:25																										
CHNC-003	Chance Creek u/s tributary	Chance	2013-08-26 15:00	0.138		0.9	<0.287	<0.372	0.328	0.898	2.13	<0.138	1.1	0.775	2.19	1.17	0.388	0.487	7.96	0.991	0.761	1.28	4.6	0.402	0.658	0.452	1.3	2.71	1.28
CHNC-003	Chance Creek u/s tributary	Chance	2014-07-22 18:30	<0.0433		1.14	0.565	<0.0798	<0.0799	<0.121	5.3	<0.134	1	0.869	1.64	0.412	<0.086	0.181	23.7	<0.269	<0.268	0.57	1.07	<0.0958	0.209	0.101	1.46	1.75	0.546
CHNC-003	Chance Creek u/s tributary	Chance	2014-09-23 10:40	<0.169		0.769	<0.211	<0.283	0.183	0.55	<0.549	0.184	0.341	0.566	2.07	0.368	0.241	0.389	0.643	0.737	0.67	<0.317	2.16	<0.0992	0.61	0.196	1.22	2.63	0.256
CHNC-003	Chance Creek u/s tributary	Chance	2015-06-05 15:40	<0.178		2.12	<0.102	<0.417	<0.096	<0.317	0.642	<0.138	0.478	0.489	1.69	0.197	<0.132	<0.337	1.2	0.296	0.317	0.506	1.98	<0.139	0.201	<0.125	1.53	1.59	0.199
CHNC-003	Chance Creek u/s tributary	Chance	2015-09-19 17:23	<0.212		0.919	2.06	<0.367	0.474	<0.333	0.828	0.272	1.94	0.748	4.33	1	<0.236	<0.281	0.521	0.64	1.46	0.63	4.09	<0.236	1.11	<0.243	1.1	3.22	0.215
CHNC-003	Chance Creek u/s tributary	Chance	2016-09-22 10:59																										
CHNC-003	Chance Creek u/s tributary	Chance	2017-06-27 9:30																										
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2013-08-26 14:02	0.066		1.01	<0.21	<0.257	0.225	0.737	2.6	<0.111	0.915	2.16	2.49	0.748	0.371	0.42	10.1	0.78	0.916	1.07	2.83	0.255	0.869	0.568	1.66	2.62	0.943
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-07-22 18:50	<0.0595		0.96	0.166	<0.236	<0.0723	<0.128	4.56	<0.113	0.19	0.59	1.48	0.245	<0.0516	0.245	21.3	<0.172	<0.165	0.403	2.19	0.162	0.102	0.101	1.32	1.93	0.177
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-09-21 15:10	<0.127		0.831	0.216	<0.961	0.342	0.568	<0.613	0.19	0.86	0.596	2.6	0.664	0.327	0.228	0.978	0.968	1.09	0.504	4.23	<0.131	1.28	<0.177	2.89	3.15	0.416
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-06-05 16:10	<0.15		1.64	<0.136	<0.403	0.208	0.691	0.94	<0.172	0.813	0.894	1.81	0.441	<0.123	0.814	1.78	0.22	0.843	0.527	2.6	0.332	0.581	<0.134	2.35	2.74	0.481
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-09-19 18:00	<0.303		1.19	3.46	<0.273	1.2	<0.852	1.27	0.834	3.8	1.55	8.75	3.28	<0.399	<0.358	0.88	1.13	3.6	1	6.43	<0.146	2.17	<0.497	2.56	4.58	1.23
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2016-03-15	<0.0952		0.532	0.284	<0.222	0.117	<0.195	3.13	<0.275	0.889	0.894	2.09	0.457	<0.0775	<0.195	17.6	0.381	0.364	3.31	2.45	<0.100	0.207	0.136	1.09	1.23	0.248
DALG-002	Dalglish Creek	Dalglish	2014-09-23 14:30	0.294		2.01	16.6	<0.927	4.44	4.46	5.58	2.75	13.1	3.48	12.3	21.6	2.69	2.3	19.4	12.2	21.8	7.07	25.5	0.246	10.9	4.92	11.2	29.9	9.45
DALG-002	Dalglish Creek	Dalglish	2015-06-06 17:40	<0.0941		1.59	0.367	<0.404	0.365	<0.317	1.17	0.26	1.16	0.787	2.91	0.856	<0.14	<0.219	2.17	1.07	1.19	0.962	4.04	<0.134	0.808	0.399	0.661	4.58	0.672
DALG-002	Dalglish Creek	Dalglish	2015-09-18 13:45	0.378		1.75	11.7	<0.559	2.95	2.73	2.88	2.96	8.54	1.8	9.97	7.42	1.86	<0.203	2.19	6.76	10.6	3.29	15.6	<0.168	4.86	1.96	5.11	17.3	4.87
DALG-002	Dalglish Creek	Dalglish	2016-03-15	<0.170		1	6.37	<0.272	0.782	0.362	4.24	2.62	3.41	1.81	7.22	4.46	0.617	<0.135	13.9	4.17	4.86	2.22	15.7	<0.128	3.08	1.02	2.66	14.6	2.92
DALG-002	Dalglish Creek	Dalglish	2016-05-10																										
DALG-002	Dalglish Creek	Dalglish	2016-06-21 17:43																										
DALG-002	Dalglish Creek	Dalglish	2016-09-20 15:30																										
DALG-002	Dalglish Creek	Dalglish	2016-09-22 14:50																										
DALG-002	Dalglish Creek	Dalglish	2017-03-07 15:00																										
DALG-002	Dalglish Creek	Dalglish	2017-06-27 16:00																										
DALG-002	Dalglish Creek	Dalglish	2017-09-21 11:05																										
DALG-002	Dalglish Creek	Dalglish	2018-03-21 14:00																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2013-08-26 15:45	<0.112		1.03	0.6	<0.321	0.238	0.6	0.892	0.298	1.29	1.04	2.86	1.03	0.302	0.458	1.94	1.52	0.688	1.33	5.14	0.261	0.659	0.697	1.45	3.7	1.36
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-07-23 11:55	0.07		1.32	2.55	<0.219	0.51	<0.183	4.98	0.989	2.11	1.83	3.87	0.994	<0.117	0.132	21.7	1.57	1.86	1.39	6.77	<0.0829	1.23	<0.305	2.61	6.79	1.14
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-09-23 11:15	<0.195		1.28	2.61	<0.39	0.636	0.358	3.62	0.439	2.12	1.08	4.76	2.1	0.478	0.375	15.3	2.3	2.77	0.957	8.59	<0.147	1.5	0.792	3.36	6.1	1.45
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-03-15 11:35	<0.128		1.09	<0.317	<0.355	<0.124	<0.33	1.44	<0.435	<0.417	<1.31	22.7	<0.268	<0.2	<0.36	4.75	<0.685	<0.244	<0.74	6.95	<0.16	<0.24	<0.273	<0.379	2.31	<0.266
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-06-05 17:50	<0.141		2.17	2.15	<0.468	0.675	0.269	1.56	0.891	2.63	1.09	6.04	2.55	0.462	<0.289	2.26	2.93	2.39	0.634	11.2	<0.121	1.86	1.06	2.58	7.93	2.01
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-09-18 18:55	<0.318			12.2		2.26	1.78		4.62	7.91	1.86		5.04	<0.343	<0.875		6.64	8.43	5.56		<0.411	4.1	1.99	8.88		2.88
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-03-16	<0.107		1.08	3.37	<0.421	0.445	<0.158	3.69	1.68	2.04	1.15	5.09	2.69	0.444	<0.134	12.3	2.44	1.84	1.22	9.12	<0.0759	1.6	<0.233	1.74	7.05	1.7
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-06-21 15:50																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-09-20 9:18																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-03-07 17:00																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-06-27 18:15																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-09-20 17:30																										
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2018-03-20 17:38																										
McPL-001	McParlon Creek above confluence wi	McParlon	2013-07-29	0.125		0.99	<0.229	<0.159	0.381	0.107	1.85	<0.202	1.01	0.379	1.83	0.876	0.212	0.192	8.52	0.411	1.26	0.94	3.77	0.19	0.393	0.545	1.42	2.94	0.602
McPL-001	McParlon Creek above confluence wi	McParlon	2014-07-22 16:55	0.051		0.97	0.537	<0.187	<0.0455	0.125	3.68	0.177	0.479	0.568	1.5	<0.244	<0.0689	0.291	17.7	<0.314	<0.166	0.394	2.19	0.176	0.335	<0.0702	0.609	1.56	0.333
McPL-001	McParlon Creek above confluence wi	McParlon	2014-09-21 13:10	<0.412		0.989	<0.244	<0.387	0.209	<0.469	2.09	0.158	0.869	1.17	2.09	0.444	<0.126	<0.261	9.78	0.569	0.85	<0.237	2.44	<0.182	0.503	0.245	2.12	2.61	0.648
McPL-001	McParlon Creek above confluence wi	McParlon	2015-06-05 12:45	<0.131		1.18	<0.143	<0.307	<0.106	0.765	0.624	<0.14	0.524	0.954	1.42	0.274	<0.117	0.88	1.11	0.368	0.286	0.977	1.25	0.315	0.294	<0.136	2.99	1.42	0.45
McPL-001	McParlon Creek above confluence wi	McParlon	2015-09-19 15:25	<0.223		0.571	1.58	<0.257	0.342	<0.363	0.64	<0.19	1.34	<0.437	2.49	0.739	<0.16	<0.206	0.412	<0.306	0.538	<0.168	2.4	<0.123	0.256	<0.162	0.811	2.53	0.176
McPL-001	McParlon Creek above confluence wi	McParlon	2016-05-10																										
McPL-001	McParlon Creek above confluence wi	McParlon	2016-06-21 12:55																										
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-20 13:16																										
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-22 12:10																										
McPL-001	McParlon Creek above confluence wi	McParlon	2017-03-07 12:40																										
McPL-001	McParlon Creek above confluence wi	McParlon	2017-06-27 12:55																										
McPL-001	McParlon Creek above confluence wi	McParlon	2017-09-20 14:05																										
McPL-001	McParlon Creek above confluence wi	McParlon	2018-03-21 12:48																										

				Benzo-jk-f	Benzo-bjk-	Biphenyl	C1-Phenar	C1-Acenap	C1-Benzo-	C1-Benzof	C1-Biphen	C1-Dibenz	C1-Fluorar	C1-Fluorer	C1-Naphth	C2-Phenar	C2-Benzo-	C2-Benzof	C2-Biphen	C2-Dibenz	C2-Fluorar	C2-Fluorer	C2-Naphth	C3-Benzo-	C3-Dibenz	C3-Fluorar	C3-Fluorer	C3-Naphth	C3-Phenar
				PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH
				org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org
				Benzo[j,k]f	Benzo{b/j/	Biphenyl	C1 Phenan	C1-Acenap	C1-Benzo[	C1-Benzofl	C1-Biphen	C1-Dibenz	C1-Fluorar	C1-Fluorer	C1-Naphth	C2 Phenan	C2-Benzo[	C2-Benzofl	C2-Biphen	C2-Dibenz	C2-Fluorar	C2-Fluorer	C2-Naphth	C3-Benzo[	C3-Dibenz	C3-Fluorar	C3-Fluorer	C3-Naphth	C3-Phenar
				ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L
Stn.Code	**Site Name**	**Group**	**Smpl Date**																										
McPL-002	McParlon Creek headwaters	McParlon	2013-08-27 11:05	<0.111	1.09	0.64	<0.378	0.238	0.436	0.523	<0.235	1.12	1.08	2.87	0.661	0.316	0.281	1.45	1.36	1.16	0.484	5.18	0.201	1.41	0.28	1.85	3.82	1.05
McPL-002	McParlon Creek headwaters	McParlon	2014-07-23 9:30	<0.103	0.798	<0.0677	<0.258	<0.0431	<0.104	4.07	<0.0992	<0.0747	0.309	1.43	0.129	<0.0475	<0.15	18.7	<0.198	<0.112	0.243	0.98	0.114	0.102	0.117	0.242	1.16	<0.324
McPL-002	McParlon Creek headwaters	McParlon	2014-09-21 16:00	<0.313	1.09	<0.2	<0.282	0.133	<0.715	2.11	0.222	0.735	0.689	2.26	0.303	<0.111	<0.424	9.86	0.444	0.677	<0.152	3.86	<0.223	0.921	<0.17	2.31	2.77	0.285
McPL-002	McParlon Creek headwaters	McParlon	2015-06-05 11:05	<0.111	1.62	<0.234	<0.391	<0.0828	1.09	0.89	<0.13	0.222	0.83	1.68	0.214	<0.0774	1.36	1.66	0.409	<0.101	0.5	0.975	0.393	0.367	<0.101	5.25	2.23	0.512
McPL-002	McParlon Creek headwaters	McParlon	2015-09-19 14:30	<0.135	0.709	0.769	<0.241	<0.0837	<0.247	0.714	<0.221	0.609	0.853	3.78	0.729	<0.139	<0.192	0.358	<0.393	0.143	0.487	2.87	<0.177	0.436	<0.147	1.63	0.747	<0.212
McPL-002	McParlon Creek headwaters	McParlon	2016-03-15	<0.128	0.663	0.557	<0.362	0.106	<0.218	2.8	<0.164	0.213	0.373	1.51	0.361	<0.119	<0.160	10.9	<0.102	0.108	0.592	1.82	<0.109	0.298	<0.0718	0.599	0.625	0.053
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2013-08-27 12:25	<0.181	0.811	<0.381	<0.25	0.157	0.381	2.34	<0.145	0.789	0.756	1.65	<0.128	0.301	0.215	9.43	0.833	0.978	0.53	5.18	0.28	1.26	0.467	1.47	2.84	0.631
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-07-22 10:20	<0.121	0.787	<0.231	<0.224	<0.0503	<0.193	2.72	0.228	<0.186	0.519	1.58	<0.153	<0.052	0.163	11.9	<0.217	<0.0745	0.387	1.41	<0.0884	<0.203	<0.161	0.566	1.31	0.131
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-09-21 14:20	<0.244	0.804	<0.195	<0.177	<0.135	<0.473	1.53	<0.28	0.688	0.559	1.78	0.373	<0.191	<0.361	6.83	0.522	1.13	<0.231	2.8	<0.2	0.71	0.459	2.06	1.75	0.22
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-06-06 15:00	<0.129	1.52	<0.365	<0.514	0.097	<0.363	0.806	<0.127	0.644	0.757	1.51	0.272	<0.123	<0.221	1.22	0.424	0.417	0.744	1.26	<0.13	0.277	<0.132	1.67	1.79	0.347
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-09-18 14:51	<0.134	0.469	0.879	<0.224	0.21	<0.156	0.412	<0.351	1.02	0.394	2.38	0.681	<0.176	<0.165	0.206	0.794	0.519	0.417	2.6	<0.112	0.802	<0.206	0.865	1	0.402

Notes:
Sample classes included in query: All

Stn.Code	Site Name	Group	Smpl Date	C4-Benzo- PAH org C4-Benzo[ng/L	C4-Dibenz PAH org C4-Dibenz ng/L	C4-Fluorar PAH org C4-Fluorar ng/L	C4-Naphth PAH org C4-Naphth ng/L	C4-Phenar PAH org C4-Phenar ng/L	Chrysene PAH org Chrysene ng/L	Dibenz-ah PAH org Dibenz[a,h ng/L	Dibenzoth PAH org Dibenzoth ng/L	Fluoranthe PAH org Fluoranthe ng/L	Fluorene PAH org Fluorene ng/L	Indeno-12 PAH org Indeno[1,2 ng/L	Naphthale PAH org Naphthale ng/L	Perylene PAH org Perylene ng/L	Phenanthr PAH org Phenanthr ng/L	Pyrene PAH org Pyrene ng/L	Retene PAH org Retene ng/L	Benz VOC org Benzene ug/L	E-Benz VOC org Ethylbenze ug/L	MTBE VOC org Methyl-ter ug/L	Styrn VOC org Styrene ug/L	Tolue VOC org Toluene ug/L	Xyl-T VOC org Xylenes, T	CO2 diss. gas carbon dio mg/L	C2 diss. gas ethane, di	CH4 diss. gas methane,	N2 diss. gas nitrogen g mg/L
CHNC-001	Chance Creek above confluence with	Chance	2013-07-29	<0.0997	0.652	0.538	<0.158	2.08	0.299	<0.0869	0.217	0.448	0.119	<0.101	1.82	0.162	1.17	0.361	0.63														
CHNC-001	Chance Creek above confluence with	Chance	2014-07-22 10:47	<0.0967	0.488	<0.116	<0.146	0.925	0.197	0.096	0.192	0.352	<0.336	0.131	2.23	<0.139	1.24	0.284	0.758														
CHNC-001	Chance Creek above confluence with	Chance	2014-09-22 19:00	<0.153	1.29	0.267	4.29	2.76	0.468	<0.334	<0.362	0.418	0.252	<0.303	5.08	1.12	1.18	0.597	1.15	<0.5	<1.0			<1.0	<2.0								
CHNC-001	Chance Creek above confluence with	Chance	2015-03-14 17:30	<0.157	<0.311	<0.256	5.69	<1.12	1	<0.498	<0.751	4.05	3.88	0.6	294	<0.189	10.8	4.19	<1.12	<0.5	<1.0	<1.0	<1.0	<1.0	<2.0								
CHNC-001	Chance Creek above confluence with	Chance	2015-06-06 11:00	0.315	0.624	<0.0944	0.868	1.32	0.338	<0.252	<0.0836	0.666	0.218	0.245	5.01	0.444	1.52	1.68	0.756	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.133281	0	0.030679	19.96407				
CHNC-001	Chance Creek above confluence with	Chance	2015-09-18 18:05	<0.135	0.876	<0.197	4.21	2.82	0.966	<0.299	0.187	0.786	0.349	0.229	7.53	0.853	2.86	0.959	1.43	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.770285	0	0.003601	21.03444				
CHNC-001	Chance Creek above confluence with	Chance	2016-03-16	<0.0689	0.388	<0.123	0.593	0.19	0.103	<0.0903	0.173	0.223	0.181	<0.0974	2.35	<0.117	0.866	0.176	0.229	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	21.41678	0	0.004321	28.96514				
CHNC-001	Chance Creek above confluence with	Chance	2016-06-21 11:15																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.476111	0	0.006049	26.44866				
CHNC-001	Chance Creek above confluence with	Chance	2016-09-20 12:00																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	6.775932	0	0.003889	31.8153				
CHNC-001	Chance Creek above confluence with	Chance	2017-03-07 10:40																	<500	<500	<500	<500	<500	<500								
CHNC-001	Chance Creek above confluence with	Chance	2017-06-27 11:30																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.207458	0	0.00749	36.63684				
CHNC-001	Chance Creek above confluence with	Chance	2017-09-20 10:21																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.519121	0	0.002737	23.31924				
CHNC-001	Chance Creek above confluence with	Chance	2018-03-21 10:25																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5								
CHNC-003	Chance Creek u/s tributary	Chance	2013-08-26 15:00	0.514	1.36	0.542	3.65	6.16	0.274	<0.229	0.336	0.368	<0.421	0.142	3.14	<0.212	1.15	0.336	4.5														
CHNC-003	Chance Creek u/s tributary	Chance	2014-07-22 18:30	<0.0934	0.485	<0.102	<0.296	1.91	0.261	<0.074	0.223	0.807	<0.131	<0.0693	1.98	0.116	1.37	0.602	2.13														
CHNC-003	Chance Creek u/s tributary	Chance	2014-09-23 10:40	0.123	1.07	<0.157	0.437	1.36	0.185	<0.179	0.205	0.287	0.225	0.409	3.93	<0.253	0.719	0.249	0.575	<0.5	<1.0			<1.0	<2.0								
CHNC-003	Chance Creek u/s tributary	Chance	2015-06-05 15:40	0.26	0.747	<0.0859	0.384	1.34	0.231	<0.374	<0.0669	0.533	<0.124	<0.22	5.58	<0.284	1.4	1.07	1.19	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.190114	0	0.013251	21.6476				
CHNC-003	Chance Creek u/s tributary	Chance	2015-09-19 17:23	<0.171	0.342	<0.223	2.32	3.51	0.76	<0.268	<0.239	0.663	0.182	0.273	6.14	1.81	2	0.685	3.12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.719942	0	0.005617	30.81275				
CHNC-003	Chance Creek u/s tributary	Chance	2016-09-22 10:59																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	2.324643	0	0.006049	24.07731				
CHNC-003	Chance Creek u/s tributary	Chance	2017-06-27 9:30																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8.035419	0	0.043498	23.41372				
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2013-08-26 14:02	0.386	1.07	0.612	3.44	3.43	0.193	<0.0966	0.295	0.486	<0.139	0.148	6.11	0.143	1	0.413	2.23														
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-07-22 18:50	<0.0655	0.552	<0.0571	<0.141	3.64	0.159	<0.0432	0.185	0.276	0.085	0.084	1.75	<0.0866	0.714	0.171	3.47														
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-09-21 15:10	<0.126	1.35	<0.13	2.12	2.96	0.351	<0.24	0.133	0.354	0.169	<0.206	3.72	<0.184	0.933	0.346	1.99	<0.5	<1.0			<1.0	<2.0								
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-06-05 16:10	0.852	0.638	<0.125	0.387	2.27	0.376	<0.227	<0.117	0.65	<0.144	0.236	5.42	0.235	1.45	1.56	1.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.147948	0	0.010082	19.26458				
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-09-19 18:00	<0.176	1.02	<0.231	18.3	10.8	1.51	<0.373	<0.43	0.902	0.278	0.416	17.8	2.5	2.66	1.23	7.16	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	6.469768	0	0.010082	24.76777				
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2016-03-15	<0.0869	1.07	<0.117	0.656	27.4	0.279	<0.118	0.208	0.44	1.11	0.132	2.84	<0.143	1.21	0.286	27.1	<0.5	<0.5	<0.5	<0.5	1	<0.5	81.70351	0	8.753601	24.03172				
DALG-002	Dalglish Creek	Dalglish	2014-09-23 14:30	0.274	4.9	<0.559	19	23.6	3.87	0.304	1.35	2.19	0.637	0.509	7.37	3.21	10	2.59	8.85	<0.5	<1.0			<1.0	<2.0								
DALG-002	Dalglish Creek	Dalglish	2015-06-06 17:40	<0.101	0.679	<0.106	1.23	1.75	0.488	<0.195	0.215	0.562	0.195	0.255	4.35	0.305	2.03	0.694	0.659	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.782128	0	0.002305	64.21666				
DALG-002	Dalglish Creek	Dalglish	2015-09-18 13:45	<0.14	1.3	<0.491	9.8	8.57	2.52	<0.26	0.545	1.19	0.511	0.432	8.51	1.89	6.22	1.63	3.12	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.725296	0	0.00216	22.8695				
DALG-002	Dalglish Creek	Dalglish	2016-03-15	<0.0782	1.28	<0.241	8.45	3.95	0.666	<0.121	0.82	0.528	0.55	<0.213	3.05	0.324	3.37	0.692	0.833	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	41.51175	0	0.122428	25.94122				
DALG-002	Dalglish Creek	Dalglish	2016-05-10																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	9.694569	0	0.005041	18.90228				
DALG-002	Dalglish Creek	Dalglish	2016-06-21 17:43																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	6.436768	0	0.002305	23.98437				
DALG-002	Dalglish Creek	Dalglish	2016-09-20 15:30																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	3.712463	0	0.002305	24.66932				
DALG-002	Dalglish Creek	Dalglish	2016-09-22 14:50																														
DALG-002	Dalglish Creek	Dalglish	2017-03-07 15:00																	<500	<500	<500	<500	<500	<500								
DALG-002	Dalglish Creek	Dalglish	2017-06-27 16:00																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.576944	0	0.001872	37.04076				
DALG-002	Dalglish Creek	Dalglish	2017-09-21 11:05																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	1.719649	0	0.001296	22.85431				
DALG-002	Dalglish Creek	Dalglish	2018-03-21 14:00																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5								
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2013-08-26 15:45	0.428	1.71	0.417	4.9	3.15	0.193	<0.0796	0.407	0.441	<0.23	0.075	3.08	<0.245	1.29	0.519	0.664														
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-07-23 11:55	<0.0728	0.534	<0.167	1.66	1.58	0.449	<0.0735	0.464	0.495	0.183	0.131	2.38	0.361	1.92	0.558	0.734														
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-09-23 11:15	<0.141	1.14	<0.284	2.25	2.06	0.562	<0.181	0.377	0.585	0.347	0.302	4.16	0.3	1.99	0.709	0.595	<0.5	<1.0			<1.0	<2.0								
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-03-15 11:35	<0.136	<0.36	<0.244	<0.319	<0.561	0.294	<0.406	<0.248	0.522	<0.513	<0.204	23.7	<0.182	1.39	0.513	<0.561	<0.5	<1.0	<1.0	<1.0	<1.0	<2.0								
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-06-05 17:50	<0.161	1.34	0.327	2.66	2.97	0.618	<0.281	0.463	0.739	0.208	0.285	5.75	0.408	2.8	1.89	0.906	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.29729	0	0.003169	18.39022				
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-09-18 18:55	<0.297	<1.23	<0.355		3.01	2.17	<0.408	1.65	1.38	0.741	0.565		2.66	5.81	1.55	0.674	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.108459	0	0.002449	28.15201				
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-03-16	<0.0777	0.683	<0.230	2.75	1.95	0.42	<0.111	0.584	0.445	0.276	<0.127	3.13	0.192	1.94	0.542	0.416	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	69.05364	0	0.229156	26.44359				
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-06-21 15:50																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.938107	0	0.004033	29.61001				
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-09-20 9:18																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	6.781432	0	0.003169	30.98498				
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-03-07 17:00																	<500	<500	<500	<500	<500	<500	59.42507	0	0.272222	32.58857				
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-06-27 18:15																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5								
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-09-20 17:30																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.677776	0	0.005617	113.3119				
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2018-03-20 17:38																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5								
McPL-001	McParlon Creek above confluence wi	McParlon	2013-07-29	<0.0677	0.712	0.413	2.29	3.97	0.313	<0.137	0.336	0.396	<0.0826	0.25	1.67	0.711	1.06	0.419	0.991														
McPL-001	McParlon Creek above confluence wi	McParlon	2014-07-22 16:55	<0.0894	0.56	<0.0739	0.275	0.668	0.142	<0.0537	0.29	0.347	<0.0745	0.128	1.7	0.326	0.782	0.301	0.565														
McPL-001	McParlon Creek above confluence wi	McParlon	2014-09-21 13:10	<0.142	1.13	0.351	1.11	1.82	0.233	<0.311	<0.169	0.515	0.222	<0.421	3.71	<0.612	0.872	0.322	0.711	<0.5	<1.0			<1.0	<2.0								
McPL-001	McParlon Creek above confluence wi	McParlon	2015-06-05 12:45	0.893	0.736	<0.0994	0.23	1.37	0.226	<0.2	<0.0894	0.634	<0.136	<0.187	2.98	<0.195	1.27	1.5	0.715	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.363289	0	0.005329	21.44233				
McPL-001	McParlon Creek above confluence wi	McParlon	2015-09-19 15:25	<0.123	0.266	<0.199	0.863	1.94	0.553	<0.204	<0.199	0.572	0.192	0.236	2.85	1.41	1.59	0.564	1.65	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.812451	0	0.004609	45.83173				
McPL-001	McParlon Creek above confluence wi	McParlon	2016-05-10																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	8.563414	0	0.020885	23.05583				
McPL-001	McParlon Creek above confluence wi	McParlon	2016-06-21 12:55																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	7.303926	0	0.006193	25.58024				
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-20 13:16																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	6.148938	0	0.004465	30.60463				
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-22 12:10																														
McPL-001	McParlon Creek above confluence wi	McParlon	2017-03-07 12:40																	<500	<500	<500	<500	<500	<500								
McPL-001	McParlon Creek above confluence wi	McParlon	2017-06-27 12:55																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	9.426905	0	0.006337	25.10298				
McPL-001	McParlon Creek above confluence wi	McParlon	2017-09-20 14:05																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.907784	0	0.003745	23.81038				
McPL-001	McParlon Creek above confluence wi	McParlon	2018-03-21 12:48																	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5								

				C4-Benzo-a	C4-Dibenz	C4-Fluorar	C4-Naphth	C4-Phenar	Chrysene	Dibenz-ah	Dibenzoth	Fluoranth	Fluorene	Indeno-12	Naphthale	Perylene	Phenanthr	Pyrene	Retene	Benz	E-Benz	MTBE	Styrn	Tolue	Xyl-T	CO2	C2	CH4	N2
				PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	PAH	VOC	VOC	VOC	VOC	VOC	VOC	diss. gas	diss. gas	diss. gas	diss. gas
				org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org	org				
				C4-Benzo[a	C4-Dibenz	C4-Fluorar	C4-Naphth	C4-Phenan	Chrysene	Dibenz[a,h	Dibenzoth	Fluoranthe	Fluorene	Indeno[1,2	Naphthale	Perylene	Phenanthr	Pyrene	Retene	Benzene	Ethylbenze	Methyl-ter	Styrene	Toluene	Xylenes, T	carbon dio	ethane, di	methane,	nitrogen g
				ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ng/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L	mg/L	mg/L	mg/L
Stn.Code	**Site Name**	**Group**	**Smpl Date**																										
McPL-002	McParlon Creek headwaters	McParlon	2013-08-27 11:05	0.613	1.75	0.3	2.77	5.51	0.243	<0.102	0.347	0.479	<0.126	0.184	3.96	<0.329	1.08	0.725	2.93										
McPL-002	McParlon Creek headwaters	McParlon	2014-07-23 9:30	<0.0578	0.392	<0.0809	<0.328	1.12	0.07	<0.0593	0.164	0.22	0.07	<0.0493	2.33	<0.154	0.505	0.159	1.02										
McPL-002	McParlon Creek headwaters	McParlon	2014-09-21 16:00	<0.167	1.18	0.206	1.55	1.65	0.147	<0.346	0.162	0.2	<0.172	<0.481	4.74	<0.515	0.71	0.202	0.203	<0.5	<1.0			<1.0	<2.0				
McPL-002	McParlon Creek headwaters	McParlon	2015-06-05 11:05	1.38	0.63	<0.0699	0.42	0.622	0.145	<0.31	<0.0903	0.443	<0.112	0.203	4.27	<0.169	1.08	0.55	0.371	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	4.451288	0	0.003457	23.20889
McPL-002	McParlon Creek headwaters	McParlon	2015-09-19 14:30	<0.133	0.46	<0.178	5.24	1.1	0.282	<0.337	<0.151	0.399	0.205	<0.173	9.89	0.416	1.11	0.403	0.527	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	6.504601	0	0.003745	20.60717
McPL-002	McParlon Creek headwaters	McParlon	2016-03-15	<0.0801	0.753	<0.0967	0.905	0.375	0.142	<0.112	0.273	0.38	<0.126	<0.107	2.2	<0.197	1	0.221	0.505	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	97.43335	0	2.4343	27.14022
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2013-08-27 12:25	0.419	1.24	0.299	3.2	2.61	0.189	<0.156	0.286	0.339	<0.124	0.175	2.79	<0.273	0.931	0.383	1.07										
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-07-22 10:20	<0.0936	0.381	<0.0869	<0.211	1.84	0.151	<0.0681	0.178	0.343	<0.0821	<0.0577	1.96	<0.183	0.786	0.184	1.37										
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-09-21 14:20	0.188	1.18	0.373	1.49	0.803	0.131	<0.321	0.119	0.31	0.215	<0.376	3.53	<0.41	0.856	0.248	0.395	<0.5	<1.0			<1.0	<2.0				
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-06-06 15:00	<0.215	0.658	<0.12	<0.243	1.11	0.15	<0.181	0.137	0.577	<0.231	<0.192	2.69	<0.186	1.38	1.48	0.543	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.191948	0.000285	0.005905	21.80133
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-09-18 14:51	<0.151	0.511	<0.185	1.98	0.36	0.454	<0.405	0.143	0.419	<0.209	<0.194	5.19	0.267	1.13	0.515	0.763	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	5.829941	0	0.003457	24.60567

Notes:
Sample classes included in query: All

Stn.Code	Site Name	Group	Smpl Date	O2 diss. gas oxygen ga mg/L	C3 diss. gas propane, d mg/L	d13C-DIC isotope iso Carbon-13 i ‰ VSMOW	d2H-water isotope iso deuterium ‰ VSMOW	d18O-SO4 isotope iso Oxygen-18 i ‰ VSMOW	d18O-wate isotope iso Oxygen-18 i ‰ VSMOW	d34S-SO4 isotope iso Sulphur-34 ‰ VSMOW	Actinium2 NORMs iso Actinium2 Bq/L	Bismuth21 NORMs iso Bismuth21 Bq/L	Bismuth21 NORMs iso Bismuth21 Bq/L	Lead210 NORMs iso Lead210 Bq/L	Lead211 NORMs iso Lead211 Bq/L	Lead212 NORMs iso Lead212 Bq/L	Lead214 NORMs iso Lead214 Bq/L	Potassium NORMs iso Potassium Bq/L	Radium22 NORMs iso Radium22 Bq/L	Radium22 NORMs iso Radium22 Bq/L	Radon219 NORMs iso Radon219 Bq/L	Thallium2 NORMs iso Thallium2 Bq/L	Thorium22 NORMs iso Thorium22 Bq/L	Thorium23 NORMs iso Thorium23 Bq/L	Thorium23 NORMs iso Thorium23 Bq/L	Uranium235 NORMs iso Uranium235 Bq/L
CHNC-001	Chance Creek above confluence with	Chance	2013-07-29																								
CHNC-001	Chance Creek above confluence with	Chance	2014-07-22 10:47																								
CHNC-001	Chance Creek above confluence with	Chance	2014-09-22 19:00																	0.007							
CHNC-001	Chance Creek above confluence with	Chance	2015-03-14 17:30			-14.15	-169.72	-1.09	-22.04	3.07										<0.005							
CHNC-001	Chance Creek above confluence with	Chance	2015-06-06 11:00	9.749004	0	-19.39	-172.73	-7.8	-22.3	-5.66										<0.005							
CHNC-001	Chance Creek above confluence with	Chance	2015-09-18 18:05	11.99237	0	-13.23	-161.33	-12.98	-20.88	-7.98	<0.8	<2	<0.5	<4	<3	0.5	<0.4	<5	<0.4	<0.01	<1	<0.2	<1	<10	<3	<1
CHNC-001	Chance Creek above confluence with	Chance	2016-03-16	1.856503	0	-13.41	-172.69	-8.33	-22.31	-5.31	<0.4	1.0	<0.3	<2	<2	0.4	<0.2	<2	<0.4	<2	<0.4	0.2	<0.4	<10	<1	<0.4
CHNC-001	Chance Creek above confluence with	Chance	2016-06-21 11:15	10.57949	0	-16.37	-163.65	-11.64	-20.197	-5.73	<0.6	<1	<0.3	<3	<2	0.3	0.4	<3	<0.7	<3	<1	<0.2	<0.9	<20	<2	<0.8
CHNC-001	Chance Creek above confluence with	Chance	2016-09-20 12:00	14.86674	0	-12.22	-162.98	-14.35	-20.706	-7.09	<0.9	<1	<0.6	<3	<2	<0.3	<0.5	<4	<0.8	0.02	<1	<0.2	<0.7	<20	<3	<0.9
CHNC-001	Chance Creek above confluence with	Chance	2017-03-07 10:40			-13.29	-171.17	-6.67	-22.184	-4.19	<0.9	<2	<0.5	<4	<6	0.6	0.5	14	<0.8	<4	<1	0.4	<0.9	<20	<4	<1
CHNC-001	Chance Creek above confluence with	Chance	2017-06-27 11:30	13.71904	0	-11.99	-166.64	-12.36	-20.235	-5.83	<1	<2	<0.8	<4	<2	1.2	<0.6	<6	<0.7	<5	<2	0.6	<1	<20	<4	1
CHNC-001	Chance Creek above confluence with	Chance	2017-09-20 10:21	11.06885	0	-11.49	-162.12	-7.84	-20.782	-8.1																	
CHNC-001	Chance Creek above confluence with	Chance	2018-03-21 10:25								1	<2	1	<4	<6	0.5	0.7	9	<0.8	<5	<1	<0.3	<1	<30	6	<1
CHNC-003	Chance Creek u/s tributary	Chance	2013-08-26 15:00																								
CHNC-003	Chance Creek u/s tributary	Chance	2014-07-22 18:30																								
CHNC-003	Chance Creek u/s tributary	Chance	2014-09-23 10:40																	<0.005							
CHNC-003	Chance Creek u/s tributary	Chance	2015-06-05 15:40	10.81786	0	-22.24	-171.82		-22.04											0.01							
CHNC-003	Chance Creek u/s tributary	Chance	2015-09-19 17:23	13.91221	0	-20.22	-165.63	12.76	-21.21		<1	<2	<0.5	<5	<7	0.5	<0.5	<6	<1	0.01	<1	0.3	<1	<20	<4	<1
CHNC-003	Chance Creek u/s tributary	Chance	2016-09-22 10:59	12.17555	0	-14.64	-164.8	-9.24	-20.751	-4.18	<0.7	<2	0.7	<3	<3	<0.3	0.8	<4	<1	<3	<1	0.4	<0.6	<10	<3	<0.8
CHNC-003	Chance Creek u/s tributary	Chance	2017-06-27 9:30	5.022071	0	-17.23	-166.79	9.31	-20.629	-4.17	<1	<2	<0.6	<5	<5	1.1	0.7	<6	<0.9	<5	<0.9	<0.3	<1	<20	<4	<1
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2013-08-26 14:02																								
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-07-22 18:50																								
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2014-09-21 15:10																	<0.005							
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-06-05 16:10	9.869372	0	-22.7	-172.1		-22.26											0.03							
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2015-09-19 18:00	12.77003	0	-21.95	-167.45	11.27	-21.15		1	<2	<0.5	<4	<3	<0.4	<0.5	<6	<1	0.008	<1	<0.2	<1	<30	<4	<1
CHNC-t-002	Unnamed tributary of Chance Creek	Chance	2016-03-15	0.788435	0.001622	-19.53	-186.96		-24.31		0.8	<2	0.8	<4	<7	<0.4	<0.5	<6	<0.9	<4	<1	<0.2	<1	<30	<4	<1
DALG-002	Dalglish Creek	Dalglish	2014-09-23 14:30																	0.006							
DALG-002	Dalglish Creek	Dalglish	2015-06-06 17:40	21.84229	0	-15.81	-170.54	-11.6	-21.79	-10.53										0.009							
DALG-002	Dalglish Creek	Dalglish	2015-09-18 13:45	12.80682	0	-10.8	-168.83	-13.24	-21.69	-10.78	<1	<2	1	<4	<6	<0.4	0.7	<5	<1	0.009	<2	<0.4	<1	<30	<4	<1
DALG-002	Dalglish Creek	Dalglish	2016-03-15	0.719579	0.000406	-10.07	-172.56	-10.74	-21.95	-1.54	<0.9	<2	0.6	<4	<4	<0.4	<0.5	<5	<0.9	<5	<1	<0.2	<0.6	<20	<4	<1
DALG-002	Dalglish Creek	Dalglish	2016-05-10	8.036785	0	-20.96	-188.1	-13.34	-24.24	-9.54	0.8	1	<0.4	<3	<3	0.5	<0.3	<4	<0.5	<3	<0.8	0.3	<0.7	<20	<2	<1.0
DALG-002	Dalglish Creek	Dalglish	2016-06-21 17:43	8.988953	0	-12.29	-168.68	-13.52	-21.426	-11.66	2	4	<0.7	<6	<6	0.8	<0.6	<7	<0.7	<8	<2	<0.4	<1	<20	<5	<2
DALG-002	Dalglish Creek	Dalglish	2016-09-20 15:30	13.1921	0	-8.87	-165.66	-14.26	-20.717	-9.65	1	<3	1	<4	<7	1	<0.7	<5	<1	0.01	<2	0.4	<0.9	<20	<4	<1
DALG-002	Dalglish Creek	Dalglish	2016-09-22 14:50																								
DALG-002	Dalglish Creek	Dalglish	2017-03-07 15:00			-9.98	-170.38	-8.33	-21.955	-2.54	<0.9	<2	<0.6	<4	<4	0.7	<0.6	6	<1	<4	<1	0.7	<1	<20	<4	<1
DALG-002	Dalglish Creek	Dalglish	2017-06-27 16:00	16.72666	0	-12.99	-164.6	-15.14	-20.71	-10.67	<0.7	<2	<0.6	<4	<5	0.7	0.8	<5	<1	<4	<0.6	<0.2	<1	<20	<4	<1
DALG-002	Dalglish Creek	Dalglish	2017-09-21 11:05	11.13665	0	-8.94	-162.37	-11.85	-20.682	-11.77																	
DALG-002	Dalglish Creek	Dalglish	2018-03-21 14:00								<1	<3	1	9	<4	0.4	0.8	14	<1	<4	<1	0.4	<1	<20	6	1
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2013-08-26 15:45																								
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-07-23 11:55																								
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2014-09-23 11:15																	<0.005							
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-03-15 11:35			-20.56	-170.66	-7.53	-21.94	-0.65										<0.005							
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-06-05 17:50	9.456758	0	-11	-171.66	-12.4	-22.12	-2.16										<0.005							
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2015-09-18 18:55	14.9603	0	-10.11	-163.85	-11.05	-20.95	-4.28	<1	<1	0.7	<6	<4	<0.3	<0.4	<5	<0.9	0.006	<1	<0.2	<1	<30	<4	<0.8
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-03-16	0.968462	0	-20.48	-172.16	-11.14	-21.78	-1.85	0.8	<0.9	<0.4	4	<4	<0.3	0.4	<4	<0.5	<4	<0.8	<0.2	<0.9	<10	<3	<0.7
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-06-21 15:50	12.13034	0	-11.4	-166.55	-14.14	-20.914	-2.84	<1	<2	0.8	<5	<7	<0.4	<0.6	<5	<1	<5	<1	<0.4	<1	<30	<4	<1
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2016-09-20 9:18	15.13428	0	-9.42	-164.79	-12.91	-20.682	-3.34	<0.8	<1	<0.5	<3	<3	<0.3	0.7	<4	<0.7	0.01	<1	<0.2	<1	<10	<3	<0.9
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-03-07 17:00	2.165307	0	-18.27	-171.03	-10.42	-21.839	-1.78	<0.9	<2	<0.6	<4	<1	1.0	<0.6	10	<1	<5	<1	0.5	<0.8	<30	<4	<1
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-06-27 18:15			-7.39	-163.72	-17.02	-20.105	-2.1	<0.4	<2	0.9	<4	<5	0.9	<0.5	<5	<0.8	<4	<1	<0.3	<1	<30	<4	<1
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2017-09-20 17:30	37.96947	0	-6.26	-163.85	-12.04	-20.917	-2.02																	
EAGL-t-003	Unnamed tributary of Eagle R	EagleT	2018-03-20 17:38								<1	<2	1	9	<5	0.6	1	12	<0.8	<4	<0.9	<0.4	<1	<20	8	1
McPL-001	McParlon Creek above confluence wi	McParlon	2013-07-29																								
McPL-001	McParlon Creek above confluence wi	McParlon	2014-07-22 16:55																								
McPL-001	McParlon Creek above confluence wi	McParlon	2014-09-21 13:10																	<0.005							
McPL-001	McParlon Creek above confluence wi	McParlon	2015-06-05 12:45	10.04309	0	-21.16	-170.04	-9.58	-21.95	-4.63										<0.005							
McPL-001	McParlon Creek above confluence wi	McParlon	2015-09-19 15:25	18.17344	0	-16.49	-163.9	-8.73	-21.3	-5.9	<1	<2	<0.6	<4	5	0.8	<0.5	<4	<0.9	0.02	<1	<0.2	<0.6	<30	<4	<1
McPL-001	McParlon Creek above confluence wi	McParlon	2016-05-10	10.48514	0	-23.29	-189.85	-13.03	-24.21	-3.86	<0.6	<2	0.5	<3	<3	1.0	<3	<3	<0.7	<3	<0.9	0.4	<0.7	<8	<2	<0.6
McPL-001	McParlon Creek above confluence wi	McParlon	2016-06-21 12:55	10.30669	0	-15.94	-166.69	-10.76	-21.144	-4.08	<1	<2	<0.8	<4	<5	<0.4	<0.6	5	<0.5	<5	<2	<0.4	<1	<20	<4	<1
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-20 13:16	14.31352	0	-12.96	-165.61	-13.63	-20.962	-5.15	1	<2	0.6	<3	<3	<0.3	0.6	<4	<0.9	0.01	<1	<0.2	<1	<10	<3	<1
McPL-001	McParlon Creek above confluence wi	McParlon	2016-09-22 12:10																								
McPL-001	McParlon Creek above confluence wi	McParlon	2017-03-07 12:40			-15.52	-180.9	-12.97	-23.979	-4.44	<0.9	<2	<0.5	<4	<6	<0.4	<0.4	10	<1	<4	<0.9	0.4	<0.6	<30	<4	<1
McPL-001	McParlon Creek above confluence wi	McParlon	2017-06-27 12:55	8.73823	0	-19.13	-166.03	4.6	-20.811	-3.24	<1	<2	<0.8	<4	<6	0.4	<0.7	6	<1	<5	<2	<0.3	<1	<30	<4	<1
McPL-001	McParlon Creek above confluence wi	McParlon	2017-09-20 14:05	11.03363	0	-12.02	-161.96	-6.74	-20.632	-3.16																	
McPL-001	McParlon Creek above confluence wi	McParlon	2018-03-21 12:48								<1	<2	1	<4	<6	0.8	1	8	<0.8	<5	<2	0.6	<1	<30	6	<1

				O2	C3	d13C-DIC	d2H-water	d18O-SO4	d18O-wate	d34S-SO4	Actinium2	Bismuth21	Bismuth21	Lead210	Lead211	Lead212	Lead214	Potassium	Radium22	Radium22	Radon219	Thallium2	Thorium22	Thorium23	Thorium23	Uranium235
				diss. gas	diss. gas	isotope	isotope	isotope	isotope	isotope	NORMs	NORMs	NORMs	NORMs	NORMs	NORMs	NORMs	NORMs	NORMs	NORMs	NORMs	NORMs	NORMs	NORMs	NORMs	NORMs	NORMs
						iso	iso	iso	iso	iso	iso	iso	iso	iso	iso	iso	iso	iso	iso	iso	iso	iso	iso	iso	iso	iso
				oxygen ga	propane, c	Carbon-13 i	deuterium	Oxygen-18 i	Oxygen-18 i	Sulphur-34	Actinium2	Bismuth21	Bismuth21	Lead210	Lead211	Lead212	Lead214	Potassium	Radium22	Radium22	Radon219	Thallium2(	Thorium22	Thorium23	Thorium23	Uranium235
				mg/L	mg/L	‰ VSMOW	‰ VSMOW	‰ VSMOW	‰ VSMOW	‰ VSMOW	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L	Bq/L
Stn.Code	**Site Name**	**Group**	**Smpl Date**																							
McPL-002	McParlon Creek headwaters	McParlon	2013-08-27 11:05																							
McPL-002	McParlon Creek headwaters	McParlon	2014-07-23 9:30																							
McPL-002	McParlon Creek headwaters	McParlon	2014-09-21 16:00																	<0.005						
McPL-002	McParlon Creek headwaters	McParlon	2015-06-05 11:05	11.1017	0	-19.1	-167.43	-10.08	-21.47	-4.55										<0.005						
McPL-002	McParlon Creek headwaters	McParlon	2015-09-19 14:30	11.11352	0	-14.51	-169.02	-13.63	-21.55	-6.47	1	<1	<0.6	<4	<5	0.4	<0.5	<6	<0.6	0.005	<1	<0.3	<1	<30	<4	<1
McPL-002	McParlon Creek headwaters	McParlon	2016-03-15	0.541918	0.001217	-11.19	-193.7	-16.52	-25.43	-6.3	<1	<0.9	<0.7	<4	<4	<0.4	<0.6	<5	<1	<4	<1	<0.3	<1	<30	<4	<1
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2013-08-27 12:25																							
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-07-22 10:20																							
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2014-09-21 14:20																	<0.005						
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-06-06 15:00	11.15295	0	-15.95	-168.9	-12.04	-21.83	-6.26										<0.005						
NCY-PT19	Unnamed Creek d/g Permit 19	EagleT	2015-09-18 14:51	12.549	0	-9.58	-167.3	-12.34	-21.52	-6.56	<0.7	<1	<0.4	<4	<3	0.7	<0.4	<4	<0.6	0.007	<1	0.3	<0.9	<30	<3	<0.8

Notes:
Sample classes included in query: All

ATTACHMENT B WATER QUALITY DATA COLLECTED; 2019 TO 2020

Water quality results, Chance Oil and Gas

Analyte	Units	CCME-Aquatic Life (AL)	Sample ID WQ Site ID Date Sampled Detection Limit	9080353-02 McPL-002 01-Aug-2019	9080353-07 McPL-001 01-Aug-2019	WR2000096-001 MCPL-001 08-Mar-2020	9080353-11 CHNC-003 01-Aug-2019	WR2000096-006 CHNC-003 10-Mar-2020	9080353-06 CHNC-t-002 01-Aug-2019	9080353-12 CHNC-001 01-Aug-2019	WR2000096-005 CHNC-001 09-Mar-2020	WR2000096-003 CHNC-001-r 09-Mar-2020	QA/QC CHNC-001 Replicate Analysis	9080353-05 NCY-PT19 01-Aug-2019	WR2000096-002 NCY-PT19 08-Mar-2020	9080353-01 EAGL-t-003 01-Aug-2019	WR2000096-004 EAGL-t-003 09-Mar-2020	9080353-04 EAGL-t-004 01-Aug-2019	WR2000096-008 EAGL-t-004 12-Mar-2020	9080353-03 DALG-003 01-Aug-2019	9080353-09 DALG-002 01-Aug-2019	9080353-10 DALG-002-r 01-Aug-2019	QA/QC DALG-002 Replicate Analysis	WR2000096-009 DALG-002 12-Mar-2020
Physical Tests																								
Temperature (in-situ)	°C	-	-	12.6	16.7	0.3	13.4	0.2	12.2	16.1	0.1	0.1	-	13.0	-0.3	13.7	0.1	14.2	-0.1	11.8	16.4	16.4	-	0.0
Dissolved Oxygen (in-situ)	mg/L	6.5	-	-	-	***1.02***	-	***1.02***	-	-	***3.05***	***3.05***	-	-	***1.19***	-	***3.4***	-	***1.1***	-	-	-	-	***0.4***
Specific Conductivity (in-situ)	µS/cm	-	-	193.0	65.0	551	45.0	443.7	32.0	58.0	586	586	-	533.0	4,000.00	290.0	982.0	887.0	0.0	264.0	366.0	366.0	-	859.0
pH (in-situ)	pH	6.5 - 9.0	-	7.0	7.2	7.64	***4.1***	6.75	7.3	7.1	7.46	7.46	-	8.2	6.89	7.1	6.6	7.6	7.2	7.2	7.4	7.4	-	7.3
Turbidity (In-situ)	NTU	-	-	7.2	27.7	3.0	14.8	105	34.6	20.2	0.97	0.97	-	6.4	46	7.0	1.1	3.0	30.7	4.7	4.0	4.0	-	15.2
Conductivity	µS/cm	-	2	191	66.8	563	43.4	435	34.4	53	594	596	0%	620	14000	298	456	1070	6880	281	413	415	0%	839
Hardness (as CaCO3)	mg/L	-	0.5	59.4	27.5	264	21.9	215	19.4	24.2	293	302	3%	179.0	6950	96.5	177	355.0	3260	85.5	156.0	158.0	1%	386
pH (lab)	pH	6.5 - 9.0	0.1	7.26	7.08	7.8	6.94	6.9	6.64	7.12	7.81	7.83	0%	7.60	7.27	7.22	6.53	7.90	7.55	7.48	7.96	7.98	0%	7.24
Total Suspended Solids	mg/L	-	2	4.6	15.4	<3.0	7.8	150	19.6	12.6	<3.0	<3.0	<DL	4.4	17.7	3	7.2	2.6	148	4.4	3	3.8	<2xDL	42.4
Total Dissolved Solids	mg/L	-	10	112	34	-	19	-	13	25	-	-	-	353	-	161	-	680	-	146	220	238	8%	-
Anions and Nutrients																								
Ammonia, total (as N)	mg/L	temp and pH dep	0.0050	-	-	0.292	-	1.57	-	-	0.0168	0.0172	<2xDL	-	3.2	-	0.175	-	1.72	-	-	-	-	0.22
Ammonia, total (as N) (pH and temperature adjusted Guideline)	*mg/L*	*temp and pH dep*	-	-	-	*6.02*	-	*19.00*	-	-	*6.02*	*6.02*	-	-	*19.00*	-	*60.04*	-	*19.00*	-	-	-	-	*6.02*
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	1	28.7	15.7	-	12.4	-	8.8	15.6	-	-	-	52.4	-	23.5	-	97.4	-	38.5	94.0	94.5	1%	-
Alkalinity, Carbonate (as CaCO3)	mg/L	-	1	<1.0	<1.0	-	<1.0	-	<1.0	<1.0	-	-	-	<1.0	-	<1.0	-	<1.0	-	<1.0	<1.0	<1.0	<DL	-
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	1	<1.0	<1.0	-	<1.0	-	<1.0	<1.0	-	-	-	<1.0	-	<1.0	-	<1.0	-	<1.0	<1.0	<1.0	<DL	-
Alkalinity, Total (as CaCO3)	mg/L	-	1	28.7	15.7	226	12.4	187	8.8	15.6	215	215	0%	52.4	1840	23.5	39.1	97.4	977	38.5	94.0	94.5	1%	202
Bromide (Br)	mg/L	-	0.05	-	-	<0.050	-	<0.050	-	-	<0.050	<0.050	<DL	-	<5.00	-	<0.050	-	<2.50	-	-	-		<0.250
Chloride (Cl)	mg/L	120	0.1	0.2	0.18	0.9	0.21	0.84	<0.10	<0.10	0.71	0.73	3%	0.31	<50.0	2.34	2.19	0.73	<25.0	0.17	0.12	0.12	<2xDL	<2.50
Fluoride (F)	mg/L	0.12	0.1	***0.17***	***0.16***	0.094	***0.15***	***0.148***	<0.10	***0.14***	0.058	0.058	<2xDL	***0.15***	<2.00	***0.26***	***0.158***	***0.16***	<1.00	***0.2***	***0.26***	***0.26***	<2xDL	***0.334***
Nitrate (as N)	mg/L	3	0.01	<0.010	<0.010	0.0095	<0.010	0.012	<0.010	0.015	0.264	0.264	0%	0.111	<0.500	0.01	0.0157	<0.010	<0.250	0.01	<0.010	<0.010	<DL	<0.0250
Nitrite (as N)	mg/L	0.06	0.01	<0.010	<0.010	0.0012	<0.010	<0.0010	<0.010	<0.010	<0.0010	0.001	<DL	<0.010	<0.100	<0.010	<0.0010	<0.010	<0.0500	<0.010	<0.010	<0.010	<DL	<0.0050
Sulfate (SO4)	mg/L	-	1	61.00	10.70	90.6	2.20	38.6	<1.0	4.90	120	120	0%	212.00	9880	92.90	181	422.00	4160	72.40	84.50	101.00	18%	264
Organic / Inorganic Carbon																								
Dissolved Organic Carbon	mg/L	-	0.5	25.30	26.50	28.8	32.70	157	29.80	28.00	3.4	3.76	10%	26.80	123	13.70	12.4	26.30	71	21.10	22.00	19.10	14%	25.7
Total Organic Carbon	mg/L	-	0.5	-	-	29.3	-	155	-	-	3.37	3.36	0%	-	124	-	12.5	-	70.9	-	-	-	-	25.1
Total Metals													-											
Aluminium (Al)-Total [a] *(Lab Result)*	mg/L	*pH-dep*	0.005	***0.1450***	***0.5740***	0.0515	***0.2260***	***2.0000***	***0.7020***	***0.2600***	0.0044	0.0043	<2xDL	***0.1770***	***0.17***	***0.2570***	0.0618	0.0222	***0.274***	0.0698	0.0460	0.0482	5%	0.0847
Aluminium (Al)-Total (pH adjusted Guideline)	*mg/L*	*pH-dep*	-	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	-	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	*0.1000*	-	*0.1000*
Antimony (Sb)-Total	mg/L	-	0.0002	0.00027	0.00022	0.00018	0.00023	0.00075	0.00028	0.00020	<0.00010	<0.00010	<DL	<0.00020	<0.00100	<0.00020	<0.00010	<0.00020	<0.00050	<0.00020	0.00022	0.00022	<2xDL	0.00019
Arsenic (As)-Total	mg/L	0.005	0.0005	0.00113	0.00130	0.00244	0.00122	***0.00669***	0.00174	0.00099	0.00023	0.00022	<2xDL	0.00108	0.00282	0.00095	0.00037	0.00107	0.00207	0.00103	0.00099	0.00098	<2xDL	0.00244
Barium (Ba)-Total	mg/L	-	0.005	0.11600	0.14400	0.532	0.11400	0.898	0.14000	0.11500	0.195	0.193	1%	0.10900	0.112	0.08820	0.084	0.12000	0.158	0.09330	0.09890	0.09950	1%	0.14
Beryllium (Be)-Total	mg/L	-	0.0001	<0.00010	<0.00010	0.00004	<0.00010	0.000304	0.00012	<0.00010	<0.000020	<0.000020	<DL	<0.00010	<0.000200	0.00013	0.000022	<0.00010	<0.000100	<0.00010	<0.00010	<0.00010	<DL	0.000024
Bismuth (Bi)-Total	mg/L	-	0.0001	<0.00010	<0.00010	<0.000050	<0.00010	0.000056	<0.00010	<0.00010	<0.000050	<0.000050	<DL	<0.00010	<0.000500	<0.00010	<0.000050	<0.00010	<0.000250	<0.00010	<0.00010	<0.00010	<DL	<0.000050
Boron (B)-Total	mg/L	1.5	0.005	0.0272	0.011	<0.010	0.0148	0.015	0.0113	0.0116	<0.010	0.01	<DL	0.0335	0.507	0.0645	0.026	0.0686	0.292	0.0298	0.0749	0.0799	6%	0.044
Cadmium (Cd)-Total *(Lab Result)*	mg/L	*Hardness-dep*	0.00001	0.0000390	***0.0000650***	0.0000637	***0.0000540***	***0.000779***	***0.0001020***	***0.0000540***	0.0000129	0.0000143	<2xDL	***0.0003300***	***0.00124***	***0.0002070***	0.000181	0.0000310	***0.000438***	0.0000490	0.0000560	0.0000470	17%	0.0000282
Cadmium (Cd)-Total (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	*0.0001029*	*0.0000543*	*0.0003548*	*0.0000449*	*0.0002992*	*0.0000406*	*0.0000488*	*0.0003700*	*0.0003700*	-	*0.0002570*	*0.0003700*	*0.0001539*	*0.0002546*	*0.0003700*	*0.0003700*	*0.0003392*	*0.0002292*	*0.0002317*	-	*0.0003700*
Calcium (Ca)-Total	mg/L	-	0.2	13.10	7.20	83.7	5.54	49.3	5.06	6.70	88.7	92.2	4%	26.90	906	21.80	43.4	53.50	442	15.10	43.20	44.10	2%	117
Chromium (Cr)-Total	mg/L	0.0089	0.0005	0.00157	0.00233	0.0006	0.00177	0.00765	0.00279	0.00148	<0.00010	<0.00010	<DL	0.00166	0.00175	0.00123	0.00041	0.00125	0.00139	0.00139	0.00098	0.001	<2xDL	0.00067
Cobalt (Co)-Total	mg/L	-	0.0001	0.00027	0.00049	0.00304	0.00033	0.0272	0.00101	0.00027	<0.00010	<0.00010	<DL	0.00073	0.0503	0.00519	0.0269	0.00033	0.0254	0.00039	0.00079	0.00079	0%	0.00723
Copper (Cu)-Total *(Lab Result)*	mg/L	*Hardness-dep*	0.0004	***0.00644***	***0.00666***	0.00132	***0.00743***	***0.0219***	***0.00905***	***0.00653***	0.00053	<0.00050	<DL	***0.00457***	***0.0103***	***0.0039***	0.00128	0.00316	***0.00438***	***0.00443***	0.00281	***0.0112***	120%	0.00068
Copper (Cu)-Total (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	*0.00200*	*0.00200*	*0.00400*	*0.00200*	*0.00400*	*0.00200*	*0.00200*	*0.00400*	*0.00400*	-	*0.00389*	*0.00400*	*0.00229*	*0.00385*	*0.00400*	*0.00400*	*0.00207*	*0.00346*	*0.00350*	-	*0.00400*
Iron (Fe)-Total	mg/L	0.3	0.01	***1.02***	***1.59***	***3.05***	***1.49***	***29.8***	***3.07***	***0.94***	0.084	0.081	4%	***1.64***	***6.69***	***3.56***	***9.88***	***0.784***	***1.55***	***1.51***	***0.98***	***0.997***	2%	***15.3***
Lead (Pb)-Total *(Lab Result)*	mg/L	*Hardness-dep*	0.0002	0.0003	0.00062	<0.000050	0.00052	0.00184	0.00081	0.00045	<0.000050	<0.000050	<DL	0.00027	<0.000500	<0.00020	<0.000050	<0.00020	0.000254	0.00023	<0.00020	<0.00020	<DL	0.000148
Lead (Pb)-Total (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	*0.001000*	*0.001000*	*0.007000*	*0.001000*	*0.007000*	*0.001000*	*0.001000*	*0.007000*	*0.007000*	-	*0.006676*	*0.007000*	*0.003041*	*0.006581*	*0.007000*	*0.007000*	*0.002606*	*0.005604*	*0.005696*	-	*0.007000*
Lithium (Li)-Total	mg/L	-	0.0001	0.00152	0.00182	0.0019	0.00141	0.0058	0.00193	0.00198	0.0069	0.0072	4%	0.0313	1.25	0.0123	0.0081	0.0444	0.436	0.00516	0.0138	0.014	1%	0.0112
Magnesium (Mg)-Total	mg/L	-	0.01	8.83	3.04	13.3	2.14	22.2	2.16	2.41	17.4	17.5	1%	31.60	1140	11.80	16.6	61.60	525	12.60	13.90	14.10	1%	22.8
Manganese (Mn)-Total	mg/L	-	0.0002	0.05220	0.06080	***3.29***	0.03900	***7.43***	0.07400	0.07730	0.117	0.117	0%	0.09300	***21.3***	0.18900	***1.16***	0.05190	***15.6***	0.07010	0.10000	0.10000	0%	2.34
Manganese (Mn)-Total (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	*0.43*	*0.38*	*0.43*	*0.23*	*0.83*	*0.21*	*0.25*	*0.43*	*0.46*	-	*0.54*	*0.86*	*0.56*	*0.83*	*0.46*	*0.72*	*0.49*	*0.40*	*0.40*	-	*0.86*
Mercury (Hg)-Total	mg/L	0.000026	0.00001	<0.000010	<0.000010	<0.0000050	<0.000010	***0.0000482***	<0.000010	<0.000010	<0.0000050	<0.0000050	<DL	<0.000010	0.0000057	<0.000010	<0.0000050	<0.000010	<0.0000050	<0.000010	<0.000010	<0.000010	<DL	<0.0000050
Molybdenum (Mo)-Total	mg/L	0.073	0.0001	0.000430	0.000430	0.00171	0.000470	0.00111	0.000540	0.000300	0.000911	0.000811	12%	0.001060	0.002	0.002580	0.000155	0.000690	0.00739	0.000420	0.001080	0.001080	0%	0.00134
Nickel (Ni)-Total *(Lab Result)*	mg/L	*Hardness-dep*	0.0004	0.00597	0.00623	0.00654	0.00714	0.0517	0.01030	0.00553	0.00081	0.00081	<2xDL	0.00947	0.0862	0.02820	0.0331	0.00730	0.0369	0.00835	0.01040	0.01050	1%	0.0112
Nickel (Ni)-Total (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	*0.02500*	*0.02500*	*0.15000*	*0.02500*	*0.15000*	*0.02500*	*0.02500*	*0.15000*	*0.15000*	-	*0.14877*	*0.15000*	*0.09302*	*0.14751*	*0.15000*	*0.15000*	*0.08485*	*0.13401*	*0.13531*	-	*0.15000*
Phosphorus (P)-Total	mg/L	-	0.002	0.036	0.044	<0.050	0.042	0.218	0.067	0.042	<0.050	<0.050	<DL	0.032	<0.500	0.014	<0.050	0.026	<0.250	0.033	0.017	0.016	1%	0.104
Potassium (K)-Total	mg/L	-	0.1	0.54	0.57	1.18	0.46	1.86	0.43	0.45	0.699	0.706	1%	1.46	42.5	1.05	1.3	2.71	20.6	0.81	1.34	1.35	1%	2.05
Selenium (Se)-Total	mg/L	0.001	0.0005	<0.00050	<0.00050	0.000491	<0.00050	***0.00239***	<0.00050	<0.00050	***0.00131***	***0.00131***	<2xDL	<0.00050	***0.0028***	<0.00050	0.000258	<0.00050	***0.00193***	<0.00050	0.00057	0.00056	<2xDL	0.000573
Silicon (Si)-Total	mg/L	-	1.00	1.70	2.90	3.92	2.40	19.10	3.10	2.30	2.06	2.07	<2xDL	2.20	13.80	3.10	3.05	<1.0	8.14	1.10	2.00	1.90	<2xDL	3.38
Silver (Ag)-Total	mg/L	0.00025	0.00005	<0.000050	<0.000050	<0.000010	<0.000050	0.000135	<0.000050	<0.000050	<0.000010	<0.000010	<DL	<0.000050	<0.000100	<0.000050	<0.000010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<DL	0.000011
Sodium (Na)-Total	mg/L	-	0.1	15.800	3.670	14.9	1.510	15.1	0.660	1.990	6.58	6.55	0%	60.100	2220	20.700	14.2	98.600	816	23.900	24.000	24.000	0%	20.8
Strontium (Sr)-Total	mg/L	-	0.001	0.05300	0.05040	0.254	0.03750	0.298	0.02650	0.03510	0.241	0.246	2%	0.05650	1.22	0.09070	0.144	0.11400	0.74	0.04790	0.16000	0.16100	1%	0.274
Sulfur (S)-Total	mg/L	-	3	22.20	6.10	31.7	3.70	14.4	<3.0	4.00	41.1	41.5	1%	87.70	3640	40.60	60.5	159.00	1510	32.40	40.30	40.00	1%	89.3
Tellurium (Te)-Total			0.0005	<0.00050	<0.00050	-	<0.00050	-	<0.00050	<0.00050	-	-	-	<0.00050	-	<0.00050	-	<0.00050	-	<0.00050	<0.00050	<0.00050	<DL	-
Thallium (Tl)-Total	mg/L	0.0008	0.00002	<0.000020	<0.000020	<0.000010	<0.000020	0.000016	<0.000020	<0.000020	<0.000010	<0.000010	<DL	<0.000020	<0.000100	<0.000020	0.000014	<0.000020	<0.000050	<0.000020	<0.000020	<0.000020	<DL	<0.000010
Thorium (Th)-Total			0.0001	0.00015	0.00021	-	0.00024	-	0.00028	0.0002	-	-	-	0.00017	-	0.00011	-	<0.00010	-	0.00013	<0.00010	<0.00010	<DL	-
Tin (Sn)-Total	mg/L	-	0.0002	<0.00020	<0.00020	<0.00010	<0.00020	<0.00010	<0.00020	<0.00020	<0.00010	<0.00010	<DL	<0.00020	<0.00100	<0.00020	<0.00010	<0.00020	<0.00050	<0.00020	<0.00020	<0.00020	<DL	<0.00010
Titanium (Ti)-Total	mg/L	-	0.005	<0.0050	0.00710	0.00079	<0.0050	0.0276	0.00720	<0.0050	<0.00030	<0.00030	<DL	<0.0050	0.00663	<0.0050	<0.00030	<0.0050	0.00502	<0.0050	<0.0050	<0.0050	<DL	0.00138
Tungsten (W)-Total			0.001	<0.0010	<0.0010	-	<0.0010	-	<0.0010	<0.0010	-	-	-	<0.0010	-	<0.0010	-	<0.0010	-	<0.0010	<0.0010	<0.0010	<DL	-
Uranium (U)-Total	mg/L	0.015	0.00002	0.000106	0.000132	0.00121	0.000199	0.000653	0.000151	0.000140	0.00152	0.00151	1%	0.000632	***0.0363***	0.000131	0.000112	0.000542	0.0136	0.000117	0.000497	0.000499	0%	0.00141
Vanadium (V)-Total	mg/L	-	0.001	0.00230	0.00320	0.00206	0.00240	0.0121	0.00490	0.00210	<0.00050	<0.00050	<DL	0.00180	<0.00500	0.00110	<0.00050	0.00100	<0.00250	0.00150	0.00130	0.00130	<2xDL	0.00165
Zinc (Zn)-Total	mg/L	-	0.004	0.0051	0.0075	<0.0030	0.0092	0.0284	0.0138	0.0058	<0.0030	<0.0030	<DL	0.0101	0.0852	0.0497	0.0737	0.0047	0.0262	0.0082	0.0117	0.0120	<2xDL	0.0087
Zirconium (Zr)-Total	mg/L	-	0.0001	0.00098	0.00114	0.00115	0.00149	0.00543	0.00131	0.00117	<0.00030	<0.00030	<DL	0.00106	0.0109	0.00051	0.00039	0.0004	0.00222	0.00073	0.0004	0.00044	<2xDL	0.00056

Water quality results, Chance Oil and Gas

Analyte	Units	CCME-Aquatic Life (AL)	Sample ID WQ Site ID Date Sampled Detection Limit	9080353-02 McPL-002 01-Aug-2019	9080353-07 McPL-001 01-Aug-2019	WR2000096-001 MCPL-001 08-Mar-2020	9080353-11 CHNC-003 01-Aug-2019	WR2000096-006 CHNC-003 10-Mar-2020	9080353-06 CHNC-t-002 01-Aug-2019	9080353-12 CHNC-001 01-Aug-2019	WR2000096-005 CHNC-001 09-Mar-2020	WR2000096-003 CHNC-001-r 09-Mar-2020	QA/QC CHNC-001 Replicate Analysis	9080353-05 NCY-PT19 01-Aug-2019	WR2000096-002 NCY-PT19 08-Mar-2020	9080353-01 EAGL-t-003 01-Aug-2019	WR2000096-004 EAGL-t-003 09-Mar-2020	9080353-04 EAGL-t-004 01-Aug-2019	WR2000096-008 EAGL-t-004 12-Mar-2020	9080353-03 DALG-003 01-Aug-2019	9080353-09 DALG-002 01-Aug-2019	9080353-10 DALG-002-r 01-Aug-2019	QA/QC DALG-002 Replicate Analysis	WR2000096-009 DALG-002 12-Mar-2020
Dissolved Metals													-												
Aluminium (Al)-Dissolved [a] *(Lab Result)*	mg/L	*pH-dep*	0.005	0.0521	***0.1020***	0.0508	***0.1460***	***0.591***	***0.2060***	***0.1370***	0.0015	0.0019	<2xDL	0.0888	0.0494	***0.1860***	0.0622	0.0131	0.0235	0.0425	0.0180	0.0170	<2xDL	0.0124
Aluminium (Al)-Diss. (pH adjusted Guideline)	*mg/L*	*pH-dep*	-	*0.10000*	*0.10000*	*0.10000*	*0.00500*	*0.10000*	*0.10000*	*0.10000*	*0.10000*	*0.10000*	-	*0.10000*	*0.10000*	*0.10000*	*0.10000*	*0.10000*	*0.10000*	*0.10000*	*0.10000*	*0.10000*	-	*0.10000*
Antimony (Sb)-Dissolved	mg/L	-	0.0002	0.00023	<0.00020	0.00016	0.00021	0.00067	0.00023	<0.00020	<0.00010	<0.00010	<DL	<0.00020	<0.00100	<0.00020	<0.00010	<0.00020	<0.00050	<0.00020	<0.00020	0.00020	<DL	0.00014
Arsenic (As)-Dissolved	mg/L	0.005	0.0005	0.00068	0.00069	0.00258	0.00093	0.00494	0.00087	0.00062	0.00021	0.00019	<2xDL	0.00069	0.00267	0.00059	0.0004	0.00070	0.00149	0.00073	0.00067	0.00066	<2xDL	0.00138
Barium (Ba)-Dissolved	mg/L	-	0.005	0.088300	0.099200	0.54	0.094700	0.837	0.096400	0.086500	0.2	0.202	1%	0.088400	0.106	0.074200	0.0843	0.101000	0.146	0.079300	0.085000	0.085500	1%	0.129
Beryllium (Be)-Dissolved	mg/L	-	0.0001	<0.00010	<0.00010	0.00005	<0.00010	0.000252	<0.00010	<0.00010	<0.000020	<0.000020	<DL	<0.00010	<0.000200	<0.00010	<0.000020	<0.00010	<0.000100	<0.00010	<0.00010	<0.00010	<DL	<0.000020
Bismuth (Bi)-Dissolved	mg/L	-	0.0001	<0.00010	<0.00010	<0.000050	<0.00010	<0.000100	<0.00010	<0.00010	<0.000050	<0.000050	<DL	<0.00010	<0.000500	<0.00010	<0.000050	<0.00010	<0.000250	<0.00010	<0.00010	<0.00010	<DL	<0.000050
Boron (B)-Dissolved	mg/L	1.5	0.005	0.0212	0.0104	<0.010	0.0152	<0.020	0.0108	0.0111	<0.010	<0.010	<DL	0.0333	0.493	0.0611	0.024	0.0652	0.291	0.0302	0.0746	0.0813	9%	0.042
Cadmium (Cd)-Dissolved *(Lab Result)*	mg/L	*Hardness-dep*	0.00001	0.0000190	0.0000370	0.0000344	0.0000380	***0.000504***	***0.0000640***	0.0000330	0.0000105	0.0000104	<2xDL	0.0000380	***0.00102***	***0.0001750***	0.00014	0.0000180	0.000247	0.0000420	0.0000250	0.0000260	<2xDL	<0.0000050
Cadmium (Cd)-Diss. (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	*0.0001029*	*0.0000543*	*0.0003548*	*0.0000449*	*0.0002992*	*0.0000406*	*0.0000488*	*0.0003700*	*0.0003700*	-	*0.0002570*	*0.0003700*	*0.0001539*	*0.0002546*	*0.0003700*	*0.0003700*	*0.0001392*	*0.0002292*	*0.0002317*	-	*0.0003700*
Calcium (Ca)-Dissolved	mg/L	-	0.2	10.70	6.28	83.4	5.12	49.2	4.40	5.82	90.8	93.4	<DL	24.50	863	20.10	41.2	47.30	440	13.90	39.60	40.10	1%	115
Chromium (Cr)-Dissolved	mg/L	0.0089	0.0005	0.00073	0.00092	0.00059	0.00123	0.0051	0.00124	0.0008	<0.00010	<0.00010	<DL	0.00098	0.00117	0.00051	0.00041	0.00115	0.0008	0.00066	<0.00050	<0.00050	<DL	0.00037
Cobalt (Co)-Dissolved	mg/L	-	0.0001	<0.00010	<0.00010	0.003	0.00012	0.0265	0.00023	0.00012	<0.00010	<0.00010	-	0.00047	0.0487	0.00323	0.0265	0.00017	0.0248	0.00012	0.00012	0.00016	<2xDL	0.00676
Copper (Cu)-Dissolved *(Lab Result)*	mg/L	*Hardness-dep*	0.0004	***0.00499***	***0.0054***	0.0008	***0.00666***	***0.0182***	***0.00756***	***0.00547***	0.00048	0.00045	<2xDL	0.00362	***0.0078***	***0.00318***	0.00111	0.00249	0.00298	***0.00395***	0.00212	0.00215	1%	<0.00020
Copper (Cu)-Diss. (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	*0.00200*	*0.00200*	*0.00400*	*0.00200*	*0.00400*	*0.00200*	*0.00200*	*0.00400*	*0.00400*	-	*0.00389*	*0.00400*	*0.00229*	*0.00385*	*0.00400*	*0.00400*	*0.00207*	*0.00346*	*0.00350*	-	*0.00400*
Iron (Fe)-Dissolved	mg/L	0.3	0.01	***0.496***	***0.523***	***3.07***	***0.873***	***19.6***	***0.982***	***0.509***	0.029	0.021	<2xDL	***0.906***	***4.68***	***2.510***	***11.5***	0.280	0.165	***1.060***	***0.448***	***0.453***	1%	***7.16***
Lead (Pb)-Dissolved *(Lab Result)*	mg/L	*Hardness-dep*	0.0002	<0.00020	0.000310	<0.000050	0.000270	0.000787	<0.00020	0.000210	<0.000050	<0.000050	<DL	<0.00020	<0.000500	<0.00020	<0.000050	<0.00020	<0.000250	<0.00020	<0.00020	<0.00020	<DL	<0.000050
Lead (Pb)-Diss. (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	*0.001000*	*0.001000*	*0.007000*	*0.001000*	*0.007000*	*0.001000*	*0.001000*	*0.007000*	*0.007000*	-	*0.006676*	*0.007000*	*0.003041*	*0.006581*	*0.007000*	*0.007000*	*0.002606*	*0.005604*	*0.005696*	-	*0.007000*
Lithium (Li)-Dissolved	mg/L	-	0.0001	0.00118	0.00116	0.002	0.00131	0.0042	0.00127	0.00167	0.007	0.0074	6%	0.0287	1.2	0.0113	0.0079	0.0393	0.437	0.00481	0.013	0.0132	2%	0.011
Magnesium (Mg)-Dissolved	mg/L	-	0.01	7.93	2.87	13.6	2.20	22.7	2.04	2.34	17.9	17.8	1%	28.60	1120	11.20	16.8	57.60	520	12.30	13.80	13.90	1%	23.7
Manganese (Mn)-Dissolved	mg/L	-	0.0002	0.01050	0.01190	***3.26***	0.01330	***7.46***	0.02880	0.03920	0.12	0.119	1%	0.06880	***21.1***	0.15300	***1.15***	0.00352	***15.2***	0.02520	0.00741	0.01020	32%	***2.36***
Manganese (Mn)-Dissolved (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	*0.43*	*0.38*	*0.43*	*0.23*	*0.83*	*0.21*	*0.25*	*0.43*	*0.46*	-	*0.54*	*0.86*	*0.56*	*0.83*	*0.46*	*0.72*	*0.49*	*0.40*	*0.40*	-	*0.86*
Mercury (Hg)-Dissolved	mg/L	0.000026	0.00004	<0.000040	<0.000040	<0.0000050	<0.000040	0.0000135	<0.000040	<0.000040	<0.0000050	<0.0000050	<DL	<0.000040	<0.0000050	<0.000040	<0.0000050	<0.000040	<0.0000050	<0.000040	<0.000040	<0.000040	<DL	<0.0000050
Molybdenum (Mo)-Dissolved	mg/L	0.073	0.0001	0.00038	0.00032	0.00169	0.00047	0.000952	0.00049	0.00027	0.000901	0.000766	16%	0.00096	0.00206	0.00224	0.000366	0.00058	0.00412	0.00038	0.00098	0.00098	0%	0.00109
Nickel (Ni)-Dissolved *(Lab Result)*	mg/L	*Hardness-dep*	0.0004	0.00519	0.00527	0.0063	0.00731	0.0463	0.00887	0.00514	0.0006	0.00058	<2xDL	0.00984	0.0811	0.0261	0.0327	0.00714	0.0344	0.00856	0.00961	0.00988	3%	0.01
Nickel (Ni)-Diss. (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	*0.02500*	*0.02500*	*0.15000*	*0.02500*	*0.15000*	*0.02500*	*0.02500*	*0.15000*	*0.15000*	-	*0.14877*	*0.15000*	*0.09302*	*0.14751*	*0.15000*	*0.15000*	*0.08485*	*0.13401*	*0.13531*	-	*0.15000*
Phosphorus (P)-Dissolved	mg/L	-	0.05	<0.050	<0.050	0.054	<0.050	<0.100	<0.050	<0.050	<0.050	<0.050	<DL	<0.050	<0.500	<0.050	<0.050	<0.050	<0.250	<0.050	<0.050	<0.050	<DL	<0.050
Potassium (K)-Dissolved	mg/L	-	0.1	0.41	0.37	1.2	0.36	1.74	0.26	0.36	0.709	0.742	5%	1.26	41.2	0.94	1.33	2.49	20.2	0.73	1.26	1.26	0%	2.09
Selenium (Se)-Dissolved	mg/L	0.001	0.0005	<0.00050	<0.00050	0.000575	<0.00050	***0.00216***	<0.00050	<0.00050	***0.0017***	***0.00156***	<2xDL	<0.00050	***0.00254***	<0.00050	0.000306	<0.00050	***0.00231***	<0.00050	<0.00050	0.0005	<DL	0.00051
Silicon (Si)-Dissolved	mg/L	-	1	1.500	2.100	3.99	2.500	17.5	2.400	2.200	2.07	2.1	<2xDL	2.000	13.5	3.000	3.16	<1.0	7.54	1.100	1.900	2.000	<2xDL	3.37
Silver (Ag)-Dissolved	mg/L	0.00025	0.00005	<0.000050	<0.000050	<0.000010	<0.000050	0.000096	<0.000050	<0.000050	<0.000010	<0.000010	<DL	<0.000050	<0.000100	<0.000050	<0.000010	<0.000050	<0.000050	<0.000050	<0.000050	<0.000050	<DL	<0.000010
Sodium (Na)-Dissolved	mg/L	-	0.1	14.000	3.410	14.6	1.470	14.8	0.610	1.900	6.35	6.41	1%	53.900	2100	19.300	13.7	90.700	786	22.900	23.300	23.600	1%	21.9
Strontium (Sr)-Dissolved	mg/L	-	0.001	0.0447	0.0441	0.249	0.0345	0.287	0.0224	0.0305	0.236	0.232	2%	0.0481	1.18	0.0822	0.138	0.1010	0.718	0.0448	0.1490	0.1500	1%	0.278
Sulfur (S)-Dissolved	mg/L	-	3	19.30	<3.0	31.3	<3.0	15.1	<3.0	<3.0	42.2	42.4	0%	84.90	3700	39.90	62.2	162.00	1560	32.60	40.70	41.10	1%	92.4
Tellurium (Te)-Dissolved	mg/L	-	0.0005	<0.00050	<0.00050	-	<0.00050	-	<0.00050	<0.00050	-	-	<DL	<0.00050	-	<0.00050	-	<0.00050	-	<0.00050	<0.00050	<0.00050	<DL	-
Thallium (Tl)-Dissolved	mg/L	0.0008	0.00002	<0.000020	<0.000020	<0.000010	<0.000020	<0.000020	<0.000020	<0.000020	<0.000010	<0.000010	<DL	<0.000020	<0.000100	<0.000020	0.000014	<0.000020	<0.000050	<0.000020	<0.000020	<0.000020	<DL	<0.000010
Thorium (Th)-Dissolved	mg/L	-	0.0001	0.00012	0.00018	-	0.00023	-	0.00025	0.0002	-	-	<DL	0.00016	-	<0.00010	-	<0.00010	-	0.00012	<0.00010	<0.00010	<DL	-
Tin (Sn)-Dissolved	mg/L	-	0.0002	<0.00020	<0.00020	<0.00010	<0.00020	<0.00020	<0.00020	<0.00020	<0.00010	<0.00010	<DL	<0.00020	<0.00100	<0.00020	<0.00010	<0.00020	<0.00050	<0.00020	<0.00020	<0.00020	<DL	0.00014
Titanium (Ti)-Dissolved	mg/L	-	0.005	<0.0050	<0.0050	0.00076	<0.0050	0.00984	<0.0050	<0.0050	<0.00030	<0.00030	<DL	<0.0050	0.00342	<0.0050	<0.00030	<0.0050	<0.00150	<0.0050	<0.0050	<0.0050	<DL	<0.00030
Tungsten (W)-Dissolved	mg/L	-	0.001	<0.0010	<0.0010	-	<0.0010	-	<0.0010	<0.0010	-	-	<DL	<0.0010	-	<0.0010	-	<0.0010	-	<0.0010	<0.0010	<0.0010	<DL	-
Uranium (U)-Dissolved	mg/L	0.015	0.00002	0.000081	0.000093	0.00122	0.000106	0.00055	0.000119	0.00012	0.0015	0.0015	0%	0.000432	***0.0362***	0.000111	0.000119	0.000497	0.0133	0.000076	0.000441	0.000453	3%	0.0013
Vanadium (V)-Dissolved	mg/L	-	0.001	<0.0010	<0.0010	0.00197	0.001	0.00587	0.0012	<0.0010	<0.00050	<0.00050	<DL	<0.0010	<0.00500	<0.0010	<0.00050	<0.0010	<0.00250	<0.0010	<0.0010	<0.0010	<DL	0.00051
Zinc (Zn)-Dissolved [c] *(Lab Result)*	mg/L	*Hardness, DOC-d*	0.004	<0.0040	<0.0040	0.0022	0.0061	0.0144	0.0072	0.0046	<0.0010	0.001	<DL	0.0049	0.0788	0.0373	0.0753	<0.0040	0.0222	0.0042	0.0059	0.0056	<2xDL	0.0016
Zinc (Zn)-Diss. (DOC & Hardness Adjusted Guideline)	*mg/L*	*Hardness, DOC-dep*		*0.1007*	*0.0530*	*0.3340*	*0.0439*	*0.2941*	*0.0397*	*0.0477*	*0.2260*	*0.2316*	-	*0.2525*	*0.3340*	*0.1427*	*0.2309*	*0.3340*	*0.3340*	*0.1364*	*0.2251*	*0.2275*	-	*0.3340*
Zirconium (Zr)-Dissolved	mg/L	-	0.0001	0.00092	0.0013	0.00117	0.00155	0.00822	0.00151	0.00134	<0.00030	<0.00030	<DL	0.00104	0.011	0.00037	0.00041	0.00053	0.00245	0.00078	0.00035	0.00035	<2xDL	0.00042

Applied Guidelines: 'Federal CCME Canadian Environmental Quality Guidelines 2018), CCME: Freshwater Aquatic Life

Hardness-Dep = Hardness Dependent guideline for CCME-WATER-AL

[a] The CCME WATER-AL guidelinefor total ammonia-N is temperature and pH dependent

[b] The CCME WATER-AL guideline for aluminium is lowered to 0.005 mg/L when pH is below 6.5

[c] The CCME WATER-AL guideline for dissolved zinc is hardness and dissolved organic carbon dependent

COLOUR KEY:

Exceeds CCME Guideline

QA/QC Codes: RPD - Relative Percent Difference, <DL - below detection limit, and <2XDL - less than two times the detection limit.

Water quality results, Chance Oil and Gas

Analyte	Units	CCME-Aquatic Life (AL)	Sample ID WQ Site ID Date Sampled Detection Limit	9080353-08 Field Blank 01-Aug-2019	WR2000096-007 Field Blank 10-Mar-2020	WR2000096-010 Travel Blank 05-Mar-2020	9080353-13 82-SHEEN 31-Jul-2019	9080353-14 348-SHEEN 31-Jul-2019	9080353-15 1014-SHEEN 31-Jul-2019	9080353-16 1413-SHEEN 31-Jul-2019
Physical Tests										
Temperature (in-situ)	°C	-	-	-	-	-	-	-	-	-
Dissolved Oxygen (in-situ)	mg/L	6.5	-	-	-	-	-	-	-	-
Specific Conductivity (in-situ)	µS/cm	-	-	-	-	-	-	-	-	-
pH (in-situ)	pH	6.5 - 9.0	-	-	-	-	-	-	-	-
Turbidity (In-situ)	NTU	-	-	-	-	-	-	-	-	-
Conductivity	µS/cm	-	2	3.3	<2.0	<2.0				
Hardness (as CaCO3)	mg/L	-	0.5	<0.500	<0.60	<0.60	75.1	76.1	86.6	144.0
pH (lab)	pH	6.5 - 9.0	0.1	***5.86***	***5.38***	***5.39***	-	-	-	-
Total Suspended Solids	mg/L	-	2	<2.0	<3.0	<3.0	-	-	-	-
Total Dissolved Solids	mg/L	-	10	<10	-	-	-	-	-	-
Anions and Nutrients										
Ammonia, total (as N)	mg/L	temp and pH dep	0.0050	-	0.0088	0.0085	-	-	-	-
Ammonia, total (as N) (pH and temperature adjusted Guideline)	*mg/L*	*temp and pH dep*	-	-	-	-				
Alkalinity, Bicarbonate (as CaCO3)	mg/L	-	1	<1.0	-	-	-	-	-	-
Alkalinity, Carbonate (as CaCO3)	mg/L	-	1	<1.0	-	-	-	-	-	-
Alkalinity, Hydroxide (as CaCO3)	mg/L	-	1	<1.0	-	-	-	-	-	-
Alkalinity, Total (as CaCO3)	mg/L	-	1	<1.0	<1.0	<1.0	-	-	-	-
Bromide (Br)	mg/L	-	0.05	-	<0.050	<0.050	-	-	-	-
Chloride (Cl)	mg/L	120	0.1	<0.10	<0.50	<0.50	-	-	-	-
Fluoride (F)	mg/L	0.12	0.1	<0.10	<0.020	<0.020	-	-	-	-
Nitrate (as N)	mg/L	3	0.01	0.025	<0.0050	<0.0050	-	-	-	-
Nitrite (as N)	mg/L	0.06	0.01	<0.010	<0.0010	<0.0010	-	-	-	-
Sulfate (SO4)	mg/L	-	1	<1.0	<0.30	<0.30	-	-	-	-
Organic / Inorganic Carbon										
Dissolved Organic Carbon	mg/L	-	0.5	<0.50	<0.50	-	-	-	-	-
Total Organic Carbon	mg/L	-	0.5	-	<0.50	<0.50	-	-	-	-
Total Metals										
Aluminium (Al)-Total [a] *(Lab Result)*	mg/L	*pH-dep*	0.005	0.0054	<0.0030	<0.0030	***0.8190***	***0.1290***	***0.2830***	***1.5200***
Aluminium (Al)-Total (pH adjusted Guideline)	*mg/L*	*pH-dep*	-	-	-	-	*0.1000*	*0.1000*	*0.1000*	*0.1000*
Antimony (Sb)-Total	mg/L	-	0.0002	<0.00020	<0.00010	<0.00010	0.00041	0.00021	0.00031	0.00052
Arsenic (As)-Total	mg/L	0.005	0.0005	<0.00050	<0.00010	<0.00010	***0.00726***	0.00158	***0.00823***	***0.00614***
Barium (Ba)-Total	mg/L	-	0.005	<0.0050	<0.00010	<0.00010	0.87900	0.14300	0.55800	0.52100
Beryllium (Be)-Total	mg/L	-	0.0001	<0.00010	<0.000020	<0.000020	0.0003	<0.00010	0.00013	0.00036
Bismuth (Bi)-Total	mg/L	-	0.0001	<0.00010	<0.000050	<0.000050	<0.00010	<0.00010	<0.00010	<0.00010
Boron (B)-Total	mg/L	1.5	0.005	0.0124	<0.010	<0.010	0.0055	0.0221	0.0236	0.016
Cadmium (Cd)-Total *(Lab Result)*	mg/L	*Hardness-dep*	0.00001	<0.000010	<0.0000050	<0.0000050	***0.0002810***	0.0000200	***0.0001950***	***0.0007370***
Cadmium (Cd)-Total (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	-	-	-	*0.0001250*	*0.0001263*	*0.0001407*	*0.0002145*
Calcium (Ca)-Total	mg/L	-	0.2	<0.20	<0.050	<0.050	13.40	14.50	18.40	28.70
Chromium (Cr)-Total	mg/L	0.0089	0.0005	<0.00050	<0.00010	<0.00010	0.00396	0.00135	0.00301	0.0054
Cobalt (Co)-Total	mg/L	-	0.0001	<0.00010	<0.00010	<0.00010	0.0209	0.0034	0.0224	0.0223
Copper (Cu)-Total *(Lab Result)*	mg/L	*Hardness-dep*	0.0004	<0.00040	<0.00050	<0.00050	***0.00546***	0.00107	***0.00415***	***0.0205***
Copper (Cu)-Total (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	-			*0.00200*	*0.00200*	*0.00209*	*0.00323*
Iron (Fe)-Total	mg/L	0.3	0.01	<0.010	<0.010	<0.010	***87.7***	***5.36***	***39***	***28.8***
Lead (Pb)-Total *(Lab Result)*	mg/L	*Hardness-dep*	0.0002	<0.00020	<0.000050	<0.000050	0.00096	<0.00020	0.0006	***0.00633***
Lead (Pb)-Total (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	-			*0.002210*	*0.002247*	*0.002649*	*0.005061*
Lithium (Li)-Total	mg/L	-	0.0001	<0.00010	<0.0010	<0.0010	0.00059	0.00279	0.00359	0.00196
Magnesium (Mg)-Total	mg/L	-	0.01	<0.010	<0.100	<0.100	10.10	9.67	9.82	17.60
Manganese (Mn)-Total	mg/L	-	0.0002	<0.00020	0.00013	<0.00010	***1.87***	***0.792***	***2.01***	***8.02***
Manganese (Mn)-Total (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	-	-	-	*0.86*	*0.49*	*0.49*	*0.57*
Mercury (Hg)-Total	mg/L	0.000026	0.00001	<0.000010	<0.0000050	<0.0000050	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Total	mg/L	0.073	0.0001	0.001310	0.000205	<0.000050	0.000290	0.000540	0.002180	0.000880
Nickel (Ni)-Total *(Lab Result)*	mg/L	*Hardness-dep*	0.0004	<0.00040	<0.00050	<0.00050	0.02390	0.00700	0.03420	0.03920
Nickel (Ni)-Total (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	-			*0.07688*	*0.07766*	*0.08568*	*0.12610*
Phosphorus (P)-Total	mg/L	-	0.002	<0.0020	<0.050	<0.050	0.085	0.130	0.085	0.280
Potassium (K)-Total	mg/L	-	0.1	<0.10	<0.100	<0.100	0.76	0.62	1.17	1.20
Selenium (Se)-Total	mg/L	0.001	0.0005	<0.00050	<0.000050	<0.000050	0.00055	0.00058	***0.00131***	***0.00143***
Silicon (Si)-Total	mg/L	-	1.00	<1.0	<0.10	<0.10	2.90	2.20	3.90	2.30
Silver (Ag)-Total	mg/L	0.00025	0.00005	<0.000050	<0.000010	<0.000010	<0.000050	<0.000050	<0.000050	<0.000050
Sodium (Na)-Total	mg/L	-	0.1	1.160	<0.050	<0.050	11.500	50.700	4.960	28.400
Strontium (Sr)-Total	mg/L	-	0.001	<0.0010	<0.00020	<0.00020	0.09850	0.08980	0.09680	0.11700
Sulfur (S)-Total	mg/L	-	3	<3.0	<0.50	<0.50	<3.0	23.10	<3.0	10.00
Tellurium (Te)-Total			0.0005	<0.00050	-	-	<0.00050	<0.00050	<0.00050	<0.00050
Thallium (Tl)-Total	mg/L	0.0008	0.00002	<0.000020	<0.000010	<0.000010	<0.000020	<0.000020	<0.000020	<0.000020
Thorium (Th)-Total			0.0001	<0.00010	-	-	0.00042	<0.00010	0.00065	0.00141
Tin (Sn)-Total	mg/L	-	0.0002	<0.00020	<0.00010	<0.00010	<0.00020	<0.00020	<0.00020	<0.00020
Titanium (Ti)-Total	mg/L	-	0.005	<0.0050	<0.00030	<0.00030	0.01320	<0.0050	<0.0050	0.00560
Tungsten (W)-Total			0.001	<0.0010	-	-	<0.0010	<0.0010	<0.0010	<0.0010
Uranium (U)-Total	mg/L	0.015	0.00002	<0.000020	<0.000010	<0.000010	0.000524	0.000045	0.000422	0.001160
Vanadium (V)-Total	mg/L	-	0.001	<0.0010	<0.00050	<0.00050	0.01790	0.00120	0.00980	0.01960
Zinc (Zn)-Total	mg/L	-	0.004	<0.0040	<0.0030	<0.0030	0.0185	0.0052	0.0228	0.0442
Zirconium (Zr)-Total	mg/L	-	0.0001	<0.00010	<0.00030	<0.00030	0.00277	0.00048	0.00299	0.00428

Water quality results, Chance Oil and Gas

Analyte	Units	CCME-Aquatic Life (AL)	Sample ID WQ Site ID Date Sampled Detection Limit	9080353-08 Field Blank 01-Aug-2019	WR2000096-007 Field Blank 10-Mar-2020	WR2000096-010 Travel Blank 05-Mar-2020	9080353-13 82-SHEEN 31-Jul-2019	9080353-14 348-SHEEN 31-Jul-2019	9080353-15 1014-SHEEN 31-Jul-2019	9080353-16 1413-SHEEN 31-Jul-2019
Dissolved Metals										
Aluminium (Al)-Dissolved [a] *(Lab Result)*	mg/L	*pH-dep*	0.005	<0.0050	<0.0010	-	-	-	-	-
Aluminium (Al)-Diss. (pH adjusted Guideline)	*mg/L*	*pH-dep*	-	-	-	-	-	-	-	-
Antimony (Sb)-Dissolved	mg/L	-	0.0002	<0.00020	<0.00010	-	-	-	-	-
Arsenic (As)-Dissolved	mg/L	0.005	0.0005	<0.00050	<0.00010	-	-	-	-	-
Barium (Ba)-Dissolved	mg/L	-	0.005	<0.0050	<0.00010	-	-	-	-	-
Beryllium (Be)-Dissolved	mg/L	-	0.0001	<0.00010	<0.000020	-	-	-	-	-
Bismuth (Bi)-Dissolved	mg/L	-	0.0001	<0.00010	<0.000050	-	-	-	-	-
Boron (B)-Dissolved	mg/L	1.5	0.005	<0.0050	<0.010	-	-	-	-	-
Cadmium (Cd)-Dissolved *(Lab Result)*	mg/L	*Hardness-dep*	0.00001	<0.000010	<0.0000050	-	-	-	-	-
Cadmium (Cd)-Diss. (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	-	-	-	-	-	-	-
Calcium (Ca)-Dissolved	mg/L	-	0.2	<0.20	<0.050	-	-	-	-	-
Chromium (Cr)-Dissolved	mg/L	0.0089	0.0005	<0.00050	<0.00010	-	-	-	-	-
Cobalt (Co)-Dissolved	mg/L	-	0.0001	<0.00010	<0.00010	-	-	-	-	-
Copper (Cu)-Dissolved *(Lab Result)*	mg/L	*Hardness-dep*	0.0004	<0.00040	<0.00020	-	-	-	-	-
Copper (Cu)-Diss. (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	-	-	-	-	-	-	-
Iron (Fe)-Dissolved	mg/L	0.3	0.01	<0.010	<0.010	-	-	-	-	-
Lead (Pb)-Dissolved *(Lab Result)*	mg/L	*Hardness-dep*	0.0002	<0.00020	<0.000050	-	-	-	-	-
Lead (Pb)-Diss. (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	-	-	-	-	-	-	-
Lithium (Li)-Dissolved	mg/L	-	0.0001	<0.00010	<0.0010	-	-	-	-	-
Magnesium (Mg)-Dissolved	mg/L	-	0.01	<0.010	<0.100	-	-	-	-	-
Manganese (Mn)-Dissolved	mg/L	-	0.0002	<0.00020	<0.00010	-	-	-	-	-
Manganese (Mn)-Dissolved (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	-	-	-	-	-	-	-
Mercury (Hg)-Dissolved	mg/L	0.000026	0.00004	<0.000040	<0.0000050	-	-	-	-	-
Molybdenum (Mo)-Dissolved	mg/L	0.073	0.0001	0.00043	0.000213	-	-	-	-	-
Nickel (Ni)-Dissolved *(Lab Result)*	mg/L	*Hardness-dep*	0.0004	<0.00040	<0.00050	-	-	-	-	-
Nickel (Ni)-Diss. (Hardness Adjusted Guideline)	*mg/L*	*Hardness-dep*	-	-	-					
Phosphorus (P)-Dissolved	mg/L	-	0.05	<0.050	<0.050	-	-	-	-	-
Potassium (K)-Dissolved	mg/L	-	0.1	<0.10	<0.100	-	-	-	-	-
Selenium (Se)-Dissolved	mg/L	0.001	0.0005	<0.00050	<0.000050	-	-	-	-	-
Silicon (Si)-Dissolved	mg/L	-	1	<1.0	<0.050	-	-	-	-	-
Silver (Ag)-Dissolved	mg/L	0.00025	0.00005	<0.000050	<0.000010	-	-	-	-	-
Sodium (Na)-Dissolved	mg/L	-	0.1	1.090	<0.050	-	-	-	-	-
Strontium (Sr)-Dissolved	mg/L	-	0.001	<0.0010	<0.00020	-	-	-	-	-
Sulfur (S)-Dissolved	mg/L	-	3	<3.0	<0.50	-	-	-	-	-
Tellurium (Te)-Dissolved	mg/L	-	0.0005	<0.00050	-	-	-	-	-	-
Thallium (Tl)-Dissolved	mg/L	0.0008	0.00002	<0.000020	<0.000010	-	-	-	-	-
Thorium (Th)-Dissolved	mg/L	-	0.0001	<0.00010	-	-	-	-	-	-
Tin (Sn)-Dissolved	mg/L	-	0.0002	<0.00020	<0.00010	-	-	-	-	-
Titanium (Ti)-Dissolved	mg/L	-	0.005	<0.0050	<0.00030	-	-	-	-	-
Tungsten (W)-Dissolved	mg/L	-	0.001	<0.0010	-	-	-	-	-	-
Uranium (U)-Dissolved	mg/L	0.015	0.00002	<0.000020	<0.000010	-	-	-	-	-
Vanadium (V)-Dissolved	mg/L	-	0.001	<0.0010	<0.00050	-	-	-	-	-
Zinc (Zn)-Dissolved [c] *(Lab Result)*	mg/L	*Hardness,DOC-d*	0.004	<0.0040	<0.0010	-	-	-	-	-
Zinc (Zn)-Diss. (DOC & Hardness Adjusted Guideline)	*mg/L*	*Hardness,DOC-dep*		-	-					
Zirconium (Zr)-Dissolved	mg/L	-	0.0001	<0.00010	<0.00030	-	-	-	-	-

Applied Guidelines: 'Federal CCME Canadian Environmental Quality Guidelines 2018), CCME: Freshwater Aquatic Life

Hardness-Dep = Hardness Dependent guideline for CCME-WATER-AL

[A] The CCME WATER-AL guidelinefor total ammonia-N is temperature and pH dependent

[B] The CCME WATER-AL guideline for aluminium is lowered to 0.005 mg/L when pH is below 6.5

[C] The CCME WATER-AL guideline for dissolved zinc is hardness and dissolved organic carbon dependent

COLOUR KEY:

Exceeds CCME Guideline

QA/QC Codes: RPD - Relative Percent Difference, <DL - below detection limit, and <2XDL - less than two times the detection limit.

APPENDIX A. Fish and Fish Habitat Studies

Chance Oil and Gas, Eagle Plains Project: Fish and Fish Habitat Studies



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EXECUTIVE SUMMARY

The Eagle Plains Project (the Project) is an oil and gas exploration program in north-central Yukon, approximately 605 km north of Whitehorse along the Dempster Highway. Chance Oil and Gas Ltd. intends to conduct exploratory activities over 10 years to confirm the quality, quantity, and areal extent of hydrocarbons. Project activities will include seismic exploration and exploratory wells supported by an expanded winter road network. The purpose of this study was to collect information to understand better the distribution of fish and fish habitat across the Regional Study Area (RSA) in both summer and winter. This information will be used to assess the Project's potential effects on fisheries values and guide measures to mitigate effects, if warranted.

The RSA is located within the Eagle Plains Ecoregion, which consists of a relatively subdued topography of rolling hills and sloping plains between the Richardson and Ogilvie Mountains. The RSA is centred on a local height of land, with areas to the north and west draining into the Yukon River (Pacific) system via the Porcupine watershed, and areas to the southeast draining into the Mackenzie River (Arctic) system via the Peel watershed. The largest named streams in the RSA include Chance (Porcupine), McParlon (Porcupine), Dalglish (Peel), and Enterprise (Peel) creeks. The RSA encompasses 1,467 streams, most of which are smaller headwater streams; there are 1,142 first-order streams[1], 239 second-order, 68 third-order, 16 fourth-order, and 2 fifth-order streams in the RSA. Few ponds and lakes occur in the RSA, with none greater than 5 ha. Before this study, very little was known about fisheries values in the RSA; Arctic grayling had been detected in a handful of locations across the RSA.

This study aimed to determine fish occurrence patterns across the RSA. This included: (i) a quantitative estimate of the probability of fish occurrence in all streams during summer and (ii) a more qualitative description of fish distribution based on habitat in winter (due to limitations in surveying fish presence during the winter). Due to the large number of streams in the area it was not possible to survey all streams that had the potential to be affected by exploration activities. Instead, a predictive, model-based approach was used, like a recent study conducted by the Yukon Government in the adjacent Peel watershed. The approach consisted of surveying a representative subsample of streams across the RSA and interpolating the probability of fish presence at all streams in the RSA using a statistical model. The environmental variables considered in the model included: stream order, stream slope, terrain slope, elevation, catchment area, and, as measures of potential overwintering habitat, distance to third-, fourth-, and fifth-order streams, as well as the distance to in-line ponds. The relationship between fish presence and environmental conditions was analyzed using logistic regression. Models with different combinations of the environmental variables were compared using corrected Akaike Information Criterion (AIC) scores.

To obtain a representative subsample of streams to support statistical analyses, survey sites were selected using a stratified random design, stratifying by stream order. Summer field surveys included fish sampling, habitat assessment, and water quality sampling. Fish sampling involved electrofishing supplemented with minnow trapping at a subsample of sites. Fish habitat descriptions included a broad suite of stream characteristics, such

[1] Stream order refers to the relative position of a stream within a watershed and is based on the number of upstream tributaries. The greater the stream order number, the larger the stream and the lower/further downstream it occurs within a watershed.

as stream width and depth, gradient, type and extent of cover, and type of bed material, as well as qualitative assessments of spawning, overwintering and rearing potential. Water sampling included temperature, turbidity, conductivity, and dissolved oxygen. In winter, sampling initially required drilling holes through the ice to determine if water was present. If water was present, the presence of fish was assessed with an underwater camera and water temperature, conductivity, and dissolved oxygen were measured. A total of 118 sites were surveyed in the summer, from July 25 to August 1, 2019, and 49 sites were surveyed in the winter, from March 7 to 13, 2020.

Survey results showed clear fish distribution patterns in summer and habitat availability for fish during winter. In summer, the best model for fish occurrence was based solely on stream order. The probability of fish occurrence was 8% in first-order streams, 45% in second-order, 89% in third-order, 99% in fourth-order, and 100% in fifth-order streams. Fish were detected in almost none of the first-order streams, half of the second-order streams, and almost all third-order and greater streams during summer sampling. The variability of fish presence in second-order streams was partly attributable to differences in site-specific conditions (e.g., different channel widths and stream depths at different streams); however, across many second-order streams the intermediate probability of fish occurrence simply reflects marginal fish habitat conditions. Five fish species were captured during the summer sampling program. Arctic grayling (*Thymallus arcticus*) were the most widespread captured species, accounting for 85% of captured fish. Slimy sculpin (*Cottus cognatus*), longnose sucker (*Catostomus catostomus*), round whitefish (*Prosopium cylindraceum*), and burbot (*Lota lota*) were also captured in limited numbers and locations. No salmon were observed in the RSA, consistent with historical information about salmon distribution within the area. In terms of habitat, most streams (all streams in the Porcupine watershed) consisted of low gradient, slow-moving streams with turbid water and bed materials dominated by fines and organics. Most streams were rated as having low spawning potential and moderate summer rearing potential for most fish species.

Winter field assessments determined that most first-, second- and third-order streams either freeze to bed or dewater during the winter. The presence of water at one second-order stream and four third-order streams all occurred in residual pools in ponds the streams flowed through. The outlet channels of these ponds were all dewatered, indicating that water was limited to residual pools and no stream flow was present. Of the 16 fourth- and fifth-order streams surveyed, 63% of the sites contained water, but the majority also appeared to be residual pools with no flow; only four sites had evidence of flowing water. Of the fifteen sites where water was detected, only one site had dissolved oxygen levels able to support fish. No fish were detected via underwater cameras.

The results of this study indicated a dynamic pattern of fish occurrence in the RSA between summer and winter. Overwintering habitat is very limited in the RSA and most fish likely migrate out of the RSA to find suitable overwintering habitat in larger rivers. The lower reaches of Chance Creek and select sites along McParlon, Dalglish, and Enterprise creeks may offer limited overwintering habitat to a small number of fish (based on water conditions in March 2020 and the presence of non-migratory slimy sculpin at some sites). During summer, transient fish, most notably Arctic grayling, travel tens to greater than 100 km from larger, higher order rivers outside the RSA to use second order and greater streams as seasonal rearing habitat.

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This work was completed within the traditional territories of the Vuntut Gwitchin First Nation (VGFN), First Nation of the Na-Cho Nyäk Dun, and the Tetlit Gwich'in Council (Secondary Use Area). Tyrel Kassi, a VGFN citizen, played an active role in all field components of the project. We thank him for the diligence and perspectives that he shared during the project. During summer fieldwork, crews include Petra Szekeres (EDI crew lead), Pat Tobler (EDI crew lead), Matt Power (EDI), Jonathan Lowey (EDI), and Tyrel Kassi (a VGFN member). Winter fieldwork was conducted by EDI employees Petra Szekeres (lead), Jonathan Lowey, and Tyrel Kassi. Horizon Helicopters provided transportation to sampling sites for both field trips.

AUTHORSHIP

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
2D	Two Dimensional
3D	Three Dimensional
AIC	Akaike's Information Criterion
AUC	Area Under the Curve
BC	British Columbia
°C	degrees Celsius
cm	centimetre
DFO	Fisheries and Oceans Canada
FISS	Fisheries Information Summary System
FL	Fork Length
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectares
IMA	Integrated Management Area
km	kilometers
km²	square kilometers
m	meter
mg/L	milligrams per litre
mm	millimeter
µS/cm	microSiemens per centimetre
NCD	Non-classified Drainages
NND	Na-cho Nyäk Dun
NYLUP	North Yukon Land Use Plan
PWLUP	Peel Watershed Land Use Plan
ROC	Receiver Operating Characteristics
the Project	the Eagle Plains Project (proposed by Chance Oil and Gas Ltd.)
TGC	Tetlit Gwich'in Council
THFN	Tr'ondëk Hwëchin First Nation
TL	Total Length
VGFN	Vuntut Gwitchin First Nation
YESAA	*Yukon Environmental and Socio-Economic Assessment Act*
YESAB	Yukon Environmental and Socio-Economic Assessment Board
YOY	Young-of-the-year

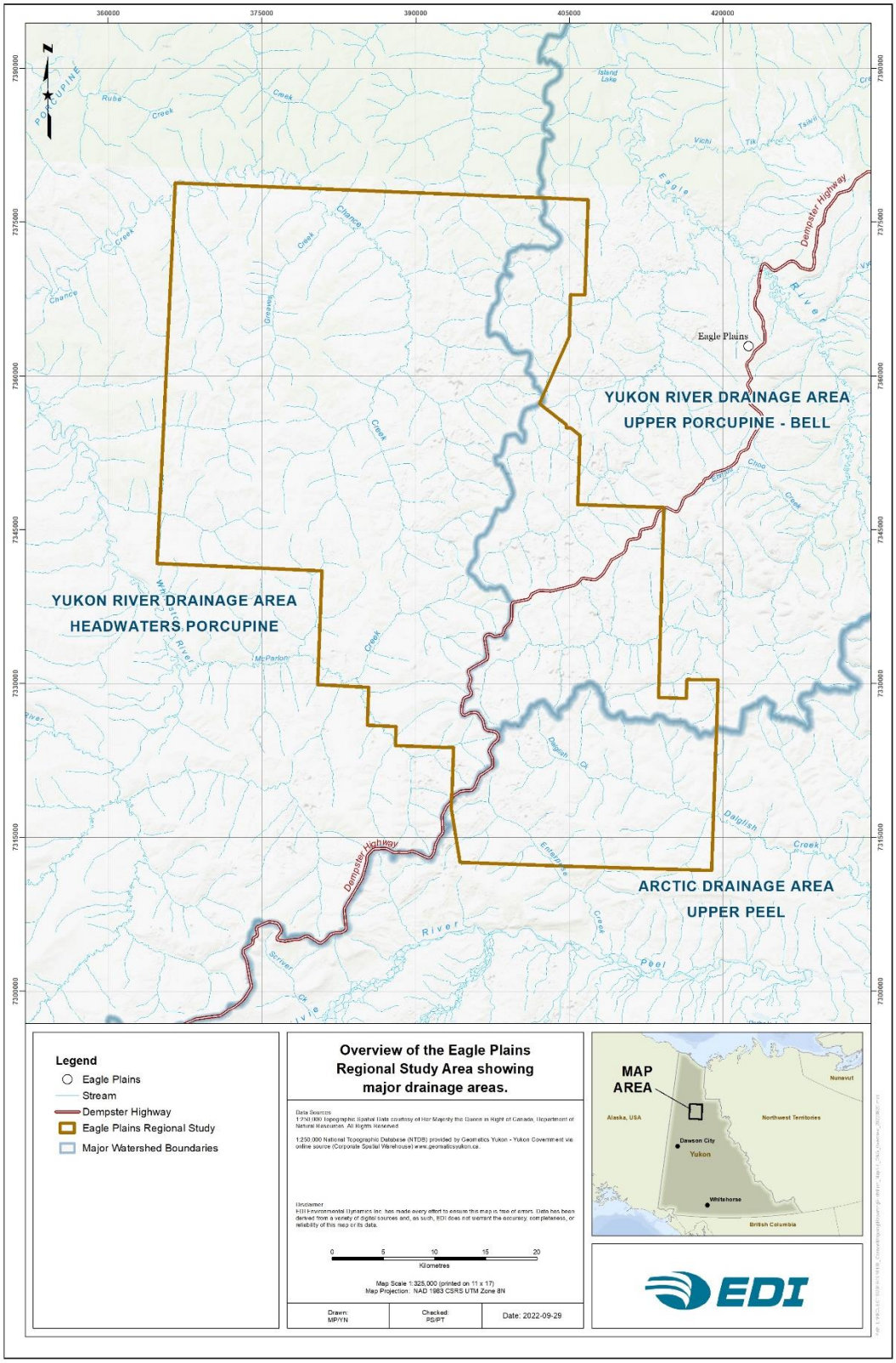
1 INTRODUCTION

1.1 PROJECT DESCRIPTION

The Eagle Plains Project (the Project) encompasses a 2,386 km² area in north-central Yukon, approximately 600 km north of Whitehorse and 40 km south and west of Eagle Plains Hotel, along the Dempster Highway (Map 1-1). The Project occurs within the Eagle Plains petroleum basin, north of the Ogilvie River and west of the Richardson Mountains. The basin contains proven natural gas and oil reserves (Peel Watershed Planning Commission 2019), including 4.6 billion m³ of gas and 3.2 million m³ of oil (Hannigan 2014).

The Regional Study Area (RSA; Map 1-1) has had intermittent periods of oil and gas exploration since the 1950s. That activity has resulted in the development of winter roads, seismic lines, and exploratory wells across parts of the current RSA. Approximately 40 exploration wells have been drilled at Eagle Plains. Eight wells are currently being maintained in suspended status and the remaining wells have been decommissioned. Seismic exploration has included approximately 10,000 km of two-dimensional (2D) lines (mostly before 1985), and about 325 km² of three-dimensional (3D) seismic was conducted in 2013/2014 (Northern Cross (Yukon) Ltd. 2014).

The current exploration program will build on past exploration to better define the extent, amount and quality of oil and gas deposits in the area. Under the current program, Chance Oil and Gas Ltd. Proposes conducting additional seismic exploration over large extents of the RSA and drill up to 30 exploratory wells over 10 years. Depending on the results of the drilling program, extended flow testing may be conducted over several months at a subset of the wells to determine the quantity and quality of the oil and gas deposit. The existing winter road network will be expanded to support the seismic and drilling programs. Most work is expected to be conducted in the winter (e.g., seismic line clearing and drilling); however, seismic recordings and extended flow testing may also occur during summer.



Map 1-1. Overview of the Eagle Plains Regional Study Area showing major drainage areas.

1.2 PURPOSE AND OBJECTIVES

Baseline environmental information and data are required for proposed oil and gas projects submitted to the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee for screening under the *Yukon Environment and Socio-Economic Assessment Act* (YESAA), as well as applications submitted for an Industrial Licence and Type A Water Licence from the Yukon Water Board, among other permits and licences (YESAB 2016).

Aspects of the Project activities (e.g., winter operations using winter roads that avoid soil disturbance) and design (e.g., location of roads to avoid streams and riparian areas) will minimize the potential effects of the Project on fish and fish habitat; however, a small number of streams will need to be crossed. The purpose of this study was to collect baseline information on fish and fish habitat within the RSA. This information can be used to assess the Project's potential effects on fish and fish habitat in the permit proposal to the YESAB and support management measures to mitigate potential effects.

The overall objective of the 2019 and 2020 fisheries and aquatics study was to collect information on fish occurrence across the range of streams within the RSA and use predictive modelling to quantify the probability of fish presence in all streams within the RSA.

The specific objectives of this study were to:

- develop and implement a fish occurrence inventory across the RSA during summer, including:
  - compiling historic fish occurrence data;
  - assembling relevant stream variables to support survey stratification and statistical modelling;
  - developing stream stratification criteria and conducting a stratified random sample to obtain a representative field sample;
  - conducting fish and fish habitat surveys using standardized field survey methods;
  - quantifying relationships between fish presence and environmental variables using statistical models and using the results to predict the probability of fish presence across the remaining streams in the RSA;
- conduct winter water level and quality surveys to determine potential overwintering habitat within the RSA; and,
- provide recommendations for using the results of this study for the YESAB assessment and management measures to mitigate the project's potential effects on fish and fish habitat.

Fish surveys were conducted in July and August when fish distribution is likely most widespread. It was predicted that fish presence was greatly reduced in lower-order streams in winter due to reduced water flow and water quality (i.e., dissolved oxygen). This is due to the lack of permafrost melting as a water source in winter and the general lack of groundwater sources in permafrost-controlled systems (Connon et al. 2014). To address this issue, winter surveys were also conducted to assess water levels and quality across various stream types within the RSA.

1.3 STUDY AREA

The Project encompasses 2,386 km² (238,566 ha), centred in the Eagle Plains Ecoregion in north Yukon. The area consists of subdued topography of rolling hills and sloping plains. The Dempster Highway crosses the southern portion of the RSA (Map 1-1) along a local height of land. From there, the RSA drains into the Porcupine River watershed to the north (via Chance Creek) and west (via McParlon Creek and the Whitestone River) and into the Peel River watershed to the southeast (via Dalglish Creek).

The RSA overlaps four First Nation traditional territories. Most of the RSA is located within the traditional territory of the Vuntut Gwitchin First Nation (VGFN). The southeastern portion is in an area of overlapping traditional territories of VGFN, the Tetlit Gwich'in Council (TGC), the First Nation of Na-cho Nyäk Dun (NND), and Tr'ondëk Hwëchin First Nation (THFN). Although the RSA is located outside any First Nation Settlement Lands, it adjoins VGFN Settlement Lands on parts of its east and southwest borders.

Anthropogenic development in the RSA and the surrounding Eagle Plains is low. The Dempster Highway is the main vehicle access corridor, running from Dawson City, Yukon in the southwest, to Inuvik, Northwest Territories, to the northeast, and transiting the RSA along the way. Several winter access roads also branch off the Dempster Highway. Past oil and gas exploration includes a network of seismic lines, in various stages of regeneration and approximately 40 well sites, all but 8 of which have been decommissioned. The Eagle Plains settlement is located along the Dempster Highway, about 30 km east of the Project boundary and consists of the Eagle Plains Hotel and the Government of Yukon's Highway Maintenance Branch.

The Project is located within the North Yukon Planning Region and Peel Watershed Planning Region and is, therefore, subject to the North Yukon Land Use Plan (NYLUP) and Peel Watershed Land Use Plan (PWLUP) (Vuntut Gwitchin Government and Yukon Government 2009, Peel Watershed Planning Commission 2019). The Project falls within the Integrated Management Area (IMA) Zone IV of both plans, with lower ecological and cultural values and the most permissible development of the four IMA zones. Both Plans describe General Management Directions for fish and fish habitat and identify potential concerns associated with water removal from sensitive and vital overwintering fish habitats, stream crossings, and seismic lines resulting in increased traffic and use of otherwise inaccessible regions and fish stocks.

1.3.1 ECOLOGICAL OVERVIEW

The Eagle Plains Ecoregion is in the Taiga Cordillera Ecozone, characterized by subarctic coniferous forest (90%), and mixed forest and Arctic/alpine tundra (5% each; Yukon Ecoregions Working Group 2004). Black spruce woodlands dominate this Ecoregion, with black spruce-tussock tundra at lower elevations, and shrub-tundra above 800 m (Smith et al. 2004). The Ecoregion is characterized by long winters, generally extending from October to May, with a mean annual temperature of −7.5°C (average −28°C in January and 13°C in July). The Eagle Plains Ecoregion has extensive permafrost, approximately 89 m deep, with the active layer in the top 1 m (i.e., thaws in summer and refreezes in the winter). Permafrost landscapes are prone to dynamic changes in the late spring and summer months due to the thawing of the active layer, resulting in changes to hydrology and overall water quality. Permafrost thaw has been occurring at unprecedented rates

in northern latitudes, characterized by elevated discharge rates, elevated silt deposits into waterways, and changes to adjacent riparian zones (e.g., slumping banks, higher sediment loads; Connon et al. 2014).

The major drainages within and adjacent to the RSA include the Porcupine (Yukon Basin) and Peel (Mackenzie Basin) river watersheds, with the subdrainages of the Eagle and Whitestone rivers entering the Porcupine drainage and the Ogilvie River entering the Peel drainage. The largest drainages within the RSA include Chance (Porcupine), McParlon (Porcupine), Dalglish (Peel), and Enterprise (Peel) creeks. The RSA encompasses 1,467 streams, most of which are smaller headwater streams; there are 1,142 first-order streams, 239 second-order, 68 third-order, 16 fourth-order, and 2 fifth-order streams in the RSA (using the Strahler method; Barker et al. 2011). Few ponds and lakes occur in the RSA, with none greater than 5 ha.

Several fish species are found in the major drainages adjacent to the RSA (Table 1-1); however, limited information was available on fisheries values within the RSA, with some available knowledge on fish presence and distribution. The only works conducted in the proximity of the RSA include work conducted by the Yukon Government for the Peel watershed that modelled the likelihood of fish presence based on different environmental variables (Barker et al. 2011), as well as preliminary baseline fish sampling in support of past oil and gas exploration in the area (Anderson Resources Ltd. 2001).

Permafrost and climate strongly affect hydrology and fish presence within the Eagle Plains Ecoregion. Low precipitation occurs in the area, with permafrost largely controlling stream flow. Groundwater flow appears to be very limited across the RSA, as the Eagle Plains Ecoregion is characterized by extensive ground ice (Smith et al. 2004). Peak stream flows are associated with snow and permafrost melt in June, with minimum flows occurring in March. Small streams, and even some intermediate-sized streams, often experience zero flows during the winter months (Smith et al. 2004). Fish presence is expected to be seasonal in response to the variable hydrology throughout the year. Due to the absence of water in lower-order streams during most months of the year, and even intermediate streams experiencing no winter flows, fish are excluded from many streams for much of the year. As a result, little suitable year-round habitat is available for resident fish, with many species instead employing transient, seasonal rearing use of local streams. Arctic grayling is a highly transient fish species and known to travel long distances (e.g., West et al. 1992, EDI 2015).

Conversely, slimy sculpin have high site fidelity and do not travel distances greater than a few hundred metres within their lifetime (Gray et al. 2004, 2018) — as such, they are often used as an indicator species for overwintering potential. Suitable overwintering habitat is often the most limiting factor for seasonal fish presence in northern latitudes and is a requirement for non-transient species. Other habitat requirements include adequate food sources and stream productivity; cover (e.g., vegetation, undercut banks) for rearing, resting, and predator avoidance; and suitable water quality metrics, notably dissolved oxygen levels (CCME 1999).

In the late 1990s, members of the VGFN discussed catching grayling in the spring and whitefish in the summer. They noted that important fishing sites in their territory were where small creeks entered the Peel River and the Ogilvie River. They observed fewer fish than many years before and fewer fish in lakes, although more in rivers (Sherry and Vuntut Gwitchin First Nation 1999, p. 249, 247).

Table 1-1. Fish species known to occur in the Peel and Porcupine watersheds.

Common Name	Vuntut Gwitch'in	Scientific Name	Species Abbreviation	Porcupine River (Yukon Basin)	Peel River (Mackenzie Basin)
Arctic grayling	sriijaa	*Thymallus arcticus*	GR	✓	✓
Slimy sculpin	–	*Cottus cognatus*	CCG	✓	✓
Arctic lamprey	–	*Lethenteron camtschaticum*	AL	✓	✓
Inconnu	shryuh	*Stenodus leucichthys*	IN	✓	✓
Lake whitefish	łuk dagàii	*Coregonus clupeaformis*	LW	✓	✓
Round whitefish	–	*Prosopium cylindraceum*	RW	✓	✓
Broad whitefish	chihshòo	*Coregonus nasus*	BW	✓	✓
Northern pike	atlin	*Esox lucius*	NP	✓	✓
Lake chub	–	*Couesius plumbeus*	LKC	✓	✓
Longnose sucker	daats 'at	*Catostomus catostomus*	LSU	✓	✓
Burbot	chèhlùk	*Lota lota*	BB	✓	✓
Trout perch	–	*Percopsis omiscomaycus*	TP	✓	
Chinook salmon	łuk choo	*Oncorhynchus tshawytscha*	CH	✓	
Chum salmon	shii	*Oncorhynchus keta*	CM	✓	
Coho salmon	nèhdlii	*Oncorhynchus kisutch*	CO	✓	
Least cisco	–	*Coregonus sardinella*	CS	✓	
Pygmy whitefish	–	*Prosopium coulterii*	PW		✓
Lake trout	vit	*Salvelinus namaycush*	LT		✓
Dolly Varden	–	*Salvelinus malma*	DV		✓
Longnose dace	–	*Rhinichthys cataractae*	LNC		✓
Flathead chub	–	*Platygobio gracilis*	FHC		✓
Spoonhead sculpin	–	*Cottus ricei*	CRI		✓

(McPhail and Lindsey 1970, Yukon Native Language Centre 1976, Lindsey et al. 1981, Scott and Crossman 1998, Anderson Resources Ltd. 2001, First Voices 2022)

2 METHODS

2.1 STUDY DESIGN

Limited information regarding fish presence and fisheries values within the RSA is available. Due to the large number of streams within the RSA, it was not feasible to survey all streams. Also, the exact location of Project development, including stream crossings, have not been predetermined. To address these issues, a study design was developed to predict the probability of fish presence across all streams, based on field surveys at a representative subsample of streams. This approach follows a similar study in the adjacent Peel watershed (Barker et al. 2011).

The approach uses the observed relationships between fish presence and environmental variables, such as stream order, gradient, catchment area, and adjacent vegetation, to interpolate the statistical probability of fish presence in non-surveyed streams. The authors of the Peel study indicated the importance and relevance of completing landscape-scale statistical modelling to understand the relationships between fish and their environment. They further highlighted the utility of using predictive modelling in costly or logistically difficult areas to complete comprehensive sampling, as with the Eagle Plains RSA. As such, the current study used the same approach as Barker et al. (2011), conducting a representative field-based study and using those results to support a comprehensive landscape-scale predictive model with GIS-derived environmental data to determine the probabilities of fish presence at all 1,467 streams in the RSA.

The study design included the following steps:

- compile historic fish occurrence data;
- assemble relevant stream variables to support survey stratification and statistical modelling;
- develop stream stratification criteria and conduct a stratified random sample to obtain a representative field sample;
- conduct fish and fish habitat surveys using standardized field survey methods; and,
- quantify relationships between fish presence and stream variables using statistical models and use the results to predict the probability of fish presence across the remaining streams in the RSA.

To obtain a representative subsample of streams to support statistical analyses, summer survey sites were selected using a stratified random design, stratifying by stream order. Stream order refers to the relative position of a stream within a watershed and is based on the number of upstream tributaries. The greater the stream order number, the larger the stream and the lower/farther downstream it occurs within a watershed. Stream order correlates to several different stream characteristics, including stream width and depth, gradient, and channel morphology, which makes it a good metric for stratifying field samples.

2.2 HISTORIC FISH INVENTORY INFORMATION

Before study design and field surveys, existing fisheries information was compiled to guide study design and site selection (e.g., to avoid surveying sites where fish presence was known). The Fisheries Information Summary System (FISS) was examined for fisheries information within the RSA and available grey literature that contained information on streams within or adjacent to the RSA (Anderson Resources Ltd. 2001, Barker et al. 2011). Stream files from Fisheries and Oceans Canada (DFO) were also searched for fisheries information within the RSA.

2.3 GIS-BASED STREAM DATA DERIVATION

The GIS-based environmental data were required to estimate the probability of fish presence at all streams across the RSA (i.e., because it was not feasible to collect field data for all 1,467 streams in the RSA). Nine stream variables were chosen for the analysis: stream order; distance to third, fourth, and fifth-order streams; stream slope; terrain slope; elevation; catchment area; and distance to large inline pools[2]. All these variables are known to affect fish occurrence and fish habitat (e.g., Barker et al. 2011). Stream order is a valuable qualitative proxy for water volume and flow rate metrics. Higher-order streams (i.e., third-order and greater) were initially predicted to have stream conditions sufficient for overwintering habitat, and thus distances to these streams may relate to fish presence. Landscape components such as slope (stream and terrain) and elevation relate to flow, flooding potential, temperature, and productivity, respectively. The total catchment area upstream from a location measures total water quantity, which may also affect the probability of fish presence. Inline pools may also be important during high summer temperatures and low-flow dry seasons or as overwintering habitat for fish. The nine predictors were developed in ArcGIS as unique raster layers at a 100 m × 100 m resolution.

2.4 FIELD SURVEYS

Fish presence, habitat, and water conditions were assessed in the field in July, August 2019, and March 2020. The summer sampling consisted of two crews: one crew of two EDI Environmental Dynamics Inc. (EDI) employees and another of two EDI employees and a VGFN assistant. A helicopter shared by both crews accessed all sites; sites for the day were coordinated to make the most efficient use of sampling and helicopter time. Sampling in March 2020 was limited to fewer variables due to the winter conditions, including the lack of water at many sites. There was one crew of two EDI employees and a VGFN assistant for March fieldwork.

[2] Large pools or ponds (>0.25 ha) occurring along a stream reach.

2.4.1 SUMMER

Surveys for fish presence and habitat conditions in the RSA occurred between July 25 and August 1, 2019, with two field crews. Field assessments included habitat quality assessments and fish sampling via electrofishing (and occasional minnow trapping) when sufficient water was present. In total, 118 streams in the RSA were assessed for fish presence and had British Columbia (BC) site cards filled out. Stream orders with higher occurrence had higher sampling effort (i.e., more lower-order streams sampled; Table 2-1). Stratified random sampling was used to sample a subset of streams from each order while providing relatively even spatial coverage across the RSA. Site assessment occurred on 52 first-order streams, 42 second-order, 18 third-order, four fourth-order, and two fifth-order sites (Table 2-1; Map 2-1). Sampling occurred in all the watersheds within the RSA — the Bell (upper Porcupine), Whitestone (Porcupine), and Ogilvie (upper Peel). Some larger order streams were visited at two spatially separated sites within the RSA to achieve the appropriate spatial coverage (e.g., Chance Creek). Each site with water had in situ water quality parameters recorded; a YSI ProPlus and YSI ProSOLO were used to collect data on temperature (°C), dissolved oxygen (% and mg/L), specific conductivity (µS), and pH (pH was only recorded on the ProPlus). Where applicable, digital photos and GPS coordinates were taken at the downstream and upstream extents sampled.

A broad suite of stream characteristics were documented in the field, following the BC Ministry of Environment's Fish and Fish Habitat Inventory standards and using the BC site cards (BC Ministry of Environment 2008). The primary metrics of interest included: channel and wetted widths, residual pool depth, gradient, type and total cover, and bed material. Qualitative estimates of habitat quality for spawning, overwintering, and rearing potential was also recorded. The BC Fish and Fish Habitat Inventory definitions were used to classify drainages as either: a stream; no defined channel; or no visible channel drainage. The definition relies on both fluvial material (sediment or substrate) and a stream channel (BC Ministry of Environment 2008). Field results from site cards and electrofishing supported the field-based predictive model.

All streams that contained water at the time of survey were surveyed for fish using standard electrofishing methods. The electrofishers were a Smith-Root LR-24 and a Smith-Root 12B POW. A minimum sampling effort of approximately 100 m and 500 sec was attempted at each site; however, this was not achieved at a small number of first- and second-order streams (n = 11) due to partially dry stream channels. Sampling covered an average of 92 m (± 43 SD; range = 25 – 200 m) and 455 sec (± 89 SD; range = 211 – 693 sec) per site (Attachment A). The electrofisher settings were also variable due to large discrepancies in specific conductivity between sites. Electrofishing was completed by moving upstream. Once a fish was stunned, it was transferred to a bucket with fresh water to be measured and to recover. During fish handling, fish experienced limited air exposure, no contact with abrasive or dry surfaces, and minimal handling; nets were knotless rubberized mesh, and all fish were measured using a soft tape measure with the gills submerged underwater. Captured fish were enumerated, identified to species, and measured to fork length (FL; mm); burbot and slimy sculpin were measured to total length (TL; mm). The species and count were recorded if a fish was not captured and only observed. Fish were released back into the stream once electrofishing had concluded.

Minnow trapping was conducted at six sites, primarily in larger streams or ponds to complement or verify electrofishing data. Minnow traps were placed in areas of good cover and suitable depth and stream velocity. Each site had three small gee-type minnow traps (0.6 cm mesh size) baited with roe in a perforated bag and deployed along stream margins in slow water habitats. In the case of the pond that was sampled, sampling occurred along the pond shore. Water depth, site characteristics, and photos were recorded for each trap and traps were left to soak overnight (Attachment A).

Table 2-1. Summary of sampled stream orders during summer sampling in July and August 2019.

Stream Order	Streams in RSA	Streams Sampled in Summer	Percent Sampled (%)
1	1,142	52	1.9
2	239	42	17.6
3	68	18	26.5
4	16	4	25.0
5	2	2	100.0

2.4.2 WINTER

The RSA was visited again from March 7 to 13, 2020, to assess the presence of water and overwintering fish habitat at a subsample of streams across the RSA. In total, 49 unique sites were visited—1 first-order stream, 14 second-order, 18 third-order, 13 fourth-order, and three fifth-order (Map 2-1). Sites were accessed via helicopter. Only one first-order stream was surveyed because summer surveys found very low fish presence in first-order streams, and because past work adjacent to the RSA in the Peel watershed indicated most first- and second-order systems are dewatered or froze to bed in winter (Barker et al. 2011). Some larger order streams were visited at more than one location of the stream (e.g., Chance Creek) as they extended through the entire RSA, and because those streams were suspected to be the primary overwintering habitats within the RSA.

It is important to highlight the difficulties associated with winter assessments and the nature of random sampling (i.e., uncertainties as to what part of the stream is most likely to contain water). To address these issues, efforts were made to target some sites that had either pools (characterized by widening or a bend in stream) or a visible inline pond, as these sites were more likely to have residual pools at lower winter flows. If sites corresponded to an inline pond or a pool, a site was sampled in the stream channel (i.e., where it appeared to be average channel width), as well as in the inline pond and/or pool, and lastly at the inlet or outlet to determine if there was flowing water (Photo 2-1; Table 2-2). As such, some sites included two or three distinct sampling locations. This situation occurred most frequently at some of the third- and fourth-order sites visited (Table 2-2). While every effort was made to locate survey sites at locations most likely to contain water, it is possible that some survey locations missed the 'best' microsites in the vicinity (i.e., locations with the deepest pool or the part of the channel with the most flow).

Upon arrival at a site, the stream bed was located under the snow and the snow was removed from the surface of the stream. The ice was initially checked with an ice spud (probe) for thickness. Occasionally an ice spud was sufficient to penetrate the ice; in the event of thicker ice, a power auger was used. The hole was assessed

for the presence of water. If no water was found in the first drilled hole, then another spot along the stream was surveyed (though on some occasions, only a single hole was drilled due to concerns of cold exposure). If the bank width of a stream was small enough (<2 m), a trench was chipped across. At channels greater than 2 m wide, one to five holes were drilled across the width of the channel to evaluate for the presence of water. If water was identified at the site, and the water was greater than 10 cm deep, an Aqua-Vu underwater fish viewing camera was submersed and the video feed was viewed for 10 to 20 minutes to check for fish activity. Each site with sufficient water had in situ water quality parameters recorded using a YSI ProSOLO to collect temperature (°C), dissolved oxygen (% and mg/L), and specific conductivity (µS/cm). At all holes drilled or chipped, the overlaying snow depth, ice depth, hollow depth, water depth, and depth from substrate to the top of the ice were recorded (m); hollow depth was measured when a hollow space was present between the ice and water or frozen substrate. Photos and GPS coordinates were recorded for each site visited, as well as notes of the findings from each site.

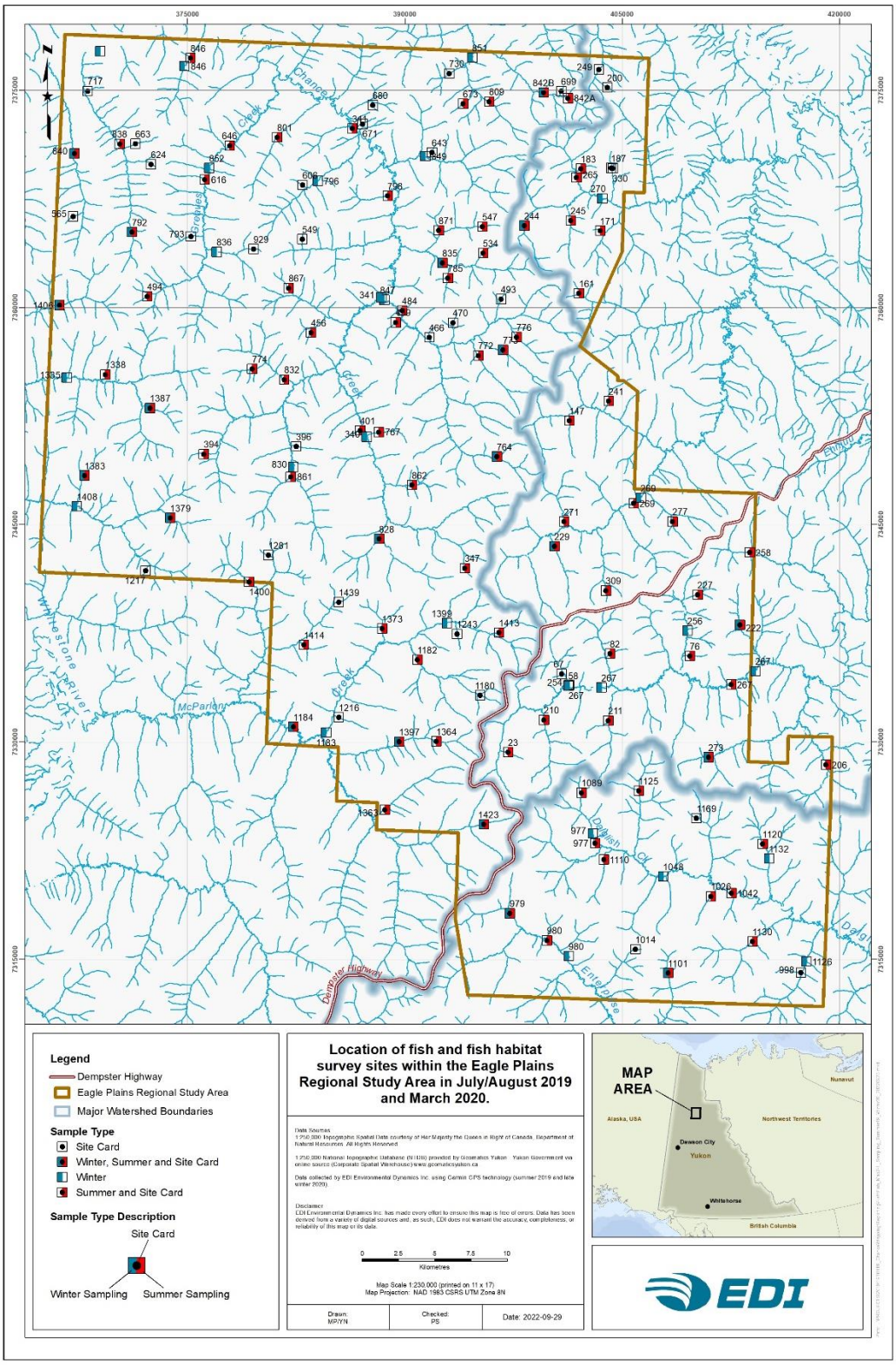
Table 2-2. Distribution of sampled streams regarding stream order and type of environment sampled in March 2020.

Stream Order	Sampled Stream Channel	Sampled Inline Pond or Pool	Sampled Inline Pond or Pool Inlet/Outlet	Total Sampling Locations[1]
1	1	0	0	1
2	13	1	1	15
3	15	4	4	23
4	10	5	4	19
5	3	0	0	3

[1] Some sites were sampled in more than one distinct location (e.g., the same site was sampled in a stream section, a pool, and the pool outlet).



Photo 2-1. Example sampling locations within the average channel width, the outlet (or inlet), and inline pond (or pool) during sampling in March 2020.



Map 2-1. Location of fish and fish habitat survey sites within the Eagle Plains Regional Study Area in July/August 2019 and March 2020.

2.5 FISH PRESENCE — PREDICTIVE MODELLING

Estimates of fish presence during summer were derived using logistic regression analysis. Logistic regression quantifies the contribution of environmental covariates to fish presence and yields predictions in the form of probabilities. Several candidate models, consisting of different combinations of the nine environmental variables (see Section 2.3), were developed and information-theoretic procedures were used to select the most parsimonious model (Burnham and Anderson 2002). Environmental covariates were chosen based on their relevance to fish ecology and their potential for variation in the RSA. For the analysis, stream order was treated as an ordinal, continuous variable because (1) the limited and unbalanced sample sizes across stream orders and (2) the expectation that the probability of fish presence would increase in consecutively higher-order streams (Table 2-3). All other predictors were treated as continuous, numeric variables: elevation, catchment area, stream and terrain slope, distance to inline ponds, and distance to third-, fourth-, and fifth-order streams. Predictor values were extracted from the 100 m raster layers for each of the 118 sampled locations and corresponded with the presence or absence of fish. Statistical analyses were conducted using R Statistical Software, version 3.6.1 (R Development Core Team 2020).

Before model construction, multicollinearity among variables was evaluated to confirm unbiased estimates of coefficients (and their associated error) for each environmental covariate. A correlation matrix (for variables with high Pearson's correlation coefficients, $r > 0.7$) and variance inflation factor scores (scores >4) were used — neither identified problematic variables. Due to large and differing ranges of values among continuous numeric predictors, these variables were centered and standardized to have a mean of zero and a standard deviation of one.

Analyses began by specifying a 'global model' with all environmental covariates. Diagnostic plots of the global model's residuals to fitted values did not identify any concerns of heterogeneity or outliers. Coefficient estimates associated with each covariate were also evaluated based on logical predictions and removed if contrary to fish biology. For instance, in the global model, "distance to fith-order streams" had a positive coefficient (i.e., increased probability of occurrence associated with distances farther from fifth-order streams). Such an estimate is illogical from an ecological perspective and likely the result of spurious correlation; the expectation is that the probability of occurrence should decrease with distances farther from fifth-order streams because of low water volumes and flow rates. Therefore, this distance covariate was dropped from additional consideration.

Beginning with the global model, model comparisons were conducted via sequential log-likelihood ratio tests in which covariates were removed one at a time depending on their contribution to residual deviance (i.e., analysis of deviance table using a $p < 0.05$ threshold). A series of candidate models were considered during model selection, ranging from the global model to those with single predictors. As per information theoretic procedures, corrected Akaike Information Criterion (AICc) scores, used when the sample size is small (e.g., $n = 118$), were calculated for each model (R package "AICcmodavg", Mazerolle 2019). An AICc score is the amount of information a candidate model loses when compared to the "true", unknown (and unattainable) model, which perfectly describes a natural phenomenon (Burnham and Anderson 2002). In this case, the model with the lowest AICc score (and statistics) yields the best approximation for explaining fish

presence, given the data. Significant main effects, as well as AICc weights (w_{AICc}) and corresponding evidence ratios (e.g., $\frac{w_{model\,8}}{w_{model\,7}}$) were considered for model selection.

The final step was model validation. Predictions from the final model were evaluated with observed data using a Receiver Operating Characteristics (ROC) curve (or area under the curve, AUC) in R software (package "pROC", Robin et al. 2011). The ROC curves (or AUC scores) identify the proportion of true positives to false positives based on predictions from the model, using an iteratively variable threshold to convert probabilities to binary responses (1, 0). An AUC value of 1 signifies that the model perfectly distinguishes between presence and absence (1, 0), while 0.5 means it cannot differentiate between them.

An alternative model was developed using field data collected in the RSA to evaluate further the robustness and predictive power of the GIS-based analysis. This additional analysis was also conducted to determine whether field-based covariates could address aspects of fish presence that geospatial data could not (i.e., to improve model accuracy and confidence). Stream order was retained for the analysis, and the following field-based covariates were also included: channel width, wetted width, residual pool depth, overwintering habitat quality, dissolved oxygen, and gradient. During preliminary multicollinearity tests, two variables were removed from further analyses — channel width and wetted width — because of their high correlation with stream order (r = 0.78 and 0.80, respectively) and high variance inflation factor (VIF) scores. The model construction, selection, and evaluation procedures followed were identical to those used for the GIS-based model.

Table 2-3. Contingency table comparing fish presence and absence among stream orders from sampled locations in the Regional Study Area during July and August 2019.

Stream Order	% Fish Present	Total Sites Visited
1	3.8	52
2	54.8	42
3	77.8	18
4	100	4
5	100	2
TOTAL		**118**

3 RESULTS

3.1 HISTORICAL INFORMATION

Very little fisheries information was found during the literature search for historical and baseline information within the RSA. No information was contained in FISS within the RSA. The only fish inventory conducted in the RSA is limited baseline fish sampling supporting past oil and gas exploration in the area (Anderson Resources Ltd. 2001; Attachment B). In the adjacent Peel watershed, the Yukon Government conducted broad inventory work that modelled the likelihood of fish presence based on different environmental variables (Barker et al. 2011).

Anderson (2001) indicated that historical fish surveys in the broader Eagle Plains area primarily focused on larger drainages rather than smaller order streams, with data being somewhat dated in the proximity of the RSA (e.g., mainstem Eagle, Ogilvie, Peel, and Porcupine rivers; Bryan et al. 1973, Steigenberger et al. 1975, Eby and Associates 1977, Lindsey et al. 1981). Anderson (2001) concluded that diversity and habitat use are lower within the headwaters of these mainstem rivers (i.e., within the smaller streams of the RSA) and that overwintering habitat would be limited to areas of groundwater or deeper pools.

Anderson (2001) surveyed the physical stream characteristics and conducted electrofishing, beach seining, minnow trapping, gillnetting, and angling on eight streams and two ponds within and adjacent to the currently proposed RSA during June, August, and September 2001 (Attachment B). Species captured and observed by Anderson (2001) included: Arctic grayling, slimy sculpin, longnose sucker, burbot, round whitefish, and lake whitefish. They electrofished for an average of 350 sec (± 192.4 SD; range = 33 – 795 sec; Attachment B) per site. Regarding habitat, fish cover was primarily in the form of turbidity, large woody debris, and undercut banks. Although turbidity could provide cover, several negatives are associated with excess turbidity (e.g., poor foraging opportunities and increased ventilation/metabolic costs; Henley et al. 2000, Lowe et al. 2015, Alaska Department of Environmental Conservation 2016). Overhanging and instream vegetation was also present in some streams and the occasional pool. Many stream banks were characterized by erosion and slumping banks from melting permafrost, contributing to the turbidity at some sites.

The Yukon Government Peel watershed study by Barker et al. (2011) used GIS-based covariates to develop hypothesis-driven models to predict the presence and abundance of Dolly Varden, Arctic grayling, and slimy sculpin; they also used a model which considered all fish species. Habitat covariates included: elevation, mean slope, upstream extent, distance to ≥5th-order streams, rock proportion and upland vegetation cover. The hypothesis-driven models they developed included different combinations of covariates: flooding (rock proportion + mean slope + upstream extent + distance to ≥5th order streams); freezing (elevation + upstream extent + distance to ≥5th order streams); drying (upstream extent + distance to ≥5th order streams); stream volume (upstream extent); migration (elevation + distance to ≥5th order streams); and productivity (vegetation proportion + elevation + upstream extent). The field findings and predictive model indicated fish were absent from nearly all first-order streams and present in nearly all fourth-order streams; they assumed fish were present at fifth-order streams. The model combining all species found very low probability of fish

presence in first-order and upper reaches of second-order streams and had high predicted fish presence in most third- and fourth-order streams. Their predictive hypothesis-driven models indicated that the stream volume model was the best predictor for Dolly Varden and slimy sculpin presence. In contrast, the productivity model best predicted Arctic grayling presence and all fish combined. The stream productivity model also had the most predictive power for fish abundance of Dolly Varden, Arctic grayling, and slimy sculpin (Barker et al. 2011).

3.2 FIELD SURVEYS

3.2.1 SUMMER

3.2.1.1 Fish Sampling

A total of 118 sites were visited across all orders, 81 of which contained enough water to sample for fish (Map 3-1; Attachment C). Twenty-seven first-order and four second-order drainages were considered non-classified (NCD; i.e., not a stream) based on the definition provided in the BC Site Card Field Guide (BC Ministry of Environment 2008). To be an NCD, a drainage lacks evidence of a defined bank or fluvial deposits (i.e., stream bed material; BC Ministry of Environment 2008). Another six first-order streams could not be sampled for fish as they were dry or did not contain enough water for sampling (Map 3-1; BC Ministry of Environment 2008). Field crews supporting the wildlife and vegetation components of the baseline studies noted that water levels were considerably higher in June than in late July and early August when streams were assessed for fish presence (a June peak is common in this region; Yukon Ecoregions Working Group 2004).

Overall, the proportion of sites with fish present increased considerably with increasing stream order (Table 3-1). Few fish were captured in first-order streams, with only 3.8% of sites visited containing fish (Table 3-1). The only fish captured in first-order streams were adult Arctic grayling in one site in the Dalglish Creek watershed (Site 1026) and another in the MacParlon Creek watershed (Site 1423; Table 3-1; Map 3-1; Attachment C). These two Arctic grayling were among the largest captured throughout the RSA (Table 3-2). Both streams had a wetted width of less than 1 m and were considered to have moderate rearing habitat, though both had poor connectivity and the fish were in isolated residual pools at the time of sampling (i.e., the fish had moved into the streams during higher flows and had become stranded).

Second-order streams had the most variable fish presence, with 52.4% of visited sites containing fish (Table 3-1). Four fish species were captured in second-order streams: Arctic grayling, slimy sculpin, longnose sucker, and burbot (Table 3-2). Arctic grayling were captured most frequently in second-order streams. Notably, young-of-the-year (YOY; <50 mm) Arctic grayling were captured at one site in the Chance Creek watershed (Site 861; Map 3-1; Attachment C) and another site in the Eagle River watershed (Site 229; Photo 3-1; Table 3-2; Map 3-1; Attachment C). Slimy sculpin were captured at three second-order streams (Site 210, 211, 273; Map 3-1; Attachment C), all in the Eagle River watershed. Longnose sucker and burbot were captured at two second-order streams (Sites 1387, 1383) in the Whitestone River watershed, and

longnose sucker were captured at one other site in the MacParlon Creek watershed (Site 1373; Map 3-1; Attachment C).

Third-order streams had a fish presence at 77.8% of sites, with five fish species captured (Table 3-2). Adult Arctic grayling were captured at all but three sites (Photo 3-2), and YOY Arctic grayling were present at six sites total: three sites in the Chance watershed (Site 828, 832, 835), one in the Dalglish watershed (977), one in the MacParlon watershed (Site 1182), and one site in the Whitestone watershed (Site 1406; Table 3-2; Map 3-1; Attachment C). Slimy sculpin were captured at one site in the Enterprise Creek watershed (Site 980) and one site in the MacParlon watershed (Site 1397; Table 3-2; Map 3-1; Attachment C). Round whitefish were only captured at two sites in the whole RSA, both in the Dalglish Creek watershed (Site 977, 1130; Photo 3-3; Table 3-2; Map 3-1; Attachment C). Lastly, a single longnose sucker was captured (Photo 3-4) and a burbot was observed at the same site in the Chance Creek watershed (Site 840).

Fourth- and fifth-order streams had fish present in 100% of the sites visited, albeit few sites were visited as fish presence was anticipated in these higher-order streams (Barker et al. 2011). Arctic grayling and slimy sculpin were the only species captured in fourth- and fifth-order streams (Table 3-2; Attachment C). Slimy sculpin were captured at two fourth-order streams (Site 267 and 269) and in one fifth-order stream (MacParlon Creek; Site 1184).

Minnow traps were set at six locations within the RSA (Attachment C). Only one site successfully captured fish, with two Arctic grayling caught in the same trap in a third-order stream (fork length = 45 mm each; catch-per-unit-effort = 0.5 fish per 24 hr). Minnow trapping was initially used at a subset of sites to verify the success of electrofishing. As minnow trapping was not gathering any new information, electrofishing became the preferred method for capturing fish.

Table 3-1. Summary of fish sampling sites and corresponding fish presence from July and August 2019.

Stream Order	Sites Visited	Sites Sampled for Fish	Sites with Fish Present	Percent of Sites Visited with Fish Present (%)
1	52	19	2	3.8
2	42	38	22	52.4
3	18	18	14	77.8
4	4	4	4	100
5	2	2	2	100
Total	**118**	**81**	**44**	**54.3**

Table 3-2. Fish species and measurement metrics summary based on stream order from July and August 2019 sampling.

Order	Species	Number of Sites with Fish Present	Number of Fish Observed/Captured	Number Measured	Average Fork Length (mm, ± SE)	Fork Length Range (mm)
1	GR	2	3	3	238.8 ± 13.3	200 – 250
2	GR	19	67	44	171.2 ± 12.0	38 – 350
	CCG	3	16	4	104.3 ± 6.7	90 – 120
	LSU	3	10	5	129.8 ± 13.8	87 – 170
	BB	2	8	3	245.0 ± 24.7	200 – 285
3	GR	15	66	51	117.8 ±12.6	27 – 325
	CCG	2	15	2	68.5 ± 1.5	67 – 70
	LSU	1	8	1	211.0 ± 0.0	–
	BB	1	1	–	–	–
	RW	2	8	2	294.0 ± 4.0	290 – 298
4	GR	4	38	20	49.5 ± 1.7	33 – 65
	CCG	2	5	3	85.7 ± 4.2	81 – 94
5	GR	2	13	9	46.0 ± 6.1	34 – 93
	CCG	1	6	4	71.0 ± 12.1	64 – 89

GR = Arctic grayling; CCG = slimy sculpin; LSU = longnose sucker; BB = burbot; RW = round whitefish



Photo 3-1. Young-of-the-year Arctic grayling captured in a second-order stream within the Eagle River watershed on July 29, 2019.



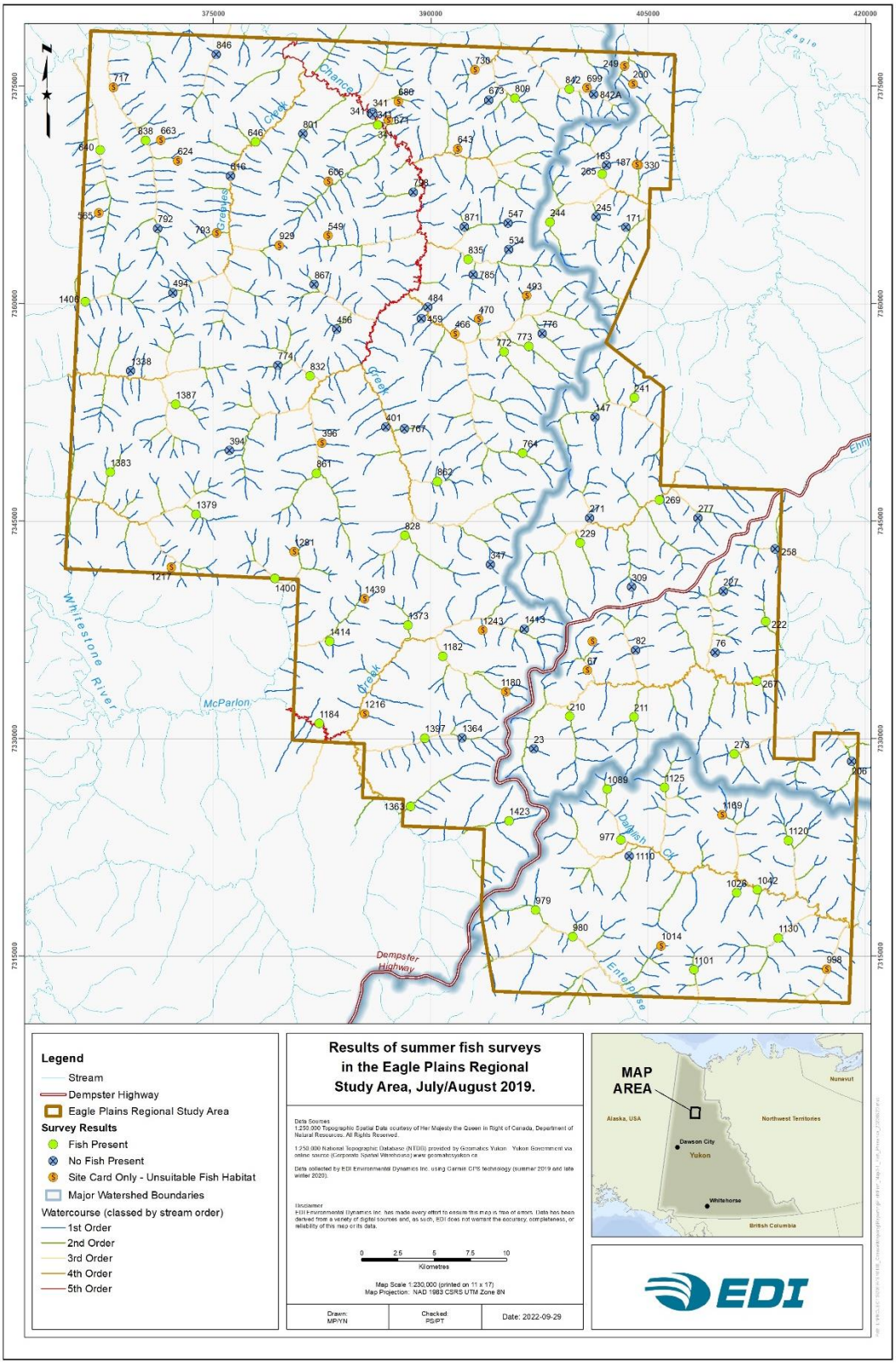
Photo 3-2. Adult Arctic grayling captured in a third-order stream within the Dalglish Creek watershed on July 31, 2019.



Photo 3-3. A round whitefish captured in a third-order stream within the Dalglish Creek watershed on July 31, 2019.



Photo 3-4. A longnose sucker captured in a third-order stream within the Chance Creek watershed on July 27, 2019.



Map 3-1. Results of summer fish surveys in the Eagle Plains Regional Study Area, July/August 2019.

3.2.1.2 Water Quality

First- and smaller second-order streams were frequently characterized by little or no flow, inconsistent connectivity, and isolated residual pools. Many wetted first-order streams did not have consistently flowing water at the time of sampling, and many sites were sampled from isolated residual pools; this was occasionally the case in some smaller second-order streams as well. As such, the fish captured in these streams were at least temporarily stranded and likely travelled upstream into these first and second-order streams during high spring water levels. These low or no flow streams were characterized by low dissolved oxygen (Table 3-3; Attachment D). Water temperatures were lowest in first-order streams due to the greater inputs from the melting of the active layer of the permafrost; in some streams, ice was discovered below the substrate. As stream order increased, water temperature also increased on average (Table 3-3). General guidelines for dissolved oxygen in fish-bearing waters indicate that most fish require dissolved oxygen levels above 6 mg/L, with potentially lethal consequences to prolonged exposure below 2 mg/L (Doudoroff and Shumway 1970, Davis 1975, Leppi et al. 2016). The lowest dissolved oxygen that contained fish was 2.2 mg/L in a first-order stream, where fish were caught in a disconnected residual pool (Table 3-3; Attachment D).

Table 3-3. Water quality parameters at sites that contained fish during July and August 2019 fish sampling.

Stream Order	Sites with Fish Present	Dissolved Oxygen (%)		Dissolved Oxygen (mg/L)		Temperature (°C)	
		Average DO of Sites with Fish Present (± SE)	Range	Average DO of Sites with Fish Present (mg/L ± SE)	Range	Average Temperature of Sites with Fish Present (± SE)	Range
1	2	31.4 ± 17.2	18.2 – 44.5	3.7 ± 2.7	2.2 – 5.3	8.7 ± 1.8	8.4 – 8.7
2	22	65.8 ± 2.9	42.9 – 89.8	7.2 ± 0.3	4.3 – 10.2	11.2 ± 0.5	7.3 – 16.2
3	14	72.7 ± 4.6	6.2 – 15.4	7.8 ± 0.5	7.6 – 14.5	11.6 ± 0.5	7.6 – 14.5
4	3	82.0 ± 6.4	70.6 – 92.8	8.7 ± 0.2	8.4 – 8.9	12.6 ± 2.6	8.1 – 17.1
5	2	99.0 ± 15.7	70.6 – 92.8	10.1 ± 1.5	8.4 – 9.0	14.4 ± 0.4	14.0 – 14.7

3.2.1.3 Habitat

Most first- to third-order streams in the RSA were characterized by fine bed material and overhanging vegetation (Photo 3-5, Photo 3-6, Photo 3-7). Areas of permafrost melting and slumping of stream banks added to the siltation of the stream bottoms and turbidity. The exception was lower order streams in the Peel watershed (e.g., Dalglish and Enterprise creeks and tributaries) that had bed material predominantly comprised of gravels (Photo 3-8). Larger third-, fourth- and fifth-order streams throughout the RSA were still characterized by a large amount of fines and moderate turbidity, although some had sections of gravel present (Photo 3-8, Photo 3-9, Photo 3-10).

Habitat quality in the RSA generally increased with increasing stream order. Generally, first- and second-order streams provided discontinuous habitat at the time of survey due to low water flow. In first- and second-order streams, habitat complexity was low, with most cover restricted to undercut banks, overhanging vegetation,

and occasional woody debris (Photo 3-5, Photo 3-6). A few pools occurred, many of which were not substantial in size or residual depth (Table 3-4; Attachment D). However, in all third-order and greater streams, the depths of pools and runs generally offered adequate cover to support fish in many stream sections. Channel widths also generally increased with increasing stream order. Stream gradient generally decreased with increasing stream order; the highest stream gradient was 7.0% at a first-order stream (Table 3-5). However, the gradient is unlikely to play a major role in fish presence in the RSA because fish passage is normally not hindered below 20% gradient. At many sites there was an indiscernible amount of gradient (Table 3-5; Attachment E)—this was particularly true in poorly defined and braided streams.

Table 3-4. Stream measurement metrics summary based on stream order from sampling in July and August 2019.

Stream Order	Sites[1]	Channel Width		Wetted Width		Residual Pool Depth	
		Average (m; ± SE)	Range (m)	Average (m; ± SE)	Range (m)	Average (m; ± SE)	Range (m)
1	2	31.4 ± 17.2	18.2 – 44.5	3.7 ± 2.7	2.2 – 5.3	8.7 ± 1.8	8.4 – 8.7
2	22	65.8 ± 2.9	42.9 – 89.8	7.2 ± 0.3	4.3 – 10.2	11.2 ± 0.5	7.3 – 16.2
3	14	72.7 ± 4.6	6.2 – 15.4	7.8 ± 0.5	7.6 – 14.5	11.6 ± 0.5	7.6 – 14.5
4	3	82.0 ± 6.4	70.6 – 92.8	8.7 ± 0.2	8.4 – 8.9	12.6 ± 2.6	8.1 – 17.1
5	2	99.0 ± 15.7	70.6 – 92.8	10.1 ± 1.5	8.4 – 9.0	14.4 ± 0.4	14.0 – 14.7

[1] Sites that were not considered a stream (i.e., no banks or bed material) were not included in these calculations.

Table 3-5. Stream gradient summary based on stream order from sampling in July and August 2019.

Stream Order	Gradient (%)	
	Average (± SE)	Range
1	2.05 ± 0.31	0.00 – 7.00
2	1.16 ± 0.17	0.00 – 3.50
3	1.06 ± 0.28	0.00 – 3.50
4	0.44 ± 0.21	0.00 – 1.00
5	0.63 ± 0.13	0.50 – 0.75



Photo 3-5. A wetted first-order drainage in the Chance Creek watershed.



Photo 3-6. A second-order stream in the Chance Creek watershed; notice the slumping banks and associated siltation.



Photo 3-7. A third-order stream in the Porcupine River watershed.



Photo 3-8. A third-order stream in the Enterprise Creek watershed, characterized by gravel and cobble substrate.



Photo 3-9. A fourth-order stream in Chance Creek watershed.



Photo 3-10. McParlon Creek, a fifth-order stream in the McParlon Creek watershed.

3.2.2 WINTER

Forty-nine sites were evaluated for fish presence potential in March 2020 within the RSA (Map 3-2; Table 3-6; Attachment F). Efforts were made to sample a typical stream section with average channel width. Sampling was also conducted at inline ponds or pools along the stream, where they occurred, and at their corresponding inlets/outlets (Table 3-7). If water was detected in one of the holes drilled at a site (e.g., pond/pool/stream) but not in others, the site was still designated as containing water. Fifteen of the 49 sites visited in March contained water (Map 3-2; Table 3-6).

In March 2020, no water was present in the single first-order stream visited, and the only second-order stream with water present was in a small inline pond, although the water was in the form of wet mud and not suitable fish habitat at the time of sampling (Photo 3-11; Table 3-6, Table 3-7). The ice depth was 0.63 m, with 0.32 m between the bottom of the ice at the top of the water—the water measured 0.05 m in depth (Photo 3-12). At all other second-order sites no water was detected during winter sampling (Photo 3-12). In third-order streams, all four inline ponds/pools sampled contained water (Photo 3-13), but with the outlets frozen to bed or as layered ice, indicating water level lowering and draining (Photo 3-14; Table 3-6, Table 3-7). As such, the water in the inline ponds and pool was likely to be standing water, acting as a residual pool as the rest of the stream water level dropped and froze during the fall and winter. The water quality of these sites was unsuitable for long-term fish rearing, with very low dissolved oxygen levels (range = 0.1 – 0.5 mg/L; Table 3-8; Attachment F, Attachment G) and generally dark-coloured water with a strong anoxic smell. Adequate under-ice dissolved oxygen is important for fish overwintering, with potentially lethal effects to prolonged exposure to below 2 mg/L, with preferred levels at or above 6 mg/L (Doudoroff and Shumway 1970, Davis 1975, Leppi et al. 2016). The water was deep enough to use the fish camera at two sites; during 10 to 20 minutes of observation, no indication of fish presence was found at either site.

Eight of 14 fourth-order streams contained water in March 2020. Five of the sites (646, 270, 340, 1408, 267) contained water in a pool or inline pond, and of these, two also contained water in the adjacent stream channel (both sites on stream 267), suggesting flowing water may have been present (Table 3-6, Table 3-7). The other three sites had water present in the stream channel (also used for water quality sites in the EDI Surface Water Quality and Hydrology Baseline Report: NCY-PT19, DALG-003, EAGL-t-004; EDI 2021). Four of the sites had enough water to use the fish camera for 15 to 20 minutes—no fish were detected at any of the sites. Most of the sites containing water did not have suitable water quality parameters for fish presence, with average dissolved oxygen levels ranging from 0.2 to 1.7 mg/L at five of the six sites that had water quality collected (Table 3-11). Only one of the fourth-order streams (Site 267) had low to moderate dissolved oxygen levels in the pool and stream channel sampled (3.97 mg/L and 8.50 mg/L, respectively; Table 3-8; Attachment G); these dissolved oxygen levels are likely sufficient for fish to overwinter (Leppi et al. 2016).

Fifth-order stream sampling included two sites on Chance Creek and one on McParlon Creek. Chance Creek was sampled for fish at the water quality site CHNC-003 and at a site at the farthest downstream extent before leaving the RSA. Five holes were drilled across the channel at site CHNC-003, with four of the five holes frozen to the bed (Photo 3-15). The fifth hole contained very little water (0.17 m) and was a ferrous orange in colour. The downstream site on Chance Creek also had five holes drilled cross-sectionally, with all holes

frozen to bed and no detectable water. Water quality site CHNC-001 (located outside of the RSA) did contain water very near to the confluence with the Whitestone River. The site on McParlon Creek contained water but had poor overwintering habitat potential, with a low dissolved oxygen level (1.70 mg/L) and anoxic-smelling water (Table 3-8). Due to the nature of sampling beneath the ice, it is possible that the best overwintering habitat (e.g., areas of flow) could have been missed. However, this issue was minimized by sampling multiple locations at each site and drilling multiple holes across the channels.

Generally, most sites with water had a strong anoxic smell and low dissolved oxygen levels (Table 3-8). No fish were detected using the underwater fish viewer on the nine occasions water depth was sufficient to use it. The temperature did not vary considerably among sites (Table 3-8; Attachment F), with no sites appearing to have groundwater influence (i.e., warmer water inputs) at the sampled locations (Table 3-8; Attachment F, Attachment G).

Table 3-6. Summary of sites visited and those that contained water from the overwintering assessments in March 2020.

Stream Order	Sampled Sites	Sites Containing Water	Percent of Sites Visited that Contained Water (%)	Average Water Depth[1] (± SE; m)	Water Depth Range[1] (m)
1	1	0	0	–	–
2	14	1	7	0.05 ± 0.00	0.05 – 0.05
3	18	4	22	0.64 ± 0.24	0.1 – 1.1
4	13	8	62	0.37 ± 0.11	0.01 – 1.1
5	3	2	67	0.33 ± 0.16	0.17 – 0.48
TOTAL	**49**	**15**			

[1] Average water depth calculations and ranges only used sites that contained water and did not include zeroes.

Table 3-7. Summary of water presence based on stream order and habitat of stream sampled in March 2020.

Stream Order	Sites Containing Water in a Stream Reach	Sites Containing Water in an Inline Pond or Pool	Sites Containing Water in the Outlet/Inlet of an Inline Pond or Pool	Total Sites Containing Water
1	0	0	0	**0**
2	0	1	0	**1**
3	0	4	0	**4**
4	5	5	1	**11[1]**
5	2	0	0	**2**

[1] Two fourth-order streams contained water in the stream and pool, and one contained water in the outlet.

Table 3-8. Summary of in situ water quality parameters from the March 2020 investigations.

Stream Order	Sites with In Situ Water Quality	Dissolved Oxygen (%)		Dissolved Oxygen (mg/L)		Temperature (°C)	
		Average (± SE)	Range	Average (± SE)	Range	Average (± SE)	Range
1	2	31.4 ± 17.2	18.2 – 44.5	3.7 ± 2.7	2.2 – 5.3	8.7 ± 1.8	8.4 – 8.7
2	22	65.8 ± 2.9	42.9 – 89.8	7.2 ± 0.3	4.3 – 10.2	11.2 ± 0.5	7.3 – 16.2
3	14	72.7 ± 4.6	6.2 – 15.4	7.8 ± 0.5	7.6 – 14.5	11.6 ± 0.5	7.6 – 14.5
4	3	82.0 ± 6.4	70.6 – 92.8	8.7 ± 0.2	8.4 – 8.9	12.6 ± 2.6	8.1 – 17.1
5	2	99.0 ± 15.7	70.6 – 92.8	10.1 ± 1.5	8.4 – 9.0	14.4 ± 0.4	14.0 – 14.7



Photo 3-11. The only second order stream (inline pond) containing trace amounts of water (ice thickness 0.63 m), sampled on March 10, 2020.



Photo 3-12. Dry inlet of the inline pond in the second-order stream, characterized by thin layered ice and overhanging vegetation on March 10, 2020.



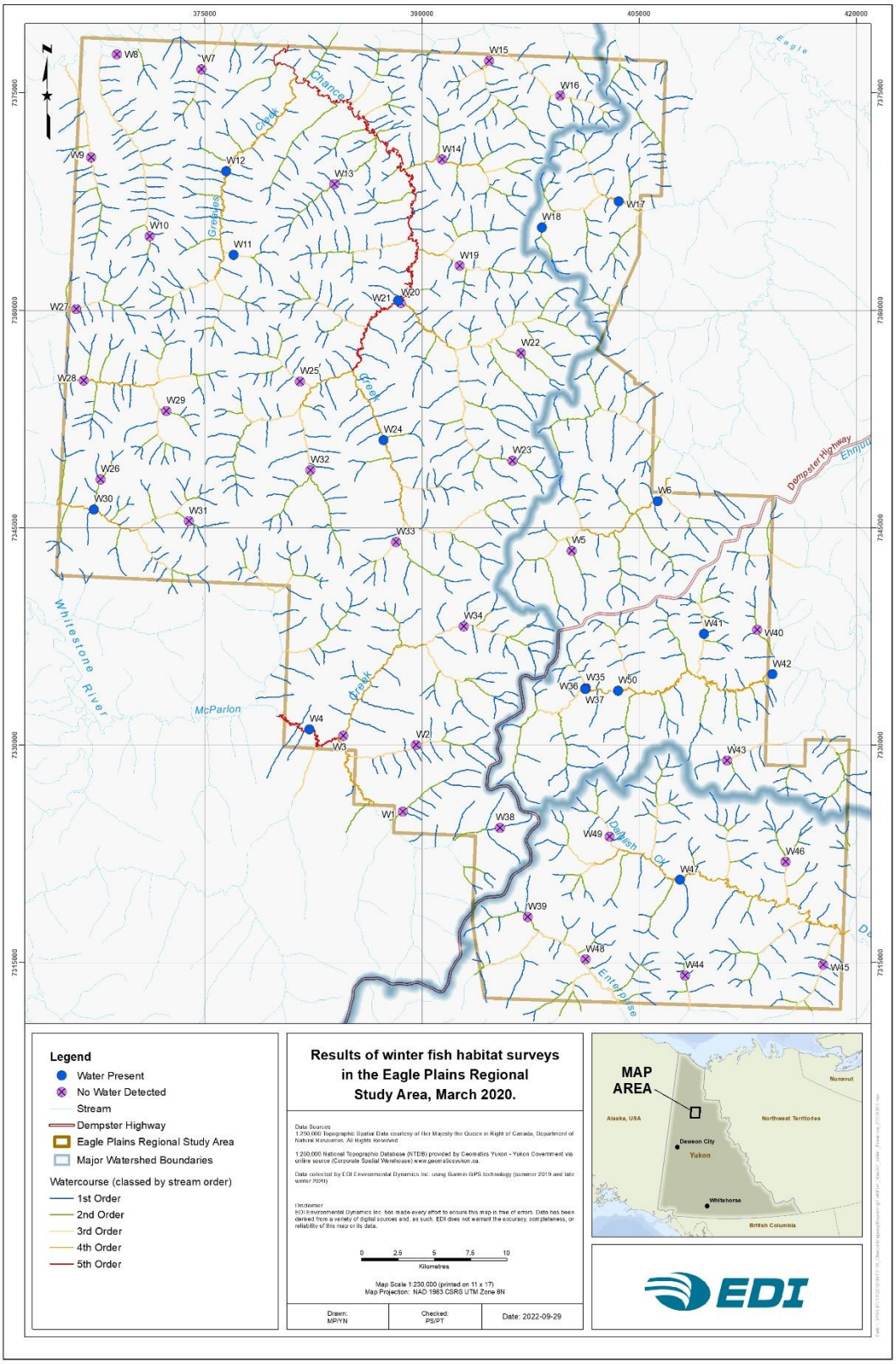
Photo 3-13. Inline pond in a third-order stream containing water on March 9, 2020.



Photo 3-14. Layered ice at a dry pond outlet in a third-order stream (ice thickness 0.62 m) during sampling on March 9, 2020.



Photo 3-15. Holes drilled at Chance Creek water quality site CHNC-003 March 10, 2020.



Map 3-2. Results of winter fish habitat surveys in the Eagle Plains Regional Study Area, March 2020.

3.3 FISH PRESENCE — PREDICTIVE MODELLING

Eight models were developed that represented plausible combinations of the nine environmental variables to explain fish presence in the RSA (Table 3-9). The top model for predicting fish presence contained a single variable, stream order (Table 3-9). There was also support for models that included either distance to third--order stream or distance to third-order stream + terrain slope (i.e., Δ AICc <2 relative to the top model). Together, the top three models account for 83% of model weights. Although the 2nd and 3rd ranked models have modest wAICc values, adding those extra variables does little to improve prediction accuracy over the univariate model with stream order (Table 3-10). Based on this, the univariate model of stream order is recommended for management use due to its simplicity and model parsimony. The odds of fish presence increased with stream order (Table 3-10; Map 3-3). Absolute probabilities of occurrence associated with each stream order were as follows: 7.6% in first-order, 45.3% in second-order, 89.3% in third-order, 98.8% in fourth-order, and 99.9% in fifth-order streams. A test of the model's performance using a ROC curve indicated that the model was statistically valid for prediction with an AUC score of 0.87.

For the secondary analysis using field-based data, the top two models had nearly equivalent AICc scores and weights (Table 3-11). The model that included only stream order and pool depth was selected as the best model because it was the most parsimonious[3] and because a post hoc Fisher's exact (contingency table) test revealed that if stream order were used as a categorical variable, it would be highly associated with overwintering habitat ($p = 0.0005$). That model was then evaluated using a ROC curve, resulting in an AUC score of 0.89.

The GIS-based and field-based models performed relatively equivalently, though the latter had slightly higher accuracy in differentiating between the presences and absences of fish. In both models, stream order was the best predictor and explained a substantial proportion of the variation in fish presence. In the field-based model, stream order and pool depth had a relatively similar magnitude of effect on fish occurrence, but the room for error in those estimates were narrower for stream order. In terms of model prediction, including pool depth made a nominal difference in estimates of fish presence over the univariate model with stream order (Table 3-12).

[3] a simple model with exceptional explanatory predictive power; explains data with minimal number of parameters.

Table 3-9. Candidate logistic regression models predicting fish presence, ranked by AICc raw scores, differences (Δ AICc), and weights (w_{AICc}), in the Eagle Plains Regional Study Area.

Rank	Model Structure	K[1]	AICc	Δ AICc	wAICc[2]
1	stream order	2	102.81	0	0.35
2	stream order + distance to third-order stream	3	103.31	0.50	0.27
3	stream order + distance to third-order stream + terrain slope	4	103.86	1.05	0.21
4	stream order + distance to third-order stream + terrain slope + distance to inline pools	5	105.29	2.48	0.10
5	stream order + distance to third-order stream + terrain slope + distance to inline pools + stream slope	6	106.71	3.89	0.05
6	stream order + distance to third-order stream + terrain slope + distance to inline pools + stream slope + elevation	7	108.88	6.07	0.02
7	stream order + distance to third-order stream + terrain slope + distance to inline pools + stream slope + elevation + catchment area	8	110.66	7.85	0.01
8	stream order + distance to third-order stream + terrain slope + distance to inline pools + stream slope + elevation + catchment area + distance to 4th order stream	9	113.00	10.19	0

[1] *K* parameters = intercept + number of covariates.

[2] Weight of evidence favouring a best model (i.e., 'relative model probabilities'; Burnham and Anderson 2002).

Table 3-10. Predicted probabilities (% and lower–upper confidence intervals) of fish presence across stream order for the top three models using GIS-based covariates.

Stream Order	Model – Predicted Probabilities		
	Stream Order	Stream Order + Distance to Third-Order	Stream Order + Distance to Third-Order + Terrain Slope
1	7.6% (0.6 – 48.9)	7.5% (0.2 – 59.4)	7.4% (0.2 – 59.4)
2	45.3% (2.7 – 96.2)	45.6% (1.4 – 97.7)	45.7% (1.2 – 97.3)
3	89.3% (11.4 – 99.8)	88.8% (8.6 – 99.9)	88.6% (8.1 – 99.9)
4	98.8% (37.8 – 100.0)	99.1% (33.9 – 100.0)	99.0% (34.5 – 100.0)
5	99.9% (74.1 – 100.0)	99.9% (73.7 – 100.0)	99.9% (80.5 – 100.0)

Table 3-11. Candidate logistic regression models constructed with field-based covariates (with *K* parameters) predicting fish presence, ranked by AICc raw scores, differences (Δ AICc), and weights (w_{AICc}) with reference to the best-supported model.

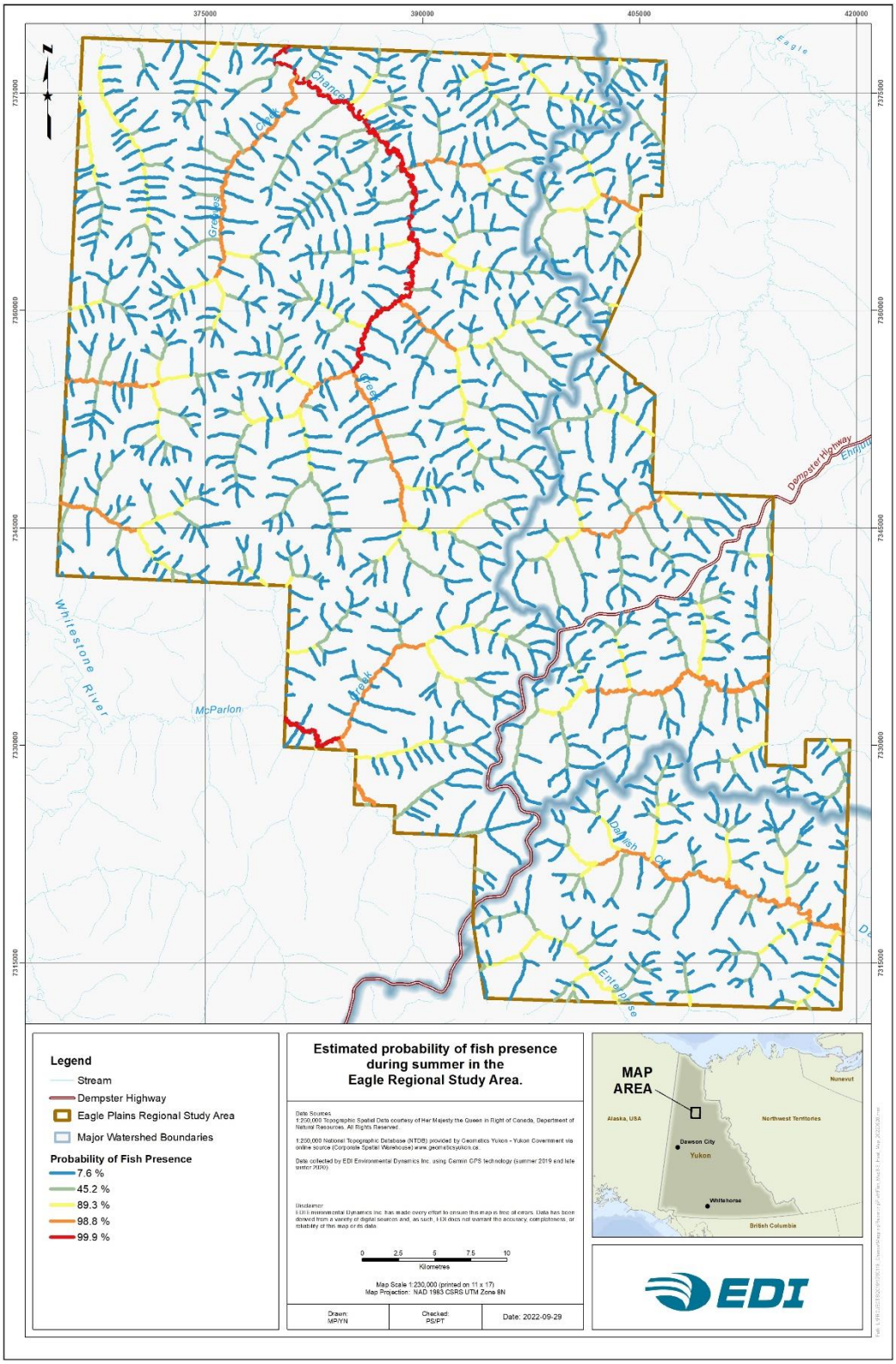
Rank	Model Structure	K[1]	AICc	Δ AICc	wAICc[2]
1	stream order + pool depth + overwintering habitat	6	99.05	0	0.39
2	stream order + pool depth	3	99.06	0.01	0.39
3	stream order + overwintering habitat	5	101.63	2.58	0.11
4	stream order	2	102.81	3.76	0.06
5	stream order + pool depth + dissolved oxygen (%) + temperature + gradient + overwintering habitat	9	102.99	3.94	0.05
6	pool depth + overwintering habitat	5	109.45	10.4	0
7	overwintering habitat	4	116.50	17.45	0
8	pool depth	2	131.61	32.56	0

[1] *K* parameters = intercept + number of covariates. Each level of a categorical variable adds a parameter.

[2] Weight of evidence favouring a best model (i.e., 'relative model probabilities'; Burnham and Anderson 2002).

Table 3-12. Predicted probabilities (% and lower – upper 95% confidence intervals) of fish presence across stream order comparing the base model with just stream order to the top model where field covariates were also considered (stream order + pool depth).

Stream Order	Model – Predicted Probabilities	
	Stream Order (GIS Based Model)	Stream Order + Pool Depth (Field Based Model)
1	7.6% (0.6 – 48.9)	7.0% (0.4 – 51.6)
2	45.3% (2.7 – 96.2)	46.9% (1.4 – 96.9)
3	89.3% (11.4 – 99.8)	87.3% (4.9 – 99.9)
4	98.8% (37.8 – 100.0)	99.2% (16.8 – 100.0)
5	99.9% (74.1 – 100.0)	99.7% (36.51 – 100.0)



Map 3-3. Estimated probability of fish presence during summer in the Eagle Plains Regional Study Area.

4 DISCUSSION

These baseline investigations on fish and fish habitat in the RSA showed clear patterns of fish distribution in summer and of habitat availability for fish during winter. During the summer, the strong relationship between fish presence and stream order provides a clear and simple pattern of fish distribution that can be used for management to assess and mitigate potential Project effects to fish values in the RSA. Almost no first-order streams contained fish and all third-order or greater streams did contain fish during summer sampling. The variability of fish presence in second-order streams was partly attributable to differences in site-specific conditions (e.g., different channel widths and stream depths at different streams); however, across many second-order streams the intermediate probability of fish occurrence simply reflects marginal fish habitat conditions with low fish densities. Although evidence exists that additional GIS-based covariates (distance to third-order stream and terrain slope), and a field-based covariate (pool depth) may slightly improve model performance, the improvements those variables add to prediction accuracy are nominal. As such, they were not included in the final model, in favour of a simple univariate model's simplicity and ease of use (i.e., stream order only).

Electrofishing was successful at capturing several species within the RSA. Five species were captured: Arctic grayling, slimy sculpin, longnose sucker, round whitefish, and burbot. All but Arctic grayling were captured in low densities throughout the RSA. Six longnose sucker were captured at four sites in the Chance Creek, Whitestone River, and MacParlon Creek watersheds (Porcupine drainage) in second- and third-order streams. Longnose sucker are a generalist species and are the most widespread sucker in the north, commonly found in headwater streams (McPhail 2007). Four burbot were captured at three sites in second- and third-order streams in the Whitestone River and Chance Creek watersheds (Porcupine drainage). Burbot are widely distributed throughout the Northern Hemisphere and are not uncommon in riverine habitats (McPhail 2007). A study in the National Petroleum Reserve in Alaska completed a tagging study and found that burbot commonly travel up to 100 km in a season and were found in small headwater tributaries (Morris 2003). Lastly, two round whitefish were found in a third-order stream in the Dalglish Creek watershed (Peel drainage). While round whitefish are more commonly associated with larger riverine systems, they are still found in smaller streams, barring steep gradients (McPhail 2007).

The results of this study are similar to the findings in the adjacent Peel watershed study (Barker et al. 2011). The Peel study also observed a very low probability of fish in first-order streams and a high probability in third- and fourth-order (authors assumed presence in fifth-order streams; Barker et al. 2011). The Peel study findings also indicated the greatest variability in fish presence and abundance occurred in second-order streams. The Peel study identified ≥50% probability for Arctic grayling to be present in third-order streams (and only in larger, lower reaches), with probabilities 'declining rapidly to nil' in upstream sections (Barker et al. 2011).

A comparison of the AUC scores between the two studies (AUC = 0.87 Eagle Plains model vs. 0.75 Peel model) suggests that the Eagle Plains model provides somewhat better predictive performance than the Peel model in quantifying fish occurrence. This may be due to how environmental variables were assessed between the two studies. The Peel study was designed to test specific ecological hypotheses about fish distribution. In

contrast, this study was designed to develop the best model to predict fish occurrence, and the two studies varied their model sets accordingly. Another potential limitation in the Peel study is that they did not use stream order as a variable in the model. Instead, they used 'upstream extent', described as the cumulative length of all stream segments upstream from the sampled location (Barker et al. 2011). In the Peel study the predictor's coefficients were weak in magnitude (e.g., $\beta = 0.0001$ on a logit scale; Barker et al. 2011). By comparison, the coefficient of stream order in the current study was fairly strong (i.e., $\beta = 2.14$ on a logit scale). This demonstrates how a simple variable like stream order captures most of the variation in fish presence. For the GIS-based model, stream order outperformed eight other predictors: distance to third-, fourth-, and fifth-order streams; stream slope; terrain slope; elevation; catchment area; and distance to inline pools.

Higher stream orders are typically associated with higher quality and more diverse fish habitat, and thus greater abundances and species diversity (Gorman and Karr 1978, Harvey and Stewart 1991). Although stream order is a simple metric, it is correlated with several other stream characteristics that, individually and in combination, tend to support more fish. As stream order increases, the metrics involved with stream width, depth, water volume, habitat complexity, and potential for overwintering habitat all increase (Harrel et al. 1967, Gorman and Karr 1978, Reynolds 1997). The results from the current study support this concept, whereby fish presence increased as stream order increased. During the summer field studies, more fish were observed or captured in higher-order streams, with very few (n = 4) fish being captured or observed in the 52 first-order streams sampled. In third-, fourth- and fifth-order streams, the proportions of streams containing fish were approaching or reaching 100%. Habitat assessments also indicated that habitat quality (e.g., pool depths) and complexity increased with increasing stream order, with higher-order streams having higher quality habitat for rearing, spawning, and potential overwintering (Attachment C).

The field studies conducted in the RSA provide a temporal picture of habitat availability and utilization. Between the summer (n = 118) and winter (n = 49) sampling, a total of 167 sites were sampled within the RSA (some sites from the summer were revisited during winter sampling). As such, all the sampling conducted provided updated information on temporal fish distribution within the RSA. Ultimately the findings of the current study illustrated the disproportionate amount of habitat available to fish during the summer compared to winter. While most of the habitat assessed in the summer was considered to have poor or no spawning habitat (with some higher-order streams considered moderate to good), the observed and captured fish indicated that rearing habitat was widespread throughout the RSA. While not many sites were considered to have optimal Arctic grayling spawning habitats, YOY were captured in second- to fifth-order streams, suggesting that spawning does occur in some streams sampled. Young-of-the-year Arctic grayling were captured in two second-order streams; both streams had channel widths of greater than 3 m and had fines for bed material (Attachment D). Young-of-the-year Arctic grayling were present in eight third-order streams, three fourth-order streams, and in both fifth-order streams sampled.

Notwithstanding the gradient of habitat quality across stream orders, the overall diversity and habitat quality in the RSA was relatively low at a regional level. Streams are low gradient, with slow-moving, turbid water. The stream beds and banks are predominantly fines and organics, which reduce water quality, forage diversity and quantity, and spawning potential compared to streams with clearer water and rocky steam beds/banks

(Gorman and Karr 1978). On average, streams in the RSA were rated as moderate quality rearing habitat and low or nil quality spawning habitat for the dominant species, Arctic grayling. Despite the suboptimal conditions, Arctic grayling were the most frequently captured species during summer fieldwork (85%) and were the most widespread regarding being higher upstream in headwater streams.

The ability of Arctic grayling to travel long distances to occupy seasonally available streams is well known. During the open water months, Arctic grayling travel upstream into the feeding areas of headwater streams for more optimal foraging opportunities and less competition (Tack 1980, Hughes 1999, McFarland 2015). This was clearly apparent in the current study, whereby Arctic grayling were found high in the headwaters of different watersheds during the summer. Streams within the RSA are highly influenced by local hydrology (i.e., permafrost, snowmelt, and precipitation events), as illustrated during summer fieldwork (Smith et al. 2004). When terrestrial field crews were in the RSA in June, water levels were considerably higher than during fish sampling in July and August; the peak flow throughout Eagle Plains typically occurs in June (Smith et al. 2004). As a result, more accessible habitat for Arctic grayling was available higher in the watersheds in June, and they occupied habitats that are otherwise inaccessible during much of the year, using headwater streams for feeding opportunities. Foraging success during the short open water season is critical for fish to acquire sufficient energy reserves before winter, when habitats are less productive overall (Morris 2003, Heim et al. 2016). Arctic grayling forage on aquatic and terrestrial invertebrates, and depending on availability, on smaller fish; these feeding behaviours change seasonally (e.g., aquatic invertebrates during the winter months; Armstrong et al. 1986, McFarland 2015). Some Arctic grayling were found isolated in residual pools with no downstream connectivity and were at risk of being stranded in areas that would become anoxic or freeze, unless a heavy rainfall event elevated the water flow and allowed them to travel downstream. Arctic grayling movements in Arctic ecosystems are strongly tied to seasonal changes in discharge and temperature (Heim et al. 2016).

Another finding from this study that is consistent with the literature is of larger Arctic grayling occupying habitats higher in headwater streams (Hughes 1992, Hughes and Reynolds 1994, Heim et al. 2016). Foraging opportunities tend to be higher in smaller, headwater streams (less water volume to cover for drift-feeding) and large grayling often occupy these areas and exclude smaller grayling from them (Vascotto 1970, Hughes 1992, 1999, Hughes and Reynolds 1994, Heim et al. 2016). This size-sorting was evident in the results herein—on average, the largest Arctic grayling were found in first-order streams (238.8 ± 13.3 mm SE), with average fork length decreasing as stream order increased (e.g., third-order average fork length = 117.8 ± 12.6 mm SE; fifth-order average fork length = 46.0 ± 6.1 mm SE).

In the late summer and fall, Arctic grayling seasonally migrate considerable distances (up to 320 km; Tripp and McCart 1974), leaving smaller headwater lakes and streams to overwinter in larger waterbodies, as the small headwater streams they inhabited in the summer often dewater or freeze to bottom during the winter months (Armstrong et al. 1986, West et al. 1992, Stewart et al. 2007, Heim 2014). This pattern appears consistent with our winter field results. Several of the same streams were visited in the summer and winter, and in nearly all cases, the streams were found to be dewatered or frozen to bed. Information on the Eagle Plains Ecoregion supports that small to intermediate streams in the region have no flow during the winter months (Smith et al. 2004).

Although water was detected in 15 of 49 sites during the winter field visit, the water depth and dissolved oxygen levels were insufficient to support overwintering fish at most sites. Adequate under-ice dissolved oxygen is a requirement for overwintering fish, as it affects fish respiration and metabolism, reproduction, growth, and survival (Leppi et al. 2016). General freshwater fish guidelines for dissolved oxygen indicate that most fish require dissolved oxygen levels above 6.0 mg/L, with potentially lethal consequences to prolonged exposure below 2.0 mg/L (Doudoroff and Shumway 1970, Davis 1975, Leppi et al. 2016). In third- and fourth-order streams sampled in the winter, dissolved oxygen levels ranged from 0.1 – 1.2 mg/L in all but one fourth-order stream. This site had dissolved oxygen levels of 4.0 mg/L in a pool, and 8.5 mg/L in the adjacent stream channel (where water was less stagnant). The only fifth-order stream with enough water to take water quality parameters was on McParlon Creek, and had dissolved oxygen levels of 1.7 mg/L. As such, based on the accepted published values of overwintering dissolved oxygen values, only one site sampled contained moderate dissolved oxygen levels for fish to overwinter.

A baseline water and sediment quality report (Golder Associates Ltd. 2018) assessed several of the same sites that were considered for the fish and water quality work completed in this report and the EDI Surface Water Quality and Hydrology Baseline Report (EDI 2021). Overall, the findings from the Golder study, completed between 2014 and 2017, are consistent with this study's water quality parameters and their suitability for fish rearing. Their findings determined that while there was sufficient dissolved oxygen during freshet and the open-water season, the ice-covered seasons had dissolved oxygen levels below the federal guidelines for aquatic life (5.5 – 9.5 mg/L; CCME 1999, Golder Associates Ltd. 2018). The water quality site CHNC-001 (located downstream, outside of the RSA) has been recorded by the Yukon Government from summer 2014 to fall 2017. During the three years of winter sampling (mid-March), the dissolved oxygen levels varied from 0.93 – 5.8 mg/L. As detailed in the EDI Surface Water Quality and Hydrology Baseline Report, CHNC-001 contained water during March 2019 with dissolved oxygen levels of 3.05 mg/L (EDI 2021). Though this site appears to contain water during the winter (potentially due to its proximity to the Whitestone River), the under-ice dissolved oxygen is considered poor to moderate for fish rearing (Doudoroff and Shumway 1970, Davis 1975, Leppi et al. 2016). Several other sites sampled by the Yukon Government were frozen or were characterized by shallow, muddy water (Golder Associates Ltd. 2018).

Slimy sculpin are considered an important indicator species for overwintering habitat, as they have strong site fidelity and only move a few hundred metres during their lifetime (Gray et al. 2004, 2018). Therefore, it is commonly accepted that if a slimy sculpin is captured in the summer, overwintering habitat will occur within several hundred metres of that location. Within this study, all slimy sculpin were captured in a concentrated area in the southern end of the RSA. Individuals were caught in five sites in Eagle River tributaries (Porcupine drainage; second- and fourth-order), two sites in the MacParlon River watershed (Porcupine drainage; third- and fifth-order), and one site in a tributary to Enterprise Creek (Peel drainage; third-order; Attachment C). Slimy sculpin were captured at eight sites during the summer sampling. These sites were revisited, and five winter sites contained water near summer slimy sculpin sites. As discussed above, one of these sites was the only site with sufficient under-ice dissolved oxygen to support overwintering fish (8.5 mg/L, site 267; Attachment G). Two other winter sites downstream of this site contained water, but at the point of sampling, they both had insufficient dissolved oxygen for overwintering fish. With the evidence

of summer sampling capturing slimy sculpin in second-order streams upstream of these sites, it is likely pockets of overwintering habitat exist elsewhere and within the range a slimy sculpin would travel.

Despite appropriate sampling methods, no salmon were captured or observed in the RSA. This finding is consistent with past work in the Porcupine River watershed that indicated salmon rearing appears to be limited to natal streams (streams in which they spawn; Anderton 2004). Known salmon spawning areas in the Porcupine drainage downstream of the RSA include the Whitestone (Chinook), Bell (Chinook and chum), and Rock rivers (Chinook and chum; Anderton 2004, EDI 2016), all of which are tens of km downstream from the RSA. From a habitat perspective, the predominance of slow-moving, turbid water, with silty/organic stream beds offers no spawning potential and low-quality juvenile rearing for salmon. Based on the far distances to suitable spawning habitat outside the RSA and the poor quality of rearing habitat within the RSA, salmon are unlikely to use the streams within the RSA.

5 CONCLUSIONS

This study successfully met its objectives of improving the understanding of fish distribution across the RSA in summer and winter. The results of this study indicate a dynamic pattern of fish occurrence in the RSA between summer and winter. Overwintering habitat is very limited in the RSA, and most fish likely migrate out of the RSA to find suitable overwintering habitat in larger rivers. During summer, transient fish, most notably Arctic grayling, travel tens to greater than 100 km from larger, higher order rivers to use second-order and greater streams in the RSA as seasonal rearing habitat.

Overall, the habitat diversity in the RSA was low and dominated by slow-moving, turbid water, with fines and organics bed materials. Despite this habitat not typically being considered quality rearing habitat for Arctic grayling, this fish was the most widespread species in the RSA, accounting for 85% of fish captured in the summer. Burbot, round whitefish, longnose sucker and slimy sculpin made up the other 15% of fish captured during the summer field program. No salmon were captured or observed within the RSA; these findings are consistent with the known extent of salmon use in the Porcupine River watershed. During the summer, fish presence was predominantly explained by stream order—fish were detected in almost none of the first-order streams, approximately half of the second-order streams, and almost all third-order and greater streams. The strong relationship between fish presence and stream order provides a clear and simple pattern of fish distribution that can be used for management to assess and mitigate potential Project effects to fish values in the RSA.

While fish (especially Arctic grayling) were found widely across the RSA during the summer months, nearly all sites assessed in the winter were frozen to bed, dewatered, or had insufficient under-ice dissolved oxygen levels for fish to overwinter. The lower reaches of Chance Creek and select sites along McParlon, Dalglish, and Enterprise creeks may offer limited overwintering habitat to a small number of fish (based on water conditions in March 2020 and the presence of non-migratory slimy sculpin at some summer sites). However, the extent of suitable overwintering habitat appears limited to small pockets capable of supporting only small numbers of fish. Most fish (i.e., all species other than slimy sculpin) likely migrate to higher-order streams outside the RSA with better overwintering conditions and larger stream extents.

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ATTACHMENTS

ATTACHMENT A ELECTROFISHING SETTINGS AND ELECTROFISHING AND MINNOW TRAPPING EFFORT

Table A-1. Electrofisher settings and site sampling details, July and August 2020.

Electrofisher	Stream ID	Time "On" (secs)	Distance (m)	Voltage (V)	Frequency (Hz)	Duty cycle	Pulse width (ms)	Power (w)	Amps (A)
LR-24	773	483	50	350	30	20	4	44	0.1
LR-24	871	419	80	360	30	20	4	-	0.1
LR-24	547	364	90	360	30	20	4	30	0.1
LR-24	244	372	40	300	30	30	5	37	0.1
LR-24	183	420	40	375	30	20	4	26	0.1
LR-24	842A	400	45	300	30	30	4	47	0.2
LR-24	842B	427	45	-	30	20	4	87	0.3
LR-24	809	427	50	450	30	20	4	18	0.3
LR-24	801	483	100	450	30	20	4	90	0.2
LR-24	494	407	70	500	30	20	4	42	0.1
LR-24	846	480	60	500	30	20	4	48	0.1
LR-24	840	496	-	450	30	20	4	41	0.1
LR-24	867	211	70	685	30	12	4	-	0.1
LR-24	456	450	40	500	30	20	4	-	0.1
LR-24	1387	476	70	450	30	20	4	46	0.1
LR-24	1383	492	70	450	30	20	4	49	0.1
LR-24	1379	495	60	500	30	20	4	54	0.1
LR-24	1271	438	65	600	30	20	4	60	0.1
LR-24	767	482	60	500	30	30	5	40	0.1
LR-24	862	461	60	550	30	12	4	40	0.1
LR-24	764	439	80	550	30	20	4	40	0.1
LR-24	271	461	60	550	30	20	4	-	-
LR-24	229	486	-	250	30	20	4	130	0.5-0.8
LR-24	309	427	65	400	30	20	4	40	0-1
LR-24	1182	498	-	250	40	20	5	130	0.7
LR-24	210	441	50	300	40	20	5	130	0.5
LR-24	1364	456	60	250	30	20	4	45	0.1
LR-24	1397	450	60	250	30	20	4	-	0.1
LR-24	1373	499	60	400	30	20	4	55	0.1
LR-24	979	467	60	400	30	20	4	80	0.1
LR-24	980	518	60	400	30	20	4	80	0.2
LR-24	1110	442	40	250	30	12	4	47	0.1
LR-24	1101	445	25	400	40	20	5	65	0.1
LR-24	1130	447	30	400	40	20	5	70	0.1
LR-24	206	439	60	200	30	20	4	70	0.1
12B POW	459	430	125	600	60	36	6	n/a	n/a
12B POW	776	418	150	400	60	36	6	n/a	n/a

Electrofisher	Stream ID	Time "On" (secs)	Distance (m)	Voltage (V)	Frequency (Hz)	Duty cycle	Pulse width (ms)	Power (w)	Amps (A)
12B POW	835	609	200	400	60	36	6	n/a	n/a
12B POW	785	585	-	500	60	36	6	n/a	n/a
12B POW	534	454	200	300	60	36	6	n/a	n/a
12B POW	245	408	150	500	60	36	6	n/a	n/a
12B POW	171	402	150	500	60	36	6	n/a	n/a
12B POW	265	461	150	400	60	36	6	n/a	n/a
12B POW	673	248	-	400	60	36	6	n/a	n/a
12B POW	341	460	-	500	60	36	6	n/a	n/a
12B POW	798	633	100	500	60	36	6	n/a	n/a
12B POW	646	628	80	500	60	36	6	n/a	n/a
12B POW	616	423	70	500	60	36	6	n/a	n/a
12B POW	792	573	-	400	60	36	6	n/a	n/a
12B POW	838	524	80	400	60	36	6	n/a	n/a
12B POW	1406	414	80	400	60	36	6	n/a	n/a
12B POW	861	509	70	400	60	36	6	n/a	n/a
12B POW	1400	503	100	500	60	36	6	n/a	n/a
12B POW	832	430	80	500	60	36	6	n/a	n/a
12B POW	394	463	150	500	60	36	6	n/a	n/a
12B POW	774	449	100	500	60	36	6	n/a	n/a
12B POW	1338	351	65	500	60	36	6	n/a	n/a
12B POW	277	411	160	100	60	36	6	n/a	n/a
12B POW	147	415	100	500	60	36	6	n/a	n/a
12B POW	241	313	120	600	60	36	6	n/a	n/a
12B POW	269	669	150	100	60	36	6	n/a	n/a
12B POW	401	323	-	400	60	36	6	n/a	n/a
12B POW	828	465	60	500	60	36	6	n/a	n/a
12B POW	347	404	100	600	60	36	6	n/a	n/a
12B POW	772	491	80	500	60	36	6	n/a	n/a
12B POW	1184	689	75	300	60	36	6	n/a	n/a
12B POW	1414	299	80	500	60	36	6	n/a	n/a
12B POW	1413	545	-	300	60	36	6	n/a	n/a
12B POW	23	406	100	300	60	36	6	n/a	n/a
12B POW	1423	403	-	300	60	36	6	n/a	n/a
12B POW	1363	276	150	500	60	36	6	n/a	n/a
12B POW	977	567	150	200	60	36	6	n/a	n/a
12B POW	1089	331	150	100	60	36	6	n/a	n/a
12B POW	1125	595	200	100	60	36	6	n/a	n/a
12B POW	1026	453	80	400	60	36	6	n/a	n/a

Electrofisher	Stream ID	Time "On" (secs)	Distance (m)	Voltage (V)	Frequency (Hz)	Duty cycle	Pulse width (ms)	Power (w)	Amps (A)
12B POW	1042	693	150	200	60	36	6	n/a	n/a
12B POW	1120	430	120	100	60	36	6	n/a	n/a
12B POW	211	503	80	200	60	36	6	n/a	n/a
12B POW	273	416	100	200	60	36	6	n/a	n/a
12B POW	267	565	65	100	60	36	6	n/a	n/a
12B POW	222	493	100	100	60	36	6	n/a	n/a
12B POW	76	285	200	200	60	36	6	n/a	n/a
12B POW	82	410	100	300	60	36	6	n/a	n/a
12B POW	227	477	120	100	60	36	6	n/a	n/a
12B POW	258	445	100	300	60	36	6	n/a	n/a

ATTACHMENT B ANDERSON RESOURCES LTD. 2001 PRELIMINARY BASELINE DATA

Table B-1. Access Consulting electrofishing results, June, August, and September 2001. Modified from Anderson (2001).

Sampling Site	River Drainage	Subdrainage	Date	Effort (seconds)	Fish Captured
AXL1	Peel	Ogilvie River	June 20, 2001	458	12 GR, 1 RW, 1 LW
AXL1	Peel	Ogilvie River	August 31, 2001	795	1 GR, 3 CCG, 1 BB, 2 LSU
AXL2 (pond)	Porcupine (Whitestone)	McParlon Creek	June 19, 2001	300	NFC
AXL2 (pond)	Porcupine (Whitestone)	McParlon Creek	September 3, 2001	33	NFC
AXL3	Porcupine (Whitestone)	McParlon Creek	June 19, 2001	190	NFC
AXL3	Porcupine (Whitestone)	McParlon Creek	September 3, 2001	424	1 GR
AXL4	Porcupine (Whitestone)	Chance Creek	June 19, 2001	588	NFC
AXL4	Porcupine (Whitestone)	Chance Creek	September 4, 2001	381	NFC
AXL5	Porcupine (Eagle)	Fly Creek	September 3, 2001	165 (u/s culvert); 126 d/s culvert	NFC both u/s and d/s culvert
AXL6 (pond)	Porcupine (Eagle)	Eagle Creek	June 21, 2001	178	NFC
AXL6 (pond)	Porcupine (Eagle)	Eagle Creek	September 1, 2001	199	NFC
AXL7	Porcupine (Eagle)	Eagle Creek	June 21, 2001	389	1 CCG
AXL7	Porcupine (Eagle)	Eagle Creek	September 1, 2001	277	1 GR
AXL8	Peel	Enterprise Creek	June 20, 2001	495	1 CCG
AXL8	Peel	Enterprise Creek	September 1, 2001	565	1 CCG
AXL9	Peel	Dalglish Creek	June 20, 2001	480	4 GR, 1 CCG, 1 LSU, 1 LW, 1 RW,1 CCG
AXL9	Peel	Dalglish Creek	September 1, 2001	516	1 CCG
AXL10	Porcupine (Eagle)	Eagle River	June 21, 2001	290	NFC
AXL11	Porcupine (Whitestone)	McParlon Creek	September 2, 2001	143	2 GR

Table B-2. Access Consulting angling results from June and September 2001. Modified from Anderson (2001).

Sampling site	River Drainage	Subdrainage	Date	Effort (hours)	Fish captured
AXL8	Peel	Enterprise Creek	September 1, 2001	0.25	1 GR
AXL9	Peel	Dalglish Creek	September 1, 2001	0.25	1 GR
AXL10	Porcupine (Eagle)	Eagle River	June 21, 2001	0.50	NFC

Table B-3. Access Consulting beach seining results from June, August, and September 2001. Modified from Anderson (2001).

Sampling Site	River Drainage	Subdrainage	Date	Effort (m^2)	Fish Captured
AXL1	Peel	Ogilvie River	August 31, 2001	144 (6 seine hauls)	1 GR
AXL1	Peel	Ogilvie River	September 1, 2001	95 (3 seine hauls)	1 GR
AXL6 (pond)	Porcupine (Eagle)	Eagle Creek	September 1, 2001	60 (1 seine haul)	NFC
AXL8	Peel	Enterprise Creek	September 1, 2001	136 (3 seine hauls)	2 GR, 2 CCG, 1 RW
AXL9	Peel	Dalglish Creek	September 1, 2001	416 (4 seine hauls)	3 LSU, 3 CCG, 1 GR
AXL10	Porcupine (Eagle)	Eagle River	June 21, 2001	108 (3 seine hauls)	10 CCG
AXL10	Porcupine (Eagle)	Eagle River	September 2, 2001	810 (6 seine hauls)	10 GR, 5 LSU, 4 CCG, 1 NP

ATTACHMENT C SUMMER SAMPLING FISH METRICS

Table C-1. Summer fish capture data and metrics, July and August 2020.

Date	Stream ID	Lat	Long	Stream Order	Method	Waterbody/Tributary	Species	Fork Length (mm)
25-Jul-19	244	66.39362	-137.27721	2	EF	Eagle River tributaries	GR	250
25-Jul-19	773	66.31628	-137.30335	2	EF	Chance Creek and tributaries	GR	210
25-Jul-19	773	66.31628	-137.30335	2	EF	Chance Creek and tributaries	GR	215
25-Jul-19	835	66.36866	-137.40148	3	EF	Chance Creek and tributaries	GR	32
25-Jul-19	835	66.36866	-137.40148	3	EF	Chance Creek and tributaries	GR	35
25-Jul-19	835	66.36866	-137.40148	3	EF	Chance Creek and tributaries	GR	35
26-Jul-19	265	66.42464	-137.19939	3	EF	Eagle River tributaries	GR	270
26-Jul-19	265	66.42464	-137.19939	3	EF	Eagle River tributaries	GR	180
26-Jul-19	341	66.44963	-137.54914	5	EF	Chance Creek and tributaries	GR	42
26-Jul-19	341	66.44963	-137.54914	5	EF	Chance Creek and tributaries	GR	34
26-Jul-19	341	66.44963	-137.54914	5	EF	Chance Creek and tributaries	GR	42
26-Jul-19	341	66.44963	-137.54914	5	EF	Chance Creek and tributaries	GR	35
26-Jul-19	341	66.44963	-137.54914	5	EF	Chance Creek and tributaries	GR	44
26-Jul-19	341	66.44963	-137.54914	5	EF	Chance Creek and tributaries	GR	38
26-Jul-19	341	66.44963	-137.54914	5	EF	Chance Creek and tributaries	GR	38
26-Jul-19	809	66.46959	-137.33893	2	EF	Porcupine River tributaries	GR	225
26-Jul-19	842B	66.47637	-137.25497	3	EF	Porcupine River tributaries	GR	220
27-Jul-19	646	66.43586	-137.73723	4	EF	Chance Creek and tributaries	GR	42
27-Jul-19	646	66.43586	-137.73723	4	EF	Chance Creek and tributaries	GR	47
27-Jul-19	646	66.43586	-137.73723	4	EF	Chance Creek and tributaries	GR	40
27-Jul-19	646	66.43586	-137.73723	4	EF	Chance Creek and tributaries	GR	42
27-Jul-19	646	66.43586	-137.73723	4	EF	Chance Creek and tributaries	GR	41

Date	Stream ID	Lat	Long	Stream Order	Method	Waterbody/Tributary	Species	Fork Length (mm)
27-Jul-19	646	66.43586	-137.73723	4	EF	Chance Creek and tributaries	GR	45
27-Jul-19	646	66.43586	-137.73723	4	EF	Chance Creek and tributaries	GR	33
27-Jul-19	838	66.43382	-137.90719	3	EF	Chance Creek and tributaries	GR	230
27-Jul-19	840	66.42658	-137.97697	3	EF	Chance Creek and tributaries	BB	-
27-Jul-19	840	66.42658	-137.97697	3	EF	Chance Creek and tributaries	GR	168
27-Jul-19	840	66.42658	-137.97697	3	EF	Chance Creek and tributaries	GR	190
27-Jul-19	840	66.42658	-137.97697	3	EF	Chance Creek and tributaries	GR	170
27-Jul-19	840	66.42658	-137.97697	3	EF	Chance Creek and tributaries	LSU	211
28-Jul-19	832	66.29263	-137.63791	3	EF	Chance Creek and tributaries	GR	325
28-Jul-19	832	66.29263	-137.63791	3	EF	Chance Creek and tributaries	GR	33
28-Jul-19	832	66.29263	-137.63791	3	EF	Chance Creek and tributaries	GR	43
28-Jul-19	832	66.29263	-137.63791	3	EF	Chance Creek and tributaries	GR	43
28-Jul-19	832	66.29263	-137.63791	3	EF	Chance Creek and tributaries	GR	45
28-Jul-19	832	66.29263	-137.63791	3	EF	Chance Creek and tributaries	GR	45
28-Jul-19	861	66.23264	-137.62143	2	EF	Chance Creek and tributaries	GR	200
28-Jul-19	861	66.23264	-137.62143	2	EF	Chance Creek and tributaries	GR	260
28-Jul-19	861	66.23264	-137.62143	2	EF	Chance Creek and tributaries	GR	280
28-Jul-19	861	66.23264	-137.62143	2	EF	Chance Creek and tributaries	GR	200
28-Jul-19	861	66.23264	-137.62143	2	EF	Chance Creek and tributaries	GR	45
28-Jul-19	861	66.23264	-137.62143	2	EF	Chance Creek and tributaries	GR	45
28-Jul-19	861	66.23264	-137.62143	2	EF	Chance Creek and tributaries	GR	250
28-Jul-19	861	66.23264	-137.62143	2	EF	Chance Creek and tributaries	GR	40

Date	Stream ID	Lat	Long	Stream Order	Method	Waterbody/Tributary	Species	Fork Length (mm)
28-Jul-19	861	66.23264	-137.62143	2	EF	Chance Creek and tributaries	GR	45
28-Jul-19	1379	66.20401	-137.80348	2	EF	Whitestone River tributaries	GR	169
28-Jul-19	1379	66.20401	-137.80348	2	EF	Whitestone River tributaries	GR	176
28-Jul-19	1379	66.20401	-137.80348	2	EF	Whitestone River tributaries	GR	175
28-Jul-19	1383	66.22768	-137.93771	2	EF	Whitestone River tributaries	BB	200
28-Jul-19	1383	66.22768	-137.93771	2	EF	Whitestone River tributaries	BB	250
28-Jul-19	1383	66.22768	-137.93771	2	EF	Whitestone River tributaries	LSU	127
28-Jul-19	1383	66.22768	-137.93771	2	EF	Whitestone River tributaries	LSU	145
28-Jul-19	1387	66.27138	-137.84242	2	EF	Whitestone River tributaries	BB	285
28-Jul-19	1387	66.27138	-137.84242	2	EF	Whitestone River tributaries	GR	140
28-Jul-19	1387	66.27138	-137.84242	2	EF	Whitestone River tributaries	GR	190
28-Jul-19	1387	66.27138	-137.84242	2	EF	Whitestone River tributaries	LSU	87
28-Jul-19	1400	66.16558	-137.67757	3	EF	MacParlon Creek and tributaries	GR	45
28-Jul-19	1406	66.33226	-137.98871	3	EF	Whitestone River tributaries	GR	48
28-Jul-19	1406	66.33226	-137.98871	3	EF	Whitestone River tributaries	GR	37
29-Jul-19	229	66.19591	-137.21330	2	EF	Eagle River tributaries	GR	38
29-Jul-19	229	66.19591	-137.21330	2	EF	Eagle River tributaries	GR	45
29-Jul-19	229	66.19591	-137.21330	2	EF	Eagle River tributaries	GR	50
29-Jul-19	229	66.19591	-137.21330	2	EF	Eagle River tributaries	GR	45
29-Jul-19	241	66.28690	-137.13797	2	EF	Eagle River tributaries	GR	200
29-Jul-19	269	66.22424	-137.09426	4	EF	Eagle River tributaries	CCG	94
29-Jul-19	269	66.22424	-137.09426	4	EF	Eagle River tributaries	GR	45
29-Jul-19	764	66.25010	-137.30640	2	EF	Chance Creek and tributaries	GR	260
29-Jul-19	772	66.31227	-137.34092	1	EF	Chance Creek and tributaries	GR	250
29-Jul-19	828	66.19646	-137.48249	3	EF	Chance Creek and tributaries	GR	230

Date	Stream ID	Lat	Long	Stream Order	Method	Waterbody/Tributary	Species	Fork Length (mm)
29-Jul-19	828	66.19646	-137.48249	3	EF	Chance Creek and tributaries	GR	38
29-Jul-19	828	66.19646	-137.48249	3	EF	Chance Creek and tributaries	GR	38
29-Jul-19	828	66.19646	-137.48249	3	EF	Chance Creek and tributaries	GR	46
29-Jul-19	828	66.19646	-137.48249	3	EF	Chance Creek and tributaries	GR	27
29-Jul-19	828	66.19646	-137.48249	3	EF	Chance Creek and tributaries	GR	30
29-Jul-19	828	66.19646	-137.48249	3	EF	Chance Creek and tributaries	GR	51
29-Jul-19	828	66.19646	-137.48249	3	EF	Chance Creek and tributaries	GR	37
29-Jul-19	828	66.19646	-137.48249	3	EF	Chance Creek and tributaries	GR	27
29-Jul-19	828	66.19646	-137.48249	3	EF	Chance Creek and tributaries	GR	32
29-Jul-19	828	66.19646	-137.48249	3	EF	Chance Creek and tributaries	GR	37
29-Jul-19	862	66.23062	-137.43553	2	EF	Chance Creek and tributaries	GR	298
29-Jul-19	862	66.23062	-137.43553	2	EF	Chance Creek and tributaries	GR	265
30-Jul-19	210	66.08836	-137.21996	2	EF	Eagle River tributaries	CCG	97
30-Jul-19	210	66.08836	-137.21996	2	EF	Eagle River tributaries	CCG	110
30-Jul-19	977	66.01317	-137.13562	3	EF	Dalglish Creek and tributaries	GR	210
30-Jul-19	977	66.01317	-137.13562	3	EF	Dalglish Creek and tributaries	GR	260
30-Jul-19	977	66.01317	-137.13562	3	EF	Dalglish Creek and tributaries	GR	40
30-Jul-19	977	66.01317	-137.13562	3	EF	Dalglish Creek and tributaries	WF	290
30-Jul-19	1182	66.12263	-137.41684	3	MT	MacParlon Creek and tributaries	GR	245
30-Jul-19	1182	66.12263	-137.41684	3	MT	MacParlon Creek and tributaries	GR	46
30-Jul-19	1182	66.12263	-137.41684	3	MT	MacParlon Creek and tributaries	GR	45
30-Jul-19	1182	66.12263	-137.41684	3	MT	MacParlon Creek and tributaries	GR	45
30-Jul-19	1182	66.12263	-137.41684	3	EF	MacParlon Creek and tributaries	GR	45

Date	Stream ID	Lat	Long	Stream Order	Method	Waterbody/Tributary	Species	Fork Length (mm)
30-Jul-19	1182	66.12263	-137.41684	3	EF	MacParlon Creek and tributaries	GR	45
30-Jul-19	1182	66.12263	-137.41684	3	EF	MacParlon Creek and tributaries	GR	250
30-Jul-19	1182	66.12263	-137.41684	3	EF	MacParlon Creek and tributaries	GR	200
30-Jul-19	1184	66.07806	-137.60150	5	EF	MacParlon Creek and tributaries	CCG	64
30-Jul-19	1184	66.07806	-137.60150	5	EF	MacParlon Creek and tributaries	CCG	89
30-Jul-19	1184	66.07806	-137.60150	5	EF	MacParlon Creek and tributaries	CCG	67
30-Jul-19	1184	66.07806	-137.60150	5	EF	MacParlon Creek and tributaries	CCG	64
30-Jul-19	1184	66.07806	-137.60150	5	EF	MacParlon Creek and tributaries	GR	48
30-Jul-19	1184	66.07806	-137.60150	5	EF	MacParlon Creek and tributaries	GR	93
30-Jul-19	1363	66.03002	-137.45626	2	EF	MacParlon Creek and tributaries	GR	250
30-Jul-19	1373	66.14102	-137.47226	2	EF	MacParlon Creek and tributaries	LSU	170
30-Jul-19	1373	66.14102	-137.47226	2	EF	MacParlon Creek and tributaries	LSU	120
30-Jul-19	1397	66.07154	-137.43953	3	EF	MacParlon Creek and tributaries	CCG	-
30-Jul-19	1397	66.07154	-137.43953	3	EF	MacParlon Creek and tributaries	GR	195
30-Jul-19	1397	66.07154	-137.43953	3	EF	MacParlon Creek and tributaries	GR	142
30-Jul-19	1397	66.07154	-137.43953	3	EF	MacParlon Creek and tributaries	GR	200
30-Jul-19	1414	66.12903	-137.59081	1	EF	MacParlon Creek and tributaries	GR	260
30-Jul-19	1423	66.02239	-137.30629	1	EF	MacParlon Creek and tributaries	GR	245
31-Jul-19	979	65.96795	-137.26147	2	EF	Enterprise Creek and tributaries	GR	121
31-Jul-19	979	65.96795	-137.26147	2	EF	Enterprise Creek and tributaries	GR	120
31-Jul-19	979	65.96795	-137.26147	2	EF	Enterprise Creek and tributaries	GR	120
31-Jul-19	979	65.96795	-137.26147	2	EF	Enterprise Creek and tributaries	GR	120

Date	Stream ID	Lat	Long	Stream Order	Method	Waterbody/Tributary	Species	Fork Length (mm)
31-Jul-19	979	65.96795	-137.26147	2	EF	Enterprise Creek and tributaries	GR	200
31-Jul-19	979	65.96795	-137.26147	2	EF	Enterprise Creek and tributaries	GR	350
31-Jul-19	980	65.95205	-137.20335	3	EF	Enterprise Creek and tributaries	CCG	70
31-Jul-19	980	65.95205	-137.20335	3	EF	Enterprise Creek and tributaries	CCG	67
31-Jul-19	980	65.95205	-137.20335	3	EF	Enterprise Creek and tributaries	GR	-
31-Jul-19	980	65.95205	-137.20335	3	EF	Enterprise Creek and tributaries	GR	-
31-Jul-19	980	65.95205	-137.20335	3	EF	Enterprise Creek and tributaries	GR	-
31-Jul-19	980	65.95205	-137.20335	3	EF	Enterprise Creek and tributaries	GR	-
31-Jul-19	980	65.95205	-137.20335	3	EF	Enterprise Creek and tributaries	GR	-
31-Jul-19	980	65.95205	-137.20335	3	EF	Enterprise Creek and tributaries	GR	180
31-Jul-19	980	65.95205	-137.20335	3	EF	Enterprise Creek and tributaries	GR	190
31-Jul-19	980	65.95205	-137.20335	3	EF	Enterprise Creek and tributaries	GR	180
31-Jul-19	980	65.95205	-137.20335	3	EF	Enterprise Creek and tributaries	GR	125
31-Jul-19	1026	65.98262	-136.95693	1	EF	Dalglish Creek and tributaries	GR	200
31-Jul-19	1026	65.98262	-136.95693	1	EF	Dalglish Creek and tributaries	GR	250
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	54
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	56
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	53
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	53
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	52
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	52
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	56

Date	Stream ID	Lat	Long	Stream Order	Method	Waterbody/Tributary	Species	Fork Length (mm)
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	57
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	51
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	50
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	65
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1042	65.98499	-136.92573	4	EF	Dalglish Creek and tributaries	GR	-
31-Jul-19	1101	65.93429	-137.01817	2	EF	Enterprise Creek and tributaries	GR	196
31-Jul-19	1101	65.93429	-137.01817	2	EF	Enterprise Creek and tributaries	GR	220
31-Jul-19	1101	65.93429	-137.01817	2	EF	Enterprise Creek and tributaries	GR	128

Date	Stream ID	Lat	Long	Stream Order	Method	Waterbody/Tributary	Species	Fork Length (mm)
31-Jul-19	1101	65.93429	-137.01817	2	EF	Enterprise Creek and tributaries	GR	124
31-Jul-19	1120	66.01606	-136.88086	2	EF	Dalglish Creek and tributaries	GR	185
31-Jul-19	1120	66.01606	-136.88086	2	EF	Dalglish Creek and tributaries	GR	200
31-Jul-19	1125	66.04642	-137.07181	2	EF	Dalglish Creek and tributaries	GR	200
31-Jul-19	1130	65.95552	-136.89151	3	EF	Dalglish Creek and tributaries	GR	275
31-Jul-19	1130	65.95552	-136.89151	3	EF	Dalglish Creek and tributaries	GR	157
31-Jul-19	1130	65.95552	-136.89151	3	EF	Dalglish Creek and tributaries	GR	145
31-Jul-19	1130	65.95552	-136.89151	3	EF	Dalglish Creek and tributaries	RW	298
01-Aug-19	211	66.08931	-137.12180	2	EF	Eagle River tributaries	CCG	120
01-Aug-19	211	66.08931	-137.12180	2	EF	Eagle River tributaries	GR	140
01-Aug-19	211	66.08931	-137.12180	2	EF	Eagle River tributaries	GR	-
01-Aug-19	222	66.15111	-136.92546	2	EF	Eagle River tributaries	GR	117
01-Aug-19	267	66.11403	-136.93640	4	EF	Eagle River tributaries	CCG	81
01-Aug-19	267	66.11403	-136.93640	4	EF	Eagle River tributaries	CCG	82
01-Aug-19	267	66.11403	-136.93640	4	EF	Eagle River tributaries	GR	55
01-Aug-19	273	66.06855	-136.96714	2	EF	Eagle River tributaries	CCG	90
01-Aug-19	273	66.06855	-136.96714	2	EF	Eagle River tributaries	GR	175

ATTACHMENT D SUMMER WATER QUALITY PARAMETERS

Table D-1. Summer site water quality parameters, July and August 2019.

Date	Stream ID	Latitude	Longitude	Stream Order	DO (mg/L)	(DO %)	Temperature (C°)
25-Jul-19	244	66.39362	-137.2772	2	6.87	69.8	16.2
25-Jul-19	245	66.39774	-137.2063	2	6.77	66.2	14.5
25-Jul-19	459	66.33082	-137.4702	1	8.90	73.4	7.4
25-Jul-19	470	66.332	-137.382	1	3.47	31.9	9.1
25-Jul-19	484	66.33816	-137.4609	1	6.02	52.2	9.1
25-Jul-19	493	66.34765	-137.3092	1	2.71	25.2	11.3
25-Jul-19	534	66.37569	-137.3396	1	0.72	6.5	11.9
25-Jul-19	547	66.392	-137.3421	1	8.23	76.1	11.7
25-Jul-19	773	66.31628	-137.3034	2	4.26	42.9	14.3
25-Jul-19	776	66.3245	-137.2833	2	7.36	69.2	12.7
25-Jul-19	785	66.35938	-137.3926	2	9.83	88.0	10.5
25-Jul-19	835	66.36866	-137.4015	3	7.94	75.2	13.0
25-Jul-19	871	66.38873	-137.4091	2	8.72	76.7	9.7
26-Jul-19	171	66.39209	-137.1602	1	16.70	17.0	9.6
26-Jul-19	183	66.43003	-137.1931	1	8.11	72.0	10.3
26-Jul-19	187	66.43113	-137.1464	1	5.54	48.0	8.6
26-Jul-19	200	66.48093	-137.1565	1	1.16	1.1	8.8
26-Jul-19	249	66.4918	-137.1707	2	0.76	6.5	11.8
26-Jul-19	265	66.42464	-137.1994	3	8.82	81.8	12.0
26-Jul-19	341	66.44963	-137.5491	5	11.53	114.7	14.7
26-Jul-19	643	66.43681	-137.4243	1	9.71	97.1	15.4
26-Jul-19	673	66.46764	-137.3792	1	3.54	33.2	11.7
26-Jul-19	809	66.46959	-137.3389	2	7.32	70.8	13.8
26-Jul-19	842A	66.47348	-137.2169	3	9.45	82.5	9.4
26-Jul-19	842B	66.47637	-137.255	3	8.40	78.0	11.6
27-Jul-19	494	66.34035	-137.8542	1	8.36	71.2	8.8
27-Jul-19	565	66.38764	-137.9742	1	7.32	69.4	13.1
27-Jul-19	616	66.41416	-137.7735	2	5.06	45.1	10.6
27-Jul-19	646	66.43586	-137.7372	4	7.31	70.5	13.7
27-Jul-19	663	66.43439	-137.8836	1	1.72	15.0	8.7
27-Jul-19	792	66.37972	-137.8823	2	10.06	85.8	8.4
27-Jul-19	793	66.37863	-137.7911	2	4.07	33.1	9.0
27-Jul-19	798	66.40889	-137.4901	2	9.24	93.1	15.7
27-Jul-19	801	66.44221	-137.6647	2	5.02	49.4	14.7
27-Jul-19	838	66.43382	-137.9072	3	8.94	84.8	13.2
27-Jul-19	840	66.42658	-137.977	3	8.21	77.8	13.0
27-Jul-19	846	66.48896	-137.8039	3	5.61	51.6	10.9

Date	Stream ID	Latitude	Longitude	Stream Order	DO (mg/L)	(DO %)	Temperature (C°)
28-Jul-19	347	66.18079	-137.3507	1	9.08	77.0	8.2
28-Jul-19	394	66.2444	-137.7567	1	1.90	15.6	7.9
28-Jul-19	396	66.2516	-137.6151	1	3.88	35.5	11.9
28-Jul-19	456	66.32227	-137.5995	1	4.86	42.6	9.3
28-Jul-19	774	66.2984	-137.6879	2	10.90	90.2	7.2
28-Jul-19	832	66.29263	-137.6379	3	7.52	72.1	13.4
28-Jul-19	861	66.23264	-137.6214	2	9.05	89.8	14.9
28-Jul-19	867	66.34926	-137.6371	2	8.16	65.8	6.0
28-Jul-19	1217	66.17073	-137.8379	1	10.30	86.9	7.9
28-Jul-19	1338	66.29083	-137.9135	1	5.50	47.7	9.5
28-Jul-19	1379	66.20401	-137.8035	2	7.94	74.0	12.0
28-Jul-19	1383	66.22768	-137.9377	2	8.90	83.4	12.5
28-Jul-19	1387	66.27138	-137.8424	2	8.32	72.8	8.9
28-Jul-19	1400	66.16558	-137.6776	3	7.79	76.0	14.5
28-Jul-19	1406	66.33226	-137.9887	3	9.58	89.3	12.2
29-Jul-19	147	66.27397	-137.1972	1	0.40	4.0	12.0
29-Jul-19	229	66.19591	-137.2133	2	6.92	61.5	9.7
29-Jul-19	241	66.2869	-137.138	2	5.95	53.7	7.3
29-Jul-19	269	66.22424	-137.0943	4	8.74	82.4	12.7
29-Jul-19	271	66.21147	-137.2004	3	8.07	70.8	9.8
29-Jul-19	277	66.2138	-137.0339	2	6.60	61.0	10.9
29-Jul-19	309	66.16972	-137.1325	1	5.64	51.2	11.0
29-Jul-19	401	66.26299	-137.5179	1	8.05	71.9	10.4
29-Jul-19	764	66.2501	-137.3064	2	4.58	45.1	11.5
29-Jul-19	767	66.26252	-137.4892	2	6.73	58.4	9.1
29-Jul-19	772	66.31227	-137.3409	2	7.25	70.6	13.7
29-Jul-19	828	66.19646	-137.4825	3	4.40	40.7	11.2
29-Jul-19	862	66.23062	-137.4355	2	4.91	44.2	9.6
30-Jul-19	23	66.0675	-137.2728	1	4.83	41.7	8.8
30-Jul-19	210	66.08836	-137.22	2	7.58	73.9	13.6
30-Jul-19	977	66.01317	-137.1356	3	10.23	85.7	7.6
30-Jul-19	1089	66.03002	-137.4563	1	9.96	79.9	5.8
30-Jul-19	1180	66.10212	-137.3189	1		6.2	54.4
30-Jul-19	1182	66.12263	-137.4168	3	8.67	80.2	11.8
30-Jul-19	1184	66.07806	-137.6015	5	8.61	83.4	14.0
30-Jul-19	1216	66.08516	-137.5328	1	0.46	3.5	7.0
30-Jul-19	1363	66.03002	-137.4563	2	5.71	49.6	9.2
30-Jul-19	1364	66.0726	-137.3827	2	4.23	35.6	7.9
30-Jul-19	1373	66.14102	-137.4723	2	6.95	65.1	12.2

Date	Stream ID	Latitude	Longitude	Stream Order	DO (mg/L)	(DO %)	Temperature (C°)
30-Jul-19	1397	66.07154	-137.4395	3	7.45	66.5	10.3
30-Jul-19	1413	66.14128	-137.2938	2	5.77	57.8	13.1
30-Jul-19	1414	66.12903	-137.5908	2	6.63	60.1	10.7
30-Jul-19	1423	66.02239	-137.3063	1	2.18	18.2	8.7
30-Jul-19	1439	66.1563	-137.54	1	8.22	73.8	10.6
31-Jul-19	206	66.06615	-136.7881	2	9.11	88.5	13.2
31-Jul-19	979	65.96795	-137.2615	2	9.10	76.1	7.6
31-Jul-19	980	65.95205	-137.2034	3	8.51	77.2	10.5
31-Jul-19	998	65.93714	-136.8167	1	3.32	32.5	14.1
31-Jul-19	1026	65.98262	-136.9569	1	5.28	44.5	8.6
31-Jul-19	1042	65.98499	-136.9257	4	8.95	92.8	17.1
31-Jul-19	1101	65.93429	-137.0182	2	5.63	52.7	12.1
31-Jul-19	1110	66.00323	-137.1217	2	5.16	44.1	7.8
31-Jul-19	1120	66.01606	-136.8809	2	10.20	87.9	8.7
31-Jul-19	1125	66.04642	-137.0718	2	7.58	64.7	8.2
31-Jul-19	1130	65.95552	-136.8915	3	4.02	35.6	8.4
31-Jul-19	1169	66.03066	-136.9827	1	6.61	54.0	6.5
01-Aug-19	67	66.11721	-137.1957	1	4.50	37.5	7.5
01-Aug-19	76	66.13092	-137.0008	1	5.88	50.4	8.9
01-Aug-19	82	66.13076	-137.1228	1	8.31	80.4	13.4
01-Aug-19	211	66.08931	-137.1218	2	6.59	57.0	9.0
01-Aug-19	222	66.15111	-136.9255	2	8.32	76.5	10.8
01-Aug-19	227	66.16889	-136.9918	2	8.17	75.8	11.8
01-Aug-19	258	66.19616	-136.9141	3	2.88	24.4	9.0
01-Aug-19	267	66.11403	-136.9364	4	8.26	79.7	13.5
01-Aug-19	273	66.06855	-136.9671	2	8.35	70.6	8.1

ATTACHMENT E SUMMER BC SITE CARD DATA

Table E-1. Data collected from BC site cards, July and August 2019. [4]

Date	Stream ID	Stream Order	Lat (deg)	Long (deg)	Fish Present[5]	Channel Width (m)	Wetted Width (m)	Residual Pool Depth (m)	Gradient (%)	DO (mg/L)	DO (%)	Temp (C°)	Total Cover[6]	Bed Material[7]	Spawning	Over Wintering	Rearing
25-Jul-19	459	1	66.331	-137.470	N	1.51	1.46	0.25	0.25	8.90	73.40	7.40	L	F	None	Poor	Poor
25-Jul-19	466	1	66.322	-137.418	NS	-	-	-	-	-	-	-	-	-	None	None	None
25-Jul-19	470	1	66.332	-137.382	NS	-	-	-	-	3.47	31.90	9.10	-	O	None	None	None
25-Jul-19	484	1	66.338	-137.461	N	1.67	0.59	0.06	1.75	6.02	52.20	9.10	-	F	None	None	Poor
25-Jul-19	493	1	66.348	-137.309	NS	-	-	-	0.50	2.71	25.20	11.30	H	O	Poor	Poor	Poor
25-Jul-19	534	1	66.376	-137.340	N	0.79	2.27	0.39	0.25	0.72	6.50	11.90	L	F	None	None	Poor
25-Jul-19	547	1	66.392	-137.342	N	3.39	1.88	0.10	1.50	8.23	76.10	11.70	M	F	None	None	None
25-Jul-19	244	2	66.394	-137.277	Y	5.68	2.03	-	1.00	6.87	69.80	16.20	-	F	Poor	Poor	Poor
25-Jul-19	245	2	66.398	-137.206	N	1.82	1.14	0.49	0.25	6.77	66.20	14.50	M	F	None	Poor	Poor
25-Jul-19	773	2	66.316	-137.303	Y	1.84	0.72	0.28	0.50	4.26	42.90	14.30	H	F	Poor	Poor	Mod
25-Jul-19	776	2	66.325	-137.283	N	1.57	0.87	0.50	0.00	7.36	69.20	12.70	M	F	None	Poor	Mod
25-Jul-19	785	2	66.359	-137.393	N	2.06	1.22	0.50	0.75	9.83	88.00	10.50	H	F	Poor	Poor	Mod
25-Jul-19	871	2	66.389	-137.409	N	6.51	1.48	-	1.50	8.72	76.70	9.70	-	F	Poor	Poor	Poor
25-Jul-19	835	3	66.369	-137.401	Y	4.54	2.79	0.69	0.50	7.94	75.20	13.00	H	F	Poor	Good	Good
26-Jul-19	161	1	66.135	-137.189	NS	-	-	-	-	-	-	-	-	-	None	None	None
26-Jul-19	171	1	66.392	-137.160	N	0.91	0.38	0.29	1.50	16.70	17.00	9.60	L	F	None	Poor	Poor
26-Jul-19	183	1	66.430	-137.193	N	3.83	1.26	0.43	0.75	8.11	72.00	10.30	H	F	None	None	Poor
26-Jul-19	187	1	66.431	-137.146	NS	-	-	-	-	5.54	48.00	8.60	-	-	None	None	None
26-Jul-19	200	1	66.481	-137.157	NS	-	-	-	-	1.16	1.08	8.80	-	-	None	None	None
26-Jul-19	330	1	66.431	-137.144	NS	-	-	-	-	-	-	-	-	-	None	None	None
26-Jul-19	643	1	66.437	-137.424	NS	-	-	-	-	9.71	97.10	15.40	-	-	None	None	None

[4] See (BC Ministry of Environment 2008) for more detailed descriptions.

[5] N=no, Y=yes, NS=not sampled

[6] Total cover = Any structure within the wetted width or within 1 m above the water surface that provides rearing habitat; L=low (≤ 5%), M=moderate (6-20%), H=high (≥21%)

[7] F=fines, O=organics, C=cobble, G=gravel
(-) denotes metrics not taken or not applicable, most often due to insufficient water.

Date	Stream ID	Stream Order	Lat (deg)	Long (deg)	Fish Present[5]	Channel Width (m)	Wetted Width (m)	Residual Pool Depth (m)	Gradient (%)	DO (mg/L)	DO (%)	Temp (C°)	Total Cover[6]	Bed Material[7]	Spawning	Over Wintering	Rearing
26-Jul-19	671	1	66.453	-137.533	NS	-	-	-	-	-	-	-	-	F	None	None	Poor
26-Jul-19	673	1	66.468	-137.379	N	1.76	0.67	0.15	-	3.54	33.20	11.70	L	F	None	None	Poor
26-Jul-19	680	1	66.465	-137.519	NS	-	-	-	-	-	-	-	-	-	None	None	None
26-Jul-19	699	1	66.478	-137.228	NS	-	-	-	-	-	-	-	-	-	None	None	None
26-Jul-19	730	1	66.486	-137.403	NS	-	-	-	-	-	-	-	-	-	None	None	None
26-Jul-19	249	2	66.492	-137.171	NS	-	-	-	-	0.76	6.50	11.80	-	-	None	None	None
26-Jul-19	809	2	66.470	-137.339	Y	3.03	1.41	0.62	0.50	7.32	70.80	13.80	-	F	None	Mod	Mod
26-Jul-19	265	3	66.425	-137.199	Y	4.03	2.22	0.45	1.00	8.82	81.80	12.00	H	F	Poor	Mod	Mod
26-Jul-19	842A	3	66.473	-137.217	N	3.76	2.45	0.56	0.75	9.45	82.50	9.40	-	F	None	Poor	Good
26-Jul-19	842B	3	66.476	-137.255	Y	3.04	2.43	-	0.25	8.40	78.00	11.60	M	F	Poor	Mod	Good
26-Jul-19	341	5	66.450	-137.549	Y	14.87	9.93	-	0.75	11.53	114.70	14.70	-	F	Mod	Mod	Good
27-Jul-19	494	1	66.340	-137.854	N	3.45	0.60	0.20	-	8.36	71.20	8.80	H	F	None	None	Poor
27-Jul-19	549	1	66.380	-137.619	NS	-	-	-	-	-	-	-	-	-	None	None	None
27-Jul-19	565	1	66.388	-137.974	NS	-	-	-	-	7.32	69.40	13.10	-	-	None	None	None
27-Jul-19	606	1	66.413	-137.622	NS	-	-	-	3.00	-	-	-	-	-	None	None	None
27-Jul-19	624	1	66.422	-137.856	NS	-	-	-	-	-	-	-	-	-	None	None	None
27-Jul-19	663	1	66.434	-137.884	NS	6.00		0.26	2.50	1.72	15.00	8.70	-	F	None	None	None
27-Jul-19	717	1	66.466	-137.961	NS	-	-	-	-	-	-	-	-	F	None	None	None
27-Jul-19	929	1	66.373	-137.694	NS	-	0.58	0.10	3.00	-	-	-	-	F	None	None	Poor
27-Jul-19	616	2	66.414	-137.773	N	1.32	1.08	0.24	0.75	5.06	45.10	10.60	L	F	None	None	Poor
27-Jul-19	792	2	66.380	-137.882	N	2.08	1.06	0.56	1.00	10.06	85.80	8.40	M	F	Poor	Poor	Mod
27-Jul-19	793	2	66.379	-137.791	NS	-	-	-	-	4.07	33.10	9.00	-	F	None	None	None
27-Jul-19	798	2	66.409	-137.490	N	3.18	2.44	0.58	1.00	9.24	93.10	15.70	H	F	Poor	Mod	Mod
27-Jul-19	801	2	66.442	-137.665	N	3.02	1.88	-	-	5.02	49.40	14.70	M	F	None	None	Mod
27-Jul-19	838	3	66.434	-137.907	Y	4.68	3.98	0.45	0.00	8.94	84.80	13.20	H	F	Poor	Mod	Mod
27-Jul-19	840	3	66.427	-137.977	Y	6.33	3.55	0.42	3.50	8.21	77.80	13.00	H	F	Mod	Good	Good
27-Jul-19	846	3	66.489	-137.804	N	0.40	0.32	0.07	2.00	5.61	51.60	10.90	H	F	None	Poor	Mod
27-Jul-19	646	4	66.436	-137.737	Y	9.50	5.25	0.85	0.25	7.31	70.50	13.70	H	F	Poor	Mod	Mod

Date	Stream ID	Stream Order	Lat (deg)	Long (deg)	Fish Present[5]	Channel Width (m)	Wetted Width (m)	Residual Pool Depth (m)	Gradient (%)	DO (mg/L)	DO (%)	Temp (C°)	Total Cover[6]	Bed Material[7]	Spawning	Over Wintering	Rearing
28-Jul-19	347	1	66.181	-137.351	N	1.46	0.95	0.43	1.00	9.08	77.00	8.20	L	F	None	None	Poor
28-Jul-19	394	1	66.244	-137.757	N	2.74	1.53	0.11	2.50	1.90	15.60	7.90	-	F	None	None	Poor
28-Jul-19	396	1	66.252	-137.615	NS	-	-	-	-	3.88	35.50	11.90	-	-	None	None	None
28-Jul-19	456	1	66.322	-137.599	N	2.65	0.58	0.09	3.50	4.86	42.60	9.30	M	F	None	None	Poor
28-Jul-19	1217	1	66.171	-137.838	NS	1.49	0.81	0.15	2.00	10.30	86.90	7.90	-	F	None	None	Poor
28-Jul-19	1281	1	66.184	-137.651	NS	-	-	-	-	-	-	-	-	-	None	None	None
28-Jul-19	1338	1	66.291	-137.914	N	1.07	0.66	0.06	2.00	5.50	47.70	9.50	-	F	None	None	Poor
28-Jul-19	774	2	66.298	-137.688	N	2.60	1.80	0.06	1.00	10.90	90.20	7.20	-	F	None	None	Poor
28-Jul-19	861	2	66.233	-137.621	Y	3.18	1.02	0.45	0.50	9.05	89.80	14.90	H	F	Poor	None	Mod
28-Jul-19	867	2	66.349	-137.637	N	-	-	-	-	8.16	65.80	6.00	-	-	None	None	None
28-Jul-19	1379	2	66.204	-137.803	Y	7.93	3.23	-	2.50	7.94	74.00	12.00	-	F	Good	Mod	Good
28-Jul-19	1383	2	66.228	-137.938	Y	4.04	2.30	0.45	3.00	8.90	83.40	12.50	M	F	None	None	Mod
28-Jul-19	1387	2	66.271	-137.842	Y	6.29	5.00	1.20	1.00	8.32	72.80	8.90	H	F	None	None	Mod
28-Jul-19	832	3	66.293	-137.638	Y	5.26	3.36	0.40	0.00	7.52	72.10	13.40	H	F	Poor	Poor	Mod
28-Jul-19	1400	3	66.166	-137.678	Y	3.07	1.89	0.83	0.00	7.79	76.00	14.50	M	F	Poor	Poor	Mod
28-Jul-19	1406	3	66.332	-137.989	Y	6.57	5.30	0.44	2.75	9.58	89.30	12.20	H	F	None	Mod	Mod
29-Jul-19	147	1	66.274	-137.197	N	1.12	0.82	0.26	0.00	0.40	4.00	12.00	L	F	None	None	Poor
29-Jul-19	309	1	66.170	-137.132	N	2.18	1.03	0.56	3.00	5.64	51.20	11.00	M	F	None	None	Poor
29-Jul-19	401	1	66.263	-137.518	N	1.02	0.59	0.32	1.75	8.05	71.90	10.40	L	F	None	None	Poor
29-Jul-19	229	2	66.196	-137.213	Y	3.41	2.33	-	-	6.92	61.50	9.70	H	F	Poor	None	Mod
29-Jul-19	241	2	66.287	-137.138	Y	1.63	1.04	0.13	0.50	5.95	53.70	7.30	M	F	None	None	Poor
29-Jul-19	277	2	66.214	-137.034	N	1.78	1.00	0.33	0.00	6.60	61.00	10.90	H	F	None	None	Poor
29-Jul-19	764	2	66.250	-137.306	Y	6.93	2.32	-	1.00	4.58	45.10	11.50	M	F	None	None	Poor
29-Jul-19	767	2	66.263	-137.489	N	3.14	1.65	0.43	3.00	6.73	58.40	9.10	H	F	None	Poor	Poor
29-Jul-19	772	2	66.312	-137.341	Y	2.28	1.29	0.75	0.50	7.25	70.60	13.70	H	F	Poor	Poor	Mod
29-Jul-19	862	2	66.231	-137.436	Y	2.77	1.93	-	-	4.91	44.20	9.60	-	F	None	Mod	Mod
29-Jul-19	271	3	66.211	-137.200	N	3.02	1.67	-	1.00	8.07	70.80	9.80	H	F	None	None	None
29-Jul-19	828	3	66.196	-137.482	Y	3.22	1.22	0.50	0.50	4.40	40.70	11.20	H	F	Poor	Poor	Mod

Date	Stream ID	Stream Order	Lat (deg)	Long (deg)	Fish Present[5]	Channel Width (m)	Wetted Width (m)	Residual Pool Depth (m)	Gradient (%)	DO (mg/L)	DO (%)	Temp (C°)	Total Cover[6]	Bed Material[7]	Spawning	Over Wintering	Rearing
29-Jul-19	269	4	66.224	-137.094	Y	10.30	8.90	1.05	0.00	8.74	82.40	12.70	M	F	Poor	Good	Mod
30-Jul-19	23	1	66.067	-137.273	N	0.84	0.46	0.42	0.50	4.83	41.70	8.80	M	F	Poor	None	Poor
30-Jul-19	1089	1	66.030	-137.456	N	1.52	0.68	0.29	7.00	9.96	79.90	5.80	L	F	None	None	Poor
30-Jul-19	1180	1	66.102	-137.319	NS	-	-	-	-		6.17	54.40	-	-	None	None	None
30-Jul-19	1216	1	66.085	-137.533	NS	-	-	-	-	0.46	3.47	7.00	-	F	None	None	None
30-Jul-19	1243	1	66.140	-137.358	NS	-	-	-	0.50	-	-	-	-	F	None	None	Poor
30-Jul-19	1423	1	66.022	-137.306	Y	1.31	0.93	0.27	4.00	2.18	18.20	8.70	M	F	Poor	Poor	Mod
30-Jul-19	1439	1	66.156	-137.540	NS	-	-	-	3.00	8.22	73.80	10.60	-	-	None	None	None
30-Jul-19	210	2	66.088	-137.220	Y	6.67	5.62	1.60	0.25	7.58	73.90	13.60	A	F	Poor	Good	Good
30-Jul-19	1363	2	66.030	-137.456	Y	2.69	1.61	0.20	1.00	5.71	49.60	9.20	-	F	None	None	Mod
30-Jul-19	1364	2	66.073	-137.383	N	2.81	1.01	0.25	2.00	4.23	35.60	7.90	A	F	None	None	Poor
30-Jul-19	1373	2	66.141	-137.472	Y	3.43	1.61	-	3.00	6.95	65.10	12.20	A	F	Poor	Poor	Mod
30-Jul-19	1413	2	66.141	-137.294	N	1.94	1.21	0.66	0.00	5.77	57.80	13.10	M	F	Poor	Poor	Poor
30-Jul-19	1414	2	66.129	-137.591	Y	-	1.03	0.45	0.00	6.63	60.10	10.70	M	O	Poor	Poor	Poor
30-Jul-19	977	3	66.013	-137.136	Y	4.26	1.97	0.27	3.50	10.23	85.70	7.60	M	F	Poor	Mod	Good
30-Jul-19	1182	3	66.123	-137.417	Y	7.18	3.42	1.25	0.75	8.67	80.20	11.80	A	F	Poor	Mod	Mod
30-Jul-19	1397	3	66.072	-137.440	Y	4.86	2.89	-	-	7.45	66.50	10.30	M	F	Poor	Poor	Mod
30-Jul-19	1184	5	66.078	-137.602	Y	11.60	9.57	0.70	0.50	8.61	83.40	14.00	A	F	Mod	Good	Good
31-Jul-19	998	1	65.937	-136.817	NS	2.32	-	0.08	4.00	3.32	32.50	14.10	A	C	Poor	Poor	Poor
31-Jul-19	1014	1	65.948	-137.069	NS	1.77	-	0.16	3.00	-	-	-	-	F	Poor	Poor	Poor
31-Jul-19	1026	1	65.983	-136.957	Y	1.22	0.82	0.61	1.50	5.28	44.50	8.60	H	F	Poor	Poor	Mod
31-Jul-19	1169	1	66.031	-136.983	NS	-	-	-	-	6.61	54.00	6.50	-	-	None	None	None
31-Jul-19	206	2	66.066	-136.788	N	7.10	6.10	-	0.75	9.11	88.50	13.20	M	F	Poor	Good	Mod
31-Jul-19	979	2	65.968	-137.261	Y	3.53	2.15	0.56	3.50	9.10	76.10	7.60	M	G	Mod	Poor	Good
31-Jul-19	1101	2	65.934	-137.018	Y	5.37	-	1.15	2.50	5.63	52.70	12.10	H	F	Poor	None	Poor
31-Jul-19	1110	2	66.003	-137.122	N	2.68	1.68	0.80	-	5.16	44.10	7.80	-	F	Poor	Poor	Poor
31-Jul-19	1120	2	66.016	-136.881	Y	1.29	1.20	0.41	2.00	10.20	87.90	8.70	A	F	Poor	Poor	Mod
31-Jul-19	1125	2	66.046	-137.072	Y	1.91	1.10	0.13	0.50	7.58	64.70	8.20	-	F	None	Mod	Mod

Date	Stream ID	Stream Order	Lat (deg)	Long (deg)	Fish Present[5]	Channel Width (m)	Wetted Width (m)	Residual Pool Depth (m)	Gradient (%)	DO (mg/L)	DO (%)	Temp (C°)	Total Cover[6]	Bed Mater-ial[7]	Spawning	Over Wintering	Rearing
31-Jul-19	980	3	65.952	-137.203	Y	6.93	5.40	0.73	0.75	8.51	77.20	10.50	A	G	Mod	Mod	Good
31-Jul-19	1130	3	65.956	-136.892	Y	3.41	2.32	0.50	0.75	4.02	35.60	8.40	A	F	Poor	Poor	Mod
31-Jul-19	1042	4	65.985	-136.926	Y	10.88	6.56	0.63	0.50	8.95	92.80	17.10	M	C	Good	Mod	Good
1-Aug-19	67	1	66.117	-137.196	NS	-	-	-	3.00	4.50	37.50	7.50	-	-	None	None	None
1-Aug-19	76	1	66.131	-137.001	N	1.40	0.31	0.14	1.00	5.88	50.40	8.90	L	F	None	None	Poor
1-Aug-19	82	1	66.131	-137.123	N	-	-	-	-	8.31	80.40	13.40	-	-	None	None	None
1-Aug-19	211	2	66.089	-137.122	Y	2.73	1.60	0.86	0.00	6.59	57.00	9.00	A	F	None	Good	Mod
1-Aug-19	222	2	66.151	-136.925	Y	4.36	2.35	0.57	1.50	8.32	76.50	10.80	L	F	None	Poor	Poor
1-Aug-19	227	2	66.169	-136.992	N	1.42	0.55	0.23	1.50	8.17	75.80	11.80	L	F	None	None	Poor
1-Aug-19	273	2	66.069	-136.967	Y	1.80	1.19	0.33	2.00	8.35	70.60	8.10	M	F	None	None	Poor
1-Aug-19	258	3	66.196	-136.914	N	2.13	2.01	0.58	0.00	2.88	24.40	9.00	A	F	Poor	Poor	Mod
1-Aug-19	267	4	66.114	-136.936	Y	9.70	8.70	0.90	1.00	8.26	79.70	13.50	A	F	Mod	Mod	Good

ATTACHMENT F WINTER SAMPLING SITE DATA

Table F-1. Winter sampling site data, March 2020 (bold denotes sites with water present).

Date	Site	Order	Water	Type	Hole Number	Snow Depth (m)	Ice Depth (m)	Water Depth (m)	Hollow Depth (m)	Bed to Top of Ice (m)
8-Mar-20	1363	2	N	Stream	H1	1.10	0.35	0.00	0.45	0.80
8-Mar-20	1363	2	N	Stream	H2	0.87	0.23	0.00	0.20	0.43
8-Mar-20	1397	3	N	Stream	H1	0.57	0.15	0.00	0.20	0.35
8-Mar-20	1397	3	N	Stream	H2	0.57	0.20	0.00	0.10	0.35
8-Mar-20	1397	3	N	Stream	H3	0.77	0.45	0.00	0.15	0.58
8-Mar-20	1397	3	N	Stream	H4	0.50	0.56	0.00	0.20	0.75
8-Mar-20	1397	3	N	Stream	H5	0.60	0.48	0.00	0.29	0.76
8-Mar-20	MCPL-002	4	N	Stream	H1	0.68	0.21	0.00	0.00	0.21
8-Mar-20	MCPL-002	4	N	Stream	H2	0.68	0.22	0.00	0.12	0.34
8-Mar-20	MCPL-002	4	N	Stream	H3	0.50	0.40	0.00	0.10	0.45
8-Mar-20	MCPL-002	4	N	Stream	H4	0.50	0.35	0.00	0.07	0.45
8-Mar-20	**1184**	**5**	**Y**	**Stream**	**H1**	**0.65**	**0.40**	**0.48**	**0.00**	**0.44**
8-Mar-20	229	2	N	Stream	H1	0.55	0.45	0.00	0.00	0.45
8-Mar-20	**NCY-PT19**	**4**	**Y**	**Stream**	**H1**	**0.43**	**0.95**	**0.15**	**0.00**	**1.12**
9-Mar-20	846	3	N	Stream	H1	1.30	0.43	0.00	0.00	0.43
9-Mar-20	CHNC-no label	5	N	Stream	H1	0.70	0.10	0.00	0.05	0.15
9-Mar-20	CHNC-no label	5	N	Stream	H2	0.63	0.43	0.00	0.00	0.43
9-Mar-20	CHNC-no label	5	N	Stream	H3	0.63	0.44	0.00	0.00	0.44
9-Mar-20	CHNC-no label	5	N	Stream	H4	0.61	0.48	0.00	0.00	0.48
9-Mar-20	840	3	N	Stream	H1	0.62	0.35	0.00	0.09	0.47
9-Mar-20	840	3	N	Stream	H2	0.62	0.20	0.00	0.35	0.52
9-Mar-20	792	2	N	Stream	H1	0.78	0.20	0.00	0.30	0.47
9-Mar-20	**836**	**3**	**Y**	**Pond**	**H1**	**0.50**	**0.61**	**1.00**	**0.00**	**1.60**
9-Mar-20	836	3	N	Pond outlet	H2	0.70	0.09	0.00	0.80	0.90
9-Mar-20	836	3	N	Stream	H3	0.78	0.27	0.00	0.37	0.62
9-Mar-20	**646**	**4**	**Y**	**Pond**	**H1**	**0.68**	**0.48**	**1.10**	**0.00**	**1.55**
9-Mar-20	646	4	N	Pond outlet	H2	0.65	0.37	0.00	0.00	0.37
9-Mar-20	646	4	N	Pond outlet	H3	0.65	0.44	0.00	0.13	0.61
9-Mar-20	646	4	N	Pond outlet	H4	0.65	0.23	0.00	0.00	0.23
9-Mar-20	796	2	N	Stream	H1	0.95	0.10	0.00	0.50	0.60
9-Mar-20	849	4	N	Stream	H1	0.57	0.46	0.00	0.00	0.46
9-Mar-20	849	4	N	Stream	H2	0.65	0.19	0.00	0.12	0.30
9-Mar-20	851	4	N	Stream	H1	0.83	0.15	0.00	0.25	0.40
9-Mar-20	851	4	N	Stream	H2	0.83	0.16	0.00	0.25	0.37
10-Mar-20	842B	3	N	Stream	H1	0.64	0.25	0.00	0.23	0.50
10-Mar-20	842B	3	N	Stream	H2	0.64	0.25	0.00	0.30	0.60
10-Mar-20	**270**	**3**	**Y**	**Pool**	**H1**	**0.68**	**0.61**	**0.35**	**0.00**	**0.98**
10-Mar-20	270	3	N	Pool outlet	H2	0.68	0.23	0.00	0.30	0.55
10-Mar-20	**244**	**2**	**Y**	**Pool**	**H1**	**0.66**	**0.63**	**0.05**	**0.32**	**0.95**

Date	Site	Order	Water	Type	Hole Number	Snow Depth (m)	Ice Depth (m)	Water Depth (m)	Hollow Depth (m)	Bed to Top of Ice (m)
10-Mar-20	244	2	N	Pool inlet	H2	0.70	0.03	0.00	0.14	0.18
10-Mar-20	835	3	N	Stream	H1	0.72	0.18	0.00	0.33	0.52
10-Mar-20	CHNC-t-002	4	N	Stream	H1	0.58	0.08	0.00	0.20	0.30
10-Mar-20	CHNC-t-002	4	N	Stream	H2	0.58	0.06	0.00	0.20	0.27
10-Mar-20	CHNC-t-002	4	N	Stream	H3	0.63	0.24	0.00	0.33	0.56
10-Mar-20	CHNC-003	5	N	Stream	H1	0.70	0.35	0.00	0.11	0.46
10-Mar-20	CHNC-003	5	N	Stream	H2	0.70	0.29	0.00	0.00	0.29
10-Mar-20	CHNC-003	5	N	Stream	H3	0.70	0.47	0.00	0.00	0.47
10-Mar-20	**CHNC-003**	**5**	**Y**	**Stream**	**H4**	**0.70**	**0.33**	**0.17**	**0.37**	**0.86**
10-Mar-20	773	2	N	Stream	H1	0.63	0.26	0.00	0.00	0.26
10-Mar-20	773	2	N	Stream	H2	0.63	0.33	0.00	0.00	0.33
10-Mar-20	764	2	N	Stream	H1	0.70	0.67	0.00	0.35	0.44
10-Mar-20	**340**	**4**	**Y**	**Pool**	**H1**	**0.70**	**0.60**	**0.80**	**0.00**	**1.40**
10-Mar-20	340	4	N	Pool inlet	H2	0.80	0.10	0.00	0.25	0.35
10-Mar-20	832	3	N	Stream	H1	0.65	0.50	0.00	0.60	1.40
10-Mar-20	1383	2	N	Stream	H1	0.75	0.20	0.00	0.00	0.20
11-Mar-20	1406	3	N	Stream	H1	0.74	0.50	0.00	0.20	0.70
11-Mar-20	1406	3	N	Stream	H2	0.74	0.50	0.00	0.27	0.75
11-Mar-20	1409	4	N	Stream	H1	0.64	0.38	0.00	0.20	0.54
11-Mar-20	1387	2	N	Stream	H1	0.65	0.69	0.00	0.15	0.84
11-Mar-20	**1408**	**4**	**Y**	**Pool**	**H1**	**0.66**	**0.40**	**0.34**	**0.14**	**0.91**
11-Mar-20	1408	4	N	Pool inlet	H2	0.51	0.20	0.00	0.25	0.44
11-Mar-20	1379	2	N	Stream	H1	0.74	0.10	0.00	0.23	0.33
11-Mar-20	830	3	N	Stream	H1	0.76	0.27	0.00	0.10	0.39
11-Mar-20	830	3	N	Stream	H2	0.76	0.05	0.00	0.15	0.20
11-Mar-20	828	3	N	Stream	H1	0.75	0.15	0.00	0.37	0.41
11-Mar-20	828	3	N	Stream	H2	0.75	0.20	0.00	0.49	0.70
11-Mar-20	399	3	N	Stream	H1	0.57	0.40	0.00	0.30	0.70
11-Mar-20	**254**	**3**	**Y**	**Pond**	**H1**	**0.66**	**0.60**	**0.10**	**0.00**	**0.70**
11-Mar-20	254	3	N	Pond outlet	H2	0.66	0.16	0.00	0.00	0.16
11-Mar-20	**267**	**4**	**Y**	**Stream**	**H1**	**0.50**	**0.80**	**0.21**	**0.00**	**1.02**
11-Mar-20	**267**	**4**	**Y**	**Pool**	**H2**	**0.40**	**1.00**	**0.37**	**0.00**	**1.34**
11-Mar-20	1423	1	N	Stream	H1	0.85	0.15	0.00	0.36	0.54
11-Mar-20	979	2	N	Stream	H1	0.62	0.44	0.00	0.26	0.68
12-Mar-20	222	2	N	Stream	H1	0.75	0.11	0.00	0.80	0.91
12-Mar-20	256	3	N	Pond	H1	0.53	0.57	0.00	0.03	0.60
12-Mar-20	**256**	**3**	**Y**	**Pond**	**H2**	**0.45**	**0.55**	**1.10**	**0.00**	**1.13**
12-Mar-20	256	3	N	Pond outlet	H3	0.73	0.08	0.00	0.08	0.16
12-Mar-20	256	3	N	Pond outlet	H4	0.73	0.10	0.00	0.60	0.16
12-Mar-20	256	3	N	Pond outlet	H5	0.73	0.07	0.00	0.90	0.16

Date	Site	Order	Water	Type	Hole Number	Snow Depth (m)	Ice Depth (m)	Water Depth (m)	Hollow Depth (m)	Bed to Top of Ice (m)
12-Mar-20	**EAGL-t-004**	**4**	**Y**	**Stream**	**H1**	**0.70**	**0.41**	**0.01**	**0.00**	**0.54**
12-Mar-20	273	2	N	Stream	H1	0.71	0.20	0.00	0.43	0.66
12-Mar-20	1101	2	N	Stream	H1	0.82	0.13	0.00	0.00	0.13
12-Mar-20	1126	3	N	Stream	H1	0.60	0.47	0.00	0.24	0.73
12-Mar-20	1126	3	N	Stream	H2	0.63	0.57	0.00	0.00	0.57
12-Mar-20	1132	3	N	Stream	H1	0.80	0.32	0.00	0.35	0.67
12-Mar-20	**DALG-003**	**4**	**Y**	**Stream**	**H1**	**0.62**	**0.65**	**0.08**	**0.00**	**0.75**
12-Mar-20	**DALG-003**	**4**	**Y**	**Stream**	**H2**	**0.62**	**0.63**	**0.10**	**0.00**	**0.70**
12-Mar-20	980	3	N	Stream	H1	0.69	0.35	0.00	0.00	0.35
12-Mar-20	977	3	N	Stream	H1	1.03	0.15	0.00	1.05	1.20
12-Mar-20	**267**	**4**	**Y**	**Pond**	**H1**	**0.69**	**0.39**	**0.25**	**0.00**	**0.64**
12-Mar-20	**267**	**4**	**Y**	**Pond outlet**	**H2**	**0.62**	**0.61**	**0.60**	**0.00**	**1.25**
12-Mar-20	**267**	**4**	**Y**	**Stream**	**H3**	**0.60**	**0.65**	**0.48**	**0.00**	**1.10**

ATTACHMENT G WINTER SAMPLING WATER QUALITY PARAMETERS

Table G-1. Winter sampling water quality parameters, March 2020.

Site	Order	Type	Hole Number	DO (%)	DO (mg/L)	Temperature (°C)	SPC (µS/cm)
1184	5	Stream	H1	11.7	1.70	0.1	704
NCY-PT19	4	Stream	H1	8.6	1.19	-0.3	13980
836	3	Pond	H1	2.0	0.28	0.3	102
646	4	Pond	H1	2.5	0.35	0.0	205
270	3	Pool	H1	0.7	0.11	0.1	418
340	4	Pool	H1	1.5	0.21	0.1	269
1408	4	Pool	H1	3.5	0.50	0.2	529
254	3	Pond	H1	3.5	0.49	0.6	279
267	4	Stream	H1	59.6	8.50	-0.1	5641
267	4	Pool	H2	27.7	3.97	-0.1	5098
256	3	Pond	H2	2.7	0.36	0.7	5413
267	4	Pond	H1	1.2	0.17	0.2	2780
267	4	Pond outlet	H2	5.2	0.74	-0.1	2344

APPENDIX A. Ecological and Landscape Classification Mapping

Chance Oil and Gas, Eagle Plains Project: Ecological and Landscape Classification Mapping



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EXECUTIVE SUMMARY

The Chance Oil and Gas Project (the Project) is in northeast Yukon, 32 km southwest of the Eagle Plains settlement and 260 km northeast of Dawson City. The site is accessed via the Dempster Highway. The Regional Study Area (RSA) encompasses 2,386 km². It contains no major rivers but has notable tributaries, including Greaves Creek, Chance Creek, McParlon Creek, Enterprise Creek, and Dalglish Creek. The Dempster Highway runs southwest to northeast through the southern half of the RSA. The Project overlaps the traditional territories of three First Nations, including the Vuntut Gwitchin First Nation, First Nation of Na-Cho Nyäk Dun, and the Tetlit Gwich'in Council Primary and Secondary Use Area.

Chance Oil and Gas Limited proposes conducting exploration activities for oil and gas. This will include a combination of seismic exploration (mostly three-dimensional [3D]) and drilling up to 30 exploratory wells. Both seismic and drilling activities will be conducted during the winter. However, some potential exists for year-round maintenance at certain wells for flow-testing. Access will be via existing and new winter roads.

Baseline vegetation information and data are required for most proposed oil and natural gas projects for screening under the *Yukon Environment and Socio-Economic Assessment Act* and other permits and licence applications. This Ecological and Landscape Classification (ELC) baseline report aims to provide information and data on the current condition of ecological communities (i.e., ecosites) within the RSA.

The Project falls within the Taiga Cordillera Ecozone and is located entirely within the Eagle Plains Ecoregion. The Eagle Plains Ecoregion is a 20,400 km² area in north Yukon between the Richardson and Ogilvie Mountains. Most of the region is low altitude rolling topography. The Eagle Plains Ecoregion is primarily unglaciated terrain within the continuous permafrost zone, where permafrost can be found up to 200 m thick. Several permafrost-produced landforms and processes can be found across the region. Within the continuous permafrost zone, the depth to and specific location of the permafrost depend mainly on the thickness of the surface organic horizon and the moisture content of the active layer. Evidence of forest fires is observed throughout the RSA. Fires increase the depth of the active permafrost layer, causing slope failures and changes in ecosystem moisture regimes.

Tree growth is limited by cool and short summers and permafrost in many areas, causing stunted forests. This results in disclimax vegetation communities with tall and low shrub structural stages. Upland black and white spruce forests typically have well-developed shrub communities, including Labrador tea, scrub/shrub birch, willow, alder, rose, blueberry, lowbush cranberry and spiraea with a groundcover of lichen and moss. Areas with low slope gradients and fine-textured soils often have ground cover dominated by cottongrass tussocks and are associated with shrub species such as scrub/shrub birch, black spruce, and Labrador tea.

In interviews, members of the Vuntut Gwitchin First Nation (VGFN) have discussed the ecology and phenology of their traditional berry harvesting areas. Most berry harvesting focused on blueberries, raspberries, salmonberries and cranberries, and important berry harvesting areas were in wetter areas.

The ELC mapping approach consisted of interpreting digital imagery to delineate and attribute polygons based on vegetation patterns and environmental conditions, such as slope, aspect, and slope position. Site-level

ecosystem units have not been previously described for the RSA; therefore, new ecosystem units (i.e., ecosites, ecological communities) were developed. The mapping and classification methodology conforms to the Yukon Government classification and mapping guidelines.

A total of 6,617 ELC polygons were delineated and attributed within the RSA, representing 31 different ecosystem communities. The ELC polygons had an average polygon size of 36 ha. Large polygons generally covered large homogenous slopes and were often in fire-disturbed areas. Smaller polygons were used to delineate small water bodies, wetland features or high-value wildlife habitats (e.g., areas with high lichen abundance for caribou and productive riparian conifer forests that offered mature stand structure characteristics not found in other parts of the RSA). Field surveys documented 126 different plant species, including six tree species, 29 shrub species, 48 forb species, seven ferns and fern allies, 12 graminoid species, 11 lichen species, ten moss species, and two liverwort species.

Most of the RSA has a soil moisture regime ranging from moist to wet, typically associated with seasonal melting of the active layer of the permafrost. Sixty-four percent of the RSA is composed of moist ecosystem units and another 13% is composed of wet ecosystem units. Seventeen percent of the RSA has ecosystem units within a mesic soil moisture regime. Only 2% of the RSA is composed of dry ecosystem units typically found on warm steep aspects.

Thirty-one ecosystem units were mapped within the RSA. The RSA is composed of 2,528 ha of wetland habitat. The most common ecosystem unit mapped in the RSA is Moist Spruce – Labrador Tea (44%), followed by Moist Spruce – Alder – Labrador Tea (12%) and Mesic Black Spruce – Alaska Paper Birch (9%). The least common ecosystem units mapped are Dry Sparsely Vegetated <0.05%), Mesic Birch – Willow (<0.05%) and Moist Birch – Willow <0.05%). Both Birch – Willow ecosystem units are influenced by old anthropogenic disturbances. Other less common ecosystem units that occur on undisturbed units are Dry Aspen - Lichen (<0.05%), Mesic White Spruce – Alaska Paper Birch – Alder <0.05%), and Wet Shrub Scrub Birch – Graminoid (<0.05%). Bogs were the most common wetland ecosystem unit mapped across the RSA. Fen and marshes were observed and mapped. No swamps were identified during the field program and no swamps were mapped within the RSA.

Most of the RSA is mapped in a 'Shrub' structural stage (74%), which includes 29% in Tall Shrub (>2 m) and 45% in Low Shrub (<2 m). Tall Shrub consists mainly of disclimax stunted black and white spruce ecosystem unit types and regenerating burns (old burns >25 years). Low Shrub areas consist primarily of younger regenerating burns (recent burns <25 years) and disclimax shrub sites, dominated by willow or scrub/shrub birch. About 1% of the RSA is in an old forest structural stage, and 21% is in a mature forest structural stage.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
2D	Two Dimensional
3D	Three Dimensional
asl	above sea level
BC	British Columbia
°C	degrees Celsius
CWD	Coarse Woody Debris
DBH	Diameter at Breast Height
DEM	Digital Elevation Model
ELC	Ecosystem and Landscape Classification
EOSD	Earth Observation for Sustainable Development of Forests
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectares
IMT	Information Management Branch
km	kilometers
km²	square kilometers
m	meter
mm	millimeter
NEF	National Ecological Framework
NND	Na-cho Nyäk Dun
PEM	Predictive Ecosystem Mapping
RSA	Regional Study Area
SIVI	Standard Site Visit Forms
SMR	soil moisture regime
the Project	the Eagle Plains Project (proposed by Chance Oil and Gas Ltd.)
TGC	Tetlit Gwich'in Council
VGFN	Vuntut Gwitchin First Nation
YBEC	Yukon Bioclimate Ecosystem Classification
YBIS	Yukon Biophysical Inventory System
YESAA	*Yukon Environmental and Socio-Economic Assessment Act*
YESAB	Yukon Environmental and Socio-Economic Assessment Board

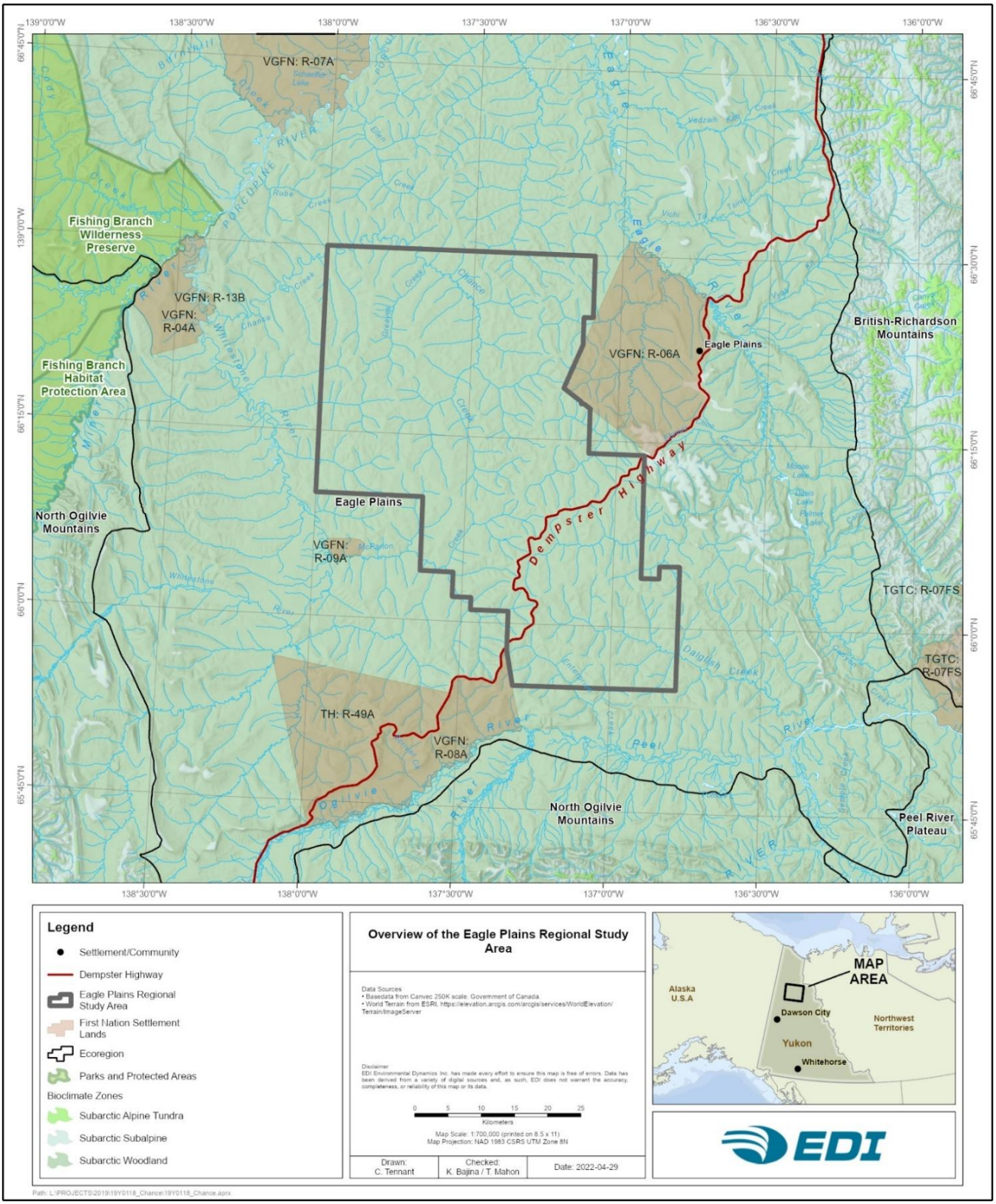
1 OVERVIEW

Chance Oil and Gas Limited (Chance) proposes conducting exploration activities for oil and gas within a 2,400 km^2 area in Eagle Plains. The Eagle Plains Exploration Project (the Project) is located along the Dempster Highway in northern Yukon, approximately 32 km southwest of the settlement of Eagle Plains and 260 km northeast of Dawson City (Map 1-1). The work will include a combination of seismic exploration (mostly three-dimensional [3D]) and drilling up to 30 exploratory wells. Both seismic and drilling activities will be conducted during the winter, though some potential exists for year-round maintenance at certain wells for flow-testing. Access will be via existing and new winter roads. The Project would build on 2D and 3D seismic exploration completed by Northern Cross Limited and others in the Eagle Plains area. The extent and density of seismic activity are not determined at this point but will be adapted based on the program's findings. Both seismic and drilling activities will be conducted during the winter and accessed via existing and new winter roads.

The Project is located within the North Yukon Planning Region and Peel Watershed Planning Region. Several First Nation Settlement Lands occur near or adjacent to the Project, but none overlap the Project itself. The Fishing Branch Wilderness Preserve is approximately 15 km west of the northwest boundary of the Regional Study Area (RSA); no other designated parks or preserves occur near the Project (Map 1-1).

The Project overlaps the traditional territories of three First Nations, including the First Nation of Na-cho Nyäk Dun (NND), Tetlit Gwich'in Council (TGC) Primary and Secondary Use Area and the Vuntut Gwitchin First Nation (VGFN) (Map 1-1).

In interviews, members of the Vuntut Gwitchin First Nation (VGFN) have discussed the ecology and phenology of their traditional berry harvesting areas. They observed that blueberries, raspberries and salmonberries began to ripen in July, and salmonberries grew in acidic, peaty soils (Sherry and Vuntut Gwitchin First Nation 1999, p. 108). Cranberries grew on lakeshores, mountainsides and hilltops and would ripen from the end of August until early September. Important berry harvesting areas were in wetter areas where berries grew bigger around lakes and Whitestone Village (Sherry and Vuntut Gwitchin First Nation 1999, p. 109, 110). However, during the interviews in the late 1990s, VGFN elders expressed concerns with increasing sun strength drying out moss and possibly affecting berry production. They noted that it had become harder to find berries, which they felt may have been attributed to acid rain, groundwater pollution and the rainfall at the beginning of spring (Sherry and Vuntut Gwitchin First Nation 1999, p. 115, 116).



Map 1-1. Overview of the Eagle Plains Regional Study Area.

1.1 PROJECT OVERVIEW

Baseline vegetation information and data are required for most proposed oil and natural gas projects submitted to the Yukon Environment and Socio-economic Assessment Board (YESAB) Executive Committee for screening under the *Yukon Environment and Socio-Economic Assessment Act* (YESAA), and applications to be submitted for a Geoscience Exploration Licence and a Water Licence, among other permits and licences. To receive authorization for the Eagle Plain Exploration Project to proceed, the Project must be evaluated under YESAA. Specific vegetation objectives, as identified in the YESAB's Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions (YESAB 2005), are to:

- provide information on land cover types, forest cover and site quality;
- document plant communities to the species level, on the sites that may be disturbed as a result of development;
- describe vegetation and vegetation assemblages, including any identified rare, sensitive, or endangered species and ecological reserves; and,
- identify any wetlands in the RSA.

The overall objective of this Ecological and Landscape Classification (ELC) baseline report is to provide information and data on the current condition of ecological communities (i.e., ecosites) within the RSA. The collection of ELC baseline data will describe the current conditions of ecological communities found within the RSA to assist with assessing potential Project effects on vegetation and assessing wildlife habitat in the area. Baseline information and data on other vegetation components such as rare plants, traditional and medicinal plants and invasive plant species were not assessed as part of this study. The ELC mapping can guide the assessment of those components based on the environmental conditions and vegetation species associated with the various ecosystem units documented as part of the ELC program. Wetlands were identified and classified as part of the ELC mapping.

1.2 REGIONAL ECOLOGICAL OVERVIEW

The Project falls within the Taiga Cordillera Ecozone and is located entirely within the Eagle Plains Ecoregion. The Taiga Cordillera Ecozone is associated with most of the northern half of the Yukon. The Taiga Cordillera Ecozone is characterized by mountain topography (though the Eagle Plains region is not mountainous), both glaciated and unglaciated terrain, and continuous permafrost underlying most soils. The climate in the Taiga Cordillera varies from its northern to southern extent. Annual precipitation ranges from less than 300 mm in the north to over 700 mm in the southeast. Generally, summers are cool to warm with extended periods of daylight, while winters are long, cold, and dark. Weather is influenced heavily by the Arctic and Alaskan Coasts (Ecological Stratification Working Group 1995).

The RSA is in the Eagle Plains Ecoregion, a 20,400 km^2 area between the Richardson and Ogilvie Mountains. Most of the region is low altitude rolling topography, between 300 m and 600 m above sea level (asl), with few scattered peaks above and around 1,000 masl. Most of the Ecoregion drains north into the Yukon River via the Whitestone, Porcupine and Eagle rivers. The southeast corner of the region drains east to the

Mackenzie River via the Peel, Wind and Ogilvie Rivers. The drainages in the northeast of the RSA are tributaries of the Porcupine River. These include the headwaters of the Eagle River and the upper reaches of the Whitestone River, which are the Chance and McParlon Creek sub-drainages. The drainages of the southwest of the RSA contain several creeks, including Dalglish and Enterprise Creeks, which flow directly into the Peel River (Access Consulting Group and EBA Engineering Consultants Ltd. 2001a). Few lakes occur in the Ecoregion and mainly consist of lowland oxbow and thermokarst lakes (Yukon Ecoregions Working Group 2004a). Within the RSA, several wetland complexes are associated with the larger creeks.

The Eagle Plains Ecoregion experiences a moderate amount of precipitation, with annual amounts around 400 mm. Most precipitation falls as rain throughout the summer months, averaging 50 to 80 mm per month, June through August. Precipitation is less from September to April and falls as snow. The temperature in this Ecoregion is affected by season and latitude, causing extended winter conditions that usually last from October through to early May. A strong variation occurs in seasonal temperatures on the Eagle Plains Plateau. Average winter temperatures are around −30°C and −25°C, with extremes as low as −60°C. Average summer temperatures are around 13°C, with extremes as high as 30°C. Minimal wind data are available for this region. Winter winds are generally light, and summer winds are moderate to light, generally from the west or east (Yukon Ecoregions Working Group 2004a).

The Eagle Plains Ecoregion is within the continuous permafrost zone, where permafrost can be found up to 200 m thick. Several permafrost-produced landforms and processes can be found across the region, including ice-wedge polygons, cryoturbation, solifluction, soil creep and active layer detachment slides on shale. Within the continuous permafrost zone, the depth to and specific location of the permafrost depends mainly on the thickness of the surface organic horizon, which acts as an insulator during the warmer summer months, and on the moisture content of the active layer (Yukon Ecoregions Working Group 2004b).

The Eagle Plains Ecoregion is primarily underlain by sedimentary rock, primarily sandstone and shale. Colluvial deposits cover most of the Ecoregion, with the remaining areas being covered by glaciolacustrine, glaciofluvial and alluvial deposits. Most of the surficial features result from processes associated with permafrost and frozen ground, including thermokarst subsidence and soil creep, cryoturbation, solifluction and active layer detachment slides on shale. Most of the Eagle Plains Ecoregion is unglaciated terrain (Yukon Ecoregions Working Group 2004a).

The Eagle Plains Ecoregion has predominately Crysolic soils with patches of Brunisolic soils. Cryosols are soils underlain by near-surface permafrost, while Brunisols are mildly weathered forest soils (Yukon Ecoregions Working Group 2004b). Soils on the well-drained slopes and active alluvial locations, where permafrost is absent, are classified as Dystric Brunisols. Due to long weathering periods, these soils may contain large amounts of iron oxides and may have pH as low as 4. Tuberic Cryosols are associated with hummocks and produce patterned ground formations. They are often found under open stands of black spruce, tamarack and birch. The active permafrost layer in these ecosystems generally ranges between 20 cm and 90 cm below the surface. The active layer depth is dependent on the location of the hummocks and will be deeper directly under hummock and shallower under the inter-hummock areas (Yukon Ecoregions Working Group 2004a).

Drainages of the Ecoregion are often represented by dendritic to trellis patterns, formed due to the fine-grained soils over sedimentary bedrock and unglaciated terrain. Larger streams are typically meandering. The presence of a permafrost layer restricts vertical drainage, and imperfect drainage is common. Low slope gradients and fine-textured soils restrict lateral groundwater flow, often limiting water availability during the low flow period (November to April). Some areas with moderate or steep slopes and colluvium mineral soil will be well to moderately well-drained (Access Consulting Group and EBA Engineering Consultants Ltd. 2001a).

Peak streamflow in the Ecoregion occurs in May and June because of the annual snow melt. Secondary peaks occur due to summer rain events. The region's annual mean runoff ranges from 173 to 233 mm, with an ecosystem mean of 201 mm. Cold winter temperatures and permafrost dramatically reduce winter flows, and some small streams will experience zero winter flows. Minimum flow generally occurs in March or earlier depending on seasonal temperatures and precipitation (Yukon Ecoregions Working Group 2004a).

Evidence of forest fires can be observed throughout the RSA. Alaskan paper-birch is commonly the first tree species to colonize burn areas. Occasionally, on well-drained sites, aspen (*Populus tremuloides*) and balsam poplar (*Populus balsamifera*) may be the first tree species to re-colonize. The extent of burns can be recognized by the current black spruce – Alaskan paper birch woodlands (Yukon Ecoregions Working Group 2004a). Fires increase the depth of the active permafrost layer, causing slope failures and changes in ecosystem moisture regimes.

The Eagle Plains Ecoregion is within the Subarctic Bioclimate Region, characterized by stunted, open canopy spruce-dominated habitats (Environment Yukon 2016). It occurs between the Arctic tree limit and the closed canopy boreal forests characteristic of southern Yukon, and acts as a transition zone between the two (Yukon Ecoregions Working Group 2004b). Two subzones occur within the Subarctic Bioclimate Region: Subarctic Woodland Zone, and Subarctic Alpine Zone (Environment Yukon 2016). General information about each Bioclimate zone is presented in Table 1-1. The ELC mapping did not distinguish between the two Bioclimate zones because only a very small portion of the RSA was in the Subarctic Alpine Zone. Permafrost often limits tree growth in many areas of the Ecoregion, causing stunted forests. This results in disclimax vegetation communities with tall and low shrub structural stages. The most common climax forest community is black spruce (*Picea mariana*) woodlands associated with hummocks. Upland black and white spruce (*Picea glauca*) forests typically have well-developed shrub communities, including Labrador tea (*Rhododendron groenlandicum*), scrub/shrub birch (*Betula glandulosa*), willow (*Salix* species), alder (*Alnus* species), rose (*Rosa* species), blueberry (*Vaccinium* species), and *Spiraea* and with a groundcover of lichen and moss. Well-drained sites commonly have white spruce stands with lichen ground cover. Areas with low slope gradients and fine-textured soils often have ground cover dominated by cottongrass tussocks and are associated with shrub species such as scrub/shrub birch, black spruce, Labrador tea, and occasionally tamarack (*Larix laricina*) (Yukon Ecoregions Working Group 2004a).

Graminoid and shrubby fens, bogs and graminoid marshes are scattered throughout the region. Several sedge species are dominant in both the graminoid fens and marshes, including narrow-leaf cottongrass (*Eriophorum angustifolium*), aquatic sedge (*Carex aquatilis*), northern beaked sedge (*Carex utriculata*) and mud sedge (*Carex limosa*). Shrub species in fens include leatherleaf (*Chamaedaphne calyculata*) and bog rosemary (*Andromeda*

polifolia). The ground cover of the shrubby bogs is dominated by sphagnum, sometimes with extensive lichen cover. Shrub species typically include low bush cranberry (*Vaccinium vitis-idaea*), bog cranberry (*Vaccinium oxycoccos*), bog rosemary, baked apple/cloudberry (*Rubus chamaemorus*), Labrador tea, scrub/shrub birch, willow, black spruce and occasionally tamarack.

Riparian forests are found as narrow strips along most major watercourses in the study area. These are well-drained white and black spruce stands and may have prickly rose (*Rosa acicularis*), willow, shrub and Alaska paper birch (*Betula neoalaskana*) in their understory. Deciduous stands can be found on warm, moderately well to well-drained slopes. These stands are typically Alaska paper birch, but some sites may also have balsam poplar, willow or trembling aspen. Deciduous stands are often found in areas of recent anthropogenic disturbance, such as old roads, drill sites and gravel pits.

Table 1-1. Bioclimate zones in the Eagle Plains RSA.

Bioclimate Zone	Description	RSA (ha)
Subarctic Woodland Zone (SUW)	Mixed wood or coniferous forests with an open canopy. Occur on plateaus, plains, valley bottoms and lower slopes of mountains. Vegetation dynamics and distribution is influenced by slope position and aspect, and the distribution and depth of permafrost (Environment Yukon 2016)	238,620
Subarctic Subalpine Zone (SUS)	Tall or low shrubs, with sparse to sporadic tree cover. Occurs at high elevations in northern mountain systems or in areas influenced by Arctic weather systems (Environment Yukon 2016).	19

1.2.1 EXISTING ECOLOGICAL DATA

In addition to the broad ecoregion description provided in Yukon Ecoregions Working Group (2004a), two types of local, regional ecological data exist for the area. A preliminary ecosystem classification was developed for Eagle Plains Ecoregion (Rosie 2000) and predictive Ecosystem Mapping models were developed for the North Yukon (Meikle et al. 2005) and Peel Planning Areas (Meikle and Waterreus 2008). Rosie (2000) describes possible vegetation types in the Peel River Plateau, Richardson Mountains and Eagles Plains Ecoregions. This report has no spatial or non-spatial files associated with it. Field work was carried out by the Yukon Territorial Government Protected Areas Secretariat in July and August 2000 to gather site, vegetation, and soil information. Approximately 153 plots were established across all three Ecoregions. Rosie tabulated and analyzed the collected data to develop vegetation types associated with the three Ecoregions. She developed six vegetation type categories with associated vegetation communities (Attachment A):

1. Alpine Communities: Ground Shrub Types; Alpine Blockfields and Rocky Slopes.
2. Shrub Types: Shrub Birch Stands; Willow Stands, Mixed Shrub Birch/Willow Stands; Alder Stands
3. Treed Types: Black Spruce Stands; White Spruce Stands; Birch Stands; Balsam Poplar Stands
4. Graminoid Types and Wetlands: *Eriophorum* Tussock Community; Wetlands

5. Slumps (Detachment Slides)

6. Miscellaneous Other Types: Small Gravel Beach at Davis Lake; Gravel Bar on Caribou River; Transect from River Inward to Older part of Floodplain; Small brook on mountain slope; Repeating Pattern of Vegetation on Steep Mountain Slope.

The Rosie (2000) report states that the most encountered vegetation communities found in these Ecoregions were described, but several uncommon types could likely have been missed during the field program.

Two Predictive Ecosystem Mapping (PEM) products were also available for the RSA. They are the North Yukon PEM and the Peel Watershed PEM. These two spatial PEM products cover the Chance RSA. The North Yukon PEM was completed in 2005, and the Peel Watershed PEM was completed in 2008. Both products use the Earth Observation for Sustainable Development of Forests (EOSD) as their model's land cover classification input.

The North Yukon PEM (Meikle et al. 2005) covers the following six Ecoregions: Richardson Mountains, Eagle Plains, Old Crow Flats, Old Crow Basin, Davidson Mountains, and North Ogilvie Mountains. The Mountain landscapes are organized by elevation (Bioclimate Zones), and Plateau landscapes are organized by relative moisture gradient (Ecosite). Mapping was completed with input data at scales ranging from 1:100,000 to 1:250,000, and a raster mapping approach was chosen for this PEM product (Meikle et al. 2005).

Meikle et al. (2005) did use an ecosite approach and it resulted in 3 Bioclimate Zones (Taiga Wooded; Taiga Shrub; Alpine) and 28 biophysical classes, organized by high elevation, low-middle elevation, riparian and wetland landscape positions (Attachment A). They list the Landscape Types associated with the Bioclimate Zones with representative photographs but do not provide vegetation descriptions.

The Peel Watershed PEM (Meikle and Waterreus 2008) covers the Peel Watershed, which contains in whole or in part the following six Ecoregions: Eagle Plains, British-Richardson Mountains, Ft. McPherson Plain, Peel River Plateau, North Ogilvie Mountains and Mackenzie Mountains. The goal of this product was to produce mapped classes with distinctions reliably supported by input data that were also meaningful for anticipated uses by the Peel Watershed Planning Commission.

The Peel Watershed ecosystem classification is derived from the EOSD interpretation with other inputs such as bioterrain to describe thirty-one Ecosystem Classes. The ecosystem classes developed by the authors were correlated by adjacent projects that used similar approaches, such as the North Yukon PEM (Meikle et al. 2005) and the Vegetation Types described by Rosie (2000). The 31 biophysical classes are organized by high elevation, medium to low elevation, riparian, wetland and open water groups (Attachment A). The associated Peel Watershed PEM report includes a one-page factsheet for each of the 31 ecosystem classes. The factsheets provide an ecosite descriptive paragraph with representative photo, a list of model inputs and correlation to other classifications.

Some of the North Yukon and Peel Watershed PEM product limitations are:

1. The documentation associated with the North Yukon PEM is a PowerPoint presentation. Many technical details associated with the product are undocumented and require guessing of how the PEM was constructed and the environmental conditions associated with the BEU outputs.

2. Accuracy due to errors inherent in the input data (EOSD, bioterrain and moisture class)

3. Missing data (cloud cover, shadows)

4. Ecosystem classification detail level. The number of BEU classes used to describe the area is perhaps too few, given the ecological diversity of this large area, potentially failing to classify important ecosystems (e.g., habitats for wildlife or rare plants).

5. The ecosystem classification is based on vegetation plot data but the completed PEM product was never field verified, so the accuracy of the product is unknown

6. The way wetlands are defined potentially underestimates wetland classes.

Overall, there is a lack of wetland differentiation within the PEMs and Rosie's work. Often various types and classes of wetlands provide habitat for rare plants and traditional and medicinal plants. The PEMs do not provide any structural stage data, which can be important for wildlife suitability mapping. For example, a young forest provides a different type of habitat than a mature forest. Similarly, an area composed of low shrubs could be mapped as unsuitable habitat. In contrast, an area composed of tall shrubs could be considered suitable habitat.

The adequacy of the two PEMs was assessed, and the PEMs were determined to be inadequate for the needs of this project. The inadequacies were determined based on field observations. Some of the key issues which need to be addressed in a final map product to help support wildlife needs include:

- Mapping needs to be refined to identify lichen sites. Although areas mapped as Dry in the PEMs currently include most lichen sites, they also include much larger extents that do not contain lichen.
- Mapping needs to be refined to include structural stage (or lumped structural stage categories), at least for Sb-leading types.
- Mapping needs to differentiate between deciduous shrubs (mostly from recent burns) and shrub-stage Sb.

Beyond wildlife-specific needs, the following observations are systematic PEM 'problems' that limit its accuracy and utility:

- Riparian areas: these units are generally too wide — often twice as wide as what was observed. Also, they often are not riparian areas, rather wet sites in valley bottoms and lower and toe slope positions, where moisture is received from upslope areas versus streams. These units also tend to truncate short on first and second-order streams, which have similar, if narrower, wet shrubby

areas as the 3XXs. These truncated areas are typically mapped as Moist units when they are Wet units.

- Most Dry areas are not dry. They are stunted Sb-permafrost bog.
- Location of Wet vs Moist areas. The relative locations of Wet and Moist locations do not correspond with slope positions. Most Wet areas are on Mid-Upper-Crest positions in association with Dry areas, above Moist areas in Lower-Toe-Valley Bottom sites. It would make more intuitive sense if the wet and moist classifications were reversed (i.e., wet areas below moist).
- There is a bias to overestimate Herb areas. Many areas mapped as Herb were Shrub, including several burns.
- There are no Moist areas mapped for the Peel PEM

Notwithstanding the limitations of the PEMs and the preliminary ecosite classification developed by Rosie, the information from these sources was used to help develop the ecosystem units for this ELC study.

1.3 ECOSYSTEM LANDSCAPE CLASSIFICATION

Ecological and Landscape Classification mapping is an integrated approach to mapping and classifying land units according to their ecological similarity (Environment Yukon 2016). The ELC mapping provides information on various landscape components' biological and physical characteristics to facilitate a range of interpretations and assist in sustainable management (Rowe and Sheard 1981, Environment Yukon 2016). For example, defining ecosystem units (i.e., ecosites, ecological communities) with similar vegetation, site and soil characteristics provides information on the current condition of vegetation, can facilitate the development of vegetation mitigation measures during infrastructure development, and aid in assessing habitat suitability for wildlife across a landscape.

Two ecological frameworks are used for ELC work in the Yukon: The Yukon Bioclimate Ecosystem Classification (YBEC) Framework and the National Ecological Framework (NEF) of Canada (Environment Yukon 2016). The YBEC system is modelled, in general, after the Biogeoclimatic Ecosystem Classification (BEC) System of British Columbia (Pojar et al. 1987, Meidinger and Pojar 1991). The BC classification system consists of a site-level, or local, classification but considers climate to be the overarching primary influence on ecosystem development and distribution. Within areas of a similar climate, ecosystems (ecological communities, ecosites) are expected to vary due to differences in topography and soil. The YBEC system provides detailed local-level ecological mapping and interpretations, set within a regional context (Environment Yukon 2016). Conversely, NEF describes the biophysical properties of large land units based on ecological similarity (Ecological Stratification Working Group 1995). An example of this framework is the Ecoregions of the Yukon Territory (Smith et al. 2004), which provides generalized regional biophysical information about the landscapes of the Yukon but does not support detailed site-level mapping.

Combined, the YBEC and NEF frameworks group ecosystems at different levels in a complementary way (regional to local levels). This ELC study aimed to work within these frameworks, using a hierarchical ecosystem classification of ecoregions, bioclimate zones and local ecosites (ecological communities, ecosystem

units). Ecoregions are large areas (scale of 1:3,000,000 to 1:1,000,000) within the NEF system characterized by a distinctive regional climate expressed by vegetation (Smith et al. 2004, Environment Yukon 2016). Bioclimate zones are broad areas within the YBEC system with the same regional climatic patterns, such as subalpine, alpine and boreal high areas. These zones are used to establish the ecological context for local ecosites (i.e., ecological communities, ecosystem units), which are the classification system's site-level 'building blocks.' They represent vegetation potential and are relatively stable and enduring features defined by landscape position and characteristic site conditions, including soil moisture and nutrient regimes (Environment Yukon 2016).

Within the RSA, the diversity of plant species occurrences is due to the range in elevation and topography, extensive permafrost and river and creek floodplains. Aspect, slope gradient and presence of near-surface permafrost heavily influence plant community composition across the landscape.

1.4 SPATIAL BOUNDARIES

The Eagle Plains RSA is 2,386 km² (238,640 ha). It is characterized by rolling taiga topography and does not contain major rivers (Map 1-1, Photo 1-1). Notable tributaries include Greaves Creek, Chance Creek, McParlon Creek, Enterprise Creek, and Dalglish Creek. The Dempster Highway runs southwest to northeast through the southern half of the RSA.

The RSA is dissected by numerous 2D seismic lines and winter roads from previous exploration activities dating back to the 1960s. Most 2D exploration occurred between 1961 and 1984, with new 2D exploration in 2001 (Access Consulting Group and EBA Engineering Consultants Ltd. 2001b, GEOTIR 2014). Approximately 2,200 km of new 3D LIS exploration was conducted in a 325 km² area between November 2013 and April 2014 (GEOTIR 2014). This new 3D exploration is located near the centre of the RSA, spanning north and south of the Dempster Highway.

One of the key requirements for the YESAB proposal effects assessment will be having a study area-wide ecosystem map.



Photo 1-1. Example of the RSA's rolling topography and changes in vegetation composition.

2 METHODS

An examination of the adequacy of existing ecosystem maps was completed to verify if these maps would meet effect assessment needs and could be used to support habitat mapping for wildlife Valued Components. Currently, vegetation mapping defines vegetation communities in the RSA and their value as habitats for focal wildlife species, rare plants, and traditional and medicinal plants.

Typically, ecosystem mapping can be developed using one of three methods:

1. Manual process — where an ecologist visually completes an interpretation of aerial photographs or satellite images to identify and delineate ecosystems and their attributes (e.g., Yukon Ecological and Landscape Classification framework);

2. GIS modelling, or predictive approaches — where an ecologist uses their knowledge of ecosystem patterns and relationships to predict the locations of ecosystems on the landscape using a model-based approach (e.g., PEM); and,

3. Hybrid approach — where an ecologist uses manual approach methods to supplement or increase the accuracy of certain features within a map modelled with GIS.

Two options for vegetation mapping were presented to Chance: the use of existing PEM products or the creation of a new ELC product. Initially, it was decided to use the existing PEM products to create an ecological spatial database for the RSA.

Most of the RSA is within the North Yukon PEM with a small portion of the southern section of the RSA within the Peel Watershed PEM. The Peel Watershed PEM and North Yukon PEM ecosystem classification and mapping methodologies are very similar, and the ecosystem classification methodology for both was developed and conducted by the Yukon Land Use Planning Council working with the Habitat and Regional Management Section, Environment Yukon. Both ecological classifications were derived by designing and implementing a model that uses applicable spatial digital data layers. The model inputs were:

- broad landcover data (EOSD raster layer);
- Yukon Bioclimate Zones;
- slope and aspect from a Digital Elevation Model (DEM); and,
- soil moisture model.

The resolution of the PEMs output was 25 m; however, the native resolution of the EOSD layer is 200 m, which delimits the functional accuracy of the final PEM. As a result, the spatial accuracy of the final product is approximately 100 m (half the width of a 200 m pixel).

The initial step for this mapping exercise was to amalgamate the spatial North Yukon PEM (Meikle et al. 2005) and the Peel Watershed PEM (Meikle and Waterreus 2008) into a single cohesive database that covered the entire RSA. The spatial file was converted from a raster (grids) format to a vector (polygons) format for the field assessment maps.

EDI recommended that a two-staged field assessment be implemented. The first field assessment would be to verify the quality and accuracy of the PEM layer. If the PEM was inadequate, a second field survey would be tailored to support a new ELC product. Otherwise, the second survey would supplement the first round of surveys to meet overall sample size requirements. Additional details on the field sampling program are provided in the next section.

2.1 FIELD SAMPLING AND DATA ENTRY

Plots and PEM polygon checks were distributed throughout the entire RSA, with sampling occurring across the various ecosystem types and structural stages, including a representative sample of ecosystems across the various slope positions and moisture/nutrient combinations on the edatopic grid. Sampling was focused on sites and ecosystems of special interest, including:

- a representative sample of the full range of potential ecosites;
- wetlands and riparian areas;
- non-forested site series, including bluffs and lichen, bryophyte, herbaceous, and shrub communities;
- ecosystems of interest that have the potential to occur in the RSA;
- focal wildlife species key habitats; and,
- other special or anomalous features of interest.

Field crews recorded field data using Yukon Standard Site Visit Forms (SIVIs) for all ground inspection plots. Visual checks were recorded separately in field notebooks. Data collection followed the standard ecological data collection techniques and methods defined in the *Field Manual for Describing Yukon Ecosystems* (Environment Yukon 2017) and the *BC Field Manual for Describing Terrestrial Ecosystems* (BC MFLNRORD and BC MOE 2010). Section 5 of the latter reference provides detailed information specific to the Site Visit Form and mandatory data fields for ground plots.

Ground inspections provide data for characterizing ecosystem attributes, including vegetation composition, slope position, soil characteristics, and structural stage. Visual checks are quick field recordings of site, soil and vegetation conditions that help inform ecosite identification or other useful attributes (e.g., structural stage, soil moisture). Visual checks are intended to be quick assessments and can include observations from a helicopter (air call), viewpoint, or as a note while walking through a habitat. The GPS coordinates were recorded and digital photographs were taken at all plot locations.

Upon completion of field sampling, the plot cards and associated notes were reviewed for completeness and accuracy during an internal data quality assurance (QA) process. All associated digital photographs and GPS coordinates were examined to ensure they corresponded to, and were named for, the appropriate field plots. Ground inspections with vegetation percent cover information were entered into the Yukon Biophysical Inventory System (YBIS). Visual checks without vegetation percent cover information were entered into an excel spreadsheet database.

2.2 ELC SYSTEM AND DATABASE DEVELOPMENT

To best meet the needs of the Project, a manual ELC mapping approach was completed, where mappers examine and interpret digital ortho-imagery to manually delineate and attribute polygons with ecological information. This method typically provides more detail and accuracy than predictive modelling approaches. The mapping and classification methodology conforms to the Yukon Ecological and Landscape Classification and Mapping Guidelines, Version 1.0 (Environment Yukon 2016), and the Standard for Terrestrial Ecosystem Mapping in British Columbia (Resources Inventory Committee 1998) were used as guidelines.

Ecosystem Landscape Classification mapping projects in the Yukon are encouraged to follow the YBEC Framework. The YBEC system is developing detailed site-level ecosystem units (i.e., ecosites, ecological communities) for bioclimate subzones located throughout the territory. Currently, site-level ecosystem units do not exist for the RSA; therefore, the YBEC system methodology was used to develop Project-specific ecosystem units (i.e., ecosites, ecological communities). Wherever possible, non-forested and sparsely/non-vegetated ecosystem units (e.g., alpine ecosites, talus, pond, mine) used standard codes and definitions from the BC BEC System. Standards and guidelines used during ELC development for the Project included:

- Yukon Ecological and Landscape Classification and Mapping Guidelines, Version 1.0. (Environment Yukon 2016);
- Standard for Terrestrial Ecosystem Mapping in British Columbia (Resources Inventory Committee 1998);
- Field Manual for Describing Terrestrial Ecosystems. Second Edition (BC MFLNRORD and BC MOE 2010);
- Biogeoclimatic Ecosystem Classification of Non-forested Ecosystems in British Columbia, Technical Report 068 (Mackenzie 2012); and,
- Ecoregions of the Yukon Territory: Biophysical properties of Yukon landscapes (Smith et al. 2004).

ELC data collection and plant species nomenclature referenced the following resources:

- Field Manual for Describing Yukon Ecosystems, draft document (Environment Yukon 2017);
- Field Manual for Describing Terrestrial Ecosystems, Second Edition (BC MFLNRORD and BC MOE 2010);
- Flora of the Yukon Territory, Second Edition (Cody 1996);
- Yukon Conservation Data Centre plant list 2019,
- Online Flora of North America, www.eFloras.org; and,
- Yukon Biophysical Inventory System. Data management system and government utilized vegetation codes database—Environment Yukon's Information Management Branch (IMT).

2.2.1 SPATIAL DATA PREPARATION

Various digital data were acquired, for use in ArcMap (ArcGIS 10.7.0), in preparation for ELC mapping. Medium and high-resolution satellite imagery for the Project was sourced from the Yukon Government (2019) and Chance. Other data sources acquired or prepared to support ELC mapping included:

- Digital Elevation Model (DEM; Yukon Government 2002);
- 1:50,000 Yukon Stream and Water Bodies Mapping (Government of Canada 2012);
- 1:250,000 Draft Yukon Bioclimate Zone Boundaries (Yukon Government 2014);
- 1:100,000-1:1250,000 Surficial Geology Mapping (Yukon Government 2014);
- 50 m Contours (Government of Canada 2012);
- Yukon Fire History (Yukon Government 2020);
- Peer Solutions Fire History (Peer Solutions 2021);
- The Earth Observation for Sustainable Development of Forests (EOSD) Land Cover map (25 m pixel; Wulder et al. 2014);
- User-defined spatial slope (flat, gentle, moderate and steep) and aspect (warm, cool) layers (refer to Attachment A for slope and aspect class values); and,
- ELC mapping database (YBIS).

Data sources, such as the EOSD, surficial materials mapping, and Yukon stream and water bodies mapping, generated at a smaller scale were used as reference material to assist ELC mapping; however, the data were used with appropriate caution given the differences in scale.

2.2.2 ELC SYSTEM DEVELOPMENT

The PEM units and polygons were used during the planning and field work stages. However, the field assessments revealed several limitations of the PEM products, including lack of structural stage, very generalized broad-ecosystem units and large polygons that did not capture specific wildlife habitats or habitat features.

To complete the ELC mapping of the RSA, new broad-ecosystem classification units were developed that had similar floristic composition and clearly interpretable ecological context in terms of site-scale climate, landscape position, substrate, hydrology conditions, and moisture and nutrient regimes. The goal was to develop Project-specific ecosites representing the range of ecological communities within the RSA while being reliably and repeatedly identifiable from a mapping perspective. The final ELC system used for the Project merged the methodology outlined by the YBEC system with aspects of the BEC system used in BC and referenced some of the existing units (Attachment A).

A plot tabling method was used to develop Project-specific ecosites, similar to the methods used by Environment Yukon to develop ELC systems for the subzones of the Boreal Low Bioclimate Zone (D. Meidinger pers. comm). Field plots were initially sorted based on environmental variables (e.g., elevation,

slope position, aspect, soil characteristics, moisture and nutrient regime) as these factors drive the ecological communities that exist across the landscape.

Following initial sorting, ecosites were developed through detailed plot-by-plot comparisons of plant species presence and percent cover, using indicator species wherever possible. By their presence or absence, indicator species can demonstrate an environment's distinctive aspect or quality (e.g., golden fuzzy fen moss and glow moss indicate wet, nutrient medium to rich sites). Field plots were also plotted spatially on ortho-imagery to aid in incorporating interpretability into the classification. The final ecosites contain all available environmental variables and floristic composition information collected and included some potential units that no field data were collected for but were described in the existing ecological data (Meikle et al. 2005, Meikle and Waterreus 2008, and Rosie 2000). A table comparing the Chance ELC units to the PEM units can be viewed in Attachment A.

The vegetation association organization and ecosite and coding system follows the Yukon ELC Mapping Guidelines (Environment Yukon 2016). High elevation non-forested and sparsely/non-vegetated ecosystem are assigned the two-letter group/realm and class classification system (BC MFLNRORD and BC MOE 2010, Mackenzie 2012), while anthropogenic units are coded using two upper case letters, following the BC provincial standards (Resources Inventory Committee 1998). Wetland sites are classified according to the Canadian Wetland Classification System for class, form, subform, type and subtype (Warner and Rubec 1997). The remaining ecosites are coded with a two-digit number that indicates, by its number series, a certain range of soil moisture conditions:

- The 10s are the dry sites.
- The 00s are the mesic sites.
- The 20s are the riparian sites.
- The 30s are the moist sites.
- The 40s are the wet sites.
- Wetlands were designated with a letter referring to the wetland class (e.g., F=fen, M=marsh, S=swamp).

Ecosite names reflect plant species that are important indicators of the vegetation found within the ecosite (e.g., 33 – Moist Spruce – Labrador Tea). A description of the ecosites developed for the Eagle Plains RSA ELC mapping product can be reviewed in Table 2-1.

Table 2-1. General ecosite descriptions used for ELC mapping in the Eagle Plains RSA.

Code	Unit Name	Description and typical situation	Mapped (Y/N)
10	Sparsely Vegetated	Vegetation cover less than 10%. Not specific to any soil moisture regime (SMR) or soil nutrient regime (SNR).	Y
11	Dry Herb	Dry area dominated with herbaceous vegetation, very low shrub cover (less than 5%) and a SMR ranging from xeric to submesic. No mottles, seepage or permafrost presence in the rooting zone.	N
12	Dry Lichen	Very xeric to submesic areas dominated by *Cladonia* species (caribou forage species) with very low shrub cover (less than 5%) typically on moderate to steep south facing slopes. No mottles, seepage or permafrost presence in the rooting zone.	N
13	Dry Mix Shrub	Xeric to submesic shrubby areas with very low *Cladonia* species (caribou forage species) cover (less than 10%). This is a disclimax community. No mottles, seepage or permafrost presence in the rooting zone.	N
14	Dry Spruce-Lichen (Conifer)	Areas with spruce tree species cover greater than 5% and *Cladonia* species (caribou forage species) cover greater than 10%. Areas with xeric to submesic SMR and poor to medium SNR. No mottles, seepage or permafrost presence in the rooting zone. Difficult to differentiate from Code 06 in some imagery.	Y
15	Dry Aspen-Lichen (Deciduous)	Areas with aspen tree cover greater than 5% and *Cladonia* species (caribou forage species) cover greater than 10%. These areas also have a SMR ranging from xeric to submesic and a poor SNR. No mottles, seepage or permafrost presence in the rooting zone.	Y
16	Dry Spruce-Birch-Lichen (Mixedwood)	Areas with either white spruce, black spruce and/or birch (Alaskan paper birch) or aspen tree cover, with spruce and birch (scrub birch) shrubs and *Cladonia* species (caribou forage species) cover greater than 10%. Areas that have been burned have dense alder cover in the early successional stage. These areas have a SMR ranging from xeric to submesic and SNR ranging from very poor to poor. No mottles, seepage or permafrost presence in the rooting zone. Difficult to differentiate from Code 04 in some imagery.	Y
17	Dry Aspen (Deciduous)	Xeric to submesic moderate to steep areas dominated with aspen tree cover and very low *Cladonia* species (caribou forage species) cover (less than 5%). These areas typically have poor SNR. No mottles, seepage or permafrost presence in the rooting zone.	Y
01	Mesic Herb	Area dominated with herbaceous vegetation, very low shrub cover (less than 5%) and a mesic to subhygric SMR. No distinct mottles or seepage present, some sites may have permafrost but the frozen layer contains no signs of ice crystals or ice layers.	N
02	Mesic Birch - Willow	These areas have been historically anthropogenically disturbed and regeneration has been affected. These areas are typically dominated by either Alaska paper birch or willow tree species or a mix of both deciduous species. Soil moisture regime is typically subhygric and SNR ranges from poor to medium. No distinct mottles or seepage present, some sites may have permafrost but the frozen layer contains no signs of ice crystals or ice layers. If vegetation is very sparse and difficult to see in imagery, may be called Anthropogenic (Code AN).	Y
03	Mesic White Spruce – Alaska Paper Birch - Alder	These areas are typically dominated by Alaskan paper birch and white spruce mixedwood with an alder understory. The SMR ranges from mesic to subhygric and the SNR ranges from poor to medium. No distinct mottles or seepage present, some sites may have permafrost but the frozen layer contains no signs of ice crystals or ice layers.	Y

Code	Unit Name	Description and typical situation	Mapped (Y/N)
04	Mesic Black Spruce – Alaska Paper Birch (mixedwood)	These areas are typically dominated by a black spruce and Alaska paper birch and with an understory of greater than 30% shrub cover. May have dense alder understory, or a very open understory. The SMR ranges from mesic to subhygric and the SNR ranges from poor to medium. No distinct mottles or seepage present, some sites may have permafrost but the frozen layer contains no signs of ice crystals or ice layers.	Y
05	Mesic Alaska Paper Birch (Deciduous)	Area is dominated by Alaska paper birch trees with an understory composed of more than 30% shrub cover. The SMR ranges from mesic to subhygric and the SNR ranges from poor to medium. No distinct mottles or seepage present, some sites may have permafrost but the frozen layer contains no signs of ice crystals or ice layers.	Y
06	Mesic Black Spruce – Labrador Tea (Conifer)	Areas dominated by black spruce trees with Labrador tea dominating the shrub layer. The SMR ranges from mesic to subhygric and the SNR ranges from poor to medium. No distinct mottles or seepage present, some sites may have permafrost but the frozen layer contains no signs of ice crystals or ice layers. Likely underrepresented in some areas due to its similarity to Code 33 in some imagery.	Y
20	Shrubby Riparian Birch – Willow	Shrubby riparian areas dominated by scrub birch, tea-leaved willow or diamond leaved willow and bog cranberry. Typically, these areas have a SMR ranging from subhygric to subhydric and SNR ranging from medium to rich. Faint to distinct mottles can be observed in the soil profile. In some cases, seepage maybe present and most sites have permafrost but found at variable depths. This is a disclimax community.	Y
21	Riparian White Spruce – Prickly Rose	Treed riparian area dominated by white spruce with a mixture of shrub species but usually rose presence in the understory. These sites are usually a thin strip of trees along streams and rivers. Typically, mesic sites but some sites can be described as subhygric. Sites usually have medium to rich SNR. Typically, no distinct mottles or seepage are present in these sites but occasionally permafrost can be observed at various depths.	Y
22	Riparian Spruce – Birch - Willow	Treed riparian area dominated by white and black spruce, some Alaska paper birch may be present and a mixture of shrub species such as scrub birch and willow can be observed in the understory. These sites are typically moister sites (subhygric to hygric) with wider strip of trees along streams and rivers. Faint to distinct mottles can be observed, slight seepage can be present, permafrost is maybe present but at variable depths. Signs of flooding also may be observed.	Y
23	Drainage Shrubby Riparian	Shrubby areas along undefined or very narrow drainage channels where shrub cover may include alder, scrub birch, Alaska paper birch, and willow. Some scattered stunted spruce (<5%) may be visible. Typically, these sites have a SMR that ranges from subhygric to subhydric and SNR ranging from poor to rich. Faint to distinct mottles can be observed, seepage may be present and most sites have permafrost but at variable depths.	Y
30	Moist Herb	These moist areas are dominated with herbaceous vegetation with less than 5% shrub cover and have a SMR ranging from subhygric to hygric. Faint to distinct mottles can be observed, no seepage or slight seepage maybe present, permafrost is present but at variable depths. Some ice crystals can be observed in the permafrost layer.	N

Code	Unit Name	Description and typical situation	Mapped (Y/N)
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	Areas dominated by an understory composed of scrub birch and northern Labrador tea and with less than 10% spruce cover. The shrub layer also may contain tea-leaved willow. Successional pathway is unknown and this site is considered a shrub disclimax site. Maybe part of seasonal drainage pathways. Similar to other sites, the SMR ranges from subhygric to hygric and the SNR ranges from poor to medium. Faint to distinct mottles can be observed, slight seepage may be present. Permafrost is present and some ice crystals can be observed in the permafrost layer.	Y
32	Moist Shrub \ Spruce – Scrub Birch – Labrador Tea	Areas dominated by greater than 10% spruce cover, less than 5% willow cover, and greater than 15% lowbush cranberry cover. The successional pathway is unknown and this site is also considered a shrub disclimax site. The SMR ranges from subhygric to hygric and the SNR ranges from poor to medium. Faint to distinct mottles can be observed, slight seepage may be present. Permafrost is present and at various depths. Some ice crystals can be observed in the permafrost layer.	N
33	Moist Spruce – Labrador Tea	Areas dominated by greater than 10% spruce tree cover. Presence of *Cladonia* species (caribou forage species). Can be found on both cool and warm aspects. Large variation in tree canopy closure from very open to closed. The SMR ranges from subhygric to hygric and the SNR ranges from poor to medium. Faint to distinct mottles can be observed, slight seepage may be present. Permafrost is present and at variable depths. Some ice crystals can be observed in the permafrost layer.	Y
34	Moist Spruce – Alder – Labrador Tea	Area dominated by greater than 15% spruce tree cover with presence of alder understory. Presence of *Cladonia* species (caribou forage species). Generally found on cooler aspects. The SMR ranges from subhygric to hygric and the SNR ranges from poor to medium. Faint to distinct mottles can be observed, slight seepage may be observed, and permafrost is present but at variable depths due to frost boils. Some ice crystals can be observed in the permafrost layer. Can be difficult to differentiate from Code 33 in some imagery.	Y
35	Moist Spruce – Scrub birch – Labrador Tea	Area dominated by less than 15% spruce tree cover. Presence of *Cladonia* species (caribou forage species). May have dense scrub birch understory. Generally found on warmer aspects. The SMR ranges from subhygric to hygric and the SNR ranges from poor to medium. Faint to distinct mottles can be observed, slight seepage may be observed, and permafrost is present but at variable depths due to frost boils. Some ice crystals can be observed in the permafrost layer. Can be difficult to differentiate from Code 33 in some imagery.	Y
36	Moist Birch – Willow	Area dominated by willow and birch trees often associated with old anthropogenic disturbances and successional pathway unknown. The SMR ranges from subhygric to hygric and the SNR is typically medium. Faint to distinct mottles can be observed, slight seepage may be observed, and permafrost is present but at variable depths due to frost boils. Some ice crystals can be observed in the permafrost layer.	Y
40	Wet Herb	Area dominated with herbaceous vegetation with less than 5% shrub cover. The SMR ranges from hygric to subhydric and the SNR is variable. Distinct to prominent mottles can be observed, seepage is present, and permafrost layer is near the surface. A layer of ice is typically present within or above the frozen soil or frozen organic layer.	N

Code	Unit Name	Description and typical situation	Mapped (Y/N)
41	Wet Shrub – Tamarack	Area with greater than 5% tamarack cover, low presence of *Cladonia* species (caribou forage species) and a high presence of Sphagnum or glow moss. Scrub birch and Labrador tea are present in the shrub layer. Often present in thin strips between bog and riparian areas. The SMR ranges from hygric to subhydric and the SNR ranges from poor to medium. Distinct to prominent mottles can be observed, seepage is present, and permafrost layer is near the surface. A layer of ice is typically present within or above the frozen soil or frozen organic layer. May be underrepresented in mapping because this ecosite often does not make up an entire decile.	Y
42	Wet Shrub – Black Spruce – Tussock Cottongrass	Area dominated by greater than 5% black spruce and 10% tussock cottongrass. There is the presence of Labrador tea, scrub birch, *Sphagnum* and *Cladonia* species (caribou forage species). This is a disclimax shrub community. The SMR ranges from hygric to subhydric and the SNR ranges from poor to medium. Distinct to prominent mottles can be observed, seepage is present, and permafrost layer is near the surface. A layer of ice is typically present within or above the frozen soil or frozen organic layer.	Y
43	Wet Shrub – Black Spruce - Sphagnum	Area dominated by greater than 5% black spruce, less than 30% tussock cottongrass and greater than 25% *Sphagnum*. This is a disclimax shrub community. The SMR ranges from hygric to subhydric and the SNR ranges from poor to medium. Distinct to prominent mottles can be observed, seepage is present, and permafrost layer is near the surface. A layer of ice is typically present within or above the frozen soil or frozen organic layer.	Y
44	Wet Shrub – Scrub Birch – Tussock Cottongrass	Area dominated by less than 5% black spruce, greater than 10% scrub/shrub birch and greater than 30% tussock cottongrass. This is a disclimax shrub community. The SMR ranges from hygric to subhydric and the SNR ranges from poor to medium. Distinct to prominent mottles can be observed, seepage is present, and permafrost layer is near the surface. A layer of ice is typically present within or above the frozen soil or frozen organic layer.	Y
45	Wet Shrub – Scrub Birch - Graminoid	Area is composed of less than 5% black spruce; dominant shrub is scrub/shrub birch and dominant graminoid is either spruce muskeg sedge or bluejoint reedgrass. This is a disclimax shrub community. The SMR ranges from hygric to subhydric and the SNR ranges from poor to medium. Distinct to prominent mottles can be observed, seepage is present, and permafrost layer is near the surface. A layer of ice is typically present within or above the frozen soil or frozen organic layer. Difficult to differentiate from Code 44.	Y
46	Wet Black Spruce – Labrador Tea – Cladonia	Area has greater than 15% black spruce, greater than 20% *Cladonia* species (caribou forage species) and less than 5% tussock cottongrass. Often associated with Code 44 sites, as transition between wet shrub 44 and treed moist 33. The SMR ranges from hygric to subhydric and the SNR ranges from poor to medium. Distinct to prominent mottles can be observed, seepage is present, and permafrost layer is near the surface. A layer of ice is typically present within or above the frozen soil or frozen organic layer. Difficult to differentiate from Codes 33 and 47. If canopy closure is open, *Cladonia* component is visible; however, if closed canopy, then difficult to differentiate between Codes 46 and 47 because *Cladonia* and cottongrass components are difficult to see. Difficult to differentiate from Code 33 because both ecosites are found in similar areas, but moisture content can vary from area to area. Likely Code 46 is underrepresented and called Code 33 in some areas.	Y

Code	Unit Name	Description and typical situation	Mapped (Y/N)
47	Wet Black Spruce – Tussock Cottongrass - Sphagnum	Area has greater than 15% Labrador tea, and less than 10% *Cladonia* species (caribou forage species). The SMR ranges from hygric to subhydric and the SNR is typically medium. Distinct to prominent mottles can be observed, seepage is present, and permafrost layer is near the surface. A layer of ice is typically present within or above the frozen soil or frozen organic layer. Difficult to differentiate from Codes 33 and 46. If canopy closure is open, cottongrass components is visible; however, if closed canopy, then difficult to differentiate between Codes 46 and 47 because *Cladonia* and cottongrass components are difficult to see. Difficult to differentiate from Code 33 because both ecosites are found in similar areas, but moisture content can vary from area to area. Likely Code 47 is underrepresented and called 33 in some areas.	Y
48	Wet Black Spruce – Carex	Area where herbaceous layer is dominated by either spruce muskeg sedge or bluejoint reedgrass and shrub layer is a mixture of Labrador tea, scrub birch and willow species greater than 30% cover. The SMR ranges from hygric to subhydric and the SNR ranges from poor to medium. Distinct to prominent mottles can be observed, seepage is present, and permafrost layer is near the surface. A layer of ice is typically present within or above the frozen soil or frozen organic layer. Difficult to differentiate from Code 47 in some imagery. May be underrepresented in mapping because this ecosite often does not make up an entire decile.	Y
B1	Bog – Black spruce – Lichen	Treed or shrubby peatland ecosystem unit with poor nutrient regime within the rooting zone. Stunted black spruce with less than 50% sphagnum and greater than 10% *Cladonia* species. The SMR typically ranges from subhydric to hydric. These sites generally have a thick fibric organic layer and there is the presence of permafrost. Seepage is present.	Y
B2	Bog – Black Spruce – Sphagnum	Treed or shrubby peatland ecosystem unit with poor to medium nutrient regime within the rooting zone. Stunted black spruce with greater than 50% sphagnum. The SMR typically ranges from subhydric to hydric. These sites generally have a thick fibric organic layer and there is the presence of permafrost. Seepage is present.	Y
F	Fen	Treed, shrubby or graminoid peatland ecosystem unit where groundwater inflow maintains relatively high mineral content within the rooting zone. Graminoid fen has greater than 20% Sphagnum or moss cover. The ecosystem has a hydric moisture regime and a nutrient regime that can range from poor to rich. These sites generally have a thick fibric organic layer and there is the presence of permafrost. Seepage is often present.	Y
M	Marsh	Shallowly flooded mineral wetland ecosystem dominated by emergent vegetation. Area dominated by graminoids and has less than 10% Sphagnum or moss cover. Seepage, permafrost and gleying are often observed.	Y
S	Swamp	Treed or shrubby mineral wetland ecosystem unit dominated trees and shrubs on sites with a flowing or fluctuating, semi-permanent, near-surface water table.	N
W	Shallow-water	Shallow water ecological communities dominated by rooted, water submerged floating aquatic plants.	N
AN	Anthropogenic	An area of anthropogenic disturbance, not included in other definitions (e.g., areas cleared for camps).	Y
ES	Exposed Soil	Any area of exposed soil, not included in other definitions. Includes areas of recent disturbance (e.g., terrain slides) and human-made disturbances where vegetation cover is less than 5%.	Y

Code	Unit Name	Description and typical situation	Mapped (Y/N)
Fa	Flood Active Channel	Ecological communities scoured by river floodwaters for prolonged periods. Usually dominated by annuals, or herbs that can re-sprout from underground structures. May be underrepresented in mapping because this ecosite often does not make up an entire decile.	Y
LA	Lake	A body of water greater than 2 m deep or large enough to be classified as a lake (greater than 8 ha).	Y
PD	Pond	A small body of water greater than 2 m deep, but not large enough to be classified as a lake (less than 8 ha). May be underrepresented in mapping because this ecosite often does not make up an entire decile.	Y
RI	River	A watercourse formed when water flows between continuous, definable banks. The flow may be intermittent or perennial.	Y
RZ	Road	An area cleared and compacted for the purpose of transporting goods and services by vehicle. May be underrepresented in mapping because this ecosite often does not make up an entire decile.	Y

2.2.3 ELC MAPPING DATABASE

After acquiring spatial data and reviewing available supporting information, ELC mapping was completed in two dimensions directly to a digital system using ArcMap in ArcGIS 10.7.0. Polygon delineation and attribution were completed for the entire RSA. The ELC mapping was completed at a scale of 1:10,000, with a target average polygon size of 30 ha.

As the Yukon Ecological and Landscape Classification and Mapping Guidelines recommended, mappers used the delineation methods outlined in the Standard for Terrestrial Ecosystem Mapping in British Columbia (Resources Inventory Committee 1998) as a guideline. The ELC polygons were delineated by biologists based upon discernible differences among the following criteria:

- vegetation (species composition, canopy characteristics, stand age and height);
- topography (landscape position, aspect, slope, drainage patterns);
- terrain (landform/parent material);
- soils (depth and drainage); and,
- gradients and patterns (relationship patterns between ecosystem units, polygon shape and orientation).

Several large wildfires have affected the RSA between 1959 and 2018 (Map 2-1). Areas that were affected by fire, and are still regenerating, were labelled with a fire disturbance code. For older burn areas, the adjacent non-burned area was compared to the burn area to see if there was a noticeable difference in vegetation. Areas that did not have a noticeable difference were not characterized as fire disturbed as they are considered regenerated. The appropriate structural stage was assigned to reflect the stage of regeneration.

All ELC polygons were assessed individually (in two dimensions using supporting spatial data files in ArcMap) and ecological attributes were estimated and entered in the ELC database (Table 2-2). The attributes were assessed and entered, taking care that:

1) no more than three ecosystem units (i.e., ecosites) were entered per polygon;

2) defined ecosite and modifier codes were used; and,

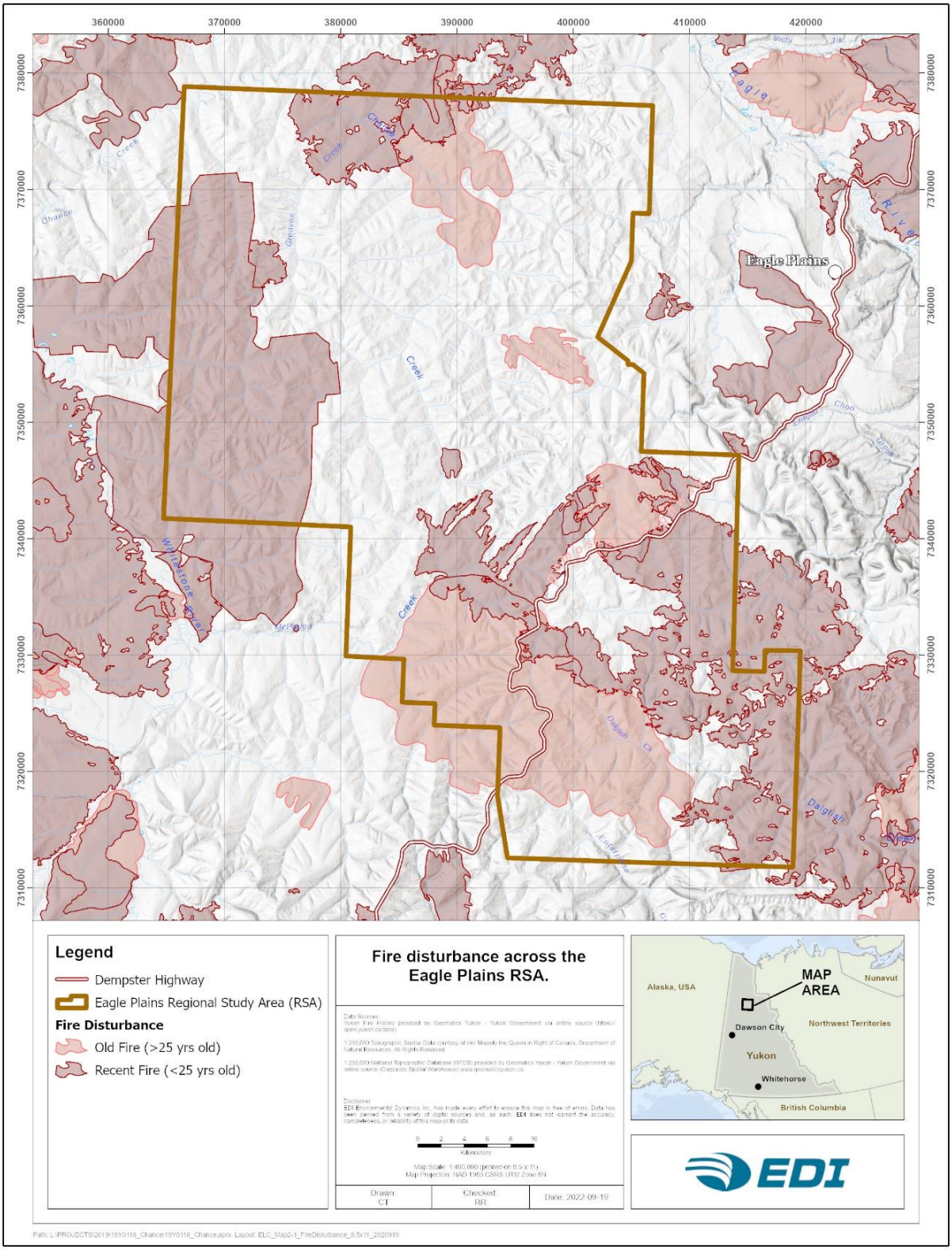
3) all information was completed for every polygon.

The descriptions and codes of assumed and atypical site modifiers, structural stages and stand modifiers used are presented in Attachment A.

After completing the mapping, the ELC database was reviewed through an internal quality assurance process for completeness and correctness, including the correct application of ecosites, structural stages, disturbance types and canopy composition modifiers. Finally, the spatial attributes of the ELC database were reviewed to ensure all deciles sum to 100%, and that no sliver polygons (typically <1 ha) or polygon overlaps remained. A finalized seamless polygon spatial coverage was prepared following database review.

Table 2-2. ELC database fields and descriptions.

ELC Database Field	Field Description
UniqueID	Unique Polygon Identifier
Eco_Reg	Ecoregion
Bio_Zon	Bioclimate Zone
Bio_Subzon	Bioclimate Subzone
SDEC_1	Decile 1 (percentage of the polygon from 4 – 10)
EcositeS1	Ecosite for Decile 1
SiteAM_S1a	Assumed Modifier 1 for Ecosite 1
SiteAM_S1b	Assumed Modifier 2 (if applicable)
SiteAM_S1c	Assumed Modifier 3 (if applicable)
SiteM_1a	Atypical Site Modifier 1 (if applicable)
SiteM_1b	Atypical Site Modifier 2 (if applicable)
Strct_S1	Structural Stage for Decile 1
Strct_M1	Structural Stage modifier
Stand_A1	Stand Composition Modifier: B (Broadleaf), C (Coniferous) or M (Mixedwood)
Distcls_1	Disturbance Modifier: T (Terrain), S (Soil), L (Logging)
Dec_1_Area	Area of Decile 1 (hectares)
SDEC _2	Decile 2 (percentage of the polygon from 0 – 5)
EcositeS2	Same sequence as above for Decile 2; ends at Dec_2_Area
SDEC _3	Decile 3 (percentage of the polygon from 0 – 3)
EcositeS3	Same sequence as above for Decile 3; ends at Dec_3_Area
Area_Ha	Total Polygon Area (hectares)
Interpreter	Initials of ecosystem mapper
Source	Source of Estimate: P (Photo estimate), G (Ground plot), V (Visual plot), A (Aircall/from afar)
Plot_ID	ID of Field plot(s) completed in polygon



Map 2-1. Fire disturbances across the Eagle Plains RSA, 1959–2018.

2.2.4 LIMITATIONS

The type and variety of imagery used for the ELC mapping created several polygon attributions and delineation limitations. Imagery sources across the RSA varied, resulting in differences in the quality of imagery available for a given area. The differences in quality included changes in resolution, sharpness, cloud cover and time of year that the imagery was taken. The mappers were required to "re-calibrate" when encountering each new imagery set. A full range of ELC field plots was not available in all imagery sets, so representative plots were not always available to aid in interpreting the imagery. In these cases, estimations or best guesses were made based on plots found in similar imagery.

Several of the ecosites were challenging to differentiate from each other. Some ecosites may be over or underrepresented in the polygon attribution. This was compounded by the variety of imagery used to complete the mapping. Some ecosites were even more difficult to differentiate in imagery with poor resolution. The most common or likely ecosite found in that location (based on slope, aspect and surrounding ecosites) was chosen for attribution.

Attributing the fire-disturbed polygons was completed based on the expected ecosite for that location (based on slope, aspect and surrounding ecosites). The post-fire successional pathways for many of the ecosites were the same or very similar, making differentiating ecosites based on revegetation difficult. Often the post-fire succession also varied for an ecosite depending on several factors, including: the number and frequency of fires, the intensity of the fire, and the amount of permafrost present before and after the fire. Field observations suggest that hot fires likely melt a larger portion of the permafrost, permanently altering the moisture regime of the affected area; therefore, sites become drier and do not return to the same ecosite that had been established before the fire.

The current structural stage for some of the more recent fire-disturbed areas was difficult to determine due to the range in age and variety of the imagery (Photo 2-1 and Photo 2-2). To be consistent, the mappers assigned a shrub structural stage to all fire disturbed areas unless strong evidence suggested another structural stage (i.e., a plot stating it was graminoid dominant). The structural stage for older fire-disturbed areas was detectable from the imagery.



Photo 2-1. Recent fire through lichen-dominated mesic site.



Photo 2-2. Regenerating moist ecological unit.

3 RESULTS

3.1 FIELDWORK

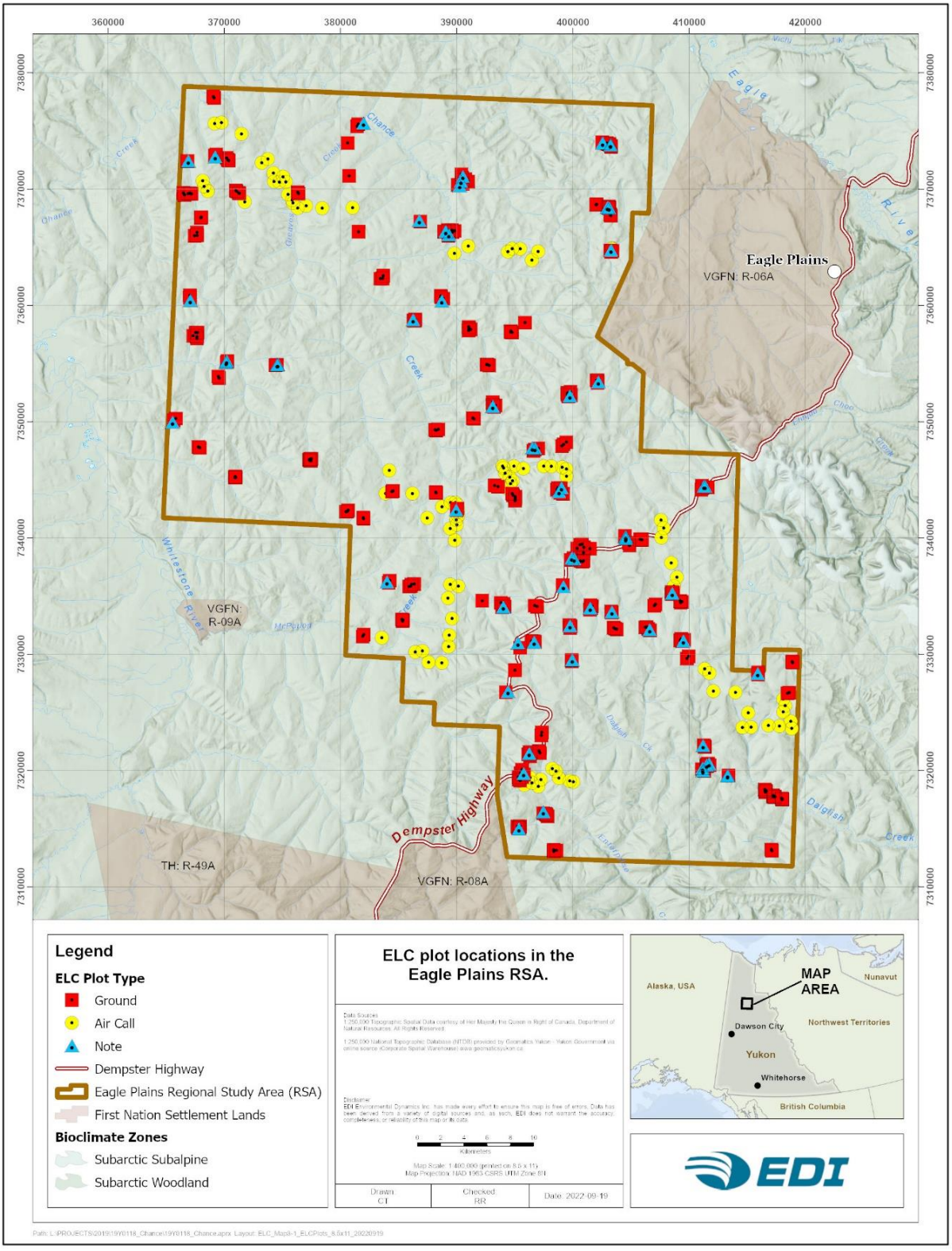
The ELC fieldwork was completed between June 25 and July 7, 2019, and July 26 and August 7, 2019. Sampling was conducted by one crew of two EDI personnel. Field plots were accessed using ground transportation (truck) and helicopter to obtain good area coverage and sample a diversity of ecological communities.

A total of 450 ELC field plots were completed, consisting of 286 ground plots (64%), 63 visual notes (14%), and 101 visual air calls (22%) (Map 3-1). Field surveys documented 126 different plant species, including 6 tree species, 29 shrub species, 48 forb species, 7 ferns and fern allies, 12 graminoid species, 11 lichen species, 10 moss species, and 2 liverwort species (Attachment B).

The terrain and vegetation in the RSA made access difficult for field crews in some areas. Helicopter landing sites had scattered availability, and the Dempster Highway was the only road providing access into the RSA. When on-the-ground field crews could not access a location, air calls were made to complete ELC observations of that area. Achieving the minimum intensity as laid out by the Yukon ELC Mapping Guidelines (Environment Yukon 2016) was impossible. However, due to the landscape's homogenous nature, field crews could obtain an adequate number of field survey plots to provide representative coverage of each ecosite type during the field assessments (Photo 3-1).



Photo 3-1. Photograph showing various plant species present in RSA.



Map 3-1. ELC plot locations in the Eagle Plains RSA.

3.2 ELC MAPPING

A total of 6,617 ELC polygons were delineated and attributed within the RSA. The polygons ranged from 2.3 ha to 248.5 ha, with an average polygon size of 36 ha. All but two polygons were under 168 ha; the two largest polygons represent long, narrow creek habitats. Large polygons generally covered large homogenous slopes and were often in fire-disturbed areas. The smaller polygons delineated small water bodies, wetland, or special wildlife features. A total area of 238,640 ha was mapped (Attachment C).

Forty potential ecosystem units were initially developed for the Project. However, that list was reduced to 31 for mapping purposes. Some ecosystem units had very small extents and did not constitute a large enough component of polygons to map. Some ecosystem units were difficult to differentiate from similar ecosystem units and maybe underrepresented. Refer to Attachment D for ecosystem unit photographs.

Table 3-1 and Map 3-2 shows the general breakdown of ecosystem extents by group. Most of the RSA has a soil moisture regime ranging from moist to wet. Sixty-four percent of the RSA comprises moist ecosystem units, and another 13% comprises wet ecosystem units. The RSA is composed of approximately 2,528 ha of sites officially classified as wetland habitat. However, many moist and wet ecosystems have vegetation associations and structures similar to wetlands (bogs). Bogs were the most common wetland ecosystem unit mapped across the RSA. No swamps were identified during the field program, and no swamps were mapped within the RSA. Seventeen percent of the RSA has ecosystem units within a mesic soil moisture regime. Only 2% of the RSA comprises dry ecosystem units (Table 3-1), typically found on warm steep aspects. Approximately 707 ha was mapped as non-vegetated units (Anthropogenic, Exposed Soil, Flood Active Channel, Lake, Pond, River and Road). The most common non-vegetated unit was associated with Rivers (457 ha).

Fire is a common natural disturbance in the RSA; many forest stands show signs of previous burns. Historic oil and gas exploration disturbances, including seismic lines, winter roads, and well sites were observed throughout the RSA (Photo 3-2). No evidence of recent human activity was observed except within a few hundred metres of the Dempster Highway.

The most common plant species recorded across all soil moisture regimes throughout the RSA are black spruce, scrub/shrub birch, lowbush cranberry, northern Labrador tea (*Rhododendron tomentosum*) and alpine blueberry (*Vaccinium uliginosum*). Prickly rose and crowberry (*Empetrum nigrum*) are typically observed in dry to moist sites and baked apple/cloudberry and Arctic sweet coltsfoot (*Petasites frigidus*) are usually observed in moist to wet sites. Herbaceous forb cover is limited across the RSA.

The most common ecosystem unit mapped in the RSA is Moist Spruce – Labrador Tea (Code 33) (44%) followed by Moist Spruce – Alder – Labrador Tea (Code 34) (12%) and Mesic Black Spruce – Alaska Paper Birch (Code 04) (9%) (Table 3-2). The least common (<0.05%) ecosystem units mapped in the RSA are Dry Sparsely Vegetation (Code 10) and Mesic Birch – Willow (Code 02), and Moist Birch – Willow (Code 36) (Table 3-2). Both Birch – Willow ecosystem units are influenced by anthropogenic disturbances. Other less common ecosystem units that occur more naturally are Dry Aspen (Code 17), Mesic White Spruce – Alaska Paper Birch – Alder (Code 03), and Wet Shrub Scrub Birch – Graminoid (Code 45) (Table 3-2).

In many cases, it was challenging to differentiate some ecosystem units solely based on the imagery: 1) especially between ecosystem units with similar plant species composition but different soil moisture regimes such as Dry Spruce – Lichen (Code 14), Mesic Black Spruce – Labrador Tea (Code 06) and Moist Black Spruce – Labrador Tea (Code 33); or 2) between ecosystem units with slightly different plant species composition in the understory and with similar soil moisture regimes such as Moist Spruce – Alder – Labrador Tea (Code 34) and Moist Spruce – Scrub Birch – Labrador Tea (Code 35).

The Dry Spruce–Lichen (Code 14) ecosystem unit is a spruce dominated conifer stand with an understory composed of 40% shrubs such as scrub/shrub birch, prickly rose, lowbush cranberry, alpine blueberry and crowberry and it can have a small component of Alaska paper birch (*Betula neoalaskina*) in the canopy. This ecosystem unit typically has less than 2% forb cover, has no graminoid cover, and less than 5% moss cover but greater than 50% lichen cover. Lichen cover is usually very diverse and includes the following species: *Cladonia arbuscula* (10–50% cover), *Cladonia rangiferina* (1–20% cover), *Cladonia stellaris* (1–20% cover), *Cladonia* species (5–15% cover), *Stereocaulon* species (5–30% cover), *Flavocetraria* species (1–20% cover and with some *Nephroma arcticum* and *Peltigera aphthosa* presence (1% cover).

The Dry Aspen – Lichen (Code 15) ecosystem unit is an aspen dominated deciduous stand on south facing slopes with an understory composed of lowbush cranberry, crowberry, and bearberry. This ecosystem unit may have greater than 5% forb cover, less than 1% graminoid cover and less than 5% moss cover. The lichen cover is high and mostly composed of *Cladonia arbuscula* (>10%), *C. rangiferina* (>10%), *Stereocaulon* species (>10%) and *Flavocetraria* species (>10%).

The Dry Spruce – Birch – Lichen (Code 16) ecosystem unit is a mixedwood dominated stand composed of spruce and Alaska paper birch, with an understory composed of prickly rose, lowbush cranberry, bearberry (*Arctostaphylos uva-ursi*), less than 2% forb cover and less than 10% moss cover. This ecosystem unit has greater than 30% lichen cover. The lichen cover is composed of *Cladonia arbuscula* (2–25% cover), *Cladonia* species (5–20% cover), *Stereocaulon* species (5–25% cover) and *Flavocetraria* species (1–15% cover).

The Mesic Black Spruce – Alaska Paper Birch (Code 04) ecosystem unit is typically a mixedwood plant community dominated by spruce and Alaska paper birch with an understory composed of more than 60% shrubs such as northern Labrador tea, prickly rose, willow species, scrub/shrub birch, lowbush cranberry, alpine blueberry, and Alaska spiraea (*Spiraea stevenii*). This ecosystem unit also includes Alaska wild-rhubarb (*Aconogonon alaskanum*), and the small presence of horsetails (*Equisetum* species). The ground cover is variable but typically composed of a mix of feathermosses (> 10%) and lichens (>35%). The lichen cover is very diverse but usually consists of the following species: *Cladonia arbuscula* (1–40% cover), *Cladonia rangiferina* (0–20% cover), *Cladonia stellaris* (1–20% cover), *Cladonia* species (0–20% cover), and Flavocetraria cucullate (2–20%) cover. This ecosystem unit may also contain *Stereocaulon* species (0–15% cover), *Cetraria islandica* (0–5% cover), *Nephroma arcticum* (0–15% cover), and *Peltigera aphthosa* (0–5% cover).

The Mesic Alaska Paper Birch (Code 05) ecosystem unit is an Alaska paper birch-dominated deciduous stand with an understory composed of alder (*Alnus viridis*), willow species, prickly rose and wild red currant. This unit has a feathermoss ground cover (5–20%), a graminoid cover greater than 5% composed of Poa species (*Poaceae* species) and no lichen cover.

The Mesic Black Spruce – Labrador Tea (Code 06) ecosystem unit has a black spruce dominated canopy with a small component of Alaska paper birch, with an understory composed of northern Labrador tea, scrub/shrub birch, prickly rose, lowbush cranberry, willow species, wild red currant (*Ribes triste*) and less than 2% forb cover. This ecosystem unit usually has more than 3% Poa species (Poaceae species) and more than 15% of feathermoss cover and lichen cover ranging from none to 75%. The lichen cover mostly comprises Cladonia species such as *Cladonia arbuscula* and *C. stellaris*.

The Moist Spruce – Labrador Tea (Code 33) ecosystem unit has a black spruce-dominated canopy, while the understory species commonly include scrub/shrub birch, tea-leaved willow (*Salix planifolia*), northern Labrador tea, lowbush cranberry, baked apple, crowberry, prickly rose and a few herb species, including Arctic sweet coltsfoot, and narrow-leaved sawwort (*Saussurea angustifolia*). This ecosystem unit can have greater than 5% graminoid cover varying from spruce muskeg sedge (*Carex lugens*) (0–30%), tussock cotton-sedge (*Eriophorum vaginatum*) (0–10%) and Poa species (*Poaceae species*) (0–10%). This unit also has more than 15% of moss cover that can vary from step feathermoss (0–30%) (*Hylocomium splendens*) cover, Sphagnum (0–-35%) cover, glow moss (1–30%) (*Aulacomnium palustre*) and golden fuzzy fen moss (0–50%) (*Tomenthypnum nitens*). The lichen cover is usually similar or higher than the moss cover and dominated by *Cladonia arbuscula* (10–35%), *C. rangiferina* (5–30%) and *Flavocetraria cucullate* (3–20%).

The Moist Spruce – Alder – Labrador tea (Code 34) ecosystem unit also has a black spruce dominated canopy with a shrub understory greater than 45% cover composed of mostly alder, with some scrub/shrub birch, Alaska paper birch, northern Labrador tea, prickly rose, lowbush cranberry, baked apple/cloudberry and Alaska spirea. This unit has less than 10% graminoid species (*Poaceae* species), less than 20% lichen cover and greater than 40% feathermoss cover. The feathermoss cover comprises step feathermoss, red-stemmed moss (Pleurozium schreberi), and Sphagnum in some sites. *Cladonia arbuscula* and *C. rangiferina* and *Flavocetraria cucullate* make up the lichen cover.

The moist Spruce – Scrub Birch – Labrador Tea (Code 35) ecosystem unit also has a black spruce dominated canopy with a shrub understory greater than 40% cover composed of scrub/shrub birch, northern Labrador tea, crowberry (<10%), lowbush cranberry, alpine blueberry, willow species, baked apple/cloudberry and small bog cranberry (*Vaccinium oxycoccos*). Alder and Alaska paper birch are not included in this ecosystem unit. This unit has greater than 10% graminoid species composed of a spruce muskeg sedge and tussock cotton-sedge mixture. The bryophyte layer is mostly composed of Sphagnum moss, and the lichen layer mainly consists of *Cladonia* species such as *C. arbuscula* with some presence of *Cetraria islandica* (<5%).

The Wet Shrub Black Spruce – Tussock Cottongrass (Code 42) ecosystem unit is dominated by a shrub layer greater than 40% cover composed of black spruce, scrub/shrub birch, northern Labrador tea, lowbush cranberry, alpine blueberry, baked apple/cloudberry and small bog cranberry. This unit usually comprises 20 to 50% tussock cotton-sedge cover and less than 20% spruce muskeg sedge with greater than 10% bryophyte cover composed of *Sphagnum* species. The lichen cover is variable but usually composed of *Cladonia* species and *Flavocetraria cucullate*, with a small presence of *Cetraria islandica* (<10%). It also has a very low forb layer species diversity and percent cover (<2%).

The Wet Shrub Black Spruce – Sphagnum (Code 43) ecosystem unit is dominated by a shrub layer greater than 60% cover composed of black spruce, scrub/shrub birch, northern Labrador tea, lowbush cranberry, small bog cranberry and baked apple/cloudberry (>10%). This unit has less than 10% graminoid cover and the species present is usually a sedge species (<5%) and lichen cover is usually variable but composed of *Cladonia* species, *Flavocetraria* species and Arctic tumbleweed lichen (*Masonhalea richardsonii*). The bryophyte layer is generally greater than 30% cover and comprises Sphagnum species. It also has a very low forb layer species diversity and percent cover (<2%).

The Wet Shrub Scrub Birch – Tussock Cottongrass (Code 44) ecosystem unit is dominated by a shrub layer greater than 40% cover composed of scrub/birch, northern Labrador tea, alpine blueberry, lowbush cranberry, willow species (>5%), baked apple/cloudberry (<5%) and occasionally the presence of leatherleaf/Cassandra (*Chamaedaphne calyculata*) (0–10% cover). This unit has less than 10% lichen cover and a bryophyte layer ranging from 10 to 25% cover composed of a mixture of glow moss, Sphagnum species and *Polytrichum* species. The graminoid layer is greater than 40% cover and dominated by tussock cotton-sedge (>30%) with some spruce muskeg sedge (5–40%). This unit has a variable forb layer percent cover and species composition, including *Epilobium* species.

The Wet Black Spruce – Labrador Tea – Cladonia (Code 46) ecosystem unit has a black spruce tree layer greater than 15% and with a shrub layer greater than 60% cover composed of black spruce, scrub/shrub birch, northern Labrador tea, lowbush cranberry, tea-leaved willow, alpine blueberry and baked apple/cloudberry. Arctic sweet coltsfoot can be present in the forb layer. This unit can have a graminoid layer less than 30% cover and composed of a mixture of spruce muskeg sedge and tussock cotton-sedge. The bryophyte layer is variable but usually ranges between 25 to 50% cover and composed of glow moss, step moss, red-stemmed moss and Sphagnum species. The lichen layer can be greater than 30% cover and composed of various *Cladonia* species, *Flavocetraria cucullate* and with a small presence of *Peltigera aphthosa* (<5%).

The Wet Black Spruce – Tussock Cottongrass – Sphagnum (Code 47) ecosystem unit has a black spruce tree layer greater than 10% and with a shrub layer greater than 30% cover composed of scrub/shrub birch, norther Labrador tea, lowbush cranberry and baked apple/cloudberry. The graminoid layer is dominated with tussock cotton-sedge and Sphagnum dominates the bryophyte layer. The lichen layer has less than 20% cover and is dominated by *Cladonia* species.

The Wet Black Spruce – Carex (Code 48) ecosystem unit has a black spruce dominated tree layer with a shrub layer greater than 30% cover composed of black spruce, scrub/shrub birch, northern Labrador tea, prickly rose, lowbush cranberry and willow species. Sweet Arctic coltsfoot is present in the forb layer. The graminoid, bryophyte and lichen layers have variable percent covers. The graminoid layer includes *Carex* and *Calamagrostis* species, and the bryophyte layer comprises Sphagnum species.

Most of the RSA is mapped in a shrub structural stage (74%) with 45% of the RSA in a low shrub structural stage (Table 3-3). Only approximately 1% of the RSA is in an old forest structural stage and 21% is in a mature forest structural stage (Table 3-3) (Map 3-3). A table listing the mapped ecosite by structural stage can be viewed in Attachment E.



Photo 3-2. Example of some historical oil and gas disturbances.

Table 3-1. Grouped ecosystem units mapped in the Eagle Plains RSA.

Code	Group Name	Total Area (ha)	% of RSA
10s	Dry Ecosystem Units	4,294	1.8
00s	Mesic Ecosystem Units	40,298	16.8
20s	Riparian Ecosystem Units	6,181	2.6
30s	Moist Ecosystem Units	152,452	63.9
40s	Wet Ecosystem Units	31,880	13.4
Wetlands	Peat and Mineral Wetlands	2,828	1.2
	Total	**237,933**	**99.7**

Table 3-2. Ecosites mapped in the Eagle Plains RSA.

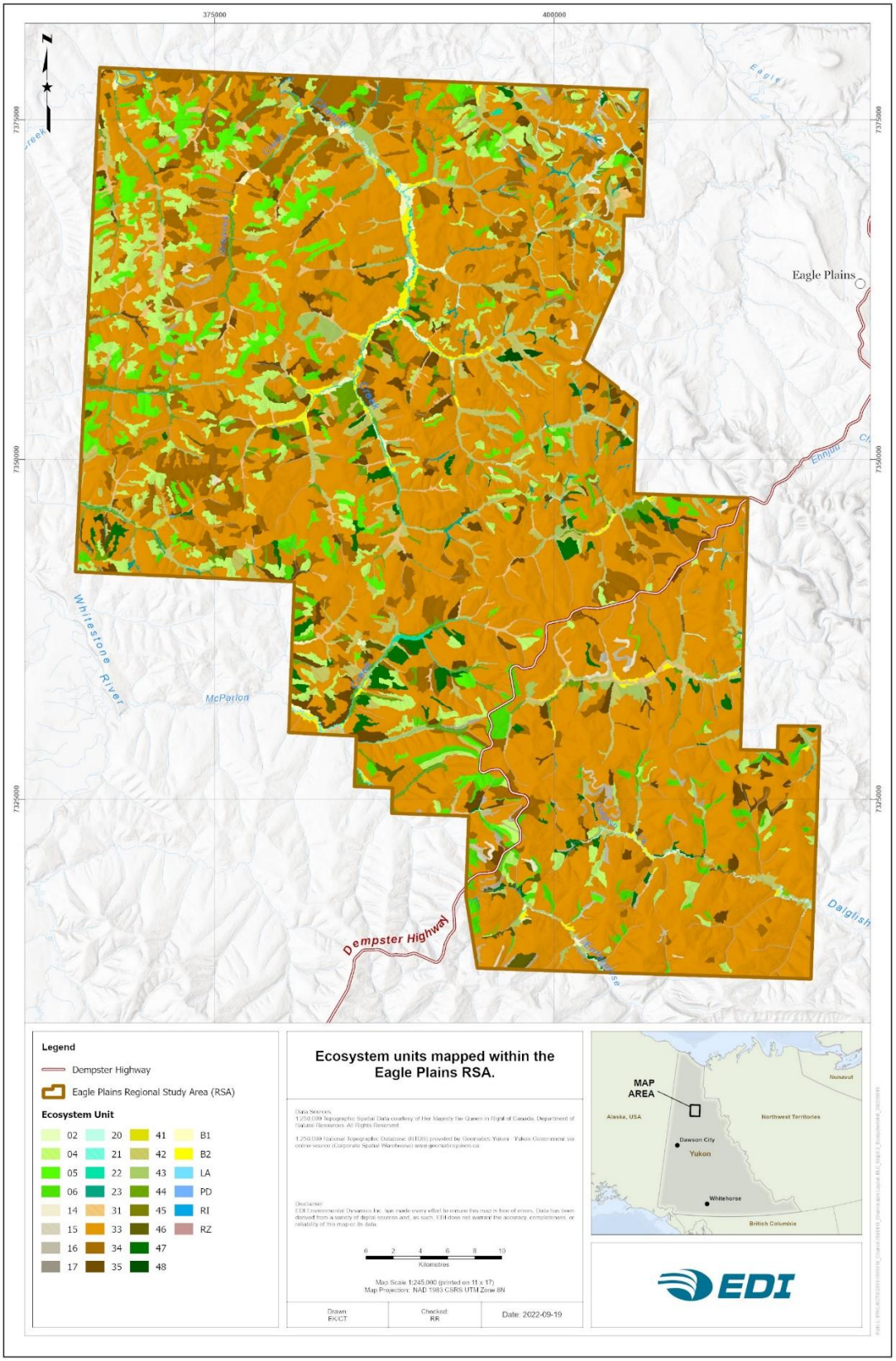
Code	Name	Total Area (ha)	% of RSA
10	Sparsely Vegetated	2.6	<0.05
14	Dry Spruce-Lichen (Conifer)	1,826.5	0.8
15	Dry Aspen-Lichen (Deciduous)	280.8	0.1

Code	Name	Total Area (ha)	% of RSA
16	Dry Spruce-Birch-Lichen (Mixedwood)	2,103.6	0.9
17	Dry Aspen (Deciduous)	80.1	<0.05
02	Mesic Birch - Willow	90.5	<0.05
03	Mesic White Spruce – Alaska Paper Birch – Alder	98.3	<0.05
04	Mesic Black Spruce – Alaska Paper Birch (mixedwood)	21,150.0	8.9
05	Mesic Alaska Paper Birch (Deciduous)	11,496.0	4.8
06	Mesic Black Spruce – Labrador Tea (Conifer)	7,463.5	3.1
20	Shrubby Riparian Birch – Willow	860.2	0.4
21	Riparian White Spruce – Prickly Rose	192.1	0.1
22	Riparian Spruce – Birch - Willow	674.4	0.3
23	Drainage Shrubby Riparian	4,454.2	1.9
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	9,129.9	3.8
33	Moist Spruce – Labrador Tea	103,696.5	43.5
34	Moist Spruce – Alder – Labrador Tea	27,428.6	11.5
35	Moist Spruce – Scrub birch – Labrador Tea	12,163.3	5.1
36	Moist Birch – Willow	33.4	<0.05
41	Wet Shrub – Tamarack	177.3	0.1
42	Wet Shrub – Black Spruce – Tussock Cottongrass	14,517.0	6.1
43	Wet Shrub – Black Spruce - Sphagnum	3,315.6	1.4
44	Wet Shrub – Scrub Birch – Tussock Cottongrass	6,844.7	2.9
45	Wet Shrub – Scrub Birch – Graminoid	98.7	<0.05
46	Wet Black Spruce – Labrador Tea – Cladonia	2,498.0	1.0
47	Wet Black Spruce – Tussock Cottongrass – Sphagnum	4,232.3	1.8
48	Wet Black Spruce – Carex	196.6	0.1
B1	Bog – Black spruce – Lichen	764.7	0.3
B2	Bog – Black Spruce – Sphagnum	1,960.9	0.8
F	Fen	42.5	<0.05
M	Marsh	59.5	<0.05
AN	Anthropogenic	34.9	<0.05
ES	Exposed Soil	14.5	<0.05
Fa	Flood Active Channel	5.1	<0.05

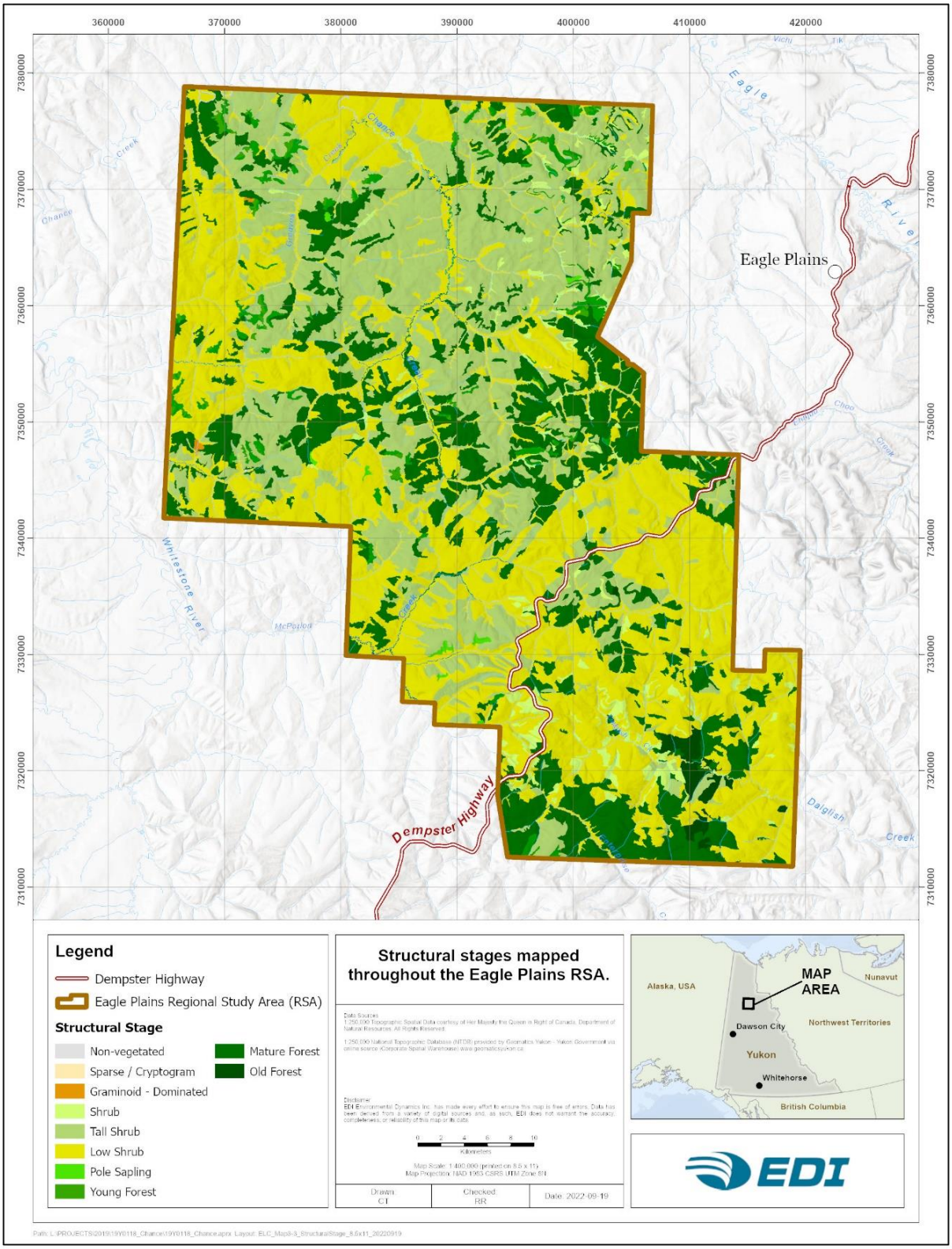
Code	Name	Total Area (ha)	% of RSA
LA	Lake	6.5	<0.05
PD	Pond	130.4	0.1
RI	River	457.1	0.2
RZ	Road	58.9	<0.05
	Total Area	238,640	

Table 3-3. Structural stages mapped in the Eagle Plains RSA.

Code	Structural Stage	Area (ha)	% of RSA
1	Non-vegetated	8.0	<0.05
2	Sparse / cryptogram	76.9	0.03
2a	Sparse (5-10% vegetation cover)	2.6	<0.05
3	Herb	7.8	<0.05
3b	Graminoid – dominated	161.1	0.07
3c	Aquatic	0	<0.05
3d	Dwarf shrub	0	<0.05
4	Shrub	10,196.7	4.3
4a	Tall shrub	57,934.3	24.3
4b	Low shrub	107,861.2	45.2
5	Pole sapling	554.8	0.2
6	Young Forest	8,322.6	3.5
7	Mature Forest	50,518.9	21.2
8	Old Forest	2,302.7	1.0
n/a	Not Applicable (River, etc.)	692.4	0.3
	Total RSA	**238,640**	



Map 3-2. Ecosystem units mapped within the Eagle Plains RSA.



Map 3-3. Structural stages mapped throughout the Eagle Plains RSA.

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ATTACHMENTS

ATTACHMENT A ELC MAPPING DESCRIPTIONS AND CODES

Comparison of ecosystem classes used in various existing ecological community mapping or classification systems.

North Yukon PEM		Peel PEM		Peel PEM correlation to Rosie 2000	Peel PEM Correlation to EOSD layer
Code	**Landscape Type Name**	**Code**	**Landscape Type Name**	**Ecosystem Class**	**Landscape Class**
100	High elevation rock/exposed	100	High elevation rock/exposed	Alpine Blockfields; Rocky Slopes	Rock/Rubble; Exposed Land
		102	High elevation dry sparse herb	Dryas/Lichen	Herb
110	High elevation sparsely vegetated	110	High elevation bryoid	Between Dryas/Lichen and Alpine Ground Shrub Meadows	Bryoid
111	High elevation herb	111	Dryas dwarf shrub	Similar to Alpine Ground Shrub Meadows	Herb
112	High elevation shrub	112	Subalpine shrub	Similar to Willow/Forbs	Tall Shrub; Low Shrub; Broadleaf Dense; Broadleaf Open; Mixedwood Open; Mixedwood Sparse
113	High elevation coniferous forest	113	High elevation coniferous forest	Open White Spruce/Ground Shrubs/Forbs	Conifer Dense; Conifer Open; Conifer Sparse
200	Low elevation exposed/sparsely vegetated	200	Low-mid elevation exposed/rock/rubble	Slumps (Detachment Slides)	Rock/Rubble; Exposed Land
210	Wet herb (plateau, valley)	210	Low-mid elevation wet herb	na	Herb
211	Wet shrub (plateau, valley)	211	Low-mid elevation wet shrub	Shrub Birch – Willow / Eriophorum	Tall Shrub Low Shrub
212	Wet mixedwood forest (plateau, valley)	212	Low-mid elevation wet mixedwood/broadleaf	Birch-Spruce / Alder-Rose	Broadleaf Dense; Broadleaf Open; Broadleaf Sparse; Mixedwood Dense Mixedwood Open; Mixedwood Sparse

North Yukon PEM		Peel PEM		Peel PEM correlation to Rosie 2000	Peel PEM Correlation to EOSD layer
Code	**Landscape Type Name**	**Code**	**Landscape Type Name**	**Ecosystem Class**	**Landscape Class**
213	Wet coniferous forest (plateau, valley)	213	Low-mid elevation wet coniferous forest	Low Black Spruce / Eriophorum / Sphagnum	Coniferous Dense; Coniferous Open; Coniferous Sparse
220	Moist herb (plateau, valley)	220	Low-mid elevation moist herb	Eriophorum Tussock	Herb
221	Moist shrub (plateau, valley)	221	Low-mid elevation moist shrub	Willow Stands	Tall Shrub; Low Shrub
222	Moist mixedwood forest (plateau, valley)	222	Low-mid elevation moist mixedwood/broadleaf	Birch-Spruce / Alder-Rose	Broadleaf Dense; Broadleaf Open; Broadleaf Sparse; Mixedwood Dense Mixedwood Open; Mixedwood Sparse
223	Moist coniferous forest (plateau, valley)	223	Low-mid elevation moist coniferous forest	Low Black Spruce / Shrub Birch-Willow / Moss-Lichen	Coniferous Dense; Coniferous Open; Coniferous Sparse
230	Mesic herb (plateau, valley)	230	Low-mid elevation dry herb	na	Herb
231	Mesic shrub (plateau, valley)	231	Low-mid elevation dry shrub	Shrub Birch / Lichen	Tall Shrub; Low Shrub
232	Mesic mixedwood forest (plateau, valley)	232	Low-mid elevation dry mixedwood/broadleaf	Birch-Spruce Stands	Broadleaf Dense; Broadleaf Open; Broadleaf Sparse; Mixedwood Dense Mixedwood Open; Mixedwood Sparse
233	Mesic coniferous forest (plateau, valley)	233	Low-mid elevation dry coniferous forest	na	Coniferous Dense; Coniferous Open; Coniferous Sparse
241	Dry Shrub				
242	Dry Mixedwood forest				
243	Dry Coniferous forest				
240	Dry herbaceous (lichen)	240	Low-mid elevation lichen	na	Bryoids

North Yukon PEM		Peel PEM		Peel PEM correlation to Rosie 2000	Peel PEM Correlation to EOSD layer
Code	**Landscape Type Name**	**Code**	**Landscape Type Name**	**Ecosystem Class**	**Landscape Class**
300	Riparian – exposed	300	Riparian gravel/sand bar	Gravel Bar (on Caribou River)	Rock/Rubble; Exposed Land
310	Riparian – herb	310	Riparian herb marsh	na	Bryoids; Wetland Herb; Herb
311	Riparian – shrub	311	Riparian shrub	River Alder – Willow	Tall Shrub; Low Shrub; Wetland Shrub
312	Riparian – mixedwood	312	Riparian mixedwood/broadleaf forest	Balsam Poplar Stands	Broadleaf Dense; Broadleaf Open; Broadleaf Sparse; Mixedwood Dense Mixedwood Open; Mixedwood Sparse
313	Riparian – conifer	313	Riparian Spruce forest	Tall White Spruce / Alder – Rose	Coniferous Dense; Coniferous Open; Coniferous Sparse
320	Riparian – wetland		na	na	Wetland Herb; Wetland Shrub Tall Shrub; Low Shrub; Herb
400	Wetland – herb	400	Wetland herb	Wetlands (various listed)	Wetland Herb
401	Wetland – shrub	401	Wetland shrub	na	Wetland Shrub
402	Wetland – forest	402	Wetland forested	Low Black Spruce / Ledum / Sphagnum	Wetland Treed
500	Open water	500	Open water	na	Water
	Open water (500)	501	Flowing water	na	Water
	na	510	Snow/ice	na	Snow / Ice

Comparison of Ecosite Units Used for ELC Mapping to the Existing PEMs.

Chance ELC		North Yukon PEM		Peel Watershed PEM	
Code	Name	Code	Name	Code	Name
10	Sparsely Vegetated	200	Exposed/Sparsely Vegetated	200	Mid-Low Elevation Exposed Rock/Rubble
11	Dry Herb			230	Mid-Low Elevation Dry Herb
12	Dry Lichen			230	Mid-Low Elevation Dry Herb
13	Dry Mix Shrub			231	Mid-Low Elevation Dry Shrub
14	Dry Spruce-Lichen (Conifer)			233 240	Mid-Low Elevation Dry Coniferous Forest Mid-Low Elevation Lichen
15	Dry Aspen-Lichen (Deciduous)			232	Mid-Low Elevation Dry Mixedwood/Broadleaf Forest
16	Dry Spruce-Birch-Lichen (Mixedwood)			232	Mid-Low Elevation Dry Mixedwood/Broadleaf Forest
17	Dry Aspen (Deciduous)			232	Mid-Low Elevation Dry Mixedwood/Broadleaf Forest
01	Mesic Herb	230	Mesic Herb		
02	Mesic Birch - Willow	231	Mesic Shrub		
03	Mesic White Spruce – Alaska Paper Birch - Alder	232	Mesic Mixedwood Forest		
04	Mesic Black Spruce – Alaska Paper Birch (mixedwood)	232	Mesic Mixedwood Forest		
05	Mesic Alaska Paper Birch (Deciduous)	232	Mesic Mixedwood Forest		
06	Mesic Black Spruce – Labrador Tea (Conifer)	233	Mesic Coniferous		
20	Shrubby Riparian Birch – Willow	311	Riparian Shrub	311	Riparian Shrub
21	Riparian White Spruce – Prickly Rose	313	Riparian Coniferous Forest	313	Riparian Spruce Forest
22	Riparian Spruce – Birch - Willow	313	Riparian Coniferous Forest	313	Riparian Spruce Forest
23	Drainage Shrubby Riparian	311	Riparian Shrub	311	Riparian Shrub
30	Moist Herb	220	Moist Herb	220	Mid-Low Elevation Moist Herb
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	221	Moist Shrub	221	Mid-Low Elevation Moist Shrub
32	Moist Shrub \ Spruce – Scrub Birch – Labrador Tea	221	Moist Shrub	221	Mid-Low Elevation Moist Shrub
33	Moist Spruce – Labrador Tea	223	Moist Coniferous Forest	223	Mid-Low Elevation Moist Coniferous Forest

Chance ELC		North Yukon PEM		Peel Watershed PEM	
Code	Name	Code	Name	Code	Name
34	Moist Spruce – Alder – Labrador Tea	223	Moist Coniferous Forest	223	Mid-Low Elevation Moist Coniferous Forest
35	Moist Spruce – Scrub birch – Labrador Tea	223	Moist Coniferous Forest	223	Mid-Low Elevation Moist Coniferous Forest
36	Moist Birch – Willow	222	Moist Mixedwood Forest	222	Mid-Low Elevation Moist Mixedwood/Broadleaf Forest
40	Wet Herb	210	Wet Herb	210	Mid-Low Elevation Wet Herb
41	Wet Shrub – Tamarack	211	Wet Shrub	211	Mid-Low Elevation Wet Shrub
42	Wet Shrub – Black Spruce – Tussock Cottongrass	211	Wet Shrub	211	Mid-Low Elevation Wet Shrub
43	Wet Shrub – Black Spruce - Sphagnum	211	Wet Shrub	211	Mid-Low Elevation Wet Shrub
44	Wet Shrub – Scrub Birch – Tussock Cottongrass	211	Wet Shrub	211	Mid-Low Elevation Wet Shrub
45	Wet Shrub – Scrub Birch - Graminoid	211	Wet Shrub	211	Mid-Low Elevation Wet Shrub
46	Wet Black Spruce – Labrador Tea – Cladonia	213	Wet Coniferous Forest	213	Mid-Low Elevation Wet Coniferous Forest
47	Wet Black Spruce – Tussock Cottongrass - Sphagnum	213	Wet Coniferous Forest	213	Mid-Low Elevation Wet Coniferous Forest
48	Wet Black Spruce – Carex	213	Wet Coniferous Forest	213	Mid-Low Elevation Wet Coniferous Forest
B1	Bog – Black spruce – Lichen	401 402	Wetland Shrub Wetland Forested	401 402	Wetland Shrub Wetland Forested
B2	Bog – Black Spruce – Sphagnum	401 402	Wetland Shrub Wetland Forested	401 402	Wetland Shrub Wetland Forested
F	Fen	400 402	Wetland Herb Wetland Shrub	400 402	Wetland Herb Wetland Shrub
M	Marsh	400	Wetland Herb	400	Wetland Herb
S	Swamp	401 402	Wetland Shrub Wetland Forested	401 402	Wetland Shrub Wetland Forested
W	Shallow-water	500	Open Water	500	Open Water

Site modifiers codes and descriptions

Modifier	Code	Criteria
Gentle slope	j	site occurs on gently sloping topography (less than 20%)
Cool	k	sites occur on cool, northerly aspects (300°-60°), on moderately steep slopes (20%-65%)
Warm	w	site series occurs on warm, southerly aspects (130°-230°), on moderately steep slopes (20-65%)
Steep cool	q	site series occurs on steep slopes (>65%) with cool, northerly aspects (300°-60°)
Steep warm	z	site series occurs on steep slopes (>65%) with warm, southerly aspects (130°-230°)
Shallow	s	site series occurs where soils are shallow to bedrock
Deep	d	site series occurs on soils are not considered to deep
Coarse-textured	c	site series occurs on soils with a coarse texture, including sand and loamy sand; sandy loam, loam and sandy clay loam with greater than 70% coarse fragment volume
Permafrost	p	Site is influenced by permafrost
Neutral	n	Sites occurs on flat ground (no aspect) or areas considered neither warm nor cool.

Structural stage modifier codes and descriptions

Modifier	Code	Criteria
Non-vegetated	1	No vegetation or less than 5% established vegetation; often due to recent disturbance (e.g., placer mining) or unvegetated rock.
Sparse/cryptogram	2	Either the initial stages of primary and secondary succession or a cryptogram community maintained by environmental conditions; sparsely vegetated or dominated by bryophytes and lichens; may be prolonged where there is little or no soil development (e.g., bedrock).
Sparse	2a	5 – 10% vegetation cover
Bryoid	2b	Bryophyte-dominated
Lichen	2c	Lichen-dominated
Herb	3	Early successional stage or herbaceous communities maintained by environmental conditions or disturbance (e.g., wetlands, post-fire forest succession); herb dominated, including forbs, graminoids and ferns; some invading or residual shrubs and trees may be present but are usually sparse or absent; many herbaceous communities are continually maintained in this stage.
Forb-dominated	3a	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by non-graminoid herbs, including ferns.
Graminoid dominated	3b	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by grasses, sedges, reeds and rushes.
Aquatic	3c	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by floating or submerged aquatic plants; does not include sedges growing in marshes with standing water.
Dwarf shrub	3d	Communities dominated (greater than 1/2 of the total herb cover) by dwarf woody species, such as kinnikinnick or dwarf willows.
Shrub	4	Early successional stage or shrub communities maintained by environmental conditions or disturbance (e.g., wetlands, flooding, post-fire forest succession); dominated by shrubby vegetation; either dominated by shrubby vegetation, including tree seedlings/saplings, or if sparsely vegetated overall, the dominance of shrubs characterizes the community as a shrubland. This may include sites where

Modifier	Code	Criteria
		trees are stunted due to the presence of permafrost, preventing the stand from reaching a higher structural stage.
Tall shrub	4a	Communities dominated by tall shrub layer vegetation - woody plants > 2m tall and ≤ 7 cm dbh; may be a successional stage or may be in this stage perpetually due to environmental conditions or disturbance.
Low shrub	4b	Communities dominated by low shrub layer vegetation - woody plants < 2m tall; may be a successional stage or may be in this stage perpetually due to environmental conditions or disturbance.
Pole sapling	5	Trees > 5m tall and > 7 cm dbh, typically densely stocked. Self-thinning and vertical structure are not yet evident in the canopy. Younger stands are vigorous (usually > 15–20 years old); older stagnated stands (up to 100 years old) are also included; time since disturbance usually < 40 years; up to 100+ years for dense (5000 – 15000+ stems per ha) stagnant stands.
Young forest	6	Self-thinning has become evident, and the forest canopy has begun to differentiate into distinct layers. A more open stand than the pole/sapling stage.
Mature forest	7	Trees established after the last stand-replacing disturbance have matured; a second cycle of shade tolerant trees may have become established; shrub and herb understories become well developed as the canopy opens up.
Old forest	8	Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstory. Fire maintained stands may have a 'single-storied' appearance. Very old stands having complex structure with abundant large-sized trees, snags and coarse woody debris (CWD); snags and CWD occurring in all stages of decomposition; stands are comprised entirely of shade-tolerant overstory species with well-established canopy gaps.

Stand composition modifiers and stand influencing site disturbance modifiers.

Modifier	Code	Criteria
Canopy Composition		
Coniferous	C	Greater than 3/4 of total tree layer cover is coniferous
Deciduous	D	Greater than 3/4 of total tree layer cover is broadleaf
Mixed	M	Neither coniferous nor broadleaf account for greater than 3/4 of total tree layer cover
Site Disturbance		
Fires	F	Areas influenced by wildfire
Seismic Line	S	Areas disturbed by seismic line, associated with oil and gas exploration.

ATTACHMENT B LIST OF PLANT SPECIES OBSERVED DURING ELC SURVEYS

List of plant species observed during baseline ELC plot surveys in the Eagle Plains Exploration RSA.

Scientific Name	Common Names	Synonym	Type	Tracked or Watched[1]
Diphasiastrum alpinum (L.) Holub	alpine clubmoss	*Lycopodium alpinum*	Fern and Fern Allies	Do Not Track
Dryopteris fragrans (L.) Schott	fragrant wood fern	*Dryopteris fragrans var. remotiuscula, Thelypteris fragrans*	Fern and Fern Allies	Do Not Track
Equisetum pratense Ehrh.	meadow horsetail		Fern and Fern Allies	Do Not Track
Equisetum scirpoides Michx.	dwarf scouring-rush		Fern and Fern Allies	Do Not Track
Equisetum sylvaticum L.	woodland horsetail	*Equisetum sylvaticum var. pauciramosum, Equisetum sylvaticum var. multiramosum*	Fern and Fern Allies	Do Not Track
Huperzia selago (L.) Bernh. ex Mart. & Schrank	fir clubmoss	*Lycopodium selago, Lycopodium selago ssp. selago*	Fern and Fern Allies	Do Not Track
Lycopodium annotinum L.	stiff clubmoss	*Spinulum canadense, Lycopodium canadense, Lycopodium annotinum ssp. pungens, Lycopodium annotinum var. annotinum, Lycopodium annotinum var. pungens, Spinulum annotinum*	Fern and Fern Allies	Do Not Track
Achillea millefolium L.	common yarrow	*Achillea lanulosa, Achillea millefolium ssp. borealis, Achillea millefolium var. borealis, Achillea millefolium var. nigrescens, Achillea millefolium var. occidentalis, Achillea millefolium ssp. lanulosa, Achillea millefolium var. lanulosa, Achillea millefolium var. alpicola, Achillea nigrescens, Achillea lanulosa var. lanulosa*	Forb	Do Not Track
Aconogonon alaskanum (Small) Soják	wild rhubarb	*Polygonum alpinum, Polygonum alpinum var. alaskanum, Polygonum alaskanum, Polygonum alpinum ssp. alaskanum*	Forb	Do Not Track
Arnica angustifolia Vahl	narrow-leaved arnica	*Arnica alpina ssp. angustifolia, Arnica alpina var. angustifolia*	Forb	Do Not Track
Artemisia campestris L.	field wormwood	*Artemisia borealis, Artemisia canadensis, Artemisia campestris ssp. borealis*	Forb	Do Not Track
Astragalus alpinus L.	alpine milk-vetch		Forb	Do Not Track

[1] According to the June 2019 Yukon Conservation Data Centre Plant List

Scientific Name	Common Names	Synonym	Type	Tracked or Watched[1]
Boschniakia rossica (Cham. & Schlecht.) Fedtsch.	northern groundcone		Forb	Do Not Track
Calla palustris L.	wild calla		Forb	Do Not Track
Chamaenerion angustifolium (Linnaeus) Scopoli	fireweed	Epilobium angustifolium, Chamerion angustifolium	Forb	Do Not Track
Chrysosplenium tetrandrum Th. Fries	northern golden-saxifrage	*Chrysosplenium alternifolium var. tetrandrum, Chrysosplenium alternifolium ssp. tetrandrum*	Forb	Do Not Track
Comarum palustre L.	marsh cinquefoil	*Potentilla palustris*	Forb	Do Not Track
Coptidium lapponicum (L.) Gandog.(Linnaeus) Gandoger ex Rydberg	lapland buttercup	*Ranunculus lapponicus*	Forb	Do Not Track
Corydalis sempervirens (L.) Pers.	pale corydalis	*Capnoides sempervirens*	Forb	Do Not Track
Delphinium glaucum S. Wats.	tall larkspur	*Delphinium brownii*	Forb	Do Not Track
Drosera rotundifolia L.	roundleaf sundew		Forb	Do Not Track
Epilobium ciliatum Raf.	hairy willow-herb	*Epilobium adenocaulon*	Forb	Do Not Track
Epilobium lactiflorum Hausskn.	white-flower willow-herb	*Epilobium alpinum var. lactiflorum*	Forb	Do Not Track
Galium trifidum L.	three-petalled bedstraw		Forb	Do Not Track
Gentianella propinqua (Richards.) J. Gillett	four-parted gentian		Forb	Do Not Track
Geocaulon lividum (Richards.) Fern.	orange berry bastard toadflax		Forb	Do Not Track
Hedysarum alpinum L.	alpine sweet-vetch	*Hedysarum alpinum var. americanum, Hedysarum alpinum ssp. americanum*	Forb	Do Not Track
Hippuris vulgaris L.	common mare's-tail		Forb	Do Not Track
Lupinus arcticus S. Wats.	Arctic lupine	*Lupinus multifolius, Lupinus yukonensis, Lupinus nootkatensis var. kjellmannii, Lupinus borealis*	Forb	Do Not Track
Mertensia paniculata (Ait.) G. Don	tall blue bells		Forb	Do Not Track
Micranthes hieraciifolia (Waldst. & Kit. ex Willd.) Haw.	hawkweed-leaved saxifrage	*Saxifraga hieracifolia, Saxifraga hieraciifolia*	Forb	Do Not Track
Moehringia lateriflora (L.) Fenzl	grove sandwort	*Arenaria lateriflora*	Forb	Do Not Track
Moneses uniflora (L.) Gray	single delight		Forb	Do Not Track

Scientific Name	Common Names	Synonym	Type	Tracked or Watched[1]
Orthilia secunda (L.) House	one-sided wintergreen	*Pyrola secunda ssp. obtusata, Pyrola secunda var. obtusata, Pyrola secunda, Pyrola secunda ssp. secunda*	Forb	Do Not Track
Parnassia palustris L.	northern grass-of-parnassus	*Parnassia palustris ssp. neogaea, Parnassia palustris var. neogaea, Parnassia palustris var. montanensis, Parnassia palustris var. tenuis, Parnassia montanensis, Parnassia multiseta*	Forb	Do Not Track
Pedicularis labradorica Wirsing	Labrador lousewort		Forb	Do Not Track
Petasites frigidus ssp. frigidus	Arctic coltsfoot	*Petasites frigidus var. frigidus*	Forb	Do Not Track
Petasites frigidus ssp. palmatus (Ait.) Cody	palmate coltsfoot	*Petasites frigidus var. palmatus, Petasites palmatus, Tussilago palmata, Nardosmia palmata*	Forb	Do Not Track
Pinguicula villosa L.	hairy butterwort		Forb	Do Not Track
Platanthera obtusata (Banks ex Pursh) Lindl.	small northern bog orchid	*Orchis obtusata, Habenaria obtusata, Lysiella obtusata*	Forb	Do Not Track
Pyrola asarifolia Michx.	pink wintergreen	*Pyrola asarifolia var. purpurea, Pyrola asarifolia ssp. asarifolia, Pyrola asarifolia var. asarifolia, Pyrola rotundifolia var. purpurea*	Forb	Do Not Track
Pyrola chlorantha Sw.	green flowered wintergreen	*Pyrola virens*	Forb	Do Not Track
Pyrola grandiflora Radius	Arctic wintergreen	*Pyrola grandiflora var. canadensis, Pyrola grandiflora var. gormanii, Pyrola gormani*	Forb	Do Not Track
Ranunculus gmelinii DC.	Gmelin's buttercup		Forb	Do Not Track
Rumex arcticus Trautv.	Arctic dock		Forb	Do Not Track
Saussurea angustifolia (Willd.) DC.	narrow-leaved sawwort		Forb	Do Not Track
Saxifraga tricuspidata Rottb.	prickly saxifrage		Forb	Do Not Track
Senecio sp.	groundsel		Forb	N/A
Solidago multiradiata Ait.	northern goldenrod	*Solidago multiradiata var. scopulorum, Solidago multiradiata var. multiradiata*	Forb	Do Not Track
Spiranthes romanzoffiana Cham.	hooded ladies-tresses		Forb	Do Not Track
Spiranthes romanzoffiana Cham.	hooded ladies'-tresses		Forb	Do Not Track
Stellaria calycantha (Ledeb.) Bong.	northern starwort		Forb	Watch

Scientific Name	Common Names	Synonym	Type	Tracked or Watched[1]
Tephroseris palustris (L.) Reichenbach	mastodon flower	*Senecio congestus, Tephroseris palustris ssp. congesta*	Forb	Do Not Track
Tofieldia pusilla (Michx.) Pers.	small tofieldia		Forb	Do Not Track
Valeriana capitata Pallas ex Link	clustered valerian		Forb	Do Not Track
Calamagrostis canadensis (Michx.) Beauv.	bluejoint reedgrass		Graminoid	Do Not Track
Calamagrostis sp.	reedgrass		Graminoid	N/A
Carex aquatilis Wahlenb.	water sedge		Graminoid	Do Not Track
Carex capillaris L.	hair-like sedge		Graminoid	Do Not Track
Carex disperma Dewey	softleaf sedge		Graminoid	Do Not Track
Carex limosa L.	mud sedge		Graminoid	Do Not Track
Carex lugens Holm	spruce muskeg sedge	*Carex bigelowii ssp. lugens*	Graminoid	Do Not Track
Carex rotundata Wahlenb.	round-fruited sedge		Graminoid	Do Not Track
Carex supina Willd. ex Wahlenb.	weak Arctic sedge		Graminoid	Do Not Track
Carex utriculata Boott	northern beaked sedge		Graminoid	Do Not Track
Eriophorum angustifolium Honckeny	narrowleaf cottongrass	*Eriophorum angustifolium ssp. subarcticum, Eriophorum angustifolium ssp. angustifolium, Eriophorum polystachion*	Graminoid	Do Not Track
Eriophorum vaginatum L.	tussock cottongrass	*Eriophorum vaginatum ssp. spissum, Eriophorum vaginatum ssp. vaginatum, Eriophorum spissum*	Graminoid	Do Not Track
Cetraria islandica (L.) Ach.	true Iceland lichen		Lichen	Do Not Track
Cladonia arbuscula ssp. mitis (Sandst.) Ruoss	green reindeer lichen	*Cladonia mitis, Cladina mitis*	Lichen	Do Not Track
Cladonia rangiferina (L.) F. H. Wigg.	grey reindeer lichen	*Cladina rangiferina*	Lichen	Do Not Track
Cladonia sp.	cladonia		Lichen	N/A
Cladonia stellaris (Opiz) Pouzar & Vezda	star reindeer lichen	*Cladina aberrans, Cladonia stellaris var. aberrans, Cladina stellaris var. aberrans, Cladina alpestris, Cladonia aberrans, Cladina stellaris*	Lichen	Do Not Track
Dactylina arctica (Richardson) Nyl.	Arctic butterfingers lichen		Lichen	Do Not Track

Scientific Name	Common Names	Synonym	Type	Tracked or Watched[1]
Flavocetraria cucullata (Bellardi) Karnefelt & Thell	curled snow lichen	*Cetraria cucullata, Allocetraria cucullata*	Lichen	Do Not Track
Flavocetraria nivalis (L.) Karnefelt & Thell	crinkled snow lichen	*Cetraria nivalis, Allocetraria nivalis*	Lichen	Do Not Track
Icmadophila ericetorum (L.) Zahlbr.	fairy puke		Lichen	Do Not Track
Masonhalea richardsonii (Hook.) Karnef.	Arctic tumbleweed lichen	*Cetraria richardsonii*	Lichen	Do Not Track
Stereocaulon sp.	foam lichen		Lichen	N/A
Marchantia polymorpha L.	green-tongued liverwort		Liverwort	Do Not Track
Ptilidium ciliare (L.) Hampe	ciliate fringewort		Liverwort	Do Not Track
Aulacomnium palustre (Hedw.) Schwaegr.	glow moss	*Aulacomnium palustre var. imbricatum, Aulacomnium palustre var. congestum*	Moss	Do Not Track
Drepanocladus sp.	hook moss		Moss	N/A
Hylocomium splendens (Hedw.) Schimp. in B.S.G.	step moss	*Hylocomium alaskanum, Hylocomium splendens var. obtusifolium*	Moss	Do Not Track
Mnium sp.	leafy moss		Moss	N/A
Nephroma arcticum (L.) Torss.	Arctic kidney lichen		Moss	Do Not Track
Peltigera aphthosa (L.) Willd.	common frecklepelt		Moss	Do Not Track
Pleurozium schreberi (Brid.) Mitt.	red-stemmed feathermoss		Moss	Do Not Track
Polytrichum sp.	haircap moss		Moss	N/A
Sphagnum sp.	sphagnum moss		Moss	N/A
Tomentypnum nitens (Hedw.) Loeske	woolly feather-moss	*Camptothecium nitens, Tomenthypnum nitens, Hypnum nitens, Camptothecium nitens var. leucobasis, Camptothecium nitens var. microtheca, Homalothecium nitens*	Moss	Do Not Track
Alnus alnobetula (Ehrh.) K. Koch	green alder	*Betula viridis, Alnus crispa, Alnus viridis*	Shrub	Do Not Track
Andromeda polifolia L.	bog rosemary		Shrub	Do Not Track
Arctostaphylos uva-ursi (L.) Spreng.	kinnikinnik	*Uva-ursi uva-ursi, Uva-ursi procumbens, Arbutus uva-ursi, Arctostaphylos uva-ursi var. uva-ursi, Arctostaphylos uva-ursi var. adenotricha, Uva-ursi procumbens var. adenotricha, Arctostaphylos uva-ursi ssp.*	Shrub	Do Not Track

Scientific Name	Common Names	Synonym	Type	Tracked or Watched[1]
		adenotricha, Arctostaphylos uva-ursi ssp. uva-ursi, Arctostaphylos uva-ursi ssp. stipitata, Arctostaphylos uva-ursi ssp. longipilosa		
Arctous rubra (Rehd. & Wilson) Nakai	red bearberry	*Arctous alpinus var. ruber, Arctous erythrocarpa, Arctostaphylos alpina var. rubra, Arctostaphylos alpina ssp. rubra, Arctostaphylos rubra*	Shrub	Do Not Track
Betula glandulosa Michx.	scrub birch/shrub birch		Shrub	Do Not Track
Chamaedaphne calyculata (L.) Moench	leatherleaf	*Chamaedaphne calyculata var. angustifolia*	Shrub	Do Not Track
Dasiphora fruticosa (L.) Rydb.	shrubby cinquefoil	*Dasiphora fruticosa ssp. floribunda, Potentilla fruticosa ssp. floribunda, Potentilla fruticosa, Potentilla floribunda, Pentaphylloides floribunda*	Shrub	Do Not Track
Empetrum nigrum L.	crowberry		Shrub	Do Not Track
Rhododendron tomentosum (Stokes) Harmaja	northern Labrador tea	*Ledum decumbens, Ledum palustre ssp. decumbens, Ledum palustre*	Shrub	Do Not Track
Rhododendron groenlandicum (Oeder) Kron & Judd	common Labrador tea	*Ledum palustre ssp. groenlandicum, Ledum groenlandicum*	Shrub	Do Not Track
Ribes hudsonianum Richards.	northern black currant		Shrub	Do Not Track
Ribes triste Pallas	wild red currant		Shrub	Do Not Track
Rosa acicularis Lindl.	prickly rose		Shrub	Do Not Track
Rubus chamaemorus L.	baked apple/cloudberry		Shrub	Do Not Track
Rubus idaeus L.	red raspberry		Shrub	Do Not Track
Salix alaxensis (Anderss.) Coville	felt-leaf willow		Shrub	Do Not Track
Salix arbusculoides Anderss.	little-tree willow		Shrub	Do Not Track
Salix barclayi Anderss.	Barclay's willow		Shrub	Do Not Track
Salix bebbiana Sarg.	Bebb's willow	*Salix depressa ssp. rostrata, Salix rostrata*	Shrub	Do Not Track
Salix fuscescens Anderss.	Alaska bog willow		Shrub	Do Not Track
Salix planifolia Pursh	tea-leaved willow	*Salix planifolia ssp. planifolia, Salix planifolia var. planifolia, Salix planiflora var. nelsonii, Salix phylicifolia ssp. planifolia*	Shrub	Do Not Track

Scientific Name	Common Names	Synonym	Type	Tracked or Watched[1]
Salix pulchra Cham.	diamond-leaved willow	*Salix planifolia ssp. pulchra, Salix pulchra var. yukonensis, Salix phylicifolia var. subglauca, Salix phylicifolia ssp. pulchra*	Shrub	Do Not Track
Salix reticulata L.	net-veined willow	*Salix reticulata ssp. reticulata*	Shrub	Do Not Track
Salix scouleriana Barratt ex Hook.	Scouler's willow		Shrub	Do Not Track
Shepherdia canadensis (L.) Nutt.	soapberry		Shrub	Do Not Track
Spiraea stevenii (Schneid.) Rydb.	Alaskan spiraea	*Spiraea beauverdiana var. stevenii, Spiraea beauverdiana*	Shrub	Do Not Track
Vaccinium oxycoccos L.	bog cranberry	*Oxycoccus oxycoccos, Vaccinium oxycoccus var. microcarpus, Vaccinium microcarpos, Oxycoccus microcarpus, Vaccinium microcarpum*	Shrub	Do Not Track
Vaccinium uliginosum L.	bog blueberry	*Vaccinium uliginosum ssp. alpinum, Vaccinium uliginosum var. alpinum, Vaccinium uliginosum ssp. microphyllum*	Shrub	Do Not Track
Vaccinium vitis-idaea L.	lowbush cranberry	*Vaccinium vitis-idaea ssp. minus, Vaccinium vitis-idaea var. minus*	Shrub	Do Not Track
Betula neoalaskana Sarg.	Alaska paper birch	*Betula papyrifera ssp. humilis, Betula papyrifera var. neoalaskana, Betula papyrifera var. humilis, Betula alaskana, Betula resinifera*	Tree	Do Not Track
Larix laricina (Du Roi) K. Koch	tamarack	*Larix laricina var. alaskensis*	Tree	Do Not Track
Picea glauca (Moench) Voss	white spruce	*Picea glauca var. albertiana*	Tree	Do Not Track
Picea mariana (P. Mill.) B.S.P.	black spruce		Tree	Do Not Track
Populus balsamifera L.	balsam poplar	*Populus balsamifera ssp. balsamifera, Populus tacamahacca*	Tree	Do Not Track
Populus tremuloides Michx.	trembling aspen		Tree	Do Not Track

ATTACHMENT C ELC POLYGON DELINEATION MAPS

Appendix C Overview Map
ELC Polygon Delineations and Plot Locations

Legend

ELC Plot Type
- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

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- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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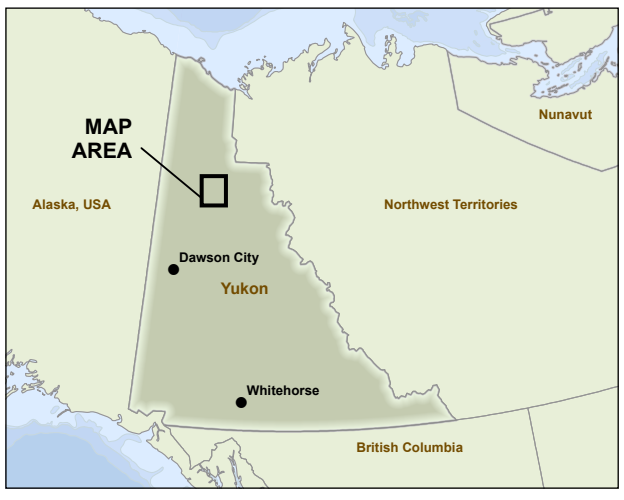
0 5 10 15 20
Kilometres

Map Scale 1:275,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:	Overview	Date:
CT	RR		2021-11-24



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04 7
33/31 4b/4b
04 4b

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 1
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Maxar
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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EDI Environmental Dynamics Inc. has made every effort to ensure this map is free of errors. Data has been derived from a variety of digital sources and, as such, EDI does not warrant the accuracy, completeness, or reliability of this map or its data.

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Kilometres

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Map Projection: NAD 1983 Yukon Albers

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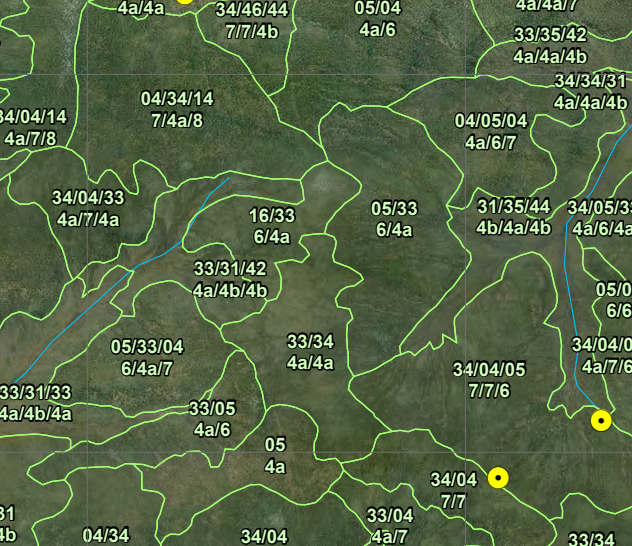
C. Tennant	R. Robitaille		



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CREEK

Chance

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Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 2
ELC Polygon Delineations and Plot Locations

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- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

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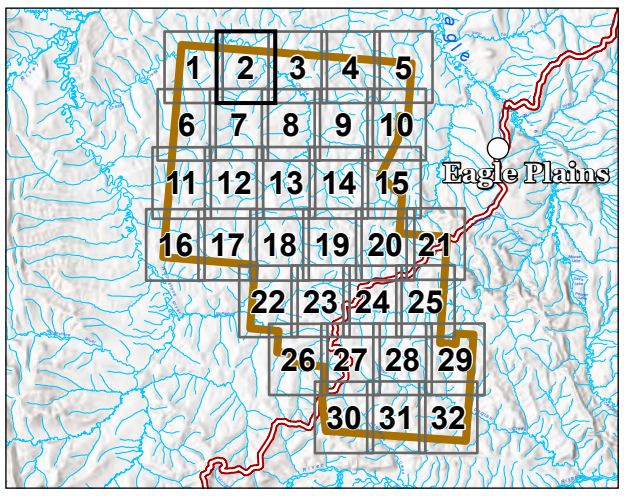

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Creek

Eagle

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 3
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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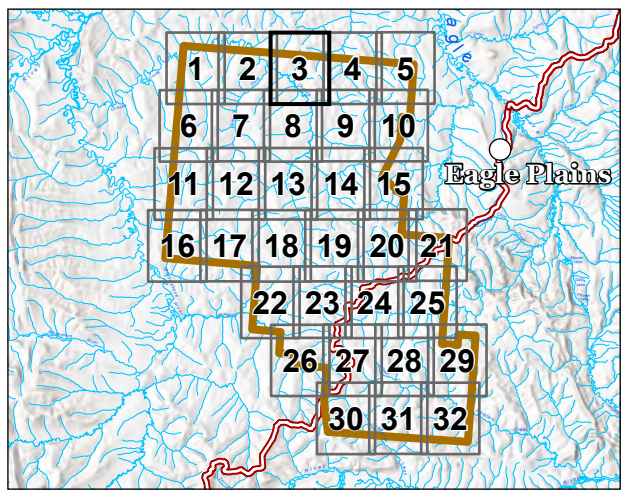
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn: C. Tennant	Checked: R. Robitaille	Map 3	Date: 2021-11-24



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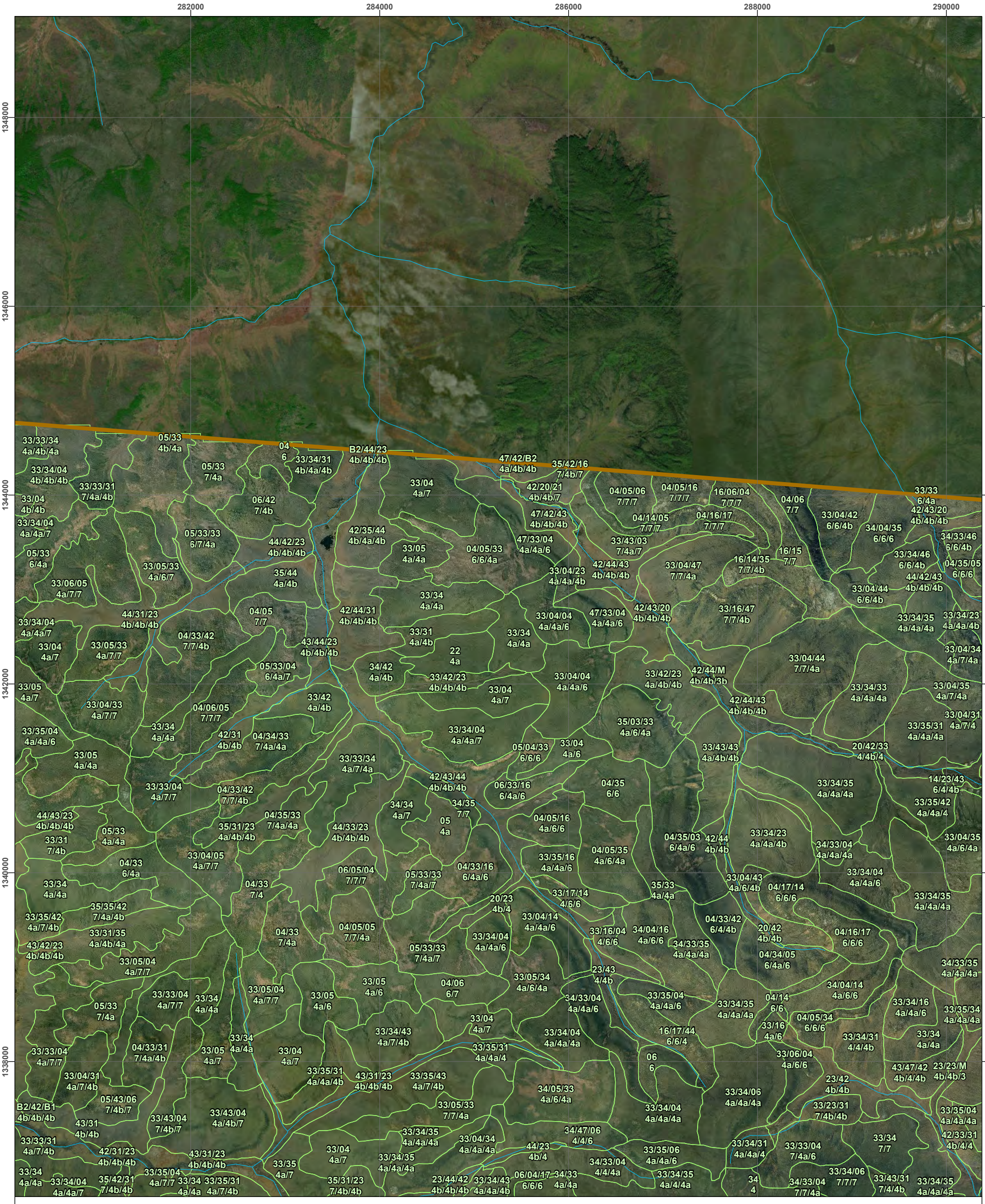

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 4
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

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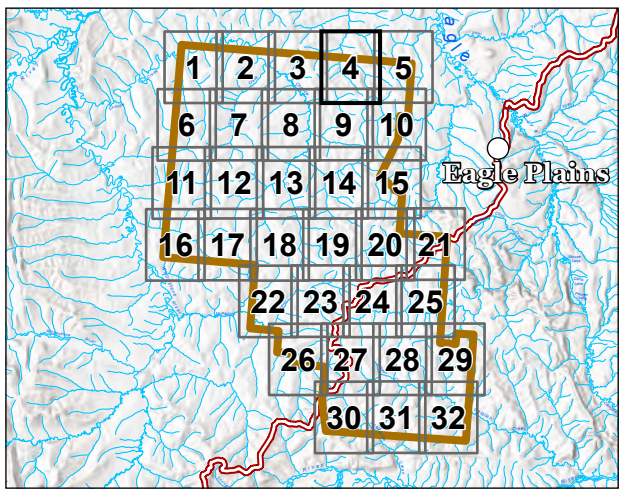
C. Tennant	R. Robitaille	Map 4	Date: 2021-11-24



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Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 5
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:		
C. Tennant	R. Robitaille	Map 5	Date: 2021-11-24



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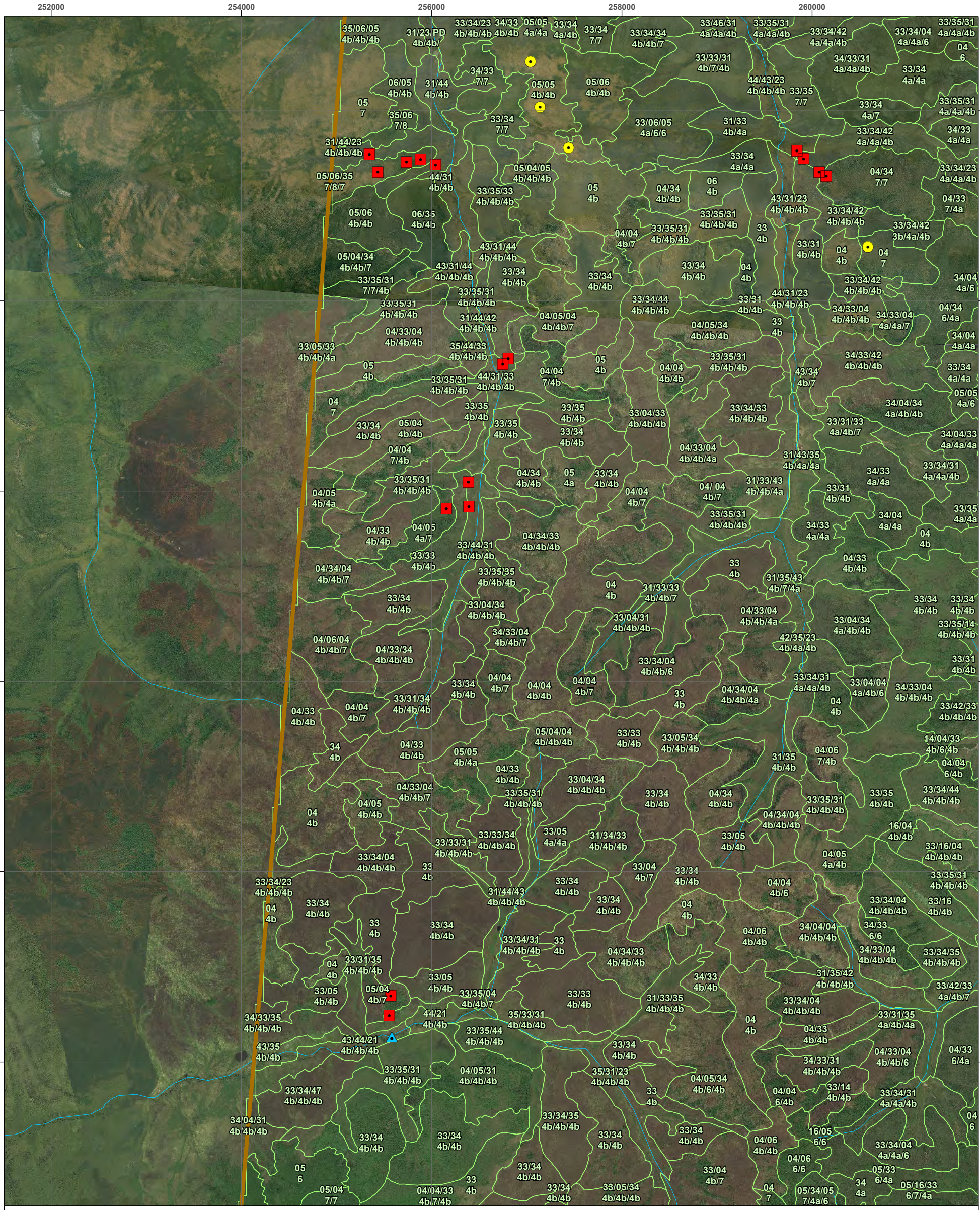

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 6
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

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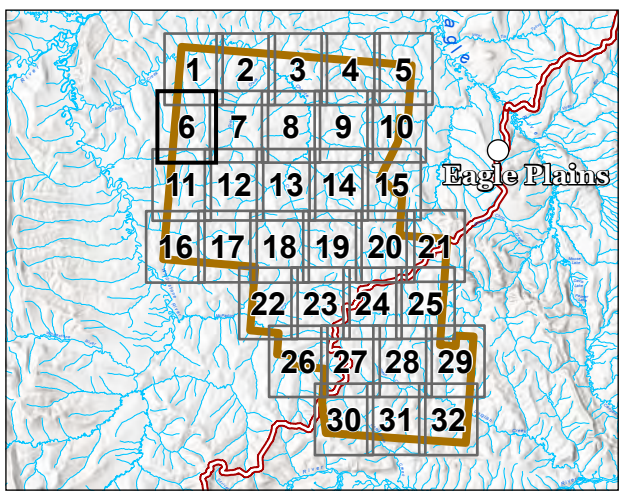

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Creek

Greaves

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 7
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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Kilometres

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Map Projection: NAD 1983 Yukon Albers

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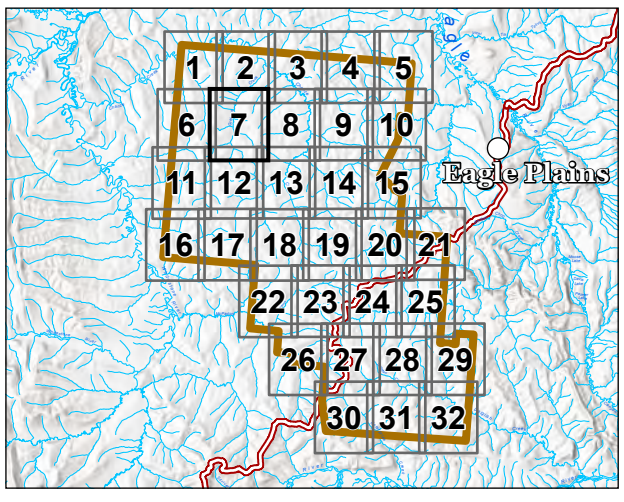
C. Tennant	R. Robitaille		



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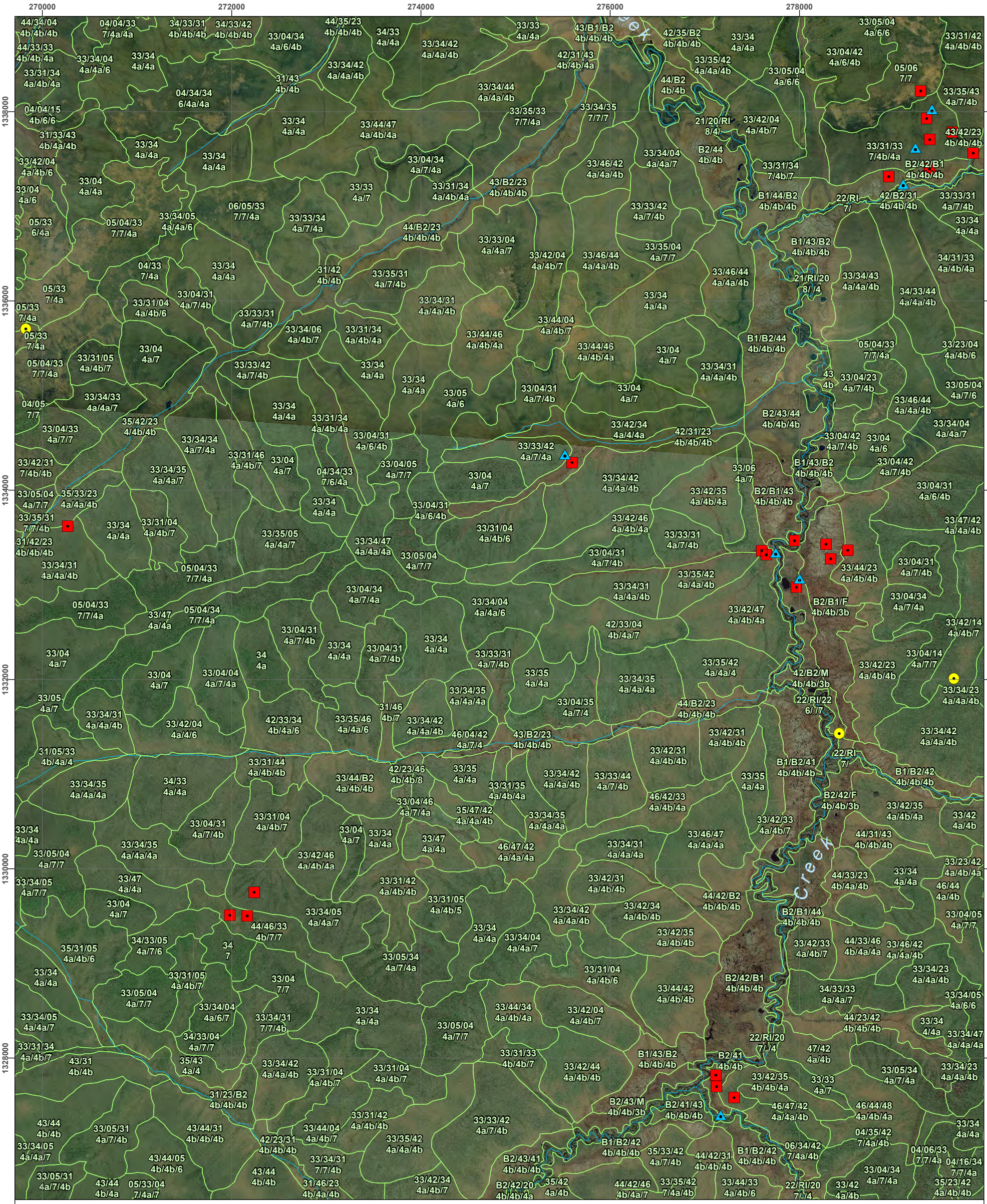

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 8
ELC Polygon Delineations and Plot Locations

Data Sources
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- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
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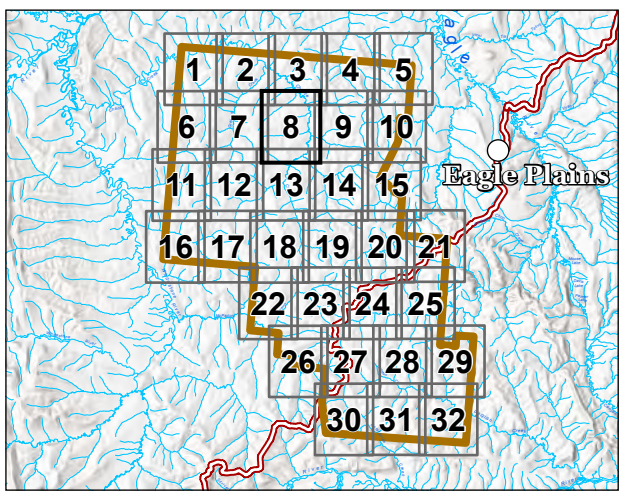

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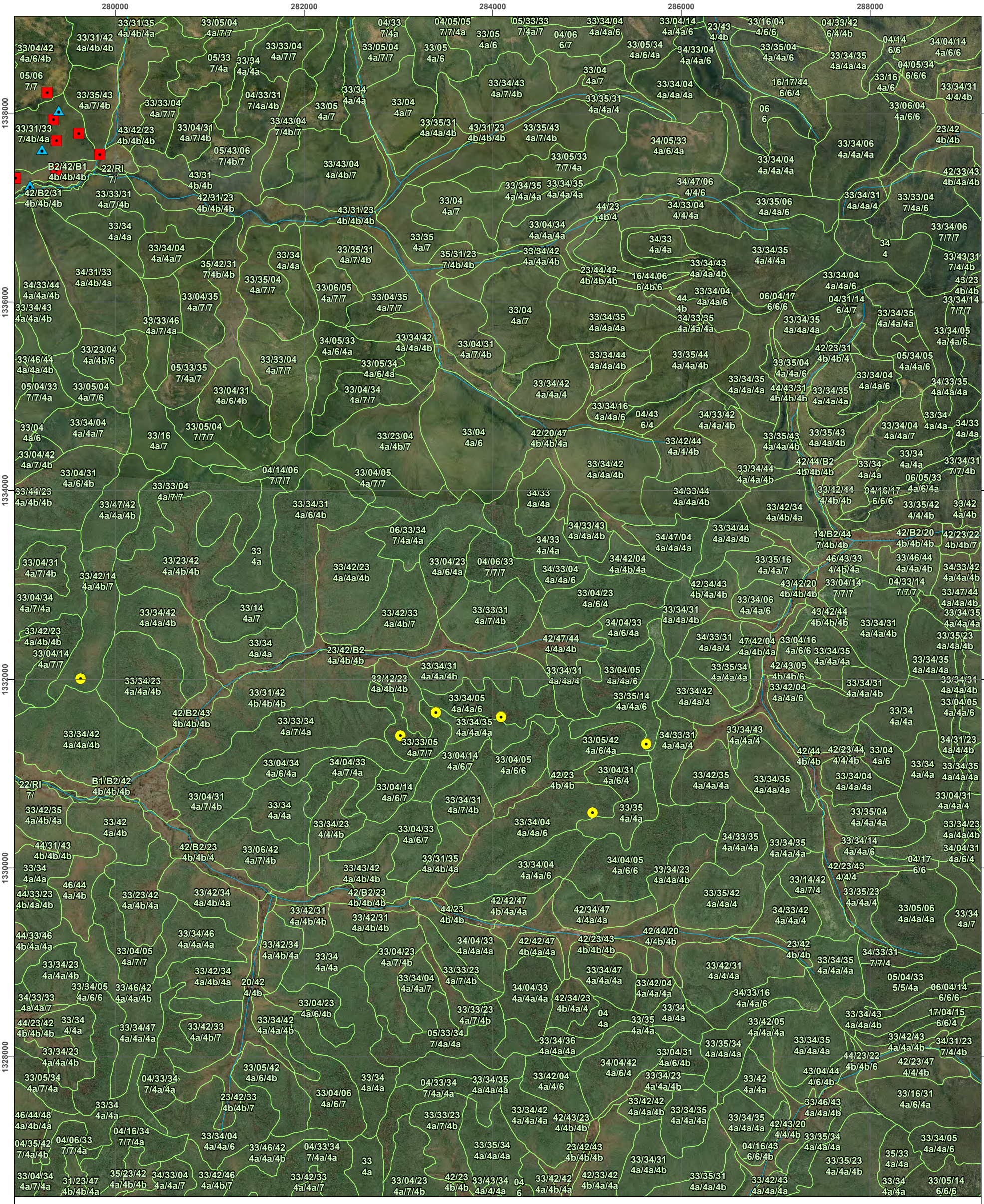

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 9
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
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- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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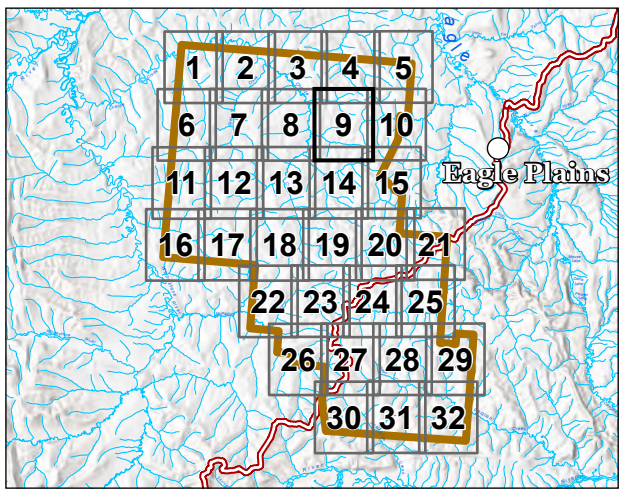
0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:	Map 9	Date: 2021-11-24
C. Tennant	R. Robitaille		



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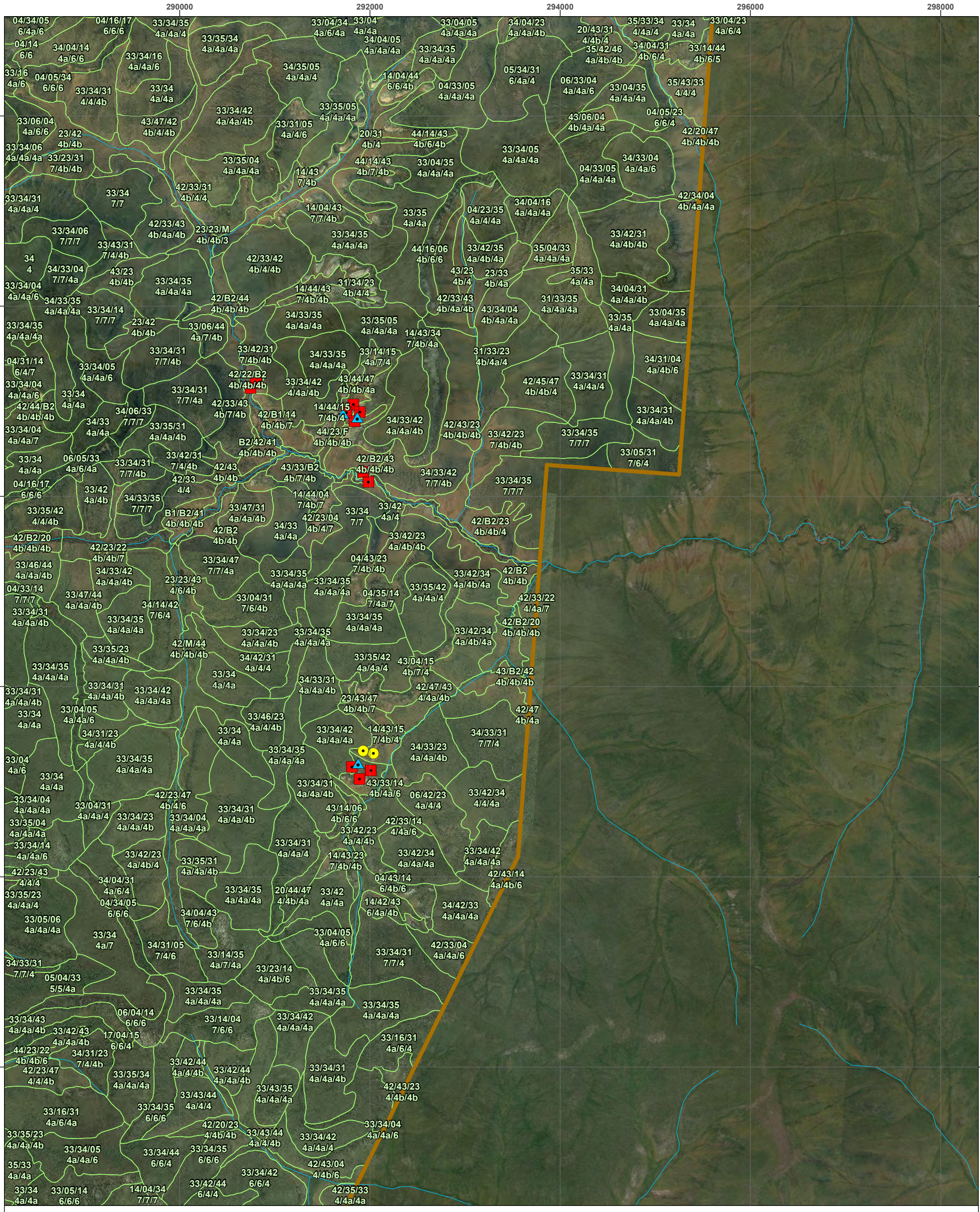

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 10
ELC Polygon Delineations and Plot Locations

Data Sources
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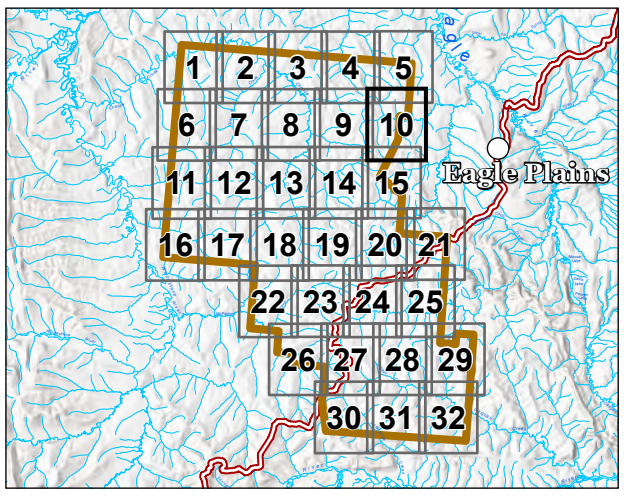
0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:		
C. Tennant	R. Robitaille	Map 10	Date: 2021-11-24



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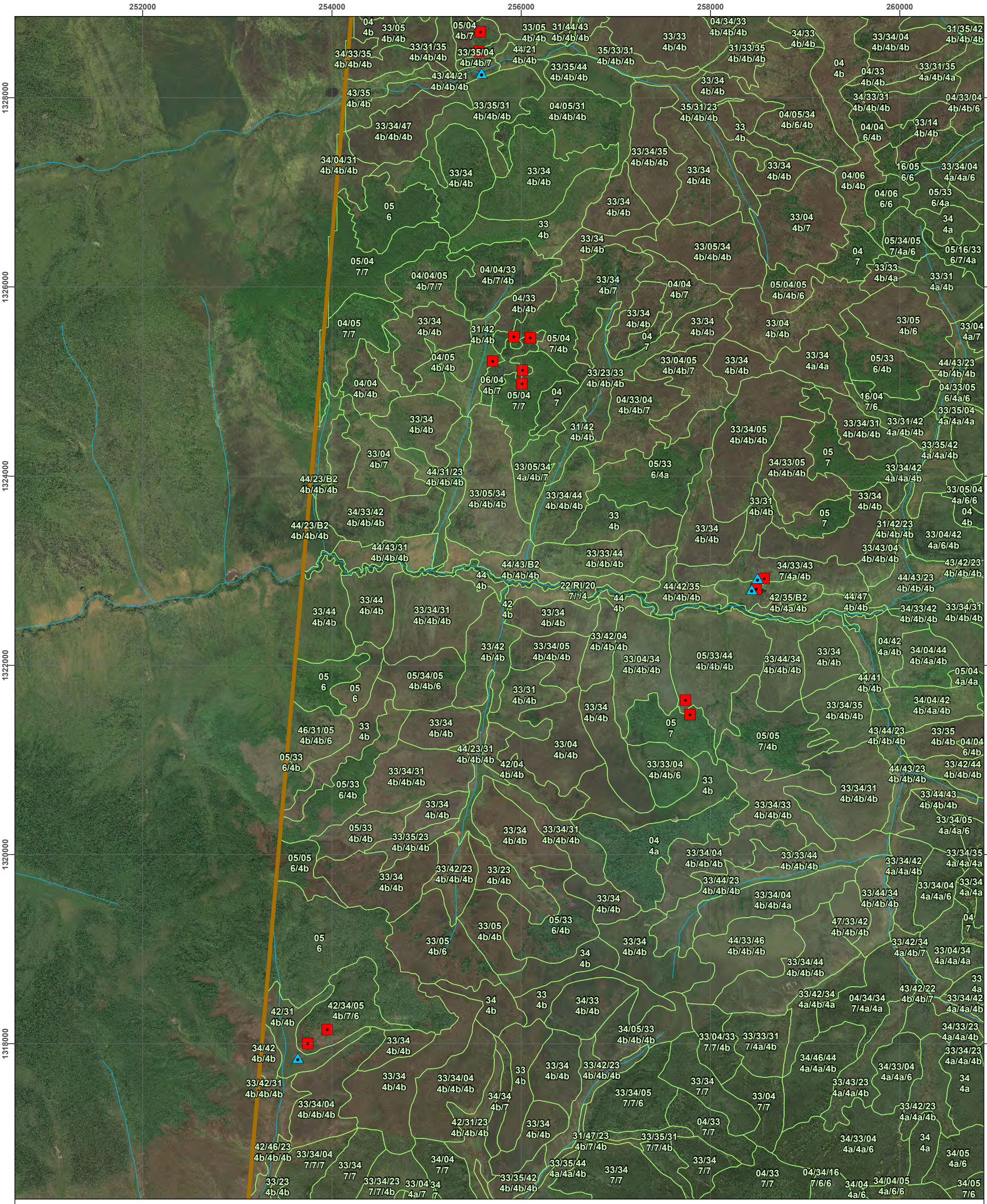

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 11
ELC Polygon Delineations and Plot Locations

Data Sources
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- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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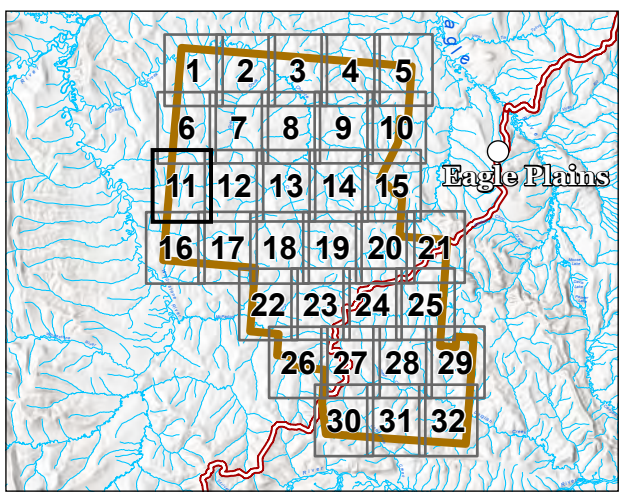
0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:	Map 11	Date: 2021-11-24
C. Tennant	R. Robitaille		



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Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 12
ELC Polygon Delineations and Plot Locations

Data Sources
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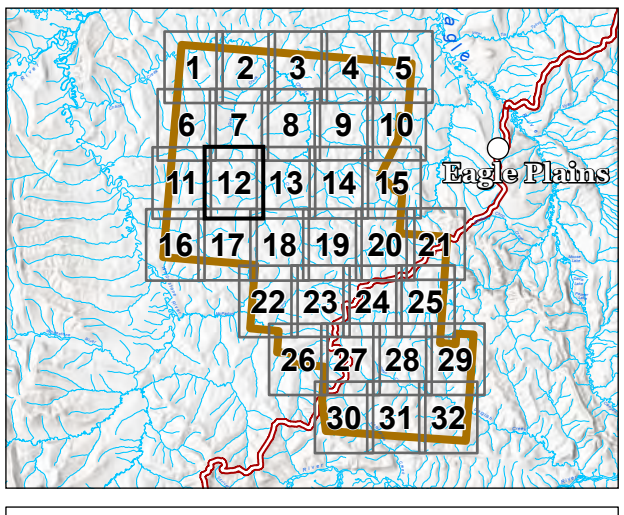
0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn: C. Tennant	Checked: R. Robitaille	Map 12	Date: 2021-11-24



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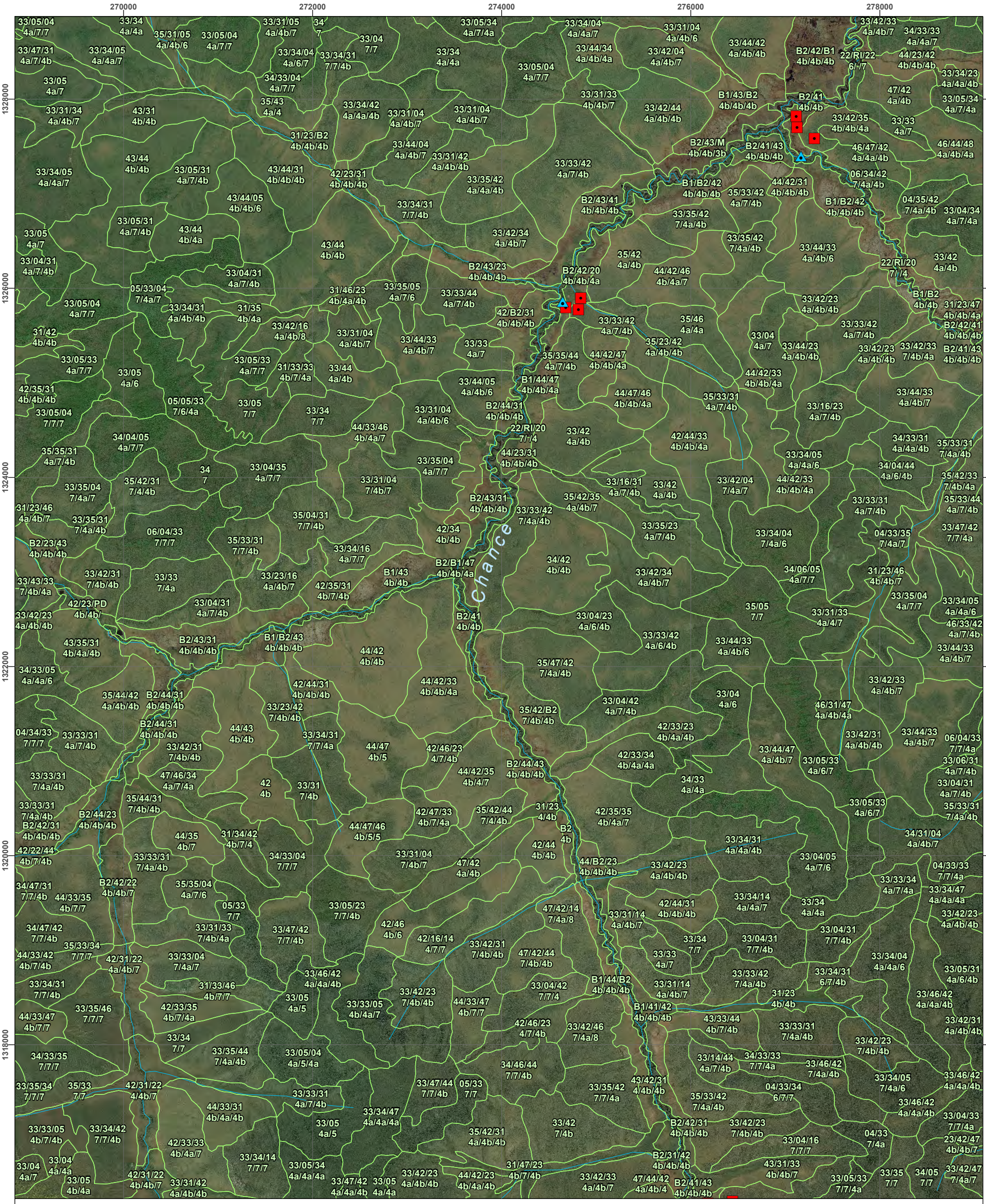

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 13
ELC Polygon Delineations and Plot Locations

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0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:	Map 13	Date: 2021-11-24
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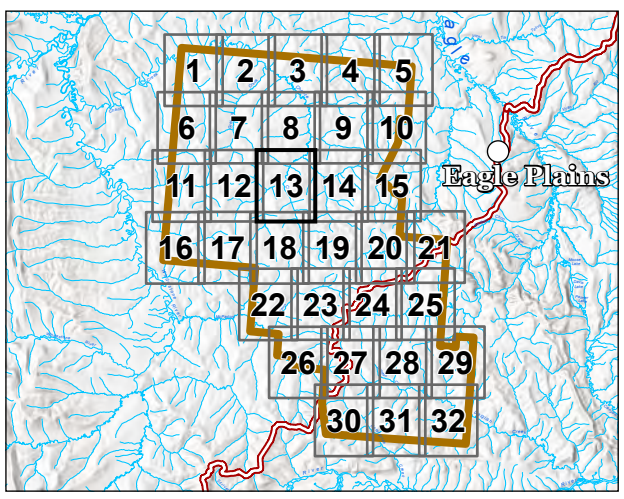

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Path: L:\PROJECTS\2019\19Y0118_Chance\19Y0118_Chance.aprx Layout: ELC_AppendixC_MapSeries_202110

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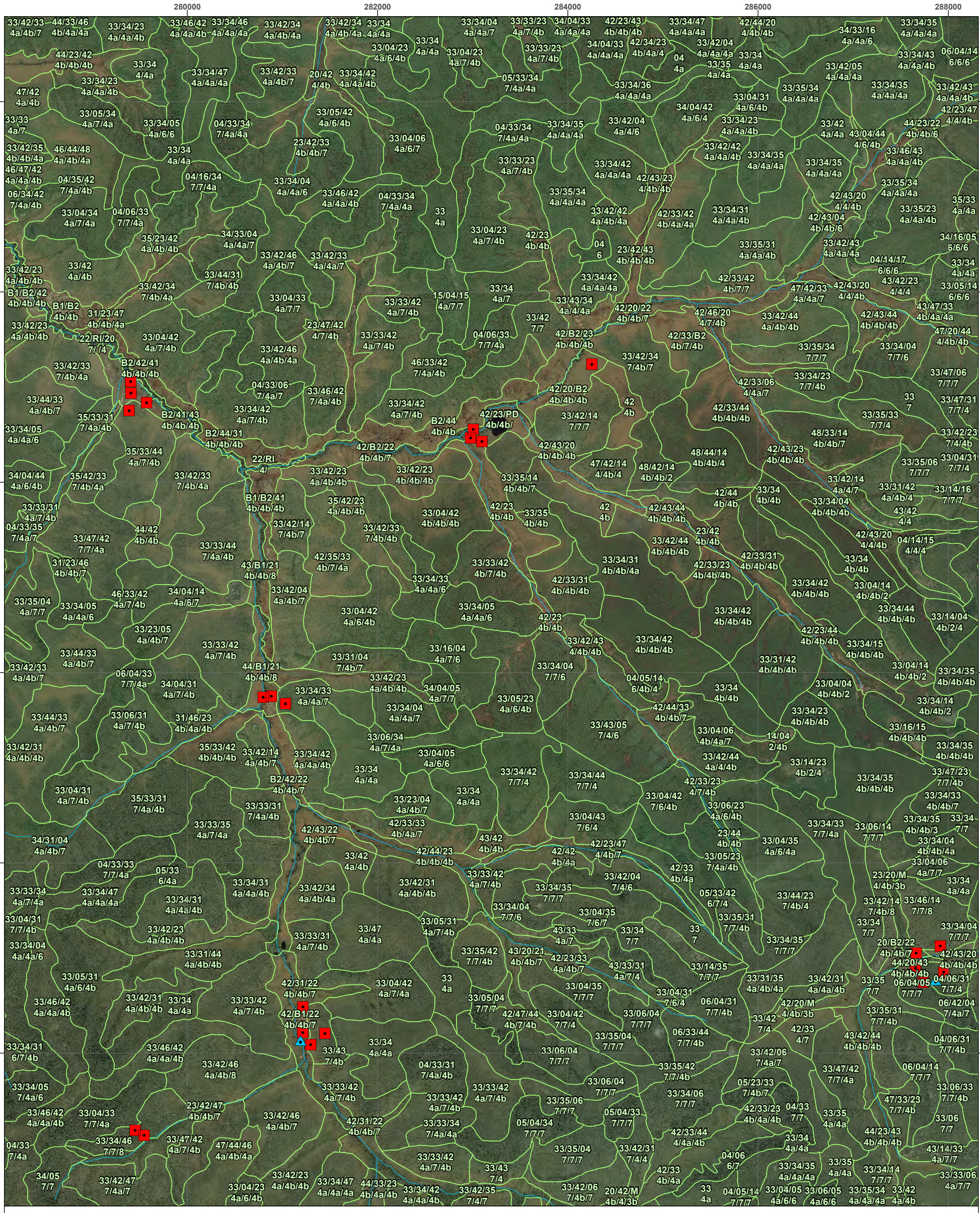
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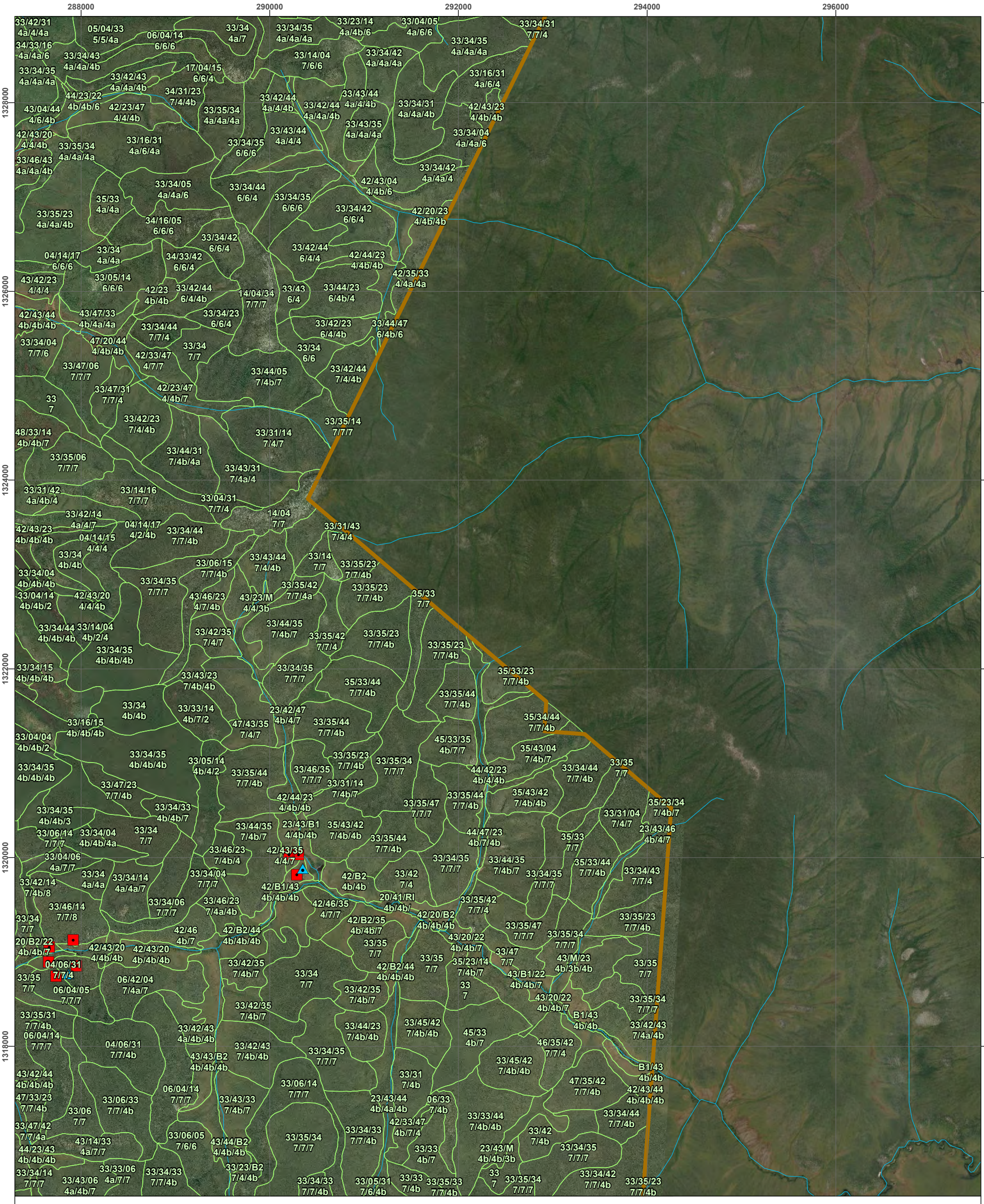

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 15
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

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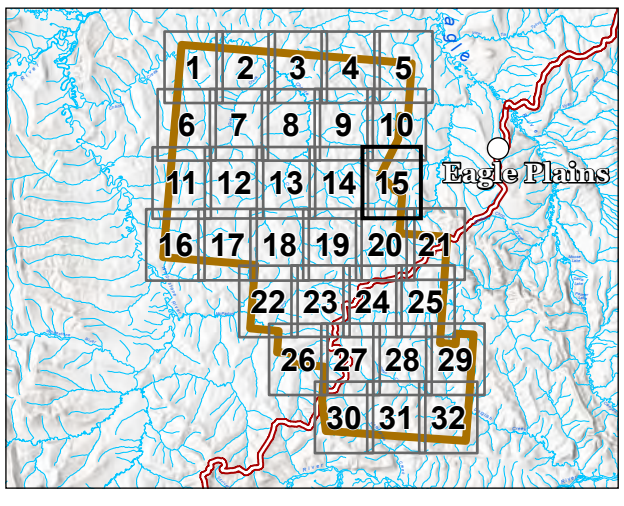

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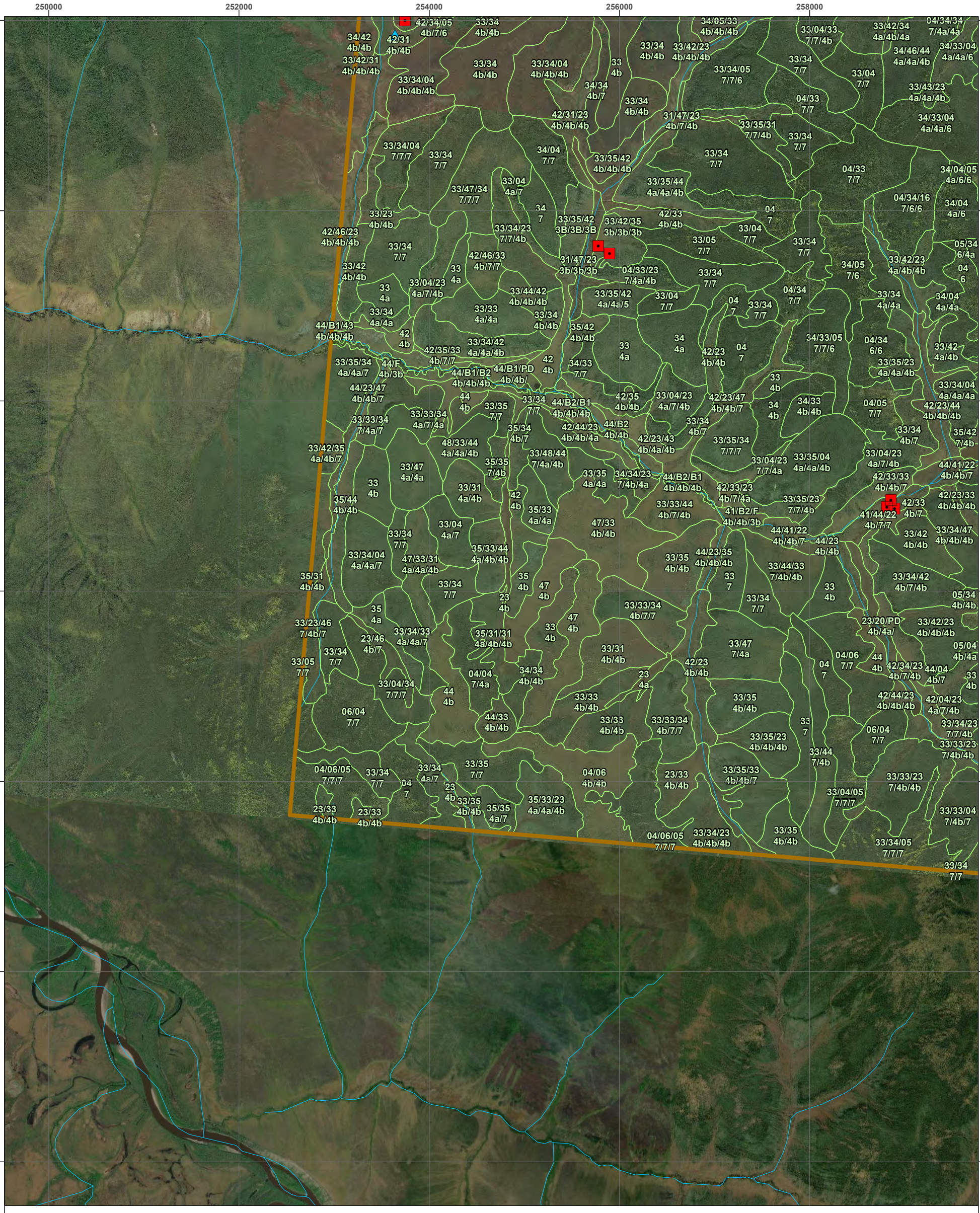

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 16
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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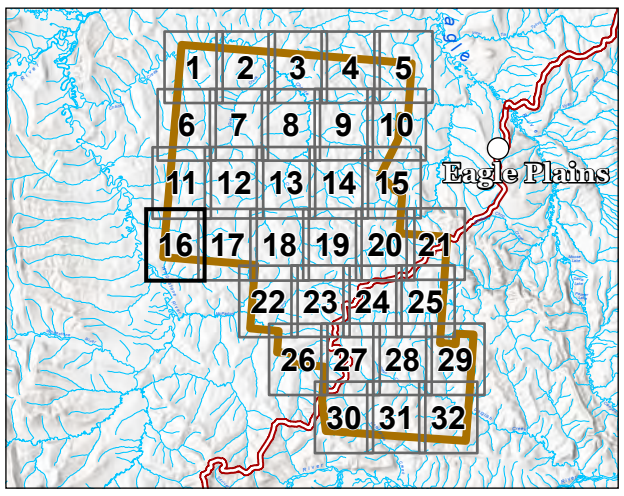
0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:		
C. Tennant	R. Robitaille	Map 16	Date: 2021-11-24



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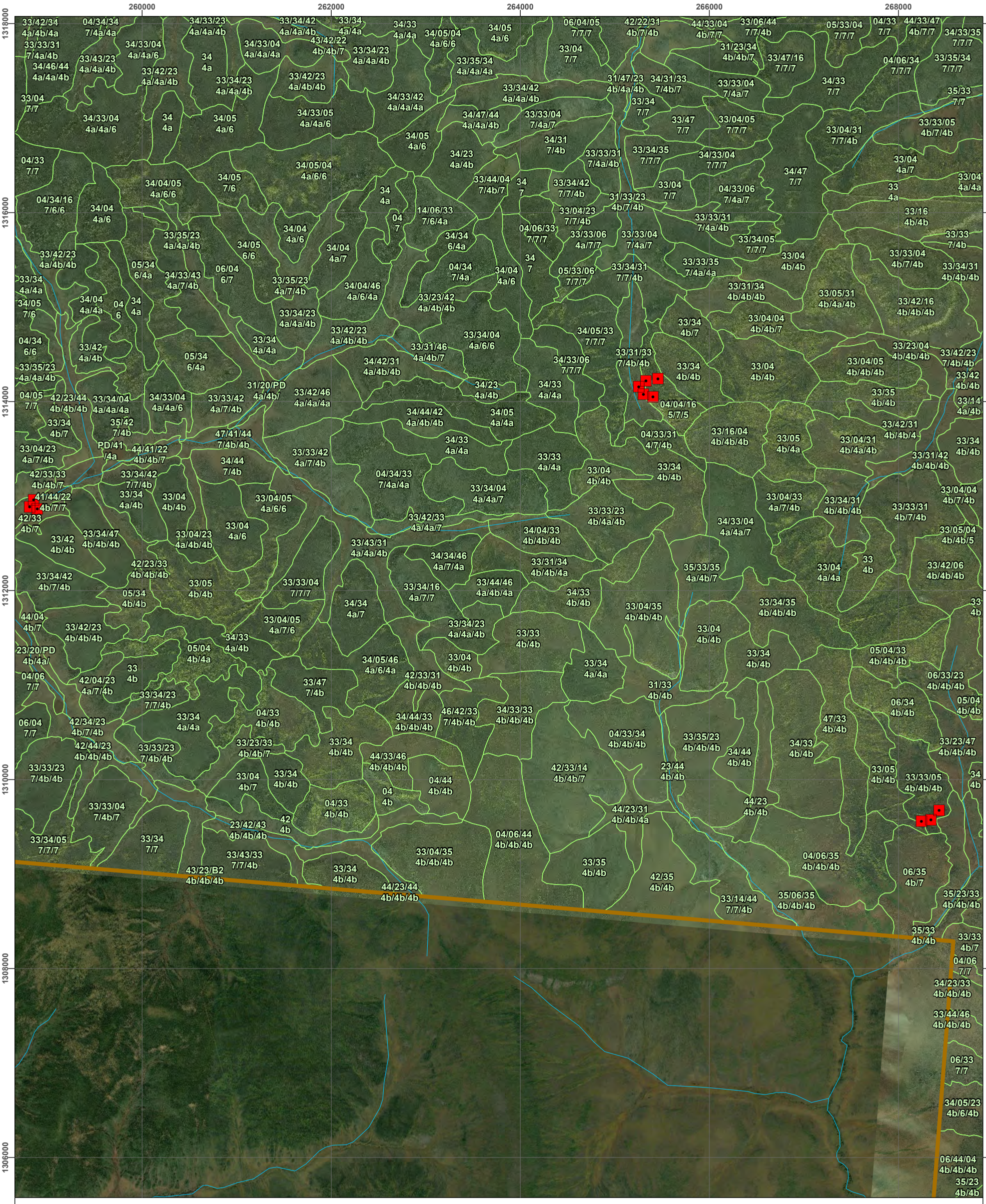

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 17
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:		
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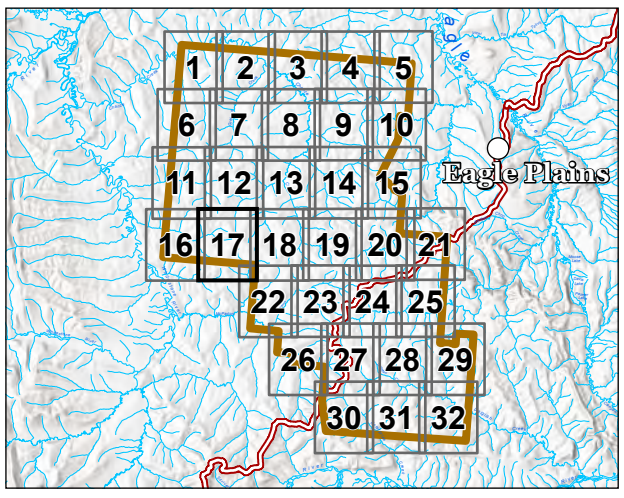

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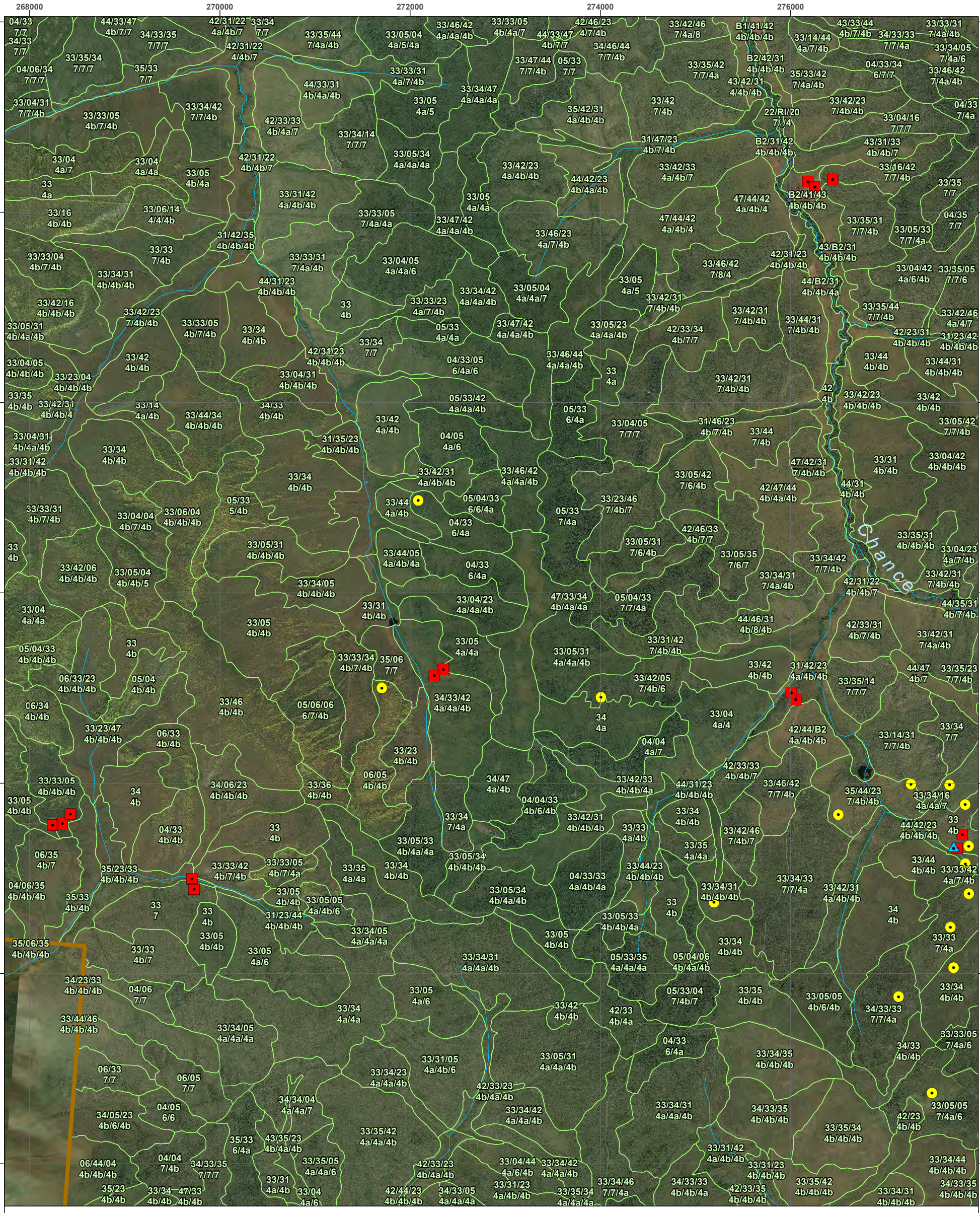

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 18
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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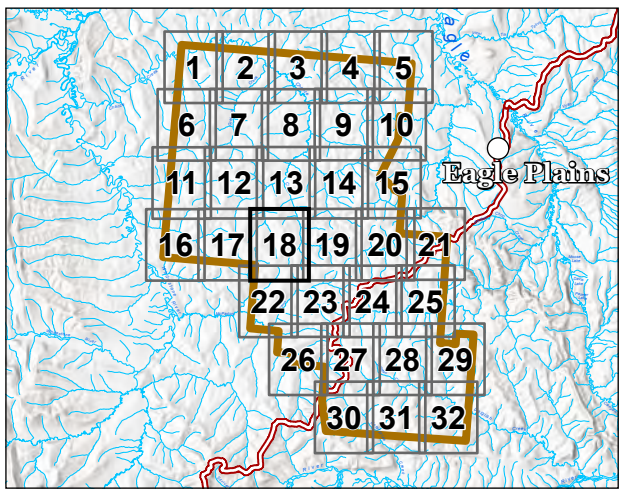
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:		
C. Tennant	R. Robitaille	Map 18	Date: 2021-11-24



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Path: L:\PROJECTS\2019\19Y0118_Chance\19Y0118_Chance.aprx Layout: ELC_AppendixC_MapSeries_202110

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1318000 1316000 1314000 1312000 1310000 1308000 1306000

Creek

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 19
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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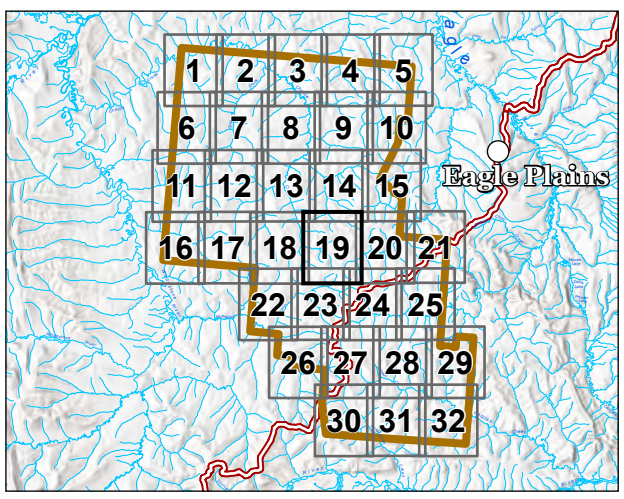
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:	Map 19	Date: 2021-11-24
C. Tennant	R. Robitaille		



EDI

Path: L:\PROJECTS\2019\19Y0118_Chance\19Y0118_Chance.aprx Layout: ELC_AppendixC_MapSeries_202110

Appendix C Map 20
ELC Polygon Delineations and Plot Locations

Legend

ELC Plot Type
- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:		
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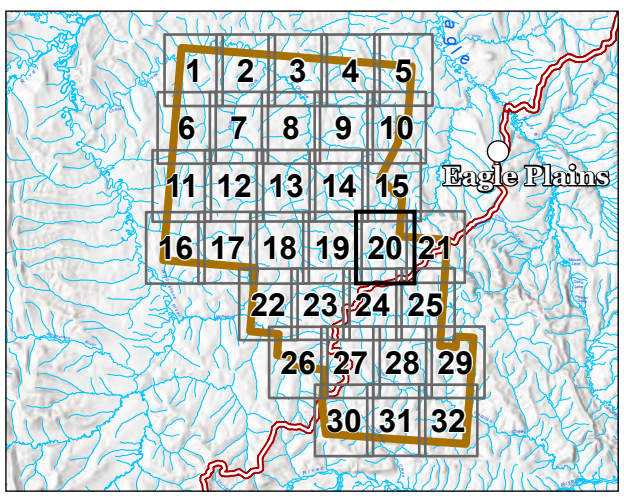

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Dempster Highway

RZ/ES/04
RZ/AN/04

46/42 7/4b
B2/43/23 4b/4b/4b
33/34/35 7/7/7
42/46/33 4b/7/7
06/33 7/7
46/33/23 4a/7/4b
33/06/04 7/7/7
42/35/23 4/7/4b
06/33/20 7/7/4b
33/06 7/7
23/33 4b/7
33/06/31 7/7/4b
33/35/06 7/7/7
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33/14/RZ 4a/4b/
44/B1/43 4b/4b/4b
44/43/42 4b/4b/4b
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33/06/20 7/7/4b
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33/34/35 4/4/4b

Legend

ELC Plot Type
- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 21
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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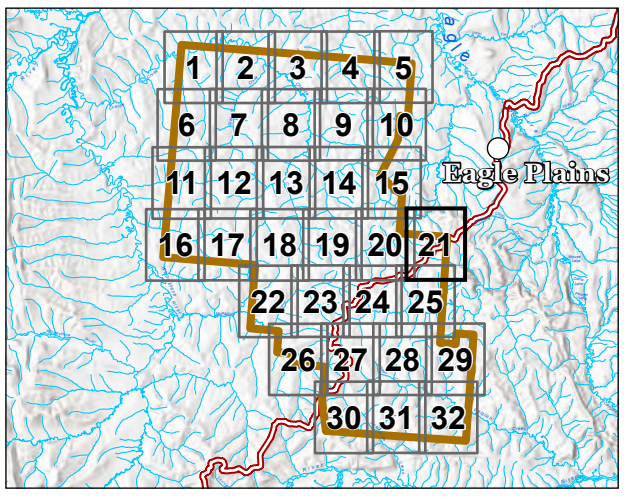
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn: C. Tennant	Checked: R. Robitaille	Map 21	Date: 2021-11-24



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34/23/33 4b/4b/4b | 04/06 7/7 | 33/05 4a/6 | 33/42 4b/4b | 05/33/04 7/4b/7 | 33/35 4b/4b
33/44/46 4b/4b/4b | 33/34 4a/4a | 42/33 4b/4a
33/34/05 4a/4a/4a | 04/33 6/4a
06/33 7/7 | 33/31/05 4a/4b/6 | 33/05/31 4a/4a/4b | 33/34/35 4b/4b/4b
06/05 7/7 | 33/34/23 4a/4a/4b | 42/33/23 4b/4a/4b
34/34/04 4a/4a/7 | 33/34/42 4a/4a/4b | 33/34/31 4a/4a/4b | 34/33/35 4b/4b/4b
04/05 6/6 | 34/05/23 4b/6/4b
33/35/42 4a/4a/4b
06/44/04 4b/4b/4b | 04/04 7/4b | 33/35/05 4a/4a/6 | 42/33/23 4b/4a/4b | 33/04/44 4a/6/4b | 33/34/42 4a/4a/4b | 33/31/23 4b/4b/4b
33/31 4a/4b | 33/34/46 7/7/4a | 34/33/33 4b/4b/4a | 33/35/42 4b/4b/4b
34/33/35 7/7/7 | 35/33 6/4a | 43/35/23 4b/4a/4b | 33/34/05 4a/4a/4a | 33/31/23 4a/4b/4b | 05/33/02 7/4b/6
35/23 4b/4b | 33/34 4b/4b | 42/44/23 4b/4b/4b | 33/42/34 4a/4b/4a | 42/33/35 4b/4b/4b
33/04 4a/6 | 33/35/34 4a/4a/4a | 33/35/42 4b/4b/4b
42/44/31 4b/4b/4b | 42/23/31 4b/4b/4b
47/33 4b/4b | 33/34/33 4a/7/4b | 33 4b | 31/42/23 4b/4b/4b | 33/44 4b/4b | 33/05 4a/6 | 33/34/02 4a/4a/7
04 4b | 33/42/33 4b/4b/7 | 33/34/34 4b/4b/4a | 42/33 4b/4b
33 4a | 33/34/42 4b/7/4b
06/14 4b/4b | 33/35/05 4a/4b/6 | 34/33 4a/4a | 33/05 4b/4b | 33/35/33 4b/4b/4a
33/42 4b/4b | 34/33 4b/4a | 44/33/33 4b/4a/4b | 42/46/AN 4b/4a/ | 33/35/04 4b/4a/6
44/35 4b/4b | 43/34 4b/7 | 33/35/31 4a/4a/4b | 22/RI/20 7/ /4
B1/44/41 4b/4b/4b | 33/34/42 4b/4b/4b | 31/43 4b/4b | 33/33/36 4b/7/4b | 02 7 | 42/05/23 4b/4b/4b | 33/34/42 4a/4a/4b | 22/RI/20 7/ /4
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35/04 4b/4b | 47/33 4b/4a | 34/33 7/4a | 33/14/42 4a/7/4b | 42/23 4b/4b
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04/05 4b/4b | 42/23/35 4b/4b/4b | 42/35 4b/4a | 04/34/33 4b/4b/4b
42/B2/44 4b/4b/4b | 35 4b
04/35 4b/4b | 33/33/42 4a/7/4b | 47/34/31 4b/4b/4b | 47 4b | 33/47 4b/4b
33/23/34 4b/4b/4b | B2/41 4b/4b
33/46/44 7/4a/4b | 04 7 | 33/34 4b/4b | 04/34/33 4b/4a/4b
33/46/44 4b/4b/4b | 42/42/33 4b/4b/4b
47/33 4b/4b | 42/B2/44 4b/4b/4b | 47/42 4b/4b | 47/33 4b/4a
34/34 4b/7 | 33/35/34 7/7/7
04/23 4b/4b | 33 7 | 04/23 4b/4b | B2/44 4b/4b | 35/35/06 4b/7/7 | 34/33/35 4b/4b/4b | 33/34/35 4a/4a/4a
04/33 7/7 | 33/42/23 4b/4/4b | 04/33/05 4b/4b/4b
33/35 7/7 | 35/23/35 4b/4b/7 | 44/31 4b/4b
33/23 7/4b | 44/B2/23 4b/4b/4b
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35/B2 4b/4b | 33/35 4b/4b
B2/44/41 4b/4b/4b | 33/35 4b/4b | 33/34/04 4a/4a/4a
35/44/35 4b/4b/7 | 33/35 7/7 | B2/44/PD 4b/4b/ | 33/34/47 4a/4a/4b
33/34/42 7/7/4b | 33/05/23 4a/4a/4b | 33/34/23 4b/4b/4b
33/35 7/7 | 33/23 4b/4b
35/44/35 4b/4b/7 | B2/F/PD 4b/3b/ | 47/33 4b/4b
33/42/23 7/4b/4b | 21/RI/20 8/ /4 | B2 4b | 33/35 4a/4a | 04/06 5/4a
33/42 4b/4b | 33/44/33 4b/4b/4b | 33/47 4b/4a
B2 4b | 31/B2/B1 4b/4b/4b | 04/16/05 5/4a/4b
42/33 4b/4b | 35 4b | 35/06 4b/4b | 33/35/31 4b/4b/4b | 42/B2/F 4b/4b/4b
35/44 4b/4b | 42/B2/23 4b/4b/4b | 42/44/31 4b/4b/4b
22/20/RI 7/4/ | 33/47/04 4a/4b/4b
33/44/34 4b/4b/4b | 33/34 4b/4b | 33/34/47 4a/4a/4b | 33/42/23 4a/4b/4b
44 4b | 33/23 4b/4b | 33/23 4a/4b

Creek

1296000

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 22
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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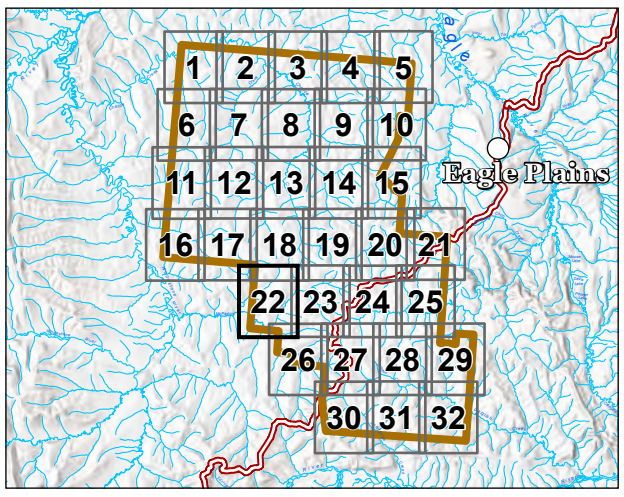
0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:	Map 22	Date: 2021-11-24
C. Tennant	R. Robitaille		



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Path: L:\PROJECTS\2019\19Y0118_Chance\19Y0118_Chance.aprx Layout: ELC_AppendixC_MapSeries_20211101

276000 278000 280000 282000 284000

1308000 1306000 1304000 1302000 1300000 1298000 1296000

McParlon

Creek

Dempster Highway

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 23
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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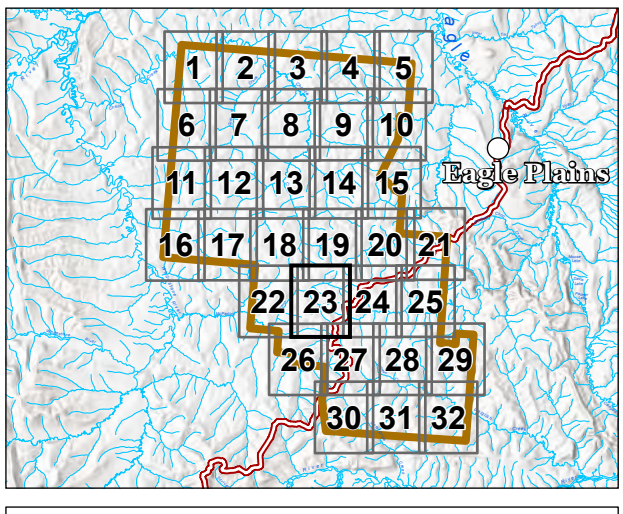
0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:	Map 23	Date: 2021-11-24
C. Tennant	R. Robitaille		



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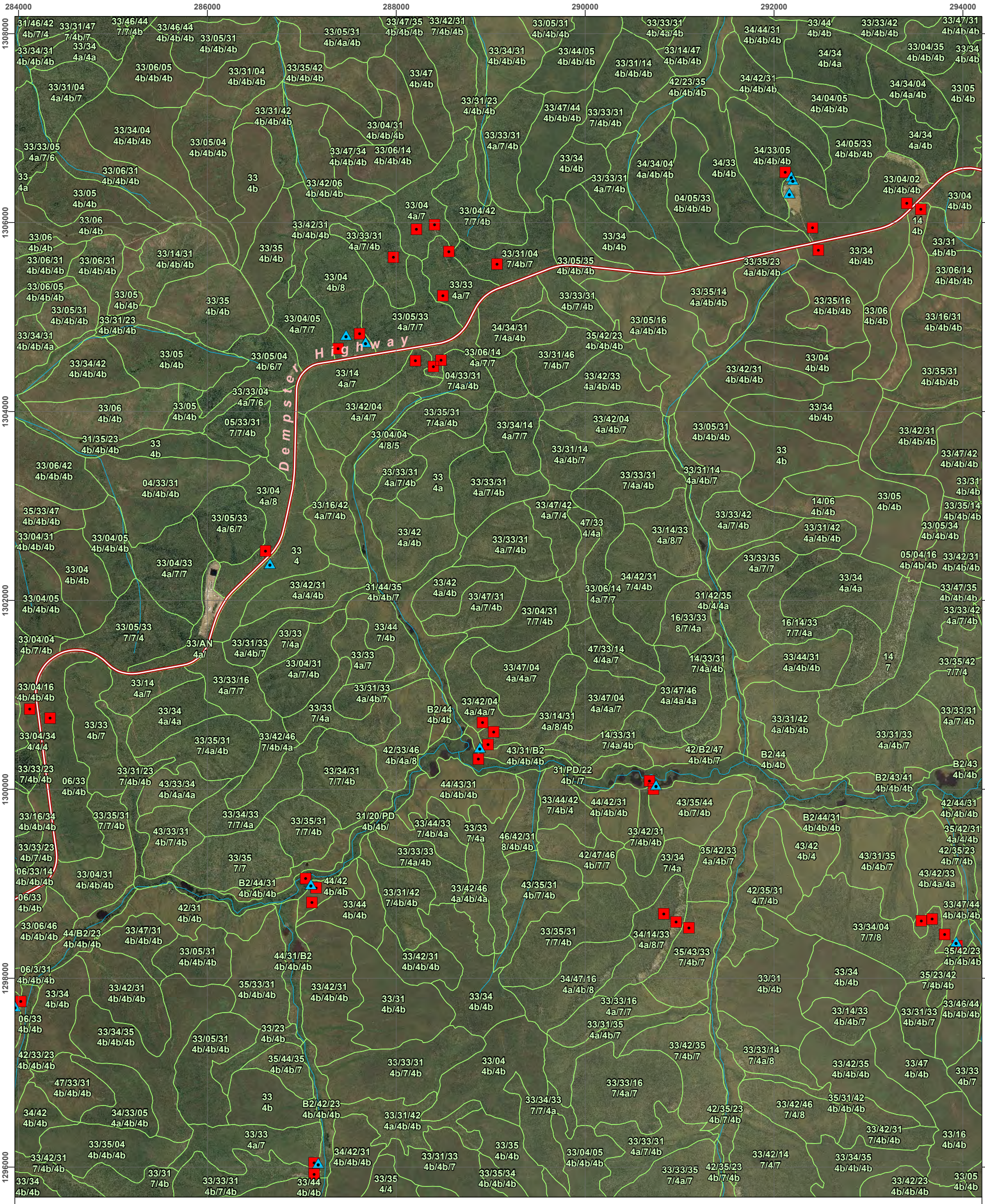

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 24
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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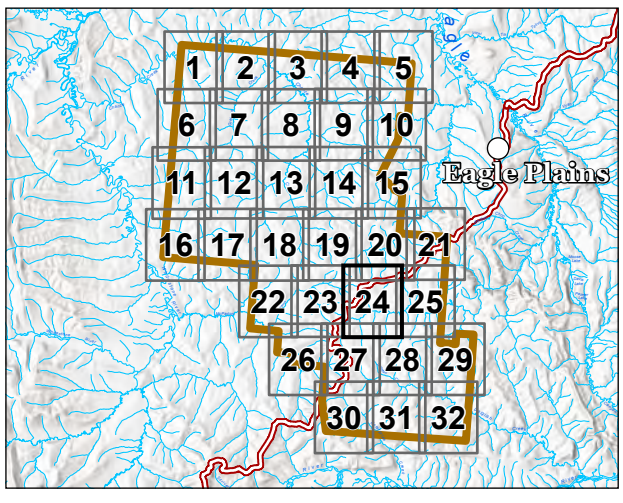
0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:	Map 24	Date: 2021-11-24
C. Tennant	R. Robitaille		



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Path: L:\PROJECTS\2019\19Y0118_Chance\19Y0118_Chance.aprx Layout: ELC_AppendixC_MapSeries_20211

294000 296000 298000 300000 302000

1308000 1306000 1304000 1302000 1300000 1298000 1296000

Dempster Highway

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 25
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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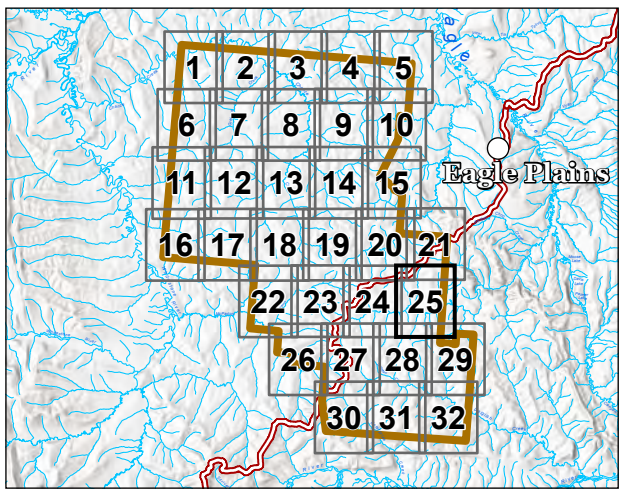
0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:	Map 25	Date: 2021-11-24
C. Tennant	R. Robitaille		



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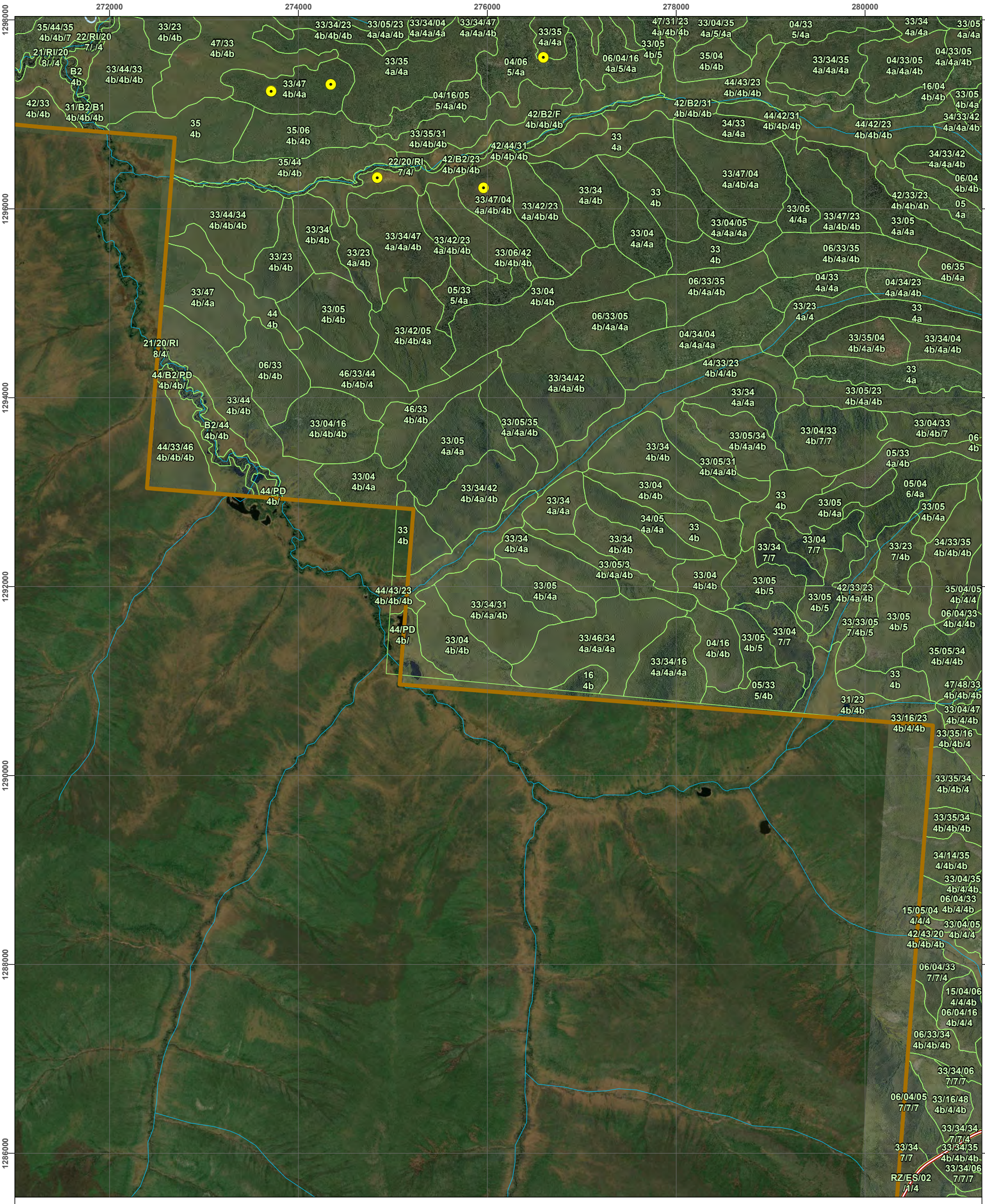

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 26
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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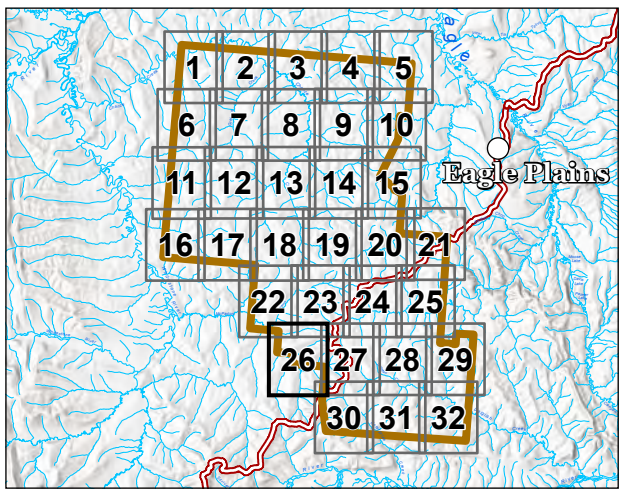
0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn: C. Tennant	Checked: R. Robitaille	Map 26	Date: 2021-11-24



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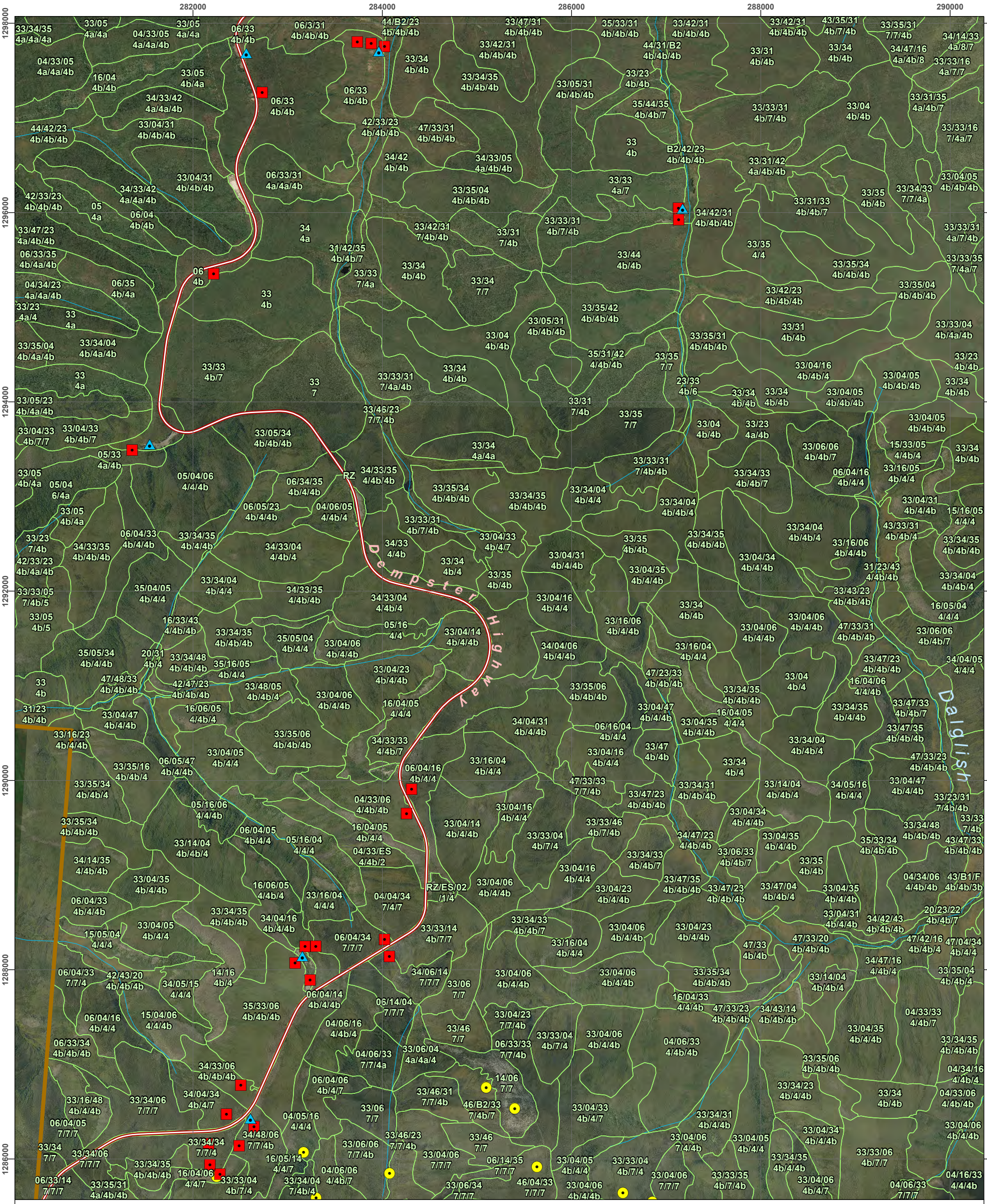
Path: L:\PROJECTS\2019\19Y0118_Chance\19Y0118_Chance.aprx Layout: ELC_AppendixC_MapSeries_202110



Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 27
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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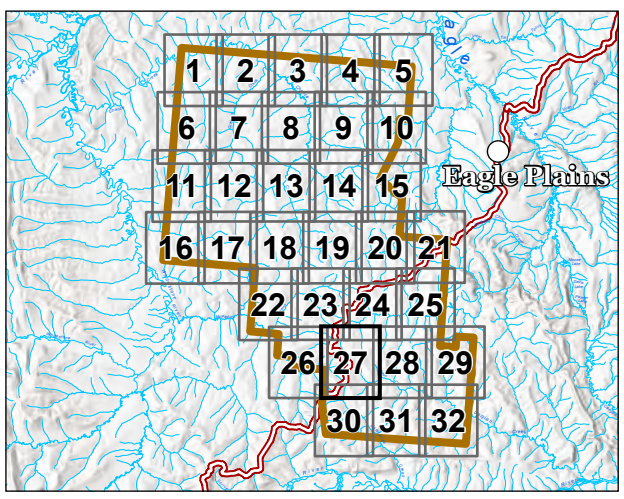
0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:		
C. Tennant	R. Robitaille	Map 27	Date: 2021-11-24



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Path: L:\PROJECTS\2019\19Y0118_Chance\19Y0118_Chance.aprx Layout: ELC_AppendixC_MapSeries_202110

290000 292000 294000 296000 298000

1298000 1296000 1294000 1292000 1290000 1288000 1286000

Dalglish Creek

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 28
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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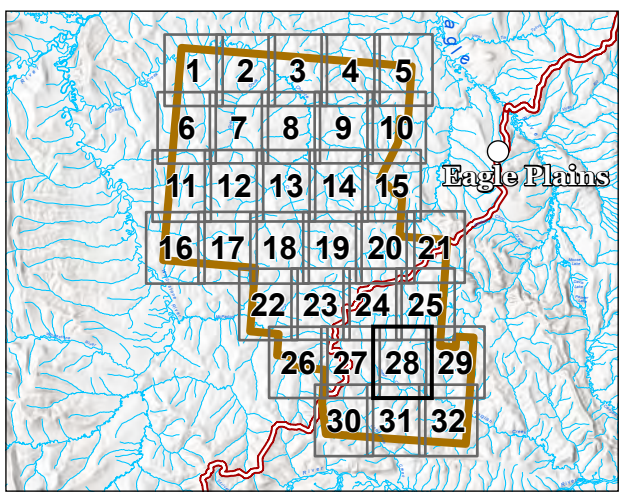
0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:	Map 28	Date: 2021-11-24
C. Tennant	R. Robitaille		



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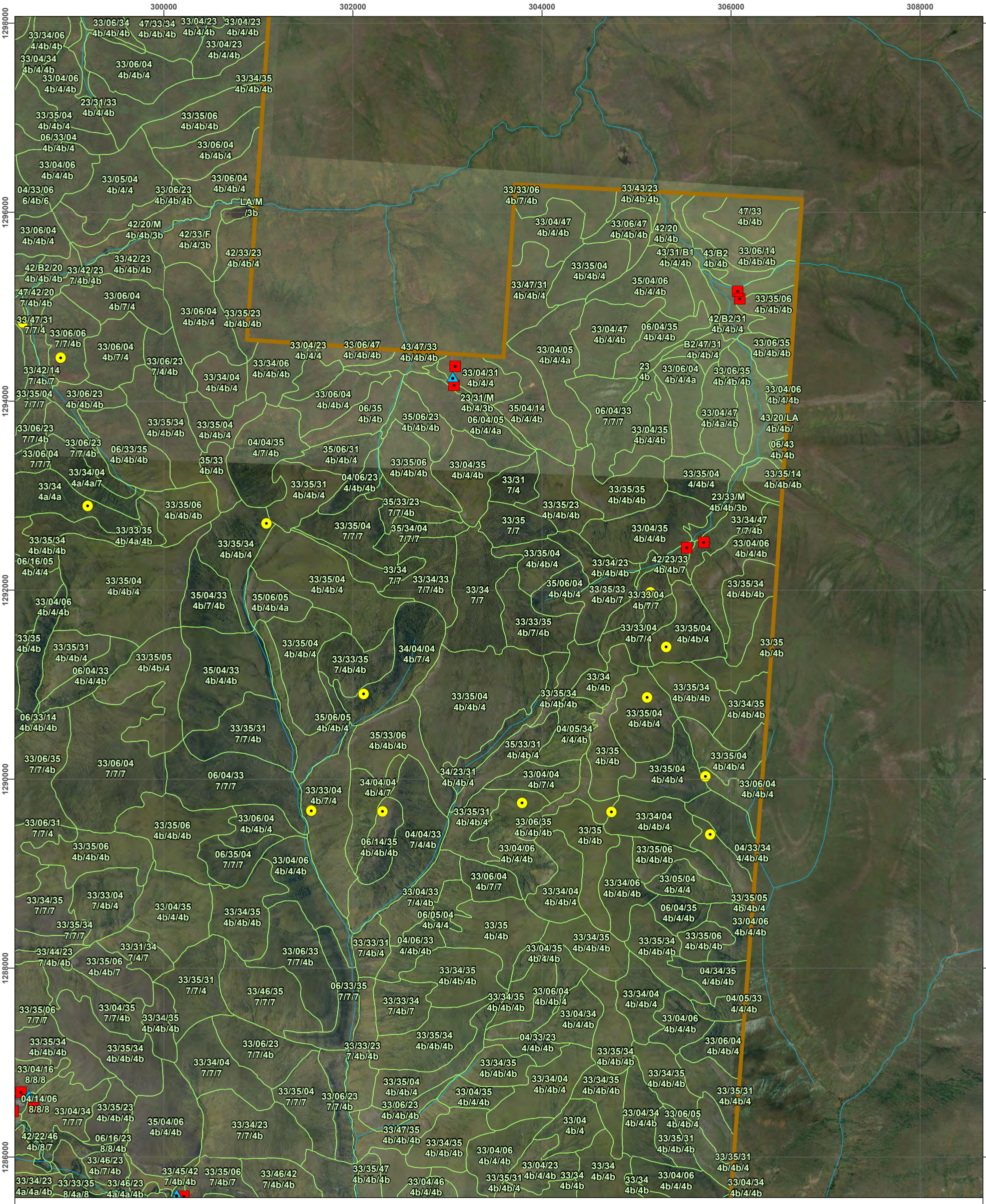

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 29
ELC Polygon Delineations and Plot Locations

Data Sources
- 1:250,000 Topographic Spatial Data courtesy of Her Majesty the Queen in Right of Canada, Department of Natural Resources. All Rights Reserved.
- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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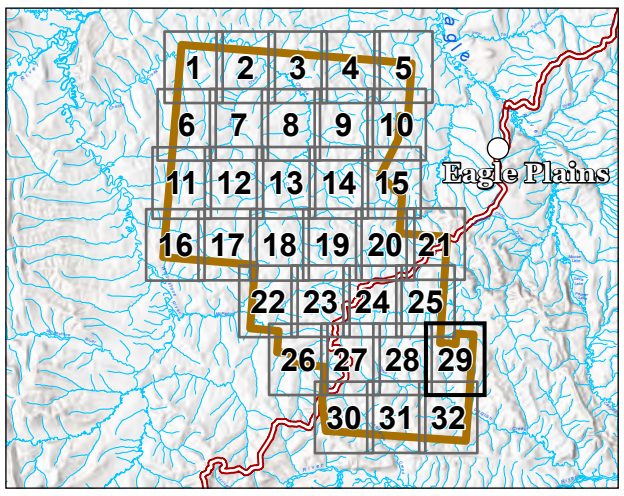
0 0.5 1 1.5 2
Kilometres

Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

Drawn:	Checked:		
C. Tennant	R. Robitaille	Map 29	Date: 2021-11-24



EDI

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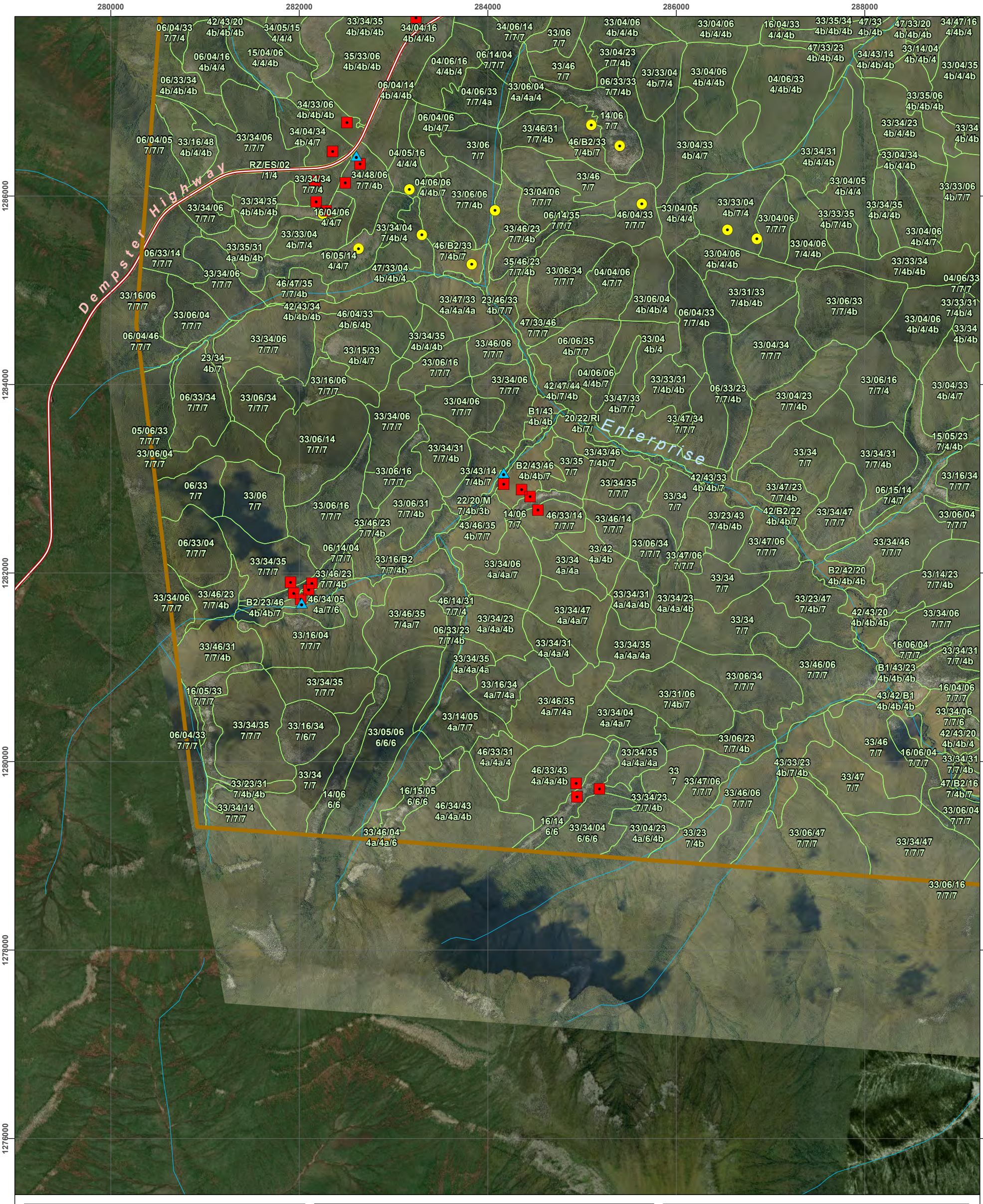

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 30
ELC Polygon Delineations and Plot Locations

Data Sources
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- 1:250,000 National Topographic Database (NTDB) provided by Geomatics Yukon - Yukon Government via online source (Corporate Spatial Warehouse) www.geomaticsyukon.ca.
- Orthoimage. 2014-2019.
- Inset Basemap. World Imagery: Earthstar Geographics
- Main Basemap. Terrain: Multi-Directional Hillshade: Airbus,USGS,NGA,NASA,CGIAR,NCEAS,NLS,OS,NMA,Geodatastyrelsen,GSA,GSI and the GIS User Community

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Map Scale 1:40,000 (printed on 11 x 17)
Map Projection: NAD 1983 Yukon Albers

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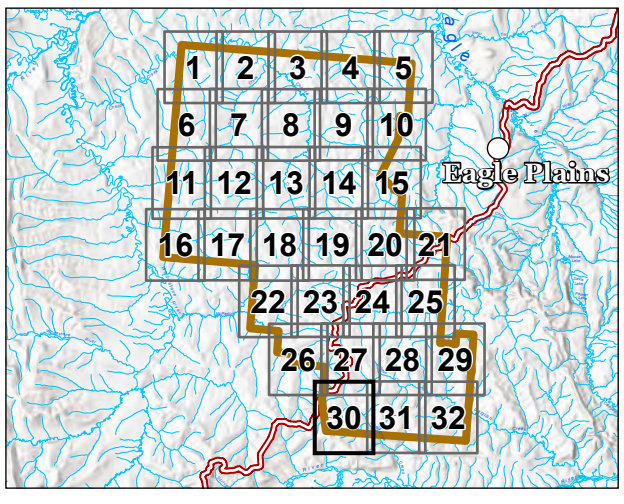

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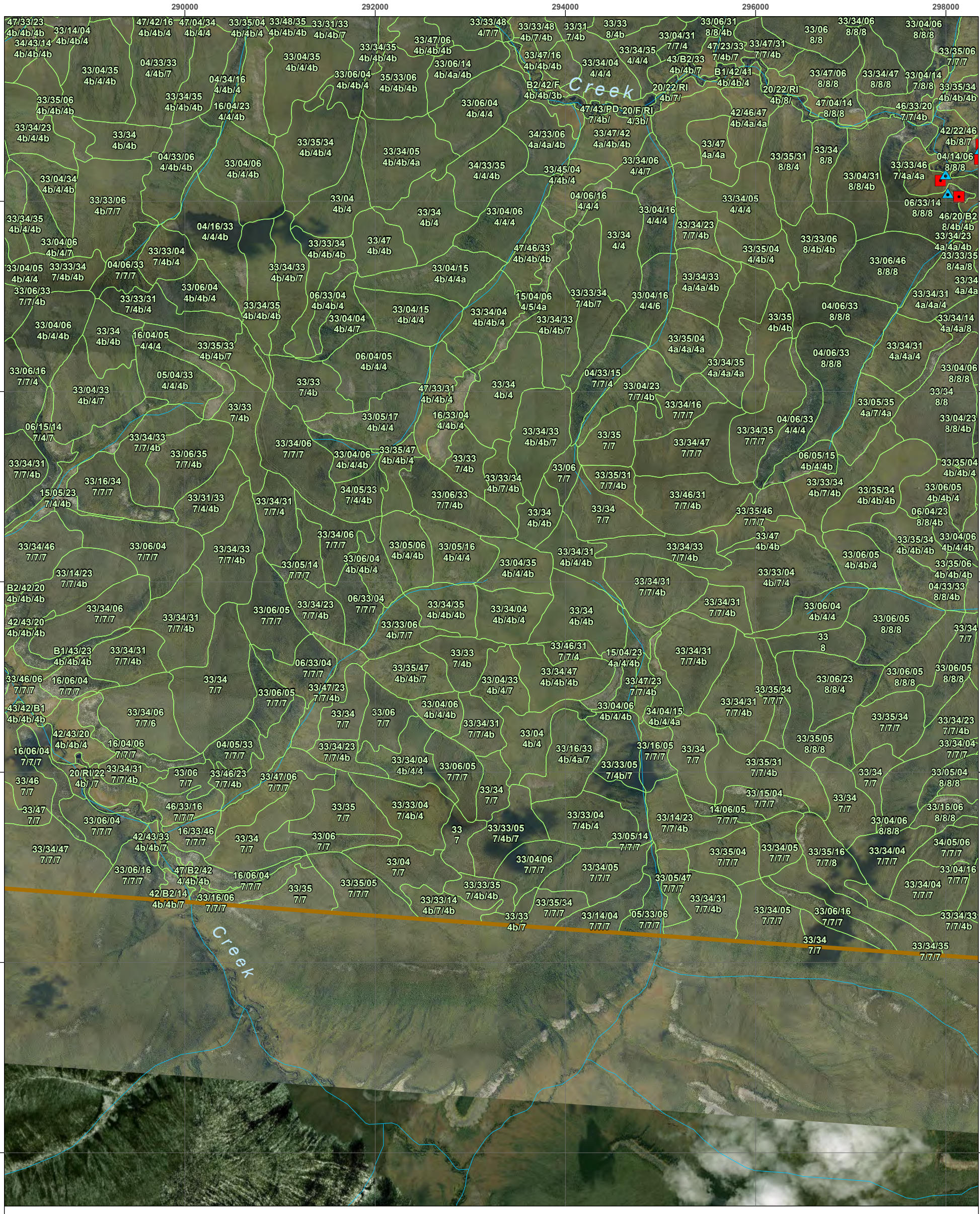

Legend

ELC Plot Type

- Ground
- Air Call
- Note
- Dempster Highway
- Watercourse
- Waterbody
- Eagle Plains Regional Study Area (RSA)
- ELC Polygon

Appendix C Map 31
ELC Polygon Delineations and Plot Locations

Data Sources
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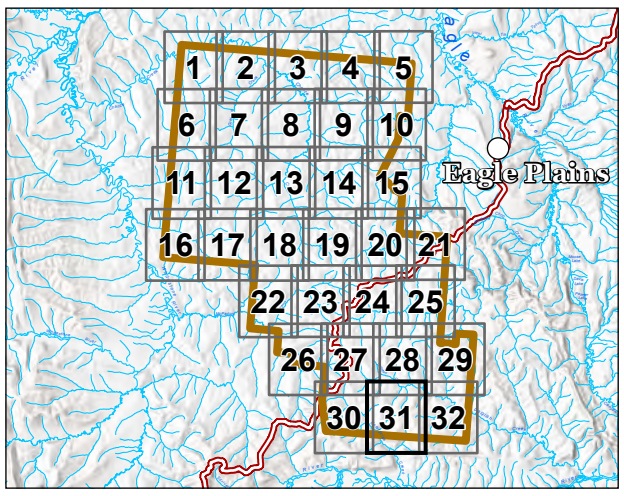

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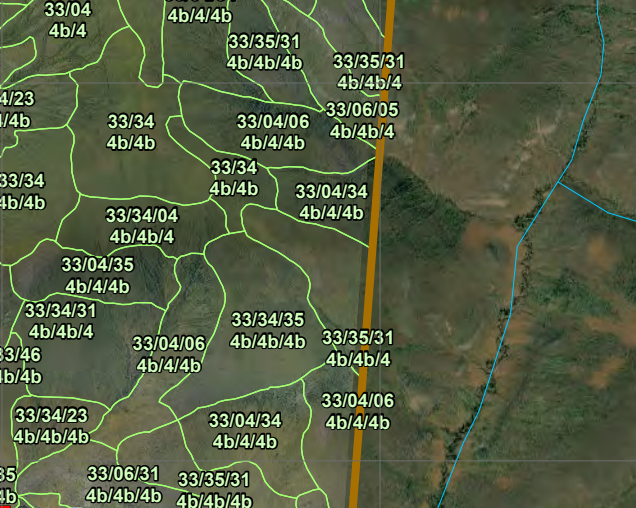

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Attachment Photo 2. Northern and Ground View of a Dry Spruce Lichen Ecosystem Unit (EU 14) (Plot BS009)



Attachment Photo 3. Southern and Ground View of a Dry Aspen Lichen Ecosystem Unit (EU 15) (Plot RR072)



Attachment Photo 4. Eastern and Ground View of a Dry Spruce – Birch – Lichen Ecosystem Unit (EU16) (Plot BS001)



Attachment Photo 5. Western and Ground View of a Dry Aspen Ecosystem Unit (EU 17) (Plot RR075)



Attachment Photo 6. Eastern and Ground View of a Mesic Birch – Willow Ecosystem Unit (EU 02) (Plot BS107)



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Attachment Photo 8. Eastern and Ground View of a Fire Disturbed Mesic Black Spruce – Alaska Paper Birch Ecosystem Unit (EU 04) (Plot BS033)



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Attachment Photo 14. Southern and Ground View of a Riparian White Spruce – Prickly Rose Ecosystem Unit (EU 21) (Plot BS013)



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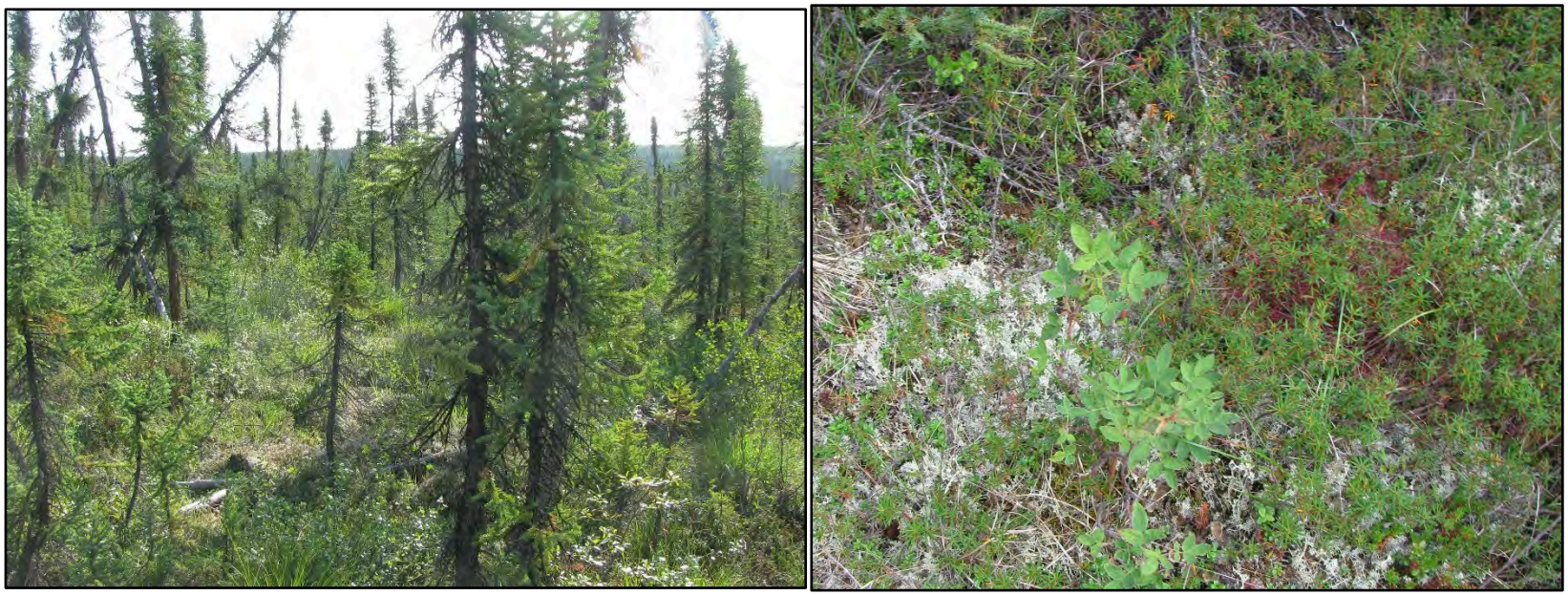


Attachment Photo 19. Eastern and Ground View of a Moist Spruce – Labrador Tea Ecosystem Unit (EU 33) (Plot BS030)



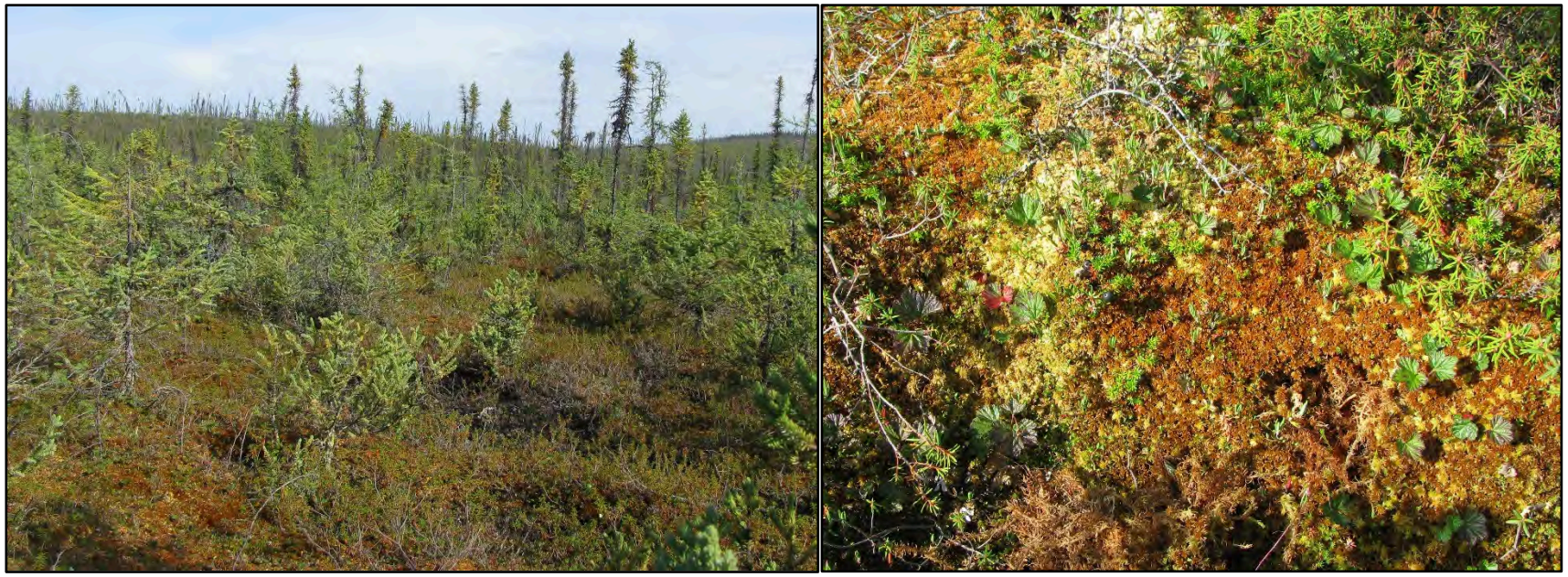
Attachment Photo 20. Southern and Ground View of a Fire Disturbance Moist Spruce – Labrador Tea Ecosystem Unit (EU 33) (Plot BS049)



Attachment Photo 21. Southern and Ground View of a Moist Spruce – Scrub/Shrub Birch – Labrador Tea Ecosystem Unit (EU 35) (Plot BS041)



Attachment Photo 22. Southern and Ground View of a Moist Birch – Willow Ecosystem Unit (EU 36) (Plot RR048)



Attachment Photo 23. Northern and Ground View of a Wet Shrub – Tamarack Ecosystem Unit (EU 41) (Plot BS018)



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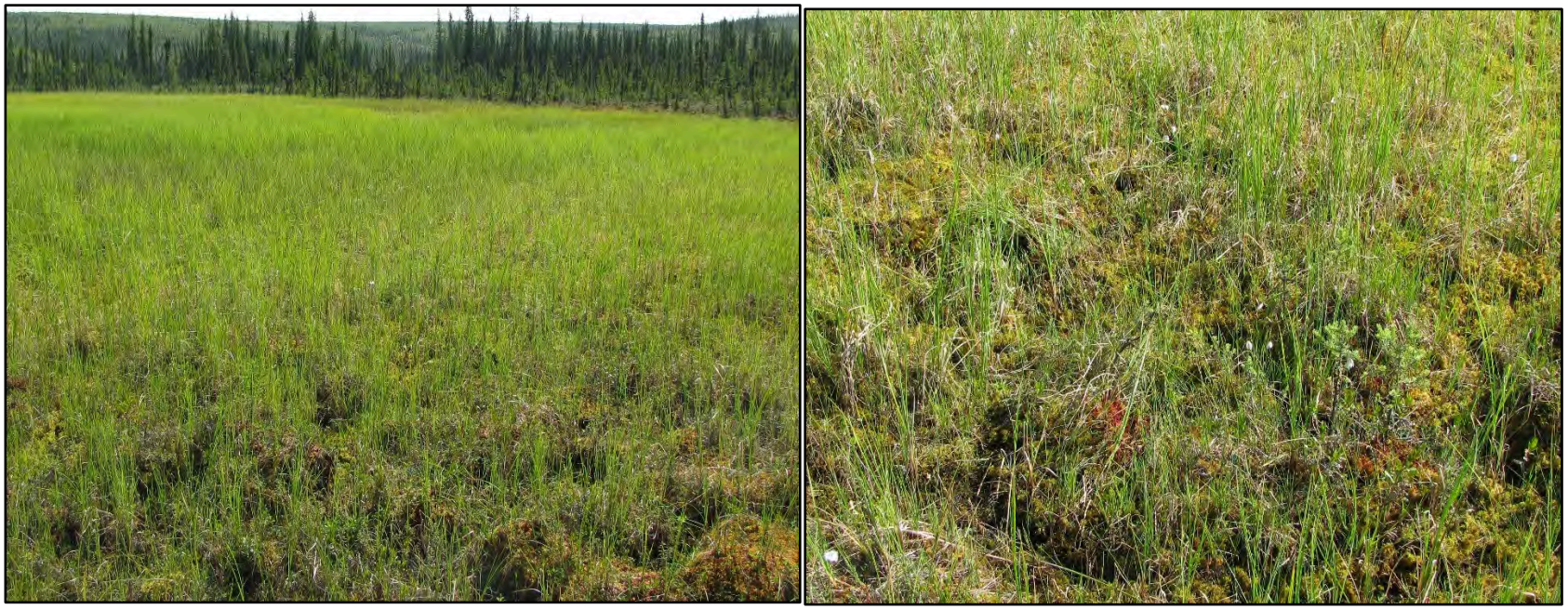
Attachment Photo 34. Western and Ground View of a Bog – Black Spruce – Sphagnum Ecosystem Unit (EU B2) (Plot BS063)



Attachment Photo 35. Southern And Ground View of a Fen Ecosystem Unit (EU F) (Plot BS025)



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Ecosites by Structural Stage Mapped in the Eagle Plains Exploration RSA.

Map Ecosite Code	Structural Stage													
	1	2	2a	3	3b	4	4a	4b	5	6	7	8	n/a	Total
02	0	0	0	0	0	4.0	0	15.9	0	13.0	57.6	0	0	90.5
03							6.8	42.1		40.0	9.3			98.3
04		4.1				3,592.1	1,719.2	5,121.3	237.5	2,973.7	7,244.5	257.6		21,150.0
05						617.1	1,589.0	2,229.4	268.0	3,366.1	3,383.16	43.4		11,496.0
06						133.6	164.8	3,398.3		366.9	3,043.5	356.2		7,463.5
10			2.6											2.6
14		69.1				22.3		489.8		146.9	997.8	101.1		1,826.9
15						146.8	42.7	23.5		31.3	36.6			280.8
16						638.8	53.3	353.6	6.0	241.8	745.5	64.6		2,103.6
17						14.7		5.2		54.8	5.4			80.1
20						343.9	15.2	501.1						860.2
21								9.3			6.5	176.4		192.1
22						8.2	41.9	4.9		65.4	487.2	66.8		674.4
23					3.5	314.4	78.8	4,054.5		2.9				4,454.2
31					10.6	430.9	199.0	8,475.5			13.9			9,129.9
33					29.6	1,037.8	36,547.8	40,104.7		508.2	24,493.1	975.3		103,696.5
34						831.6	11,250.1	9,840.3		382.0	5,016.4	108.2		27,428.6
35				4.2	11.3	164.5	3,242.2	5,534.3		86.0	3,092.2	28.7		12,163.3
36						6.4	2.5	5.6		13.2	5.8			33.4
41						4.2	1.0	172.1						177.3
42					17.1	1,417.0	673.9	12,379.1	4.2		25.8			14,517.0
43						296.0	168.8	2,817.4			33.4			3,315.6
44						43.5	49.5	6,744.9	1.2		5.5			6,844.7
45								98.7						98.7
46						23.9	952.2	460.7	8.9	26.9	923.8	101.4		2,498.0
47					3.5	101.6	1,104.4	2,101.3	29.0	3.5	866.0	22.9		4,232.3
48							31.4	139.2			26.0			196.6

Map Ecosite Code	Structural Stage												
	1	2	2a	3	3b	4	4a	4b	5	6	7	8	n/a	Total
B1								764.7						764.7
B2								1,960.9						1,960.9
F					36.3			6.2						42.5
M				3.6	49.2			6.7						59.5
AN													34.9	34.9
ES	8.0	3.7											2.8	14.5
Fa						3.3							1.7	5
LA													6.5	6.5
PD													130.4	130.4
RI													457.1	457.1
RZ													58.9	58.9
Total	8	77	2.6	8	89	10,206	62,308	98,877	540	8,776	54,724	2,332	696	238,640

APPENDIX B. Linear Feature Study

Chance Oil and Gas, Eagle Plains Project: Linear Feature Study



Prepared For
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Senior Wildlife Biologist

EDI Project
22Y0505
May 2023

EDI
ENVIRONMENTAL DYNAMICS INC.
Down to Earth Biology

EXECUTIVE SUMMARY

The Eagle Plains Exploration Project (the Project) is an oil and gas exploration project located in north Yukon. Chance Oil and Gas Ltd. (Chance) intends to conduct exploratory activities to confirm the quality, quantity, and extent of hydrocarbons over ten years. Work will include seismic exploration and exploratory wells supported by an expanded winter road network. Oil and gas exploration activities create long, narrow clearings through natural vegetation, such as seismic lines and roads, collectively known as 'linear features.' Linear features can be a management challenge because they can affect how people and animals move and plants disperse within a landscape. For example, in southern parts of the boreal forest, linear features appear to affect predator-prey dynamics that can result in increased caribou mortality by wolves. The North Yukon and Peel Watershed Regional Land Use Plans identify mitigations to minimize the potential effects of linear features, including cautionary (0.75 km/km^2) and critical (1.0 km/km^2) indicator levels of linear disturbance.

Intermittent exploration activities in the Eagle Plains area from the 1950s to 2014 have created a network of winter roads, 2D seismic lines, and, most recently, 3D seismic lines in parts of the Regional Study Area (RSA). However, the extent of liner features that currently occur in the RSA, the structural, vegetation, and functional characteristics of different linear feature types, and their degree of regeneration are unknown. EDI Environmental Dynamics Inc. conducted a linear features study to characterize the structural, vegetation, and functional aspects of linear features in the RSA to address these information gaps. The study addressed three objectives: (1) comprehensive mapping and classification of existing linear feature footprints within the RSA; (2) quantification of structural aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and (3) quantification of regeneration pathways and structural stages of linear features. This combined information supports assessing potential effects of linear features in the Project application and refinement of mitigation measures for linear features to minimize possible effects.

The linear features inventory was compiled from multiple spatial datasets and was verified and supplemented using satellite imagery in a Geographic Information System. Linear feature densities were estimated for each linear feature type. Estimates were adjusted to account for (i) overlap with open habitats, such as recent burns, where vegetation heights were similar on and off the line, and (ii) for average rates of regeneration determined from field studies.

Site selection used a stratified random design to obtain a representative sample of different feature types across the RSA. Ground and aerial surveys measured specific structural, vegetation, and functional characteristics across the different line types. Measures included width, successional class, structural stage, vegetation composition and height, and sightline distances. A 'walk test' was used to index ease of movement for large mammals. A driving survey documented the visibility of seismic lines from the Dempster Highway (i.e., as an index of potential human access onto the seismic lines). An aerial winter track survey was conducted in March 2020 to assess ungulates' relative use of different linear feature types.

Four primary types of linear features occur in the RSA, totalling 4,269 km: 2D seismic (34%), 3D seismic (51%), winter roads (14%), and the Dempster Highway (1%). The unadjusted linear feature density for the RSA totalled 1.79 km/km^2. After accounting for burns, natural openings and regeneration, the adjusted linear

feature density for the RSA totalled 0.52 km/km², below the cautionary and critical indicator levels in the North Yukon and Peel Watershed Regional Land Use Plans.

Structural, vegetation, and functional characteristics differed substantially among linear feature types. 3D seismic accounts for the largest extent of linear features in the RSA and had the narrowest widths and limited functional effects (e.g., the proportion of features used by ungulates in the winter was less than a third of the rates of use on 2D and winter roads). Winter roads had the widest average widths and the greatest functional effects except for the Dempster Highway. However, a substantial portion (39%) had also regenerated into or past the Tall Shrub stage (which this study suggests may be the best criterion for functional recovery). Most 2D lines had substantial vegetation regeneration, resulting in the shortest average sightlines and slowest movement speeds. However, ungulates still appeared to select them to travel on during winter.

Except for the Dempster Highway, where walking speeds were near twice the rate of other linear feature types, there was relatively little difference in movement rates among linear feature types and control areas. The density of shrubs and trees primarily limited movement rates. 2D lines, which had the highest density of shrubby regeneration, had the slowest average movement rates. For other linear feature types, the combination of vegetation regeneration on linear features and the naturally open nature of most adjacent undisturbed areas did not convey a substantial increase in movement rates on linear features compared to undisturbed areas.

Sightline distances on 2D lines and winter roads were also affected mainly by the degree of vegetation regeneration. Where regeneration was limited, sightlines on 2D lines and winter roads regularly exceeded 150 m. On 3D lines, which have not had enough time since their creation for vegetation to regenerate to the height that restricts vision, sightlines were limited by meanders purposely constructed to reduce sightlines. The meanders employed on 3D lines were also effective in reducing the detectability of the lines from the Dempster Highway. In the blind test, where observers did not know the location of the 3D lines, only 5% (4 out of 74) crossings were spotted. With a map showing the crossing locations, only two additional 3D lines were detected.

These results provide information to assess the potential effects of linear features in the Project application and refine mitigation measures.

ACKNOWLEDGEMENTS

EDI Environmental Dynamics Inc. (EDI) completed the work within the traditional territories of the Vuntut Gwitchin First Nation (VGFN), First Nation of the Na-Cho Nyäk Dun, and the Tetlit Gwich'in Council (Secondary Use Area). Tyrel Kassi, a VGFN citizen, played an active role in the field components of the project. We thank him for his diligence and shared perspectives during the project.

AUTHORSHIP

Team members from EDI who contributed to preparing this report include:

Todd Mahon, M.Sc., R.P.Bio., ... Study Design and Author

Kerman Bajina, M.Sc. ..... Statistical Analysis and Author

Elaine Kennedy, B.Sc.Env. ..... Author

Mike Setterington, M.Sc., R.P.Bio., CWB ..... Senior Review

Todd Mahon, Hannah Gray, Rachelle Robitaille, and Brodie Smith conducted the field surveys for this study.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
2D	Two Dimensional
3D	Three Dimensional
AIC	Akaike's Information Criterion
asl	above sea level
BC	British Columbia
°C	degrees Celsius
ELC	Ecosystem and Landscape Classification
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectares
IMA	Integrated Management Area
km	kilometers
km^2	square kilometers
km/hr	kilometer per hour
LIS	Low Impact Seismic
LMU	Landscape Management Unit
m	meter
mm	millimeter
NND	Na-cho Nyäk Dun
NWT	Northwest Territories
NYRLUP	North Yukon Regional Land Use Plan
PCH	Porcupine Caribou Herd
OHV	Off-Highway Vehicle
PWRLUP	Peel Watershed Regional Land Use Plan
RSA	Regional Study Area
the Project	the Eagle Plains Project (proposed by Chance Oil and Gas Ltd.)
YLUPC	Yukon Land Use Planning Council

1 INTRODUCTION

1.1 PROJECT OVERVIEW

The Eagle Plains Project (the Project) encompasses a 2,386 km² area in north-central Yukon, approximately 605 km north of Whitehorse and 40 km south and west of Eagle Plains hotel, along the Dempster Highway (Map 1-1). The Project occurs within the Eagle Plains petroleum basin, north of the Ogilvie River and west of the Richardson Mountains. The basin contains proven natural gas and oil reserves (Peel Watershed Planning Commission 2019), including 4.6 billion m³ of gas and 3.2 million m³ of oil (Hannigan 2014).

The Regional Study Area (RSA) has had intermittent periods of oil and gas exploration since the 1950s. That activity has developed winter roads, seismic lines, and exploratory wells across parts of the current RSA. Approximately 40 exploration wells have been drilled at Eagle Plains. Eight wells are maintained in suspended status, and the remaining wells have been plugged and abandoned. Seismic exploration has included approximately 10,000 km of two-dimensional (2D) lines (mainly before 1985), and about 325 km² of three-dimensional (3D) seismic was conducted in 2013–2014 (Northern Cross (Yukon) Ltd. 2014).

The current exploration program will build on past exploration to better define the extent, amount and quality of oil and gas deposits. Under the current program, Chance Oil and Gas Ltd. proposes conducting additional 3D seismic over large extents of the RSA and drilling up to 30 exploratory wells. Depending on the drilling program results, extended flow testing over several months may be conducted at a subset of the wells to determine the quantity and quality of the oil and gas deposit. The existing winter road network will be expanded to support the seismic and drilling programs. Most work is expected to be conducted in the winter (e.g., seismic line clearing and drilling); however, seismic recordings and extended flow testing may also occur during summer.

Oil and gas exploration activities create long, narrow clearings through natural vegetation, such as seismic lines and roads, collectively known as 'linear features.' Linear features can be a management challenge because they can affect how people and animals move and plants disperse within a landscape. For example, in southern parts of the boreal forest, linear features appear to affect predator-prey dynamics that can result in increased caribou mortality by wolves. The North Yukon and Peel Watershed Regional Land Use Plans identify mitigations to minimize the potential effects of linear features. The Plans also include cautionary (0.75 km/km²) and critical (1.0 km/km²) linear density indicator levels.

1.2 PURPOSE AND OBJECTIVES

Intermittent exploration activities in the Eagle Plains area from the 1950s to 2014 have created a network of winter roads, 2D seismic lines, and, most recently, 3D seismic lines in parts of the RSA. However, the extent of liner features that currently occur in the RSA, the physical and functional characteristics of different linear feature types, and their degree of regeneration are unknown.

EDI Environmental Dynamics Inc. (EDI) conducted a linear features study to characterize the physical and functional aspects of linear features in the RSA to address these information gaps. The three objectives of this study were to: (1) conduct comprehensive mapping and classification of existing linear feature footprints within the RSA; (2) determine physical aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and, (3) quantify regeneration pathways and stages of linear features. The combined information forms the basis for assessing the potential effects of linear features in the RSA and refining mitigation measures for linear features.

1.3 STUDY AREA

The RSA for the Eagle Plains Project is approximately 2,386 km² (238,566 ha), centred in the Eagle Plains Ecoregion in north Yukon (Map 1-1). The area consists of subdued topography of rolling hills and sloping plains. The RSA is centred on a major watershed divide (denoted by the location of the Dempster Highway), with the northwestern two-thirds of the RSA draining into the Porcupine River watershed to the north, via Chance Creek, and west, via McParlon Creek and the Whitestone River. The southeastern third of the RSA drains into the Peel River watershed via Dalglish Creek.

Development in the RSA and the surrounding Eagle Plains is low. The Dempster Highway is the primary vehicle access corridor, running from approximately Dawson City, Yukon in the south to Inuvik, Northwest Territories in the north, and transiting the RSA. The Eagle Plains settlement is on the Dempster Highway, approximately 40 km northeast of the RSA and includes the Eagle Plains Hotel and the Government of Yukon's Highway Maintenance camp. The Eagle Plains area has had intermittent periods of oil and gas exploration since the 1950s. That activity has created winter roads, seismic lines, and exploratory wells across parts of the RSA. Approximately 40 exploration wells have been drilled at Eagle Plains. Eight wells are maintained in suspended status, and the remaining wells have been plugged and abandoned. Approximately 10,000 km of 2D lines have been developed across the Eagle Plains Ecoregion, mostly between 1961 and 1984 (Access Consulting Group and EBA Engineering Consultants Ltd. 2001, GEOTIR 2014). More recently, approximately 2,200 km of 3D LIS exploration was conducted in a 325 km² area between November 2013 and April 2014 (GEOTIR 2014). This 3D exploration grid is near the centre of the RSA, spanning north and south of the Dempster Highway.

1.3.1 REGIONAL ECOLOGICAL SETTING

The Eagle Plains Ecoregion is a 20,400 km² portion of the Taiga Cordillera Ecozone in north Yukon between the Richardson and Ogilvie Mountains. Unlike much of the mountainous Taiga Cordillera, most of the Eagle Plains Ecoregion occurs as low altitude rolling topography between 300 m and 600 m above sea level (masl), with few scattered peaks above and around 1,000 masl (Ecological Stratification Working Group 1995). Most of the ecoregion is unglaciated terrain, with surficial features formed due to permafrost and frozen ground-related processes, including thermokarst subsidence, soil creeps, cryoturbation, solifluction, and active layer detachment slides on shale (Yukon Ecoregions Working Group 2004).

The Eagle Plains Ecoregion experiences moderate precipitation, with annual amounts around 400 mm. Most precipitation falls as rain throughout the summer, averaging 50 to 80 mm per month, June through August. Precipitation is lighter through September to April and falls as snow, with average winter snowpacks of 80 cm peaking in April. The climate is strongly affected by latitude, with extended winter conditions from October to early May. There is a substantial variation in seasonal temperatures in the Eagle Plains, with cool short summers and long cold winters. Average winter temperatures are between −30°C and −25°C, with extremes as low as −60°C. Average summer temperatures are around 13°C, with extremes as high as 30°C. Due to the northern latitude, this region experiences continuous sun above and below the horizon, in summer and winter, respectively.

Most of the Ecoregion, including the northeast portion of the RSA, drains north into the Yukon River via the Whitestone, Porcupine and Eagle rivers. That part of the RSA includes the headwaters of the Eagle River and several other tributaries of the Porcupine River, along with the Chance and McParlon Creek subdrainages of the Whitestone River. The southeast corner of the Ecoregion drains east to the Mackenzie River via the Peel, Wind and Ogilvie Rivers. Dalglish and Enterprise creeks flow directly into the Peel River. The few lakes in the Ecoregion are generally oxbow or thermokarst lakes (Yukon Ecoregions Working Group 2004). Several wetland complexes are associated with larger creeks in the RSA.

The Eagle Plains Ecoregion is within the continuous permafrost zone where permafrost can be found up to 200 m thick. The Eagle Plains Ecoregion is dominated by the Cryosolic soils that occupy much of the northern third of Canada, characterized by near-surface permafrost. Turbic Cryosols predominate, exhibiting patterned ground formations and hummocks, and are often associated with open stands of black spruce (*Picea mariana*), tamarack (*Larix laricina*) and birch (*Betula* spp.). The active permafrost layer in these ecosystems generally ranges between 20 cm and 90 cm below the surface. The active layer depth is generally deeper directly under hummocks and shallower under inter-hummock areas (Yukon Ecoregions Working Group 2004).

The RSA is entirely within the Subarctic Bioclimate Zone (Environment Yukon 2014). Vegetation in the RSA is characterized by open-canopy, spruce-dominated habitats where permafrost and short cool growing seasons limit tree growth and often result in stunted, disclimax vegetation communities (Environment Yukon 2016). Hummocky, black and white spruce (*Picea glauca*) woodlands with well-developed shrub communities are common in upland areas. White spruce and ground lichens increase in abundance in well-drained sites. Areas with low slope gradients and fine-textured soils often have ground cover dominated by cottongrass tussocks beneath a shrub layer of birch, black spruce, Labrador tea (*Rhododendron groenlandicum*), and occasionally tamarack (*Larix laricina*) (Yukon Ecoregions Working Group 2004).

Forest fires are a common disturbance agent in the region, and burns of various ages occur throughout the RSA. Fires increase the depth of the active permafrost layer and changes in soil moisture and productivity, affecting vegetation regeneration and resulting in terrain disturbances, such as slope failures and erosion. Regenerating burns are dominated by shrubs, such as scrub birch (*Betula glandulosa*), willows (*Salix spp.*) and alder (*Alnus spp.*), with Alaskan paper-birch (*Betula neoalaskana*) often the first tree species to colonize burn areas. As burns regenerate into young and mature forest, black and white spruce typically become the dominant forest species. Residual Alaskan birch in spruce-dominated stands often defines the extent of old burns (Yukon Ecoregions Working Group 2004).

Mammal diversity is relatively low in the Eagle Plains Ecoregion due to its northern location and low productivity. Voles (*Microtus* spp., *Myodes* spp., *Phenacomys* spp.), American marten (*Martes americana*), ermine (*Mustela erminea*), and red fox (*Vulpes vulpes*) are common smaller mammals. Wolves (*Canis lupus*), wolverines (*Gulo gulo*), and both black and grizzly bears (*Ursus americanus* and *U. arctos*.) are present at low densities. Moose (*Alces alces*) inhabit the region year-round. The RSA overlaps a small portion of the winter range of the Porcupine caribou herd (PCH), a subpopulation of the barren-ground caribou (*Rangifer tarandus granti*). The PCH is an iconic species in north Yukon, with high cultural, social, economic, and ecological values. The PCH's population has been increasing over the last several decades and is currently estimated to consist of 202,106 to 234,808 caribou (Caikoski 2017, Porcupine Caribou Technical Committee 2018). The PCH is known to occupy portions of the Eagle Plains Ecoregion in fall and winter when they tend to occur in smaller groups over a larger area than during other seasons.

1.3.2 REGIONAL LAND USE PLANNING

The RSA overlaps four First Nation Traditional Territories. Most of the RSA is within the Traditional Territory of the Vuntut Gwitchin First Nation. The southeastern portion is in an area of overlapping Traditional Territories of Vuntut Gwitchin First Nation, the Tetlit Gwich'in Council, the First Nation of Na-cho Nyäk Dun, and Tr'ondëk Hwëchin. Although the RSA is located outside of any First Nation Settlement Lands, it does abut Vuntut Gwitchin First Nations Settlement Lands on parts of its east and southwest borders. Each First Nations government has provided input to, and approved of, the Regional Land Use Plan(s) on their Traditional Territory under the respective First Nation Final Agreements.

1.3.2.1 North Yukon Regional Land Use Plan

The RSA lies mainly within the North Yukon Planning Region and is subject to the North Yukon Regional Land Use Plan (NYRLUP) (Map 1-1). The NYRLUP was created to protect the natural and cultural resources of the region while allowing sustainable economic development opportunities (Vuntut Gwitchin Government and Yukon Government 2009). It provides management direction for using public and settlement lands based on four principles: sustainable development, precautionary principle, conservation, and adaptive management. The NYRLUP divides the Planning Region into 23 land management units classified into three categories: protected area, integrated management area (IMA), and community area. IMAs are further classified into four zones: Zone 1 (lowest development), Zone II (low development), Zone III (moderate development), and Zone IV (highest development). IMA zones are classified based on the area's sensitivity to landscape disturbance, ecological and cultural values, risk of significant impacts, and level of acceptable change. The RSA is a Zone IV IMA with lower ecological and cultural values in a moderately sensitive biophysical setting. Subsequently, Zone IV IMAs allows for the highest development level to occur.

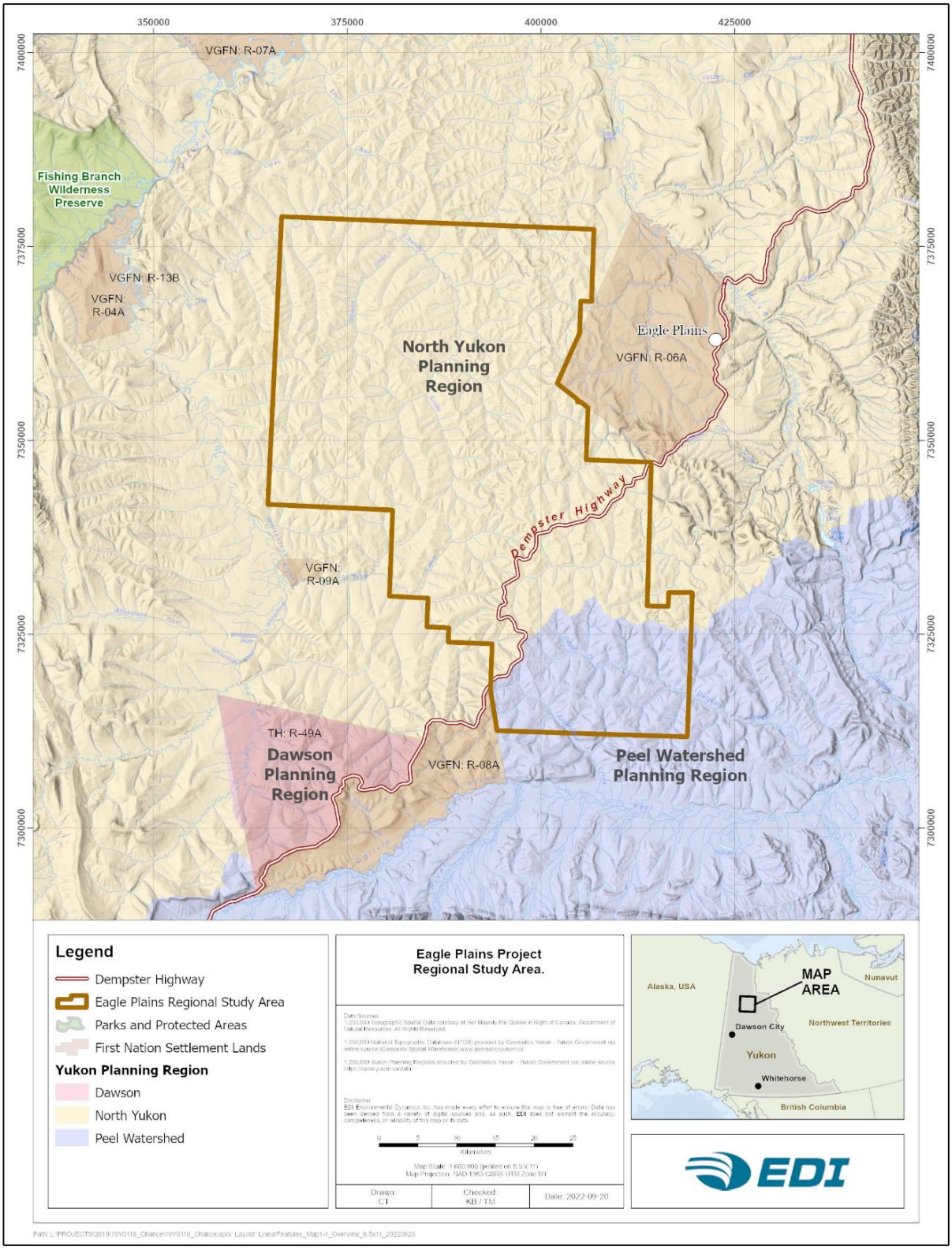
The NYRLUP encourages results-based management and uses cumulative effects indicators to determine if goals and objectives are met. Results-based management allows for innovation and creativity in land-use strategies and approaches. The two cumulative effects indicators included in the NYRLUP are direct surface disturbance and linear density. The NYRLUP guidelines for Zone IV IMAs are 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density (Vuntut Gwitchin Government and Yukon Government 2009).

However, as surface disturbances and linear features reach a level of functional recovery and become part of the continuous landscape, they can be subtracted from the total amount of disturbed area (Vuntut Gwitchin Government and Yukon Government 2009). The NYRLUP suggests using a height of 1.5 m for woody vegetation in forested areas, as vegetation above this height would likely no longer allow for travel or access by humans or wildlife and is, therefore, considered functionally recovered. Activities considered exempt from functional disturbance restrictions are (1) new linear features less than 1.5 m wide; (2) land-use activities that occur on frozen water bodies; (3) winter work with no required clearing of trees; and (4) winter work that uses existing disturbances and linear features.

1.3.2.2 Peel Watershed Regional Land Use Plan

The southeastern corner of the RSA lies within the Peel Watershed Planning Region (PWPR) and is subject to the Peel Watershed Regional Land Use Plan (PWRLUP) (Peel Watershed Planning Commission 2019) (Map 1-1). Like the NYRLUP, the PWRLUP was established to provide management direction and ensure long-term sustainable development in the Planning Region. The PWRLUP was founded on three main themes: environmental protection, social considerations, and economic development. It follows a similar framework as the NYRLUP. The PWPR is divided into 16 Landscape Management Units (LMU), which each share similar ecological characteristics, planning issues, and management intent. Each LMU is categorized by a land-use designation system. Conservation Areas are managed to protect ecological and cultural resources, while IMAs are 'working' landscapes where new development and surface disturbance may be allowed. IMAs are further classified into Zones, which correspond to the level of allowable development with comparable justification as the NYRLUP. The RSA is part of LMU 7 (Dalglish Creek), classified as an IMA Zone IV, allowing for the highest level of development.

Like the NYRLUP, the PWRLUP encourages results-based management and uses the same cumulative effects indicators, surface disturbance and linear density to inform decisions. The PWRLUP cautionary and critical indicators are identical to those of the NYRLUP: 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density. As surface disturbances reach a level of functional recovery and no longer enable travel or access by wildlife and people, they can be subtracted from the total amount of disturbed area. The PWRLUP suggests using a 1.5 m woody vegetation height as a threshold for functional recovery in forested or shrubland areas. In areas dominated by low-growing vegetation, a feature could be considered functionally recovered when covered by native species roughly the same height and composition as the surrounding vegetation. To be considered as "functionally recovered," features must have similar sediment and run-off compared to background levels, roughly match original contours, and have no human-brought materials on the site. Exceptions to the linear density calculation are identical to those outlined in the NYRLUP.



Map 1-1. Eagle Plains Project Regional Study Area.

2 BACKGROUND

The term "linear feature" refers to any narrow, linear clearings of vegetation on the landscape. They include roads, seismic lines, power lines, and pipelines. Seismic lines are the dominant linear feature class in northern Canada, accounting for approximately 46% of all linear features in the Canadian boreal region (Pasher et al. 2013). Seismic exploration detects underground oil and natural gas reservoirs by analyzing sound waves reflected from the underlying geology (Yukon Energy Mines and Resources 2006). Sound waves are emitted by detonating small charges in a series of drilled shot holes (up to 20 m deep) or by vibrating a heavy metal plate on the ground's surface using a truck-mounted vibrator (Yukon Energy Mines and Resources 2006). Both methods require cleared travel corridors for equipment transportation, which results in a network of seismic lines across the landscape where seismic exploration has occurred.

Until the late 1990s, conventional 2D was the primary form of seismic exploration used in North America. 2D seismic lines were created using bulldozers to clear all vegetation in straight swaths, approximately 5–10 m wide in their earliest form. These wide, straight lines were necessary to enable large, heavy equipment movement. This process resulted in significant physical disturbance, often removing most surface vegetation and roots and the top layer of soil (Bliss and Wein 1972). Progressive improvements in 2D seismic exploration methods reduced the environmental impact, such as clearing in winter instead of summer and raising and adding mushroom shoes to the bulldozer blade to reduce soil disturbance. Despite these improvements, many of the 2D seismic lines created in the 1960s and 1970s in northern Canada remain disturbed, with little evidence of ecological recovery (Lee and Boutin 2006, van Rensen et al. 2015).

3D seismic exploration provides more accurate subsurface geological structure data than 2D technology. 3D seismic exploration techniques were developed in the mid-1990s, and their use became widespread in the early 2000s (Dabros et al. 2018). At the same time as the transition to 3D, the seismic industry was transitioning to smaller and more specialized equipment that reduces cost, improves efficiency and reduces environmental impacts. Modern seismic equipment and methods typically use what is referred to as Low Impact Seismic (LIS) methods that minimize line widths and site disturbance and compaction. Typical 3D seismic lines are 2–3 m wide, constructed in 100–500 m spaced grids, and follow meandering rather than straight routes. There have been substantial improvements in the equipment used for 3D seismic line creation: low ground pressure mulchers, lighter equipment, ATV-mounted equipment, mushroom shoes and smear blades, and 'envirodrills' greatly reduce physical and vegetation disturbance (Dabros et al. 2018). These methods often leave the ground vegetation intact and only remove trees and tall shrubs, reducing overall disturbance and facilitating faster regeneration. The location of the seismic line can be adjusted on the fly in the field to minimize impacts, such as avoiding the cutting of large trees.

Continuous advancements in seismic exploration technology have improved geophysical accuracy while simultaneously reducing environmental impact. Numerous studies have examined the effects of linear disturbances on soil, hydrology, vegetation, regeneration, and wildlife responses (see Dabros et al. 2018 for a comprehensive review). Although the bulk of literature focuses on 2D seismic lines, as they have been part of the landscape for over 60 years, there have been several recent studies investigating the effects of LIS and 3D seismic lines (e.g., Kemper and Macdonald 2009a, Kansas et al. 2015, Golder Associates 2016).

Linear features have been associated with various environmental effects, including permafrost thaw, soil compaction and rutting, increased soil moisture and pooling, altered snow cover, temperature and wind patterns, and varied vegetation and wildlife responses (Dabros et al. 2018). In addition to the immediate loss of vegetation, linear features can create extensive edge effects, facilitate non-native or disturbance-induced species establishment, alter species composition, and positively and negatively affect wildlife (Dabros et al. 2018).

One of the most extensively studied effects of linear features in the southern boreal forest is the indirect effects that linear features can have on mortality risk to woodland caribou (*R. tarandus caribou*). Linear features can result in complex effects on populations dynamics that include (i) increases in secondary prey (moose and deer), which elevate wolf populations (apparent competition) and (ii) more efficient hunting by predators along linear features (facilitated predation) (Wittmer et al. 2007, Latham et al. 2011, Dickie et al. 2017a, Keim et al. 2019b, 2021). Research has also documented the responses of birds to linear features (Bayne et al. 2005, Machtans 2006, Lankau et al. 2013), bears (Tigner et al. 2014, Finnegan et al. 2018), and furbearers (Tigner et al. 2015).

Most studies investigating impacts and recovery of seismic lines and other linear features were conducted in southern boreal forest ecosystems (i.e., Boreal Plains Ecozone; e.g., Lee and Boutin 2006, Kansas et al. 2015, van Rensen et al. 2015, Dickie et al. 2017a). There are fundamental differences in the climate, vegetation communities, wildlife communities, and ecological processes in taiga ecosystems that may result in different patterns and responses to linear features. For example, regeneration patterns of linear features in taiga ecosystems over permafrost can follow different successional trajectories than those of southern boreal regions (Simpson 2008). The few studies that have examined linear features in taiga regions have found similarities and differences to southern studies revegetation (Kemper and Macdonald 2009, Dabros et al. 2018). One of the key objectives of this study was to collect local information from Eagle Plains that can be used to better contextualize or adapt the findings from other studies to the Eagle Plains Project.

3 METHODS

A GIS analyses and field surveys were conducted to characterize linear features within the RSA. The inventory of linear features in the RSA was developed in a GIS by compiling available spatial data and then verifying and updating that against satellite imagery. Field studies quantified the width, vegetation characteristics, ecological function (line-of-sight, large mammal ease of movement assessment), and visibility of lines from the Dempster Highway.

3.1 LINEAR FEATURES INVENTORY

The inventory of existing linear features in the RSA was developed in a GIS by compiling available spatial data and then verifying and updating that against satellite imagery. A preliminary linear feature database was first developed that was used to support field surveys (described below in this section). A second step linked the field data to the linear feature database and conducted a more thorough review and verification process using satellite imagery to produce a final linear feature dataset for the RSA (see details in section 3.5.1).

Linear feature spatial data were obtained from the following sources:

- Yukon Government Energy, Mines and Resources "Oil and Gas Seismic Lines" dataset (a combination of less detailed National Energy Board data pre-1999 and the more detailed company-submitted data post-1999) (Yukon Government 2019)
- Natural Resources Canada CanVec "Roads," "Trails," and "Cut Lines" 1:50,000 scale datasets (Natural Resources Canada 2019)

The two datasets were merged into one dataset of all linear features documented in Yukon and clipped to the RSA. Key attribute data included (if available) the linear feature type (i.e., 2D and 3D seismic lines, winter roads, trails, Dempster Highway), width, year of establishment, and data source. This preliminary linear feature dataset was compared against satellite imagery at a (minimum) 1:10,000 scale to verify its accuracy. Any linear features that did not correspond with features visible in satellite imagery were either corrected or deleted based on satellite imagery interpretation. In the case of duplicate features across datasets, the 'best' data were attributed to a single feature by considering the spatial accuracy and the amount and accuracy of attribute data, as assessed against satellite imagery. Where duplicate widths occurred in the two source datasets, the wider width was retained.

3.2 LINEAR FEATURE CHARACTERISTICS SURVEY

Field studies quantified the width, vegetation characteristics, line-of-sight, and large mammal ease of travel assessment across the linear feature types identified from the GIS inventory. One aspect of the field study was to compare vegetation, line-of-sight, and ease of movement on the linear features to undisturbed areas adjacent to the cleared lines. Three types of surveys collected data for the linear feature study: ground surveys

(finest level of detail), air surveys (medium level of detail), and air calls (coarsest level of detail). EDI crews collected field data between July 28 and August 8, 2019.

3.2.1 SITE SELECTION

All ground surveys and aerial surveys occurred at predetermined, random sites. Sample sites were selected using a clustered, random sampling approach. This approach balanced obtaining a random, representative sample across linear feature types with survey efficiency (i.e., without clustering sites, the travel time between points would have been substantially greater and resulted in smaller sample size). Survey sites were drawn from 5,000 points distributed randomly across the set of mapped linear features (minimum spacing of 200 m between points). Each point was randomly assigned a unique number.

Each survey cluster included options for both ground and air surveys. For ground surveys, the cluster used a 2 km radius designed to accommodate approximately four ground survey sites, intended to be surveyed within a half-day of work (and close enough so crews could walk between sites). The objective was that two ground clusters could be surveyed by a crew each day. For air surveys, a 4 km radius was used that generally provided at least ten random survey site options. The objective for air survey clusters was that they could be surveyed while transiting between ground survey clusters.

Survey sites were selected via a two-stage process. The first stage was randomly drawing 100 points from the 5,000-point dataset. These points defined the survey clusters and served as actual survey sites. In this first stage, site selection was stratified to obtain an approximately equal sample across 2D, 3D and winter roads. This overweighted sampling of 2D and winter roads, relative to their extents in the RSA, but those features had the highest uncertainty in terms of their widths, vegetation characteristics, and functional characteristics. Stratification was necessary to obtain sufficient sample sizes across these less-common features. The second site-selection stage selected additional random points from the 5,000-point dataset in proximity to the first point, using the 2 km radius for ground surveys and the 4 km radius for aerial surveys.

The RSA was divided into 10 work areas to implement the sample design, each corresponding to a day of surveys. Each day the survey crew selected clusters to survey using the ascending order of the random identification number of the first point used to define each cluster. Similarly, points within each cluster were prioritized in ascending order of the random identification number. Normally, at least two ground clusters and two air clusters were sampled each day. However, that varied somewhat depending on the number of sample sites available in each cluster and the availability of the helicopter.

3.2.2 LINEAR FEATURE CHARACTERISTICS AND SURVEY METHODS

3.2.2.1 Linear Feature Characteristics

A range of structural, vegetation, human use, and functional characteristics was assessed in the field. A list of the various characteristics examined, with a description of each, is provided in Table 3-1. Successional classes and structural stages of vegetation are defined in Table 3-2 and Table 3-3, respectively.

Table 3-1. Description of physical, ecological and function characteristics assessed in the Eagle Plains linear feature study.

Parameter	Description	Survey Measured [1]
Plot location	Latitude and longitude using WGS 1984, measured by Garmin GPS units to ~4 m accuracy.	G, AS, AC
Linear feature type	Dempster Highway, winter road, 2D, 3Dc (conductor lines), 3Dr (receiver lines), and 3D5 (3D lines used both for seismic and local equipment/vehicle travel.	G, AS, AC
Linear feature width	During ground surveys, measured to the nearest 0.05 m and replicated four times. During aerial surveys, they were visually estimated to the nearest 1 m.	G, AS
Percent mulch	Percent cover of mulch (wood chips) on the seismic line, estimated to the nearest 1% using visual estimates. In areas with dense trees or large shrubs, the thick mulch layer produced during line clearing can hinder vegetation regeneration.	G, AS
Successional class	Refers to the successional trajectory of vegetation regeneration on the linear feature. Includes normal, magnified, stagnated, retrogressive, no succession, or recent disturbance class following Simpson (2008)[1].	G, AS, AC
Burn status	Burnt or not burnt; based on visual assessment (i.e., burned trees, charred ground vegetation).	G, AS, AC
Structural stage	Categorical descriptor of the dominant vegetation life form in the plot following the *Field Manual for Describing Yukon Ecosystems* criteria (Environment Yukon 2017). Structural stage categories are defined in Table 3-3.	G, AS
Height and species of tallest vegetation	Measured to the nearest 0.1 m for the tallest vegetation layer, approximated by the 90th percentile height to exclude extreme heights of individual plants.	G
Cover and species of dominant trees	Percent cover was recorded to the nearest 1% if less than 10%, and to the nearest 5% if over 10%. One or two dominant tree species were recorded.	G, AS
Cover and species of dominant shrubs	Percent cover was recorded to the nearest 1% if less than 10%, and to the nearest 5% if over 10%. Up to five co-dominant shrub species were recorded. Ground shrubs were excluded.	G, AS
Ecosite	Ecosite was recorded using Predictive Ecosystem Mapping (PEM) Units, available at the time of the survey. However, separate vegetation surveys indicated that the accuracy of the PEM mapping was poor, and ecosites were not used in subsequent analyses.	G
Permafrost activity/degradation	Present or absent. Additional comments (i.e., type of activity, percent cover) were recorded if applicable.	G
Wildlife trails	Present or absent. If present, rated as poorly, moderately, or well defined.	G
Potential for Off-Highway Vehicle (OHV) passage	Present or absent. Based on professional judgment, a 4x4 side-by-side is summer, considering obstructing vegetation, ground conditions (e.g., wetlands, peatlands), and graminoid tussocks.	G, AS
Signs of human activity	Present or absent. If present, applicable comments were recorded.	G
Ground disturbance	Percent cover of visibly disturbed ground. If present, type and additional descriptive comments were recorded.	G

[1] G=Ground Survey, AS=Aerial Survey, AC=Air Call.

[2] Between 2006 and 2008, Yukon Government, Department of Energy, Mines, and Resources investigated the recovery status of linear features in the Eagle Plains, British Mountains, and Peel River Plateau Ecoregions (Simpson 2008). They found that linear features typically regenerated into one of six categories: normal succession, magnified succession, retrogressive succession, successional stagnation, no succession, and recent disturbance (Table 3-2).

Table 3-2. Descriptions of successional classes on linear features in the Eagle Plains area (following Simpson 2008).

Successional Class	Description
Normal succession	Vegetation is similar to the adjacent undisturbed area but often in an earlier seral stage. E.g., often young trees surrounded by early successional shrubs and forbs. The disturbance was likely limited to removing trees and shrubs, with little to no disturbance to soil or permafrost.
Magnified succession	Vegetation on the feature is taller than the adjacent undisturbed area. Deciduous species often dominate tree and shrub layers, but a similar pattern was also observed for coniferous trees on some sites. The response is likely due to increased site productivity (including increased soil moisture, nutrients, and temperature) due to soil disturbance or increased depth to permafrost. Most frequently, but not exclusively, observed in burns.
Retrogressive succession	Sites are typically moss or sedge-dominated (rarely forb or low shrub), with high moisture content, often including standing water (i.e., micro wetlands), that contrast to upland conditions in adjacent undisturbed areas. The condition appears to result from permafrost melting and water pooling associated with vegetation removal and removal/compaction of the peat layer and mostly associated with winter roads.
Successional stagnation	Vegetation is typically dominated by graminoids or shrubs and not progressing to more advanced successional stages. Disturbance to soil or permafrost is likely. The ground may have been compacted. Almost exclusively associated with winter roads.
No succession	No ecological differences between the linear feature and adjacent undisturbed areas except that there is no or very little tree or shrub regeneration on the line, other than what was left after creation of the feature. Disturbance appears to be limited to the removal of trees and shrubs, with little to no disturbance to ground vegetation, soil, or permafrost.
Recent disturbance	Newer seismic line where successional patterns could not be determined. Features in this class were most likely trending to 'normal succession' or 'no succession', but the degree of regeneration was too limited to classify confidently.

Table 3-3. Structural stage categories used in ground and air surveys for the Eagle Plains linear feature study.

Structural Stage Code	Structural Stage Name	Description
1	Non-vegetated	Very recent disturbance (e.g., fire or flood) and no vegetation or less than 5% vegetation.
2	Sparse/Cryptogram	Either the initial stages of primary succession or a cryptogram community maintained by environmental conditions (e.g., bedrock, talus). Sparse tree, shrub and herb cover. Either sparsely vegetated overall (low cover of vascular plants and cryptograms, if present) or dominated by cryptograms.
2a	Sparse	5–10% vegetation cover.
2b	Bryoid	Bryophyte-dominated.
2c	Lichen	Lichen-dominated.
3	Herb	Early successional stage (e.g., post-fire forest succession) or a herb community maintained by environmental conditions or disturbance. Vegetation is dominated by herbs, although if the site overall is sparsely vegetated, herb cover can be low as long as herbs characterize the vegetation. Trees and shrubs are usually sparse or absent; however, shrub cover and stature (compared to herb cover and stature) determine whether the site is considered herbaceous.
3a	Forb-dominated	Includes non-graminoid herbs and ferns.

Structural Stage Code	Structural Stage Name	Description
3b	Graminoid-dominated	Includes grasses, sedges, reeds, and rushes.
3c	Aquatic	Floating or submerged plants dominate.
3d	Ground shrub-dominated	Dominated by dwarf woody species such as kinnikinnick (*Arctostaphylos uva-ursi*) or dwarf willows.
4	Shrub	Early successional stage of a forest or a shrub community maintained by environmental conditions or disturbance. Dominated either by shrubby vegetation, including tree seedlings or saplings; or, if sparsely vegetated overall, dominated by shrubs, which characterize the community as a shrubland.
4a	Tall Shrub	Dominated by woody plants >2 m tall with diameter at breast height (dbh) ≤7 cm.
4b	Low Shrub	Dominated by woody plants <2 m tall.
5	Treed: Pole/Sapling	Trees >2 m tall and with dbh >7 cm, typically densely stocked. Self-thinning and vertical structure are not yet evident in the canopy. Younger stands are vigorous (usually >15 to 20 years old); older stagnated stands (up to 100 years old) are also included; time since disturbance usually <40 years; up to 100+ years for dense (5,000–15,000+ stems per ha) stagnant stands.
6	Treed: Young Forest	Self-thinning has become evident and the forest canopy has begun to differentiate into distinct layers. A more open stand than at the pole/sapling stage.
7	Treed: Mature Forest	Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understoreys become well developed as the canopy opens up.
8	Treed: Old Forest	Stands of old age with complex structure; patchy shrub and herb understoreys are typical; regeneration is usually of shade-tolerant species with a composition similar to the overstorey. Fire-maintained stands may have a single-storey appearance.
9	Treed: Very Old Forest	Very old stands with complex structures, abundant large trees, snags and coarse woody debris (CWD); snags and CWD occurring in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species, with well-established canopy gaps.

3.2.2.2 Survey Methods

Three types of surveys assessed linear feature characteristics: ground surveys (finest level of detail), air surveys (medium level of detail), and air calls (coarsest level of detail). The reason for using different survey types was to maximize the sample size obtained, recognizing that the ability to collect certain types of data, or the level of measurement precision, decreased from ground surveys to aerial surveys to air calls. The characteristics that were measured during each survey type are noted in Table 3-1. Surveys were conducted between July 28 and August 8, 2019.

Ground surveys collected the most information and had the highest measurement precision of the three survey methods. All parameters listed in Table 3-1 were recorded. Field measurements generally followed methods in *Field Manual for Describing Terrestrial Ecosystems* (BC MFLNRORD and BC MOE 2010) with parameter specific details noted in Table 3-1. Photographs were taken of representative on-line and off-line plots.

Air surveys collected moderate resolution data on linear features. Air surveys efficiently collected a larger quantity of more generalized data than ground surveys. The subset of parameters recorded for aerial surveys is noted in Table 3-1. The survey methods generally followed procedures outlined for helicopter-based 'visual checks' in *Standard for Terrestrial Ecosystem Mapping in British Columbia* (Resources Inventory Committee 1998). Data were collected by hovering in a helicopter approximately 30 m over the sample sites for approximately three minutes while field crews recorded data for the reduced set of variables. Like ground surveys, relevant data were collected for both on-line and off-line plots. Photographs were taken at representative air survey plots (Attachment A).

Air calls collected data at the coarsest resolution of the three survey types, and no off-line data were collected. The data collected during air calls were limited to linear feature type, successional class, and burn status. Air calls were opportunistically conducted when EDI crews were flying through the RSA and linear features were encountered.

A fundamental aspect of the field study was to compare linear feature characteristics to adjacent undisturbed areas. Hence, field surveys included paired on-line and off-line plots at each sample site (excluding sites assessed via air calls). Off-line plots were located 50 m off the linear feature, with the direction off the feature selected randomly at each site using a coin toss. Data collected for each sample site were recorded on tailored survey forms (Attachment B).

3.2.2.3 Line-of-Sight and Ease of Travel

In addition to the structural and vegetation measures noted above, line-of-site and ease-of-movement were assessed as functional characteristics of the linear features at each ground plot. The sightline, measured to the nearest metre, was calculated as the farthest line that could be sighted using a range finder at the height of 1.5 m off the ground. Two measurements were recorded, one in each direction along the linear feature. Sightline measurements were repeated using the same bearings in the off-line plot.

Ease of travel was assessed using a 'walk test,' as Keim et al. (2019a) described in a study assessing the functional recovery of linear features. They found that ease of travel, as measured by a walk test conducted by human researchers, positively correlated with the intensity of use by several wildlife species. One EDI crew member timed themselves to the nearest second for the walk test while walking an approximately 75 m transect, measured to the nearest metre using a hip chain. This walk test was repeated in both the on-line and off-line plots, the paired transects spaced in parallel, approximately 50 m apart. The same observer conducted both walk tests to minimize observer bias at each site.

3.3 VISIBILITY OF LINEAR FEATURES FROM THE DEMPSTER HIGHWAY

One of the management concerns associated with seismic exploration is that seismic lines create travel routes that humans use. The probability of human use of seismic lines to access the surrounding landscape likely increases if the seismic line is visible and accessible from roads. The intersections of seismic lines and winter roads with the Dempster Highway are the primary locations where this could originate. Driving surveys were conducted along the 47 km section of the Dempster Highway within the RSA to determine the number and

type of linear features that could be located and accessed by the public from the Dempster Highway. Two types of surveys were conducted: a blind search where the location of the linear features was unknown and a 'map search,' where the observers had a map of the linear features that showed where they occurred. Both surveys were conducted on August 8, 2019.

The blind search approximated the proportion and type of linear features that the public could locate and access without prior knowledge of their locations. An EDI field crew drove along Dempster Highway at 35 km/h and attempted to identify linear features by visual inspection alone, unaware of where they intersected the highway. When a linear feature was identified, the crew stopped to record the following parameters:

- linear feature type;
- sight line distance;
- evidence of human use;
- evidence of wildlife use; and
- potential for OHV passage.

Photographs were taken, and relevant comments were recorded for each linear feature intersection where applicable.

The map search was a targeted search designed to approximate the proportion and type of linear features the public could spot from the Dempster Highway with prior knowledge of their locations. Using a map of linear features present in the RSA, an EDI field crew drove along the Dempster Highway, slowing to 10 km/h and attempting to identify the linear features when passing a point where the map showed they intersected the highway. When a linear feature intersection was reached, the crew recorded whether the line was visible or not and the parameters listed above for the blind search where a line was detected.

3.4 WINTER TRACK SURVEY

An aerial survey was conducted to assess the relative frequency of use of different liner feature types by ungulates and humans in late winter (March 2020). The survey consisted of 11 transects spanning the width of the RSA. Three of the transects were established parallel to the Dempster Highway at 50 m, 1 km and 5 km off the highway. The remaining transects were spaced approximately 5 km apart across the remainder of the RSA.

Before the field survey, each transect was established in a GIS. Each intersection with a linear feature was given a unique identification point and used to generate a field form (i.e., with a row for each linear feature intersection). The field survey involved flying along each transect and recording the presence of ungulate tracks or human tracks (e.g., snowmobile tracks) at each linear feature that was traversed. Surveys were conducted via helicopter at approximately 70 km/h, 50 m above the ground, with one navigator/data recorder and one primary observer. The surveyors classified tracks to species and counted the number of unique tracks. However, overlapping tracks and dustings of new snow made track identification and counts uncertain in over

half the detections. Therefore, analyses defaulted to the simple presence/absence of ungulate tracks. The primary metric examined was the proportion of linear features with ungulate tracks.

The original survey plan was also to count tracks in undisturbed areas between linear features. However, tracks were so numerous that surveying the entire area between linear features would have required substantially reducing the aircraft speed. This would have reduced the number of transects that could have been surveyed. As a compromise, field crews subsampled the area between lines by surveying an approximate 200 m band of an undisturbed area adjacent to each linear feature.

In conjunction with winter fish habitat assessments, the transects were surveyed over six days (March 7–13, 2020). Each day, one or two transects were surveyed while transiting to/from the study area. No track-erasing snowfalls occurred during the survey period. Snow depths ranged from 65 to 80 cm.

3.5 DATA PREPARATION AND ANALYSIS

3.5.1 SPATIAL DATA

The project generated two primary spatial datasets — a point database corresponding to all field survey sites and the linear feature database. The Linear Feature Survey Point Database (ArcGIS point feature class) contains all location-specific (point coordinate) field data collected at sample sites in summer 2019. Several fields were added to this database based on calculations and spatial joins (e.g., year of linear feature establishment and most recent fire). Paired on-line and off-line plot data were recorded as part of the same sample site coordinate.

The Linear Feature Inventory (ArcGIS polyline feature class) is a compilation of all documented linear features within the RSA, verified by comparing the preliminary linear feature inventory to aerial and satellite imagery and ground-truthing results.

Several modifications were made to improve the accuracy and detail of the Linear Feature Inventory:

- Linear features were classified into the following categories:
  - 2D (historical seismic lines, typically >3m wide),
  - 3D5 (including 4–5 m wide 3D lines that were used for both seismic and local vehicle/equipment travel);
  - 3Dc (3 m wide 3D seismic conductor lines);
  - 3Dr (2 m wide 3D seismic receiver lines);
  - winter roads (any trails or limited use roads used by vehicle or equipment, generally wider than 5 m and often with an obviously curving path); and,
  - Dempster Highway.
- Overlapping features (within a 3 m tolerance) were addressed according to the following rules:

- If two linear features of the same or unknown age overlapped, the wider feature was saved and the narrower feature deleted.
- If two linear features of the same or unknown width overlapped, the more recent feature was saved and the older feature deleted.
- If a 3D line overlapped with a 2D line, both lines were saved. This is because the older 2D lines were often still evident on the landscape in some state of regeneration, as were the 3D lines. However, both were saved since it was unknown at what state each line was in (i.e., if the 2D line was still evident, or only the 3D line, or both in varying states of regeneration). This occurred for 33 km of linear features within the RSA.

The preliminary linear feature inventory within the RSA was compared against a recent high-resolution satellite or aerial imagery (generally, 0.5–1 m resolution) at a 1:10,000 (or finer) scale to verify the accuracy of the source data. Any features that were visibly offset from georeferenced imagery were corrected to match the imagery.

Some older (1960s and 1970s) 2D seismic lines included in the source databases did not appear in satellite imagery. These 2D lines were compared against the imagery along the length of the feature to search for any sign of linear disturbance and then cross-referenced with field surveys conducted along the line, if present. These unverified linear features were classified as 'not applicable' and excluded from analysis if there was no evidence of linear disturbance along the feature's length in the imagery, which could often be verified with associated surveys noting that the feature was 'not present,' 'not visible,' or 'completely regenerated.' Unverified linear features were retained if there was evidence of linear disturbance along any feature's length in the imagery or if associated surveys had noted that the feature was present and in some state of regeneration, even if the feature was not visible in the imagery. A total of 199,473 m of erroneous or regenerated linear features were deleted from the linear feature inventory within the RSA.

Some linear features were visible on the imagery that had not been included in any of the source databases. In these cases, the linear features were manually digitized and classified into linear feature types based on visual assessment and attributes of adjacent connecting features, if present. Digitized linear features were assigned a year if they were obviously a continuation of a documented feature or if they were surrounded by features of the same type and year. Otherwise, the year was not included. High-resolution imagery was not available for the southernmost portion of the RSA (approximately 25 km by 15 km). This area was compared against lower quality Google Earth imagery, but this was not detailed enough to detect undocumented linear features if any existed (Google Earth 2019). However, existing linear features were verified using this method. A total of 202,945 m of linear features were digitized within the RSA.

After the Linear Feature Inventory was verified and corrected to be consistent with imagery and field observations, it was spatially joined to the Linear Feature Survey Point Database. In cases where the survey point did not correspond with any nearby linear feature, or if a linear feature was deleted (following the methods described above), the data were retained in the survey point database, but the linear feature type was updated to 'not applicable' and excluded from data analysis. Ten survey plots were identified as 'not applicable' and excluded from analyses; thus, the corrected sample size for survey plots is n = 210.

3.5.2 FIELD DATA

After completing field sampling, data forms and field notes were reviewed for completeness and accuracy during an internal data quality-assurance process. All associated digital photographs and GPS coordinates were reviewed to correspond to the appropriate field plots. A summary of field plots by linear feature type and survey type is provided in Table 3-4. All recorded data were entered into MS Excel databases (Microsoft 2019). Spatial data were uploaded to the ArcGIS platform (ESRI 2019).

Field-collected data were summarized primarily using Excel spreadsheets (Microsoft 2019). More detailed statistical analyses were performed on select data using R Statistical Software (R Development Core Team 2020). For example, the variation in ease of travel and vegetation cover as a function of linear feature types, burn history, successional stage, or ecosite were explored. During formal analyses, standard assumptions of normality and homogeneity of variance were assessed, and variance-covariance structures were applied to model heterogeneity (of residuals) if required. For instance, the sightline distance (m) was fourth-root transformed to meet normality. In certain models, random effects were included to account for variance among different subjects. For example, observers were included as a random variable to account for observer bias (i.e., a random intercept model; package "nlme", Pinheiro et al. 2016). Corrected Akaike's Information Criteria (AICc) scores were used to compare sets of candidate models. Models with the lowest AICc score were selected because they yielded the best balance (parsimony) between explained variance and level of complexity.

Table 3-4. The number of sites surveyed using ground surveys, air surveys, and air calls for each linear feature type in the Eagle Plains RSA.

Linear Feature Type	Survey Type			
	Ground Survey	Air Survey	Air Call	Total
2D	31	32	44	107
3D-5m wide	5	0	0	5
3D-Conductor	26	3	0	29
3D-Receiver	23	1	0	24
Winter Road	18	17	8	43
Dempster Highway	2	0	0	2
Not Applicable	3	2	5	10
Total	108	55	57	220

3.5.3 LINEAR FEATURE DENSITY CALCULATION

Linear feature densities were calculated in two ways: (1) using the total linear feature extents, and (2) adjusting the extents to account for (a) lines through 'open' habitats, such as wetlands and recent burns, where the vegetation on the line did not differ from vegetation off the line, and (b) functionally recovered linear features such as 2D lines from the 1960s and 1970s that had advanced regenerated at least to the Tall Shrub structural stage. Adjustments were determined by intersecting the Linear Feature Inventory with a recently developed

Ecological Landscape Classification (ELC) map of the RSA (a companion Eagle Plains Project baseline report). The ELC map documented the type and structural stage of vegetation communities across the RSA. The extent of linear features in open habitats was determined by the lengths of linear features overlapping Low Shrub, Herb and Bryoid structural stages in the ELC maps. This includes seral habitats regenerating from burns and ecosystems that are maintained in those stages over time, such as wetlands and shrub-carrs. The extent of regenerated linear features was determined by integrating the proportion of regenerated lines observed from the field surveys (e.g., 61% for 2D lines) with the length of lines through non-open vegetation types in the ELC map. Adjustments were applied to generate functional linear feature densities for each linear feature type individually (i.e., to compare the relative extents of different feature types) and combined to provide an overall density for all linear feature types. For example, the linear feature density for 2D lines was calculated by starting with the total length of 2D lines in the RSA, reducing that by the length of lines through open vegetation types, then reducing the remaining extent by the average proportion of 2D lines that were observed to be regenerated, and then dividing the remaining total length of lines by the extent of the RSA.

4 RESULTS

4.1 LINEAR FEATURE INVENTORY AND DENSITIES

A total of 4,269 km of linear features were mapped and verified in the RSA (Map 4-1, Table 4-1). Winter roads and 2D seismic occur in varying densities across much of the RSA. The extent of 3D seismic is limited to the one area straddling the Dempster Highway in the centre of the RSA.

The total linear feature density in the RSA was 1.79 km/km², based on a total length of 4,269 km and the RSA area of 2,386 km². 3D seismic lines accounted for approximately half of the total length of linear features in the RSA, 2D seismic lines accounted for about one-third, followed by winter roads and the Dempster Highway (Table 4-1). Adjusting for open habitats (i.e., areas in structural stages Low Shrub, Herb, and Bryoid) and vegetation regeneration[1] resulted in substantially lower densities of 0.52 km/km² (Table 4-2). Relatively large extents of recent wildfires were the greatest factor reducing linear feature densities. The relative proportions of the different linear feature types were similar after adjustments, though the proportion of 3D increased and 2D decreased. This was mainly due to the greater degree of vegetation regeneration on 2D lines, consistent with their age since disturbance.

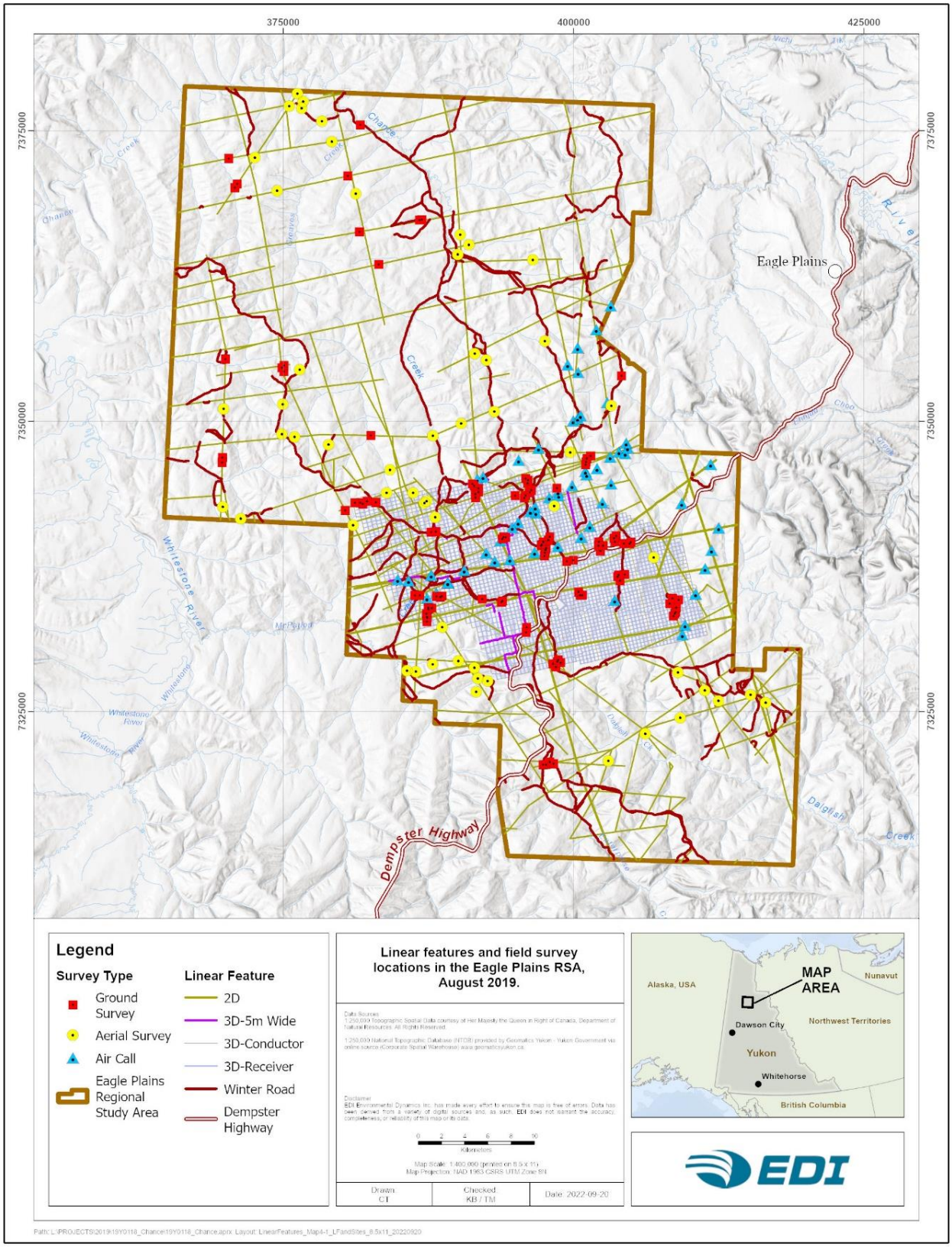
Table 4-1. Summary of total length and density of linear features documented in the Eagle Plains RSA.

Linear Feature Type	Total Length (km)	The Proportion of Total Length	Linear Feature Density (km/km²)
2D	1,452	34%	0.608
3D (combined)	2,165	51%	0.907
3D-5m wide	48	1%	0.020
3D-Conductor	1,189	28%	0.498
3D-Receiver	928	22%	0.389
Winter Road	596	14%	0.250
Dempster Highway	47	1%	0.020
Unknown	8	<1%	0.003
Total	**4,269**	**100%**	**1.788**

[1] See Section 5.5 Functional Recovery of Linear Features for details about vegetation regeneration criteria.

Table 4-2. Summary of total effective length and density of linear features in the Eagle Plains RSA adjusted for open habitat and vegetation regeneration.

Linear Feature Type	Total Length (km)	Proportion of Total Length	Linear Feature Density (km/km²)
2D	289	23%	0.121
3D (combined)	750	60%	0.314
3D-5m wide	21	<1%	0.009
3D-Conductor	401	32%	0.168
3D-Receiver	328	26%	0.138
Winter Road	171	14%	0.072
Dempster Highway	26	<1%	0.011
Unknown	8	<1%	0.003
Total	1,243	100%	0.521



Map 4-1. Linear features and field survey locations in the Eagle Plains RSA, August 2019.

4.2 LINEAR FEATURE CHARACTERISTICS

4.2.1 LINE WIDTHS

Line width varied by linear feature type. Mean line widths ranged from 1.96 m for the narrowest line type (3D receiver lines) to 33.75 m for the Dempster Highway (Table 4-3). Standard error around mean estimates were smallest for 3D seismic lines, which were cleared in the same season using the same equipment and methods, and greatest (by a large margin) for winter roads. The average difference in widths between 3D conductor (wider) and 3D receiver lines was 1.2 m.

Table 4-3. Widths of different linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Minimum mean width (m)	Maximum mean width (m)	Overall mean width (m)	Standard Error (m)
2D	107	3.97	8.5	5.42	0.11
3D-5m wide	5	5.30	6.40	5.68	0.22
3D-Conductor	29	2.50	4.80	3.17	0.13
3D-Receiver	24	1.63	2.53	1.96	0.04
Winter Road	43	2.53	17.97	7.42	0.66
Dempster Highway	2	33.00	34.50	33.75	0.75

4.2.2 MULCH COVER

Mulching of woody vegetation is common during seismic line clearing activities and was used in the 2013/14 3D program. In areas with thick tree or shrub cover, mulching can create a thick blanket of wood chips that inhibits vegetation regeneration (Golder Associates 2016). There was no evidence that this was an issue with any of the seismic lines within the RSA. On average, the percent cover of mulch was <1% on all line types.

4.2.3 HUMAN USE

No sign of human use was detected along linear features during the summer ground surveys (e.g., OHV tracks, ruts, water crossings, vegetation trampling/scarring, tree blazes, trap sets, garbage, and campsites), except for the two sites on the Dempster Highway.

On average, 42% of on-line sites were deemed passable to an OHV (a 4x4 side-by-side) during summer, considering obstructing vegetation, ground conditions (e.g., wetlands or peatlands), and the presence of graminoid tussocks (Table 4-4).

Table 4-4. Proportion of survey sites deemed passable to OHV in summer across different linear feature types in the Eagle Plains RSA.

Linear Feature Type	No. Survey Sites	% Passable
2D	55	9%
3D-5m wide	5	80%
3D-Conductor	29	59%
3D-Receiver	24	75%
Winter Road	29	55%
Dempster Highway	2	100%
Total	144	42%

4.2.4 SUCCESSIONAL CLASSES

Linear features surveys in the Eagle Plains RSA observed five of the six of the successional classes documented by Simpson (2008): normal succession, magnified succession, stagnated succession, no succession, and recent disturbance (Figure 4-1) (Attachment A). No retrogressive succession sites were observed at official survey sites. However, a small number of retrogressive sites were incidentally observed on winter roads while travelling through the RSA.

Most sites surveyed (79%) were undergoing normal succession. The next most common successional class was magnified succession, occurring in 11% of sites, followed by stagnated succession, occurring in 5% of sites. All 3D seismic lines surveyed followed a normal successional trajectory, except for one site that was classed as recently disturbed. Magnified succession was most common in 2D seismic lines (21%), while stagnated succession was most common in winter roads (19%). Successional classes were defined as 'not present' if the linear feature was not present in the field or had regenerated to a stage that was not discernable from the adjacent areas. The Dempster Highway was classified as recently disturbed due to the regular maintenance of the road.

Fire history appeared to influence some successional classes. Magnified succession was more common at burnt sites (19 burnt versus 5 unburnt). In contrast, stagnated succession was more common at unburnt sites (3 burnt versus 7 unburnt). Sites on a normal successional trajectory did not appear to have any relationship to burnt status. The remaining successional classes were too uncommon to draw any conclusions.

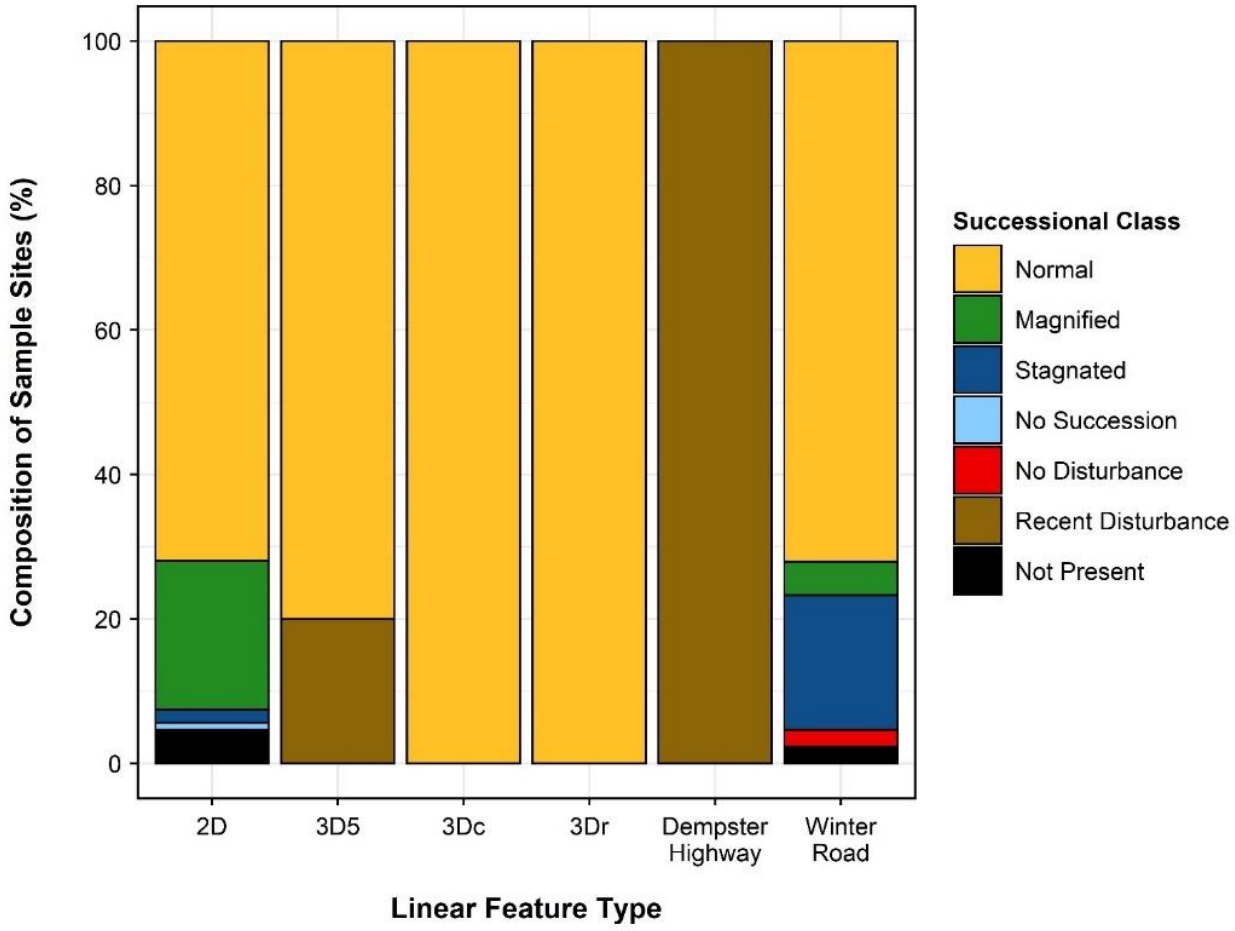


Figure 4-1. Summary of successional classes observed across different linear feature types in the Eagle Plains RSA.

4.2.5 STRUCTURAL STAGE

Most linear features were in a Low Shrub (56.1%) or Tall Shrub (29.0%) structural stage. However, the distribution of structural stages varied substantially across linear feature types (Table 4-5). Although herbaceous and forested stages occurred at some on-line plots, they were not common (less than 5%each). Nearly all forested structural stages were observed on 2D seismic lines and winter roads, reflecting the long time since they were created. Tall Shrub stages were almost twice as frequent in 2D seismic lines than any other linear feature type. Conversely, 83% of 3D linear features were in the Low Shrub structural stage, with most of the remaining in the Tall Shrub stage. The differences in structural stages between 2D and 3D lines appear to be primarily due to the time since disturbance. Winter roads were less consistent in their structural stages; herbaceous, shrubland and forested stages were all observed with moderate frequency. The two Dempster Highway plots were the only non-vegetated stages recorded.

Off-line plots were also mostly in Low Shrub and Tall Shrub stage, but they also included a higher proportion of Young Forest and Mature Forest compared to on-line plots (Table 4-5; Photos A-15 to A-20 in

Attachment A). For off-line plots, the Low Shrub sites were mostly burned areas, and the Tall Shrub sites were mostly stunted, open-canopy, black spruce forest 2–8 m tall.

Fire had a strong effect when comparing structural stages between paired on-line and off-line plots (Figure 4-2). The top two charts in Figure 4-2 show that the pattern of structural stages for burnt areas was very similar between on-line and offline plots. The bottom two charts show that the pattern of structural stages differs substantially between on-line and offline plots in unburnt areas. In unburnt areas, off-line plots had much lower numbers of sites in Low Shrub and much higher numbers of sites in Young Forest and Mature Forest than on-line plots. For burnt areas, the on-line and off-line plots at the same site were the same structural stage in 72% of cases, and within one structural stage of each other 91% of the time (e.g., Tall Shrub vs Pole Sapling). For areas that were not burnt, the on-line and off-line plots at the same site were the same structural stage in only 29% of cases. These results demonstrate that in the absence of fire, pronounced differences between linear disturbances and the surrounding community are evident in both recent (3D) and legacy (2D and winter road) linear feature types. But following a fire, the vegetation structure on-line and off-line are likely to be similar (Photos A-22 to A-24 in Attachment A).

Table 4-5. Vegetation structural stages observed on different linear feature types as a proportion of all plots sampled (n = 156) in the Eagle Plains RSA.

Linear Feature Type	No. Sites	Structural Stage[1]								
		Non-vegetated	Bryoid	Herb	Low Shrub	Tall Shrub	Pole-Sapling	Young forest	Mature forest	Old Forest
2D	62	0%	0%	2%	37%	47%	2%	8%	3%	2%
3D-5m wide	5	0%	0%	20%	80%	0%	0%	0%	0%	0%
3D-Conductor	29	0%	0%	0%	83%	14%	0%	3%	0%	0%
3D-Reciever	24	0%	4%	0%	83%	13%	0%	0%	0%	0%
Dempster Highway	2	100%	0%	0%	0%	0%	0%	0%	0%	0%
Winter Road	33	0%	0%	12%	48%	27%	3%	3%	6%	0%
Off-line	155	0%	1%	1%	33%	29%	1%	18%	17%	1%

[1] See Table 3-3 for structural stage codes and descriptions.

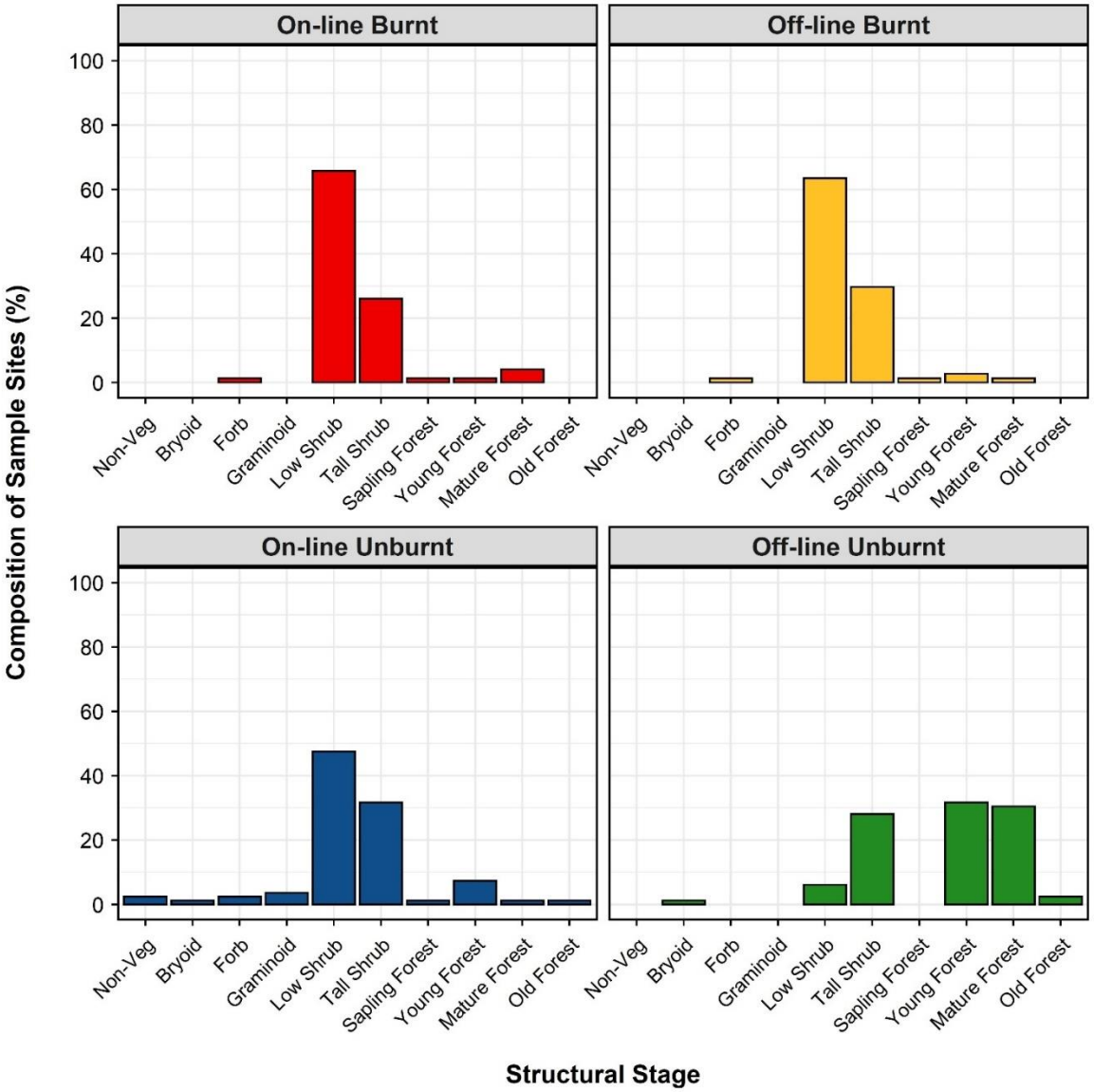


Figure 4-2. Comparison of structural stages on linear features to off-line plots in burnt and unburnt areas, in the Eagle Plains RSA.

4.2.6 VEGETATION HEIGHT

Based on the similarity of patterns in vegetation composition and structure, linear feature types were combined into two groups for assessment of patterns in height: (i) 2D and winter roads and (ii) 3D. A wide range of vegetation heights was recorded at both on-line and off-line plots in the RSA, from 0.3 m to 16 m. Collectively, off-line plots had a normal distribution of vegetation heights between 0 m and 4 m, and then a scattered distribution across heights up to 16 m (Figure 4-3). Plots with ≥4 m tall vegetation accounted for approximately 40% of all off-line reference plots.

In comparison, recovering 2D seismic lines and winter roads shared a relatively uniform distribution between 0 m and 4 m but with a peak occurring at vegetation heights measuring 1.5–2 m tall (Figure 4-4). Only 21% of 2D and winter roads contained dominant vegetation ≥4 m, and only 5% were ≥8 m tall. 3D seismic lines were rarely composed of vegetation ≥2 m, and most of the vegetation (67%) recovering on 3D lines was less than 1 m (Figure 4-5). This is very different from the off-line undisturbed height distribution. However, 3D lines were all only five years old at sampling, and shorter vegetation was expected.

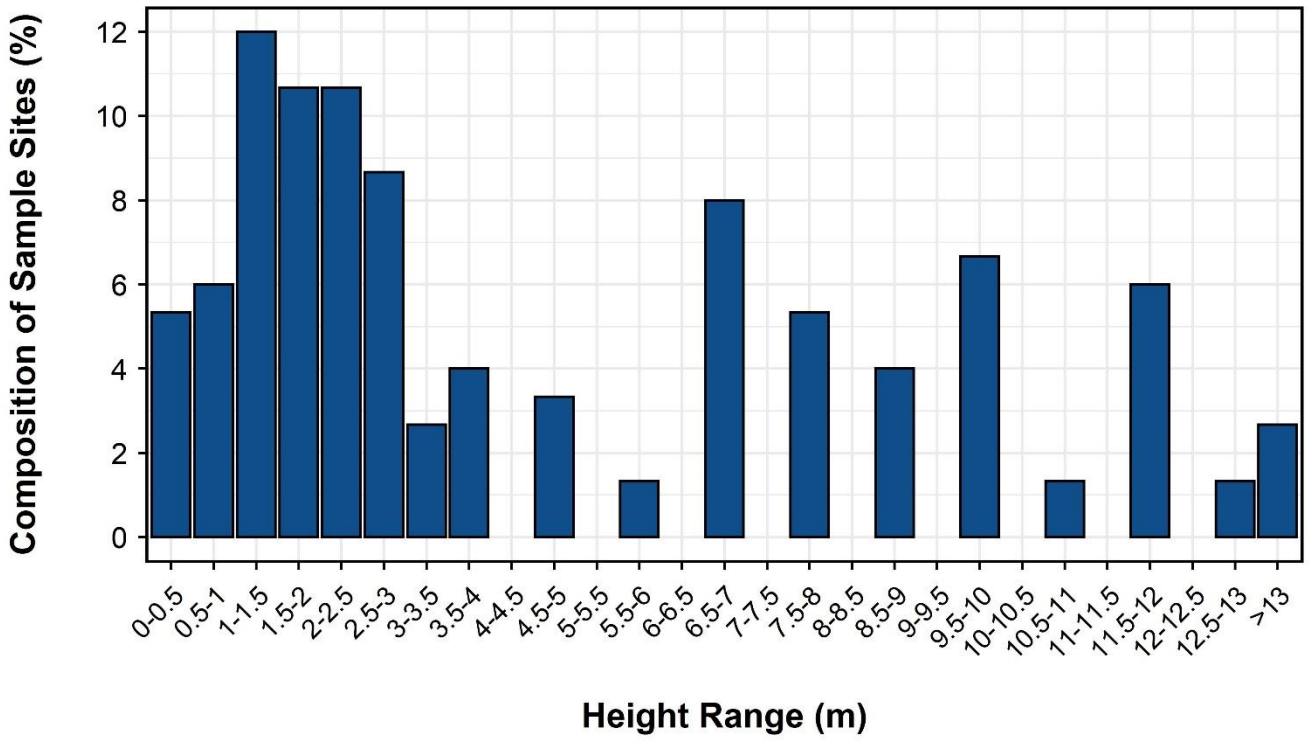


Figure 4-3. Vegetation height distribution of off-line reference plots in the Eagle Plains RSA.

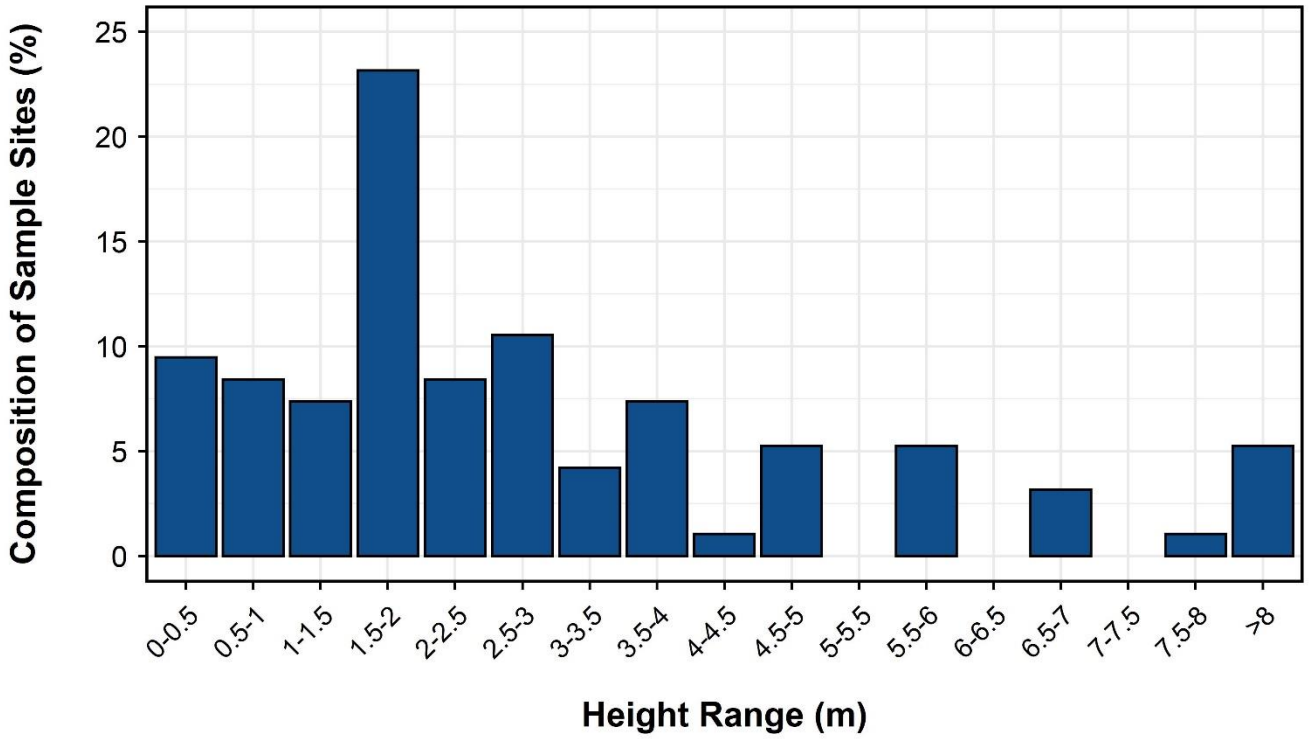


Figure 4-4. Vegetation height distribution of on-line 2D and winter road plots in the Eagle Plains RSA.

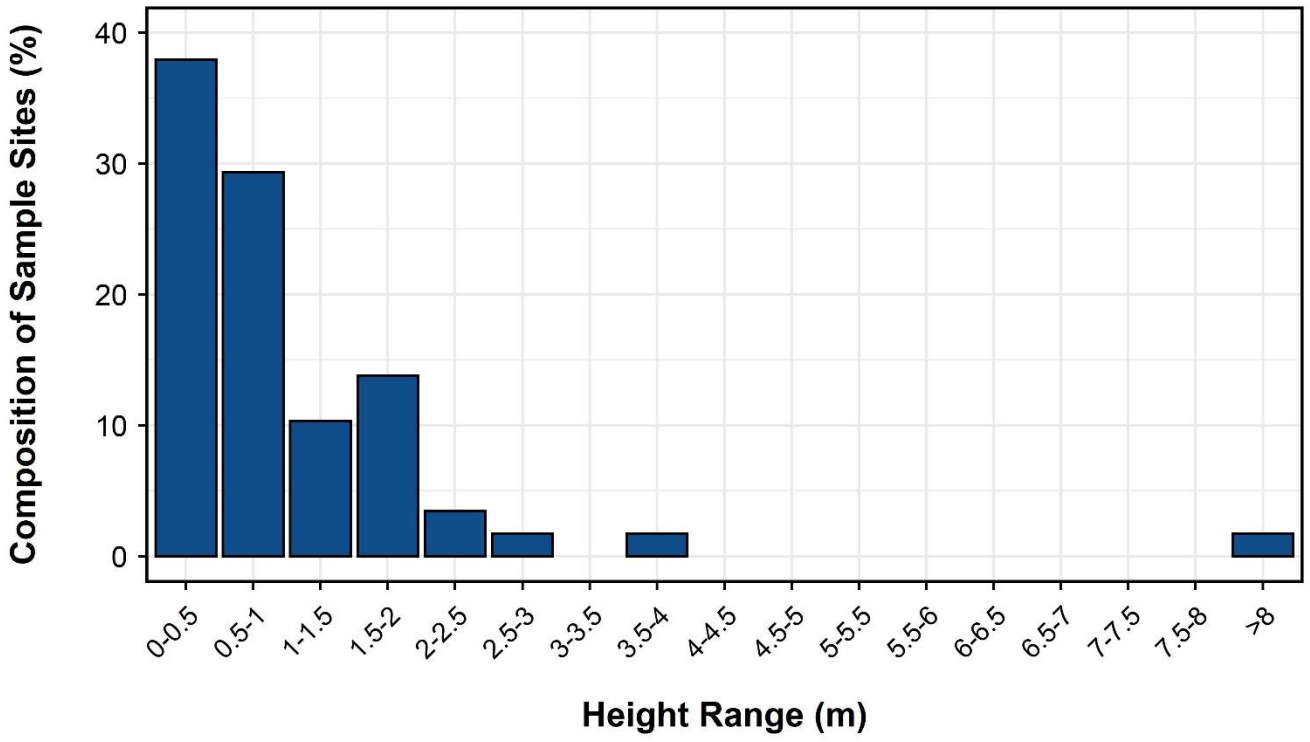


Figure 4-5. Vegetation height distribution of on-line 3D plots in the Eagle Plains RSA.

4.2.7 VEGETATION COVER

Tree and shrub cover varied between linear feature types and burn status (Table 4-6). Generally, tree cover was low on undisturbed reference plots (mean tree cover of 8% on unburnt and 2% on burnt sites). This is typical of the taiga cordillera landscape — forests are generally stunted and sparse due to poor nutrient regime and continuous permafrost conditions (Smith et al. 2004). Of the on-line plots, tree cover was greatest on 2D seismic lines and burnt winter roads (5% to 8%) and lowest on 3D seismic lines and the Dempster Highway (0%), regardless of burn status. This is likely due to the recently disturbed 3D seismic lines that are too young for trees to have re-established. Burnt 2D seismic lines and winter roads had greater tree cover than unburnt lines.

Shrub cover was much greater than tree cover overall. Shrub cover was typically 30–40% on unburnt off-line plots and 40–50% on burnt off-line plots. Shrub cover was highest on 2D seismic lines (~54%), regardless of burn status. Shrub cover was moderate on winter roads (38–45%) and lowest on unburnt 3D seismic lines (8–22%). Burnt 3D seismic lines had approximately twice as much shrub cover as unburnt 3D lines.

Table 4-6. Summary of the mean tree and shrub cover (%) between on-line and off-line, and burnt and unburnt plots surveyed in the Eagle Plains RSA.

Linear Feature Type	Burn Status	Mean Tree Cover (%)		Mean Shrub Cover (%)	
		On-line	Off-line	On-line	Off-line
2D	Burnt	7.0	3.5	54.0	36.0
	Unburnt	5.5	13.4	53.2	32.8
3D5	Burnt	0.0	0.3	41.7	60.0
	Unburnt	0.0	0.5	7.5	42.5
3Dc	Burnt	0.0	0.2	40.4	46.1
	Unburnt	0.4	6.0	21.5	34.3
3Dr	Burnt	0.0	0.7	35.0	51.9
	Unburnt	0.0	5.5	20.6	32.5
Winter Road	Burnt	7.7	1.0	45.0	43.8
	Unburnt	1.3	4.0	37.5	32.3
Dempster Highway	Unburnt	0.0	1.0	0.0	37.5

4.2.8 LINE-OF-SIGHT AND EASE OF TRAVEL

Line-of-sight (sightline) distance was examined primarily as a function of line type; however, vegetation height (the primary factor affecting sightlines) was also examined for on-line and off-line plots for each linear feature type using multiple linear regression. Mean sightlines varied significantly by linear feature type (Table 4-7, $F_{4,187} = 3.3$, $P = 0.01$). For reference, the average sightline distance for offline controls was 46.7 m. This relatively far distance reflects the open stand structure on most sites in the region. Burn status had little influence on sightlines (e.g., burnt off-line=50.2 m, unburnt offline=43.6 m). 2D lines had the shortest average sightline distances at 41.2 m. This was mainly due to the advanced stage of regenerating vegetation on the lines. Where regenerating vegetation was limited, sightline distances on 2D lines frequently exceeded 150 m.

On 3D lines, the time since clearing was too recent for regenerating vegetation to obscure sightlines. Instead, sightline distances on 3D lines were generally controlled by bends in the lines, which were specifically designed as mitigation measures to reduce sightlines. For 3D lines, sightline distances decreased from 3D5 to 3Dc to 3Dr lines. The reduction in sightline distances resulted from differences in line width and the average distance between bends across the feature types.

The regression analysis also found a significant interaction between on-line versus off-line occurrence and vegetation height ($F_{1,187}$ = 13.0, P = 0.0004), whereby on-line plots had, on average, more negative slopes than off-line plots. In other words, sightlines at on-line plots decreased more drastically than off-line plots with each incremental increase in vegetation height. This is consistent with the qualitative observations of field crews that the regenerating vegetation on lines was thicker than the vegetation off lines.

Similar to sightline distances, determining differences in ease of travel among line type the primary factor of interest for the walking speed tests. However, burn status, and the percent cover of trees and shrubs were expected to be the most important explanatory variables related to walk speeds, so they were included as secondary variables using a mixed-effects linear regression. Walking speeds across linear feature types and the differences between on- and off-line plots within linear feature types varied significantly (Table 4-8, $F_{5,170}$ = 3.4, P = 0.006). However, the magnitude of the difference between on-line and off-line plots was modest. Even the Dempster Highway only conveyed a 35% increase in walking speed over off-line plots. Other researchers, in other areas, often observed walk speeds on linear features were often at least twice as fast as off-line transects (Keim et al. 2019a).

Notwithstanding the modest magnitude of faster walking speeds on-lines, there were clear patterns in walking speed differences across linear feature types. 2D lines were the one feature type where walking speeds were slower on lines than off lines. This reflected the thick, shrub stage vegetation that had regenerated on most 2D lines, which impeded travel (similar to the effect that regenerating vegetation had on sightline distances in the previous section). Walk speeds decreased across the other feature types in relation to line width and the degree to which ground cover was levelled or compacted.

Statistical analyses indicated that both burn status ($F_{1,170}$ = 17.85, P < 0.0001) and percent cover of shrubs and trees (hereafter woody vegetation; $F_{5,170}$ = 5.29, P = 0.0002) affected walking speeds, both on and off lines. On average, walk speeds in burns were approximately 10% slower than in unburnt areas. This is partly related to thicker woody cover in most burns, which hinders walking speed because of the time it takes to push through or walk around it. Walking speeds significantly decreased, on average, by 0.04 (CI = 0.02–0.06) km/h and with every 10% increase in the percent of woody cover off-line and 0. 11 (0.07–0. 15) km/h on 2D lines.

Table 4-7. Average sightline distances along different linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Average Sightline Distance (m)	Comments
2D	30	41.2	Sightlines are frequently reduced by regenerating vegetation >1.5m tall
3D-5m	5	105.6	Has fewer bends than 3Dc and 3Dr
3D-Conductor	26	75.9	Sightlines limited by bends in lines; too recent for regenerating vegetation to impede sightlines
3D-Receiver	23	60.2	Sightlines limited by bends in lines; too recent for regenerating vegetation to impede sightlines
Dempster Highway	2	814.8	
Winter Road	17	106.2	
Off-Line Controls	103	46.7	

Table 4-8. Differences in walking speeds among linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Average Walk Speeds (km/h)		Difference (%)
		On-line	Off-line	
2D	28	2.5	2.8	-10%
3D5	5	3.8	3.0	30%
3Dc	23	3.5	3.1	13%
3Dr	23	3.2	2.9	10%
Dempster Highway	2	5.6	4.1	35%
Winter Road	16	3.6	3.1	17%
Off-Line Controls	97	n/a	2.9	

4.3 VISIBILITY OF LINEAR FEATURES FROM THE DEMPSTER HIGHWAY

Overall, the blind search identified 11 of 100 possible linear feature intersections with the Dempster Highway (Table 4-9). Five of the features were roads that were classified as winter roads in the GIS inventory, but most (four) were actually short, all-season roads leading to gravel pits or well sites. Two of the observed features were human truck/OHV trails that led to camp sites 100–200 m off the Dempster Highway, and four were 3D seismic lines. The map search detected two more 3D lines, one 2D line, and one old winter road. The 2D line and the old winter road had regenerated into Young Forest structural stages. Excluding the four short secondary roads into gravel pits and well sites, and the two human trails, only 8% of linear features that intersected the Dempster Highway were visible during the two driving surveys.

Only 6 of the 74 3D lines that crossed the Dempster were detected. The combination of construction design (i.e., creating a bend in the 3D line adjacent to the highway) and regenerating vegetation in the right-of-way made it difficult to detect the 3D lines. Evidence of human use (e.g., packed vegetation, tire tracks, rutting, garbage, campfire remnants, tree stumps, or tree blazes) was observed on four of the short, all-season roads

and the two trails. No evidence of human use was noted on any of the 2D or 3D seismic lines, or the three winter roads (including the Chance and Blackie winter roads). However, some types of human use do not leave sign during the snow-free season (e.g., snowmobile use in the winter).

Table 4-9. Summary of linear features identified and intersecting the Dempster Highway during a blind search test.

Linear Feature Type	No. Features Intersecting the Dempster	No. (%) Observed Blind Search	No. (%) Observed Map Search	Total No. (%) Observed	OHV Accessible	Sign of Human Use
2D	18	0 (0%)	1 (6%)	1 (6%)	0	0
3D	74	4 (5%)	2 (5%)	6 (8%)	4	0
Secondary Roads	8	5 (63%)	1 (13%)	6 (75%)	5	4
Trail	n/a	2 (n/a)		2	2	2
Total	100	11 (11%)	4 (4%)	15 (15%)	11	6

4.4 WINTER TRACKS

In total, 462 linear features were surveyed for winter tracks over 358 km along the 11 transects. No human sign was observed on any linear features, except the Dempster Highway. Ungulate tracks were frequently observed travelling along linear features. The proportion of linear features with tracks decreased with decreasing linear feature widths, from 29% on winter roads, 24% on 2D lines, 8% on 3D conductor lines, and 6% on 3D receiver lines (Figure 4-6).

The frequency of use in adjacent undisturbed areas, corrected to account for different survey extents between the linear features and the undisturbed areas, was 1%. As discussed in the methods, it was difficult to compare the frequency of use along linear features to use in undisturbed areas. The issue is that for the comparison to be relevant, the survey design needs to account for the size of the sample units (i.e., the extent of the undisturbed area needs to be comparable to the width of the linear features), and the two samples should be independent. These conditions were not achieved under the current survey design (i.e., the extent of the survey area in the undisturbed area was much larger than the width of the linear feature, and the location of the undisturbed area was spatially correlated to the linear feature). The estimated relative use rate of 1% in undisturbed areas adjusts the total counts within the 200 m survey area to 5 m (i.e., the average linear feature width); however, the adjustment fails to account for spatial correlation between the two samples. Therefore, the estimate of use in undisturbed areas could be biased. Notwithstanding this limitation in the estimate of travel rates in undisturbed areas, it is supported by qualitative observations of the survey crew that travel rates on even the least used linear features (i.e., 3D lines) are higher than undisturbed areas.

The relative use of linear features by ungulates also appeared to vary with distance from the Dempster Highway, with features within 1 km of the highway receiving lower use than features equal to or greater than 5 km from the highway (Figure 4-7). It is worth noting that the Highway and 1 km transects were completed on the first and second day of surveys, respectively, and the other transects were surveyed one to six days later, providing more time for tracks to accumulate. Snowfall data prior to the crew's arrival on site was not

available; however, road crews at Eagle Plains reported that there had not been a major snowfall in the area for at least a week. Based on this information, the issue of time since last snow has less potential to bias results than if a track-erasing snow event had recently occurred.

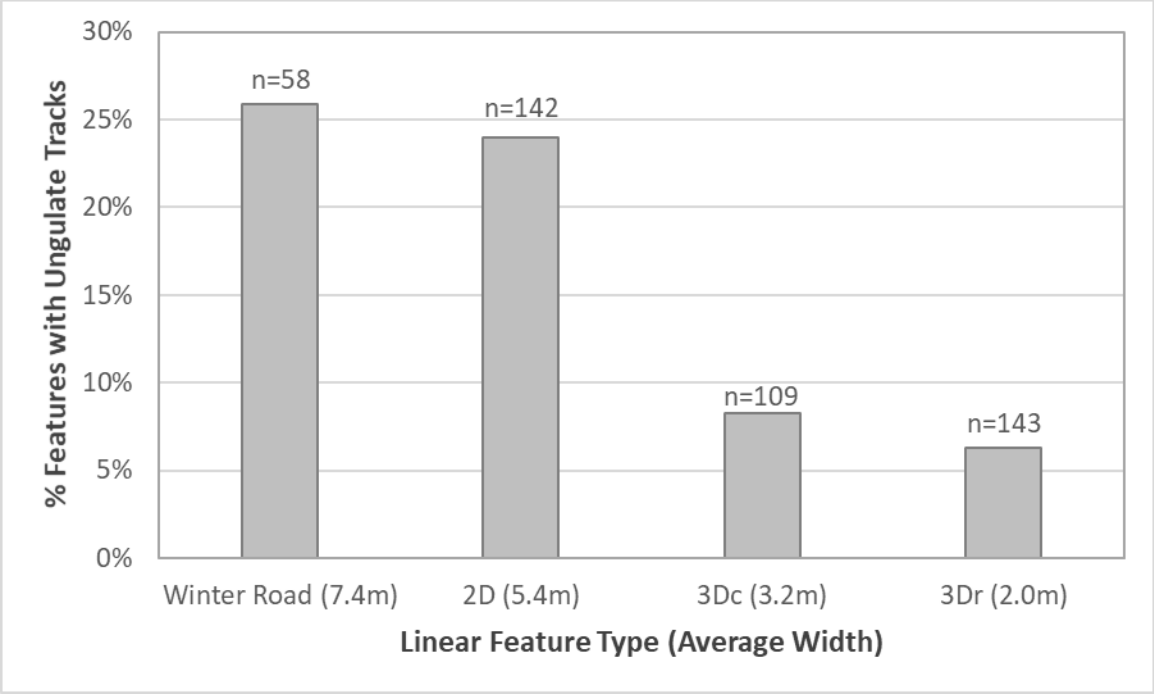


Figure 4-6. Relative use of different linear feature types by ungulates in the Eagle Plains RSA, March 2020.
The numbers above bars indicate the number of features surveyed.

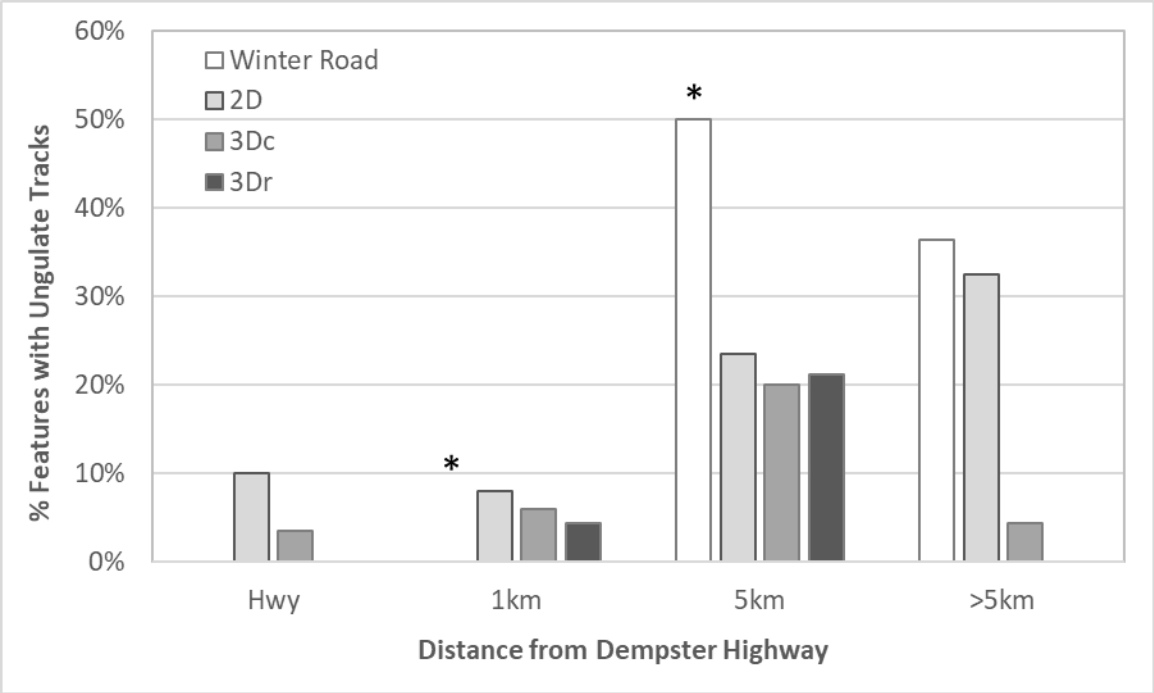


Figure 4-7. Relative use of different linear feature types by ungulates in relation to distance from the Dempster Highway in the Eagle Plains RSA, March 2020.

*The * indicates bars with small samples sizes (n=5-10); all other instances have at least 10 data points per feature type within each distance class*

5 DISCUSSION

5.1 SUMMARY OF LINEAR FEATURES IN THE EAGLE PLAINS RSA

Table 5-1 summarizes key characteristics across linear feature types in the Eagle Plains RSA.

Table 5-1. Summary of structural, ecological and functional characteristics of linear feature types in the Eagle Plains RSA.

Linear Feature Type	Mean Width (m)	Mean Sightlines (m)	Mean Movement Speed (km/h)	% Regenerated[1]	% Inhibited Regeneration[2]	Linear Feature Density (km/km²)	Adjusted Linear Feature Density (km/km²)[3]	% Ungulate Use[4]
3D seismic	2.6	71.98	3.36	14	0	0.91	0.31	7
2D seismic	5.4	41.17	2.53	61	4	0.61	0.12	24
Winter Roads	7.4	106.18	3.58	39	19	0.25	0.07	26
Dempster Highway	33.8	814.75	5.60	0	100	0.02	0.01	N/S
Off-line Controls	N/A	46.67	2.95	N/A	N/A	N/A	N/A	N/S

[1] as characterized by reaching a tall shrub stage, or greater.
[2] including stagnated and disturbed successional patterns.
[3] accounting for burns, natural openings, and regeneration.
[4] percent of lines with ungulate tracks during March 2020.

2D Seismic — 2D lines are, on average, the oldest features in the area and have had the longest time to regenerate. Most features were cleared before 1985, but some were developed in the early 2000s. Historical 2D lines were generally long and straight, with moderate widths of 4–8 m. Lines were typically constructed with bulldozers that cut into the moss layer and often included some patches of soil disturbance. The combination of site disturbance and wider widths generally resulted in a successional reset to pioneering vegetation (including early seral graminoids, forbs, and shrubs). Most sites were following a normal successional pathway (73%). However, 27% of sites exhibited atypical pathways, dominated by magnified succession (21%, mostly in burns), stagnated succession (3%) or no succession (1%). Sixty-one percent of the 2D sites had regenerated to a Tall Shrub or more advanced structural stage. 2D lines had the shortest sightlines and slowest walk test speeds of all feature types (including off-line controls), reflecting the regenerating vegetation's effect on these functional metrics. During winter, ungulates regularly used 2D lines to travel along.

3D Seismic — All 3D lines were created during the last exploration period, during the winter of 2013/14. 3D lines constitute the most extensive combined lengths of the different linear feature types, but their areal extent is limited to a relatively small portion of the RSA along the Dempster Highway. Due to their basic design, as well as specific mitigations, 3D lines minimize environmental effects compared to other linear feature types. They are narrow (averaging 3.2 m and 2.0 m for conductor and receiver, respectively), often

narrower than average tree spacing in the region. They were constructed during winter, over snow, using low-ground pressure equipment, which avoids ground disturbance and maintains vegetation in the moss, herb and low shrub layers. The lines were constructed with a meandering path, and strategically placed sharp angle dogleg bends to reduce the visibility of the lines from roads, reduce sightlines along them, and hamper travel by OHVs. All 3D lines that were surveyed were undergoing a normal successional pathway and were dominated by the same vegetation as in adjacent undisturbed areas. Regenerating vegetation was mostly in a Low Shrub structural stage, consistent with the relatively short six-year period since they were cleared. Sightlines and movement speeds were intermediate compared to other linear feature types, with sightlines primarily controlled by dogleg bends purposely designed to reduce sightline distances. Ungulates occasionally used 3D lines to travel on in winter, but at less than a third of the rate as 2D lines and winter roads.

Winter Roads — A network of winter roads across much of the RSA results from the historical exploration programs that have occurred. Although many of the winter roads were initially developed during the earliest exploration programs, vegetation has not had the same opportunity to regenerate as on 2D lines because the vegetation was re-cleared on several roads during subsequent exploration programs. The average width of winter roads was 7.4 m, but major roads, like the Chance road, were often 10–12 m wide. Historical winter roads were typically cleared with a bulldozer, and then snow was packed and graded to create a road surface. Similar to historical 2D seismic, the combination of site disturbance and wider widths (i.e., that increases solar exposure) generally resulted in a successional reset to pioneering vegetation (including early seral graminoids, forbs, and shrubs). Most sites were following a normal successional pathway (72%), but 26% of sites exhibited atypical pathways, dominated by stagnated succession (19%), magnified succession (6%) and no succession (1%); 2% of the sites were classified as no disturbance (indistinguishable from vegetation community off the road). Thirty-nine percent of the winter road sites had regenerated to a Tall Shrub or older structural stages. Winter roads had the longest sightlines and fastest walk test speeds of all feature types, other than the Dempster Highway, reflecting the variable levels of regenerating vegetation that occurred on winter roads. During winter, ungulates regularly used 2D lines for travel.

Dempster Highway — The Dempster Highway is the only all-season road in the RSA (except for short spurs off the Dempster to well sites and gravel pits). It is fundamentally different from all other linear features in the area in terms of wide width, surface material and maintenance, long sightlines, regular traffic, and base of access for human land use activities such as hunting, camping, and trapping.

5.2 LINEAR FEATURE CHARACTERISTICS

5.2.1 FIRE

The presence or absence of recent forest fires affected several linear feature characteristics, including linear feature width, successional class, structural stage, and vegetation height and cover. Mean measured linear features widths were 0.2–0.6 m wider at burnt sites than at unburnt sites. This may be due to the already shorter vegetation at burnt sites, which would reduce overgrowth occurring from forest edges and decrease the measured width between driplines (branches extending into the linear feature from either side of the line).

Magnified succession was nearly four times more common in burnt plots than unburnt plots, and stagnated succession was half as common. Fire likely facilitates magnified succession by increasing soil temperatures, accelerating decomposition, and releasing stored water and nutrients to promote vegetation growth (Seccombe-Hett and Walker-Larsen 2004, Simpson 2008). Stagnated succession is likely less common at burnt sites because the associated nutrient and water increase allows woody plant species to colonize more easily and advance through successional stages.

Overall structural stage distribution was very similar between burnt on-line and off-line plots, but was markedly different between unburnt on-line and off-line plots. Furthermore, when the structural stages were compared between paired on-line and off-line plots, they matched two to four times more frequently at burnt sites than at unburnt sites and were mismatched two to six more frequently at unburnt sites than at burnt sites. Nearly all burnt plots were in a low shrub, or tall shrub structural stage, which is expected as fires tend to remove overstory trees, and shrubs generally colonize rapidly post-fire (Seccombe-Hett and Walker-Larsen 2004).

Vegetation height was 4.4 m shorter in burnt than unburnt reference plots, and tree cover was approximately 6% less. These modest differences reflect the stunted and open nature of the taiga forest. There was little change in vegetation height between burnt and unburnt linear features, likely because there were very few linear disturbances in a forested structural stage; most of them, even in unburnt conditions, were already in a shrub-dominated stage due to the clearing of trees. For shrub cover, except for 2D seismic lines, the mean was approximately 10% to 20% greater at burnt plots than at unburnt plots. The increase in shrub cover at burnt sites was most prominent in 3D seismic lines due to their comparatively lower pre-fire shrub cover.

Post-burn vegetation was, on average, shorter and shrubbier than unburnt off-line plots, but taller and shrubbier than unburnt on-line plots. Furthermore, burnt paired plots were more similar in vegetation characteristics than unburnt paired plots. This evidence supports the theory that forest fires in taiga ecosystems resets the landscape to some extent and effectively erase signs of anthropogenic disturbance (Seccombe-Hett and Walker-Larsen 2004, Simpson 2008). Forest fire in the taiga returns ecosystems to an early successional stage (i.e., low shrub) and synchronizes baseline biophysical conditions on a landscape scale, allowing previously disturbed and undisturbed areas to recover at equal rates, as has been documented by Seccombe-Hett and Walker-Larsen (2004). Thus, most linear features that have experienced forest fires no longer create different ecological conditions or functional disturbances than the surrounding landscape.

5.2.2 SUCCESSIONAL CLASS

The idea that vegetation regeneration on linear features could follow different successional trajectories came out of work by the Yukon Government in the early 2000s (Simpson 2008). That work described six successional trajectory classes observed in the Eagle Plains area. However, that study did not quantify the relative extents of linear features that followed the different trajectories. This study used the classes that the Yukon Government work developed and quantified the proportion of linear features in each successional class across a random sample of linear features.

Successional classes in the Eagle Plains RSA varied according to linear feature type and burn status. However, one of the key findings was that normal succession was the dominant trajectory observed for all linear features except the Dempster Highway. All 3D seismic lines followed a normal successional trajectory, except for one recently disturbed site. This was likely attributable to the low impact methods used in 3D line creation that minimize ground and vegetation disturbance, creating conditions more likely to result in a normal successional trajectory (Yukon Energy Mines and Resources 2006, Golder Associates 2016). Magnified and stagnated succession were only observed in 2D seismic lines and winter roads. These linear features were generally wider and were created using methods that cause greater disturbance to soils, hydrology, and vegetation, leading to these alternative successional trajectories (Simpson 2008, Jorgenson et al. 2010, Dabros et al. 2018). Magnified succession is unique among the classes in that it results in accelerated vegetation regeneration. Magnified succession was most common on burned 2D seismic lines where the combination of site disturbance associated with the 2D lines and fire is suspected of causing accelerated soil warming, moisture availability, and nutrient flush, which increase on-line vegetation growth (Simpson 2008). Successional stagnation was most common on unburnt winter roads. Stagnation tends to occur on features that have experienced ground disturbance or have been seeded to agronomic species, which may have happened on winter roads in the RSA (Simpson 2008). Repeated disturbance associated with multiple exploration programs over time may also limit successional advancement and contribute to successional stagnation (Lee and Boutin 2006, Jorgenson et al. 2010).

Although some alternative successional pathways were observed in this study, most linear features in the Eagle Plains RSA are following a normal successional trajectory. This implies that most of these disturbances will recover to an ecological condition like that of the surrounding community with adequate time.

5.2.3 STRUCTURAL STAGE

The taiga forest in Eagle Plains presents a unique situation where the Tall Shrub stage is applied to two very different stand conditions. One condition, the more traditional, is of regenerating stands following a natural or anthropogenic disturbance. In this setting, the vegetation consists of deciduous shrubs and 2–8 m tall, 10–30 years old trees. The stage is transitional, with the vegetation expected to advance to the Pole-Sapling stage over time. The second condition where the Tall Shrub stage is applied is to stunted, old, black spruce stands in a disclimax state. In this setting, the vegetation consists of open, stunted, black spruce stands that are typically ≥50 years old and 2–8 m tall. Stands in this condition are expected to remain in the same condition over time(i.e., a disclimax state). Structurally, the stunted black spruce trees function more like shrubs than trees. Both Tall Shrub conditions (referred to as disturbance and disclimax forms hereafter) are widespread across the RSA in off-line sites. Only the disturbance form was observed on linear features.

The structural stage on linear features was predominantly Low Shrub or Tall Shrub, determined mainly by the time since line clearing and burn status. Less than 4% of surveyed features were in forested stages (Pole-Sapling or greater). Off-line plots had a higher proportion of forested structural stages (37%). However, they were still predominantly Low Shrub and Tall Shrub, resulting from extensive burns across the RSA and large extents in the disclimax form for Tall Shrub in un-burned areas.

The structural stage of on-line plots was also influenced by successional class. The small number of forested structural stages observed on features only occurred on sites undergoing normal succession. Stagnated succession was associated with only the Herb structural stage, which was expected as stagnation is defined by its high herbaceous species cover (among other factors) that limits the establishment of other structural groups. Magnified succession was the one atypical successional class with accelerated vegetation growth. Most structural stages on sites with magnified succession were in Tall Shrub and, occasionally, Pole/Sapling. Often the structural stage on magnified succession sites was one stage greater than the off-line plot.

5.2.4 VEGETATION HEIGHT

This study observed a range of vegetation heights across different feature types. Except for the 3D lines, the linear features' age was unknown, so it was impossible to estimate growth rates. Although some regenerating vegetation on 2D seismic lines and winter roads reached 8 m high, most were between 1.5 m and 2 m. Though the ages of specific features were mostly unknown, the minimum age for most was at least 35 years. Having most vegetation heights at only 1.5–2.0 m after this long period suggests regeneration growth rates on linear features may be quite slow. This pattern of slow vegetation growth on linear features may partly reflect the generally poor growing conditions in the taiga region. Still, it is also a pattern that has been observed on linear features in other studies in the southern boreal forest.

Interestingly, the vegetation heights on linear features in Eagle Plains are greater than reported in several other studies. For example, approximately 65% of sites on linear features in northeast Alberta had not advanced beyond a cover low forbs after 35 years (Lee and Boutin 2006). Key factors that have been linked to slow vegetation regeneration on linear features were continued human disturbance (e.g., OHV travel), ecosystem type (bogs and fens regenerated much slower than upland sites), competition from early seral and invasive graminoids and forbs, and soil or site degradation associated with feature construction (Lee and Boutin 2006, van Rensen et al. 2015, Finnegan et al. 2018).

There is limited data on vegetation regeneration in the taiga. A study from NWT found that vegetation regeneration on conventional seismic lines was affected by both a time lag for seedling establishment (as long as 17 years for black spruce) and slow growth rates (83 years to reach 5 m) (Seccombe-Hett and Walker-Larsen 2004). In burned areas, the seedling establishment delay was reduced to five years.

Although the 3D lines in Eagle Plains were only six years old when they were surveyed, a combination of field survey results and information from other studies suggests that vegetation recovery on 3D lines could be much faster than the previous examples for conventional 2D lines. This is because the undisturbed ground conditions and maintenance of the vegetation community in the moss, forb and low shrub layer provide both plants and growing conditions that support faster shrub and tree growth compared to sites beginning primary succession. In northeast British Columbia, Golder Associates (2016) found that in the first year following 3D seismic line creation, there were already black spruce seedlings exceeding 0.5 m in height. These seedlings were plants that were initially present on the site and that had survived line clearing. This is consistent with the results of this study, where nearly all of the 3D plots contained black spruce seedlings. Despite their relatively young age, most 3D seismic lines in Eagle Plains included shrubs and trees between 0.5 m and 1 m

tall. Although growth rates in Eagle Plains are not known, similar species that occur in Eagle Plains were observed to grow 5–10 cm per year on 3D lines in the boreal forest in northeastern British Columbia (Golder Associates 2016). If similar growth rates occur in Eagle Plains, regeneration on the 3D lines can be 2 m over the next 5–20 years.

5.3 HUMAN USE AND ACCESS ALONG LINEAR FEATURES

The NYRLUP and the PWRLUP indicate that one of the primary concerns about linear features is that they can increase human access into remote areas. This has been demonstrated in southern regions, and that access can have secondary effects of inhibiting vegetation regeneration (Lee and Boutin 2006) and, in winter, packing snow that can affect predator-prey dynamics (Latham et al. 2011, McKenzie et al. 2012, Keim et al. 2019a). In the boreal forest in northern Alberta, OHV travel was common on most conventional 2D seismic lines. After 35 years, approximately 20% of the lines were considered to have been converted to tracked access routes (Lee and Boutin 2006). In the same study, about 65% of the lines remained cleared after 35 years, and OHV use along the lines was identified as one factor contributing to the lack of vegetation regeneration. In contrast, there is little evidence of human use along linear features in the Eagle Plains RSA. No sign of human use was detected along linear features during the summer ground surveys (e.g., OHV tracks, ruts, water crossings, vegetation trampling/scarring, tree blazes, trap sets, garbage, campsites, etc.) or the winter track survey (e.g., snowmobile tracks). Although these surveys provided limited snapshots in time, and that some types of human activity leave little sign (e.g., evidence of snowmobile tracks have limited persistence during winter and leave no sign behind after snow melt), the results suggest that human use of the area is very limited outside of the Dempster Highway corridor. This is consistent with general comments from highway workers, staff at the Eagle Plains Hotel, pilots, and some First Nation residents that most areas beyond the Dempster Highway corridor receive very little human use. Specific instances of use of the area outside the Dempster Highway corridor include intermittent activity on the community trapline that occurs in Eagle Plains and occasional forays by hunters (First Nation and non-First Nation), mostly in winter.

People's limited use of the Eagle Plains area is likely due to its far distance from any human settlements and the difficulty of travel off the Dempster Highway. The network of winter roads in the area does provide access via specific types of OHVs in summer and snowmobiles in winter. However, there was no evidence observed that this occurs regularly. Travel along seismic lines, though possible in specific locations, would be hampered over any substantial distance by vegetation regeneration along the historical 2D lines, the narrow widths of and frequent dogleg bends in 3D lines and, during summer, difficult terrain (extensive peatlands and graminoid tussocks).

5.3.1 EFFECTIVENESS OF MITIGATION MEASURES FOR 3D SEISMIC LINES

In addition to the narrow widths of 3D lines, which hampers OHV travel, the 3D lines included regular bends in the lines, which were designed to limit the visibility of the lines at intersections with roads and other seismic lines, and to hamper OHV along the lines further. The driving survey along the Dempster found that this mitigation was very effective in reducing the visibility of the 3D lines from the road (i.e., only 6 of the 74 3D

lines intersecting the Dempster Highway were visible). Incidental observations during ground surveys observed similarly reduced visibility of 3D lines crossing winter roads. Regular bends in the 3D lines away from roads were also designed to limit human access by reducing sightlines and making travel more difficult along the line (i.e., needing to reduce speed to navigate the tight turns of a dogleg bend approximately every 70 m).

5.4 FUNCTIONAL CHARACTERISTICS OF LINEAR FEATURES

In addition to human travel, linear features can also affect how wildlife move within a landscape. Several studies in western Canada have documented the effects of linear features on the movements and population dynamics of large mammals, such as caribou, moose, deer, wolves and bears (Latham et al. 2011, McKenzie et al. 2012, Dickie et al. 2017b, Keim et al. 2019a). EDI focused on two established indicators of human and wildlife access and travel on linear features: sightline distance and ease of travel. These measurements act as a proxy for the functional recovery of disturbed areas. They are mainly dependent on vegetation height, cover, and terrain.

5.4.1 LINE-OF-SIGHT

Line-of-sight or sightline distance is how far one can see under normal conditions and was compared between linear features and paired reference plots. It has been proposed that humans and predators select linear disturbances because it is easier to travel and detect prey using those features (Finnegan et al. 2018). As vegetation grows taller and denser, sightlines diminish, and the use of linear features decreases (e.g., for wolves, Dickie et al. 2017a). This study found that average sightlines were farther on-line versus off-line for most linear feature types, but that sightlines varied substantially across line types. Sightlines were shorter on seismic lines than on roads, especially 2D lines which had more advanced vegetation regeneration than other feature types. On 3D lines, sightlines averaged approximately 30 m farther on lines than off lines. However, this difference probably provides little advantage to predators or human hunters because the increase is still within the olfactory and auditory detection zone for most large prey species. Average sightlines were 60 m farther on winter roads than surrounding forest, which may begin to confer more advantage to predators and hunters.

The range of sightlines observed on most linear features probably do not provide an advantage to detect prey species visually. For 2D lines and winter roads, sightline distances were primarily driven by the height and density of regenerating vegetation. The recovery period for 2D seismic lines appears to be sufficient to support vegetation that reduces visibility to a similar level as the surrounding habitats. The reason for longer sightlines on winter roads is that they are subject to intermittent re-activation, where the vegetation is cleared once again, which resets vegetation recovery and maintains longer sightlines. In contrast to 2D lines and winter roads, where sightlines were largely determined by vegetation regeneration, the sightlines on 3D lines were presently limited by the bends purposely constructed into the lines. Sightlines along all feature types will continue to diminish over time as vegetation regeneration continues.

5.4.2 EASE OF TRAVEL

Ease of travel is a fundamental indicator of functional recovery of linear features. Wolves, bears, and humans have been documented to select linear features with greater ease of travel, which is generally associated with lower and more sparse vegetation and stable, even terrain (Dickie et al. 2017b, Keim et al. 2019a). Access and travel resistance are the main determinants of predator and human use of linear features and the key concern of linear disturbances in the RSA (Vuntut Gwitchin Government and Yukon Government 2009, Peel Watershed Planning Commission 2019).

The walk test used in this study, as an index of ease of travel, found differences among linear feature types and between linear features and controls. However, the magnitude of the differences for both comparisons was modest. Even the Dempster Highway only conveyed a 35% increase in walking speed over off-line plots. Other researchers, in other areas, often observed walk speeds on linear features were often at least twice as fast as off-line transects (Keim et al. 2019a). Two conditions associated with the Eagle Plains area appear to limit the advantage of travelling on linear features. One is that the vegetation in most ecosites and structural stages is relatively open and has a limited effect on impeding movement. The second factor is that ground conditions limiting movement, including soft, thick peat and graminoid tussocks, were similar on both on-line and off-line plots for most linear feature types.

Notwithstanding the modest magnitude of faster walking speeds on-lines, there were clear patterns in walking speed differences across linear feature types. 2D lines were the one feature type where walking speeds were slower on lines than off lines. This reflected the thick, shrub stage vegetation that had regenerated on most 2D lines, which impeded travel (similar to the effect that regenerating vegetation had on sightline distances in the previous section). Walk speeds decreased across the other feature types in relation to line width and the degree to which ground cover was levelled or compacted. 3D seismic lines allowed slightly easier travel than paired off-line plots. They usually had lower vegetation cover and clearer route selection. As linear feature width decreased in 3D lines, walking speed also decreased. This implies that width may be related to functional recovery, with narrower lines having smaller impacts than wider lines, even within an already narrow linear feature type. Although ease of travel was greater in 3D seismic lines than surrounding community, it is expected that this will decrease in future years as vegetation increases in height and density.

5.5 FUNCTIONAL RECOVERY OF LINEAR FEATURES

Functional disturbance is defined in the NYRLUP and PWRLUP as "*physical land use disturbance that results in disruption of soil or hydrology, or that requires the cutting of trees*." One of the main concerns with linear disturbances under these land use plans is that such features can technically allow increased access to previously remote areas, potentially leading to a greater harvest of wildlife and fish, higher predation rates, and a change in how people and wildlife use the land (Vuntut Gwitchin Government and Yukon Government 2009). A disturbance can be considered functionally recovered and subtracted from the overall linear density when it no longer facilitates access or travel by humans or wildlife (Vuntut Gwitchin Government and Yukon Government 2009), or otherwise no longer functions as a surface disturbance (Peel Watershed Planning Commission 2019). Both plans use 1.5 m vegetation height as a threshold for functional recovery in forested communities. The

PWRLUP includes the following additional criterion for recovery "*in non-forested areas (dominated by vegetation under 1.5 m), when the disturbed area is covered by native species roughly the same height and composition as the surrounding dominant vegetation*" (Peel Watershed Planning Commission 2019):

One limitation of using height alone as a functional recovery criterion is that it does not consider vegetation density. Although regeneration may meet the recommended height criteria, if it is very sparse (as is often the case in the Eagle Plains Ecoregion), it may still facilitate access and travel by humans and wildlife. Attachment Photo A-25 provides an example in the Eagle Plains RSA where tall but sparse regeneration meets the 1.5 m criteria but does not inhibit access or travel.

The combined results of this study indicate that using regeneration to the Tall Shrub structural stage may be a more appropriate criterion for functional recovery. Attachment Photo A-3 and Attachment Photo A-10 provide examples of linear features that have regenerated to a tall shrub structural stage. Using the Tall Shrub criterion, 38% of all linear features in the RSA would be considered functionally recovered compared to 53% using the 1.5 m height criterion. For this study, the more conservative criterion of reaching the Tall Shrub structural stage was used to adjust (reduce) linear feature densities.

5.6 LINEAR FEATURE INVENTORY AND DENSITY

This study was successful in mapping all linear features within the RSA. The combined results of the mapping exercise and the field studies found that the extent of open habitats (burns and naturally open habitats like wetlands and shrublands), and the degree of vegetation regeneration, played a significant role in the effective density of linear features across the RSA. Before accounting for open areas and regeneration, the total linear feature density was 1.79 km/km². After accounting for open areas and vegetation regeneration (to the Tall Shrub structural stage), the effective linear feature density was 0.52 km/km². The NYRLUP and PWRLUP suggest cautionary levels for linear density of 0.75 km/km² and critical levels of 1.0 km/km² (Vuntut Gwitchin Government and Yukon Government 2009, Peel Watershed Planning Commission 2019).

The Yukon Land Use Planning Council (YLUPC) was conducting a pilot study of surface disturbance across the broader Eagle Plains Ecoregion (Skinner 2021) at the same time as this study. The methods they used consisted of mapping and attributing human-caused disturbances solely using high-resolution satellite imagery. The YLUPC classified vegetation into eight broad classes based on whether the surrounding area was forested or non-forested, the similarity of vegetation on-line to off-line, and the presence or absence of woody cover (i.e., shrubs or trees). The features were then classified as recovered or not-recovered based on the presence of woody cover (recovered) or, if woody cover was not present, the similarity to surrounding vegetation (i.e., if similar then recovered, if not similar, then not-recovered). Historical field data and photographs from the area (Simpson 2008) were used to verify interpretations.

The spatial data from the YLUPC work was not available to compare in detail to the linear feature inventory compiled in this study. However, the mapping linework is expected to be very similar because satellite imagery was used to verify and supplement the linear feature geospatial data compiled in this study (presumably the same satellite imagery that YLUPC used because the imagery was obtained from Yukon Geomatics). One

difference between the two products is that the YLUPC completed the inventory for the entire Eagle Plains Ecoregion, while this study was restricted to the RSA. Another difference is that the attribute data in this study is expected to be more detailed and more precise than the YLUPC data because (i) the original geospatial data includes some information, like date of creation, that would be impossible to estimate from imagery, and (ii) because this study linked field surveys to the mapping exercise to determine line widths and other characteristics more precisely.

Although it is impossible to directly compare the linear feature density estimates between the two studies, due to the different study extents, the general pattern of results is similar. The YLUPC estimated the linear density (accounting for recovery) to be 0.38 km/km² across the entire Eagle Plains Ecoregion. This is consistent with the estimate from this study for the RSA of 0.52 km/km² because the portion of the Ecoregion outside the RSA has lower linear feature density than the RSA.

6 CONCLUSION

This study successfully mapped all linear features within the RSA and measured a suite of structural, vegetation, and functional characteristics across different feature types. Generally, the effects associated with linear features (i.e., differences between conditions on-line and adjacent off-line areas) correlated to feature width and the degree of ground disturbance. In terms of combined effects across the range of feature types that occur in the Eagle Plains RSA, the ranks were:

Dempster Highway >>> Winter Roads > 2D Seismic > 3D-5m >> 3D Conductor > 3D Receiver[2]

The effects of 3D lines (both conductor and receiver lines) appear to be substantially lower than other feature types. This reduced magnitude of effects is important because 3D lines have the longest combined length of exiting linear features. They are also the predominant feature planned for the next exploration program. Important findings for 3D lines include:

- Relatively narrow line widths of 2–3 m are often smaller than natural tree spacing and minimize the potential for changes to microsite conditions (e.g., solar radiation, air and ground moisture) reported in other studies.
- Minimal ground disturbance and maintenance of the moss, herb, and low shrub layers, which retains the natural vegetation community and accelerates vegetation regeneration.
- Successful application of mitigations, notably dogleg bends that minimize sightlines, ease of human travel, and visibility of lines from roads.
- Ungulate use of 3D lines in winter was less than a third of the rate observed on 2D lines and winter roads.

The adverse effects of linear features in other areas are often caused or exacerbated by human use after the lines are initially constructed, including effects on vegetation regeneration and predator-prey dynamics. Human use does not appear to be a significant factor in Eagle Plains. No sign of human use was observed outside the Dempster Highway corridor.

Substantial vegetation regeneration has occurred on existing features in the Eagle Plains RSA. Previous work by the Yukon Government identified the potential for atypical successional trajectories to occur on linear features in the region. Although atypical succession occurred to a limited extent, this study determined that 81% of the sites exhibited a normal succession (100% on 3D lines). Only 5% exhibited inhibited regeneration trajectories (mostly stagnated succession on winter roads). Regarding functional recovery, 53% of sites met the NYRLUP and PWRLUP criterion of vegetation reaching 1.5 m, and 38% of sites met the criterion of attaining a Tall Shrub structural stage. Using the Tall Shrub structural stage as a criterion of functional recovery may be a more ecologically appropriate criterion to meet LUP objectives.

The extent of open habitats (e.g., burns, wetlands and shrublands) and the degree of regeneration on existing linear features (mostly the older 2D lines and winter roads) play an important role in calculating effective linear

[2] Relative magnitudes of effects: >>> large effect, >> moderate effect, > small effect.

feature density in the RSA. Before accounting for open areas and regeneration, the total linear feature density was 1.79 km/km². After accounting for open areas and vegetation regeneration (to the Tall Shrub structural stage), the effective linear feature density was 0.52 km/km².

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ATTACHMENTS

ATTACHMENT A EAGLE PLAINS PROJECT LINEAR FEATURES SURVEY PHOTOGRAPHS



Attachment Photo A-1. Air survey plot SL237, an unburnt 2D seismic line undergoing normal succession at a young forest structural stage when surveyed.



Attachment Photo A-2. Air survey plot SL269, an unburnt 2D seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-3. Ground survey plot SL310, an unburnt 2D seismic line undergoing normal succession at a tall shrub structural stage when surveyed.



Attachment Photo A-4. Aerial view of 3D seismic lines undergoing normal succession – meandering routes were used to mitigate some functional disturbance impacts.



Attachment Photo A-5. Ground survey plot SL357, a burnt 3D5 seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-6. Ground survey plot SL277, an unburnt 3Dc seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-7. Ground survey plot SL255, an unburnt 3Dr seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-8. Aerial view of a burnt 2D seismic line undergoing magnified succession at a tall shrub structural stage when observed.



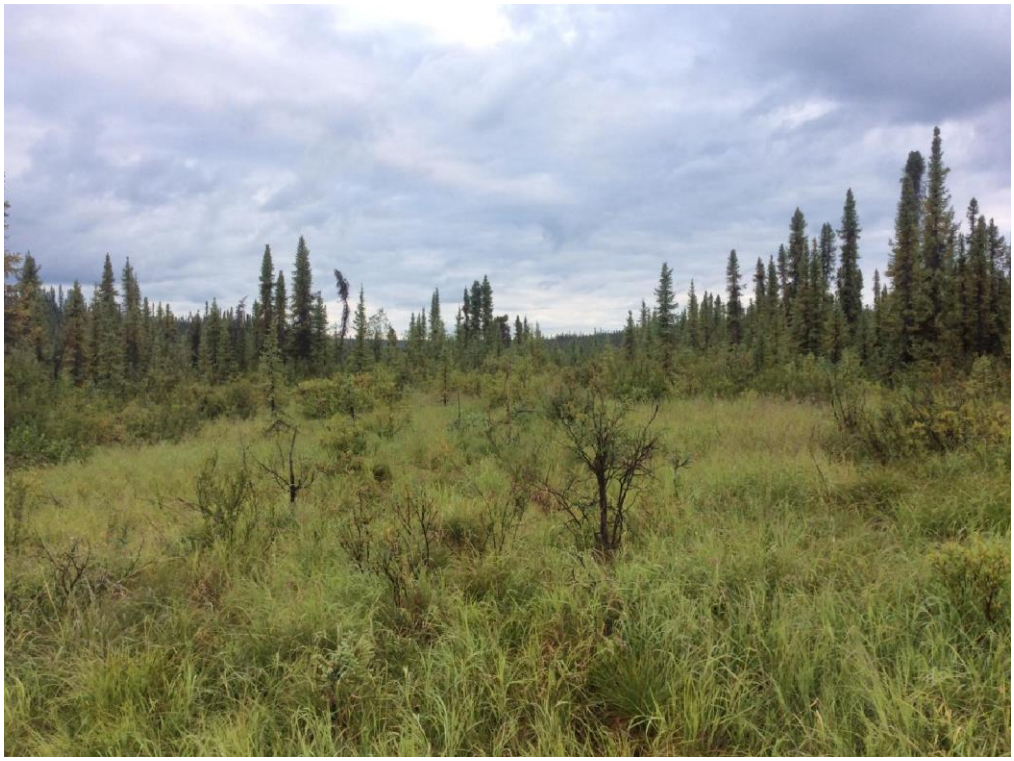
Attachment Photo A-9. Air survey plot SL234, an unburnt winter road undergoing magnified succession at a sapling forest structural stage when surveyed.



Attachment Photo A-10. Ground survey plot SL317, a burnt 2D seismic line undergoing magnified succession at a tall shrub structural stage when surveyed.



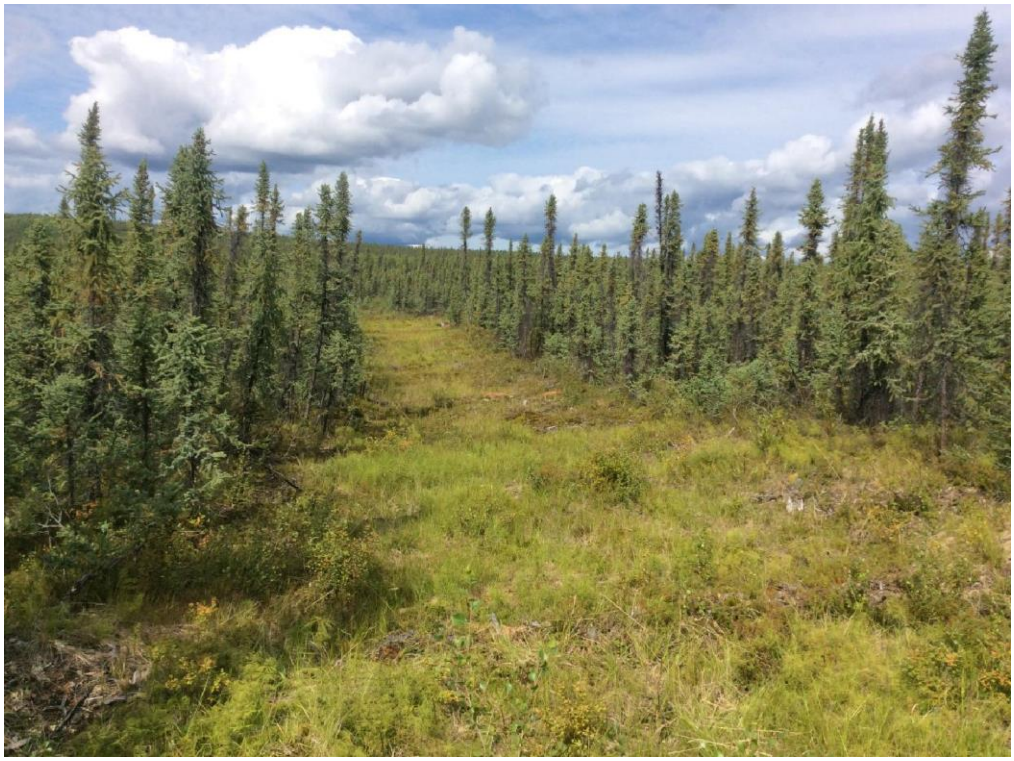
Attachment Photo A-11. Air survey plot SL238, an unburnt winter road undergoing stagnated succession at a forb-dominated herb structural stage when surveyed.



Attachment Photo A-12. Ground survey plot SL264, an unburnt winter road undergoing stagnated succession at a graminoid-dominated herb structural stage when surveyed.



Attachment Photo A-13. Ground survey plot SL226, a burnt 2D seismic line undergoing normal succession at a forb-dominated herb structural stage when surveyed.



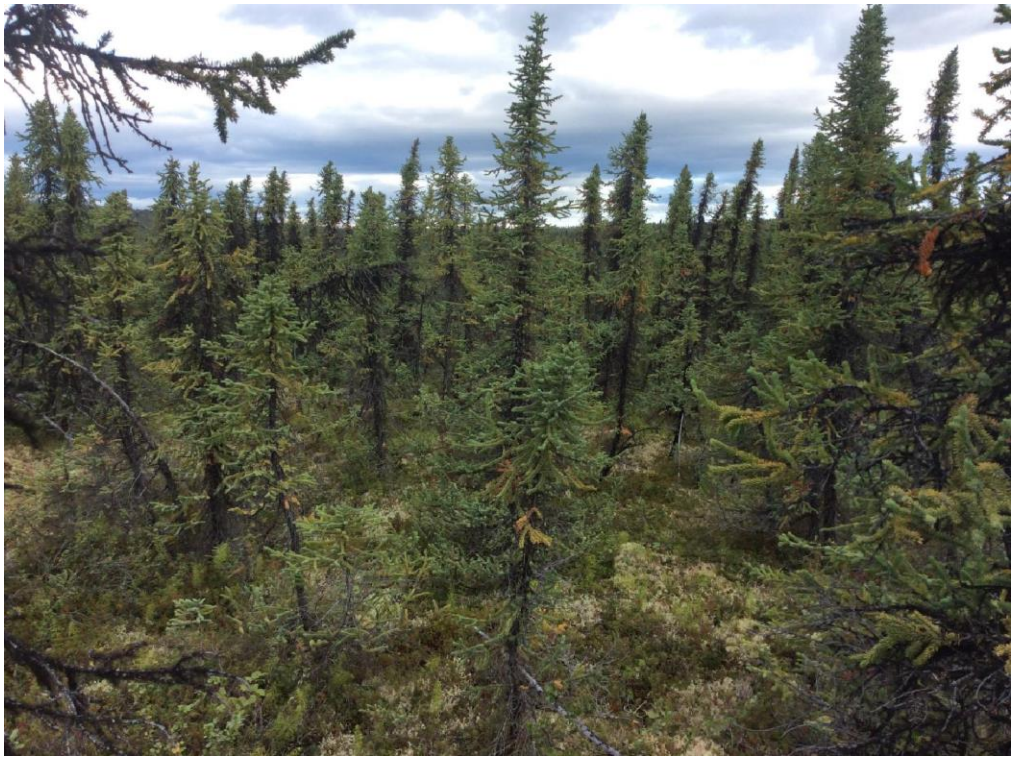
Attachment Photo A-14. Ground survey plot SL329, an unburnt 3D5 seismic line classified as recent disturbance at a forb-dominated herb structural stage when surveyed.



Attachment Photo A-15. Ground survey plot SL338, an unburnt, undisturbed reference plot at a low shrub structural stage when surveyed.



Attachment Photo A-16. Ground survey plot SL350, a burnt undisturbed reference plot at a low shrub structural stage when surveyed.



Attachment Photo A-17. Ground survey plot SL304, an unburnt undisturbed reference plot at a tall shrub structural stage when surveyed.



Attachment Photo A-18. Ground survey plot SL346, a burnt undisturbed reference plot at a tall shrub structural stage when surveyed.



Attachment Photo A-19. Ground survey plot SL3260, an unburnt undisturbed reference plot at a mature forest structural stage when surveyed.



Attachment Photo A-20. Ground survey plot SL264, an unburnt undisturbed reference plot at an old forest structural stage when surveyed.



Attachment Photo A-21. Ground survey plot SL243, a burnt winter road with melt pockets present, indicating permafrost degradation.



Attachment Photo A-22. Air survey plot SL228, a burnt 2D seismic line recovering at the same rate and stage as the surrounding community.



Attachment Photo A-23. Air survey plot SL326, a burnt winter road recovering at the same rate and stage as the surrounding community.



Attachment Photo A-24. Ground survey plot SL287, a burnt 3Dr seismic line recovering at the same rate and stage as the surrounding community.



Attachment Photo A-25. Ground survey plot SL216, a feature with regenerating trees over 1.5 m tall but very sparse, illustrating one of the limitations of the NYLUP and PWRLUP functional recovery threshold.

ATTACHMENT B DATA FORMS

Eagle Plains Linear Features Study

Surveyors: _____ **Date**: _____ **Type**: Air / Ground

Waypoint: _____ **Map Info**: _____

Line Widths: ____/____/____/____ **% Mulch**:_____

Succ. Class: Normal / No Succ / Magn / Stagn / Regress / Rcnt Dist

	On Line	Off Line
Struct. Stage		
Veg Ht / Spp	/	/
% Tree		
Tree Spp		
% Shrub		
Shrub Spp		
Ecosite		
Photos		
Sight Line (m)	/	/
Walk Test*	Dist: Time: Surveyor:	Dist: Time: Surveyor:

*Use same Surveyor for both walk tests.

Comments: _____

Eagle Plains Linear Features Study

Surveyors: _____ **Date**: _____ **Type**: Air / Ground

Waypoint: _____ **Map Info**: _____

Line Widths: ____/____/____/____ **% Mulch**:_____

Succ. Class: Normal / No Succ / Magn / Stagn / Regress / Rcnt Dist

	On Line	Off Line
Struct. Stage		
Veg Ht / Spp	/	/
% Tree		
Tree Spp		
% Shrub		
Shrub Spp		
Ecosite		
Photos		
Sight Line (m)	/	/
Walk Test*	Dist: Time: Surveyor:	Dist: Time: Surveyor:

*Use same Surveyor for both walk tests.

Comments: _____

APPENDIX A. Wildlife Baseline Studies

Chance Oil and Gas, Eagle Plains Project: Wildlife Baseline Studies



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EXECUTIVE SUMMARY

The Eagle Plains Project (the Project) is an oil and gas exploration program in north-central Yukon, approximately 605 km north of Whitehorse along the Dempster Highway. Chance Oil and Gas Ltd. intends to conduct exploratory activities over a 10-year period to confirm the quality, quantity, and areal extent of hydrocarbons. Project activities will include seismic exploration and exploratory wells supported by an expanded winter road network.

The Project's Regional Study Area (RSA) is approximately 2,400 km² and is spatially bounded by the Peel River and Ogilvie River to the south and the northern reaches of Chance Creek to the north. The Project is within the Eagle Plains ecoregion, an intermontane basin underlain by sedimentary rock. The regional land cover comprises subarctic coniferous forest with mixed forest and arctic/alpine tundra while also lying within a continuous permafrost zone.

For the Project to proceed, it must be evaluated under the *Yukon Environment and Socio-Economic Assessment Act*, which requires baseline wildlife information. As such, wildlife baseline studies were conducted to provide information about birds, American marten, grizzly bear, moose, and caribou to meet the information requirements to support a project proposal to the Yukon Environmental and Socio-economic Assessment Board. The following subsections provide an executive summary of each baseline study completed for the Project.

Birds

The purpose of the birds baseline study was to document the potential occurrence, relative abundance, and habitat associations of birds across the Project's RSA. This study consisted of a combination of a desktop assessment and field surveys. The desktop assessment included identifying ecosystem units across the RSA using predictive ecosystem mapping, collecting, and cleaning historic bird survey data in the broader area, and developing a comprehensive list of bird species with the potential for occurrence based on range and habitat requirements. Two types of field surveys were conducted, each targeted at broad habitat associations in the Project area: point count surveys (transects for terrestrial habitats) and wetland/pond surveys. The survey design followed a targeted, stratified habitat design to provide representative survey coverage across the range of habitat types that occur in the RSA. Point count stations were established along walking transects for efficient survey implementation, and sites were selected using a targeted, stratified habitat design. Ecosystem units for predictive ecosystem mapping were reclassified with field data to produce 32 ecosystem units that captured site-specific differences in vegetation. An average of 23 survey stations were located in each ecosystem unit, with a minimum of eight stations in uncommon habitats. Field surveys were conducted during the 2019 breeding season (June 25 to 30) by two experienced biologists.

To better explain broad patterns of habitat occupation by species of birds in the RSA, the initial 32 ecosystem units were consolidated into ten broad avian habitat types: Herb, Deciduous/Mixed Shrub, Tall Shrub – Black Spruce, Deciduous/Mixed Forest, Spruce Forest, Riparian/Wetland Deciduous Shrub, Riparian Coniferous Shrub, Riparian Spruce Forest, Open Water, and a classification ("Unknown") for distant (>100 m) or flyover observations that prevented associating birds with habitat.

Based on range and habitat, 128 bird species potentially occur in or adjacent to the RSA. Forty-eight bird species were recorded in adjacent areas during North American Breeding Bird Surveys. Possible species include eight listed either under the federal *Species at Risk Act* or identified in the Yukon *Wildlife Act*, and 67 are considered a priority and management concern under the federal *Bird Conservation Region 4 Plan*. Species listed in the *Species at Risk Act* include (with those in bold observed in the RSA): Horned Grebe (*Podiceps auritus*), Peregrine Falcon (*Falco peregrinus*), Short-eared Owl (*Asio flammeus*), **Red-necked Phalarope** (*Phalaropus lobatus*), **Common Nighthawk** (*Chordeiles minor*), **Olive-sided Flycatcher** (*Contopus cooperi*), Bank Swallow (*Riparia riparia*), and **Rusty Blackbird** (*Euphagus carolinus*).

During field surveys, nine hundred and seventy-nine birds from 53 species were observed in the RSA. Point counts identified 743 birds of 42 species, and wetland surveys identified 231 birds of 37 species. Five Swainson's Hawk (*Buteo swainsoni*) were also identified as incidental observations. Patterns of species relative abundance and richness (number of species) varied among the different habitat types. These patterns were consistent with regional habitat and known bird range-use and habitat requirements. Average relative abundance and species richness were greatest in Spruce Forest, Deciduous and Mixed Shrub, and Riparian/Wetland Deciduous Shrub habitats; and lowest in Herb and Tall Shrub – Black Spruce habitats. These patterns were generally related to the structural complexity and productivity of these different habitat types. However, the number of unique species in a given habitat did not depend on structural complexity. Many unique species were found in the Herb and Open Water habitats.

The general patterns of bird occurrence and habitat associations observed in this study are consistent with the limited information available for birds in the area.

Marten

Marten were selected as a Valued Component for the Project due to their value as a furbearer to the Vuntut Gwitchin First Nation and as an indicator species for mature and old forest values. Marten are a good species for assessing potential effects on habitat because they are more closely associated with habitat (mature forest) than many other species of medium-sized carnivore. However, little is known about basic marten ecology in northern boreal forest and taiga ecosystems. The RSA is located entirely within the Eagle Plains Ecoregion, where tree growth is limited by the presence of permafrost and short cool summers that limit the structural development of forests. The most common climax forest community is black spruce woodlands with open canopies and relatively small trees. The size and number of mature forest structures that marten use, such as large trees, snags, and coarse woody debris is much smaller than in forests used by marten in more southern latitudes. Therefore, indices of marten habitat suitability were evaluated in a relative context in this northern setting.

A habitat suitability index model was developed for marten to examine the amount, quality, and habitat distribution for the species in the RSA. Habitat was assigned a suitability ranking of High, Moderate, Low, or Nil/Very Low, relative to the range of habitat quality across the RSA. The rating categories correspond to qualitative predictions of the relative suitability of the habitat for supporting five life requisites of marten: reproduction, thermal cover, escape cover, foraging, and dispersal. High-quality habitat supports all five life requisites. Moderate-quality habitat supports escape cover, foraging, and dispersal. Low-quality habitat only

supports limited foraging and dispersal. Nil/Very Low-quality habitat does not contribute significantly to any life requisites; however, herb/shrub structural stages and stunted disclimax forest areas likely function as permeable barriers and allow intra-territorial movements within marten home ranges. Key habitat associations include selection for mature/old conifer structural stages and avoidance of herb/shrub structural stages (mostly resulting from fire), natural openings, wetlands, and stunted black spruce stands. The model also accounts for avoiding anthropogenic linear features, with greater rating reductions for wider linear features. The model uses two types of source information to provide a spatially explicit quantification of marten habitat across the RSA: vegetation mapping (Ecological and Landscape Classification mapping) and human disturbance, including the Dempster Highway, winter roads, and two types of seismic lines.

The model indicates a patchwork of High (16%), Moderate (23%), and Low (60%) quality marten habitats across the RSA. High-quality marten habitat is associated with mesic, spruce-dominant ecosites in mature to old structural stages. Concentrations of High-quality habitat include the southern portion of the study area, in the Enterprise and Dalglish Creeks watersheds, a band running east-west, north of the Dempster Highway, and the western portion of the northern half of the RSA. Moderate-quality habitat is associated with wetter and/or younger ecosystem units than High-quality habitat and is widespread across the RSA. High and Moderate quality habitat is also concentrated in narrow strips of mature/old riparian forests along some of the major watercourses in the RSA, including Chance and Greaves Creeks in the northwest and McParlon Creek west of the Dempster Highway. Low-quality habitat is associated with regenerating burns, wetlands, and stunted, open, black spruce areas. Concentrations of Low-quality habitat include recent burns on both sides of the Dempster Highway and wetlands and open, stunted spruce areas in valley bottoms in the lower reaches of the Chance watershed in the northwestern portion of the RSA. Nil/Very Low habitat constitutes only 1% of the RSA.

Linear features had a relatively minor effect on overall quality, amount, and distribution of potential habitat for marten in the RSA. This was due to the narrow width of linear features and small overall extent they comprise relative to the overall RSA. Though existing linear features result in reduced habitat quality at the site-level, their effects on habitat supply for marten at the home range scale are very limited.

Grizzly Bear

Grizzly bears (*Ursus arctos horribilis*) were selected as a Valued Component for the Project due to their conservation status and social, cultural, and economic value. Grizzly bears are Special Concern on Schedule 1 of the federal *Species at Risk Act*. The grizzly bear section provides baseline information about population trends, distribution, sources of mortality, diet, and habitat selection within the RSA. This section draws from multiple sources, including published and unpublished literature, personal communications with biologists, and traditional knowledge where available. Few studies on grizzly bears have been conducted in the Project area. Literature from surrounding regions was consulted when local information was not available.

Grizzly bear densities are thought to be low throughout the RSA. The most current grizzly bear population estimate for the broader Eagle Plains Ecoregion (which encompasses the RSA) is 184 individuals, based on expert opinion of grizzly bear habitat capacity from the 1980s. Little is known about seasonal grizzly bear distribution and movements within the RSA and surrounding areas. However, the Richardson and Ogilvie

Mountains (north and south of the RSA, respectively) are thought to have higher grizzly bear densities than the comparatively flat Eagle Plains Ecoregion. Grizzly bears congregate at the Fishing Branch River (20 km west of the RSA) in the fall to feed on spawning salmon. Grizzly bears may also follow the spring and fall migration of the Porcupine caribou herd to take advantage of the seasonal abundance of caribou as a food source.

Key threats to grizzly bear populations in the Yukon are human-wildlife conflict and harvest mortality. Licenced grizzly bear harvest rates are low in the RSA relative to other parts of the Yukon. Annual grizzly bear harvest in Game Management Zone 1 (which encompasses the RSA) has historically varied from zero to three bears per year. Other potential sources of grizzly bear mortality in the RSA include the defence of life and property kills, collisions with vehicles, and predation from other bears or large carnivores.

Seasonal grizzly bear diets reflect the phenological progression of key food resources such as herbaceous plants, roots, ungulate calves, berries, and fish. Terrestrial wildlife are likely an important food source for grizzly bears in northern Yukon, particularly barren-ground caribou (*Rangifer tarandus groenlandicus*) and arctic ground squirrels (*Spermophilus parryii*). The distribution of available food strongly influences habitat selection by grizzly bears during spring, summer, and fall seasons and the supply of suitable den sites in winter. Grizzly bears in the RSA may select habitats with abundant herbaceous vegetation, roots, or berries, such as riparian valleys and slopes. Grizzly bears may also travel to nearby mountain ranges to feed on ground squirrels, particularly in fall, as berry availability declines. Grizzly bears may follow caribou during spring and fall as they migrate to and from their calving grounds, targeting calves or opportunistically preying on adults.

Grizzly bears in northern Yukon hibernate in winter from approximately October to May. They prefer to den in mountainous regions; however, in areas with relatively flat topography (such as the RSA), grizzly bars will select small topographic features such as hills, steep riparian banks, or lakesides to excavate their dens. Grizzly bears in the taiga of northern Yukon have large home range sizes (females: 442–750 km^2, males: 760–1,250 km^2). They travel long distances to find suitable winter denning habitats in the mountains.

Moose

Moose (*Alces alces*) were selected as a Valued Component for the project's environmental assessment due to their value as a game species and their cultural values to local First Nations. The purpose of the moose study was to summarize existing baseline information for moose and develop a habitat model for the species within the Eagle Plains RSA. The habitat model quantifies the suitability, amount, and distribution of potential habitat for moose in the RSA. This information can be used to assess the Project's potential effects on moose and develop measures to mitigate effects if required.

There is limited incidental knowledge about moose population levels, distribution and habitat use within the Eagle Plain RSA. Formal population surveys of moose have not been conducted, but local knowledge suggests that, while moose densities in Eagle Plains are relatively low compared to areas in southern Yukon, they are relatively high compared to other areas in North Yukon. Information from two historical aerial surveys examining the distribution of moose (and other large mammals) indicates that moose occur across the RSA throughout the year, consistent with the relatively low elevation, subdued topography, and moderate

snowpacks that occur in the area. Several large, regenerating burns and smaller extents of riparian and wetland shrublands offer shrubby browse that moose depend on during winter.

The habitat model was developed specifically for the winter season because winter is the most limiting season for moose — forage is most limited, and energetic demands are greatest due to cold temperatures and the extra effort required to travel through snow. The model explicitly focussed on forage availability, which was believed to be the most significant factor affecting habitat selection in winter. During winter, moose feed almost exclusively on the stems and branches of certain shrubs. Vegetation surveys in the area found that several species of willows (*Salix spp.*) were the most abundant potential forage species and the species with the most frequent evidence of browsing by moose.

The habitat model included three variables, ecosystem type, structural stage, and fire disturbance status, all from recent vegetation mapping (Ecological and Landscape Classification mapping) conducted in the RSA. Habitat suitability ratings were developed for each combination of ecosystem type, structural stage, and fire disturbance based on the observed or potential abundance of willow. The highest-rated areas included natural shrublands, regenerating burns in riparian areas, and small extents of deciduous and mixed-wood ecosystems on mesic and moist sites. Moderate-rated areas were predominantly regenerating burns on mesic to wet sites. Low-rated sites were mostly undisturbed stands of open, stunted spruce on mesic to wet sites, ranging from tall shrub to old forest structural stages. Differentiating ratings between Moderate and Low areas was often difficult. Many burned and unburned sites had an average willow cover less than 15%, with high variation in cover among sites in the same ecosystem units. Generally, 7% willow cover was used as the threshold to differentiate between Moderate and Low sites. This is a relatively low value of willow cover but using a higher threshold would have resulted in large areas of regenerating burn being classified the same (Low) as undisturbed areas.

The habitat model indicates that High-suitability moose winter habitat is quite limited across the RSA, and Moderate habitat is widespread: High (12%), Moderate (43%), Low (44%), and Nil/Very Low (1%). Due to the scattered occurrence of High-suitability habitat across the RSA, some moose are expected to occur across the RSA in winter. However, local densities are likely to vary with the portions of Low and Moderate suitability habitats that form the matrix of habitat at a larger scale. This pattern of having extensive areas in Moderate suitability winter habitat is different than occurs in other parts of Yukon, especially in more mountainous regions, where suitable winter habitat (i.e., High and Moderate) are often constrained by elevation and broad vegetation patterns to a relatively small proportion of the landscape (e.g., <25%). In Eagle Plains, a substantial amount of winter forage occurs within large areas with relatively low willow cover (i.e., the Moderate suitability areas).

Caribou

The Porcupine Caribou Herd (PCH) is a subpopulation of barren-ground caribou (*Rangifer tarandus*), known for large population aggregations, dramatic population fluctuations, lengthy migrations, and significant cultural and social value to northern Indigenous peoples. Within the North Yukon Land Use Plan, the PCH is considered "the most significant and culturally important wildlife resource in the planning region." The PCH has been assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada, but the

subspecies is not listed on Schedule 1 of the federal *Species at Risk Act*. Within Yukon, barren-ground caribou are considered Vulnerable/Apparently Secure.

The specific objectives of this study were to:

- summarize existing information about the ecology of the PCH,

and, use telemetry data and analysis outputs from the Porcupine Caribou Technical Committee to:

- quantify the degree of seasonal range overlap by the PCH with the Eagle Plains Oil and Gas Exploration Project RSA during late fall and winter, when seasonal range use overlaps the RSA.
- quantify habitat use patterns and selection by the PCH during late fall and winter.
- quantify movement rates and residency periods of the PCH during late fall and winter.
- quantify potential effects of exiting linear features on the occurrence and movements of the PCH.

There is a long history of co-management of the PCH among indigenous, state, territorial and federal governments in Canada and the United States. In Canada, management initiatives are led by the Porcupine Caribou Management Board with technical support from the Porcupine Caribou Technical Committee. The Porcupine Caribou Technical Committee leads most monitoring and research work on the PCH, including population and demographic monitoring, seasonal movement monitoring (via GPS telemetry tracking), caribou body condition monitoring, habitat and human disturbance assessments, and annual snow surveys. The portion of the PCH annual range that occurs within Yukon is protected by a network of parks, special management areas, conservation areas, wilderness areas, protected areas, ecological preserves, habitat protection areas, and Integrated Management Area zones within the North Yukon Regional Land Use Plan and the Peel Watershed Regional Land Use Plan. In total, 54% of the annual range of the PCH within Yukon falls within some type of protected area where industrial activity is prohibited, 36% of the annual range occurs within regional land use plan Integrated Management Area zones where development is limited, and 9% of the annual range is not covered by any land management zonation.

Although most barren-ground caribou subpopulations are declining, the PCH numbers have increased over the last two decades. Since the first survey in 1972, the PCH has had two periods of population growth, with an interceding decline. The last successful population survey in 2017 estimated a record high of 218,457 caribou.

Like most barren-ground caribou subpopulations, the PCH has a large annual range and makes long-distance migrations, hundreds or thousands of kilometres, among different seasonal ranges. After calving on the north slope and Arctic coastal plains, the PCH typically splits in two, with portions of the herd moving southwest in Alaska and southeast in Yukon. Animals in the Yukon typically follow a clockwise movement through the seasonal ranges from the calving grounds on the north slope, to the British Mountains in summer, to the Richardson Mountains in late summer, dispersing widely and variably across northern Yukon (as far south as the Ogilvie Mountains) in fall and winter, before returning north to the coastal plains in spring. The PCH has historically overlapped the RSA in the rut/late fall and winter periods. However, the RSA overlaps a small

portion of those ranges — 6.0% of the late fall range and 6.5% of the winter range, and the RSA does not overlap with the most frequently used portions of those ranges.

Habitat selection by the PCH for late fall and winter was estimated using resource selection functions using GPS collar data from 2012 to 2021 for 164 caribou in late fall and 172 caribou in winter. Spatial habitat data included a set of plant functional type layers (light macrolichens, graminoids, forbs, evergreen shrubs, deciduous shrubs, and conifer trees), elevation, aspect, slope, terrain ruggedness, and distance to waterbodies >1 ha. PCH caribou tended to select and avoid similar resources in both late fall and winter. Key covariates in models for both seasons that were statistically significant (i.e., $P < 0.05$) included macrolichen cover (positive coefficient), conifer tree cover (negative coefficient), slope percent (negative coefficient), elevation (variable in fall and winter), and aspect (greater selection for south- and west-facing). Coefficients associated with lichen cover were of the greatest magnitude, suggesting that the selection of lichen is the primary driver of habitat selection in late fall, especially in winter. The resource selection function models were used to derive habitat quality maps with four ratings (Very Low, Low, Moderate, and High), which were determined by assessing selection ratios across resource selection function predictions. The distribution and proportion of selected habitat (Moderate and High) was then examined within the RSA and broader seasonal ranges. The proportion of selected habitat was equivalent between the RSA (0.404) and the broader range during late fall (0.415 ± 0.025) but was less in the RSA (0.265) than the broader range during winter (0.411 ± 0.026). Selected habitat, especially areas of High quality, were mostly dependent on the amount and distribution of macrolichen cover.

The potential for linear features (i.e., the Dempster Highway, winter roads, 2D seismic and 3D seismic) to mediate the base habitat model via avoidance of those features was assessed using a zone of influence (ZOI) framework. Although ZOIs were determined for some features, confidence in the outcomes was low because (i) the magnitude of the ZOI effects were weak (i.e., including the ZOI effects in the habitat models had little effects on the habitat predictions); (ii) the ZOI distance estimates were sensitive to the data and analytical methods used; (iii) the pattern of ZOI effects were not consistent with other studies and basic understanding of the PCH ecology. Developing ZOIs for assessment and management purposes will integrate results from other studies adapted to the Eagle Plains setting and the ecology of the PCH.

To better understand factors affecting PCH caribou movement, two analyses were conducted: (1) a comparison of daily movement rates and residency times of caribou in the Project RSA relative to the broader landscape, and (2) a delineation of movement paths to assess broad-scale movement patterns and the potential for caribou to interact with the Project. The PCH typically exhibits movements of several kilometres per day in late fall and winter. Late fall daily movements (8.7 km/day in the RSA) were substantially greater than during winter (4.4 km/day), and caribou tended to occupy portions of the landscape for shorter periods during late fall than during winter. Caribou residency times in both seasons were two-fold greater in the broader landscape than within the Project RSA, suggesting that, on average, the RSA is used as more of a transitory area than other portions of the seasonal ranges. There were relatively few collared caribou that travelled through the RSA during late fall. However, in the fall of 2015, 14 collared caribou made clear, directed movements along the height of land parallel to the Dempster Highway, from the northeast to the southwest. Most caribou appeared to avoid crossing the Dempster Highway while travelling through the Eagle Plains

region, but all animals eventually crossed the highway farther south, in the Ogilvie Mountains. The movements through Eagle Plains crossed numerous 2D seismic lines, winter roads and a large 3D seismic grid within the RSA.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
2D	Two Dimensional
3D	Three Dimensional
AIC	Akaike's Information Criterion
asl	above sea level
BBMM	Brownian Bridge Movement Model
BC	British Columbia
BCR	Bird Conservation Region
BMU	Bear Management Unit
°C	degrees Celsius
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWCS	Canadian Wetland Classification System
CWD	Coarse Woody Debris
CWS	Canadian Wildlife Service
DBH	Diameter at Breast Height
DEM	Digital Elevation Model
DLP	Defence of Life and Property Kill
ELC	Ecosystem and Landscape Classification
GAM	Generalized Additive Modelling
GIS	Geographic Information System
GMS	Game Management Subzone
GMZ	Game Management Zone
GPS	Global Positioning System
ha	hectares
HSI	Habitat Suitability Index
HMP	Harvest Management Plan
IMA	Integrated Management Area
IPCB	International Porcupine Caribou Board
km	kilometers
km^2	square kilometers
LF	Linear Feature
LIS	Low Impact Seismic
m	meter
mm	millimeter
NABBS	North American Breeding Bird Survey
NND	Na-cho Nyäk Dun
NWT	Northwest Territories
NYLUP	North Yukon Land Use Plan

PCH	Porcupine Caribou Herd
PCMB	Porcupine Caribou Management Board
PCTC	Porcupine Caribou Technical Committee
PEM	Predictive Ecosystem Mapping
PFT	Plant Functional Type
PWLUP	Peel Watershed Land Use Plan
RISC	Resources Information Standards Committee
RSA	Regional Study Area
RSF	Resource Selection Function
SARA	*Species at Risk Act*
the Project	the Eagle Plains Project (proposed by Chance Oil and Gas Ltd.)
TGC	Tetlit Gwich'in Council
THFN	Tr'ondëk Hwëchin First Nation
TRI	Terrain Ruggedness Index
VC	Valued Component
VGFN	Vuntut Gwitchin First Nation
YESAA	*Yukon Environmental and Socio-Economic Assessment Act*
YESAB	Yukon Environmental and Socio-Economic Assessment Board
ZOI	Zone of Influence

1 INTRODUCTION

Baseline wildlife information and data are required for proposed oil and gas projects submitted to the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee for screening under the *Yukon Environment and Socio-Economic Assessment Act* (YESAA), as well as applications submitted for an Industrial Licence and Type A Water Licence from the Yukon Water Board, among other permits and licences. To receive authorization for the Eagle Plains Project to proceed, the Project must be evaluated under YESAA. Specific wildlife objectives, as identified in YESAB's Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions (2005), are to:

- describe the abundance and distribution characteristics of major wildlife species within the project area and vicinity;
- describe the habitat classifications used in the project area and any implications concerning the distribution and abundance of habitat types that may influence the project;
- provide a map showing the spatial arrangement of habitats of special interest, if applicable;
- identify and describe the transportation corridor and critical, key, and sensitive habitats;
- identify any species listed on the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and Species at Risk lists;
- describe any special management requirements due to vulnerability, threatened, or endangered status; and,
- identify and describe any ongoing studies and monitoring programs concerning wildlife in the project area and vicinity.

1.1 PROJECT OVERVIEW

The Eagle Plains Project (the Project) encompasses a 2,386 km² area in north-central Yukon, centred approximately 605 km north of Whitehorse and 40 km south and west of Eagle Plains hotel, along the Dempster Highway. The Project occurs within the Eagle Plains sedimentary basin, north of the Ogilvie River and west of the Richardson Mountains. The basin contains proven natural gas and oil reserves (Peel Watershed Planning Commission 2019), including 4.6 billion m³ of gas and 3.2 million m³ of oil (Hannigan 2014).

The Regional Study Area (RSA) has had intermittent periods of oil and gas exploration since the 1950s. That activity has established winter roads, seismic lines, and exploratory well sites across parts of the current RSA. Approximately 40 exploration wells have been drilled in the Eagle Plains sedimentary basin. Eight (8) wells are currently being maintained in suspended status, and the remaining wells have been plugged and abandoned. Seismic exploration has included approximately 10,000 km of two-dimensional (2D) lines (mostly before 1985), and about 325 km² of three-dimensional (3D) seismic was conducted in 2013/2014 (Northern Cross (Yukon) Ltd. 2014).

The current exploration program will build on past exploration to better define the extent, amount and quality of oil and gas deposits in the area. Under the current program, Chance Oil and Gas Ltd. proposes conducting additional 2D and 3D seismic data acquisition programs over large extents of the RSA and drilling up to 30 exploratory wells. Depending on the drilling program results, extended flow testing lasting up to two years may be conducted at wells where crude oil and/or natural gas are discovered to determine the quantity, quality and extent of the oil and gas deposit(s). The existing winter road network will be expanded to support the seismic, drilling, and flow testing programs. Most work is expected to be conducted in the winter (e.g., seismic line clearing and drilling); however, seismic recordings and extended flow testing may also occur during summer or year-round.

1.2 STUDY AREA

The Eagle Plains Project Regional Study Area (RSA; Map 1-1) is 2,386 km² (238,566 ha), centred in the Eagle Plains Ecoregion in north Yukon. The area consists of subdued topography of rolling hills and sloping plains. The Dempster Highway crosses the RSA along the local height of land. From there, the area drains into the Porcupine River watershed to the north (via Chance Creek) and west (via McParlon Creek and the Whitestone River) and into the Peel River watershed to the southeast (via Dalglish Creek).

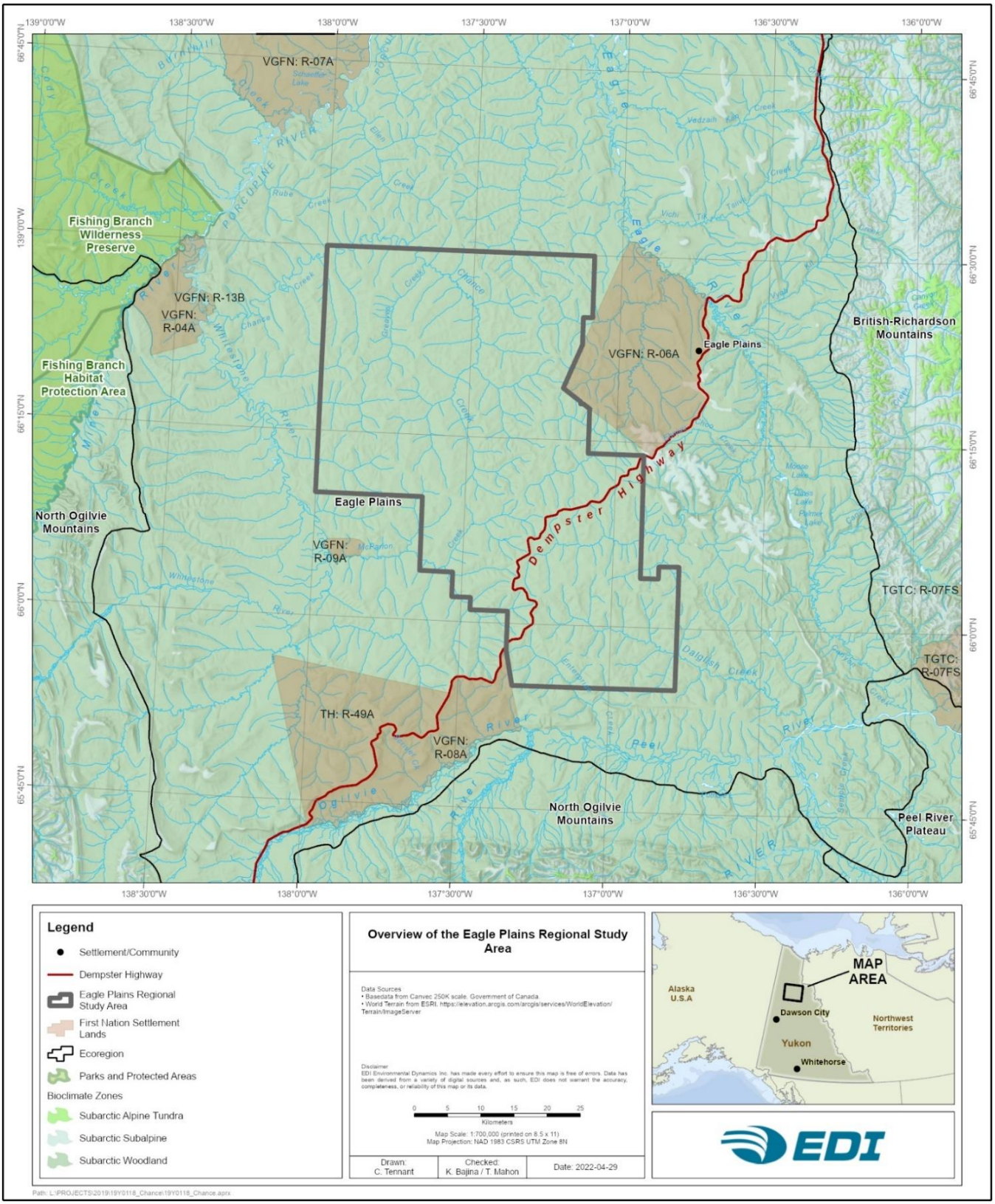
The RSA overlaps four First Nation Traditional Territories. Most of the RSA is within the Vuntut Gwitchin First Nation (VGFN) Traditional Territory. The southeastern portion is in an area of overlapping Traditional Territories of VGFN, the Tetlit Gwich'in Council (TGC), the First Nation of Na-cho Nyäk Dun (NND), and Tr'ondëk Hwëchin First Nation (THFN). Although the RSA is outside any First Nation Settlement Lands, it adjoins VGFN Settlement Lands on parts of its east and southwest borders.

Development in the RSA and the surrounding Eagle Plains is low. The Dempster Highway is the main vehicle access corridor, running from approximately Dawson City, Yukon in the southwest to Inuvik, Northwest Territories (NWT) to the northeast and transiting the RSA along the way. Several winter access roads also branch off the Dempster Highway. A network of seismic lines (Photo 1-1) from historical exploration are found in the RSA. The Eagle Plains settlement is located on the Dempster Highway, approximately 30 km east of the RSA boundary and consists of the Eagle Plains Hotel and the Government of Yukon's Highway Maintenance camp.

The Project is within the North Yukon Planning Region and Peel Watershed Planning Region. Therefore, it is subject to the North Yukon Land Use Plan (NYLUP) and Peel Watershed Land Use Plan (PWLUP). The project falls within the Integrated Management Area (IMA) Zone IV of both plans, a zone with lower ecological and cultural values and the highest permissible development of the four IMA zones.



Photo 1-1. Seismic lines from historical exploration activities within the Regional Study Area.



Map 1-1. Overview of the Eagle Plains Regional Study Area.

1.3 ECOLOGICAL OVERVIEW

The Project falls within the Eagle Plains Ecoregion (Map 1-1), a 20,400 km² region in north Yukon between the Richardson and Ogilvie Mountains. The ecoregion consists of low-altitude rolling topography between 300 m and 600 m above sea level (masl), with few scattered peaks above and around 1,000 masl (Ecological Stratification Working Group 1995).

The Eagle Plains Ecoregion experiences moderate precipitation, with annual amounts around 400 mm. Most precipitation falls as rain throughout the summer, averaging 50 to 80 mm per month, from June through August. Precipitation is lighter through September to April and falls as snow, with average winter snowpacks of 80 cm peaking in April. The climate in this region is strongly affected by its latitude, with extended winter conditions that usually last from October through to early May. There is a substantial variation in seasonal temperatures in the Eagle Plains, with cool short summers and long cold winters. Average winter temperatures are between −30°C and −25°C, with extremes as low as −60°C. Average summer temperatures are around 13°C, with extremes as high as 30°C. Due to the northern latitude, this region experiences brief periods of continuous sun above and below the horizon in summer and winter, respectively.

Most of the Ecoregion, including the northeast portion of the RSA, drains north into the Yukon River via the Whitestone, Porcupine and Eagle rivers. That part of the RSA includes the headwaters of the Eagle River and several other tributaries of the Porcupine River, along with the Chance and McParlon Creek subdrainages of the Whitestone River. The southeast corner of the Ecoregion drains east to the Mackenzie River via the Peel, Wind and Ogilvie Rivers. Dalglish and Enterprise creeks flow directly into the Peel River. The few lakes in the Ecoregion are generally oxbow or thermokarst lakes (Yukon Ecoregions Working Group 2004a). Several wetland complexes are found to be associated with larger creeks in the RSA.

The Eagle Plains Ecoregion is dominated by the Crysolic soils that occupy much of the northern third of Canada, characterized by near-surface permafrost. Turbic Cryosols predominate, exhibiting patterned ground formations and hummocks, and are often associated with open stands of black spruce (*Picea mariana*), tamarack (*Larix laricina*) and birch (*Betula* spp.). The active permafrost layer in these ecosystems generally ranges between 20 cm and 90 cm below the surface. The active layer depth is generally deeper under hummocks and shallower under inter-hummock areas (Yukon Ecoregions Working Group 2004a).

The RSA is entirely within the Subarctic Bioclimate Zone (Environment Yukon 2014a). Vegetation in the RSA is characterized by open-canopy, spruce-dominated habitats where permafrost generally limits tree growth and results in stunted, disclimax vegetation communities (Environment Yukon 2016a). Hummocky, black spruce and white spruce (*Picea glauca*) woodlands with well-developed shrub communities are common in upland areas, with white spruce and ground lichens increasing in abundance in well-drained sites. Areas with low slope gradients and fine-textured soils often have ground cover dominated by cottongrass tussocks beneath a shrub layer of birch, black spruce, Labrador tea (*Rhododendron groenlandicum*), and occasionally tamarack (Yukon Ecoregions Working Group 2004a).

Evidence of forest fires can be observed throughout the RSA (Photo 1-2 and Photo 1-3). Alaskan paper-birch (*Betula neoalaskana*) is often the first tree species to colonize burn areas, and the extent of old burns is generally

correlated with young black spruce – Alaskan paper birch woodlands (Yukon Ecoregions Working Group 2004a). Fires increase the depth of the active permafrost layer, causing slope failures and changes in ecosystem moisture regimes.



Photo 1-2. Example of a regenerating moist forest stand after a fire within the RSA.



Photo 1-3. Example of a recently burnt area of the RSA.

2 BIRDS

2.1 PURPOSE AND OBJECTIVES

This section documents the occurrence, relative abundance, and habitat associations of birds occurring or likely occurring in the RSA. It includes a desktop assessment to collect and summarize existing information about birds; and field surveys to document the occurrence, relative abundance, and habitat associations of birds within the RSA. Field surveys were recommended by the regulator responsible for migratory birds (Environment and Climate Change Canada — Canadian Wildlife Service [CWS]) because no systematic bird surveys have been previously conducted in the Project area. Surveys in adjacent areas were limited and mainly were road-based surveys, which had limited or no coverage of particular habitat types. Two field survey types were used to provide representative coverage of broad avian habitat types and associated avian communities: (1) point count surveys and (2) pond and wetland surveys.

2.2 BIRD HABITAT OVERVIEW

The Project falls within Bird Conservation Region 4 (BCR 4), the Northwestern Interior Forest (Environment Canada 2013a). BCR 4 is home to 211 regularly occurring bird species, including 31 waterfowl species, 19 water bird species, 23 shorebird species, and 138 land bird species (Environment Canada 2013a). Most species are breeding season migrants, few are year-round residents. The Project is also within ~30 km of two other bird conservation regions: region 3 (BCR 3), the Arctic Plains and Mountains, and region 6 (BCR 6), the Boreal Taiga Plains. BCR 3 habitats are influenced by a short growing season and continuous permafrost; upland habitats range from heavily vegetated heath communities to sparse cryptobiotic crusts, lichens, and moss; in the southern end, dwarfed spruce trees are often found in restricted patches (Environment Canada 2013b). BCR 6 is primarily characterized by gently rolling or undulating landscapes, vegetation dominated by the boreal forest and interspersed with wetlands and several major river systems (Environment Canada 2013c). In total, BCR 3 has 159 species of birds, while BCR 6 has 288. This current study did not find species uniquely associated with either of these two conservation regions.

The RSA has three predominant bird habitat types: black spruce upland, willow and scrub birch shrubland, and scrub fens and bogs. Upland forests provide potential breeding habitat for resident Northern Goshawk (*Accipiter gentilis*), Spruce Grouse (*Canachites canadensis*), Northern Hawk Owl (*Surnia ulula*), American Three-toed Woodpecker (*Picoides dorsalis*), Canada Jay (*Perisoreus canadensis*), Boreal Chickadee (*Poecile hudsonicus*), White-winged Crossbill (*Loxia leucoptera*), and Common Redpoll (*Acanthis flammea*) (Frisch 1987, YEWG 2004, Environment Canada 2013). Migrants that breed in upland forests include Swainson's Thrush (*Catharus ustulatus*), Gray-cheeked Thrush (*Catharus minimus*), Varied Thrush (*Ixoreus naevius*), Bohemian Waxwing (*Bombycilla garrulus*), Yellow Warbler (*Setophaga petechia*), Yellow-rumped Warbler (*Setophaga coronata*), American Tree Sparrow (*Spizelloides arborea*), and Dark-eyed Junco (*Junco hyemalis*) (Frisch 1987, YEWG 2004). American Kestrel (*Falco sparverius*), Say's Phoebe (*Sayornis saya*), American Robin (*Turdus migratorius*), Orange-crowned Warbler (*Leiothlypis celata*), and Chipping Sparrow (*Spizella passerina*), as well as other species of thrush, warbler,

and sparrow, can be found in more open forests with a well-developed shrub layer, or shrublands with tall shrub and dwarfed spruce (Frisch 1987, YEWG 2004). A frequently occurring species in the Eagle Plains ecoregion, though rare elsewhere in Yukon, is Swainson's Hawk (*Buteo swainsoni*). This species is associated with isolated stands of productive white spruce for nesting habitat, mostly found in narrow riparian strips surrounded by open bogs and shrublands where they regularly forage.

Aquatic habitats for birds consist of open bodies of water (e.g., ponds, lakes), wetlands (mostly bogs and fens) and riparian zones dominated by sedges and shrubs. Open water bodies are limited in the RSA and are thus potentially inhabited by relatively few Tundra Swan (*Cygnus columbianus*), Greater White-fronted Goose (*Anser albifrons*), Canada Goose (*Branta canadensis*), American Wigeon (*Mareca americana*), Green-winged Teal (*Anas crecca*), and Bufflehead (*Bucephala albeola*) (Frisch 1987, YEWG 2004, Environment Canada 2013). Shorebirds such as Lesser Yellowlegs (*Tringa flavipes*), Solitary Sandpiper (*Tringa solitaria*), and Wilson's Snipe (*Gallinago delicata*) remain along the water's edge and in riparian zones consisting of coniferous and deciduous vegetation. Riparian zones also provide potential breeding habitat for Willow Ptarmigan (*Lagopus lagopus*), Alder Flycatcher (*Empidonax alnorum*), Yellow Warbler, Wilson's Warbler (*Cardellina pusilla*), American Tree Sparrow, and Lincoln's Sparrow (*Melospiza lincolnii*) (Frisch 1987, YEWG 2004). Spotted Sandpiper (*Actitis macularius*), Herring and Short-billed Gulls (*Larus argentatus* and *L. brachyrhynchus*), Belted Kingfisher (*Megaceryle alcyon*), Bank Swallows (*Riparia riparia*), and Cliff Swallows (*Petrochelidon pyrrhonota*) can be found along rivers (Frisch 1987, YEWG 2004).

Alpine/subalpine areas are absent from the RSA. Species that inhabit the alpine/subalpine in other parts of the ecoregion include Golden Eagle (*Aquila chrysaetos*), Rock Ptarmigan (*Lagopus muta*), Horned Lark (*Eremophila alpestris*), American Pipit (*Anthus rubescens*), Gray-crowned Rosy Finch (*Leucosticte tephrocotis*), Upland Sandpiper (*Bartramia longicauda*), and Townsend's Solitaire (*Myadestes townsendi*) (Frisch 1987, YEWG 2004).

The Project RSA does not include cliffs or bluffs that could be used by cliff-nesting raptors, such as Golden Eagle, Peregrine Falcon (*Falco peregrinus*) or Gyrfalcon (*Falco rusticolus*). These species' nearest suitable nesting cliffs are along the Porcupine River and Eagle River (Hayes and Mossop 1978).

Data on birds in the Project area are currently limited. The first evaluation of bird occurrences in Eagle Plains was *Birds by the Dempster* (Frisch 1987). Birds of the Yukon Territory (Sinclair et al. 2003) provided a more detailed description of species occurrences, habitat, and relative abundances. More recently, a general account of birds within the region was presented by Environment and Climate Change Canada in their report, *Bird Conservation Strategy for Bird Conservation Region 4 in Canada: Northwestern Interior Forest* (Environment Canada 2013a). The North American Breeding Bird Survey (NABBS) is the best local data source. Two NABBS routes along the Dempster Highway (routes 78 and 79) are close to the Project.

2.3 METHODS

This study consisted of two components: a desktop assessment to collect and summarize existing information about birds relevant to the Project area and field surveys to document the occurrence, relative abundance, and habitat associations of birds across the Project RSA. This approach, field survey design, and methods details

were discussed with CWS representatives during the project planning stage. The methods used considered specific recommendations provided by CWS representatives and a broader set of recommendations in *A Framework for the Scientific Assessment of Potential Project Impacts on Birds* (Hanson et al. 2009). The methods selected and reporting herein also comply with the the ten key considerations identified in the DRAFT updated guidelines *Canadian Wildlife Service Guidance Regarding Information Needed to Support Assessment of Project Effects on Birds* (ECCC-CWS 2022).

2.3.1 DESKTOP ASSESSMENT

A list of bird species that had the potential to occur in the Project RSA was developed from a combination of historical occurrence data in adjacent areas, a territorial field guide, and a national bird conservation assessment.

Historical data were gathered from the NABBS database for two routes (routes 78 and 79) that run along the Dempster Highway in the Eagle Plains region (Pardieck et al. 2019). The NABBS is a long-term, large-scale monitoring program that began in 1966 to track trends in avifauna. It consists of annual (one day a year) standardized roadside surveys, during the peak breeding season, by skilled observers making 50 stops spaced 0.8 km apart, along 39.4 km long routes. Observers record the number of bird species heard from any distance or seen within a 0.4 km radius of each stop during a three-minute observation period. These data are then compiled and made freely available to analyze trends in relative abundance and species composition. From 2014 to 2018, NABBS identified 48 species along Eagle Plains' two routes (above) (Pardieck et al. 2019).

General information about bird species occurrences was obtained from *Birds by the Dempster* (Frisch 1987), *Birds of Yukon* (Sinclair et al. 2003), and the Federal conservation assessment, *Bird Conservation Strategy for Bird Conservation Region 4 in Canada: Northwestern Interior Forest* (Environment Canada 2013a). These sources ranked species as 'Likely' or 'Possible' in the RSA based on habitat requirements, range boundaries, and occurrence information. Likely species were those whose range overlapped with the RSA, and suitable habitat occurred in the RSA. Possible species included (1) those with suitable habitat in the RSA, but whose range was on the edge of the RSA, and (2) those whose range overlapped with the RSA, but for which the availability of suitable habitat was in question.

2.3.1.1 Conservation Status

The conservation status of bird species was identified based on the most recent recommendations by COSEWIC (COSEWIC 2018) and current lists in the *Species at Risk Act* (SARA) registry (i.e., the most recent amendment, Environment and Climate Change Canada 2019) and BCR 4 plan. The SARA registry groups species into one of three schedules:

- Schedule 1 — the official list of species at risk in Canada includes species that are either Extirpated, Endangered, Threatened or of Special Concern;
- Schedule 2 — species designated as Endangered or Threatened, but that have yet to be re-assessed by COSEWIC under the revised criteria; and,

- Schedule 3 — species designated as Special Concern but have yet to be re-assessed by COSEWIC under the revised criteria.

Birds that fall under conservation categories of Special Concern or higher were identified. All bird species of conservation concern, identified through the designation and ranking processes described above, were evaluated against their species conservation status assessment found in the national bird conservation strategy for BCR 4 (Environment Canada 2013a). The BCR 4 strategy outlines conservation planning and priorities to support the implementation of migratory bird conservation programs. The BCR species assessment considered population size, population trend, regional abundances and densities, and species and habitat threats to designate species warranting "Concern and Stewardship at the Regional, National, or Continental level". Stewardship species are based on "having a large proportion of their world population within BCR 4". Species managed by Environment Yukon under the Yukon *Wildlife Act* were also noted.

2.3.2 HABITAT STRATIFICATION

A broad avian habitat classification system was developed to provide representative survey coverage across the RSA. A habitat stratification approach was applied to site selection for all survey sites before field surveys. Avian habitat types were initially developed using Predictive Ecosystem Mapping (PEM), later verified with Ecological and Landscape Classification (ELC) mapping for habitat-related analyses. Two key components of the initial PEM mapping to define avian habitat types were: ecosystem units and structural stage, described below.

2.3.2.1 Ecosystem Units (Ecosites)

The North Yukon PEM was used to classify 16 ecosystem units in the Project RSA. However, the PEM model was unsatisfactory when assessing ecosite predictions in the field because of its low accuracy. The PEM ecosite codes were used to guide each survey location, but adjustments were made to the classifications according to the dominant vegetation. These changes were supplemented with detailed notes and descriptions of plant and tree species (i.e., lichen cover, percent shrubs, tree height and canopy closure), as well as photographs, with the intent of reclassification.

The purpose of reclassifying PEM ecosystem units was to describe site-specific vegetation at a finer resolution and, ultimately, develop more accurate associations between species of birds and habitat in the Project RSA. A detailed review was conducted of all point count and wetland survey forms, including a review of notes on species of vegetation and structural stage (Table 2-1) and analyzing each survey station's photographs. Deciduous and coniferous (i.e., primarily black spruce) vegetation were distinguished based on their relative densities at ecosites previously classified as mixed wood. Patterns of bird occupation were then analyzed to determine whether deciduous and mixed vegetation warranted separate ecosite codes. Shrub-stage and mature-stage spruce stands were differentiated based on tree height and the degree of canopy closure. Separating these two structurally distinct stands yields two ecological communities with different bird assemblages, e.g., species requiring mature trees for nest cavities, such as owls and woodpeckers, are unlikely to be found in shrub-stage forests. These new ecosites were summarized along with their previous PEM codes

and descriptions of key vegetation characteristics. In total, 32 distinct ecosystem units were developed from the PEM model (Table 2-2).

Table 2-1. Structural and successional stages of vegetation associated with ecosystem units in the Eagle Plains Project Regional Study Area.[1]

Code	Structural Stage	Description
1	Non-vegetated	Very recent disturbance and no vegetation (or <5% vegetation).
2a	Sparse	Initial stages of primary and secondary succession with 5–10% vegetation cover maintained by environmental conditions.
2b	Cryptogram (Bryoid-dominated)	Bryophyte-dominated community maintained by environmental conditions.
3a	Herb (Forb-dominated)	Early successional stage of herbaceous communities maintained by environmental conditions or disturbance. Includes non-graminoid herbs and ferns.
3b	Herb (Graminoid-dominated)	Early successional stage of herbaceous communities maintained by environmental conditions or disturbance. Includes grasses, sedges, reeds, and rushes.
3c	Herb (Aquatic)	Early successional stage of herbaceous communities maintained by environmental conditions or disturbance. Dominated by floating or submerged plants.
4a	Tall Shrub	Early successional stage of forest or shrub communities dominated by shrub layer vegetation > 2 m tall.
4b	Low Shrub	Early successional stage of forest or shrub communities dominated by shrub layer vegetation <2 m tall.
5	Pole/Sapling	Trees >2 m tall and typically densely stocked. Vertical structure and layering not yet evident.
6	Young Forest	Forest canopy with distinct layers and somewhat open stand.
7	Mature Forest	Mature trees and well-developed understories at canopy openings.
8	Old Forest	Old and structurally complex stands composed mainly of shade-tolerant and regenerating tree species.

[1] Modified from Environment Yukon 2017.

Table 2-2. Modified predictive ecosystem mapping ecosites relative to original ecosites in the Eagle Plains Project Regional Study Area.

Modified PEM	PEM	*N*[1]	Vegetation Description
211-D	211	7	Wet deciduous shrub; predominantly willow and scrub birch. Structural stage 4b.
211-SB	211, 213	3	Wet black spruce shrub (peat bog). Structural stages 4a–6.
211-SB-ML	211, 213	2	Wet black spruce shrub with moderate lichen cover. Structural stages 4a–6.
213-tp	213	2	Wet black spruce dominant forest; tall and productive stands. Structural stages 6 and 8.
221	221	1	Moist mixed shrub; black spruce and deciduous (scrub birch and willow). Structural stage 4b.

Modified PEM	PEM	*N*[1]	Vegetation Description
221-D	221	12	Moist deciduous shrub; predominantly scrub birch and willow. Structural stages 4a–b.
221-SB	221, 223	18	Moist black spruce shrub. Structural stages 4a-6.
221-SB-LL	221, 223	3	Moist black spruce shrub with low lichen cover. Structural stage 4a.
221-SB-ML	223	2	Moist black spruce shrub with moderate lichen cover. Structural stage 6.
221-SB-HL	221	1	Moist black spruce shrub with high lichen cover. Structural stage 4a.
222	222	6	Moist mixed forest; spruce and deciduous (birch and/or alder). Structural stages 5-8.
222-D	222	1	Moist deciduous forest; birch dominant. Structural stage 6.
223-tp	222, 223	4	Moist black spruce forest; sometimes mixed with white spruce. Structural stages 6-7.
223-LL-tp	223	2	Moist black spruce forest; sometimes mixed with white spruce; low lichen cover. Structural stages 6-7.
230	230	1	Mesic herb with <15% shrub cover. Structural stages 2b and 4b.
231-D	231	4	Mesic deciduous shrub; predominantly willow and scrub birch. Structural stages 4a–b.
231-D-ML	231	1	Mesic deciduous shrub; predominantly willow and scrub birch; moderate lichen cover. Structural stage 4a.
231-SB	231, 233	7	Mesic black spruce shrub. Structural stages 4a–6.
231-SB-HL	233	3	Mesic black spruce shrub with high lichen cover. Structural stages 4a–6.
232	232	3	Mesic mixed forest; black spruce and deciduous (paper birch and/or trembling aspen). Structural stages 5–6.
232-D	232	3	Mesic deciduous forest; predominantly paper birch and willow. Structural stages 5–6.
233-tp	233	5	Mesic black spruce forest sometimes mixed with white spruce; tall and productive stands. Structural stages 6-7.
233-LL-tp	233	1	Mesic black spruce forest with some black spruce shrubs; low lichen cover; tall and productive stands. Structural stages 4b, 6–7.
233-HL-tp	233	1	Mesic black spruce forest; high lichen cover; tall and productive stands. Structural stage 6.
310	310	4	Riparian herb with little to no shrub cover. Structural stages 3b–c.
311-D	311	22	Riparian deciduous shrub; predominantly scrub birch and willow. Structural stages 4a-b.
311-SB	311, 313	4	Riparian black spruce shrub. Structural stages 4a–6.
311-SB-T	311	4	Riparian black spruce and tamarack shrub. Structural stages 4a–6.
313	313	11	Riparian spruce forest; mix of black and white spruce, as well as hybrids. Structural stages 6–8.
400	400	4	Wetland herb. Structural stage 3b.
401-D	401	1	Wetland deciduous shrub; predominantly scrub birch and willow. Structural stage 4b.
500	500	17	Open water.

[1] Sample size, the number of survey stations (point count or pond) within each modified PEM ecosite.

2.3.2.2 Bird Habitat Types

Once ecosystem units were reclassified, they were grouped according to vegetation and structural stage similarities. Mixed and deciduous vegetation, while ecologically distinct, did not differ in their use by birds; therefore, they were grouped in a single category. Ultimately, 32 ecosystem units were consolidated into ten broad avian habitat types: Herb, Deciduous/Mixed Shrub, Tall Shrub – Black Spruce, Deciduous/Mixed Forest, Spruce Forest, Riparian/Wetland Deciduous Shrub, Riparian Coniferous Shrub, Riparian Spruce Forest, Open Water, and a classification ('Unknown') for distant (>100 m) or flyover observations that prevented associating birds with habitat (Table 2-3). As a post hoc exercise, ELC ecosite types were assigned to broad habitat types based on the spatial overlap with survey sites with the ELC map and verified using field-based habitat descriptions (Table 2-3). For a complete list of ELC codes, names, and descriptions, see Attachment Table 1 in Section 2.6.1 (Attachment 2-A).

Table 2-3. Avian habitat types developed by grouping modified Predictive Ecosystem Mapping ecosites, based on their similarities in vegetation and structural stages, in the Eagle Plains Project Regional Study Area. *A posteriori* classified ELC ecosites are provided for each habitat type.

Avian Habitat Type	Modified PEM Ecosite	ELC Ecosite[1]	Structural Stages	*N*[2]	Vegetation Description
Herb	230, 310, 400	31, 33, 42, B2	2b, 3b, 3c, 4b	9	Herb dominant sites found along crests and upper slopes, riparian zones, and wetlands; <20% shrub cover.
Deciduous and Mixed Shrub	211-D, 221, 221-D, 231-D, 231-D-ML	06, 22, 23, 31, 33, 34, 35, 42, B2	4a-b	24	Predominantly scrub birch and/or willow vegetation, sometimes with a mix of black spruce; lichen cover possible.
Tall Shrub – Black Spruce	211-SB, 211-SB-ML, 221-SB, 221-SB-LL, 221-SB-ML, 221-SB-HL, 231-SB, 231-SB-HL	05, 06, 14, 20, 23, 33, 34, 42	2b, 4a-b, 6	35	Tall shrub/dwarfed black spruce dominated area often with low to high lichen cover.
Deciduous and Mixed Forest	222, 222-D, 232, 232-D	04, 05, 06, 33, 34	5, 6, 7, 8	13	Birch dominant forest or mix of spruce and deciduous (e.g., birch, aspen, and alder) stands.
Spruce Forest	213-tp, 223-tp, 223-LL-tp, 233-tp, 233-LL-tp, 233-HL-tp	05, 33, 42, B1	6, 7, 8	14	Black spruce dominant forest, sometimes mixed with white spruce, and often with low to high lichen cover. Ranges from intermediate height stands with open canopy to tall and closed canopy forest.
Riparian/Wetland Deciduous Shrub	311-D, 401-D	20, 23, 31, 33, 35, 42, 43, 44	2b, 3b, 4a-b	23	Predominantly scrub birch and willow shrub along riparian zones and wetlands.
Riparian Coniferous Shrub	311-SB, 311-SB-T	22, 33, 35, 42, 43, B1	2b, 4a-b, 6	8	Black spruce and tamarack dominant riparian shrub.
Riparian Spruce Forest	313	22, 23, 31, 35, 42, 43, B2	6, 7, 8	11	Dominated by mix of black and white spruce, as well as spruce hybrids.
Open Water	500	LA, PD	1	17	Non-vegetated open water.
Unknown	UNK	UNK	UNK	74	Unknown habitat due to distant observations (>100 m) or flyovers.

[1] Broad ELC polygons within which survey stations were located.

[2] Sample size, the number of survey stations (point count or pond) within each habitat group.

2.3.3 OCCURRENCE AND DISTRIBUTION SURVEYS

Two experienced bird biologists conducted field surveys in the Project RSA between June 25 to 30, 2019. Each biologist had more than 15 years of experience conducting point count surveys and could reliably identify all bird species by sight and vocalizations that had the potential to occur. All surveys employed a targeted, stratified habitat design to provide sampling across all broad avian habitat types.

2.3.3.1 Breeding Bird Point Count Surveys

'Point count' surveys were conducted in terrestrial habitats following standardized survey methods (Ralph et al. 1995, Resources Inventory Committee 1999a, Matsuoka et al. 2014). Point count stations were visited along walking transects to facilitate efficient survey productivity (i.e., versus individual point counts spaced more widely, which would have resulted in longer travel time and a lower number of survey stations). Point count survey stations were established within a Geographic Information System (GIS) using guided site selection to provide coverage across all avian habitat types and broad spatial coverage across the RSA (Map 2-1). Random site selection approaches were explored but ultimately not used because of challenges associated with safety (steep terrain), logistics (access), and reduced sample sizes (i.e., randomization resulted in much smaller sample sizes due to greater travel times to transect starting stations and between stations). Site selection targeted a minimum of four stations in each habitat type. The location of existing and proposed development features was also considered to ensure the surveys covered those areas. Stations were spaced approximately 500 m apart, with a minimum spacing of 400 m, to avoid counting the same birds from multiple stations. Point count locations were chosen in two ways to associate bird occurrences with habitat types: (1) locating stations within one PEM polygon, at least 100 m from the polygon edge; and (2) locating the station on the boundary between two PEM polygons where the location of birds in different habitat types could be reliably determined (e.g., on the transition between shrubland and forest type). Each point count station was surveyed once to maximize the number of sampled sites.

Survey methods followed standard point count survey methodologies (Ralph et al. 1995, Resources Inventory Committee 1999a, Matsuoka et al. 2014). Surveys used a 10-minute detection period and an unlimited recording distance. Biologists conducted surveys during the dawn chorus (i.e., a half-hour before dawn to ~8:30) when territorial singing rates are highest. Upon arriving at the predetermined survey station location, surveyors evaluated the station location and, where appropriate, revised the location by up to 50 m to aid in accurately plotting bird locations in their associated habitat types. Once on station, surveyors waited two minutes to allow any birds disturbed by the surveyor's arrival to settle and resume their activities. Once the official observation period began, surveyors recorded all birds detected (visual or auditory) during the 10-minute detection period by plotting their locations on a point count map form and recording the standardized four-letter species name abbreviation, time of detection, sex, age, number, behaviour, and the habitat type in which they occurred (i.e., ecosystem unit and structural stage). Surveyors assigned birds estimated to be >100 m distant at a distance of 101 m due to the high uncertainty of estimates at those distances. Following the surveys, a bearing and distance were measured on the point count map from the

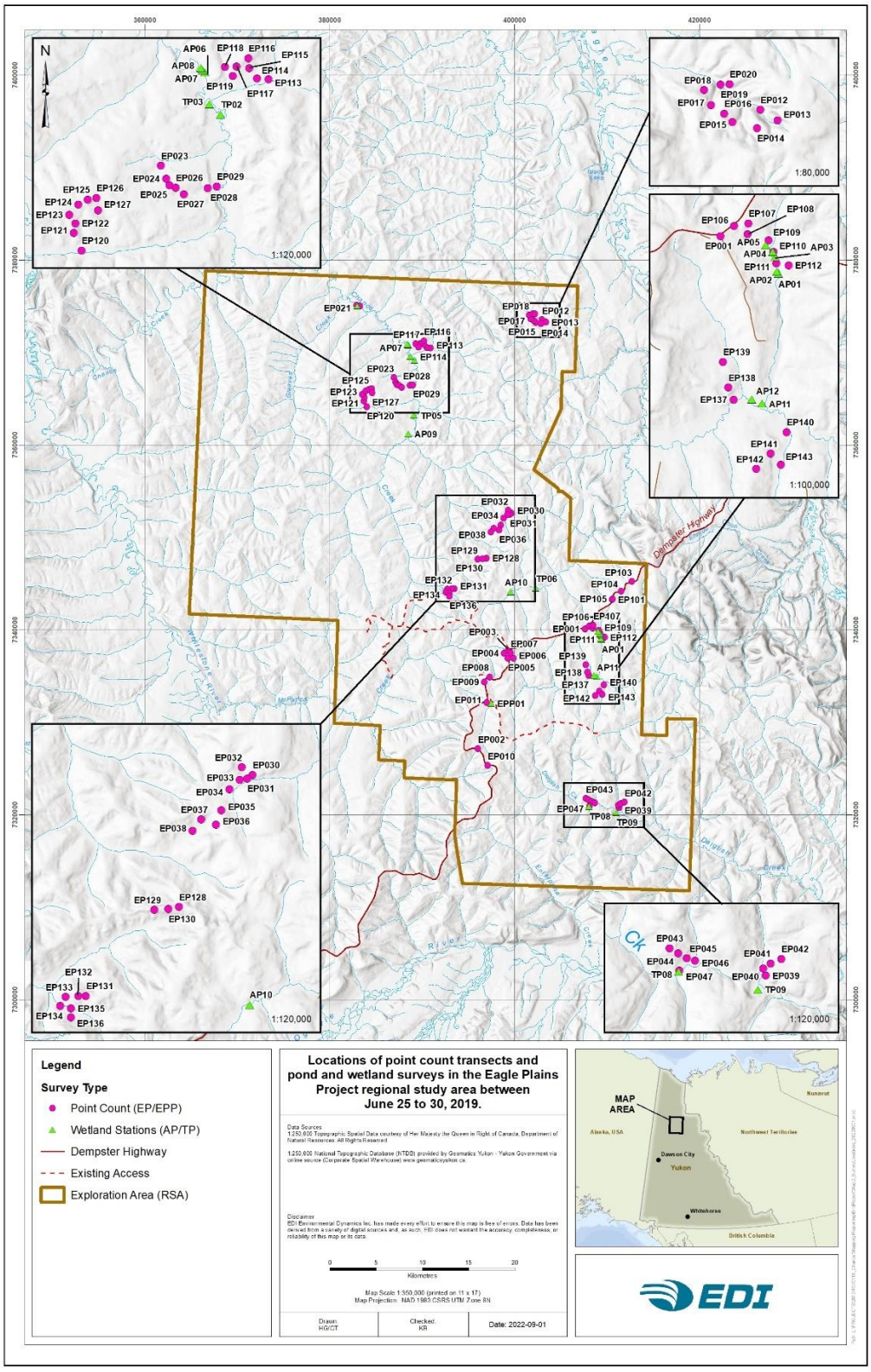
station location for each bird observation (<100 m) used to calculate coordinates for each observation. A total of 91 point count stations were surveyed over six days.

2.3.3.2 Pond and Wetland Surveys

For wetland surveys, protocols were adapted from the BC RISC Standards *Inventory Methods for Waterfowl and Allied Species* (Resources Inventory Committee 1999b). Before surveys, ponds and open water wetlands within 3 km of existing or proposed project development were identified using the PEM map. Shoreline surveys were conducted at 19 unique ponds, and observations were made from stations along the shoreline using binoculars and scopes. The number of stations varied from one to five, depending on the size and shape of the ponds. Approximately half of a pond's total perimeter was traversed along a section of shoreline parallel to the longest axis of the feature to provide complete visual coverage of the waterbody. Surveyors approached waterbodies covertly and began surveys behind screening vegetation to avoid flushing birds from the ponds before they were tallied. Ground-based surveys were thought to provide a census of birds present at each pond. However, a few birds obscured by shoreline vegetation may not have been counted. Biologists recorded the following information for each pond for all detected birds: species, sex, age, number, and habitat associations.

2.3.3.3 Cliff-nesting Raptors Habitat Assessment

Cliff-nesting raptors, including Peregrine Falcon, Gyrfalcon, and Golden Eagle, are relatively common in parts of North Yukon with suitable cliffs, such as the Ogilvie Mountains, south of Eagle Plains. Nesting occurrences of these species are not known in the Eagle Plains area. Due to the subdued topography of the Eagle Plains area, suitable nesting cliffs are likely to be uncommon or non-existent. We systematically assessed the potential for suitable nesting cliffs across the study area by mapping areas with a slope >30 degrees (the lowest gradient in which EDI Environmental Dynamics Inc. (EDI) staff have found cliff nests in other parts of the Yukon). This mapping exercise did not identify any suitable cliffs in the area. Therefore, targeted field surveys for this species group were not conducted.



Map 2-1. Locations of point count transects and pond and wetland surveys in the Eagle Plains Project Regional Study Area between June 25 to 30, 2019.

2.4 RESULTS AND DISCUSSION

2.4.1 DESKTOP ASSESSMENT

Based on range and habitat requirements, 128 species can occur in the Eagle Plains Project RSA. This includes 99 'Likely' species (52 confirmed by surveys and incidental observations presented in this report) and 29 'Possible' species. These 'Possible' species included Common Nighthawk (*Chordeiles minor*) observed once in the RSA during these surveys. Despite the confirmed occurrence, the species is still considered 'Possible' because it is outside its regular range, and none were observed during NABBS between 2014 and 2018 (i.e., the single observation during these surveys could have been an extralimital record). A summary of these potential species and conservation statuses, ordered by species groups, is provided in Table 2-4. A more detailed discussion of the species identified within the Project RSA is provided in Section 2.4.2. For an exhaustive list of all potential bird species, see Attachment Table 2 in Section 2.6.2 (Attachment 2-B).

The NABBS database is a valuable information source for the occurrence and distribution of bird species in the region because they are a recent and systematic survey. Of the two survey routes near the Project area (i.e., routes 78 and 79), route 79 was surveyed annually between 2014 and 2018, and route 78 was surveyed in each of those years except 2016. In total, observers who participated in these surveys identified 1,945 birds from 48 species (Table 2-4). Though these data are useful in identifying species common to the region, road-side surveys introduce bias in estimating species occurrences and relative abundances, especially when extrapolating to off-road areas (Sólymos et al. 2020). This may explain why 'Possible' species (e.g., Harlequin Duck [*Histrionicus histrionicus*], Surfbird [*Calidris virgata*], and Golden-crowned Sparrow [*Zonotrichia atricapilla*]) were recorded on the NABBS routes but not within the RSA, and why 18 species confirmed during surveys within the RSA (e.g., Red-necked Phalarope [*Phalaropus lobatus*], Great Gray Owl [*Strix nebulosa*], and American Three-toed Woodpecker), were not detected over five years of road-side surveys.

Overall, species occurrence and relative abundance patterns differed among years in both NABBS routes. The total number of detections decreased from 2014 to 2018, and this pattern was consistent for most bird species. This may partly correspond to the survey effort. The number of species identified and the number of birds detected were similar between route 78 (920 counts from 34 species) and route 79 (1,025 counts from 39 species) during the five-year period. No species-specific trends were evident in the data.

The NABBS data also included three species (six detections) federally designated as Special Concern: Short-eared Owl (*Asio flammeus*; one occurrence in both 2015 and 2016, and two occurrences in 2018), Rusty Blackbird (*Euphagus carolinus*; one occurrence in 2015), and Olive-sided Flycatcher (*Contopus cooperi*; one occurrence in 2018).

Table 2-4. Total number of potential (likely and possible) bird species in the Eagle Plains Project Regional Study Area, June 2019, grouped by higher-order classification. North American Breeding Bird Survey (2014–2018) confirmed species and counts are provided.

Order	Likely	Possible	Likely + Possible (Total)	NABBS Confirmed (2014–2018)[1]
Grebes – Podicipediformes	2	0	2	0
Loons – Gaviiformes	3	0	3	0
Waterfowl – Anseriformes	17	7	24	6 (24)
Shorebirds – Charadriiformes	12	9	21	3 (13)
Grouse – Galliformes	2	4	6	2 (2)
Diurnal Birds of Prey – Accipitriformes	9	0	9	4 (5)
Falcons – Falconiformes	4	0	4	1 (1)
Owls – Strigiformes	5	0	5	2 (6)
Rails – Gruiformes	1	0	1	0
Kingfishers – Coraciiformes	1	0	1	0
Nightjars – Caprimulgiformes	0	1	1	0
Woodpeckers – Piciformes	2	1	3	0
Songbirds – Passeriformes	41	7	48	30 (1,894)
Jays, Crows and Allies	2	0	2	2 (59)
Blackbirds	1	0	1	1 (1)
Thrushes and Allies	6	1	7	6 (381)
Shrikes and Vireos	1	0	1	0
Flycatchers and Allies	4	0	4	2 (2)
Swallows	3	1	4	0
Sparrows, Finches and Allies	11	3	14	10 (1,204)
Chickadees, Nuthatches and Wrens	2	1	3	0
Warblers	8	1	9	8 (245)
Others	3	0	3	1 (2)
Totals	**99**	**29**	**128**	**48 (1,945)**
SARA Schedule 1	**7**	**1**	**8**	**3**
BCR 4 Priority	**51**	**12**	**63**	**20**

[1] Count of individual bird observations for each group in brackets.

2.4.2 OCCURRENCE AND RELATIVE ABUNDANCE

A total of 974 birds from 52 species were detected during the breeding bird surveys (i.e., point count transects and wetland/pond surveys). One raptor species not included in these counts—Swainson's Hawk—was identified, incidentally, on four separate occasions between June and August 2019, totalling five individuals. These additional observations bring the number of total detections to 979 birds from 53 species.

Songbirds (*Passeriformes*) were the most diverse and abundant group of birds, while falcons (*Falconiformes*), owls (*Strigiformes*), and nightjars (*Caprimulgiformes*) were the least diverse and abundant (Table 2-5). Proportionally, more waterfowl and shorebirds were identified during wetland/pond surveys, and more songbirds and raptors were identified during point count transects. More birds were counted during point count transects (743 versus 231), but a similar number of species were identified during point counts transects and wetland/pond surveys (42 in point counts and 37 in wetlands; Table 2-5).

Table 2-5. Total counts and species of birds observed during point count transects and wetland/pond surveys in the Eagle Plains Project Regional Study Area, June 2019, grouped by higher-order classification.

Order	Point Count Transects		Wetland/Pond Surveys		Combined	
	Count	No. Species	Count	No. Species	Count	No. Species
Waterfowl – Anseriformes	3	2	99	7*	102	7
Shorebirds – Charadriiformes	18	4	38	7*	56	7
Diurnal Birds of Prey – Accipitriformes	2	2	0	0	2	2
Falcons – Falconiformes	1	1	0	0	1	1
Owls – Strigiformes	1	1	1	1*	2	1
Nightjars – Caprimulgiformes	1	1	0	0	1	1
Woodpeckers – Piciformes	3	1	0	0	3	1
Songbirds – Passeriformes	714	30	93	22*	807	32
Jays, Crows and Allies	52	2	6	1*	58	2
Blackbirds	3	1	16	1*	19	1
Thrushes and Allies	155	5	12	3*	167	5
Flycatchers and Allies	16	3	3	2*	19	3
Swallows	0	0	3	1	3	1
Sparrows, Finches and Allies	340	10	33	8*	373	10
Chickadees, Nuthatches and Wrens	9	2	0	0	9	2
Warblers	139	7	16	5*	155	7
Others	0	0	4	1	4	1
Totals	743	42	231	37*	**974**	**52**

* Number of species from wetland/pond surveys were not all unique from those in point count transects.

2.4.3 SPECIES AND HABITAT ASSOCIATIONS

Analyses of the association between bird species and habitat type controlled for survey effort (i.e., average counts per point count station). The average number of birds (i.e., relative abundance) and the average number of species varied considerably among survey stations and the different avian habitat types (Figure 2-1; Table 2-6). The average relative abundance was greatest in Open Water, Deciduous and Mixed Shrub, Riparian/Wetland Deciduous Shrub, and Spruce Forest habitats; it was lowest in Riparian Spruce Forest, Herb, and Tall Shrub – Black Spruce habitats. Among habitat types, the proportion of (average) detections to the (average) number of species was consistent, with a higher relative abundance being associated with a greater number of species. In general, this pattern was related to the structural complexity and productivity of the various habitat types. For example, Herb habitat is less structurally complex and consists exclusively of graminoid ground cover; it had the fewest species (but had a relatively high number of unique species; see Figure 2-2). In contrast, Spruce Forest habitat can be structurally complex due to variations in canopy cover, understory, and ground cover, and older stands may contain a variety of forest structures that provide habitat for a variety of bird species and life requisites including nesting (e.g., Yellow-rumped Warbler), perching (e.g., Olive-sided Flycatcher), and insect foraging (either on the ground [e.g., Gray-cheeked Thrush] or on live/dead trees [e.g., American Three-toed Woodpecker]). Consequently, Spruce Forest had the greatest species richness of all avian habitat types. The exception to the general association between relative abundance and species richness was Open Water habitat, which had the highest relative abundance but one of the lowest average number of species.

The number of species (i.e., species richness) and the number of unique species (i.e., species exclusive to a habitat type) were summarized for each avian habitat type. Unequal survey effort across habitat types could bias such comparisons of species totals across habitat types; however, it does provide a useful approach to examine general patterns of bird occurrence and assemblages within and across habitat types. Spruce Forest, Riparian/Wetland Deciduous Shrub, and Deciduous and Mixed Shrub habitat types had the greatest species richness, while Herb and Open Water habitat types had the least species richness (Figure 2-2). Patterns of species richness may, in part, be due to the distribution of survey stations in each habitat type, especially in Herb habitat (only nine stations). The Open Water habitat also had low species richness despite surveys at 17 survey stations. This may reflect the limited availability of waterbodies and wetlands in the broader region (i.e., relatively few water-associated bird species occur because the habitat is so limited and dispersed).

No clear association was found between species richness and the number of unique species. For example, Open Water was one of the least species-rich habitat types but had the most unique species. This is not surprising because Open Water is a unique habitat compared to the other terrestrial habitats, and a different complement of bird species occurs there. Other habitat types with many species (e.g., 21 species in Deciduous and Mixed Shrub) had no species unique to those habitats. Likely, riparian habitat types did not have unique species because species that occupy riparian habitat often have broad, rather than specific, requirements. For example, Rusty Blackbird and Lesser Yellowlegs were found in Riparian Coniferous Shrub, Riparian/Wetland Deciduous Shrub, and Herb habitat types.

Patterns of bird occurrences were analyzed in terms of species-specific detection rates (Table 2-6). Songbird species had the highest detection rates overall because these species consistently occupied several different habitat types. Only 15 species occupied a single habitat, and the remaining 47 species occupied multiple habitats (most frequently two or three habitats; Figure 2-3). Species that occupied four or more habitat types were exclusively songbirds and had the highest detection rates. This included species groups such as thrushes, sparrows, and their respective allies. Only 10 species occurred in six or more habitats: Canada Jay, American Robin, Gray-cheeked Thrush, Swainson's Thrush, Common Redpoll, Fox Sparrow (*Passerella iliaca*), White-crowned Sparrow (*Zonotrichia leucophrys*), American Tree Sparrow, Lincoln's Sparrow, and Yellow Warbler. Overall, species with high detection rates included a combination of habitat specialists and habitat generalists. Waterfowl and obligatory wetland species (e.g., Red-necked Phalarope), which were restricted to Open Water habitat, had high detection rates in that habitat (Table 2-6).

In contrast, thrushes (e.g., Gray-cheeked Thrush) and warblers (e.g., Yellow Warbler), which occupied several different habitat types, had high detection rates in many of the habitats they occupied (Table 2-6). The five species with the highest overall (average) detection rates (i.e., across all 110 survey stations in the RSA) were Canada Jay, Swainson's Thrush, Lincoln's Sparrow, White-crowned Sparrow and Yellow-rumped Warbler. For a general overview of bird species assemblages within each habitat type, ordered by highest to lowest detection rates, see Table 2-7. General patterns of frequency and use of habitat types by species in the RSA are consistent with expectations and correspond to patterns reported in other studies (Schieck and Song 2006, Mahon et al. 2016).

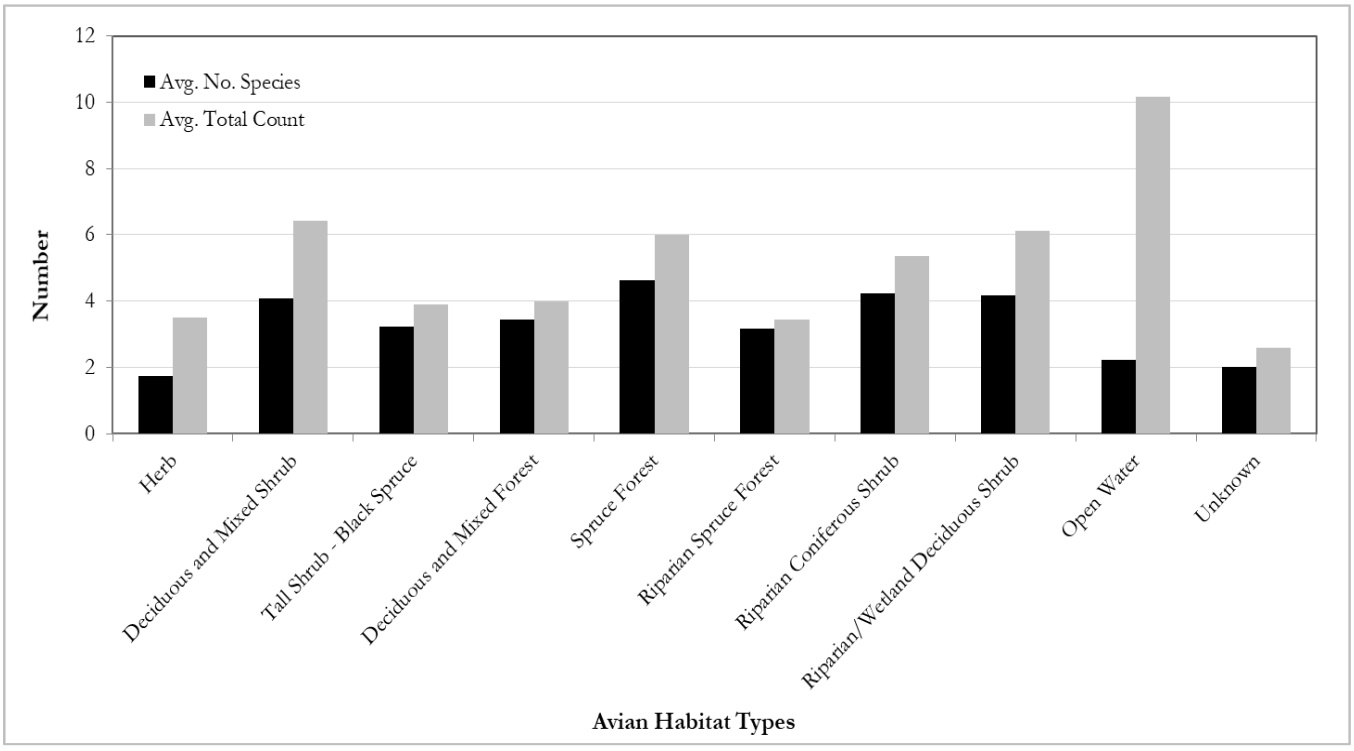


Figure 2-1. The average number of species and average total counts of birds observed among the avian habitat types in the Eagle Plains Project Regional Study Area, June 2019.

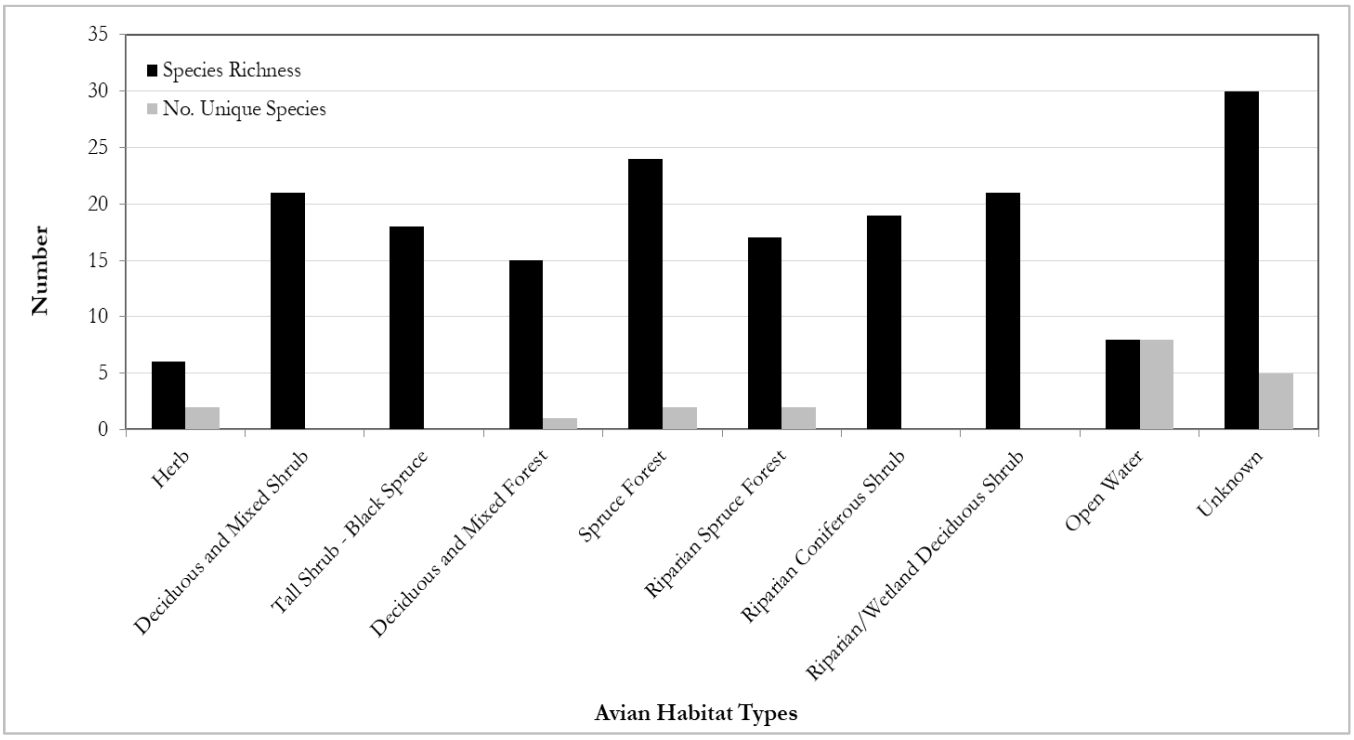


Figure 2-2. Species richness and number of unique birds observed among the avian habitat types in the Eagle Plains Project Regional Study Area, June 2019.

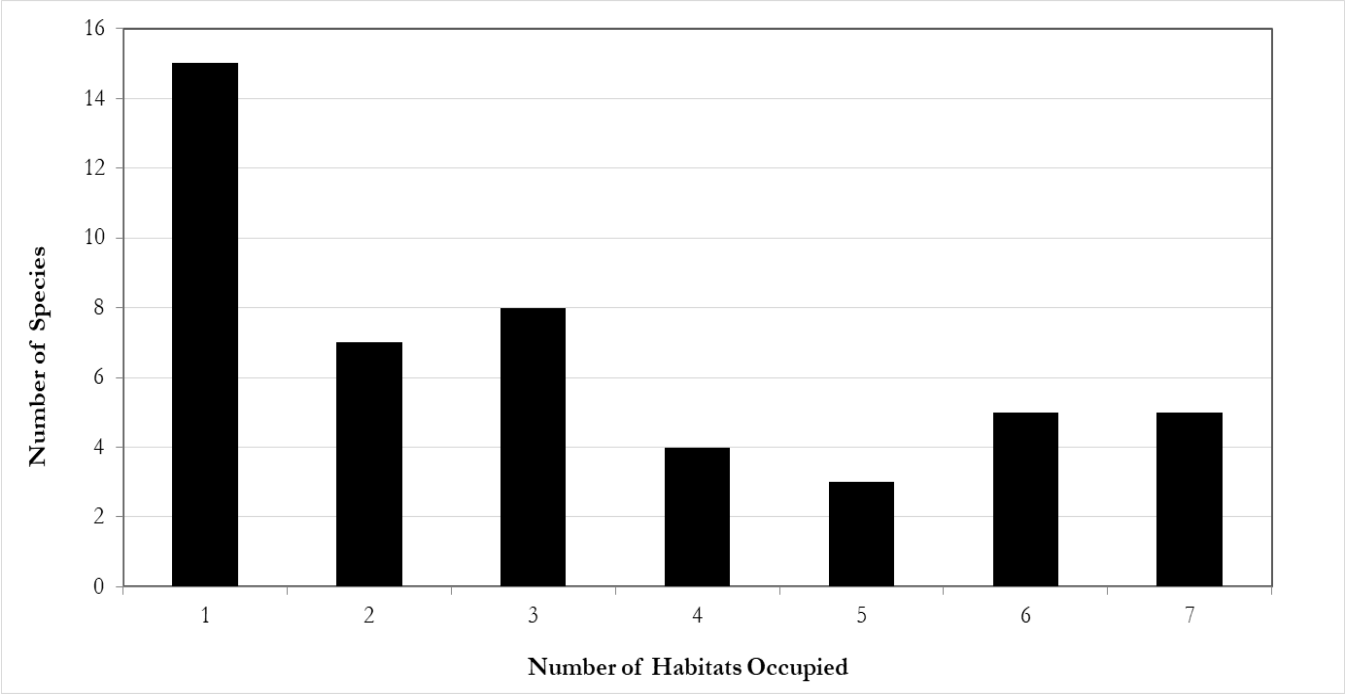


Figure 2-3. Frequency distribution of the number of habitats occupied by bird species in the Eagle Plains Project Regional Study Area, June 2019.

Table 2-6. Average detection rates (birds per survey station) for 52 bird species across 10 avian habitat types in the Eagle Plains Project Regional Study Area, June 2019.[1]

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
Waterfowl													
American Wigeon	*Mareca americana*									1.29		0.20	22
Mallard	*Anas platyrhynchos*									0.29		0.05	5
Northern Shoveler	*Spatula clypeata*									0.65		0.10	11
Northern Pintail	*Anas acuta*									0.47		0.07	8
American Green-winged Teal	*Anas crecca*									2.47		0.38	42
Lesser Scaup	*Aythya affinis*									0.41		0.06	7
Bufflehead	*Bucephala albeola*									0.41		0.06	7
Shorebirds													
Red-necked Phalarope	*Phalaropus lobatus*									0.88		0.14	15
Spotted Sandpiper	*Actitis macularius*	0.22										0.02	2
Solitary Sandpiper	*Tringa solitaria*							0.13	0.13		0.01	0.05	5
Lesser Yellowlegs	*Tringa flavipes*	1.44						0.13	0.09		0.01	0.15	17
Baird's Sandpiper	*Calidris bairdii*										0.03	0.02	2

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
Least Sandpiper	*Calidris minutilla*	0.22										0.02	2
Wilson's Snipe	*Gallinago delicata*	0.22	0.04						0.09		0.11	0.12	13
Diurnal Birds of Prey													
Northern Harrier	*Circus hudsonius*										0.01	0.01	1
Red-tailed Hawk	*Buteo jamaicensis*										0.01	0.01	1
Falcons													
Merlin	*Falco columbarius*				0.08							0.01	1
Owls													
Great Gray Owl	*Strix nebulosa*				0.08	0.07						0.02	2
Nightjars													
Common Nighthawk	*Chordeiles minor*						0.09					0.01	1
Woodpeckers													
American Three-toed Woodpecker	*Picoides dorsalis*					0.14		0.13				0.03	3
Songbirds — Jays, Crows and Allies													
Canada Jay	*Perisoreus canadensis*		0.38	0.57	0.69	0.79	0.18	0.25	0.09		0.01	0.51	56
Common Raven	*Corvus corax*										0.03	0.02	2

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
Songbirds — Blackbirds													
Rusty Blackbird	*Euphagus carolinus*	0.78						0.25	0.39		0.01	0.17	19
Songbirds — Thrushes and Allies													
American Robin	*Turdus migratorius*		0.13	0.20	0.31	0.21		0.50	0.13		0.03	0.24	26
Gray-cheeked Thrush	*Catharus minimus*		0.46	0.43		0.14	0.27	0.25	0.04		0.16	0.42	46
Swainson's Thrush	*Catharus ustulatus*		0.25	0.31	0.85	0.79	0.36	0.13	0.09		0.55	0.79	87
Hermit Thrush	*Catharus guttatus*						0.09					0.01	1
Varied Thrush	*Ixoreus naevius*				0.08	0.14					0.05	0.06	7
Songbirds — Flycatcher and Allies													
Olive-sided Flycatcher	*Contopus cooperi*		0.08			0.07	0.09	0.13			0.01	0.05	6
Yellow-bellied Flycatcher	*Empidonax flaviventris*		0.13	0.03				0.13				0.05	5
Alder Flycatcher	*Empidonax alnorum*		0.17			0.07		0.13	0.09			0.07	8
Songbirds — Swallows													
Tree Swallow	*Tachycineta bicolor*										0.04	0.03	3
Songbirds — Sparrows, Finches and Allies													
Pine Grosbeak	*Pinicola enucleator*			0.03		0.14		0.13			0.01	0.05	5

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
American Tree Sparrow	*Spizelloides arborea*		0.54	0.09	0.08	0.07	0.09	0.13	0.39		0.04	0.29	32
Chipping Sparrow	*Spizella passerina*			0.14		0.14					0.04	0.09	10
Savannah Sparrow	*Passerculus sandwichensis*	0.22	0.25					0.13	0.70		0.01	0.24	26
Fox Sparrow	*Passerella iliaca*		0.38	0.09		0.21	0.09	0.38	0.35		0.08	0.30	33
Lincoln's Sparrow	*Melospiza lincolnii*		0.92	0.17	0.08	0.36	0.18	1.50	1.09		0.03	0.68	75
White-crowned Sparrow	*Zonotrichia leucophrys*		1.08	0.29		0.14	0.09	0.63	0.52		0.24	0.67	74
Dark-eyed Junco	*Junco hyemalis*		0.08	0.37	0.15	0.07			0.09		0.08	0.24	26
White-winged Crossbill	*Loxia leucoptera*			0.23		0.36					0.43	0.41	45
Common Redpoll	*Acanthis flammea*		0.25	0.20	0.08	0.07	0.36		0.26		0.30	0.43	47
Songbirds — Chickadees, Nuthatches and Wrens													
Boreal Chickadee	*Poecile hudsonicus*		0.04	0.06		0.21	0.09					0.06	7
Red-breasted Nuthatch	*Sitta canadensis*				0.08		0.09					0.02	2
Songbirds — Warblers													
Ruby-crowned Kinglet	*Corthylio calendula*			0.11	0.23	0.29	0.18		0.04		0.07	0.17	19
Northern Waterthrush	*Parkesia noveboracensis*		0.21				0.36		0.57		0.01	0.21	23
Orange-crowned Warbler	*Leiothlypis celata*		0.25		0.31			0.13			0.03	0.12	13

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
Yellow Warbler	*Setophaga petechia*		0.17	0.03	0.38	0.14	0.55	0.25	0.57		0.03	0.32	35
Blackpoll Warbler	*Setophaga striata*					0.07						0.01	1
Yellow-rumped Warbler	*Setophaga coronata*		0.25	0.51	0.46	0.79			0.17		0.04	0.44	48
Wilson's Warbler	*Cardellina pusilla*		0.38				0.09		0.26			0.15	16
Songbirds — Others													
Bohemian Waxwing	*Bombycilla garrulus*					0.29						0.04	4
Total Habitat Detections		28	154	135	51	81	36	43	141	117	188	-	**974**

[1] Brackets in column headings indicate the number of survey stations in each avian habitat type. Birds are ordered taxonomically, first by species group then by species. Shaded cells indicate five most abundant species in each habitat (some have up to eight shaded cells due to equivalent detection rates).

Table 2-7. Bird associations for the 10 primary avian habitat types within the Eagle Plains Regional Study Area, June 2019.[1]

Herb (9)[2]	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)
Lesser Yellowlegs - 1.44	White-crowned Sparrow - 1.08	Canada Jay - 0.57	Swainson's Thrush - 0.85	Canada Jay - 0.79
Rusty Blackbird - 0.78	Lincoln's Sparrow - 0.92	Yellow-rumped Warbler - 0.51	Canada Jay - 0.69	Swainson's Thrush - 0.79
Spotted Sandpiper - 0.22	American Tree Sparrow - 0.54	Gray-cheeked Thrush - 0.43	Yellow-rumped Warbler - 0.46	Yellow-rumped Warbler - 0.79
Least Sandpiper - 0.22	Gray-cheeked Thrush - 0.46	Dark-eyed Junco - 0.37	Yellow Warbler - 0.38	Lincoln's Sparrow - 0.36
Wilson's Snipe - 0.22	Canada Jay - 0.38	Swainson's Thrush - 0.31	American Robin - 0.31	White-winged Crossbill - 0.36
Savannah Sparrow - 0.22	Fox Sparrow - 0.38	White-crowned Sparrow - 0.29	Orange-crowned Warbler - 0.31	Bohemian Waxwing - 0.29
	Wilson's Warbler - 0.38	White-winged Crossbill - 0.23	Ruby-crowned Kinglet - 0.23	Ruby-crowned Kinglet - 0.29
	Swainson's Thrush - 0.25	American Robin - 0.20	Dark-eyed Junco - 0.15	American Robin - 0.21
	Orange-crowned Warbler - 0.25	Common Redpoll - 0.20	Merlin - 0.08	Fox Sparrow - 0.21
	Yellow-rumped Warbler - 0.25	Lincoln's Sparrow - 0.17	Great Gray Owl - 0.08	Boreal Chickadee - 0.21
	Savannah Sparrow - 0.25	Chipping Sparrow - 0.14	Varied Thrush - 0.08	American Three-toed Woodpecker - 0.14
	Common Redpoll - 0.25	Ruby-crowned Kinglet - 0.11	American Tree Sparrow - 0.08	Gray-cheeked Thrush - 0.14
	Northern Waterthrush - 0.21	American Tree Sparrow - 0.09	Lincoln's Sparrow - 0.08	Varied Thrush - 0.14
	Alder Flycatcher - 0.17	Fox Sparrow - 0.09	Common Redpoll - 0.08	Pine Grosbeak - 0.14
	Yellow Warbler - 0.17	Boreal Chickadee - 0.06	Red-breasted Nuthatch - 0.08	Chipping Sparrow - 0.14
	American Robin - 0.13	Yellow-bellied Flycatcher - 0.03		White-crowned Sparrow - 0.14
	Yellow-bellied Flycatcher - 0.13	Pine Grosbeak - 0.03		Yellow Warbler - 0.14
	Olive-sided Flycatcher - 0.08	Yellow Warbler - 0.03		Great Gray Owl - 0.07
	Dark-eyed Junco - 0.08			Olive-sided Flycatcher - 0.07
	Wilson's Snipe - 0.04			Alder Flycatcher - 0.07
	Boreal Chickadee - 0.04			American Tree Sparrow - 0.07
				Dark-eyed Junco - 0.07
				Common Redpoll - 0.07
				Blackpoll Warbler - 0.07

Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)
Yellow Warbler - 0.55	Lincoln's Sparrow - 1.50	Lincoln's Sparrow - 1.09	American Green-winged Teal - 2.47
Swainson's Thrush - 0.36	White-crowned Sparrow - 0.63	Savannah Sparrow - 0.70	American Wigeon - 1.29
Common Redpoll - 0.36	American Robin - 0.50	Northern Waterthrush - 0.57	Red-necked Phalarope - 0.88
Northern Waterthrush - 0.36	Fox Sparrow - 0.38	Yellow Warbler - 0.57	Northern Shoveler - 0.65
Gray-cheeked Thrush - 0.27	Canada Jay- 0.25	White-crowned Sparrow - 0.52	Northern Pintail - 0.47
Canada Jay - 0.18	Rusty Blackbird - 0.25	Rusty Blackbird - 0.39	Lesser Scaup - 0.41
Lincoln's Sparrow - 0.18	Gray-cheeked Thrush - 0.25	American Tree Sparrow - 0.39	Bufflehead - 0.41
Ruby-crowned Kinglet - 0.18	Yellow Warbler - 0.25	Fox Sparrow - 0.35	Mallard - 0.29
Common Nighthawk - 0.09	Solitary Sandpiper - 0.13	Common Redpoll - 0.26	
Hermit Thrush - 0.09	Lesser Yellowlegs - 0.13	Wilson's Warbler - 0.26	
Olive-sided Flycatcher - 0.09	American Three-toed Woodpecker - 0.13	Yellow-rumped Warbler - 0.17	
American Tree Sparrow - 0.09	Swainson's Thrush - 0.13	Solitary Sandpiper - 0.13	
Fox Sparrow - 0.09	Olive-sided Flycatcher - 0.13	American Robin - 0.13	
White-crowned Sparrow - 0.09	Yellow-bellied Flycatcher - 0.13	Lesser Yellowlegs - 0.09	
Boreal Chickadee - 0.09	Alder Flycatcher - 0.13	Wilson's Snipe - 0.09	
Red-breasted Nuthatch - 0.09	Pine Grosbeak - 0.13	Canada Jay - 0.09	
Wilson's Warbler - 0.09	American Tree Sparrow - 0.13	Swainson's Thrush - 0.09	
	Savannah Sparrow - 0.13	Alder Flycatcher - 0.09	
	Orange-crowned Warbler - 0.13	Dark-eyed Junco - 0.09	
		Gray-cheeked Thrush - 0.04	
		Ruby-crowned Kinglet - 0.04	

[1] Birds listed in descending order of average detection rate (values after the bird names) in each avian habitat type.

[2] Values in the column headings indicate the number of samples per habitat type.

2.4.4 SPECIES OF CONSERVATION CONCERN

Four species observed in the Project RSA (Red-necked Phalarope, Common Nighthawk, Olive-sided Flycatcher, and Rusty Blackbird) were federally listed as either Special Concern or Threatened (Table 2-8). These species are either of regional, national, or continental concern, and two are designated with regional stewardship in BCR 4. The conservation statuses of all potential bird species in the Project area are listed in Attachment Table 2 in Section 2.6.2 (Attachment 2-B). Of those species, three additional species of Conservation Concern are likely to occur in the Project RSA, including Horned Grebe (*Podiceps auritus)*, Short-eared Owl, and Bank Swallow (Table 2-8). Two cliff-nesting raptors listed as 'specially protected' species under the Yukon *Wildlife Act*, Peregrine Falcon and Gyrfalcon, can occur in the broader region but are unlikely to occur in the Project RSA because of a lack of appropriate cliffs. Another 'specially protected' species, Trumpeter Swan (*Cygnus buccinator*; not listed below), is exclusive to southern Yukon and Alaska during the breeding season and, thus, is unlikely to occur in the Project RSA.

Table 2-8. The conservation status and counts of bird species in the Eagle Plains Project RSA.

Species Common Name	COSEWIC[4]	SARA[5]	BCR 4 Priority[6]	Yukon *Wildlife Act*	RSA Count	NABBS Count (2014–2018)
Horned Grebe[1]	SC (Apr 2009)	1 – SC	R – stewardship N/C – concern	No	0	0
Red-necked Phalarope	SC (Nov 2014)	1 – SC	N/C – concern	No	15	0
Peregrine Falcon[2]	NAR (Nov 2017)	–	R – stewardship N/C – concern	Yes	0	0
Gyrfalcon[2]	NAR (Apr 1987)	–	–	Yes	0	0
Short-eared Owl[1]	T (May 2021)	1 – SC	N/C – concern	No	0	4
Common Nighthawk[3]	SC (Apr 2018)	1 – T	N/C – concern	No	1	0
Olive-sided Flycatcher	SC (Apr 2018)	1 – T	R – stewardship R/N/C – concern	No	6	1
Bank Swallow[1]	T (May 2013)	1 – T	–	No	0	0
Rusty Blackbird	SC (Apr 2017)	1 – SC	R – stewardship R/N/C – concern	No	19	1
			Totals		**41**	**6**

[1] Species that are 'Likely' to occur in the Eagle Plains Project RSA.

[2] Cliff-nesting raptors that are 'Likely' to occur in the broader region, but do not have suitable habitat in the Eagle Plains Project RSA.

[3] A species that is 'Possible' in the Eagle Plains Project RSA because of its range limits. One occurrence was observed but status remains uncertain.

[4] Most recent COSEWIC assessments; E = Endangered, NAR = Not at Risk, SC = Special Concern, T = Threatened.

[5] SARA statuses from the latest amended list in May 2023 (Legislative Services Branch 2023); Schedule 1 codes equivalent to COSEWIC.

[6] Priorities, concerns, and stewardships from BCR 4 2013 report; C = Continental, N = National, R = Regional.

2.4.5 ADEQUACY OF ONE YEAR OF SURVEYS

The official guidance provided by the Canadian Wildlife Service for avian baseline studies usually is to conduct at least two years of field surveys (Hanson et al. 2009), and the DRAFT 2022 guidelines emphasize a statistical review of the power to detect changes (ECCC-CWS 2022). Repeat surveys account for annual variation in patterns of bird occurrences and distribution and imperfect detectability associated with bird survey methods. During our initial consultation with CWS we proposed conducting a single year of surveys, dependent on the outcome of the surveys. CWS indicated that they always prefer to see multiple years of data collected. However, they may not raise objections to the Project Proposal if significant avian conservation concerns or information uncertainties do not occur. In our opinion, the one year of multi-species field surveys that we conducted, in combination with the desktop assessment, provides sufficient baseline information about bird species to proceed with the Project Proposal.

2.5 SUMMARY

The purpose of this study was to document the potential occurrence, relative abundance, and habitat associations of birds across the Project's RSA. This study consisted of a combination of a desktop assessment and field surveys. The information presented in this report was collected by Professional Biologists and qualified environmental practitioners, following generally accepted scientific survey designs and methods. The field survey design used a targeted, stratified habitat design to provide a representative sample across the RSA.

Based on range and habitat, 128 species potentially occur in or adjacent to the RSA. Forty-eight (48) were recorded from the North American Breeding Bird Survey data in adjacent areas. Possible species include eight listed under the SARA or identified in the Yukon *Wildlife Act*, and 67 are considered a priority and management concern under the federal Bird Conservation Region 4 Plan. Birds listed under the SARA observed during surveys included Red-necked Phalarope, Common Nighthawk, Olive-sided Flycatcher, and Rusty Blackbird.

Field surveys observed 53 species in the RSA. Point counts identified 42 species, and wetland surveys identified 37 species. Swainson's Hawk was identified via incidental sightings and is an interesting species. It has a disjunct breeding range in North Yukon separated by several hundred kilometres from their primary range to the south. Patterns of species relative abundance and richness (number of species) varied among the different habitat types. Average relative abundance and species richness were the greatest in Spruce Forest, Deciduous and Mixed Shrub, Riparian/Wetland Deciduous Shrub habitats, and lowest in Herb and Tall Shrub – Black Spruce habitats. These patterns were generally related to the structural complexity and productivity of these different habitat types. However, the number of unique species in each habitat did not depend on structural complexity. Many unique species were found in the Herb and Open Water habitats. General patterns of bird occurrence and habitat associations in the RSA are consistent with expectations and correspond with the limited existing information about birds in the area.

2.6 BIRD SECTION ATTACHMENTS

2.6.1 ATTACHMENT 2–A — ECOLOGICAL AND LANDSCAPE CLASSIFICATION ECOSYSTEM UNITS

Ecological and Landscape Classification (ELC) Ecosystem Units (Ecosites)

Codes, names, and descriptions of ecosites assigned *a posteriori* to habitat groups in the Project RSA are listed below.

Attachment Table 1. Ecological Landscape Classification ecosystem units developed for the Eagle Plains Project Regional Study Area.

Code	Name	Description and typical situation
10	Sparsely Vegetated	Vegetative cover <10%.
11	Dry Herb	Area dominated with herbaceous vegetation with very low shrub cover (<5%).
12	Dry Lichen	*Cladonia* sp. (i.e., caribou forage species) dominated areas with very low shrub cover (<5%) typically on south facing slopes.
13	Dry Mix Shrub	Dry shrub dominated areas with very low *Cladonia* sp. (i.e., caribou forage species) cover (<10%); disclimax community.
14	Dry Shrub/ Spruce – Lichen	Dry areas with spruce cover >5% and *Cladonia* sp. (i.e., caribou forage species) cover >10%.
15	Dry Shrub/ Aspen – Lichen	Dry areas with aspen cover >5% and *Cladonia* sp. (i.e., caribou forage species) cover >10%.
16	Dry Spruce – Birch – Lichen	Dry areas with either white spruce, black spruce, and/or Alaskan paper birch cover; spruce, scrub birch, and *Cladonia* sp. (i.e., caribou forage species) cover >10%.
17	Dry Aspen	Dry areas with aspen dominant canopy and very low *Cladonia* (i.e., caribou forage species) cover (<5%).
01	Mesic Herb	Area dominated by herbaceous vegetation with very low shrub cover (<5%); neither disclimax nor successional pathway known. No distinct mottles or seepage present; some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
02	Mesic Birch – Willow	Area has a history of anthropogenic disturbance; regeneration is dominated by either Alaskan paper birch and/or willow species. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
03	Mesic White Spruce – Alaskan Paper Birch – Alder	Area dominated by Alaskan paper birch with mixed-wood understory (i.e., white spruce and alder). Usually found along upper slope to crest positions on gentle to moderate slopes. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
04	Mesic Black Spruce – Alaskan Paper Birch	Area dominated by black spruce and Alaskan paper birch with >30% shrub cover; mid-slope position. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
05	Mesic Alaskan Paper Birch	Area dominated by Alaskan paper birch stands with > 30% shrub cover; mid- to upper-slope position. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
06	Mesic Black Spruce – Labrador Tea	Area dominated by black spruce with Labrador tea shrub layer; level or mid- to upper-slope position on gentle slopes. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).

Code	Name	Description and typical situation
20	Shrubby Riparian Birch – Willow	Shrubby riparian area dominated by scrub birch, tea-leaved willow, or diamond leaved willow and bog cranberry; disclimax community.
21	Riparian White Spruce – Prickly Rose	Treed riparian zone dominated by white spruce with a mixture of shrub species; rose usually present.
22	Riparian Spruce – Birch – Willow	Treed riparian zone dominated by white and black spruce, possibly some Alaskan paper birch, and a mixture of shrub species such as scrub birch and willow.
30	Moist Herb	Area dominated with herbaceous vegetation with very low shrub cover (<5%) on gentle to moderate slopes. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths; some ice crystals can be observed in frozen layer.
31	Moist Shrub/ Scrub Birch – Labrador Tea – Willow	Area dominated by scrub birch and Labrador tea with <10% spruce cover; shrub layer has tea-leaved willow. Typically found at level or mid- to upper-slope position on gentle slopes. Successional pathway unknown but considered a shrub disclimax site. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present; some ice crystals can be observed in frozen layer.
32	Moist Shrub/ Spruce – Scrub Birch – Labrador Tea	Area dominated by >10% spruce cover, <5% willow cover, and >15% lowbush cranberry. Typically found at mid to upper slope position on gentle slopes; disclimax community. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths; some ice crystals can be observed in frozen layer.
33	Moist Spruce – Labrador Tea	Area dominated by >15% spruce tree cover. Presence of *Cladonia* sp. (i.e., caribou forage species). Typically found at level or upper-slope position on gentle slopes. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths due to frost boils; some ice crystals can be observed in frozen layer.
34	Moist Spruce – Alder – Labrador Tea	Area dominated by >15% spruce tree cover; alder and *Cladonia* sp. (i.e., caribou forage species) present. Typically found at mid-slope position on gentle slopes. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths due to frost boils; some ice crystals can be observed in frozen layer.
35	Moist Spruce – Scrub Birch – Labrador Tea	Area dominated by <15% spruce tree cover with *Cladonia* sp. (i.e., caribou forage species) present. Typically found at level or gentle slopes. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths due to frost boils; some ice crystals can be observed in frozen layer.
36	Moist Birch – Willow	Area dominated by willow and birch trees, often associated with old anthropogenic disturbances; successional pathway unknown. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths due to frost boils; some ice crystals can be observed in frozen layer.
40	Wet Herb	Area dominated with herbaceous vegetation with very low shrub cover (<5%) on level to lower-slope positions. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
41	Wet Shrub – Tamarack	Area with >5% tamarack; low presence of *Cladonia* sp. (i.e., caribou forage species) and high presence of *Sphagnum* sp. or glow moss. Scrub birch and Labrador tea present. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
42	Wet Shrub – Black Spruce – Tussock Cottongrass	Area dominated by >5% black spruce and >10% tussock cottongrass. Labrador tea, scrub birch, *Sphagnum* sp. and *Cladonia* sp. (i.e., caribou forage species) present. Typically found on level ground but also from toe to mid-slope positions; disclimax community. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.

Code	Name	Description and typical situation
43	Wet Shrub – Black Spruce – Sphagnum	Area dominated by >5% black spruce, <10% tussock cottongrass, and >25% *Sphagnum* sp.; disclimax community. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
44	Wet Shrub – Scrub Birch – Tussock Cottongrass	Area dominated by <5% black spruce, >10% scrub birch, and >30% tussock cottongrass; disclimax community. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
45	Wet Shrub – Scrub Birch – Graminoid	Burned area composed of <5% black spruce; dominant shrub is scrub birch, while dominant graminoid is either spruce muskeg sedge or bluejoint reedgrass; disclimax community. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
46	Wet Black Spruce – Labrador Tea – Cladonia	Area with >15% black spruce, >20% *Cladonia* sp. (i.e., caribou forage species), and <5% tussock cottongrass. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
47	Wet Black Spruce – Tussock Cottongrass – Sphagnum	Area with >15% Labrador tea and <10% *Cladonia* sp. (i.e., caribou forage species). Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
48	Wet Black Spruce – Carex	Area dominated by either a spruce muskeg sedge or bluejoint reedgrass herbaceous layer; shrub layer is a mixture of Labrador tea, scrub birch, and willow species with >30% cover. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
B1	Bog – Black Spruce – Lichen	Treed or shrubby peatland ecosystem unit with poor nutrient regime within the rooting zone. Stunted black spruce with <50% *Sphagnum* sp. and >10% *Cladonia* sp. (i.e., caribou forage species) ground cover.
B2	Bog – Black Spruce – Sphagnum	Treed or shrubby peatland ecosystem unit with poor nutrient regime within the rooting zone. Stunted black spruce with >50% *Sphagnum* sp. ground cover.
F	Fen	Treed, shrubby, or graminoid peatland ecosystem unit where groundwater inflow maintains relatively high mineral content within the rooting zone. Graminoid fen has >20% *Sphagnum* sp. or moss cover.
M	Marsh	Shallowly flooded mineral wetland ecosystem dominated by emergent vegetation. Area dominated by graminoids and has less than 10% Sphagnum or moss cover.
S	Swamp	Treed or shrubby mineral wetland ecosystem unit with a flowing or fluctuating, semi-permanent, near-surface water table.
W	Shallow Water	Shallow water ecological communities dominated by rooted, water submerged, and floating aquatic plants.
AN	Anthropogenic	An area of anthropogenic disturbance not included in other definitions (e.g., areas cleared for camps).
ES	Exposed Soil	Any area of exposed soil not included in other definitions. Includes areas of recent disturbance (e.g., terrain slides) and human-made disturbances where vegetation cover is <5%.
Fa	Flood Active Channel	Ecological communities scoured by river floodwaters for prolonged periods. Usually dominated by annuals or herbs that can re-sprout from underground structures.
LA	Lake	A body of water >2 m deep or large enough to be classified as a lake (>8 ha).
PD	Pond	A small body of water greater than 2 m deep, but not large enough to be classified as a lake (<8 ha).

Code	Name	Description and typical situation
Rc	Rock Cliff	Ecological communities of vertical rocky sites commonly with some bryophyte cover (rock crusts); small pockets of soils may support vascular vegetation. Also used to map non-vegetated cliffs.
RI	River	A watercourse formed when water flows between continuous, definable banks. The flow may be intermittent or perennial.
Ro	Rock Outcrop	Bluffs and knobs of solid rock with limited soil development and high cover of exposed rock; drought tolerant cryptogams often prominent.
Rt	Rock Talus	Active and inactive talus (i.e., large rocks) and scree (i.e., smaller rocks and more soil); small pockets of soils may support some vascular plants.
RZ	Road	An area cleared and compacted for the purpose of transporting goods and services by vehicle.

2.6.2 ATTACHMENT 2–B — LIST OF ALL POTENTIAL BIRD SPECIES AND THEIR CONSERVATION STATUSES

All bird species with the potential to occur in the Project area:

Names, federal conservation statuses (SARA, COSEWIC), BCR 4 priority, territorial status (i.e., species highlighted by Environment Yukon and those considered of conservation concern in the Yukon Conservation Data Centre track list), and indication of occurrence in the Project RSA for all 128 bird species, are listed below:

Attachment Table 2. List of species with the potential to occur in the Eagle Plains Project Regional Study Area.

Species Common Name[1]	Documented in RSA[2]	COSEWIC[3]	SARA[4]	Environment Yukon (YCDC Track List)[5]	BCR 4 Priority Species[6]
Horned Grebe [L]		SC (Apr 2009)	1 – SC	*	R – stewardship N/C – concern
Red-necked Grebe [L]					R – stewardship
Red-throated Loon [L]					
Pacific Loon [L]					R – stewardship N/C – concern
Common Loon [L]					C – stewardship N/C – concern
American Wigeon [L]	✓				R – stewardship R/N/C – concern
Mallard [L]	✓				R – stewardship N/C – concern
Blue-winged Teal [P]					N/C – concern
Northern Shoveler [L]	✓				R – stewardship
Northern Pintail [L]	✓				R – stewardship N/C – concern
Green-winged Teal [L]	✓				R – stewardship
Canvasback [L]					R – stewardship N/C – concern
Ring-necked Duck [P]					
Greater Scaup [L]					
Lesser Scaup [L]	✓				R – stewardship R/N/C – concern
Harlequin Duck [P]				✓	R – stewardship
Surf Scoter [L]					R – stewardship N/C – concern
White-winged Scoter [L]					R – stewardship N/C – concern
Long-tailed Duck [L]					N/C – concern
Bufflehead [L]	✓				R – stewardship
Common Goldeneye [L]					N/C – concern
Barrow's Goldeneye [L]					R – stewardship

Species Common Name[1]	Documented in RSA[2]	COSEWIC[3]	SARA[4]	Environment Yukon (YCDC Track List)[5]	BCR 4 Priority Species[6]
Red-breasted Merganser [L]					
Greater White-fronted Goose [L]					C – stewardship
Snow Goose [P]				✓	
Brant [P]				✓	
Cackling Goose [P]					
Canada Goose [L]					
Tundra Swan [P]				✓	R – stewardship
Ruffed Grouse [P]					
Spruce Grouse [L]					
Sharp-tailed Grouse [P]				✓	
Willow Ptarmigan [L]					
Rock Ptarmigan [P]					
White-tailed Ptarmigan [P]					R – stewardship
Bald Eagle [L]					
Golden Eagle [L]					R – stewardship
Osprey [L]				✓	
Northern Harrier [L]	✓				
Sharp-shinned Hawk [L]					
Northern Goshawk [L]					R – stewardship
Swainson's Hawk [L]	✓			✓	N/C – concern
Red-tailed Hawk [L]	✓				
Rough-legged Hawk [L]					
Gyrfalcon [L]					
Peregrine Falcon [L]		NAR (Nov 2017)		✓*	R – stewardship N/C – concern
American Kestrel [L]				✓	R – stewardship
Merlin [L]	✓				
Great Horned Owl [L]					
Northern Hawk Owl [L]					R – stewardship
Great Gray Owl [L]	✓				R – stewardship
Short-eared Owl [L]		T (May 2021)	1 – SC	✓*	N/C – concern
Boreal Owl [L]					R – stewardship
American Golden-Plover [P]					N/C – concern
Semipalmated Plover [L]					N/C – concern
Wandering Tattler [P]				✓	R – stewardship
Whimbrel [P]				✓	N/C – concern
Surfbird [P]				✓	R – stewardship N/C – concern
Long-billed Dowitcher [P]					
Red-necked Phalarope [L]	✓	SC (Nov 2014)	1 – SC	*	N/C – concern

Species Common Name[1]	Documented in RSA[2]	COSEWIC[3]	SARA[4]	Environment Yukon (YCDC Track List)[5]	BCR 4 Priority Species[6]
Spotted Sandpiper [L]	✓				R – stewardship
Solitary Sandpiper [L]	✓				R – stewardship N/C – concern
Lesser Yellowlegs [L]	✓				R – stewardship R/N/C – concern
Upland Sandpiper [L]					N/C – concern
Baird's Sandpiper [L]	✓				
Least Sandpiper [L]	✓				
Pectoral Sandpiper [P]					
Semipalmated Sandpiper [P]					
Wilson's Snipe [L]	✓				N/C – concern
Long-tailed Jaeger [P]					
Bonaparte's Gull [P]					R/C – stewardship N/C – concern
Short-billed Gull [L]					R – stewardship
Herring Gull [L]					N/C – concern
Arctic Tern [L]					N/C – concern
Sandhill Crane [L]				✓	
Belted Kingfisher [L]					
Common Nighthawk [P]	✓	SC (Apr 2018)	1 – T	✓*	N/C – concern
Hairy Woodpecker [P]					
American Three-toed Woodpecker [L]	✓				R – stewardship
Northern Flicker [L]					
Olive-sided Flycatcher [L]	✓	SC (Apr 2018)	1 – T	*	R – stewardship R/N/C – concern
Yellow-bellied Flycatcher [L]	✓				
Alder Flycatcher [L]	✓				C – stewardship
Say's Phoebe [L]					
Northern Shrike [L]					R – stewardship
Canada Jay [L]	✓				C – stewardship
Common Raven [L]	✓				
Horned Lark [L]					
Tree Swallow [L]	✓				
Violet-green Swallow [L]					
Bank Swallow [L]		T (May 2013)	1 – T	✓*	
Cliff Swallow [P]					
Boreal Chickadee [L]	✓				R/C – stewardship
Gray-headed Chickadee [P]				✓	R – stewardship
Red-breasted Nuthatch [L]	✓				
American Dipper [P]					

Species Common Name[1]	Documented in RSA[2]	COSEWIC[3]	SARA[4]	Environment Yukon (YCDC Track List)[5]	BCR 4 Priority Species[6]
Ruby-crowned Kinglet [L]	✓				
Northern Waterthrush [L]	✓				
Orange-crowned Warbler [L]	✓				
Yellow Warbler [L]	✓				
Blackpoll Warbler [L]	✓				R – stewardship
Palm Warbler [P]					
Yellow-rumped Warbler [L]	✓				
Townsend's Warbler [L]					R – stewardship
Wilson's Warbler [L]	✓				R – stewardship
American Robin [L]	✓				
Townsend's Solitaire [L]					
Gray-cheeked Thrush [L]	✓				
Swainson's Thrush [L]	✓				
Hermit Thrush [L]	✓				
Varied Thrush [L]	✓				R – stewardship
American Pipit [L]					
Bohemian Waxwing [L]	✓				R/C – stewardship
Lapland Longspur [L]					
Snow Bunting [P]					
Pine Grosbeak [L]	✓				R/C – stewardship
American Tree Sparrow [L]	✓				
Chipping Sparrow [L]	✓				
Savannah Sparrow [L]	✓				
Fox Sparrow [L]	✓				
Lincoln's Sparrow [L]	✓				
Harris's Sparrow [P]		SC (Apr 2017)			
White-crowned Sparrow [L]	✓				R – stewardship
Golden-crowned Sparrow [P]					R – stewardship
Dark-eyed Junco [L]	✓				
Rusty Blackbird [L]	✓	SC (Apr 2017)	1 – SC	✓*	R – stewardship R/N/C – concern
White-winged Crossbill [L]	✓				C – stewardship
Common Redpoll [L]	✓				

[1] Species identified as either 'Likely' (L) or 'Possible' (P) in the Project RSA.

[2] (✓) species observed during surveys or as incidental observations.

[3] Most recent COSEWIC assessments; E = Endangered, NAR = Not at Risk, SC = Special Concern, T = Threatened.

[4] SARA statuses from 2023; Schedule 1 codes equivalent to COSEWIC.

[5] (✓) Yukon Conservation Data Centre 2019 track list species; (*) species at risk highlighted by Environment Yukon

[6] Priorities, concerns, and stewardships from BCR 4 2013 report; C = Continental, N = National, R = Regional.

3 MARTEN

3.1 PURPOSE AND OBJECTIVES

American marten (*Martes americana*; hereafter marten) were selected as a Valued Component (VC) for the Project due to their value as a furbearer, as well as their relevance as an indicator species for mature and old forest values (Buskirk and Ruggiero 1994, Suffice et al. 2017). The VGFN have a community trapline within the RSA and value marten as a furbearer for its economic value, social values associated with trapping, and environmental values as a component of the regional wildlife community.

This section provides a summary of marten ecology in the subarctic taiga. That information is used to develop a habitat model to quantify the quality, amount, and distribution of potential marten habitat across the RSA. A Habitat Suitability Index (HSI) model was developed using relevant environmental data in a GIS to quantify the amount of marten habitat into relative quality categories (i.e., High, Moderate, Low, and Nil/Very Low).

3.2 TRAPPING

According to trapping records, marten were the most heavily trapped species in the two group trapping concessions that overlap the RSA between 2012 and 2018 (Figure 3-1,). Between 2012 and 2018, 715 marten were reported from the two concessions (i.e., 401, 402) overlapping the RSA. The number of marten reported varied widely among the trapping seasons: the greatest harvest was 240 marten reported in 2015 compared to the lowest harvest of 0 marten the following year. Unfortunately, trapping records from 2019 onwards were unavailable for those concessions.

Trapping mortality in marten is biased towards males and juveniles, and harvests that include a high proportion of adult females indicate potential overharvesting (Strickland and Douglas 1987, Hodgman et al. 1994, Fortin and Cantin 2005). Exhaustive trapping removes resident adult marten from the population and allows juveniles to establish home ranges in vacant areas, thus lowering the overall age of the population. Juveniles have lower reproductive output relative to adults; therefore, this change in age structure can lower population fecundity and growth rates (Archibald and Jessup 1984, Fortin and Cantin 2005). Without knowledge of the age and sex structure of harvested marten, it is not possible to assess the sustainability of trapping in the RSA.

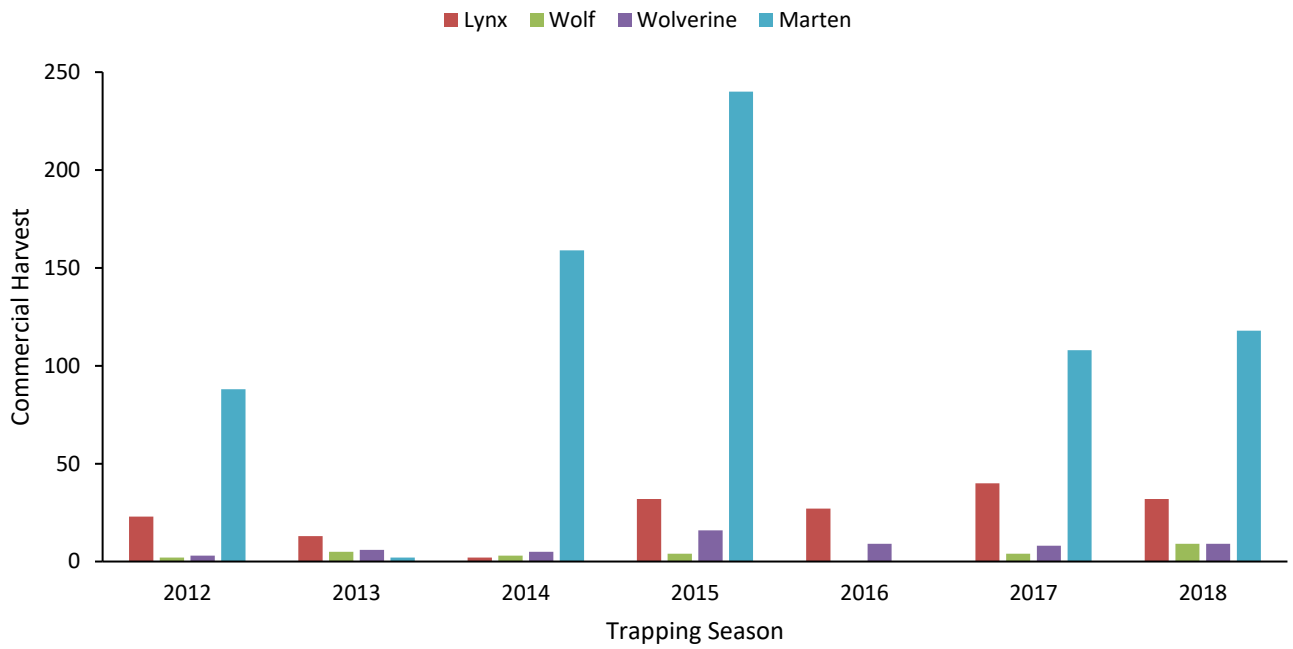
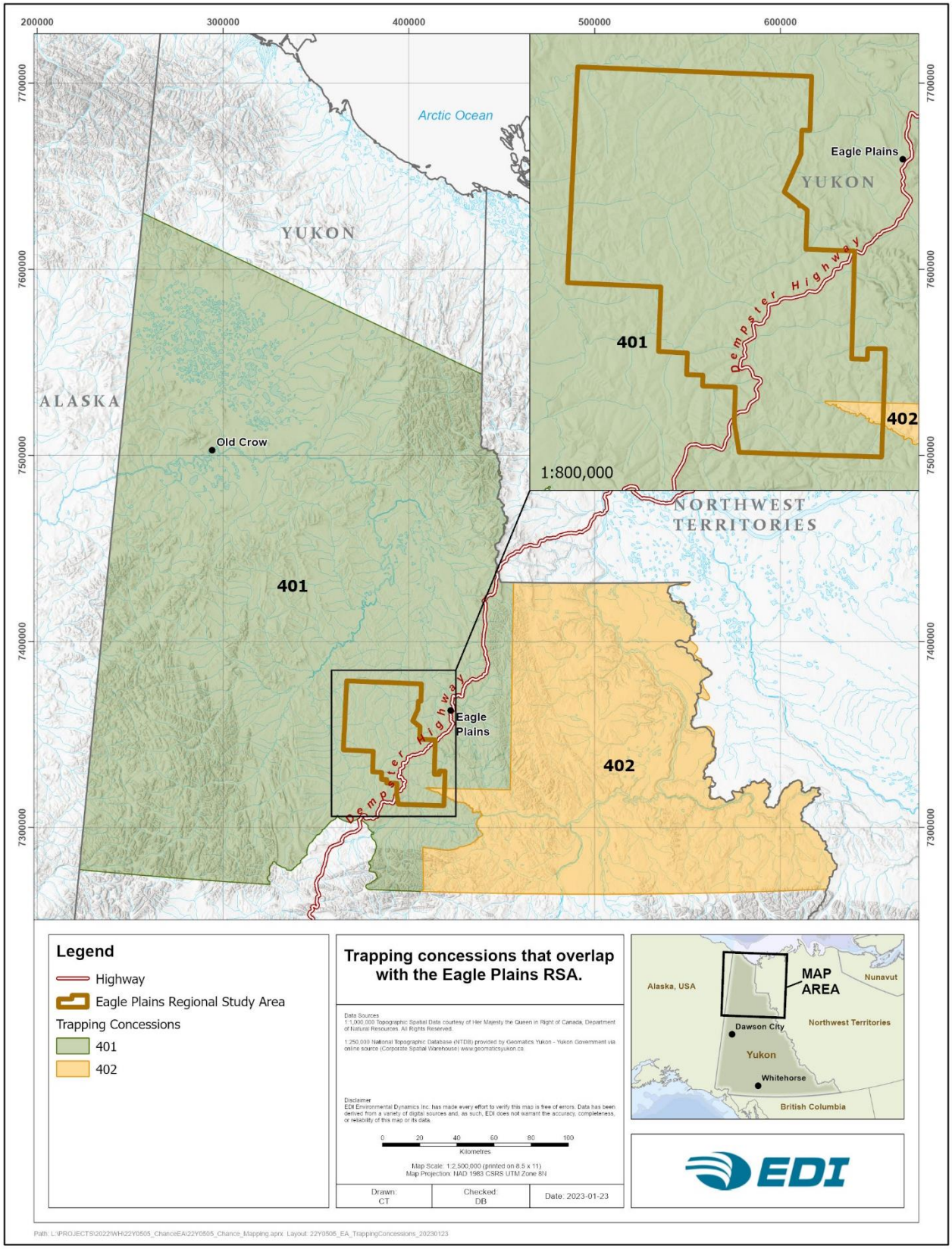


Figure 3-1. Commercial harvest returns for group trapping concessions overlapping the RSA for which records were available.



Map 3-1. Trapping concessions that overlap with the Eagle Plains RSA.

3.3 GENERAL HABITAT ECOLOGY OF MARTEN

The RSA occurs in the boreal taiga, at the northern limit of marten range (Buskirk and Ruggiero 1994, Yukon Ecoregions Working Group 2004a). While marten occur over a contiguous range across northern North America from Labrador to Alaska (Snyder and Bissonette 1987, Buskirk and Ruggiero 1994, Drew 1995, Paragi et al. 1996), little is known about their basic ecology in northern boreal forest and taiga ecosystems (Latour et al. 1994). In more productive forests to the south, marten are often associated with mature forest structures, such as large trees, snags, and coarse woody debris (CWD; Buskirk and Ruggiero 1994, Thompson et al. 2012). However, there is some evidence that in northern boreal forests, marten exploit structural stages with short, stunted trees that are sparsely distributed (Latour et al. 1994, Paragi et al. 1996). Marten in the Alaskan taiga selected habitat types with the greatest amount of CWD and the greatest abundance of vole, rather than canopy cover (Paragi et al. 1996). Across the Yukon forest-to-tundra ecotone, marten preferred open taiga areas rather than boreal forest, and were positively associated with small mammal (i.e., taiga vole [*Microtus xanthognatus*], and red-backed vole [*Myodes* spp.]) biomass (Pretzlaw 2006). Therefore, occurrence and habitat selection patterns for marten in northern boreal and taiga ecosystems can differ from those described elsewhere in North America (Pretzlaw 2006).

During 2015 and 2016, EDI performed snow tracking surveys to quantify the presence and distribution of furbearers and ungulates south of Dawson, Yukon (EDI Environmental Dynamics Inc. 2017). Snow tracking transects covered various habitat types, including 49% shrub, 13% coniferous, 10% herbs, 8% exposed land, 7% frozen rivers, and 13% other classes (i.e., broadleaf, mixedwood, rock/rubble, wetland). Marten tracks occurred in shrubland 51% of the time, coniferous forest 15% of the time, and herb sites 10% of the time. These results indicate that marten occurred across all major vegetated habitat types approximately in proportion to their availability on the landscape (EDI Environmental Dynamics Inc. 2017).

Home ranges of marten in the taiga are larger than in other regions of North America (Latour et al. 1994). In the Mackenzie Valley, NWT, mean home range sizes of adult males were 1,420 ha, and those of adult females were 680 ha. Overall, mean home range size of adult marten was 1,110 ha (Latour et al. 1994). In contrast, the average size of a marten home range in British Columbia (BC) is 525 ha for males and 316 ha for females, and in Ontario, the size of a typical marten home range is between 390 and 660 ha (Lofroth 1993, Manlick et al. 2017a). Marten density in the taiga (the carrying capacity) is likely limited by the availability of arboreal cavities for natal denning, subnivean CWD sites and underground shelters, small mammal abundance, predation, and intraguild competition (Brainerd et al. 1995). The estimated minimum density of marten was 0.0016/ha in the Mackenzie Valley, NWT (Latour et al. 1994), and 0.0025/ha in the Alaskan taiga (Paragi et al. 1996). The estimated fall density of resident adults in the northern boreal region of the Yukon was 0.006/ha (Archibald and Jessup 1984).

3.3.1 FORAGING

Marten habitat selection in the Eagle Plains Ecoregion may depend largely on prey distribution and availability (Paragi et al. 1996). Taiga vole are the prey most selected by marten in the Alaskan taiga, likely due to their larger size (mean weight = 54 g) relative to red-backed vole (mean weight = 20 g; Paragi et al. 1996). Potential

and confirmed mammalian prey in the taiga includes snowshoe hare (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*), red-backed vole, taiga vole, lemmings (*Lemmus* spp., *Dicrostonyx* spp.), and to a lesser extent, deer mice (*Peromyscus maniculatus*) (Paragi et al. 1996). Non-migratory grouse, including willow ptarmigan and spruce grouse, are available year-round and are likely prey for marten in the taiga (Paragi et al. 1996). However, marten are dietary generalists and their diet fluctuates seasonally with the breeding cycles of small mammal prey, bird migration and nesting periods, and fruiting periods of understory plants (Ben-David et al. 1997, Carlson et al. 2014, Twining et al. 2019).

In northern latitudes, marten foraging and population dynamics are influenced by fluctuations in the abundance of small mammal prey (Zielinski 2000). Multiple scat analyses in the NWT and Alaska found that small rodents, including vole and lemming, were the most important diet item for marten (Buskirk and Ruggiero 1994). Small rodents in northern regions undergo relatively large periodic fluctuations in population size (Krebs 1996). Marten populations are likely tightly coupled with these small mammal population cycles due to the relatively low diversity of mammalian prey species in the Eagle Plains Ecoregion (Yukon Ecoregions Working Group 2004a, Roth et al. 2007). Marten abundance and fecundity are correlated with temporal variability in the abundance of preferred prey, likely due to nutritionally demanding processes associated with reproduction and juvenile recruitment (Carlson et al. 2014, Flynn and Schumacher 2016).

Previous research has shown berries to be most important for marten diet during the summer and fall (July–November) when fruit availability is greatest (Baker 1992, Schaumann and Heinken 2002, Twining et al. 2019). Further, there is recent evidence that *Vaccinium* fruit are also an important winter food item for marten in coastal areas where they remain accessible year-round (Banner et al. 2014, Eriksson et al. 2019). Similarly, common juniper (*Juniperus communis*) berries are an important winter food item for marten in other regions (Hargis and McCullough 1984). Therefore, marten in the RSA likely consume fruit from several species of shrub depending on habitat and season, including blueberry and lowbush cranberry in upland woodlands, and crowberry (*Empetrum nigrum*), lingonberry, cloudberry (*Rubus chamaemorus*), and bog cranberry (*Vaccinium oxycoccos*) in lowland black spruce-shrub sites (Yukon Ecoregions Working Group 2004a).

The diet of marten in interior regions of North America is typically dominated by species of voles associated with structurally complex forests (Thompson and Colgan 1994, Poole et al. 2004, Eriksson et al. 2019). Habitat structures normally associated with old forests, including stumps, snags, and large pieces of downed wood, provide subnivean access to small mammal prey in areas with deep snow (Zielinski et al. 1983, Baker 1992, Delheimer et al. 2019). However, within the Yukon, red-backed voles are present across all vegetation types and appear to be more abundant in subalpine shrub habitats than lower elevation boreal forests (Pretzlaw 2006, EDI Environmental Dynamics Inc. 2017). Taiga vole are restricted to the taiga and avoid forest cover (Pretzlaw 2006). Taiga vole in Alaska appear to select post-fire structural stages and are found in black spruce forests, birch forests, forest-grassland edge, and grasslands (Wolff and Lidicker Jr. 1980). Provided there is sufficient understory shrub cover, habitat used for foraging is probably directly associated with increased prey availability regardless of forest age or structural stage (Keim et al. 2011, Vigeant-Langlois and Desrochers 2011).

3.3.2 COVER

Across much of their distribution, marten select home ranges with old or late-mature forests and avoid recently cut forests (Chapin et al. 1998, Bridger et al. 2017, Suffice et al. 2017). Older forests contain complex woody structures, including mature trees, stumps, snags, and large pieces of CWD that marten require to meet many life history requirements, including thermal cover and escape cover from predators (Zielinski et al. 1983, Mowat 2006a, Andruskiw et al. 2008). Shrub cover can also be an important factor influencing marten habitat quality, as marten use understory shrubs as cover from aerial predators such as Northern Goshawk (*Accipiter gentilis*; Poole et al. 2004, Zielinski et al. 2005, Slauson et al. 2007).

Important habitat features typically associated with old forests, including stumps, snags, and large pieces of downed wood, provide subnivean access to winter denning in areas with deep snow (Zielinski et al. 1983, Baker 1992, Delheimer et al. 2019). A winter den is a structure that may be used repeatedly for resting for prolonged periods (Birks et al. 2005). Natal dens are used for parturition and kit rearing during the breeding season, and may be used as resting sites in other seasons (Birks et al. 2005). A scarcity of tree cavities leads marten to use denning sites that provide suboptimal thermal cover and escape from predators (Birks et al. 2005). Marten dens may be found in tree branches, bird nests, rock crevices, underground burrows, occupied houses, nest boxes, or barns (Birks et al. 2005). Therefore, marten may use a range of below or above-ground structures for winter denning in the RSA, regardless of forest age or structural stage.

3.3.2.1 Thermal Cover

In winter, marten possess limited energy reserves and must reduce energetic costs by seeking insulated resting sites (Spencer 1987, Buskirk et al. 1989, Brainerd et al. 1995). Marten are shown to be more dependent on subnivean resting sites at more northern latitudes (Brainerd et al. 1995). Marten's choice of resting above or below snow cover depends on the ambient air temperature relative to the temperature in a microenvironment; in other words, marten are more likely to rest wherever is warmest (Buskirk et al. 1989). In Scandinavia, marten seek underground or subnivean resting sites instead of arboreal sites when the ambient air temperature is very low (Brainerd et al. 1995). Any subnivean spaces not entirely surrounded by snow are suitable; however, CWD is best in terms of thermal properties (Buskirk et al. 1989). Therefore, thermal cover generally increases with increased coniferous cover and associated CWD. Rock provides some protection from digging predators; however, rock provides poor insulation than wood, and rock dens may contain organic bedding for insulation (Buskirk et al. 1989, Birks et al. 2005).

3.3.2.2 Escape Cover

As a mesocarnivore, pressure from competition and predation can play an important role in the population dynamics of marten populations (Kiseleva 2012, Manlick et al. 2017b). Aside from marten, wolf (*Canis lupus*), red fox (*Vulpes vulpes*), lynx (*Lynx canadensis*), and wolverine (*Gulo gulo*) are the primary mammalian predators in the Eagle Plains Ecoregion. Marten likely select habitat with sufficient escape cover (e.g., medium-sized coniferous trees and CWD) to avoid risk of intraguild predation by these species (Slauson et al. 2007, Eriksson

et al. 2019). Furthermore, marten within the Eagle Plains Ecoregion compete with least weasel (*Mustela nivalis*), lynx, and red fox for shared small mammal prey (Slough and Jung 2007).

Marten in North America select home ranges that contain vertical forest or understory shrub cover where they perceive lower risk of predation from aerial predators as well as larger carnivores that, depending on the system they occupy, includes mustelid, canid, and felid species (Slauson et al., 2007; Eriksson et al., 2019). Red fox are the most generalist and widespread carnivore in the northern boreal-tundra ecotone, and may limit marten populations through intraguild predation (Lindström et al. 1995, Birks et al. 2005, Pretzlaw 2006). Therefore, fox predation may force marten to remain arboreal and den above ground (Birks et al. 2005). Aerial predators include Northern Goshawk and Great Horned Owl (*Bubo virginianus*), both of which are predators of marten in other regions and occur year-round in forests in the Yukon (Bull and Heater 2001, Doyle and Smith 2001, Sinclair et al. 2003). Golden Eagle also occur in northern Yukon during the breeding season and may be predators of marten. However, marten may perceive a lower risk of predation in open woodlands and shrublands of the Eagle Plains due to the absence of several predators of marten in more southern biomes, including bobcat (*Lynx rufus*) and coyote (*Canis latrans*; Thompson and Colgan 1994, Bull and Heater 2000, Moriarty et al. 2016).

3.3.3 REPRODUCTION

Natal dens are used for the parturition and rearing of neonates and are critical for recruitment and population viability (Buskirk and Ruggiero 1994). Across North America, most natal dens are found in structurally complex sites (Buskirk and Ruggiero 1994). Marten prefer arboreal cavities for parturition and rearing neonates due to the shelter they provide from terrestrial predators, including red fox (Spencer 1987, Brainerd et al. 1995). Marten kits are very vulnerable to fox predation when kits move out of arboreal dens (Brainerd et al. 1995). However, scarcity of arboreal cavities may force marten to use alternative structures for natal denning (Birks et al. 2005). For example, arboreal cavities are rarely used as resting sites in Finland and northern Russia (Brainerd et al. 1995). In the NWT, an adult female marten denned and produced young within a 21-year-old burn (Latour et al. 1994). Therefore, a better understanding of habitat selection by adult female marten in the taiga is needed (Paragi et al. 1996).

3.3.4 DISPERSAL

North American marten are sensitive to forest fragmentation and are found across landscapes with greater amounts of contiguous forest (Thompson et al. 2012). Previous studies show that 5 km of nonforested habitat between forest patches is an effective barrier to dispersal for marten (Buskirk and Ruggiero 1994). Timber harvesting and extensive road networks increase the density of forest edges and generally reduce habitat connectivity for species such as marten adapted to forest interiors (Robitaille and Aubry 2000, Mowat 2006b). However, marten use narrow strips of forest and abandoned roads as movement corridors between more suitable patches of mature forest (Potvin and Bertrand 2004, Breault et al. 2021).

Furthermore, there is evidence that in regions with sparse forest cover, marten may be adapted to meet certain resource requirements in nonforested habitats. For example, in Scotland, forest habitat is limited and pine

marten (*Martes martes*) consistently use matrix habitats, including scrub and tussock grassland, to meet life history requirements (Caryl et al. 2012). Intensively managed forests in Scotland lack resources such as den sites and important prey (e.g., short-tailed field vole [*Microtus agrestis*]), abundant in grasslands long thought to be impermeable to marten movement or at best suboptimal marten habitat (Caryl et al. 2012).

Cold temperatures and high seasonality result in different patterns of habitat use among marten in North America (Zielinski et al. 1983). Marten habitat selection was investigated in the Alaskan taiga in a landscape composed of mature coniferous forests of black spruce and larch (*Larix laricina*) from 5–20 cm diameter at breast height (DBH) 100–115 years post-fire, as well as dense, young forests 30 years post-fire, and tall shrub and pole sapling forests with some moss and herb structural stages 10 years post-fire (Paragi et al. 1996). Marten abundance, hunting intensity (based on snow-tracking), and CWD density were the greatest in 10-year burns relative to 30-year burns and mature forests (Paragi et al. 1996).

However, this study found that juveniles were more common in recent burns than in mature stands, and recent burns were likely used only by nonbreeding marten (Paragi et al. 1996). Non-transient marten used coniferous forest more often than transient adult and juvenile marten, which were more likely to use scrub habitat (Paragi et al. 1996). For natal denning, resources are limited in herb and shrub structural stages and prey populations are unpredictable relative to mature forests (Paragi et al. 1996). Therefore, post-fire clearings may be only suitable for dispersing juveniles and transient adult marten (Paragi et al. 1996). Herb and shrub structural stages may function as population sinks for immature and transient marten dispersing from contiguous mature forest (Paragi et al. 1996). Previous HSI models for marten in the taiga have ranked nonforested habitats, including post-fire clearing and shrubland as low-suitability habitat (EDI Environmental Dynamics Inc. 2018). However, habitat requirements of breeding marten in the taiga are not well-understood (Paragi et al. 1996).

3.3.5 DISTURBANCE

3.3.5.1 Fire

Marten are dietary generalists and are not limited to prey associated with mature/old forest structural stages (Baker 1992, Paragi et al. 1996, Poole et al. 2004). Marten in the Alaskan taiga use snags and windthrown trees as winter cover in recent burns before coniferous regeneration occurs (Paragi et al. 1996). Trappers in Alaska view fire as beneficial to furbearer populations. Rodent prey, including red-backed vole, tundra vole (*Microtus oeconomus*), meadow vole (*Microtus drummondii*), and taiga vole, are abundant in dense herbaceous vegetation growth following recent fires (Stephenson 1984). Extensive use of post-fire clearings occurred by marten 1– 3 years post-fire. High population abundance occurs within 3–10 years post-burn, with activity centred in unburned inclusions and burn edges (Stephenson 1984).

In the Alaskan taiga, marten abundance, frequency of investigations, hunting intensity, and CWD density were greatest in 10-year burns relative to older burns and mature forest (Paragi et al. 1996). Subnivean access based on tracks was greatest in 10-year burns relative to mature forests and 30-year burns (Paragi et al. 1996). Small mammal biomass and diversity were greatest in the 10-year burn. This structural stage provided a more stable

prey base due to greater diversity of rodents and more stable populations of red-backed vole (Paragi et al. 1996). Young forests 30 years post-fire had the least stable small mammal populations and lacked taiga voles, the prey most selected by marten in this study (Paragi et al. 1996). The suitability of post-fire clearings for marten may be low at first and increase 6–10 years post-fire as ground cover recovers and small mammals occupy the habitat (Paragi et al. 1996). Suitability begins to decrease 15–20 years post-fire and reaches minimum suitability 25–30 years post-fire when CWD has fully decayed and young forests establish. These forests lack near-ground structures for subnivean foraging, escape cover, denning, and resting sites (Paragi et al. 1996).

Adult marten in the NWT were more likely to have home ranges in unburned stands than burned stands (Latour et al. 1994). Unburned forests were open, 90-year-old black spruce-herb, or black spruce-bog forests with average tree height from 5–10 m, and average DBH from 4–14 cm (Latour et al. 1994). Burned stands were characterized by regeneration of open to sparse deciduous vegetation (40% bare ground), a primarily willow shrub layer, and a birch/balsam fir canopy (Latour et al. 1994). Wet areas were characterized by moss, lichen, and Labrador-tea in the understory with sparse, stunted black spruce in the tree layer (Latour et al. 1994). Long-term use by adult marten within home ranges indicated greater use of unburned forests relative to burned forests (Latour et al. 1994). In burns, most snags remained standing and deadfall lay directly on the ground; therefore, burns did not provide access to subnivean spaces, and hunting was mostly on the surface of snow with little protection from predation (Latour et al. 1994). However, an adult female marten with a home range partially within a burn, denned and produced young within the 21-year-old burn (Latour et al. 1994). Furthermore, home ranges of 1 adult and 1 juvenile tracked for 14 and 15 months were entirely within the burns (Latour et al. 1994). Using post-fire structural stages by breeding marten in the taiga is not well understood and should be explored in future studies (Paragi et al. 1996).

3.3.5.2 Roads

The Dempster Highway runs roughly southwest to northeast through the southern half of the RSA. The RSA includes numerous winter roads (15 m average width) from previous exploration activities dating back to the 1960s. Project activities will be accessed via existing and new winter roads. Generally, marten avoid open areas and areas of high human disturbance, including roads (Hargis et al. 1999, Potvin et al. 2000). Marten in North America generally avoid roads due to increased predation risk and lower availability of preferred prey; however, predation risk is assumed to be low in the RSA because primary predators of adult marten are absent or at low density in the Eagle Plains Ecoregion (Yukon Ecoregions Working Group 2004a, Moriarty et al. 2011, 2015, Joyce 2018). Therefore, marten may perceive a lower risk of predation along roads within the RSA due to the absence of several predators of marten in more southern biomes (Bull and Heater 2001, Mowat 2006a, Thompson et al. 2012). Further, abandoned roads (5 m average width) may provide easier pathways for marten movement than undisturbed forest and greater cover from aerial predators than openings (Breault et al. 2021). However, extensive road networks may fragment woodland and shrubland, reducing habitat connectivity and limiting marten dispersal (Caryl et al. 2012).

3.3.5.3 Seismic Lines

The RSA contains numerous 2D seismic lines (range = 5–8 m wide, mean = 5.4 m wide) from previous exploration activities dating back to the 1960s. Most 2D exploration occurred between 1961 and 1984, with new 2D exploration in 2001 incorporating Low Impact Seismic (LIS) techniques(Access Consulting Group and EBA Engineering Consultants Ltd. 2001, GEOTIR 2014). Approximately 2,200 km of new 3D LIS exploration (1.5–3 m wide) was conducted in a 32,500 ha area between November 2013 and April 2014 (GEOTIR 2014). This new 3D exploration is located near the RSA's centre, north and south of the Dempster Highway. The entire RSA, including legacy and contemporary seismic lines, was assessed as a linear feature study. There were signs of normal and magnified succession on 2D and 3D seismic lines. Among 2D lines, 89% had growth >1.5 m height and were considered fully recovered, and 22% of 2D lines made in the 1950s and 1960s showed magnified succession. All 3D lines were made in 2014 and showed normal succession.

In the northern boreal forest (i.e., southwest NWT, northeast BC, and northwest Alberta), marten use of seismic lines is strongly influenced by line width and state of regeneration (Tigner et al. 2015). In this study, forests were open black spruce bogs in lowlands, and upland white spruce-aspen with dense shrubs. Remote wildlife cameras were used to quantify marten use of seismic lines relative to adjacent interior forests. Marten were detected in open lines >3 m wide up to 90% less than forest interiors, but were detected in open lines <2 m wide or lines >6 m with at least partially recovery roughly equally to forest interiors (Tigner et al. 2015). Use of seismic lines is thought to be driven by the perceived risk of predation; marten avoid open habitats but use disturbed habitats following sufficient recovery of overhead and lateral cover (Tigner et al. 2015).

3.3.6 HABITAT SUMMARY

In more productive forests to the south, marten are often associated with mature forest structures, such as large trees, snags, and CWD (Buskirk and Ruggiero 1994, Thompson et al. 2012). Marten select habitats with structural complexity which provides subnivean access to small mammal prey, thermal cover, escape cover from predators, as well as natal denning sites (Spencer et al. 1983, Buskirk and Ruggiero 1994, Latour et al. 1994, Paragi et al. 1996). Within the Subarctic Bioclimate Region, characterized by stunted, open canopy spruce-dominated habitats, tree growth is often limited by the presence of permafrost resulting in disclimax vegetation communities with tall and low shrub structural stages. Therefore, patterns of habitat selection of marten in the RSA may differ from those in southern biomes (Pretzlaw 2006).

Habitat quality in the RSA should be evaluated within the context of reduced availability of old forest structures and lack of contiguous, coniferous forests in the Eagle Plains Ecoregion. Marten select habitat types with the most large pieces of downed wood and the largest standing live and dead trees available at the landscape scale (Zielinski et al. 1983, Baker 1992, Delheimer et al. 2019). Trees, snags, and CWD >30 cm in diameter are associated with older structural stages within the RSA. These structures would be considered too small to provide thermal cover and support natal denning requirements for marten elsewhere in North America (Buskirk et al. 1989, Delheimer et al. 2019). However, these structures are likely large enough to provide thermal cover and support natal denning requirements for marten in the northern context of the RSA (Spencer 1987, Brainerd et al. 1995).

3.4 METHODS

An HSI model was used to estimate habitat quality across the RSA (U.S. Fish and Wildlife Service 1980). An HSI model, also referred to as a knowledge-based habitat suitability model (Clarke 2012), is a common method for assessing habitat quality for wildlife species, and a method adapted for use in environmental impact assessments (U.S. Fish and Wildlife Service 1980). Habitat is defined as the particular place occupied by a specific population within a community and usually characterized by the dominant plant form or physical characteristics (U.S. Fish and Wildlife Service 1980). Each species requires habitat to supply space, food, cover, water, and other requirements for survival (U.S. Fish and Wildlife Service 1980). Suitability is defined as the habitat's ability, in its current structural stage, to provide the life requisites of the species (Resources Inventory Committee 1999c).

3.4.1 HABITAT SUITABILITY MODELLING

HSI modelling uses spatial datasets such as land cover, disturbance history, and topography. It ranks available habitats according to their ability to support a selected species. The habitat rankings can be based on various sources, including ecological survey data, local knowledge, expert knowledge, and traditional knowledge. HSI models can be based on suitability ratings for one habitat variable or the combination of ratings for multiple variables to quantify the quality, amount and distribution of potential habitat for the species (Dijak and Rittenhouse 2009).

3.4.1.1 Rating Scheme

Habitat ranking schemes reflect knowledge of the species' habitat use and ecology (Resources Inventory Committee 1999). A 4-class system was chosen to rank habitat suitability in this study because there is an intermediate level of knowledge of habitat quality for marten in the taiga (Resources Inventory Committee 1999, EDI Environmental Dynamics Inc. 2018). Thus, habitat was assigned a suitability ranking of High (H), Moderate (M), Low (L), or Nil/Very Low (N/VL) relative to the range of habitat quality across the RSA. Using a mathematical equation, the HSI score was produced by combining suitability ratings for several specific habitat variables (e.g., vegetation community type) into one final HSI score.

The developed habitat model produced HSI scores ranging from 0 to 1. Scores were used rather than classes to combine scores and adjustments from multiple variables into a final HSI score. Scores were categorized into four qualitative categories: High (>0.75 to 1.0), Moderate (>0.50 to 0.75), Low (>0.25 to 0.50), Nil/Very Low (>0.0 to 0.25; Resources Inventory Committee 1999). The rating categories correspond to qualitative predictions of the relative suitability of the habitat for supporting five life requisites of marten: reproduction, thermal cover, escape cover, foraging, and dispersal. High-quality habitat supports all five life requisites. Moderate-quality habitat supports escape cover, foraging, and dispersal. Low-quality habitat only supports limited foraging and dispersal. Nil/Very Low-quality habitat does not contribute significantly to any life requisites; however, herb and shrub structural stages and stunted disclimax forest areas likely function as permeable barriers and allow intra-territorial movements within marten home ranges (Caryl et al. 2012). Habitat conditions and suitability interpretations for each rating class are provided in Table 3-1.

Table 3-1. Description of habitat rating classes used in the marten HSI model.

HSI Score	Habitat Rating	Description
>0.75 to 1.0	High	Suitable (optimal). Provides conditions for natal denning (large live conifer trees, large snags, large CWD), thermal cover (medium/large-sized elevated CWD subnivean), escape cover, foraging, and dispersal.
>0.50 to 0.75	Moderate	Suitable (suboptimal). Provides conditions for escape cover (small/medium-sized live or dead conifer trees, and/or small CWD, and/or dense shrub cover), foraging, and dispersal.
>0.25 to 0.50	Low	Limited Suitability. Provides conditions for foraging (i.e., any size or species of tree that would support prey species and CWD large enough for subnivean access; grass and/or horsetails for hare, voles, birds, and/or berries for prey or marten), and dispersal (i.e., some herb or sparse deciduous/shrub cover).
>0.0 to 0.25	Nil/Very Low	Unsuitable. Non-vegetated areas, such as alpine, water, or highways, that do not provide conditions to support any life requisites for marten. Non-vegetated areas may be used for intra-territorial movements.

3.4.1.2 Habitat Variables

Habitat variables were identified as potentially important for describing marten habitat (Table 3-2). Variables were evaluated for inclusion based on the strength of relationships found in other studies, the ecological relevance to marten in the Eagle Plains Ecoregion, and the availability of the variable in GIS databases for the RSA. Based on these criteria, ELC and Linear Feature (LF) data were included in marten habitat modelling.

Distance to riparian areas was considered for inclusion in the model. Riparian areas are important foraging habitat for marten in North America (Spencer et al. 1983, Ben-David et al. 1997), and elder members of the VGFN observed good marten habitat in the area where the Blackstone and Peel rivers meet (Sherry and Vuntut Gwitchin First Nation 1999, p. 140). Riparian areas generally have greater prey availability relative to the surrounding landscape due to higher densities of prey and greater volumes of CWD, which increase access to subnivean spaces (Buskirk et al. 1989). ELC data accurately represent increased habitat quality in mature/old riparian forests found as narrow strips along most major watercourses in the RSA, including Chance Creek in the northwest and Dalglish Creek in the southeast. Therefore, a variable for distance to riparian was redundant with the ELC mapping and was not included in the model.

The history of fire disturbance has influenced marten distribution and was considered for inclusion in the model. However, the nature of the relationship between fire history and patterns of use by marten is unclear for the taiga biome. Recent burns and post-fire clearings are generally considered suboptimal habitat. They are used mainly by nonbreeding and dispersing juvenile marten (Paragi et al. 1996). In the NWT, adult martens were likelier to locate home ranges in unburned stands than burned ones (Latour et al. 1994). However, recent burns may provide foraging opportunities not present in older burns or mature forests (Paragi et al. 1996). Furthermore, fire history was explicitly accounted for in the structural stage of the ELC mapping. Therefore,

a separate variable for fire history was determined to be redundant with ELC mapping and was not included in the model.

Elevation was considered as a variable for inclusion in the model. Marten generally occur at higher elevations than similarly-sized mesocarnivores, due to adaptations for travelling over snowpack and hunting in subnivean spaces (Grinnell et al. 1937, Zielinski et al. 2005, 2017). However, elevation within the rolling topography of the RSA does not vary substantially (range = 343–752 m asl) and was likely not a significant driver of marten distribution. Therefore, elevation was not included as a variable in the model.

Table 3-2. Summary of habitat variables commonly associated with marten habitat quality from published literature relevant to the Regional Study Area.

Variable	Included in model?	Rationale
Ecosite (ELC)	Yes	Marten select conifer-dominated stands with dense shrub cover.
Structural Stage (ELC)	Yes	Marten select mature/old forests with complex structure.
Distance to Riparian	No	Most ecosites defined by permafrost rather than riparian. ELC data more accurately represent increased habitat quality in mature/old riparian forests than distance to riparian.
Linear Features	Yes	Generally, marten avoid linear features due to increased predation risk. It is included as a habitat modifier/downgrade to adjacent habitat.
Fire History	No	Different patterns of use by marten depending on study. Fire may affect habitat quality positively or negatively, dependent on ecosite and time since disturbance. Fire history was explicitly accounted for in the structural stage of the ELC mapping. Therefore, it would be redundant to include it in the model.
Elevation	No	Range in elevation within RSA (343–752 m asl) is not enough to affect marten distribution.

Ecological and Landscape Classification

ELC mapping refers to an integrated approach to mapping and classifying land units according to their ecological similarity (Environment Yukon 2016a). As part of another study in the RSA (EDI Environmental Dynamics Inc 2021), field plots were used to establish preliminary classification units and site/soil conditions across various ecological communities. The vegetation association organization and ecosite and coding system follows the Yukon ELC Mapping Guidelines (Environment Yukon 2016a). Non-forested and sparsely/non-vegetated ecosystem were assigned to group/realm following *Biogeoclimatic Ecosystem Classification of Non-forested Ecosystems in British Columbia* (BC MFLNRORD and BC MOE 2010, Mackenzie 2012), and anthropogenic units were classified following *Standards for Terrestrial Ecosystem Mapping in British Columbia* (Resources Inventory Committee 1998a). Wetland sites were classified according to the Canadian Wetland Classification System for class, form, subform, type and subtype.

The remaining ecosites were coded with a two-digit number that indicates, by its number series, a certain range of soil moisture conditions: 10s are dry sites, 00s are mesic sites, 20s are riparian sites, 30s are moist

sites, and 40s are wet sites. Ecosite names reflect plant species that are important indicators of the vegetation found within the ecosite (e.g., 33 – Moist Spruce – Labrador Tea).

Biologists delineated ELC polygons in a GIS based on discernible differences among vegetation, topography, terrain, soils, gradients, and patterns (relationship patterns between ecosystem units, polygon shape and orientation). Three or fewer ecosystem units (i.e., ecosites) were entered per polygon. Each ecosite had an associated structural stage modifier (e.g., pole sapling) and decile, representing the percent area of the polygon in each ecosite (i.e., all deciles sum to 100%).

A subsample (n = 97) of ELC field plots were used to describe habitat suitability rankings for marten within the context of the Eagle Plains Ecoregion. Field plots were identified as High (n = 10), Moderate/high (n = 21), Moderate (n = 20), Moderate/low (n = 44), and Low (n = 2). No field plots were in Nil/Very Low habitat suitability. ELC ecosites and structural stages were used to generalize habitat rankings from field plots to ELC GIS data (Table 3-3).

Every combination of ecosite and structural stage was assigned an initial HSI score of High (HSI >0.67 to 1.0), Moderate (HSI >0.33 to 0.67), Low (HSI >0 to 0.33), or Nil/Very Low (HSI = 0). Only ecosites and structural stages represented in the RSA were included in habitat modelling. All non-vegetated ecosites (AN, ES, Fa, LA, PD, RI, RZ) were ranked as Nil/Very Low (0.0). Vegetated ecosites in the non-vegetated structural stage (1) were ranked as Nil/Very Low (0.0). Ecosite 10 (sparsely vegetated) was ranked as Nil/Very Low (0.0) regardless of structural stage. All other vegetated ecosites with Sparse/cryptogram (2/2a) or Herb/graminoid-dominated (3/3b) structural stage were all ranked as Low quality (0.1). Vegetated ecosites in Low shrub (4b) structural stage were ranked as Low quality (0.33) and ranks increased with structural stage to a maximum of 1.0 (High quality) for conifer/mixedwood ecosites, and a maximum of 0.67 (Moderate quality) for deciduous/shrub ecosites, and 0.33 (Low quality) for wetland (bog, marsh, fen) ecosites.

Linear Features

Linear features (LF) were surveyed in the RSA as a companion study for the exploration project proposal (EDI Environmental Dynamics Inc., unpublished study). LFs were classified as 2D, 3D, winter roads (any trails or limited use roads with an obviously curving path), and the Dempster Highway. A subsample (n = 64) of field plots from the LF surveys were used to investigate habitat suitability for marten on-line and off-line. Determining the relative level of impact of various types of LFs established empirical evidence for modelling.

No linear features contained high suitability habitat; the average difference between off-line and on-line habitat suitability rankings across all types of LFs was 0.81 (SD = 0.79, range = 0–3, n = 64). All 2D lines (average width = 5.4 m, n = 27) were moderate-low habitat suitability on-line, and when compared to off-line habitat, the average difference in suitability ranking was 0.85 (off – on), (SD = 0.82, range = 0–2). 3D lines (width range = 1.75–5 m, n = 27) were mostly moderate-low habitat suitability (n = 24), and the average difference between off-line and on-line suitability was 0.63 (SD = 0.69, range = 0–2). The average difference among winter roads (average width = 5 m, n = 8) was 0.88 (SD = 0.64, range = 0–2). Along the Dempster Highway (average width = 15 m, n = 2), the average difference was 2.5 (SD = 0.71, range = 2–3). The average difference in HSI between off-line and on-line field plots was scaled to a score from 0–1 for downgrading:

- Dempster Hwy (30.0 m wide) = (2.5*0.25) = 0.625
- Winter Roads and 2D lines (10.0 m wide) = (0.87*0.25) = 0.218
- 3D lines (10.0 m wide) = (0.63*0.25) = 0.158

2D and 3D lines were mapped using a 10 m width due to limitations of the spatial scale of modelling (10 m raster). The 2D lines are wider than 3D lines and thus have a greater local effect on marten habitat suitability. The difference in effect between 2D and 3D lines on marten habitat was accounted for by applying a greater value for downgrading 2D lines (–0.218) compared to 3D lines (–0.158).

Table 3-3. HSI ratings for marten habitat quality in the Eagle Plains RSA based on an assessment of ELC field plots.

Ecosite Name	Ecosite Code	Structural Stage											
		Non-vegetated	Sparse / cryptogram	Sparse (5–10% cover)	Herb	Graminoid dominated	Low shrub	Shrub	Tall shrub	Pole sapling	Young Forest	Mature Forest	Old Forest
		1	2	2a	3	3b	4b	4	4a	5	6	7	8
Mesic Birch - Willow	2	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Mesic White Spruce – Alaska Paper Birch - Alder	3	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Mesic Black Spruce – Alaska Paper Birch (mixedwood)	4	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Mesic Alaska Paper Birch (Deciduous)	5	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Mesic Black Spruce – Labrador Tea (Conifer)	6	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Sparsely Vegetated	10	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dry Spruce-Lichen (Conifer)	14	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Dry Aspen-Lichen (Deciduous)	15	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Dry Spruce-Birch-Lichen (mixedwood)	16	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Dry Aspen (Deciduous)	17	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Shrubby Riparian Birch – Willow	20	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Riparian White Spruce – Prickly Rose	21	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Riparian Spruce – Birch - Willow	22	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Drainage Shrubby Riparian	23	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60

Ecosite Name	Ecosite Code	Structural Stage											
		Non-vegetated	Sparse / cryptogram	Sparse (5–10% cover)	Herb	Graminoid dominated	Low shrub	Shrub	Tall shrub	Pole sapling	Young Forest	Mature Forest	Old Forest
		1	2	2a	3	3b	4b	4	4a	5	6	7	8
Moist Shrub \ Scrub Birch – Labrador Tea – Willow	31	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Moist Spruce – Labrador Tea	33	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Moist Spruce – Alder – Labrador Tea	34	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Moist Spruce – Scrub birch – Labrador Tea	35	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Moist Birch – Willow	36	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Tamarack	41	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Black Spruce – Tussock Cottongrass	42	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Black Spruce - Sphagnum	43	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Scrub Birch – Tussock Cottongrass	44	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Scrub Birch - Graminoid	45	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Black Spruce – Labrador Tea – Cladonia	46	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Wet Black Spruce – Tussock Cottongrass - Sphagnum	47	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Wet Black Spruce – Carex	48	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Anthropogenic	AN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bog – Black spruce – Lichen	B1	0.00	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25	0.25

Ecosite Name	Ecosite Code	Structural Stage											
		Non-vegetated	Sparse / cryptogram	Sparse (5–10% cover)	Herb	Graminoid dominated	Low shrub	Shrub	Tall shrub	Pole sapling	Young Forest	Mature Forest	Old Forest
		1	2	2a	3	3b	4b	4	4a	5	6	7	8
Bog – Black Spruce – Sphagnum	B2	0.00	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Exposed Soil	ES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fen	F	0.00	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Flood Active Channel	Fa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake	LA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marsh	M	0.00	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Pond	PD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
River	RI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Road	RZ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.4.1.3 Model Structure

Each ELC polygon contains up to three ecosites with deciles indicating percent cover relative to the total area of the polygon. A weighted average HSI score was calculated for each polygon using the following equation:

$$ELC_r = \frac{\sum_{i=1}^{n} d_i h_i}{\sum_{i=1}^{n} d_i}$$

where ELC_r is the initial weighted average, d_i is the decile value, and h_i is the HSI score for each ecosite. HSI polygons were converted to a 10x10 m resolution raster, and linear feature adjustments were applied to the initial HSI scores for each cell:

$$HSI = ELC_r - LF_r$$

where LF_r is the LF adjustment.

3.5 RESULTS AND DISCUSSION

The model indicated a patchwork of High, Moderate, and Low-quality marten habitat, across the RSA (Table 3-4; Map 3-1). High-quality marten habitat is associated with mesic, spruce-dominant ecosites in mature to late structural stages. It includes some of the most common ecosystem units in the RSA, including Moist Spruce – Labrador Tea (33), Moist Spruce – Alder – Labrador Tea (34), and Mesic Black Spruce – Alaska Paper Birch (04; Figure 3-1). Concentrations of High-quality habitat include Enterprise and Dalglish Creeks watersheds in the south, a band running east-west north of the Dempster Highway, and the western part of the northern half of the RSA. Moderate-quality habitat is associated with wetter or younger ecosystem units than High-quality habitat and is widespread across the RSA. High and Moderate-quality habitat is also concentrated in narrow strips of mature/old riparian forests along some of the major watercourses in the RSA, including Chance and Greaves Creeks in the northwest and McParlon Creek west of the Dempster Highway.

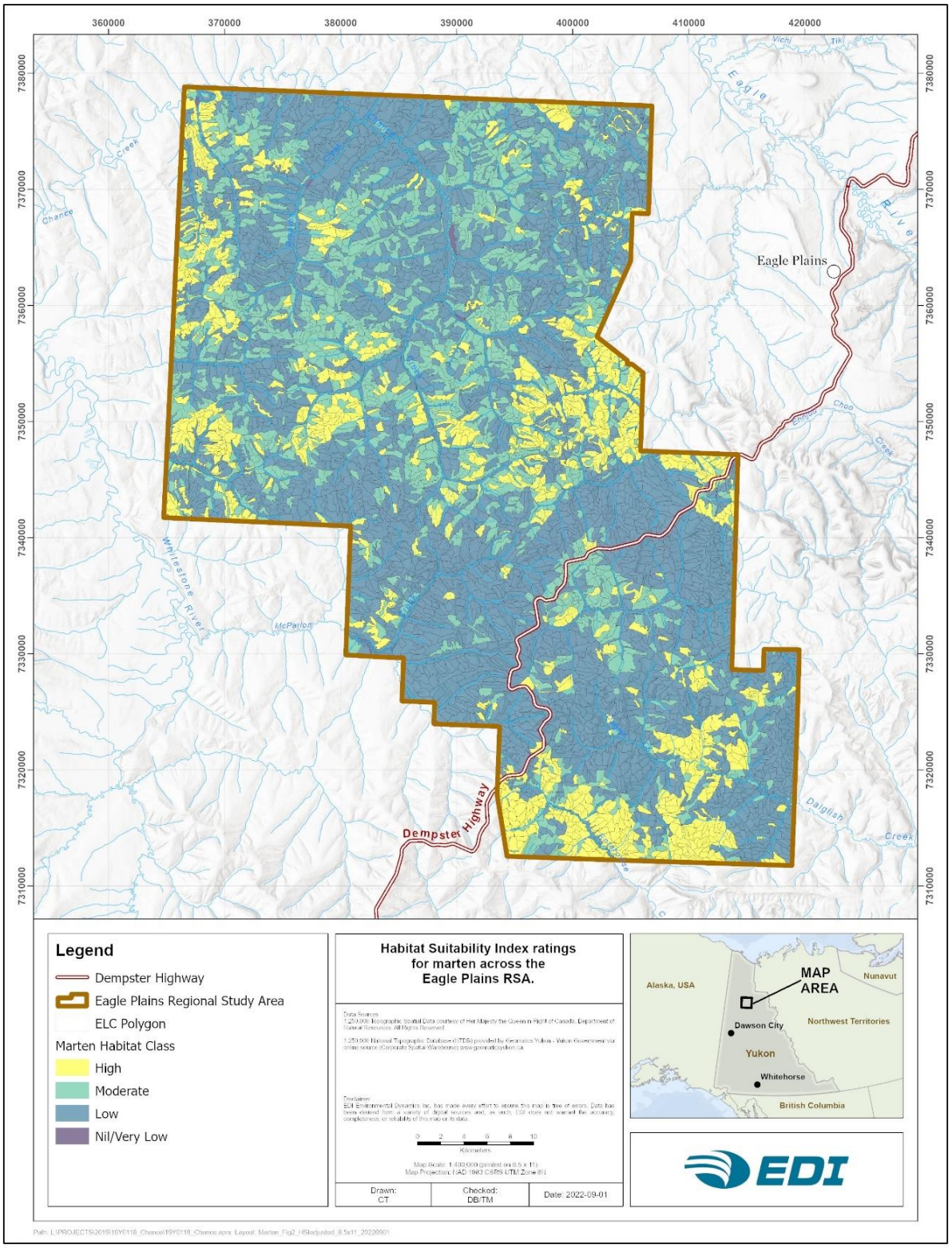
There is extensive Low-quality habitat, represented by vegetation communities in tall and low shrub structural stages found throughout the RSA (Figure 3-1). These habitats generally lack mature forest structures, such as large trees, snags, and CWD, which marten require for subnivean foraging, escape/thermal cover, and denning (Buskirk and Ruggiero 1994, Thompson et al. 2012). Low-quality habitat was associated with shrubby wetlands and stunted black spruce sites in low valley bottoms in the Chance watershed in the northwestern portion of the RSA and regenerating fire-disturbed areas on both sides of the Dempster Highway in the southern part. Completely non-vegetated areas are rare in the RSA; thus, there is almost no Nil/Very Low-quality habitat (Table 3-4; Map 3-1).

Linear features had a relatively minor effect on the overall quality, amount, and distribution of potential habitat for marten. The effect of linear features on habitat suitability for marten is mainly limited to site-level effects (Map 3-2). This effect was due to the narrow width of linear features (Moriarty et al. 2016, 2017) and their small extent relative to the overall RSA. Though existing linear features reduce habitat quality at the site level,

their effects are negligible to habitat supply at the home range scale for marten (Table 3-4). The Dempster Highway was likely the only linear feature in the RSA that could limit the movement of marten. Marten avoid crossing open areas due to increased predation risk relative to areas that provide escape cover (Slauson et al. 2017). However, the highway likely functions as a barrier, not an obstacle or constraint to their movement (Beyer et al. 2016). Therefore, it is likely that marten can and will cross the highway, so the potential barrier limits to their movement likely do not affect habitat availability at the home range scale.

Table 3-4. Relative availability of marten habitat in the Eagle Plains RSA.

Habitat Rating	HSI Scores	Area (ha)	Area (%)
High	>0.75 to 1.0	38,049.63	15.94
Moderate	>0.50 to 0.75	55,202.05	23.12
Low	>0.25 to 0.50	142,484.78	59.68
Nil/Very Low	>0.0 to 0.25	3,015.79	1.26
Total		238,752.25	100



Map 3-2. Habitat Suitability Index model ratings for marten across the Eagle Plains RSA.

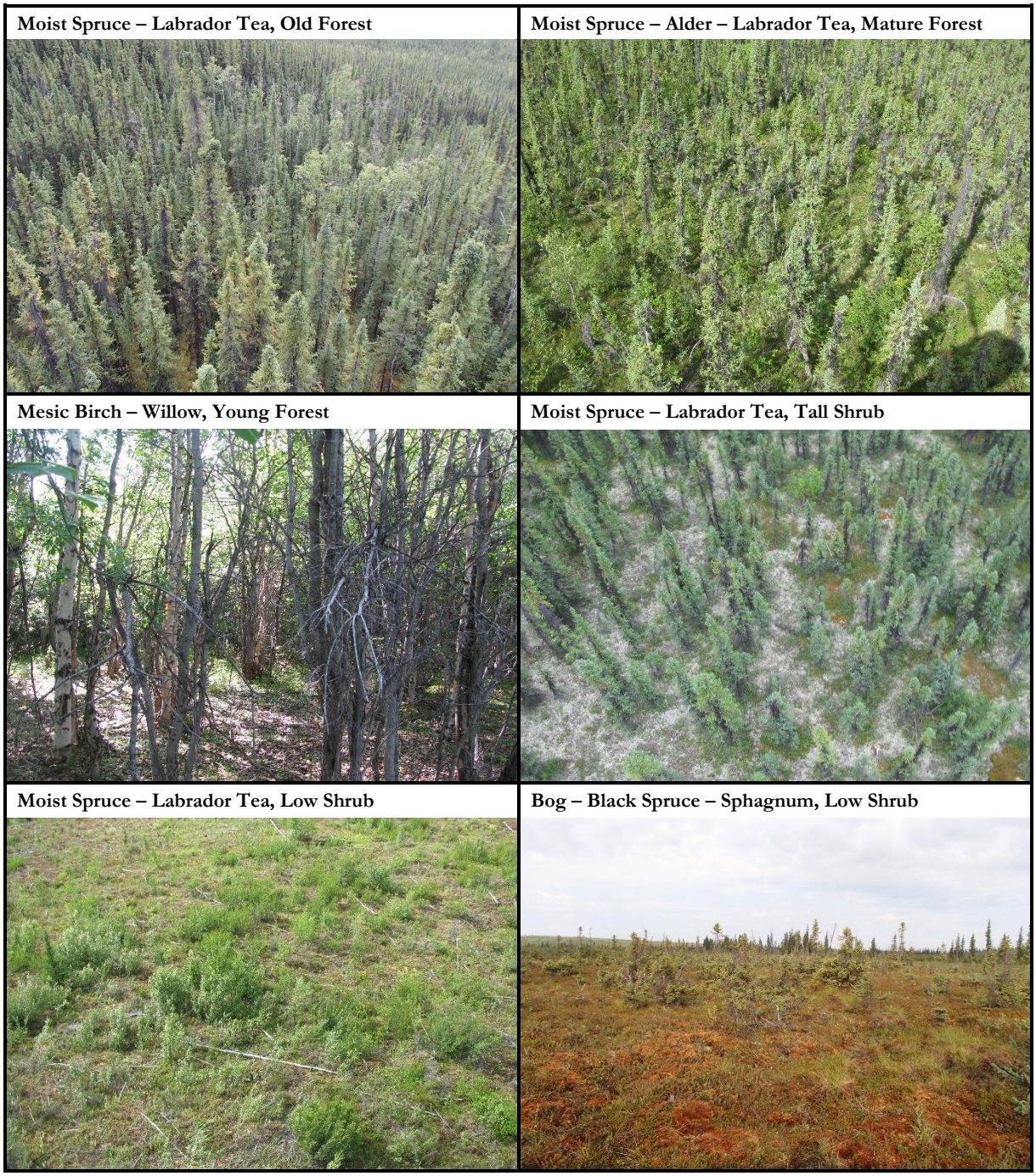
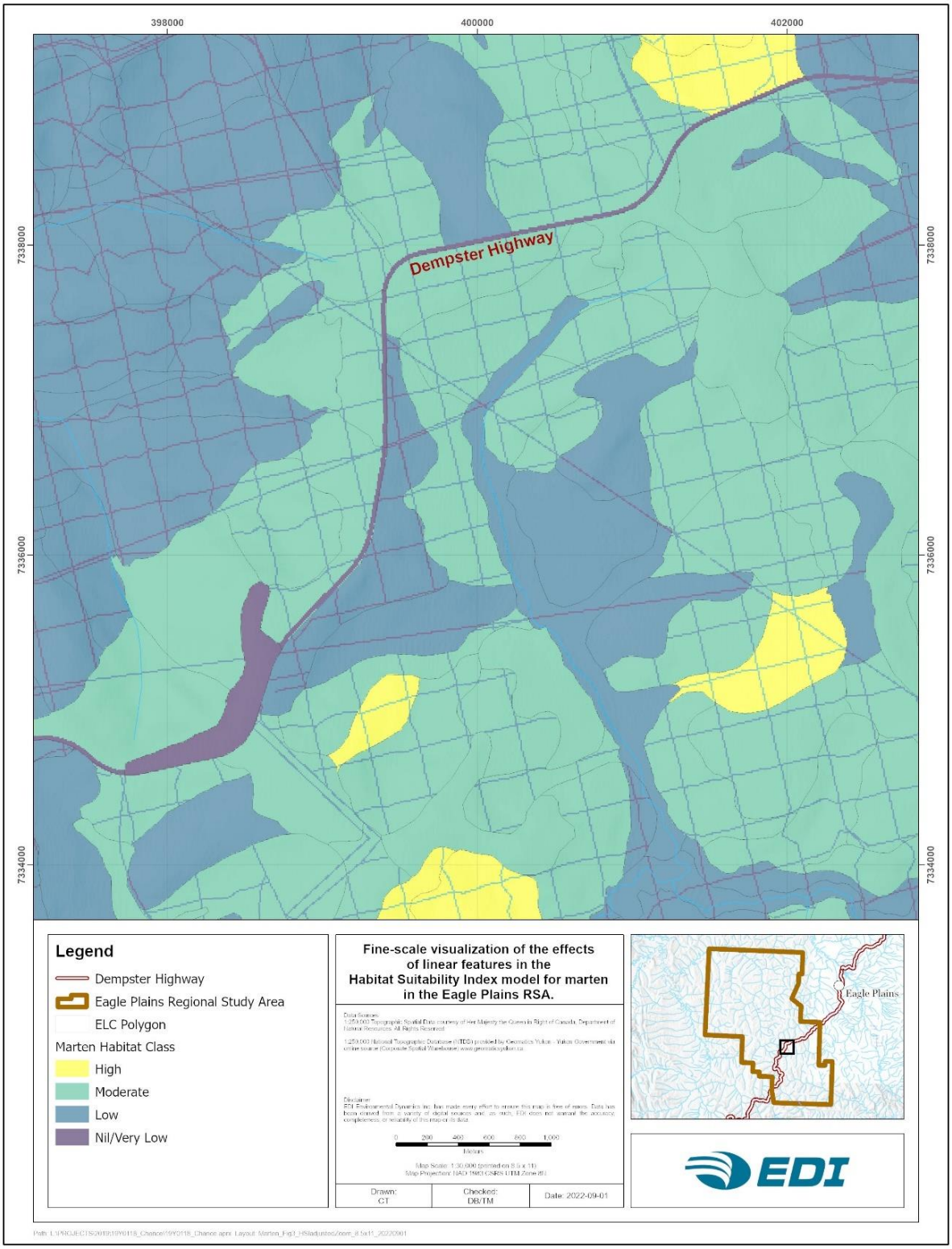


Figure 3-2. Examples of High (top row), Moderate (middle row), and Low (bottom row) quality marten habitat in the Eagle Plains RSA.



Map 3-3. Fine-scale visualization of the effects of linear features in the Habitat Suitability Index model for marten in the Eagle Plains RSA.

3.5.1 MODEL VERIFICATION AND CONFIDENCE

The frequency of use of habitat by marten in the RSA is expected to correlate to the ordinal habitat classes used in the model. However, independent marten occurrence data were not available to test that expectation. The overall confidence in the model is moderate based on moderate knowledge of marten in northern ecosystems and the lack of local field verification.

3.6 SUMMARY

The quality, amount, and distribution of potential habitat for marten were quantified across the RSA using a Habitat Suitability Index model. Ecosite and vegetation structural stages were used to assign areas an initial HSI score, which was then modified based on the presumed adverse effects of linear features on marten habitat. The HSI model indicates a patchwork of High (16%), Moderate (23%), and Low (60%) quality marten habitat across the RSA. High-quality marten habitat occurred in relatively large areas of contiguous mature/old spruce forests and narrow strips of mature/old riparian forests along major watercourses. The RSA contains extensive Low-quality habitat, associated with vegetation communities in tall and low shrub structural stages, including regenerating burns and open, stunted black spruce forest. Non-vegetated areas that constitute Nil/Very Low habitat are a minor component of the RSA. Linear features reduce habitat quality at the site level, but their effects on habitat supply at the scale of a marten's home range are limited.

4 GRIZZLY BEAR

4.1 PURPOSE AND OBJECTIVES

Grizzly bears (*Ursus arctos horribilis*) were selected as a VC for the Project due to their conservation status and social, cultural, and economic value. Grizzly bear have been assessed as a species of Special Concern in Canada, indicating their populations are at risk of becoming threatened if not adequately managed (COSEWIC 2007). Grizzly bears have cultural significance for Indigenous people of Yukon, some of which have traditional uses for their fur, fat, and meat (Benson 2014, Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a). In addition, grizzly bears are managed as a Big Game species in Yukon (Government of Yukon 2002) and harvested by Yukon residents and non-residents (i.e., outfitting operations) throughout much of the territory. Grizzly bear are considered an iconic Yukon species and the opportunity to view grizzly bears attracts tourists from around the world (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a).

This section summarizes the current state of knowledge about grizzly bear ecology in the Project and broader areas, including population trends, distribution, habitat selection, diet, and sources of mortality. This report emphasizes grizzly bear ecology specific to the Taiga Cordillera Ecozone where the Project is located. The behavioural ecology and population characteristics of grizzly bears in the taiga are likely distinct from bears inhabiting coastal, boreal, and arctic barren-ground ecosystems, given substantial variation in habitat and food availability across these regions (Mowat and Heard 2006, Mowat et al. 2013). This report draws from multiple sources, including published and unpublished literature, personal communications with biologists, and traditional knowledge where available. Few studies on grizzly bears have been conducted in the region and the broader Taiga Cordillera. Thus, literature from surrounding regions was consulted when local information was unavailable.

4.2 POPULATION STATUS AND DISTRIBUTION

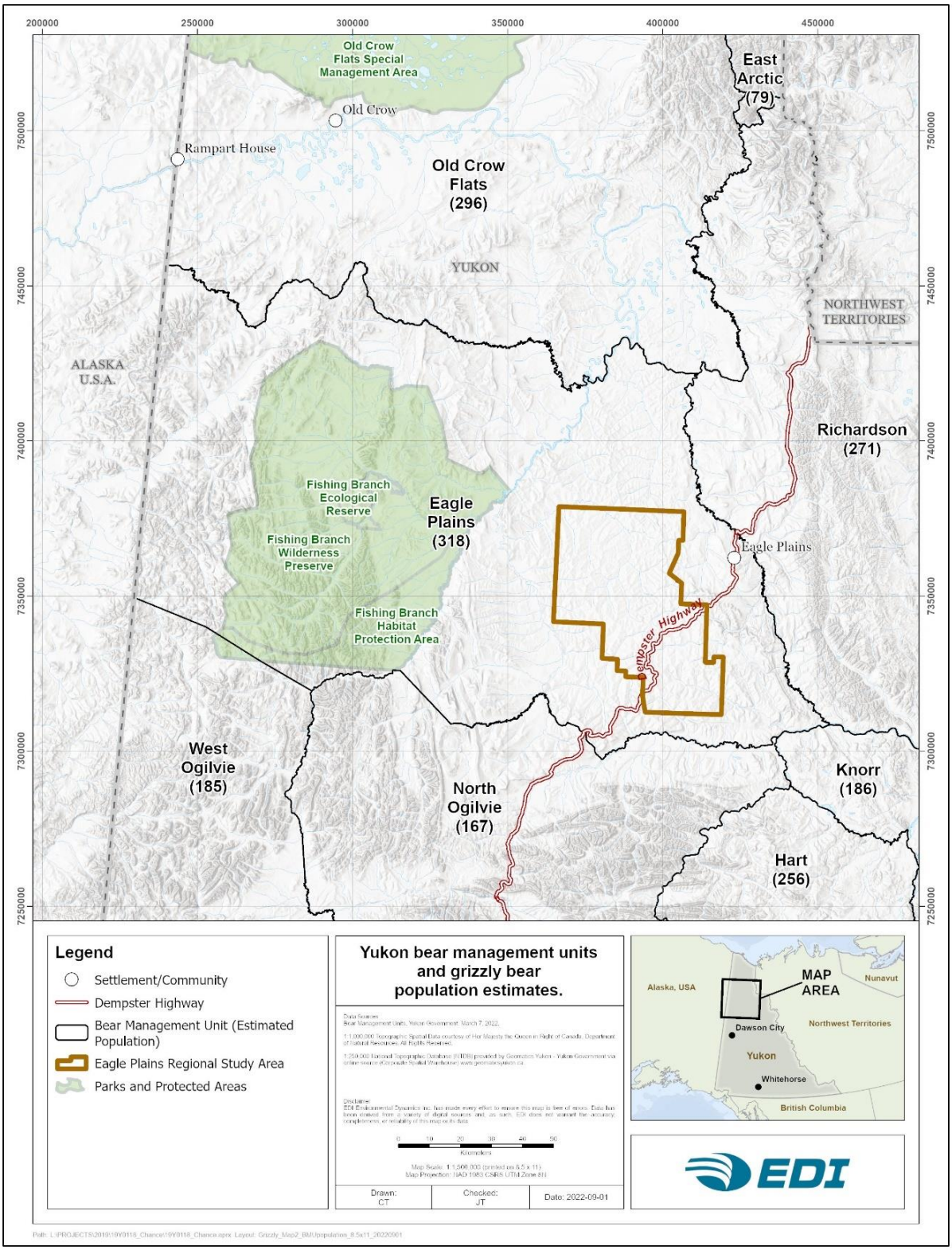
4.2.1 POPULATION

Yukon's grizzly bear population is estimated at 6,000 to 7,000 individuals, comprising approximately 25% of Canada's total grizzly bear population (COSEWIC 2007). The Yukon population estimate was derived from expert-opinion-based estimates of grizzly bear densities in each Yukon Ecoregion, using habitat information and local knowledge collected in the 1980s (Smith and Osmond-Jones 1990, Yukon Grizzly Bear Conservation and Management Plan Working Group 2019b). The exceptions are the Southern Lakes Region and Yukon North Slope, where more recent estimates are available from population assessments using genetic mark-recapture methods (Yukon Fish and Wildlife Branch 2016, 2017). The RSA is located within the Eagle Plains Ecoregion, which has a grizzly bear population estimate of 184 individuals (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019b).

Yukon's grizzly bear populations are managed within bear management units (BMU), generally delineated by outfitting concession boundaries. The Inuvialuit Settlement Region is an exception, where grizzly bears are managed under a separate co-management agreement (WMAC [NS] and WMAC [NWT] 1998). Population estimates for each BMU were derived from the original expert-based Ecoregion estimates (except the Southern Lakes Region and North Slope). Population estimates for BMUs range from 43 to 503 bears; with variation attributed to differences in habitat quality and the sizes of BMUs.

The Eagle Plains BMU, which encompasses the RSA, has a population estimate of 318 bears (Map 4-1). However, the population estimate for the Eagle Plains BMU includes Ni'iinli Njik (Fishing Branch) Territorial Park, which likely has much higher grizzly bear densities than the RSA due to abundant salmon and winter denning habitat (Vuntut Gwitchin Government and Environment Yukon 2010). Grizzly bear densities are considered low throughout the RSA, although limited information is available (Pongracz and Suitor, pers. comm., 2022). Population densities for the adjacent Richardson Mountains are estimated at approximately 23 bears per 1,000 km^2 (Clarkson et al. 1993), but grizzly bears are more abundant in the mountains than the taiga plains that characterize the RSA (Benson 2014).

Grizzly bear population trends in Yukon are primarily tracked through harvest monitoring. The Yukon population is stable (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a). There is minimal data on population trends within the Eagle Plains BMU, given low grizzly bear harvest rates (refer to Section 3.1), but traditional knowledge provides some insight. Gwich'in knowledge holders suggest that grizzly bears in the Gwitch'in Settlement Area have a generally stable population (Benson 2014). However, elders noted that grizzly bears have declined in some areas from 1940 to the early 2000s due to increased hunting pressure, the opening of the Dempster Highway, increased use of snow machines, and a general northward range shift towards the Inuvialuit Settlement Region.



Map 4-1. Yukon bear management units and grizzly bear population estimates.

4.2.2 DISTRIBUTION

Grizzly bears occur throughout the Yukon, ranging from the BC/Yukon border to the Arctic coast. They are generalist omnivores that may live in various habitat types (Mowat et al. 2013), and they occur in all Ecoregions within Yukon.

In northern Yukon, seasonal grizzly bear distribution generally tracks the availability of key food resources such as berries, fish, ungulate calves, and ground squirrels (MacHutchon and Wellwood 2003). Very little information exists about grizzly bear distribution within the RSA. The Whitestone River adjacent to the RSA (Map 1-1) is an area of higher grizzly bear concentration in the region (Pongracz and Suitor, pers. comm., 2022). During the fall, grizzly bears congregate in Ni'iinli Njik (Fishing Branch) Territorial Park, approximately 20 km west of the RSA, to feed on spawning salmon in the Fishing Branch River (Vuntut Gwitchin Government and Environment Yukon 2010).

In and adjacent to the Gwitch'in Settlement Region, grizzly bears are more common in the Richardson Mountains, the Ogilvie Mountains, and the barren arctic coast than in the flat, low-elevation taiga that overlaps the RSA (Benson 2014). These distributional patterns are attributed to a lack of ground squirrels and other key food sources in the moist, hummocky spruce forest that characterizes much of the RSA.

4.2.3 CONSERVATION STATUS AND THREATS

COSEWIC has assessed grizzly bears as a species of Special Concern (COSEWIC 2007). The Western Canadian grizzly bear population is listed under Schedule 1 of the SARA, which requires measures to prevent grizzly bears from becoming Threatened or Endangered. Within Yukon, grizzly bears are not currently considered a species of conservation concern (Yukon Conservation Data Centre 2019), although a conservation plan was developed for grizzly bears in 2019 to promote healthy and viable grizzly bear populations into the future (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a).

The greatest threats to the Canadian grizzly bear population are considered to be 1) human-caused mortality, including illegal and legal hunting, conflict kills, and railway or road mortalities, and 2) habitat loss and fragmentation (COSEWIC 2007). Members of the VGFN had observed in the late 1990s that Grizzly bears did not come near to the Dempster highway but were concerned with the old garbage dump areas along the highway possibly attracting bears (Sherry and Vuntut Gwitchin First Nation 1999, p. 286, 289). Key threats to grizzly bear populations in the Yukon are human-wildlife conflict and harvest mortality, although habitat loss and climate-related changes to food availability may also be significant (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a). Northern grizzly bear populations cannot sustain high mortality rates due to their low reproductive rates and low densities (Nagy et al. 1983). Sources of mortality in the RSA and surrounding region are discussed in detail in Section 4.4.

4.3 MORTALITY AND HARVEST

Grizzly bears are managed as a big game species in Yukon (Government of Yukon 2002), and harvest is permitted in most parts of the territory outside of National Parks, including resident, non-resident, and subsistence harvest. The overall mortality management system is based on estimated total sustainable mortality rates of ≤ 2% of the female population, ≤ 6% of the male population, and ≤ 4% of the total population (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a). Total allowable mortality rates account for mortality from harvest, and other sources, including vehicle collisions and defence of life and property (DLP) kills (i.e., conflict kills).

Yukon grizzly bear harvest is managed within BMUs, although harvest rates are often reported at the scale of Game Management Subzones (GMS) or broader Game Management Zones (GMZ). The bag limit is one grizzly bear every three years in open subzones, and hunters must report all bear kills (Government of Yukon 2021). The RSA is located within GMZ 1, with the lowest licenced grizzly bear harvest rates in the Yukon. Between 1980 and 2014, the annual grizzly bear harvest in GMZ 1 varied from zero to three bears (Milligan 2018). More specifically, within the Eagle Plains BMU (Map 4-1), only two grizzly bears were harvested from 1995 to the present (Pongracz and Suitor, pers. comm., 2022). The Eagle Plains BMU does not overlap any outfitter concessions (i.e., no non-resident harvest), so reported harvest rates are attributed to licenced resident harvest.

Other sources of grizzly bear mortality include DLP kills, collisions with vehicles, and predation from other bears or large carnivores. Grizzly bear mortality rates in the Eagle Plains BMU are low relative to other BMUs in the territory, with an annual average mortality density of < 0.1 bears per 1,000 km², based on records from 2005 to 2016 (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019b). Mortality rates tend to be higher in southern Yukon, where both the human population and road densities are comparatively high, with mortality densities up to 0.6 bears per 1,000 km² in some BMUs (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019b). However, these rates do not account for unreported human-caused mortality (e.g., unreported DLP kills) or natural sources of mortality. Reported DLP kills accounted for an average of 11 grizzly bear mortalities per year in Yukon from 1980 to 2016. DLP mortality rates are very low within the Eagle Plains BMU; from 1995 to 2021, only one grizzly bear DLP kill was reported (Pongracz and Suitor, pers. comm., 2022).

The correlation between road density and grizzly bear mortality has been well documented in other parts of western North America (McLellan 1990, Mace et al. 1996, Boulanger and Stenhouse 2014, Proctor et al. 2019). Most historical grizzly bear mortalities in central BC and Alberta were related to human activity and occurred within 500 m of a road (Ciarniello et al. 2004, Boulanger and Stenhouse 2014). In BC, grizzly bear mortality rates are known to increase in areas where road densities exceed 0.6 km/km² (Lamb et al. 2018). Mortalities were caused by higher rates of legal harvest, poaching, and conflict kills near roads, in addition to direct mortalities from road collisions. Roadside hunting of grizzly bears is currently permitted in Yukon, although this is under review in some local areas (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a).

Grizzly bear mortalities from vehicle collisions are rare in Yukon. Fifteen grizzly bear mortalities resulted from collisions with vehicles from 2003 to 2014 on all Yukon Highways (EDI Environmental Dynamics Inc. 2015). Collisions tended to occur in spring and summer when grizzly bears were foraging on roadside vegetation. Most collisions occurred on the Alaska Highway (60%), which has higher traffic volumes than other roads in the territory. The only major road in the RSA is the Dempster Highway, which has comparatively low traffic volumes and is unpaved. From 2003 to 2014, only one bear collision was reported on the Dempster Highway near Dawson City. The bear species was unidentified.

Predation is a source of mortality for grizzly bears, but predation rates are generally unknown in the Yukon. Male grizzly bears occasionally prey on females and cubs on the North Slope (Clarkson and Liepins 1994). Wolves in packs have also been known to kill grizzly bears in northern Yukon (Benson 2014).

4.4 REGIONAL HABITAT ECOLOGY AND DIET

The distribution of available forage strongly influences habitat selection by grizzly bears during spring, summer, and fall seasons (Nielsen et al. 2010, Milakovic et al. 2012) and the supply of suitable den sites in winter (Smereka et al. 2017). Security and thermal cover are also important (McLellan 1990). However, they are generally selected with nearby foraging habitats (Milakovic et al. 2012).

Much of the available information on seasonal grizzly bear habitat selection and diet comes from the interior mountains and coastal regions of western North America (e.g., Hamilton 1978, McCormick 1999, McLellan and Hovey 2001, Ciarniello et al. 2007, Maraj 2007, Nielsen et al. 2010, Milakovic et al. 2012, McClelland et al. 2020). However, the ecological characteristics of these populations may differ substantially from that of grizzly bears in northern Yukon. At a finer spatial scale, grizzly bear ecology within the RSA differs from grizzly bears elsewhere in northern Yukon, such as the Yukon North Slope or the nearby Ogilvie and Richardson Mountains (Pongracz and Suitor, pers. comm., 2022), but very little information exists about grizzly bears within the RSA. Literature and traditional knowledge from similar ecosystems in northern Yukon have been summarized to the extent possible, including the Taiga Cordillera and adjacent Taiga Plains Ecozones. When information specific to the region was unavailable, literature from other parts of the Yukon or western North America was consulted.

4.4.1 SEASONAL DIET

Grizzly bears have broad omnivorous diets, including plants, fish, terrestrial wildlife, and insects (MacHutchon and Wellwood 2003, Ciarniello and River 2018). Grizzly bear diets differ among regions due to variations in food availability across local climates (Mowat and Heard 2006, McLellan 2011, Coogan et al. 2014). Individual grizzly bear diets are also highly variable and dependent on seasonal and annual availability of food items within their home ranges (MacHutchon and Wellwood 2003, McClelland et al. 2020).

Seasonal grizzly bear diets generally reflect the phenological progression of key food resources such as herbaceous plants, ungulate calves, berries, and fish (Hamer and Herrero 1987, MacHutchon and Wellwood 2003, McClelland et al. 2020). Vegetation is a major component of grizzly bear diet in northern Yukon; for

example, vegetation comprised more than 30% of grizzly bear diet in the Richardson Mountains (Koizumi 2012). During spring, important plant foods for grizzly bears in the Taiga Cordillera include the roots of alpine hedysarum (*Hedysarum alpinum*), sedges (*Carex* spp.), grasses, horsetail (*Equisetum spp.),* and berries leftover from winter such as kinnikinnik (*Arctostaphalos uva-ursi*), bearberry (*Arctostaphalos rubra* or *A. alpina*), and crowberry (MacHutchon 2000, MacHutchon and Wellwood 2003). In summer and early fall, grizzly bear diet in northern Yukon includes a variety of berries such as blueberry (*Vaccinium uliginosum*), soapberry (*Shepherdia canadensis*), crowberry, bearberry, kinnikinnik, cranberry (*Vaccinium vitis-idaea*), and cloudberry (MacHutchon 2000, MacHutchon and Wellwood 2003). When berries are unavailable, grizzly bears may forage on herbaceous vegetation such as sedges, grasses, and horsetails. As berry availability declines in late fall, grizzly bears may dig for alpine hedysarum more frequently (MacHutchon and Wellwood 2003).

In northern Yukon, grizzly bear diets incorporate a relatively high proportion of terrestrial wildlife, comprising up to 70% of their diet (Mowat and Heard 2006, Koizumi 2012). Mammals are likely an important food source throughout the spring, summer, and fall whenever they are available, including caribou (*Rangifer tarandus*), moose (*Alces alces*), arctic ground squirrels (*Spermophilus parryii*), and small rodents (MacHutchon 2000, MacHutchon and Wellwood 2003, Koizumi 2012). Arctic ground squirrels are an important food source, and grizzly bears may spend increasing effort pursuing them as berry availability declines in late fall (MacHutchon and Wellwood 2003). Arctic ground squirrels tend to select slopes with well-drained soils and avoid wet, flat, or hummocky terrain (Barker and Derocher 2010), which characterizes much of the RSA. Thus, grizzly bears with home ranges that overlap the RSA may rely heavily on other food sources (e.g., alpine hedysarum or ungulates). Traditional knowledge suggests that bears may travel to the nearby Richardson Mountains to forage on ground squirrels in fall (Benson 2014).

Ungulates may be a particularly important food source in spring, when grizzly bears in northern Yukon and Alaska prey on caribou and moose calves (Boertje et al. 1988, MacHutchon 2000, MacHutchon and Wellwood 2003). Barren-ground caribou (*Rangifer tarandus groenlandicus*) are a focal food source for grizzly bears in northern Yukon during caribou calving and seasonal migration periods (MacHutchon and Wellwood 2003). Grizzly bears may follow caribou as they migrate to and from their calving grounds (Reynolds and Garner 1987, Benson 2014), targeting calves or opportunistically preying on adults (MacHutchon and Wellwood 2003). Northern grizzly bear populations that prey on caribou during calving or migration have higher reproductive rates and population densities than those that do not overlap caribou range (Reynolds and Garner 1987). Grizzly bear diet has not been studied within the RSA, and there is no scientific data on the relative importance of caribou as a food source. However, the Porcupine caribou herd migrates through the RSA en route to calving grounds on the arctic coastal plain and again during their return to winter range in the Richardson and Ogilvie mountains (Russell et al. 1993, Ryder et al. 2007). Grizzly bears within the RSA likely use caribou during spring and fall migration.

Salmon, trout, and char are important seasonal foods for grizzly bears (Mowat and Heard 2006, Adams et al. 2017). During fall, grizzly bears congregate at the Fishing Branch River in Ni'iinlii Njik Territorial Park to feed on chum salmon (*Oncorhynchus keta*) (Vuntut Gwitchin Government and Environment Yukon 2010). Grizzly bears on the north slope are also known to feed on Dolly Varden trout (*Salvelinus malma*) (MacHutchon and Wellwood 2003). Baseline fish inventories for the Project found that salmon and trout were absent within the

RSA (EDI Environmental Dynamics Inc. 2022a). Arctic grayling (*Thymallus arcticus*) were the most common fish species, although longnose sucker (*Catostomus catostomus*) and round whitefish (*Prosopium cylindraceum*) were also present. Grizzly bear in the Richardson Mountains have been observed feeding on arctic grayling (Benson 2014), and whitefish and sucker are known food sources in the central Canadian arctic (Gau et al. 2002, Barker 2011).

4.4.2 FORAGING HABITAT

The availability, abundance, and distribution of important grizzly bear forage directly influence grizzly bear abundance and distribution during the growing season (McLoughlin et al. 2002a, Nielsen et al. 2017, McClelland et al. 2020). Grizzly bear populations in the subarctic and arctic are generally considered limited by food (McLoughlin et al. 2002a). Grizzly bears may balance the selection of high-quality food patches with avoidance of landscape features associated with high mortality risk, such as areas with dense human developments and roads (Nielsen et al. 2010, Proctor et al. 2017). However, given the relatively low harvest rates and low levels of human development in the RSA, it is likely that grizzly bear habitat selection is driven by food availability.

The literature on grizzly bear foraging habitat selection in the mountains, boreal forest, and coastal regions of western North America is extensive (e.g., Hamilton 1978, McCormick 1999, McLellan and Hovey 2001, Ciarniello et al. 2007, Maraj 2007, Nielsen et al. 2010, Milakovic et al. 2012, McClelland et al. 2020), but far less is known about habitat use in northern ecosystems. Studies in northern Yukon, Alaska, and NWT have focused mainly on arctic barren-ground grizzly bears (Phillips 1987, MacHutchon 1996, Gau 1998, McLoughlin et al. 2002a, Barker 2011), leaving a substantial knowledge gap about grizzly bear ecology in the Taiga Cordillera (particularly non-mountainous areas such as the Eagle Plains Ecoregion).

Grizzly bear distribution was clumped in the Richardson Mountains rather than uniform; bear densities were comparatively high in habitats with abundant food such as riparian valleys and low in flat tundra plains (Clarkson et al. 1993). Local traditional knowledge suggests that mountains are better grizzly bear habitat than taiga or barren-ground plains due to the abundance of berries and ground squirrels, and the earlier snowmelt on windblown and south-facing slopes in spring (Benson 2014). Grizzly bears in northern Yukon have large home range sizes (up to 1,250 km^2) and travel long distances to reach suitable foraging habitat (MacHutchon 2000). Thus, grizzly bears in the RSA may travel to the Richardson or Ogilvie Mountains for seasonal forage. This is consistent with the knowledge that grizzly bears have low densities in the RSA, and their behaviour is characterized by seasonal movements through the area (Pongracz and Suitor, pers. comm., 2022).

In the central Canadian arctic, barren-ground grizzly bears selected eskers, shrubby riparian zones, and tussock tundra throughout the spring, summer, and fall, corresponding with the spatial and temporal availability of food (Phillips 1987, McLoughlin et al. 2002a). Esker slopes support a relatively high abundance of berry-producing shrubs and arctic ground squirrels (Gau 1998, Barker and Derocher 2010, Barker 2011), whereas riparian zones and tussock tundra may provide herbaceous forage such as horsetails, sedges, and cotton grasses (*Eriophorum* spp.) (Gau 1998, Gau et al. 2002). Barren-ground grizzly bears also selected habitat with abundant lichen, which may attract caribou (McLoughlin et al. 2002a). During the Porcupine caribou

migration on the Yukon north slope, grizzly bears travelled along river channels or selected hillsides with long sight-lines, presumably to increase their chances of detecting caribou (MacHutchon 2001).

4.4.3 COVER (SECURITY AND THERMAL HABITAT)

Security habitat includes areas of dense vegetation that provide visual screening from other grizzly bears or humans (Mace and Waller 1997). Security cover may be particularly important for sub-adult male bears and sows with cubs to avoid adult males defending their territories or killing cubs to bring females into estrus (LeFranc et al. 1987, McLellan 2005). Female grizzly bears may select lower-quality foraging habitat if it provides high security values or spatial separation from potentially aggressive male bears (Pearson 1975, McLellan and Shackleton 1988). For example, female grizzly bears in the arctic are thought to occupy the Mackenzie Delta to avoid male bears in adjacent mountain ranges (Benson 2014).

Thermal cover includes habitat that provides relief from the elements, such as solar exposure or extreme weather. Cover from heat and solar exposure is provided by various habitats such as open water (e.g., rivers, streams, lakes), permanent snow patches, steep north aspects, and mature forest patches with high canopy closure (Pearson 1975, LeFranc et al. 1987). Grizzly bears may also select forests with high canopy closure for day beds to seek shelter from heavy rains (Pearson 1975, Munro et al. 2006). The importance of thermal cover for grizzly bears in the Taiga Cordillera has not been studied.

4.4.4 WINTER DENNING HABITAT

Grizzly bears in northern Yukon hibernate in winter from approximately October to May (Nagy et al. 1983, MacHutchon 2000), although the timing for den entry and emergence depends on annual weather patterns. Grizzly bears will enter their dens as late as mid-November and emerge as early as March if the weather is warm (Benson 2014).

No records exist of grizzly bears dens within the RSA, although grizzly bears are known to den in the mountains of Ni'iinli Njik (Fishing Branch) Territorial Park, approximately 20 km west of the RSA (Pongracz and Suitor, pers. comm., 2022). Grizzly bears in the arctic and subarctic typically excavate their dens in locations with suitable soil, such as sand, gravel, or glacier-deposited rock (MacHutchon 2000, Smereka et al. 2017). Grizzly bears in Vuntut National Park in northern Yukon preferentially select den sites in the mountainous regions of the park and avoid denning in Old Crow Flats, which is characterized by flat topography, large wetland complexes, and spruce forests (MacHutchon 2000). Denning within Old Crow Flats is likely limited to dry, steep riverbank slopes (MacHutchon 2000). Grizzly bears throughout the Gwitch'in Settlement Area are known to prefer denning in the mountains; however, in areas with flat topography (such as the RSA), grizzly bears will select small topographical features such as hills, steep riparian banks, or lakesides to excavate their dens (Benson 2014). Grizzly bears in northern Yukon have large home ranges (Section 4.5.5) and may travel long distances to reach winter den sites (up to 65 km; Craighead 1976). Thus, some grizzly bears with home ranges overlapping the RSA may travel to nearby mountain ranges (Richardson Mountains, Ogilvie Mountains, or Ni'iinli Njik Territorial Park) to hibernate.

In arctic barren-ground ecosystems, grizzly bears select river banks, lakesides, or eskers with silty or sandy soil for denning (Harding 1976, Mueller 1995) and avoid open spruce forest (Smereka et al. 2017). Grizzly bears prefer to excavate their dens on steep south-facing slopes with abundant shrub cover in the arctic (Mueller 1995, McLoughlin et al. 2002b) and the boreal forest of southern Yukon (Libal et al. 2012). The root structures of tall shrubs such as willow (*Salix* spp) and dwarf birch (*Betula glandulosa*) may provide support to the ceilings of excavated grizzly bear dens (McLoughlin et al. 2002b).

4.4.5 HOME RANGE AND SEASONAL MOVEMENTS

Grizzly bear home range sizes are variable and have an inverse relationship with food availability (Nagy and Haroldson 1990, McLoughlin et al. 2000). Thus, grizzly bear home ranges in productive coastal or interior mountain habitats of BC are typically smaller and have greater overlap than those in less productive boreal, taiga, or arctic barren-ground ecosystems (McLoughlin et al. 2000, Edwards et al. 2009, Hamilton et al. 2018). Additionally, the size of individual home ranges may vary annually in response to fluctuations in the quality and abundance of food (McLoughlin et al. 2000). The largest recorded grizzly bear home range sizes in North America were in the central Canadian Arctic, where mean home range sizes for female and male bears were 2,100 km² and 7,245 km², respectively (McLoughlin et al. 2003).

No data on grizzly bear home range sizes within the RSA are available, but studies conducted in other parts of the Taiga Cordillera provide some insight. Grizzly bear home range sizes in the Old Crow flats of Vuntut National Park were estimated at 650 – 750 km² for females and 1,150 – 1,250 km² for males (MacHutchon 2000). In the Richardson Mountains north of the RSA, female grizzly bears had mean annual home ranges of 442 km² and males had home ranges of 760 km² (Koizumi 2012). The smaller home ranges in the Richardson Mountains may be attributed to more food resources, such as berries and ground squirrels relative to the taiga plains (Benson 2014).

Grizzly bears have low fidelity to home ranges in unproductive arctic ecosystems, where food distribution is spatially and temporally heterogenous, and grizzly bear population densities are low (Edwards et al. 2009). Under these conditions, it is beneficial for grizzly bears to adjust the size and location of their home ranges to maximize forage availability. For example, in northern Yukon and Alaska, grizzly bears may travel long distances to follow the seasonal migration of barren-ground caribou (Reynolds and Garner 1987, MacHutchon 2001). Grizzly bears in northern Yukon are also thought to travel long distances to find suitable winter denning habitat in the mountains (Benson 2014).

4.5 SUMMARY

Available data suggest that a low density of grizzly bears are distributed throughout the RSA. Rates of recorded harvest mortality are low within the Eagle Plains BMU, but other sources of mortality are largely unknown and unrecorded. Grizzly bear diet in the RSA and surrounding region predominantly consists of vegetation (berries, roots, and herbaceous plants) and terrestrial wildlife, including caribou, moose, and arctic ground squirrels. Grizzly bears may rely heavily on caribou (particularly calves) during the seasonal migration of the Porcupine caribou herd through the region. Habitat quality in the RSA is generally poor compared to the adjacent mountain ranges, where berries and ground squirrels are more abundant. Lastly, grizzly bears in the RSA may excavate their winter dens in riverbanks, lakesides, and hills where suitable soil can be found, or they may travel to nearby mountain ranges to den on steep south-facing slopes. Most of the information presented in this review was based on scientific studies.

5 MOOSE

5.1 PURPOSE AND OBJECTIVES

Moose (*Alces alces*) were selected as a VC for the Project due to their importance as a managed game species, and their cultural values to First Nations living in the Yukon. Winter, and especially the late winter season, is often a difficult time for moose due to the limited availability of forage and increased energetic demands to move through crusted or deep snow. A winter habitat suitability map was developed for moose in the RSA to identify high-suitability winter forage habitat areas. The map quantifies the winter forage habitat in each habitat class (high, moderate, low/nil/very low) within the RSA.

This section summarizes information and data on moose use and ecology in the subarctic taiga that was used to develop habitat suitability mapping to quantify the suitability, amount, and distribution of potential habitat for moose in the RSA.

5.2 GENERAL HABITAT ECOLOGY OF MOOSE

5.2.1 EXISTING INFORMATION

There is limited knowledge of moose within the RSA. In 2001, Anderson Resources Ltd submitted a project application and a mitigation plan for an Eagle Plains 2001–2003 Seismic Survey Program (Access Consulting Group and EBA Engineering Consultants Ltd. 2001). This report describes moose knowledge of the area as being limited and incidental. The authors reviewed the existing data and had discussions with local wildlife biologists and other resource users about winter usage patterns by moose in the general vicinity of the Eagle Plains project area. At that time, moose were only superficially studied in the Eagle Plains Area (Access Consulting Group and EBA Engineering Consultants Ltd. 2001).

The 2001 project application report stated that an approximate moose density of about 0.05 moose/km² was estimated for the project area based on general habitat assessment. The application also provided the following information:

> "*Within the project area, moose are not commercially exploited and there are no outfitting concessions. There is limited off-road access and the moose population density within the project area is known to be low, hence the subsistence harvest is minor. YTG Renewable Resources harvest data show that, in the last twenty years, only 13 moose have been harvested in the Dempster Corridor subzones (Game Management Zone 1-55 and 1-56).*
>
> *Anderson conducted a post-rut moose survey in early November of 2000, to augment the currently very limited knowledge regarding moose populations in the project area. The survey was conducted to provide baseline information on the level of range usage by moose within the project area. During the course of the 2-day survey, 30 moose were observed and an additional 64 sets of tracks were encountered. In general, moose were more frequently associated with the higher elevations (between 400 m and 700 m above sea level), but were widely dispersed throughout all of project*

area's drainages. From the survey results, an overall population of approximately 60-90 moose was estimated (Access Consulting Group and EBA Engineering Consultants Ltd. 2001)."

These observations of greater moose abundance at higher elevations are consistent with observations from VGFN elders around the same time (Sherry and Vuntut Gwitchin First Nation 1999, p. 7). They discussed that Eagle Plains was an important moose range, but that some animal populations had changed their land use after the Dempster highway was built and there was low density near the highway (Sherry and Vuntut Gwitchin First Nation 1999, p. 287, 299).

In 2001, an aerial survey was completed from June 18–22 within the 2001 project area. During that survey, 19 moose were incidentally observed, with most observations noted in the South Eagle River and Dalglish Creek area. A general point of interest was that moose calving was expected in several drainages, but was particularly noteworthy in the South Eagle River (Access Consulting Group and EBA Engineering Consultants Ltd. 2001).

In 2013 Environment Yukon conducted an 'Eagle Plains Mammal Occupancy Aerial Survey' from March 19 to March 24, 2013 (Environment Yukon, unpublished data). The survey aimed to assess the occurrence and distribution of large mammals within the broader Eagle Plains Ecoregion. Over the 6 survey days, 64 moose were observed, including cow and calf observations. The data indicated that moose were widely distributed within the Eagle Plains area, but the area was not comprehensively surveyed, and formal analyses/reporting were not included with the data.

From October 2014 through August 2016, Yukon Environment deployed 37 (2014) to 48 (2015) pairs of remote cameras in the Eagle Plains area (Burden 2016). The objective was to assess the use of linear features by medium to large mammals (wolves, caribou, and moose) by comparing the use of wildlife on and off seismic lines by placing cameras at random locations on seismic lines, and camera locations off seismic lines. The report is a data summary with no statistical analysis, and the results are non-standardized (e.g., lacking a catch per unit effort reporting metric). Regardless, there was some information collected for moose relevant to this study. Over the two years of study, moose encounters were infrequent and varied slightly among years (0.33 moose/100 camera days in 2014–2015, 0.43 moose/100 camera days in 2015–2016). Moose were found in the study area throughout the year but were observed more often from May through November (spring through fall). No statistical analyses or apparent trends were used to determine moose associations with linear disturbances.

EDI did not complete other population or distribution surveys for moose as part of the current baseline studies. Efforts focused on developing a winter habitat model to quantify habitat suitability, amount, and distribution across the RSA.

5.2.2 HABITAT ECOLOGY OF MOOSE

Moose are one of the most widely distributed ungulates and range from the Arctic coasts of North America, Europe, and Asia down to the southern limits of the boreal forest and farther south where suitable montane biomes are located exist. In the Yukon, moose densities generally range between 100 and 250 moose for every 1,000 km^2 of suitable moose habitat (Environment Yukon 2016b). The Regional Biologist has indicated that,

based on his observations, moose densities in Eagle Plains are relatively low compared to some parts of the southern Yukon, but that moose densities in Eagle Plains are high compared to other parts of North Yukon (Mike Suitor, pers comm).

Moose make seasonal movements to various habitats such as calving, summer, rutting, and winter habitats. These seasonal movements may range from a few to many kilometres (Clarke et al. 2017, Government of Yukon 2022). Changing environmental conditions can affect the quality, quantity, distribution, and accessibility of cover and forage over a landscape. Key habitat requirements are rarely distributed evenly over space or time, so moose move to access various resources as availability changes. Periodic disturbances, such as wildfire and vegetation clearing change the abundance and availability of moose cover and forage. Moose are generally not evenly distributed across the landscape; they concentrate in particular habitats offering higher forage opportunities(Government of Yukon 2022). Moose with access to large quantities of forage are known to travel less than those in areas where forage is less abundant (McCulley et al. 2017). There is a wide variation in home range sizes for moose across the boreal forest and between seasons (Phillips et al. 1973, Addison et al. 1980, Clarke et al. 2017, McCulley et al. 2017). Moose that frequent the Old Crow Flats wetland complexes in northern Yukon are known to spend summer months within this area and then migrate 250 km to spend the winter within the Alaska Arctic National Wildlife Refuge (McCulley et al. 2017).

Moose habitat selection patterns vary among populations, individuals, seasons, and sexes (Clarke et al. 2017, McLeod and Clarke 2017). Furthermore, habitat use by moose can differ depending on the type of land cover and the availability of resources in a particular area. In northern Yukon, moose appear to frequent narrow strips of forest along the rivers (Photo 5-1), and VGFN elders have observed good moose habitat just south of the RSA along the Blackstone and Ogilvie rivers and the wetlands of the Blackstone Uplands (Sherry and Vuntut Gwitchin First Nation 1999, p. 303). In the south, moose frequent the treeline in the subalpine shrub zone. Moose in the Yukon also tend to concentrate in recent burns and along waterways with interconnecting ponds, marshes and meandering streams (Government of Yukon 2022).

Moose inhabit numerous stand-cover types and structural stages. Conifer stands are generally used primarily as cover to moderate extremes of cold, wind, heat, deep snow, and security from predators (Timmermann and McNicol 1988, McCulley et al. 2017). Early seral areas are usually shrub-dominated and used by moose because shrub species comprise more than 60% of a moose's annual diet (Renecker and Schwartz 2007). During the spring and summer, moose forage primarily on the leaves of woody plants, aquatic plants, and forbs. During winter, the diet shifts to highly lignified woody stems, resulting in higher ruminating times (Renecker and Hudson 1986). Plant form and twig diameter have also been shown to affect digestion rates, influencing moose winter foraging (Vivas et al. 1991). Some preferred moose forage species include:

- Willows (*Salix* spp.)
- Red-osier dogwood (*Cornus sericea*)
- Saskatoon serviceberry (*Amelanchier alnifolia*)
- Highbush cranberry (*Viburnum edule*)
- Mountain ash (*Sorbus sitchensis*)
- Scrub birch (*Betula glandulosa / nana*)

- Trembling aspen (*Populus tremuloides*)
- Lodgepole pine (*Pinus contorta*)
- Paper birch (*Betula papyrifera*)

These browse species may be used preferentially due to their height and growth form (Baker 1990, Van Ballenberghe et al. 1989). The palatability of shrub species can also vary from region to region. Soopolallie (*Shepherdia canadensis*) was recorded as an important forage species for moose on the Kenai Peninsula, Alaska (Edwards 1940) but appears to be unpalatable in other parts of the boreal forest (Rolley and Keith 1980). In northeast Alberta, the preferred browse species was Saskatoon serviceberry; even in areas where it was uncommon, the species was still heavily used when it was present (Nowlin 1978). In the Peace-Athabasca Delta, moose feed primarily on willow, red-osier dogwood, paper birch and balsam poplar. In one study done in the taiga region ranging from northwestern Manitoba to Great Slave Lake NWT, winter moose diet was mainly composed of *Betula papyrifera* bark (Thomas 1990). Risenhoover (1989) found that willows accounted for more than 94% of the winter moose diet in Denali National Park and Preserve.

Within the RSA, willows and scrub birch are the dominant browse species available for moose. Willows often form the predominant diet in other northern areas. Willows are well adapted to wetter soils and are commonly found in wetland and riparian habitats (Photo 5-2). Willows are also an early successional species and are often abundant in early seral habitats resulting from forest fires and human-disturbed areas (e.g., seismic lines, cutblocks, and road rights-of-way). Moose have been reported selecting previously burned habitats and areas within 100 m of streams and waterbodies, presumably due to the abundant forage (Wasser et al. 2011). In habitats with low availability of twigs and leaves, moose sometimes use a foraging technique called 'bark-stripping' where long, linear strips of bark are peeled from certain trees, such as aspen (LeResche and Davis 1973, Miquelle and Van Ballenberghe 1989). However, the bark is usually a relatively small component of moose diets (Miquelle and Van Ballenberghe 1989). It is unlikely to be a significant food source in Eagle Plains due to the dominance of spruce, whose bark is non-palatable.

Across Canada, heavily used areas by moose include wetlands, floodplains of major rivers, riparian areas, regenerating cut blocks and burns, and avalanche chutes. Their preferred habitat types include recent burns, logged areas, lake and river shores, willow and alder swamps and other wetland areas MacCracken et al. 1997). Food (including forage quality) and climate are considered important aspects of habitat for moose (Franzmann 1981). Analyses of moose range commonly stress the abundance, production, and use of woody shrubs as important characteristics when describing moose habitat requirements (LeResche and Davis 1973; Jung et al. 2009).

In Labrador, moose can be observed more often in riparian areas and hardwood stands and less often in string bogs, open conifer-lichen stands, barren hilltops than expected based on the availability of those habitat types during the winter (Jung et al. 2009). Riparian areas are often high suitability habitats for moose in winter due to the availability of high-quality forage species such as willows. Willows and birch found within the riparian shrub communities are often adjacent to a strip of closed-canopy conifer-dominated forest that provides thermal cover and snow interception. The combination of shrub communities and closed-canopy mature riparian forests offer a highly suitable habitat mosaic for moose (Jung et al. 2009).

During the winter, moose are influenced by snow depth, snow density and hardness. Moose movements begin to be impeded at snow depths of 70 cm, and moose strongly avoid areas with >100 cm of snow. Moose generally winter in areas where snow depths are less than 70 cm (Coady 1974, Franzmann 1981). In mountainous areas, where snow accumulation can vary substantially, this can result in strong patterns of seasonal range use, with moose avoiding mid an upper elevation where snow accumulation is higher. For example, in the Pelly-Macmillan River area (Central Yukon), moose concentrated along the major river valleys during late winter, where the combination of shallower snow under mature forest canopies and dense willows in wetland areas provided moose with optimal habitat (O'Donoghue 2005). However, snow is not expected to strongly influence the distribution or habitat selection in the RSA in most years. This is due to the relatively modest elevation range within the RSA. The average maximum snow depths of approximately 80 cm are just on the edge of the range that moose avoid (EDI Environmental Dynamics Inc. 2021). Over much of the winter, snow depths are less than 70 cm.

Predation is recognized as a major factor affecting the dynamic of moose populations (Gasaway et al. 1992, Ballard and Van Ballenberghe 2007). In general, prey species select security habitats at multiple scales based on various factors that can affect their perceived predation risk. Perceived security is also a dynamic factor that varies over time and is dependent on the density and behaviour of predators, including humans. Moose population growth and density in Yukon are thought to be limited by wolves (Hayes et al. 2003). Consequently, moose may avoid habitats that increase the potential for wolf encounters. However, predator avoidance may be a more prominent factor in habitat selection at the landscape scale than within a home range (Dussault et al. 2005). Habitat types with taller and denser vegetation likely provide some protection from wolves during winter. Habitat types that provide cover from predators may also contain taller trees that intercept snow, reducing snow depth and reducing the energy required to move.

At a minimum, security habitat should conceal a moose from predators. It can be assumed the security habitat for moose can be provided by any forest stand of adequate density with trees and shrubs taller than 2 m. Security cover for moose is most critical during spring calving when cow moose seek out islands and gravel bars on river floodplains for calving. At calving time, cow moose and calves can find secure habitat in dense deciduous or mixedwood stands, or tall shrubs with canopy cover >50% (MacCracken et al. 1997). During winter, deep, and persistent snow has been shown to have a greater impact on the physical condition of moose and thus increasing its risk of predation. Within one study (Dickie et al. 2020), moose seem to select riparian areas to facilitate movement instead of selecting them only for foraging opportunities. In the RSA, most wildlife trails were observed adjacent to riparian areas.



Photo 5-1. A moose observed adjacent to a narrow treed riparian area in the RSA (Photo provided by Palmer Environmental 2019).



Photo 5-2. Shrubby riparian area, on the edge of a burn, where willows have been browsed by moose.

5.2.3 DISTURBANCE

5.2.3.1 Fire

Burns are often a major factor affecting the distribution and abundance of moose across the boreal forest, with densities peaking 20 to 25 years after fire (LeResche 1974). Studies have shown that moose populations are often denser in burned areas where browse is of higher quality and greater abundance than adjacent, unburned areas (Gasaway et al. 1989). Moose have been reported selecting previously burned habitats that are 10–30 years old (Maier et al. 2005) and less than 40 years old (Wasser et al. 2011). Overall, fire creates favourable forage conditions for moose when regenerating shrubs are available for browse.

Several large wildfires have affected the RSA, occurring between 1959 and 2018. Areas that were affected by fire, and are still regenerating, were labelled with a fire disturbance code in the ELC vegetation maps. For older burn areas, the adjacent non-burned area was compared to the burn area to see if there was a noticeable difference in vegetation. Areas that did not have a noticeable difference were not characterized as fire disturbed as they were considered regenerated. The appropriate structural stage was assigned to reflect the stage of regeneration.

The post-fire successional pathways for many of the ecosystem units in the RSA were the same or very similar, making the differentiation of ecosystem units based on revegetation difficult. For example, almost all ecosystem units regenerate initially with deciduous shrubs (willow and scrub birch) and a mix of spruce and deciduous trees (primarily paper birch), and, as succession progresses, the prominence of spruce increases and deciduous shrubs and trees decreases. Often the post-fire succession also varied within an ecosystem unit depending on several factors, including the number and frequency of fires, the intensity of the fire, and the amount of permafrost present before and after the fire. Field observations suggest that hot fires likely melted a larger portion of the permafrost, permanently altering the moisture regime of the affected area; therefore, site moisture regimes are altered, and some sites do not return to the same ecosystem unit that had been established before the fire. From a moose habitat perspective, the result is that, except for some ecosystem units in riparian areas, the abundance of browse species is affected more by regeneration status and structural stage than ecosystem unit type.

The current structural stage for some of the more recent fire-disturbed areas was difficult to determine due to the range in age and variety of the imagery. To be consistent, the mappers assigned a shrub structural stage to all fire disturbed areas unless there was strong evidence suggestion another structural stage (i.e., a plot stating it was graminoid dominant, Photo 5-3).



Photo 5-3. Recent burn in a graminoid structural stage. Generally, regenerating shrubs become available as browse to moose about 10 years after fire disturbance.

5.2.3.2 Linear Features

Linear features are the primary type of anthropogenic disturbance in the Project area. However, there are many uncertainties regarding the extent, impacts, and recovery status of linear features in the area. Linear features include narrow, linear clearings on the landscape, typically used for transportation and seismic exploration activities. The Project area has numerous 2D seismic lines (e.g., Photo 5-4) and winter roads from previous exploration activities dating back to the 1960s. The majority of 2D exploration occurred between 1961 and 1984. Some 2D exploration occurred in 2001 that incorporated LIS techniques (Access Consulting Group and EBA Engineering Consultants Ltd. 2001, GEOTIR 2014). More recently, approximately 2,200 km of 3D low-impact seismic (LIS) exploration was conducted in a 325 km² area between November 2013 and April 2014 (GEOTIR 2014). This 3D exploration grid is near the centre of the Project area, spanning north and south of the Dempster Highway.

Linear features can affect predation risk on moose. Facilitated predation operates by increasing the spatiotemporal overlap and interactions between wolves and prey species (Serrouya et al. 2016, Dickie et al. 2020). The magnitude and extent of such overlap are dependent on the extent and use of linear features across the contiguous woodland habitat. Linear features may enhance predation rates by increasing predator abundance via travel corridors and, ultimately, by optimizing hunting efficiency (Serrouya et al. 2016, Dickie et al. 2017, DeMars and Boutin 2018). The degree to which facilitated predation operates and affects prey species is context dependent. The primary features possibly associated with facilitated predation in the Project area are winter roads/trails, 2D and 3D seismic lines, and the Dempster Highway. In winter, clearing and compaction of snow on linear features by plowing or snowmobiles can elevate predator movements (Keim et al. 2019b), further exacerbating predation risk.

The Dempster Highway runs roughly southwest to northeast through the southern half of the RSA. The RSA includes numerous winter roads (15 m average width) from previous exploration activities dating back to the 1960s. The Project will be accessed via existing and new winter roads. Moose have been shown to avoid human development and activity, but response varies by season, sex, and population. Reduced use by moose has been documented near roads (Rolley and Keith 1980).

Moose use of seismic lines is variable. In a study completed in northern Alberta by Dickie et al. (2020), moose selected to be closer to riparian areas and avoided being closer to linear features. Another study demonstrated that seismic lines could increase encounter rates between prey and predator by facilitating predator movement (McKenzie et al. 2012). Moose, wolves and even people tend to move faster on linear features since these features create a path with less visual and physical resistance to movement but in some cases the ease of movement can increase the risk of prey species encountering a predator. Dickie et al. (2020) noted that moose had tendency to move faster while on linear features which could support the theory that moose perceive LFs as a risk to wolf encounters.

Many uncertainties surrounding the ecological impacts and recovery potentials for linear features, particularly of 2D and 3D seismic lines, in the taiga ecosystem that characterizes Eagle Plains. EDI completed a linear feature study. The purpose of that study was to systematically describe and quantify the current conditions of linear features across the RSA by providing a baseline inventory and assessing the successional and functional status of linear features. Six types of successional pathways were defined on linear features in the Eagle Plains area (Table 5-1; after Simpson 2008).

Most sites surveyed (79%) were undergoing normal succession, and that vegetation was either in a low shrub (56.1%) or tall shrub (29.0%) structural stage along the linear features sampled. Almost all 3D plots were at a low shrub structural stage (67% less than 1 m), while 2D plots and winter roads were distributed more evenly through low shrub, tall shrub, and forested structural stages (21% greater than 4 m and 5% greater than 8 m). The analyses suggested that 2D seismic lines regenerate to a more shrub-dominated community relative to pre-disturbance conditions, 3D seismic lines had lower woody cover than off-line plots after five years of regeneration, and fire has the potential to increase shrub and tree growth on linear disturbances. Sightlines along linear features decreased substantially as the height of vegetation increased, and ease of travel along linear features decreased with the amount of woody cover. Fire played an important role in shaping functional recovery by increasing the amount of woody cover and the structural stage of vegetation.

Under normal succession, 2D seismic lines had 12% to 19% greater mean shrub cover than the corresponding off-line sites in burnt and unburnt conditions, respectively. In unburnt conditions, 2D seismic lines had considerably shorter and sparser trees than paired off-line plots, but in burnt conditions, the 2D lines showed denser trees. Burn status appeared to influence some successional classes. Magnified succession was more common at burnt sites (19 burnt versus 5 unburnt), while stagnated succession was more common at unburnt sites (3 burnt versus 7 unburnt). Sites on a normal successional trajectory did not appear to have any relationship to burnt status, while other successional classes were too uncommon to draw any conclusions.

Studies focusing on the use of linear features by moose are limited. However, Keim et al. (2019a) found that moose used 3D seismic lines the least and used well-defined 2D seismic lines and pipelines the most.



Photo 5-4. Example of a low shrub 2D seismic line within the RSA.

Table 5-1. Descriptions of successional classes documented in the RSA (Simpson 2008).

Successional Class	Description
Normal succession	Similar to adjacent forest, but at an earlier seral stage. E.g., young trees that may be surrounded by early successional shrub and forb or graminoid species. Disturbance is likely only the removal of trees and shrubs, with little to no disturbance to soil or permafrost.
Magnified succession	Increased moisture and nutrient availability due to soil disturbance. Often new seral species due to removal of original trees and shrubs. Resulting vegetation is likely shrub or deciduous tree dominant, typically with more productive growth than adjacent sites. Disturbance is likely the removal of trees and shrubs, with significant disturbance to soil or permafrost.
Retrogressive succession	Removal of insulating peat layer causes a change in the soil thermal regime. Active permafrost layer depth increases, releasing water content. Resulting habitat is likely moss, graminoid, forb, or low shrub dominated, with high moisture content. Disturbance includes the complete removal of trees and shrubs, and soil or active permafrost layer.
Successional stagnation	Suspension of succession at herb or low shrub stage. Likely dominated by graminoids; area may have been seeded. Check line age to differentiate from normal succession. Disturbance to soil or permafrost is likely. Ground may have been compacted.
No succession	No ecological differences except that the forest opening is linear instead of random. Disturbance is likely only the removal of trees and shrubs, with little to no disturbance to soil or permafrost.
Recent disturbance	Newer seismic line where successional patterns cannot yet be determined. Line age was checked to differentiate from other successional patterns.

5.2.4 HABITAT SUMMARY

The late winter season is often a difficult time for moose due to the limited availability of forage and increased energetic demands to move through crusted or deep snow. A winter habitat suitability map was developed for moose in the RSA to identify high-suitability winter forage habitat areas. Moose select winter habitat based on three criteria: food availability, snow conditions, and predator avoidance (Dussault et al. 2005). Within the RSA, moose primarily select winter habitat based on browse availability.

The development of the moose habitat model will focus on the following key points:

- Habitat use is believed to be driven by forage availability.
- Winter is the most limiting season for forage availability.
- Winter forage in the RSA is primarily willow species.
- Areas with high willow cover in the RSA are riparian areas, burn areas and some mesic and moist ecosystem units with moderate willow understory.
- Elevation and snow are not likely a significant factor given the limited topography within the RSA; and
- Linear features like seismic lines and trails may provide small patches with elevated willow cover, but their extent are too small to affect habitat selection.

Willows are the primary winter food for moose and signs of moose browsing were commonly observed in the areas that contain abundant willow during the Project baseline surveys. As willow is an early succession species, the shrub is most abundant in disturbed areas such as burns. Anthropogenic disturbances in the RSA, such as 2D seismic lines, may also have a high willow cover, but the extent of these areas is too small to provide significant forage opportunities to moose. Outside of regenerating areas, the high cover of willows is mainly associated with riparian shrublands along streams and disclimax shrublands within the RSA.

5.2.5 HABITAT SUITABILITY MAPPING

Habitat suitability mapping identifies the current ability of an ecosystem unit to provide certain life requisites for a given wildlife species or provide the environmental conditions needed for cover, food and space. A habitat suitability rating is a value given to each structural stage of each ecosystem unit in a project area. The rating is the suitability value assigned to a habitat for its potential to support a particular species for a specified season and activity. It is often expressed as a percentage of the best habitat. It also reflects the species' expected use of a habitat (Resources Inventory Committee 1999c). Habitat ratings are a product of knowledge and assumptions.

The important role of vegetation is incorporated into any wildlife habitat evaluation. Biophysical factors which are considered to influence wildlife habitats can include vegetation type, slope, aspect, and other geographic features. Since vegetation cover type is an expression of various biophysical conditions such as soil moisture, aspect, and relief, it generally offers a current and valid prediction of habitat for many terrestrial wildlife species, at least at broad scales.

The wildlife habitat evaluation is essentially a modelling process that has two primary requirements:

1. Good knowledge of the habitat needs of a species, and how these habitat needs relate to the described ecosystem units; and
2. A standard approach to establishing wildlife species-habitat relationships and ratings for ecosystem units consistently.

The suitability maps use ecosystem attributes for assigning suitability values to a polygon. Wildlife habitat suitability ratings are a widely applicable method of wildlife habitat assessments. While there are recognized limitations to any habitat evaluation and assessment procedure, suitability ratings using ecosystem unit classification have the following advantages (Resources Inventory Committee 1999c):

1. It is predictive.
2. The methodology is consistent.
3. Large areas can be covered.
4. It is flexible and can be applied to a range of map scales, wildlife species, and general to detailed habitat assessments.
5. It provides strategic planning for habitat management.
6. It ties the wildlife resource to other resource uses (e.g., forestry, recreation, and corridor analyses).

The results of this type of model can provide information on the suitability, amount and distribution of potential moose foraging habitat within the RSA.

5.3 METHODS

The moose habitat suitability model was based on habitat suitability mapping standards and methodology (Resources Inventory Committee 1999c). This methodology is commonly used in habitat assessment. The habitat suitability methodology involves three key steps:

1. Selection of relevant habitat variables to include in the model.
2. Development of rating scores for each habitat variable.
3. Building a relationship among the variables to produce overall habitat suitability scores.

A moose winter forage habitat suitability model was developed based on professional opinion and the availability of suitable datasets. Land cover datasets (vegetation, linear disturbances, and fire history) were considered for the suitability modelling. Other variables were considered but not included in the model. They were assumed to correlate with the vegetation cover types and associated structural stages.

5.3.1 RATING SCHEME

This model uses a categorical rating scheme where each category represents an ordinal measure of habitat suitability. The number of categories used in a rating scheme reflects knowledge of the species' ecology and habitat use (Resources Inventory Committee 1999c). For species like moose, where our understanding of the

species and the availability of relevant base environmental data to support habitat modelling is relatively good, 4- and 6-class schemes are typically used. A 6-class system was initially chosen to rank the base habitat units because the 6-class system facilitated finer differentiation of ratings across the numerous habitat types that occur in the RSA (Table 5-2). However, for interpretive purposes, the ratings were generalized into a 4-class system for most model outputs. In the 4-class system, High and Moderately-High were combined into one category (High) and Nil and Very Low were combined into one category (Nil/Very Low).

High and Moderately High suitability habitat provides some of the best winter foraging opportunities for moose within the RSA. Moderate suitability habitat provides some winter foraging opportunities. Low and very low-quality habitat has limited winter foraging opportunities for moose in the RSA. Nil suitability habitat provides no winter foraging opportunities. It is often associated with features without vegetation (e.g., rivers, streams, roads) or with very sparse vegetation cover.

Within the RSA, the highest rated areas included natural shrublands and regenerating burns in riparian areas, as well as small extents of deciduous and mixed-wood ecosystems on mesic and moist sites. Moderate rated areas were predominantly regenerating burns on mesic to wet sites. Low rated sites were mostly undisturbed stands of open, stunted spruce on mesic to wet sites, ranging from tall shrub to old forest structural stages. Differentiating ratings between Moderate and Low areas was often difficult. Many sites, both burned and unburned, had average willow cover less than 15%, with high variation in cover among sites in the same ecosystem units. Generally, 7% willow cover was used as the threshold to differentiate between Moderate and Low sites. This is a relatively low value of willow cover but using a higher threshold would have resulted in large areas of regenerating burn being classified the same (Low) as undisturbed areas. In Eagle Plains, a substantial amount of total winter forage appears to occur within large areas with relatively low willow cover (i.e., the Moderate suitability areas).

Although the vegetation field data confirmed that the amount of shrubby browse (i.e., willow cover) was greater in fire disturbed areas than undisturbed areas, the amount of browse in regenerating burns was not as high as reported in some other studies. For example, the percent cover of willow in burns in the most common ecosystem unit, EU33-Moist Spruce Labrador Tea, was 11% compared to 7% in unburned areas. As a result of this pattern, areas with fire disturbance attributes in the ecosystem mapping database were generally rated one class higher than the same ecosystem unit that was not burned (mostly Moderate for burns and Low for unburned areas).

Table 5-2. Rating scheme used to rate moose habitat suitability.

Rating	Code	HS Score	Description
High	1	95	Suitable. Conditions at optimal. The best foraging opportunities for moose are expected to be found in these areas of the RSA. Willow percent cover is greater than 15%. Includes both disclimax and seral shrublands areas.
Moderately High	2	75	Suitable. Conditions near optimal. Above average foraging opportunities for moose is expected to be found in these areas. Willow percent cover also typically greater than 15% but, on average, less than High.
Moderate	3	50	Suitable. Suitability is lower than optimal conditions but meet minimum requirements from an energy balance perspective. Willow percent cover generally ranges between 7% to 15%.

Rating	Code	HS Score	Description
			Although willow cover is moderate to low in absolute terms, the large extent in this rating category contributes a substantial amount of the total available forage across the RSA.
Low	4	30	Suitability Unknown. Areas in this rating class offer some forage but the amount is so low and dispersed that the energetic return of using these areas are, on average, mostly negative. Willow species present but typically less than 7% cover.
Very Low	5	10	Unsuitable. Willow species presence and cover is usually less than 2%. Moose are expected to strongly avoid these areas.
Nil	6	0	Unsuitable. Willow presence not expected.

5.3.2 SELECTION OF RELEVANT HABITAT VARIABLES

Potentially relevant foraging habitat variables were identified from published literature, other habitat models, and personal experience. A suite of different habitat variables was identified as candidates in this habitat model, based on their known importance to winter foraging ecology (Table 5-3). The variables were evaluated for inclusion based on availability in GIS database, the ecological relevance to moose in the RSA, and relationships found in other studies. Based on these criteria, ecosystem unit, structural stage data and fire disturbance, all from the ELC mapping database, were included in the moose habitat modelling. Other variables were not included in the model as they were not expected to play a major role in winter habitat use by moose or because they were correlated with one of the three selected variables.

Distance to riparian areas was considered for inclusion in the model. Riparian areas are important foraging habitats for moose (Clarke et al. 2017, McCulley et al. 2017). Within the RSA, riparian areas generally contain abundant browse species relative to the adjacent ecological units. The ELC developed ecosystem units specific to riparian habitats. The ecosystem unit data accurately represent increased habitat suitability in riparian areas found as narrow strips along most watercourse and drainages in the RSA. Therefore, a variable for distance to riparian was redundant and was not included in the model.

Elevation was considered as a variable for inclusion in the model. In winter, moose generally occur at lower elevations to minimize the energetic costs of travelling through deep snow. Moose generally start avoiding areas with >70 cm of snow and rarely occur in areas with >100 cm. However, elevation within the rolling topography of the RSA does not vary substantially (range = 343–752 masl) and was likely not a significant driver of moose distribution. Therefore, elevation was not included as a variable in the model.

Slope was considered as a variable for inclusion in the model. Moose avoid very steep slopes (i.e., generally >35 degrees). In more southerly locations, moose will select moderately steep, south aspect slopes in winter where the combination of slope and aspect reduces snow depth and favours shrubby browse cover. However, steep slopes >35 degrees do not occur in the area, and south aspect slopes do not play a significant role in snow depths at this northern latitude. Therefore, slope was not included as a variable in the model.

Linear features were considered for inclusion in the model. LFs were surveyed in the RSA as a companion study for exploration project proposal (EDI Environmental Dynamics, unpublished study). LFs that were classified as 2D had an average width of 5.4 m and, under normal succession, had greater mean shrub cover than the corresponding off-line sites. The 3D lines had narrower widths and were not as shrubby, or shrubs

were not consistent in shrub cover and species present. The few winter roads also were not consistent in available browse species. The greater shrub cover does not signify the presence of higher quality browse species such as willows. The combination of shrub species cover found within LFs, and the small extent of LF did not warrant including them as a variable in the model because these two factors would not substantially affect habitat use by moose.

Table 5-3. Summary of habitat variables commonly associated with moose habitat suitability from published literature relevant to the Regional Study Area.

Habitat Variable	Ecological Rational	Included in Model (Yes or No)
Ecosystem Unit (ELC)	Ecosystems units have specific vegetation communities associated with them and are the best predictor of winter browse species occurrence.	Yes
Structural Stage (ELC)	Moose typically select shrub structural stages or open mature forest habitats as forage habitat.	Yes
Distance to Riparian	Any shrubby feature influenced by a creek or stream was given a riparian code in the ELC. ELC data more accurately represent increased habitat quality in riparian forests than the distance to riparian	No
Elevation	Elevation can strongly affect snowpack depth, with depths >70 cm limiting winter movements by moose. The limited range in elevation within RSA (343 – 752 m), combined with average winter snowpacks just reaching critical depths for moose, is assumed to be insufficient to affect moose distribution in winter.	No
Slope	Moose avoid steep slopes (>35%) and prefer south-facing slopes. A combination of slope and aspect reduces snow depth and favors shrubby browse cover. However, steep slopes >35 degrees do not occur in the area, and south aspect slopes do not play a significant roll in snow depths at this northern latitude.	No
Fire History (ELC)	Fire may increase forage habitat quality for moose, but it is dependent on time since the disturbance and ecosystem unit. The ELC mapping accounts for the fire history by using the structural stage and a disturbance code.	Yes
Linear features	Moose may avoid linear features due to increased predation risk depending on the region. Linear features may provide foraging opportunities. Linear features within the RSA may affect habitat quality positively or negatively, dependent on ecosystem unit and time since disturbance.	No

5.3.2.1 Ecological and Landscape Classification Based Variables

Ecosystems units have specific vegetation communities associated with them and are the best predictor available of winter browse species occurrence. Moose typically select shrub structural stages or open mature forest habitats as forage habitats. The ecosystem unit and structural stage variables are based on the recently completed ELC mapping of the RSA. A summary of ELC methods and results are presented here. Refer to

the separate baseline report for more detailed information about the ELC mapping (EDI Environmental Dynamics Inc 2021).

Ecosystem Unit Variable

ELC mapping refers to an integrated approach to mapping and classifying units of land according to their ecological similarity (Environment Yukon 2016a). ELC mapping aims to provide information on the biological and physical characteristics of various landscape components to facilitate a range of interpretations and assist in sustainable management (Rowe and Sheard 1981, Environment Yukon 2016a). For example, defining ecosystem units (i.e., ecosites, ecological communities) with similar vegetation, site and soil characteristics can provide information on the current condition of vegetation, can facilitate the development of vegetation mitigation measures during infrastructure development and aid in assessing habitat suitability for wildlife across a landscape.

To best meet the needs of the Project, a manual ELC mapping approach was completed, where mappers examine and interpret digital ortho-imagery to delineate and attribute polygons with ecological information manually. Using existing GIS datasets, this method typically provides a higher level of detail and accuracy than predictive modelling approaches. The mapping and classification methodology conforms to the Yukon Ecological and Landscape Classification and Mapping Guidelines, Version 1.0 (Environment Yukon 2016a), and the Standard for Terrestrial Ecosystem Mapping in British Columbia (Resources Inventory Committee 1998b) were used as guidelines.

To complete the ELC mapping of the RSA, new broad-ecosystem classification units were developed that had similar floristic composition and clearly interpretable ecological context in terms of site-scale climate, landscape position, substrate, hydrology conditions, and moisture and nutrient regimes. The goal was to develop Project-specific ecosystem units representing the range of ecological communities within the RSA while being reliably and repeatedly identifiable from a mapping perspective. The final ELC system used for the Project merged the methodology outlined by the YBEC system with aspects of the BEC system used in BC and referenced some of the existing units.

The most common ecosystem unit mapped in the RSA is Moist Spruce – Labrador Tea (Code 33) (44%) followed by Moist Spruce – Alder – Labrador Tea (Code 34) (12%) and Mesic Black Spruce – Alaska Paper Birch (Code 04) (9%) (Table 5-4). The least common (0%) ecosystem units mapped in the RSA are Dry Sparsely Vegetation (Code 10) and Mesic Birch – Willow (Code 02), and Moist Birch – Willow (Code 36). Both Birch – Willow ecosystem units are influenced by anthropogenic disturbances. Other less common ecosystem units that occur more naturally are Dry Aspen (Code 17), Mesic White Spruce – Alaska Paper Birch – Alder (Code 03), and Wet Shrub Scrub Birch – Graminoid (Code 45).

Table 5-4. Ecosystem units mapped in the Eagle Plains RSA.

Code	Name	Total Area (ha)	% of RSA	Average percent cover of *Salix* sp.
10	Sparsely Vegetated	2.6	0.0	No data
14	Dry Spruce-Lichen (Conifer)	1,826.5	0.8	5.3%
15	Dry Aspen-Lichen (Deciduous)	280.8	0.1	No data
16	Dry Spruce-Birch-Lichen (Mixedwood)	2,103.6	0.9	4.5%
17	Dry Aspen (Deciduous)	80.1	0.0	No data
02	Mesic Birch - Willow	90.5	0.0	22.0%
03	Mesic White Spruce – Alaska Paper Birch – Alder	98.3	0.0	No data
04	Mesic Black Spruce – Alaska Paper Birch (Mixedwood)	21,150.0	8.9	4.6%
05	Mesic Alaska Paper Birch (Deciduous)	11,496.0	4.8	12.5%
06	Mesic Black Spruce – Labrador Tea (Conifer)	7,463.5	3.1	12.2%
20	Shrubby Riparian Birch – Willow	860.2	0.4	27.6%
21	Riparian White Spruce – Prickly Rose	192.1	0.1	12.0%
22	Riparian Spruce – Birch - Willow	674.4	0.3	15.3%
23	Drainage Shrubby Riparian	4,454.2	1.9	57.0%
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	9,129.9	3.8	14.2%
33	Moist Spruce – Labrador Tea	103,696.5	43.5	6.6%
34	Moist Spruce – Alder – Labrador Tea	27,428.6	11.5	6.0%
35	Moist Spruce – Scrub birch – Labrador Tea	12,163.3	5.1	5.5%
36	Moist Birch – Willow	33.4	0.0	39.0%
41	Wet Shrub – Tamarack	177.3	0.1	1.7%
42	Wet Shrub – Black Spruce – Tussock Cottongrass	14,517.0	6.1	4.3%
43	Wet Shrub – Black Spruce - Sphagnum	3,315.6	1.4	5.6%
44	Wet Shrub – Scrub Birch – Tussock Cottongrass	6,844.7	2.9	8.3%
45	Wet Shrub – Scrub Birch – Graminoid	98.7	0.0	10.0%
46	Wet Black Spruce – Labrador Tea – Cladonia	2,498.0	1.0	7.0%
47	Wet Black Spruce – Tussock Cottongrass – Sphagnum	4,232.3	1.8	4.0%
48	Wet Black Spruce – Carex	196.6	0.1	14.0%
B1	Bog – Black spruce – Lichen	764.7	0.3	0.0%
B2	Bog – Black Spruce – Sphagnum	1,960.9	0.8	2.0%

Code	Name	Total Area (ha)	% of RSA	Average percent cover of *Salix* sp.
F	Fen	42.5	0.0	9.0%
M	Marsh	59.5	0.0	3.2%
AN	Anthropogenic	34.9	0.0	0
ES	Exposed Soil	14.5	0.0	0
Fa	Flood Active Channel	5.1	0.0	No data
LA	Lake	6.5	0.0	0
PD	Pond	130.4	0.1	0
RI	River	457.1	0.2	0
RZ	Road	58.9	0.0	0
	Total Area	238,640		

Structural Stage Variable

Within the ELC database, the structural stage attribute (Table 5-5) describes the appearance of a stand or vegetation community and defined by the codes and criteria listed in the Field Manual for Describing Yukon Ecosystems (Environment Yukon 2017).

Most of the RSA is mapped in a Shrub structural stage (74%), with 45% of the RSA in a Low Shrub structural stage (Table 5-5). Approximately 1% of the RSA is in an Old Forest structural stage, and 21% is in a Mature Forest structural stage.

Table 5-5. Structural stages mapped in the Eagle Plains RSA.

Code	Structural Stage	Criteria	Area (ha)	% of RSA
1	Non-vegetated	No vegetation or less than 5% established vegetation, often due to recent disturbance (e.g., placer mining) or unvegetated rock.	8.0	0
2	Sparse / cryptogram	Either the initial stages of primary and secondary succession or a cryptogram community maintained by environmental conditions; sparsely vegetated or dominated by bryophytes and lichens; may be prolonged where there is little or no soil development (e.g., bedrock).	76.9	0.03
2a	Sparse (5–10% vegetation cover)	5–10% vegetation cover.	2.6	0
2b	Bryoid	Bryophyte-dominated	0	0
2c	Lichen	Lichen-dominated	0	0

Code	Structural Stage	Criteria	Area (ha)	% of RSA
3	Herb	Early successional stage or herbaceous communities maintained by environmental conditions or disturbance (e.g., wetlands, post-fire forest succession); herb dominated, including forbs, graminoids and ferns; some invading or residual shrubs and trees may be present but are usually sparse or absent; many herbaceous communities are continually maintained in this stage.	7.8	0
3a	Forb - dominated	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by non-graminoid herbs, including ferns.	0	0
3b	Graminoid – dominated	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by grasses, sedges, reeds and rushes.	161.1	0.07
3c	Aquatic	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by floating or submerged aquatic plants; does not include sedges growing in marshes with standing water.	0	0
3d	Dwarf shrub	Communities dominated (greater than 1/2 of the total herb cover) by dwarf woody species, such as kinnikinnick or dwarf willows.	0	0
4	Shrub	Early successional stage or shrub communities maintained by environmental conditions or disturbance (e.g., wetlands, flooding, post-fire forest succession); dominated by shrubby vegetation; either dominated by shrubby vegetation, including tree seedlings/saplings, or if sparsely vegetated overall, the dominance of shrubs characterizes the community as a shrubland. This may include sites where trees are stunted due to the presence of permafrost, preventing the stand from reaching a higher structural stage.	10,196.7	4.3
4a	Tall shrub	Communities dominated by tall shrub layer vegetation - woody plants > 2m tall and ≤ 7 cm dbh; may be a successional stage or may be in this stage perpetually due to environmental conditions or disturbance.	57,934.3	24.3
4b	Low shrub	Communities dominated by low shrub layer vegetation - woody plants < 2m tall; may be a successional stage or may be in this stage perpetually due to environmental conditions or disturbance.	107,861.2	45.2
5	Pole sapling	Trees > 5m tall and > 7 cm dbh, typically densely stocked. Self-thinning and vertical structure are not yet evident in the canopy. Younger stands are vigorous (usually > 15–20 years old); older stagnated stands (up to 100 years old) are also included; time since disturbance usually < 40 years; up to 100+ years for dense (5000 – 15000+ stems per ha) stagnant stands.	554.8	0.2
6	Young Forest	Self-thinning has become evident, and the forest canopy has begun to differentiate into distinct layers. A more open stand than the pole/sapling stage.	8,322.6	3.5

Code	Structural Stage	Criteria	Area (ha)	% of RSA
7	Mature Forest	Trees established after the last stand-replacing disturbance have matured; a second cycle of shade tolerant trees may have become established; shrub and herb understories become well developed as the canopy opens up.	50,518.9	21.2
8	Old Forest	Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstory. Fire maintained stands may have a 'single-storied' appearance. Very old stands having complex structure with abundant large-sized trees, snags and CWD; snags and CWD occurring in all stages of decomposition; stands are comprised entirely of shade-tolerant overstory species with well-established canopy gaps.	2,302.7	1.0
n/a	Not Applicable (River, etc.)		692.4	0.3
	Total RSA		**238,640**	

5.3.2.2 Fire History

Fire disturbance was considered as a variable in the model. Numerous studies in boreal and sub-boreal regions have found that moose select areas regenerating from fires. Recent burns and post-fire clearings are generally considered optimal foraging habitat for moose. Forest fires are a significant component of the landscape ecology of the Eagle Plains Ecoregion. Typically, regenerating burns contain higher cover of shrubby browse species than undisturbed areas. This includes both deciduous shrubs like willow, as well as sapling deciduous trees like aspen and paper birch. Although burns are classified as Low and Tall Shrub in the ELC, structural stage alone does not uniquely identify them. Large extents of disclimax, stunted black and white spruce ecosystem unit types were also classified as Tall Shrub.

Numerous studies and data from the ELC mapping, indicate that fire disturbance results in increased shrubby browse cover during the Low and Tall Shrub structural stages of regeneration, and that regenerating burns are selected by moose in winter. Therefore, fire disturbance was included in the model.

5.3.3 WILDLIFE HABITAT RATINGS

Qualitative, categorical habitat suitability ratings were developed for each combination of ecosystem unit and structural stage in a lookup table format. For the Shrub structural stages separate ratings were provided depending on whether the area was recently burned or not. The difference in the amount of browse cover was minimal in other structural stages according to burn status and burned and unburned areas were rated equivalently. The development of ratings was based on expert opinion and primarily by the following assumptions:

- Winter habitat suitability is primarily driven by the amount of shrubby browse species that are predicted to occur and especially the percent cover of willow species. The average percent cover

of willow species by ecosystem unit per structural stage was calculated using vegetation data collected during baseline surveys (Section 5.6.1).

- Low shrub structural stages, including disclimax shrublands (wetlands and shrubby drainages) and regenerating burns, generally offer the highest value forage and are generally rated High.
- The suitability of tall shrub areas depends on disturbance status. Tall shrub areas regenerating from fire disturbance are also rated Moderate (mostly) to High, depending on the ecosystem unit. However, Tall shrub stages also include extensive areas of disclimax stunted spruce (including multiple EUs) that generally offer low to moderate browse species, which are rated accordingly.
- Older structural stages (5–8) can have similar browse and are mostly rated depending on the EU (Table 5-4). On average stage 7 and 8 tend to have slightly more browse than stages 5 and 6.

Every combination of ecosystem unit and structural stage was assigned in initial habitat suitability score based on a 6-class rating scheme (Table 5-6). If there was no structural stage listed for an ecosystem unit, it received a rating of 6 (Nil) for moose winter forage.

The extent of areas with high cover of preferred browse species (mostly willow) is limited in the RSA. The ecosystem unit by structural stage combinations with >15% willow cover was generally rated High (1) and Moderately High (2) and account for only 12% of the extent in the RSA (Photo 5-5 to Photo 5-9). Large extents of the RSA have relatively low willow cover of 5–15% and were rated as Moderate (3) and Low (4) (Photo 5-10 to Photo 5-14). Differentiating the classifications between Low and Moderate was difficult because the differences in willow presence among different sites were not consistent, and variation in willow cover within the same site type was large (i.e., resulting in overlapping confidence intervals across sites). The basis for classifying sites as Low or Moderate considered (i) average cover of willow from field plots (>7% favouring classification to Moderate), (ii) fire history (fire disturbance within 40 years favouring classification to Moderate), and (iii) a qualitative assessment of the potential for each EU and structural stage combination to support willow and other browse species.

Although Moderate and Low rated habitats have relatively low cover of willow in an absolute sense, they likely provide a substantial proportion of total winter forage for moose in the RSA due to the large extents that Moderate and Low suitability habitats cover. That is, in Eagle Plains the overall, total availability of winter forage for moose appears to be distributed in relatively low levels across large portions of the RSA, versus being concentrated in relatively small portions of the landscape, which is typical in more mountainous portions of Yukon.

Overall, EUs in sparsely vegetated or herbaceous structural stages, non-vegetated EUs and certain wetland EUs were assigned Very Low (5) or Nil (6) ratings unless the presence of willow cover was observed (Photo 5-15 and Photo 5-16).

The effect of fire disturbance in boreal ecosystems in enhancing moose browse as the stand regenerates through the low shrub and tall shrub structural stages are well documented. Although evidence of this was observed in Eagle Plains, the degree to which regenerating burns resulted in an elevated cover of browse

species was somewhat muted compared to values reported in other studies. For example, for the most extensive EU, Moist Spruce-Labrador Tea (code 33) (comprising 43% of the RSA), the average percent cover of willow was 11% in burns compared to 6% in unburned areas (Photo 5-11 and Photo 5-12). Similar patterns were evident for most other moist and wet EUs. On average, fire disturbance resulted in a modest increase in willow cover. As a result, areas with fire disturbance within the last 40 years were generally rated one class higher than unburned areas. Most frequently, this resulted in a rating change from Low to Moderate.

Table 5-6. Moose Habitat Ratings Table.

Map Code	Ecosystem Unit Name	Structural Stage														
		1	**2**	**2a**	**3**	**3b**	**4**	**4a**	**4b**	4_F	4a_F	4b_F	**5**	**6**	**7**	**8**
02	Mesic Birch – Willow	6	6	6	6	4	1	1	1	1	1	1	2	2	3	3
03	Mesic White Spruce – Alaska Paper Birch – Alder	6	6	6	6	5	3	3	3	3	3	3	4	4	3	3
04	Mesic Black Spruce – Alaska Paper Birch	6	6	6	6	5	3	3	3	3	3	3	4	4	3	3
05	Mesic Alaska Paper Birch	6	6	6	6	5	2	2	2	2	2	2	3	2	2	2
06	Mesic Black Spruce – Labrador Tea	6	6	6	6	5	3	3	3	2	2	2	4	4	4	3
10	Sparsely Vegetated	6	6	6	6	5	4	4	4	4	4	4	5	5	5	5
14	Dry Spruce – Lichen	6	6	6	6	5	4	4	4	3	3	3	4	4	3	3
15	Dry Aspen – Lichen	6	6	6	6	5	3	3	3	3	3	3	4	4	3	3
16	Dry Spruce – Birch – Lichen	6	6	6	6	5	4	4	4	3	3	3	4	4	3	3
17	Dry Aspen	6	6	6	6	5	3	3	3	3	3	3	4	4	3	3
20	Shrubby Riparian Birch – Willow	6	6	6	6	4	1	1	1	1	1	1	2	2	2	2
21	Riparian White Spruce – Prickly Rose	6	6	6	6	4	1	1	1	1	1	1	2	2	2	2
22	Riparian Spruce – Birch – Willow	6	6	6	6	4	1	1	1	1	1	1	2	2	1	1
23	Drainage Shrubby Riparian	6	6	6	6	4	1	1	1	1	1	1	2	2	2	2
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	6	6	6	6	4	2	2	2	2	2	2	3	3	3	3
33	Moist Spruce – Labrador Tea	6	6	6	6	4	4	4	4	3	3	3	3	3	3	3
34	Moist Spruce – Alder – Labrador Tea	6	6	6	6	5	4	4	4	3	3	3	4	4	4	4
35	Moist Spruce – Scrub Birch – Labrador Tea	6	6	6	6	5	4	4	4	3	3	3	4	4	4	4
36	Moist Birch - Willow	6	6	6	6	4	1	1	1	1	1	1	2	2	3	3
41	Wet Shrub – Tamarack	6	6	6	6	5	5	5	5	4	4	4	5	5	5	5
42	Wet Shrub \ Black Spruce – Tussock Cottongrass	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
43	Wet Shrub \ Black Spruce – Sphagnum	6	6	6	6	5	4	4	4	3	3	3	4	4	4	4

Map Code	Ecosystem Unit Name	Structural Stage														
		1	**2**	**2a**	**3**	**3b**	**4**	**4a**	**4b**	4_F	4a_F	4b_F	**5**	**6**	**7**	**8**
44	Wet Shrub \ Scrub Birch – Tussock Cottongrass	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
45	Wet Shrub \ Scrub Birch – Graminoid	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
46	Wet Black Spruce – Labrador Tea – Cladonia	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
47	Wet Black Spruce – Tussock Cottongrass – Sphagnum	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
48	Wet Black Spruce - Carex	6	6	6	6	4	3	3	3	3	3	3	4	4	3	3
B1	Bog – Black Spruce – Lichen	6	6	6	6	5	5	5	5	4	4	4	5	5	5	5
B2	Bog – Black Spruce – Sphagnum	6	6	6	6	5	5	5	5	4	4	4	5	5	5	5
F	Fen	6	6	6	6	4	5	5	5	4	4	4	5	5	5	5
M	Marsh	6	6	6	6	5	5	5	5	5	5	5	5	5	5	5
AN	Anthropogenic	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
ES	Exposed Soil	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Fa	Flood Active Channel	6	6	6	6	4	3	3	3	3	3	3	4	4	4	4
LA	Lake	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
PD	Pond	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
RI	River	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
RZ	Road	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6



Photo 5-5. Low shrub – shrubby riparian birch – willow habitat (code 20) rated as High winter forage habitat.



Photo 5-6. Low shrub – drainage shrubby riparian habitat (code 23) rated as High winter forage habitat.



Photo 5-7. Tall shrub – moist birch – willow habitat (code 36) rated as High moose winter forage.



Photo 5-8. Low shrub – moist shrub\scrub birch – Labrador tea – willow habitat (code 31) rated as Moderately High moose winter forage.



Photo 5-9. Young forest – mesic Alaska paper birch habitat (code 05) rated as Moderately High moose winter forage.



Photo 5-10. Mature forest – wet black spruce – carex habitat (code 48) rated as Moderate moose winter forage.



Photo 5-11. Shrubby burnt – moist spruce – Labrador tea habitat (code 33) rated as Moderate moose winter forage habitat (note that this is not rated higher than Moderate because much of the shrub cover is less preferred scrub birch).



Photo 5-12. Unburnt – moist spruce – Labrador tea habitat (code 33), in Tall Shrub structural stage, was rated as low moose winter forage habitat.



Photo 5-13. Tall shrub – wet black spruce – tussock cottongrass – Sphagnum habitat (code 47) rated as low moose winter forage habitat.



Photo 5-14. Mature forest – mesic black spruce – Labrador tea habitat (code 06) rated as low moose winter forage



Photo 5-15. Low shrub – bog – black spruce – Sphagnum habitat (code B2) rated as very low moose winter forage.



Photo 5-16. Low shrub – bog – black spruce – lichen habitat (code B1) rated as very low moose winter forage.

5.3.4 MODEL STRUCTURE

In the ELC map, each polygon contains up to three components. For example, a polygon could contain 80% EU34-Moist Spruce – Alder – Labrador Tea and 20% EU22-Shrubby Riparian Birch – Willow. These composite polygons occur because the pattern of ecosystem distribution occurs as a set of small patches that are too small to map as separate individual polygons. To account for this issue of composite polygons, habitat ratings were applied in two ways (1) an area weighted average of the habitat suitability scores for the components within each polygon, and (2) the proportion of High suitability habitat in each polygon.

The area-weighted average score was calculated using the habitat suitability scores from Table 5-2 and the decile proportion for each polygon component, following equation:

$$ELC_r = \frac{\sum_{i=1}^{n} w_i X_i}{\sum_{i=1}^{n} w_i}$$

Where ELC_r is the weighted average score, w_i is the decile proportion for each polygon component, and X_i is the habitat rating for each polygon component from Table 5-2. An example is provided in Table 5-7 for a polygon with two components:

Although this weighted average approach is a good approach for summarizing average habitat suitability across the study area, it has the disadvantage that, with the averaging process, you lose track of the occurrence of small extents of High suitability areas. This issue is addressed in the second version of model outputs, mapping the proportion of High suitability habitats within each polygon.

The two types of outputs compliment each other for assessment and management at different scales. The weighted average output is intended to be used for strategic assessments and planning, such as assessing the overall effects of the Project on moose habitat, or to compare the relative suitability of moose habitat in one sub-watershed to another. The proportion of High suitability habitat can be used to support finer-scale operational measures, such as locating roads and well sites to avoid high suitability winter moose habitat.

Although the initial habitat ratings for each ecosystem unit/structural stage/fire disturbance combination used a 6-class rating scheme, the composite ratings of the ELC polygon scores were generalized to a 4-class system for simpler interpretation, essentially combining Moderately High and High, and Nil and Very Low.

Due to the small size of many of the High and Moderately High habitats areas, they were frequently formed the second or third component of composite ELC polygons. Consequently, these areas of High were often 'lost' when calculating the weighted average rating for the polygon (i.e., the polygon they were in ended up being rated Moderate or even Low overall). To account for this issue, the amount and location of High and Moderately High areas were examined separately from the polygon weighted average score. This was done by mapping the amount of High and Moderately High areas in each polygon. For example, a polygon with a weighted average habitat score of Low, might contain 20% High+Moderately High.

Table 5-7. An example of a multiple component polygon habitat scoring.

Component	Proportion	Ecosystem Unit	Structural stage	Burn Status	Habitat Score
1	0.8	Moist Spruce – Alder – Labrador Tea	Tall Shrub	Not Burnt	30
2	0.2	Shrubby Riparian Birch – Willow	Low Shrub	Not Burnt	95

ELCr = 0.8*30 + 0.2*95 = 43, which corresponds to an overall categorical rating of Low

5.4 RESULTS AND DISCUSSION

The amounts of predicted moose winter habitat in the RSA are presented for the finer-scale 6-class rating scheme before averaging scores within ELC polygons in Table 5-8, and the consolidated 4-class rating scheme after averaging scores within ELC polygons, in Table 5-9. As mentioned in the Methods, the 4-class scheme essentially combines the High and Moderately High classes and the Nil and Very Low from the 6-class scheme. The 6-class scheme was originally used because it was assumed that there would be greater amounts of areas in the high and low ends of the habitat suitability gradient. However, since the amounts of highest and lowest suitability habitat are so low (i.e., 2.5% High and 0.4% Nil) it makes sense to use the 4-class scheme from this point forward.

The model results indicate that High-suitability winter moose habitat (12%) is limited, and that the remaining area is approximately split between Moderate and Low, with Nil/Very Low areas only accounting for approximately 1% of the RSA. The distribution of winter moose habitat shows clear spatial patterns across the RSA, when examining the average habitat suitability scores across ELC polygons (Map 5-1) and the percent of High-suitability habitats occurring in each polygon (Map 5-2 and Map 5-3). In the map of the average suitability scores (Map 5-1), areas of Moderate suitability are concentrated in the southern half and along the western and northern boundary in the northern portion of the RSA. These areas often correspond to regenerating burns. In the northern half of the RSA, much of the Chance Creek watershed is rated Low, corresponding to a lack of fire disturbance and dominance of open canopy, stunted spruce ecosystems, which offer limited browse for moose. High-suitability winter habitat is found scattered across the RSA, generally in much smaller patches than areas of Moderate and Low. High suitability areas are often in narrow riparian strips along streams and non-confined drainage areas (Map 5-2), but also includes certain deciduous and mixed-wood ecosystem units, like the Mesic Alaska Paper Birch (code 05), which accounts for the concentration of High suitability habitats in the northwest portion of Map 5-3.

This pattern of having a relatively large portion of the landscape in Moderate suitability winter habitat is different than occurs in other parts of Yukon, especially in more mountainous areas, where suitable winter habitat (i.e., High and Moderate suitability) are often constrained by elevation, snow depths and greater distribution of diverse vegetation communities (McCulley et al. 2017). In Eagle Plains, a substantial amount (74%) of the RSA is in a shrub structural stage mostly dominated by scrub birch and Labrador tea and almost half (44%) of the RSA is described as the Moist Spruce – Labrador tea ecological unit which are large areas with relatively low willow cover (i.e., the Moderate suitability areas).

The pattern of winter habitat across the RSA is likely to affect the broad distribution of moose. Due to the scattered occurrence of High suitability habitat across the RSA, some moose are expected to occur across the RSA. However, local densities are likely to be vary in relation to the portions of Low and Moderate that form the matrix of habitat at a larger scale. Where most of the habitat matrix is Low, such as across most of the Chance watershed, moose densities are expected to be relatively low and habitat use is expected to be largely constrained to the scattered patches of High. Where most of the habitat matrix is Moderate, such as the southern half of the RSA, moose densities are expected to be substantially higher; and, although moose use is

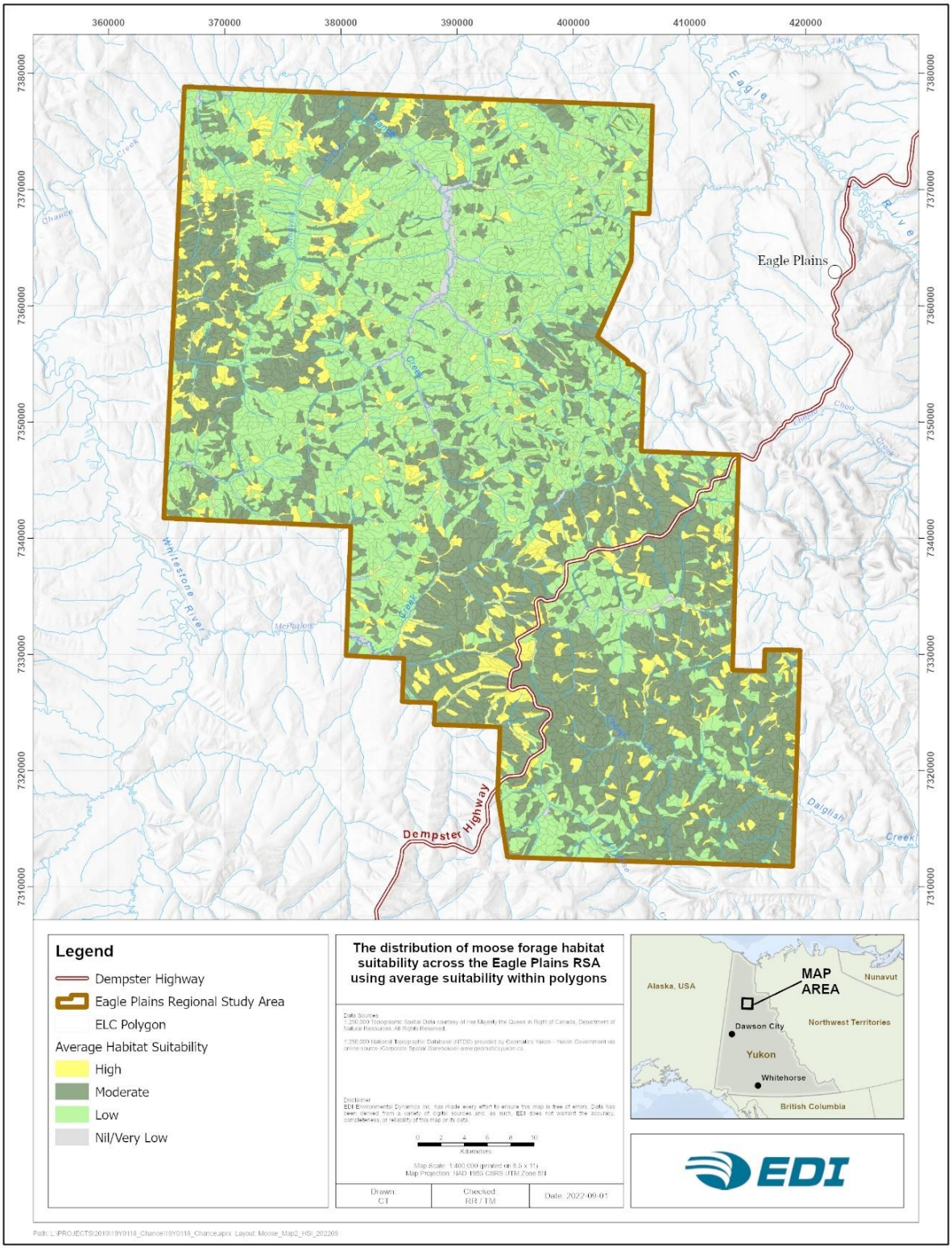
expected to still be relatively higher in the High habitats, considerable use of the Moderate suitability matrix is also expected.

Table 5-8. Estimated amounts of moose winter forage habitat across the Eagle Plains RSA using a 6-class rating scheme.

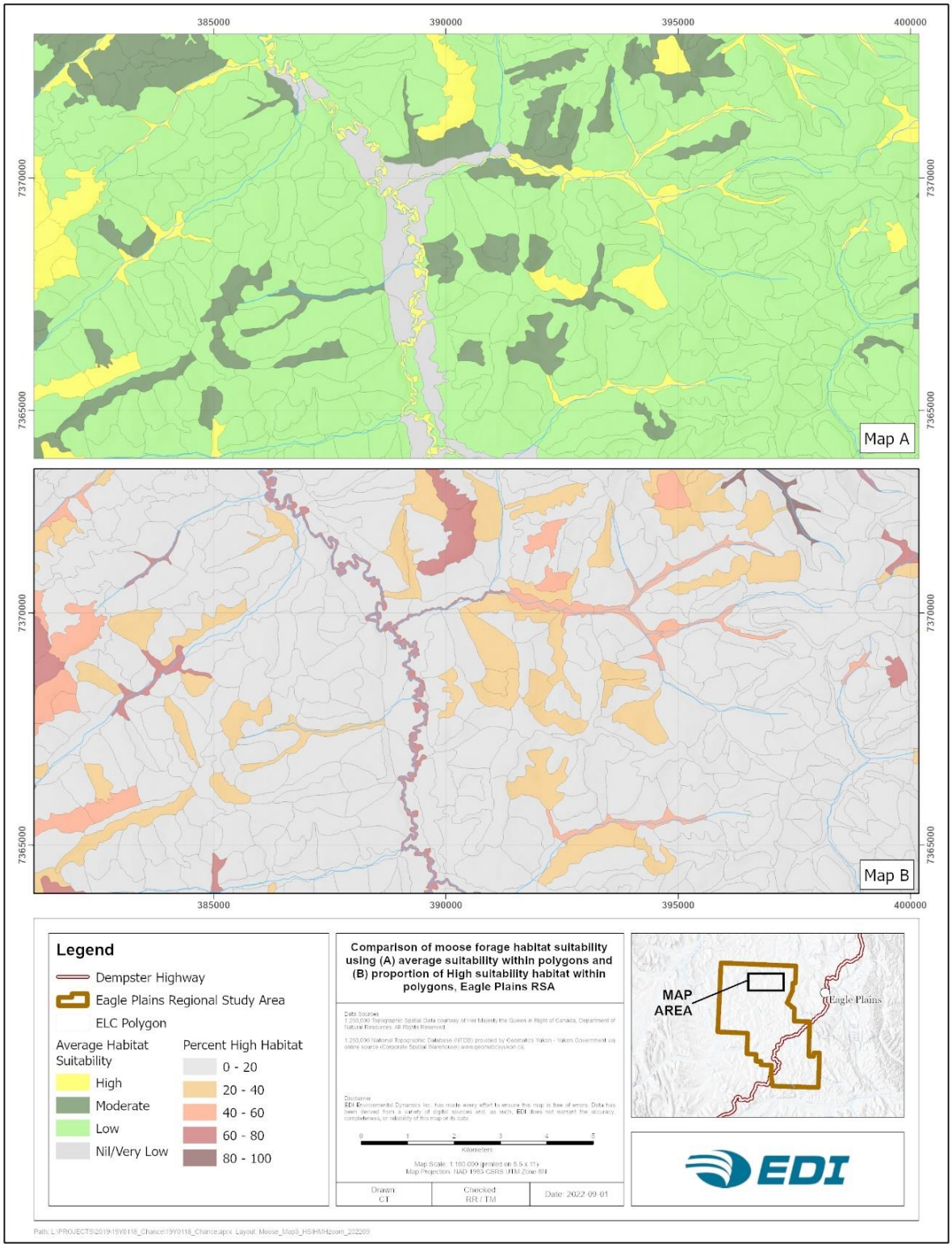
Habitat Rating	Area (ha)	Area (% of RSA)
High	5,961.9	2.5%
Moderately High	23,736.7	9.9%
Moderate	111,561.7	46.7%
Low	94,068.2	39.4%
Very Low	2,492.4	1.0%
Nil	842.6	0.4%
Total Area	238,663.5	100%

Table 5-9. Estimated amounts of moose winter forage habitat across Eagle Plains RSA averaging suitability scores within ELC polygons and generalizing to a 4-class rating scheme.

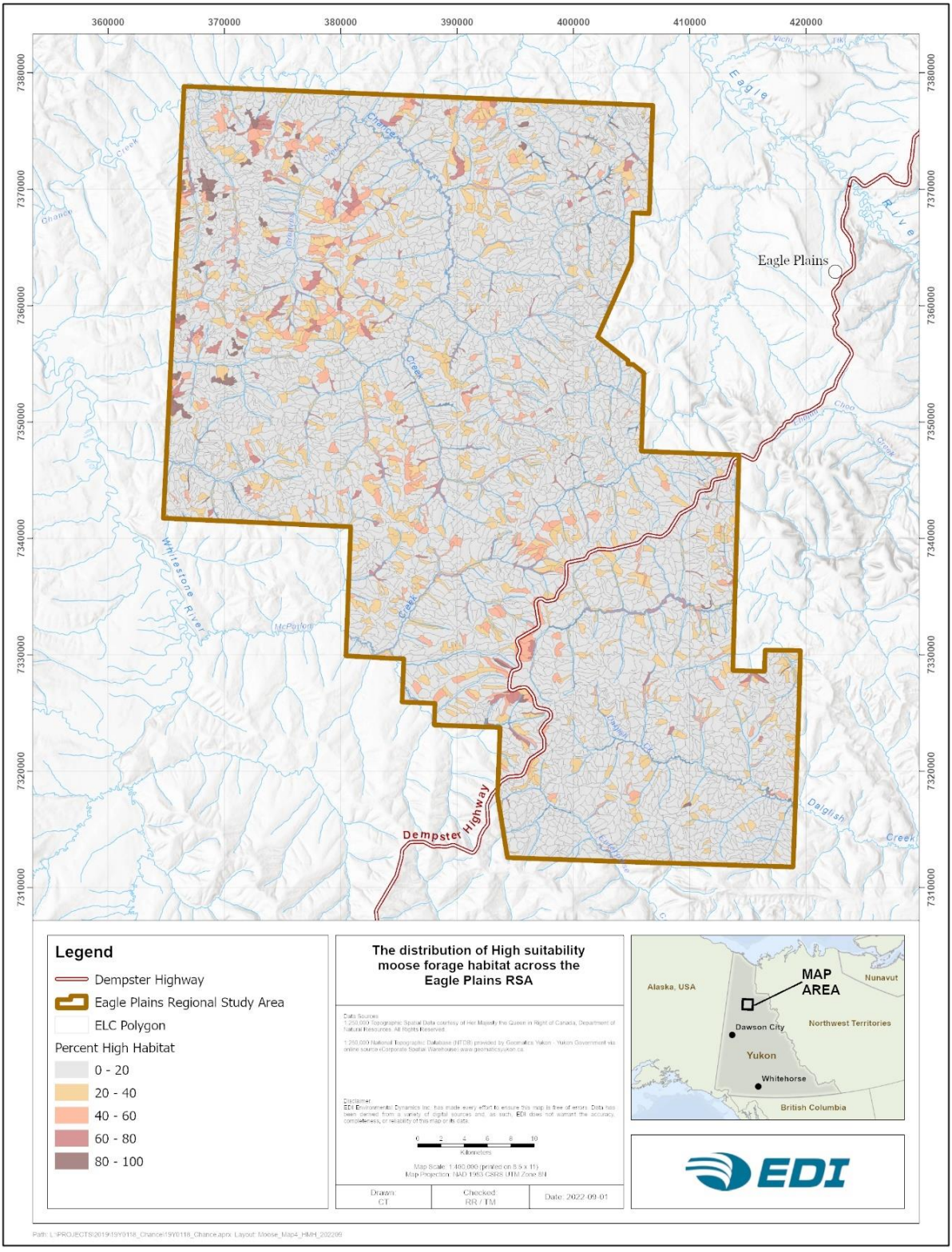
Average Habitat Suitability	Area (ha)	Area (% of RSA)
High	16,944.4	7.10%
Moderate	145,394.1	60.92%
Low	74,514.5	31.22%
Nil/Very Low	1,810.5	0.76%
Total	238,663.5	100%



Map 5-1. The distribution of moose forage habitat suitability across the Eagle Plains RSA using average suitability within polygons.



Map 5-2. Comparison of moose forage habitat suitability using (A) average suitability within polygons and (B) proportion of High suitability habitat within polygons, Eagle Plains RSA.



Map 5-3. The distribution of High suitability moose forage habitat across the Eagle Plains RSA.

5.5 SUMMARY

The suitability, amount, and distribution of potential habitat for moose were quantified across the RSA using a habitat suitability model. The habitat model was for foraging habitat during winter because this life requisite and season are believed to be the most limiting to moose in the RSA. The model consisted of qualitative ratings applied to combinations of three variables from the ELC mapping: ecosystem unit, structural stage and fire disturbance. High suitability habitats consisted of disclimax shrublands, most commonly associated with riparian areas. Moderate suitability habitats were dominated by regenerating burns but also included small areas of mixed and deciduous forests with shrubby understories. Low suitability habitats were mostly open canopy, stunted spruce forests. High-suitability moose winter foraging habitat is limited across the RSA (12%), but Moderate habitat is extensive (43%). Although moose are expected to select the High-suitability areas preferentially, a substantial amount of total winter forage appears to occur within large areas with relatively low willow cover (i.e., the Moderate suitability areas). Due to the scattered occurrence of High-suitability habitat across the RSA, some moose are expected to occur across the RSA in winter. However, local densities are likely to vary with the portions of Low and Moderate habitats that form the habitat matrix at a larger scale.

5.6 MOOSE SECTION ATTACHMENTS

5.6.1 ATTACHMENT 5–A — WILLOW SPECIES PERCENT COVER

Attachment Table 3. Calculated percent willow cover for each ecosystem unit by structural stage based on collected vegetation baseline data. In some cases, no data was collected (NDC) since no ground plots were established within the EU or within a specific structural stage.

Map Code	Ecosystem Unit Name	Structural Stage											Total #Plots
		1	2	2a	3	3b	4a	4b	5	6	7	8	
02	Mesic Birch – Willow	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	22.0 n=2	NDC	2
03	Mesic White Spruce – Alaska Paper Birch – Alder	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	0
04	Mesic Black Spruce – Alaska Paper Birch	NDC	NDC	NDC	NDC	0.0 n=1	5.0 n=1	4.0 n=3	NDC	0.0 n=2	5.2 n=9	4.4 n=6	22
05	Mesic Alaska Paper Birch	NDC	NDC	NDC	NDC	NDC	9.5 n=2	NDC	NDC	13.7 n=3	13.3 n=5	NDC	10
06	Mesic Black Spruce – Labrador Tea	NDC	NDC	NDC	NDC	NDC	38.0 n=3	12.6 n=5	1.0 n=1	0.0 n=2	3.5 n=6	5.0 n=1	18
10	Sparsely Vegetated	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	0
13		NDC	NDC	NDC	NDC	NDC	7.0 n=1	8.5 n=2	NDC	NDC	NDC	0.0 n=1	4
14	Dry Spruce – Lichen	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	2.0 n=3	6.0 n=5	8.0 n=4	12
15	Dry Aspen – Lichen	NDC	0.0 n=1	NDC	NDC	NDC	0.0 n=1	NDC	NDC	NDC	NDC	NDC	2
16	Dry Spruce – Birch – Lichen	NDC	NDC	NDC	NDC	NDC	NDC	NDC	8.0 n=2	0.0 n=1	1.0 n=1	NDC	4
17	Dry Aspen	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	0.0 n=1	NDC	NDC	1
20	Shrubby Riparian Birch – Willow	NDC	NDC	NDC	NDC	NDC	33.0 n=1	26.3 n=4	NDC	NDC	NDC	NDC	5
21	Riparian White Spruce – Prickly Rose	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	12.0 n=6	6
22	Riparian Spruce – Birch – Willow	NDC	NDC	NDC	NDC	NDC	NDC	NDC	1.0 n=1	NDC	26.7 n=4	5.5 n=2	7
23	Drainage Shrubby Riparian	NDC	NDC	NDC	NDC	NDC	NDC	57.0 n=1	NDC	NDC	NDC	NDC	1
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	NDC	NDC	NDC	NDC	NDC	NDC	14.2 n=6	NDC	NDC	NDC	NDC	6
33	Moist Spruce – Labrador Tea	NDC	NDC	NDC	NDC	4.0 n=1	3.2 n=11	8.6 n=12	NDC	9.0 n=2	7.1 n=21	6.3 n=3	38
34	Moist Spruce – Alder – Labrador Tea	NDC	NDC	NDC	NDC	NDC	11.0 n=3	5.5 n=4	NDC	NDC	3.2 n=7	0.0 n=1	15
35	Moist Spruce – Scrub Birch – Labrador Tea	NDC	NDC	NDC	NDC	NDC	7.0 n=4	7.3 n=3	NDC	NDC	4.2 n=9	NDC	16

Map Code	Ecosystem Unit Name	Structural Stage											Total #Plots
		1	2	2a	3	3b	4a	4b	5	6	7	8	
36	Moist Birch - Willow	NDC	NDC	NDC	NDC	NDC	43.0 n=1	NDC	NDC	35.0 n=1	NDC	NDC	2
41	Wet Shrub – Tamarack	NDC	NDC	NDC	NDC	NDC	NDC	1.7 n=5	NDC	NDC	0.0 n=1	NDC	6
42	Wet Shrub \ Black Spruce – Tussock Cottongrass	NDC	NDC	NDC	NDC	3.0 n=1	3.0 n=5	4.8 n=13	NDC	NDC	NDC	NDC	19
43	Wet Shrub \ Black Spruce – Sphagnum	NDC	NDC	NDC	NDC	NDC	5.0 n=4	6.5 n=9	NDC	NDC	NDC	NDC	13
44	Wet Shrub \ Scrub Birch – Tussock Cottongrass	NDC	NDC	NDC	NDC	NDC	NDC	8.3 n=19	NDC	NDC	NDC	NDC	19
45	Wet Shrub \ Scrub Birch – Graminoid	NDC	NDC	NDC	NDC	NDC	NDC	10.0 n=1	NDC	NDC	NDC	NDC	1
46	Wet Black Spruce – Labrador Tea – Cladonia	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	6.3 n=5	8.5 n=2	7
47	Wet Black Spruce – Tussock Cottongrass – Sphagnum	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	5.0 n=1	3.0 n=1	NDC	2
48	Wet Black Spruce - Carex	NDC	NDC	NDC	NDC	NDC	NDC	10.0 n=2	NDC	NDC	22.0 n=1	NDC	3
B1	Bog – Black Spruce – Lichen	NDC	NDC	NDC	NDC	NDC	NDC	0.0 n=8	NDC	NDC	NDC	NDC	8
B2	Bog – Black Spruce – Sphagnum	NDC	NDC	NDC	NDC	NDC	NDC	2.0 n=11	NDC	NDC	NDC	NDC	11
F	Fen	NDC	NDC	NDC	NDC	9.0 n=7	NDC	0.0 n=1	NDC	NDC	NDC	NDC	8
M	Marsh	NDC	NDC	NDC	NDC	3.2 n=6	NDC	NDC	NDC	NDC	NDC	NDC	6

6 CARIBOU

The Porcupine Caribou Technical Committee (PCTC) provided telemetry data and seasonal range polygons for the Porcupine Caribou Herd (PCH). Technical discussions and feedback provided by the PCTC also helped align subsequent analyses conducted in this section. This section and much of the technical content reflect responses to their detailed technical review.

6.1 PURPOSE AND OBJECTIVES

Caribou were selected as a VC for the Project due to their importance to the Gwich'in people for subsistence hunting and their cultural and ecological values. The Project occurs exclusively within the range of the PCH, which is a subpopulation of the barren-ground subspecies of caribou (*Rangifer tarandus groenlandicus*). Within the North Yukon Land Use Plan, the PCH is considered "the most significant and culturally important wildlife resource in the planning region" (Vuntut Gwitchin Government and Yukon Government 2009). The herd has been the mainstay of Gwich'in culture for centuries. It is considered a keystone species whose presence or absence influences the composition and dynamics of the wildlife communities and ecosystems in North Yukon. The PCH is a migratory herd with an extensive annual range that spans most of North Yukon and a large area in north-eastern Alaska. The PCH overlaps the Project area primarily during the rut/late fall and winter seasons.

This section summarizes existing information about the ecology of the PCH, and, using telemetry data and analysis outputs to: i) Quantify the degree of seasonal range overlap by the PCH with the RSA during fall and winter, when seasonal range use overlaps the RSA; ii) Quantify habitat use patterns and selection by the PCH during fall and winter; iii) Quantify movement rates and residency periods of the PCH during fall and winter; and, iv) Quantify the potential effects of linear features on the occurrence and movements of the PCH.

6.1.1 SPATIAL BOUNDARIES

Three spatial extents were considered as part of this study:

- The Eagle Plains Project RSA (2,386 km²)
- The Eagle Plains Ecoregion (20,400 km²), and
- The Yukon portion of the PCH's rut and late fall and winter seasonal ranges (65,000 km² and 58,000 km², respectively).

The Eagle Plains Project RSA includes all proposed exploration areas. The RSA has relatively similar patterns of vegetation communities and historical exploration disturbances across it. The Eagle Plains Ecoregion (see Section 1.3) encompasses the Project RSA and provides an ecologically similar area, beyond the proposed exploration areas, that allows certain comparisons between the RSA and adjacent undisturbed areas (e.g., habitat distribution and within-season movement patterns).

The Yukon portion of the PCH's fall and winter seasonal ranges is the largest extent and covers much of North Yukon. This area occurs predominantly within the Taiga Cordillera Ecozone. This Ecozone covers most of the northern Yukon and the southwest corner of the NWT. The Taiga Cordillera includes mountainous areas (e.g., British Mountains, Richardson Mountains, and North Ogilvie Mountains) separated by subdued basins (e.g., Eagle Plains, Old Crow Flats, and Old Crow Basin). The area consists of glaciated and unglaciated terrain and continuous permafrost. The climate in the Taiga Cordillera is variable from its northern to southern extent, with summers ranging from cool to warm with extended periods of daylight, while winters are generally long, cold, and dark. The vegetation in the taiga is dominated by stunted, open spruce forests, which result from short, cool growing seasons, and poor soils over permafrost (Ecological Stratification Working Group 1995). This extent was used to reference spatially broad questions, such as the PCH's seasonal distribution and movement patterns.

6.2 GENERAL ECOLOGY OF THE PORCUPINE CARIBOU HERD

6.2.1 CONSERVATION STATUS

The PCH is a subpopulation of barren-ground caribou in Canada, known for large aggregations of individuals, dramatic population fluctuations, lengthy migrations, and significant cultural and social value to northern Indigenous peoples and other Canadians (COSEWIC 2016). All caribou belong to one species, *Rangifer tarandus*. Within Canada, caribou populations are classified within 12 "Designatable Units" based on a suite of biological, genetic, and evolutionary traits (COSEWIC 2011). All 14–15 subpopulations of barren-ground caribou are considered part of one Designatable Unit (DU 3). Barren-ground caribou were assessed as Threatened by COSEWIC (COSEWIC 2016). The subspecies is not listed on Schedule 1 of the federal SARA. Within Yukon, barren-ground caribou are considered Vulnerable/Apparently Secure (Yukon Government 2020).

6.2.2 SEASONAL RANGES AND MOVEMENTS

Like most barren-ground caribou subpopulations, the PCH has a large annual range and makes long-distance migrations, hundreds or thousands of kilometres, among different seasonal ranges. Often, seasonal ranges vary across and within years in response to variation in forage availability, snow cover, and predation or parasite risk (Russell et al. 1993). The PCH's annual range extends approximately 250,000 km² from Alaska, through Yukon, and into the western edge of NWT. The herd undertakes long-distance migrations across seasonal ranges necessary for key aspects of their life cycle. Eight (8) primary life cycle periods occur for the PCH (Porcupine Caribou Technical Committee 1993). Key information for the eight periods are summarized in Table 6-1 (using information from Russell et al. 1993, Porcupine Caribou Technical Committee 1993, Ryder et al. 2007). The Porcupine Caribou Technical Committee (1993) assessed the relative importance of seasonal ranges using six criteria: energy balance, reproductive contribution, tolerance to disturbance, escape requirements, the intensity of use, and whether alternative habitats are available. Although all seasons are important to meeting the annual life requisites of the PCH, the calving and post-calving seasons are considered

of highest importance and fall and winter are considered of lowest importance (Porcupine Caribou Technical Committee 1993).

Key information associated with each of the eight seasons is provided below, elaborating on summary information in Table 6-1, and including a combination of scientific knowledge (Russell et al. 1993, Porcupine Caribou Technical Committee 1993, Ryder et al. 2007) and traditional ecological knowledge (Sherry and Vuntut Gwitchin First Nation 1999, Ryder et al. 2007). Typical patterns of seasonal range use are shown in Map 6-1. After calving on the north slope and Arctic coastal plains, the PCH typically splits in two, with portions of the herd moving southwest in Alaska and southeast in Yukon. Animals in the Yukon typically follow a clockwise movement through the seasonal ranges from the calving grounds on the north slope, to the British Mountains in summer, to the Richardson Mountains in late summer, dispersing widely and variably across northern Yukon (as far south as the Ogilvie Mountains) in fall and winter, before returning north to the coastal plains in spring. The PCH can potentially overlap the RSA primarily in the rut/late fall and winter periods.

During the Calving and Post-Calving periods cows and bulls tend to occupy different habitats and exhibit different movement patterns, so their ranges are described separately for these periods. During the relatively short calving period (June 1–10), cows occur in the Arctic coastal plains and adjacent uplands and foothills in Alaska and Yukon. Concentrated use often occurs in the Jago Uplands between the Hulahula and Aichilik rivers in Alaska. The calving season is one of the seasons of greatest importance (rank 1) (Porcupine Caribou Technical Committee 1993). Adult females are generally in their poorest body condition and have the largest energy deficits. The calving period is critical to the survival and development of calves (i.e., the source of initial annual population recruitment). The herd occurs in a relatively concentrated range, which appears to offer reduced predation risk and abundant forage that coincides with the timing of calving, and no alternative areas of similar value are available.

During the Post-Calving and Movement period (June 11–30) cows (and new calves) travel away from the calving areas. Cows that calved in the Yukon tend to move west into Alaska. Often, movements are higher into the foothills and uplands, following melting snow and newly emerging vegetation. However, the herd can occur anywhere from the coastline well into the foothills during this period. Selection of local habitats to avoid insect harassment is often a factor by the end of June. The Post-Calving period is also considered a period of highest importance (rank 1) (Porcupine Caribou Technical Committee 1993). Lactating females have their highest energy demands. Movement rates and group sizes increase through June, and cow/calf groups are believed to be relatively intolerant to disturbance.

During the calving to post-calving movement period (June 1–30) most bulls, juveniles, and non-productive cows occur in north Yukon between the Babbage and Firth rivers across a range of habitats within the coastal plains and the British Mountains. Animals tend to be quite mobile and follow plant emergence across habitats and elevations as spring progresses. This period is considered to have relatively low importance (rank 3) for bulls and non-productive cows (Porcupine Caribou Technical Committee 1993) because they are not tending young-of-the-year, high-quality forage is becoming abundant, and insect harassment is limited.

During Early Summer (July 1–15), both cows and bulls remain concentrated in the general north slope area, but the overall range continues to expand. Group sizes increase to the tens of thousands, and movement rates can average 25 km per day. Early summer often marks the beginning of the split of the herd between Alaska and Canada. In Alaska, distribution is widespread into the Brooks Range, and, in Canada, animals typically move into the southern British Mountains by mid-July. Local habitat use is driven by both selection for high-quality forage and insect avoidance. Insect avoidance strategies include using coastal areas adjacent to the Beaufort Sea (often primarily females) and higher elevation snow patches and barren ground in the Brooks Ranges and British Mountains (mostly males). Early summer is considered to have an importance rank of 2. Though food is generally abundant, the energy balance is limited by insect avoidance, resulting in reduced feeding times and selection of areas with less forage. Animals are still susceptible to disturbance, but tolerance is higher than during the calving and post-calving periods (e.g., calves have greater mobility, and more range is available due to snow melt).

By mid-summer (July 16–August 7), the majority of the PCH has left the coastal plains. Animals in Alaska have moved into the southern portion of the Brooks Range, and animals in Yukon have moved southeast into, or are en route to, the northern Richardson Mountains. Daily movement rates remain high through the mid-summer period, and though group sizes are often still large, groups are often breaking up and more dispersed than the aggregations that occur during post-calving and early summer. Mid-summer has an importance rating of 2 for the same reasons identified for early summer. Mid-summer is the period of potentially highest insect harassment, and, similar to early summer, habitat selection may favour insect avoidance over areas with the highest forage. Lactating females suffering insect harassment may be in an energy deficit.

During late summer and fall migration (August 8–October 7), insect harassment declines dramatically. Forage quality and abundance also begin to decline but are generally still abundant. Caribou exhibit high feeding rates during this period and gain fat reserves for the winter. During this period, the herd breaks up into smaller groups and disperses widely across North Yukon, mostly staying north of the treeline for most of the period. Fall migration often follows terrain features like ridges and valleys, but movement routes are unpredictable from year to year. Late-summer and fall migration is considered to have less importance (rank 3) due to the abatement of insect harassment, the relative abundance of forage across a variety of habitat types, the dispersed distribution of the herd, and relatively high tolerance to disturbance (Porcupine Caribou Technical Committee 1993).

The rut and late fall (October 8–November 30) continue to be a period of broad distribution and movement by the PCH, including widespread movement south of the treeline. In Yukon, the rut can occur from the Richardson Mountains to the southern Ogilvie Mountains. The areas where the rut occurs do not appear to have affinity from year to year. Rather, the rut appears to occur wherever the herd happens to be at that time along the fall migration. The rut and late fall period has the lowest level of importance(rank 4), due to the lack of insects, large range extent, ample food, the dispersed distribution of the herd, and relatively high tolerance to disturbance (Porcupine Caribou Technical Committee 1993).

During early, mid, and late winter (December 1–March 31), the PCH is at its most dispersed stage, both in terms of the extent of the range it uses and group aggregations. Average daily movement distances (2 km per

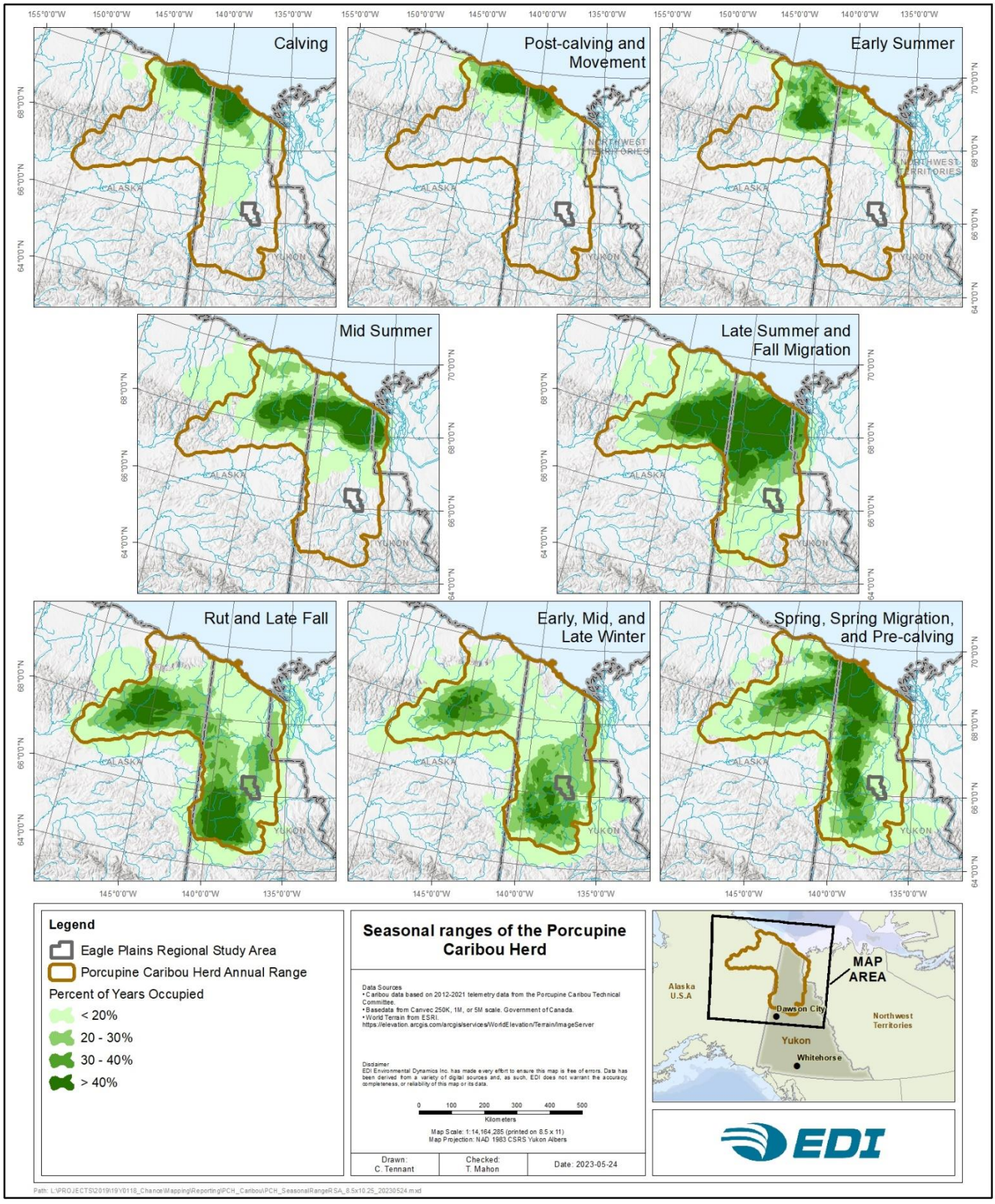
day [km/day] to 5 km/day) (Russell and Gunn 2017) are lower than in other seasons, except for cows during calving (Russell and Gunn 2017). Winter range use varies from year to year, depending on snow depth and condition. In Yukon, during deep snow years, use is concentrated in the Richardson Mountains and the Ogilvie-Hart basins. The Whitestone River and Eagle Plains areas are used more in low snow years. Forage during winter consists primarily of lichens. Unlike reports for some other caribou herds, winter habitat is generally not considered limiting for the PCH (Russell et al. 1993). In shallow to average snow years, the caribou maintain neutral to surplus energy balances (Russell et al. 1993). The PCH is relatively tolerant to human activity during the winter (Porcupine Caribou Technical Committee 1993). Similar to the rut and late fall period, winter has the lowest level of importance (rank 4) due to the lack of insects, large range extent, ample food, the dispersed distribution of the herd, and relatively high tolerance to disturbance (Porcupine Caribou Technical Committee 1993).

During the spring, spring migration, and pre-calving season, (April 1–May 31) caribou begin moving north toward the calving grounds. Average daily movement rates increase from approximately 6 km/day at the start of the season to approximately 24 km/day through May. Similar to the fall migration, no well-defined migration corridors are used consistently from year-to-year during spring migration, but certain terrain feature types like ridges and valleys are regularly used. During spring migration, local snow conditions often affect movement patterns and routes. In years or locations with low snow levels, migration tends to be more dispersed. In years or locations with high snow levels, movements tend to be more concentrated along trail networks on ridges (Porcupine Caribou Technical Committee 1993). Caribou, especially pregnant cows, typically enter an energy deficit during spring due to reduced forage availability as they leave the lichen-rich taiga and before forbs have emerged; in addition, higher energy expenditure is associated with migration. Spring is rated as higher in importance than winter, but still relatively low overall (rank 3), due to lack of association with specific habitats, relatively low threats from predators, and lack of insect harassment (Porcupine Caribou Technical Committee 1993).

Table 6-1. Key life cycle periods for the Porcupine Caribou Herd (after Porcupine Caribou Technical Committee 1993). The Porcupine Caribou Herd overlaps the Project Regional Study Area during Rut and Late Fall and Early, Mid, and Late Winter.

Season	Dates	Characteristics	Importance*
Early, Mid, and Late Winter	Dec. 1 – Mar. 31	The herd is at its most dispersed at this time across 2 winter ranges: in Yukon, mostly south of the Porcupine River in boreal taiga and in Alaska, centred in the Chandalar River/Arctic Village area. Winter range use varies from year to year, depending on snow depth and condition. Caribou at this time of year are relatively tolerant to human activity. In shallow to normal snow years, animals can gain weight.	4
Spring, Spring Migration, and Pre-Calving	Apr. 1 – May 31	Herd distribution varies depending on snowmelt; migration routes vary yearly. Pregnant females are typically in an energy deficit due to reduced forage once they leave the lichen-rich taiga.	3
Calving (cows)	June 1 – 10	Calving occurs on the coastal plain of NE Alaska and, to a lesser degree, NW Yukon. This area offers reduced predators and abundant spring forage; no alternative range is available. Cows are at the lowest point of physical condition and are least tolerant to human disturbance.	1
Post-Calving and Movement (cows)	June 11 – 30	As calves develop over the first two weeks of life, the cows and calves tend to aggregate into larger groups and increase movement rates to track plant green-up. The post-calving period imposes high energetic demands on lactating females, and cow/calf groups are relatively intolerant of disturbance. The post-calving range is primarily in Alaska, and cows that calved in Yukon tend to move west along the foothills into Arctic National Wildlife Refuge. Insect avoidance can affect distribution by the end of June.	1
Calving to Movement (bulls)	June 1 – 30	Bulls, non-pregnant cows, and subadults tend to concentrate east of the calving grounds in northern Yukon. Animals track the progression of green-up from the coastal plains to the northern foothills and into intermountain regions.	3
Early Summer	July 1 – 15	Cows continue to require a high-energy intake for milk production, but insect avoidance also drives distribution. Key areas selected for insect avoidance are the coastal plain adjacent to the Beaufort Sea (mostly cows/calves) and mountains in the Brooks and British Mountains (mostly bulls and cows without calves). Long-distance movements during this period are also an insect avoidance behaviour.	2
Mid Summer	July 16 – Aug. 7	Mid-summer continues to be a period of high insect harassment. Two areas are consistently used – the northern Richardson Mountains in Yukon and the southern portion of the Brooks Range in Alaska. Females with cows may be in energy deficit.	2
Late Summer and Fall Migration	Aug. 8 – Oct. 7	As insect activity declines, the herd disperses widely but mostly stays north of the tree line until the latter part of the period – in Alaska south of the Brooks Range and in Yukon north of the Porcupine River. Animals exhibit high feeding rates and gain fat for the winter.	3
Rut and Late Fall	Oct 8 – Nov. 30	The region where rut occurs has no affinity from year to year; rut occurs wherever the herd happens to be along fall migration. In Yukon, distribution can occur from the southern Ogilvie Mountains to the Richardson Mountains.	4

* 1 = highest importance, 4 = lowest.



Map 6-1. Seasonal ranges of the Porcupine Caribou Herd from 2012–2021.

6.2.3 DIET AND HABITAT

Barren-ground caribou are generalist foragers who feed on grasses, sedges, forbs, lichens, and shrubs during the growing season. During winter lichens constitute the primary forage of most barren-ground caribou populations (Photo 6-1 and Photo 6-2). Over three winters, the composition of PCH fecal samples was similar, consisting of, on average, 64% fruticose lichens, 11% evergreen shrubs, 8% moss, 6% horsetails, and 5% foliose lichens (Russell et al. 1993).

Russell et al. (1993) surveyed lichen distribution across the Yukon portion of the PCH range. Fruiticose lichens were widespread across survey plots and overall biomass estimates were similar to values reported in other western barren-ground caribou ranges (Joly and Cameron 2018). Within the PCH's Yukon range, lichen biomass varied across regions, habitat (range) types and stand ages. Average lichen biomass varied substantially among regions, with the highest biomass occurring in Eagle Plains (78.3 g/m^2), followed by North Fork Pass (45.0 g/m^2), Chapman Lake (33.6 g/m^2), Ogilvie Valley (32.5 g/m^2), and Richardson Mountains (29.9 g/m^2). In terms of habitat type, lichen biomass varied over three-fold across the seven habitats (range) that Russell et al. (1993) surveyed. Open conifer forest types had the greatest lichen biomass, and the forb herbaceous type had the lowest.

In terms of stand age, the generally accepted theory is that lichen biomass is greatly reduced following a fire, increases in abundance up to 125–175 years, and decreases as lichens are overtaken by mosses and shrubs (Klein 1982). Field surveys by Russell et al. (1993) found that lichen biomass in the PCH range was actually highest in stands <50 years since fire, and that lichen biomass decreased across all subsequent older age classes, to a nearly 50% reduction in the oldest age class (>270 years) (Photo 6-3). This local data suggests that younger stands may make a greater contribution to lichen forage than previously believed. Russell et al. (1993) emphasizes the importance of a mosaic of stand age classes, resulting primarily from wildlife, to maintaining lichen biomass at the regional level over time.

Although habitat selection is often driven by forge availability, especially in winter, reducing predation risk (Latham et al. 2011) and minimizing exposure to insect harassment during summer (Russell and Nixon 1990) also factor into habitat selection by caribou.

6.2.3.1 Effects of Snow

The regional patterns of PCH distribution in winter vary among years, often related to snow accumulation, which can limit forage availability (Russell et al. 1993). During the 1970s and 1980s, the distribution of the PCH in winter varied in a regular pattern across four regions with different snow regimes: Yukon/Alaska border, Richardson Mountains, Ogilvie/Hart region, and the Whitestone/Eagle region (Russell et al. 1993).

On average, the Ogilvie/Hart region had the lowest mean snow accumulation. During winters when most animals occupied this region snow depths were normal to high across the overall winter range. Heavy snows in the north early in the season seemed to emphasize concentrated use in this region, pushing animals to the south during the fall migration and rut. Once animals moved into the Ogilvie/Hart basin they typically remained in the region, taking advantage of the comparatively shallow snows, until spring migration.

During the winters when most Yukon wintering animals occupied the Richardson Mountains, snow depths tended to be normal to above normal. Strong winds in the Richardson Mountains resulted in uneven snow distribution, with many areas having reduced snowpacks, including some areas being blown completely bare. During the winters when most Yukon wintering animals occupied the Whitestone/Eagle area, snowpacks were invariably below normal. This area generally had the highest lichen biomass, but snow depths appeared prohibitive during years with normal to deep snow. In the two years when most of the Yukon wintering animals occupied the Yukon/Alaska border area (overlapping with the Fortymile Herd), snows were deeper than average in all other wintering areas.



Photo 6-1. Mesic, mature forest, with mat-forming terrestrial lichens in the Eagle Plains RSA.



Photo 6-2. Lichen communities are often diverse in Eagle Plains. This lichen mat includes *Cladonia spp.* (lighter green) that are preferred forage for caribou, as well as *Stereocaulon spp.* (darker grey) and *Flavocetraria spp.*, which are both also eaten by caribou but less preferred.



Photo 6-3. Lichen cover is generally reduced in regenerating burns. However, EDI observed high lichen abundance in some regenerating burns, consistent with previous work by other researchers (Russell et al. 1993).

6.2.4 POPULATION LEVELS AND TREND

Although most barren-ground caribou subpopulations are declining (COSEWIC 2016), the PCH numbers have increased over the last two decades. The last successful population survey in 2017 estimated the population at 218,457 (95% CI = 202,106 – 234,808) caribou (Porcupine Caribou Technical Committee 2019). Population surveys of the PCH began in the 1970s. The objective is to survey the herd every two to three years, but that period is sometimes extended depending on herd behaviour (aggregation patterns), funding, and logistical issues. Since the first survey in 1972, the PCH has had two periods of population growth, with an interceding decline (Figure 6-1). From 1972 to 1979 the population was relatively stable at just over 100,000 animals. By 1989 the herd had increased to approximately 178,000. Over the next 12 years, the herd declined by 55,000 to 123,000 in 2001. By 2010, the herd had recovered to 169,000 and increased to 218,000 in the last survey in 2017. During the latest growth phase, 2010 to 2017, the estimated population growth rate of 3.7% is almost identical to the growth rate during the 1972 to 1989 growth phase (Porcupine Caribou Technical Committee 2019).

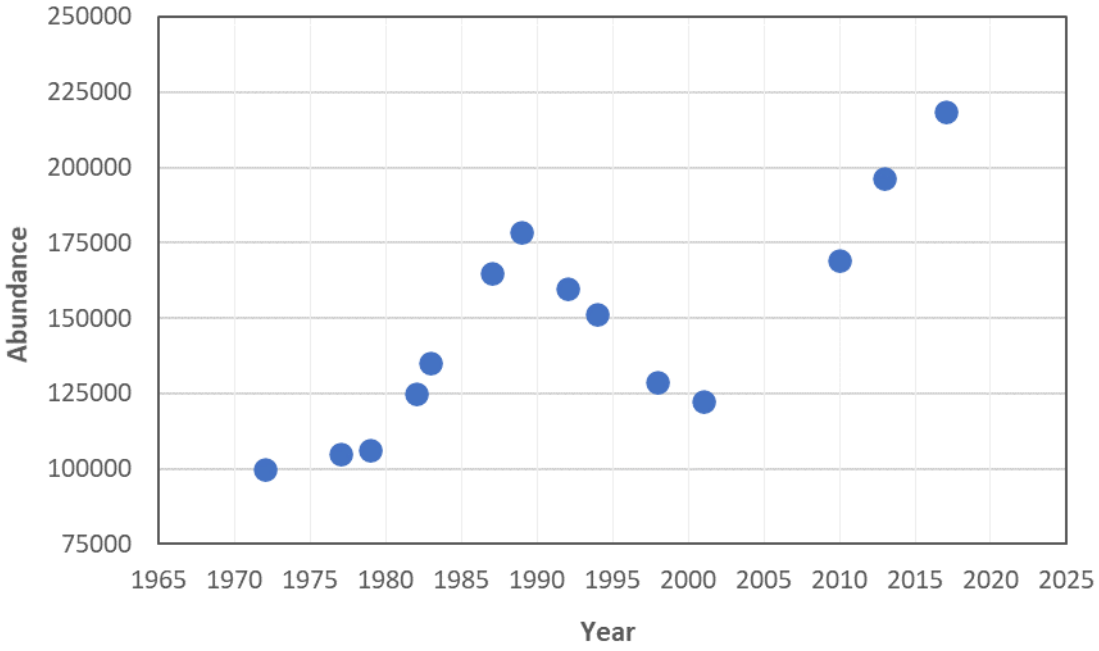


Figure 6-1. The population size of the Porcupine Caribou Herd from 1972 to 2017 (Porcupine Caribou Technical Committee 2019).

6.2.5 POPULATION DYNAMICS

Large magnitude population fluctuations are a key ecological trait of barren-ground caribou. Subpopulations (herds) often experience declines of >80% and increases >500%, which occur over several decades and caribou generations (COSEWIC 2016). Based on scientific studies and Indigenous Traditional Knowledge, the interval between population highs varies from approximately 30–80 years among subpopulations (Ferguson et al. 1998, Gunn 2003, COSEWIC 2016). There has long been debate about whether the intervals

between population highs and lows, and the population levels that occur at highs and lows, are regular enough to be considered cycles (Gunn 2003, COSEWIC 2016, Bongelli et al. 2020). A recent analytical study found that historical population fluctuations of the barren-ground caribou population overall and 9 of 11 sub-populations fit a sine-cyclic model with periods ranging from 26–55 years (Bongelli et al. 2020). However, COSEWIC (2016) points out that cumulative changes in the environment, habitat, climate, and harvest regimes for many caribou subpopulations are without historical precedent, and therefore it is uncertain whether future populations patterns will follow historical patterns.

Despite large magnitude changes in the abundance of barren-ground caribou, there is still a poor understanding of how limiting factors regulate population change. Predation, human harvest[1], parasites and disease, and food supply are all considered limiting factors of barren-ground caribou (COSEWIC 2016); however, no single factor has been conclusively demonstrated as a primary limiting factor across subpopulations and over time. Despite strong advocacy for certain factors by certain researchers (e.g., for predation by Bergerud (1996)), the weight of evidence is that population dynamics involve complex interactions among limiting factors that vary over time and among subpopulations (Klein 1991, Whitten 1996). Over the 50 years that the PCH has been monitored, the population has not exhibited population fluctuations as large as other barren-ground caribou populations (COSEWIC 2016). This may be due to the large annual and seasonal ranges and diversity of habitats across ranges (Russell et al. 1993, Whitten 1996). Whitten (1996) suggests that periods of decline are caused by nutritional stress and predation exacerbated by adverse weather. Population growth during periods of favourable weather is dampened by a combination of poor nutrition, predation, and human harvest and disease. No true density dependent regulation or equilibrium was observed for the PCH from the 1970s to early 1990s (Whitten 1996).

6.2.6 LIMITING FACTORS

6.2.6.1 Food Supply and Overgrazing

The amount and distribution of forage have implications for population distribution and demography of barren-ground caribou (COSEWIC 2016). In general, food limitation is most prevalent during winter, when caribou diet consists primarily of lichen, and does not pose a constraint to caribou from late-spring through fall when graminoids, forbs, and deciduous shrubs are bountiful and predominate their diet (Thompson and McCourt 1981, Russell et al. 1993). Lichen availability depends on both density-dependent and density-independent factors, but the degree to which either is a limiting factor depends on ecological context. For example, density-dependent competition for forage, when local densities are high, and competition is intense, can cause overgrazing of lichen and reduce its abundance (Ferguson et al. 2001, Joly 2009). Recovery of lichen communities following overgrazing can take more than 20 years (Klein 1987).

[1]Human harvest is considered a natural population factor for barren-ground caribou because hunting has occurred for centuries (Sherry and Vuntut Gwitchin First Nation 1999, COSEWIC 2016). However, it is recognized that the nature of hunting has dramatically changed over the last century with the advent of high-powered rifles and snowmobiles.

The potential for lichen supply to regulate caribou herd size and demography is most likely for herds with small ranges on low productivity tundra islands (e.g., Klein 1987). For large, widely-distributed herds, it is more likely that density-independent factors, such as climate and natural disturbance, contribute to limitations in lichen supply that affect caribou distribution (Gunn et al. 2011). Lichen is a slow-growing food source; its distribution is affected by fire (see Joly 2009) and its accessibility depends on regional snow conditions, such as snow hardness and depth (Collins and Smith 1991, COSEWIC 2016). Therefore, caribou tend to shift winter ranges and foraging locations based on burn and snow conditions so that they may access areas with higher lichen abundance (Jandt et al. 2008, Pedersen et al. 2021). In the PCH, annual variation in the distribution of caribou during winter is thought to be a result of caribou tracking available and accessible lichen patches (Russell et al. 1993, WMAC 2009).

The potential for food supply, especially lichen, to regulate the PCH is limited because of their large annual and seasonal ranges and the diversity of habitats (e.g., several broad ecoregions) found within those ranges. Variation in distribution and range use may counteract any limitations on food supply at local scales (Hinkes et al. 2005). PCH migration from the tundra, at the northern extent of their range, to the taiga cordillera, at the southern extent of their range, may serve as a strategy to maximize the available food supply. Overall, the PCH winter range is relatively rich in lichen resources and is comparable to, or better than, those of other herds that winter in taiga regions (Russell et al. 1993).

Forest Fires

Forest fires are a significant natural disturbance agent in taiga forests and play a substantial role in the availability of caribou forage, especially lichen. Occasional fires are important to maintaining lichen biomass at a landscape level. Peak lichen biomass is generally associated with forests 125-1750 years old before lichen volumes decrease due to competition from other species like moss and shrubs (Klein 1982). However, frequent fires can reduce the extent of mature and old forests where productive lichen biomass occurs. For example, forest fires in the winter range of the Bathurst Herd reduced the area of forest by 30% between 1990 and 2000 (Chen et al. 2013). More broadly, the average area burned by large fires in Canada's taiga has increased since the 1960s (Krezek-Hanes et al. 2010). Climate change modelling suggests a further increase in fire extent of 25% by 2030 and 75% by the end of the century (Wotton et al. 2010). Generally, caribou avoid burned areas in winter for several decades until lichen biomass increases to the point where it is favourable for caribou to forage. Changes in landscape vegetation patterns due to fire are believed to affect regional seasonal use areas and migration routes of caribou (Gunn et al. 2011).

The PCTC monitors the extent of burn areas across the forested portion of the PCH annual range; since 1960, 18% of the area has burned (Porcupine Caribou Technical Committee 2021a). The five-year average of the area burned in the Yukon portion of the PCH annual range is 1,552 km² (Porcupine Caribou Technical Committee 2021a).

6.2.6.2 Predation

Wolves are the primary predators of barren-ground caribou (COSEWIC 2016). However, grizzly bears can also be significant predators of caribou, especially calves (Gau et al. 2002). Predation is an important factor

affecting many facets of caribou ecology, as caribou movements and habitat choices are often made to minimize exposure to predators (Bergerud 1996). One of the hypotheses about why barren-ground caribou migrate is that it reduces predation risk. The idea is that moving throughout the year limits the numerical response of wolves (Hayes and Russell 2000). In the NWT, wolf densities in the arctic tundra calving grounds were only 22% compared to wolf densities in the taiga, where the herd wintered. However, as caribou numbers increase, their range expands, causing some caribou to return earlier to the ranges of taiga denning wolves, which results allows wolf numbers to increase (Heard et al. 1996).

A study of wolf predation on the PCH estimated that wolves killed about 7,600 adult caribou each year, regardless of herd size (Hayes and Russell 2000). In 1992 this corresponded to a predation rate of 5.8%, or about one-third of adult mortality. As the PCH declined through the 1990s, the predation rate by wolves increased from 5.8% to 7.4%. Migratory movements effectively reduced wolf predation during the calving through summer seasons due to the combination of smaller ranges and lower densities of wolves in the arctic tundra. Only 16% of the mortality occurred during the calving/summer seasons compared to 84% during the fall and winter seasons, when wolves were predominantly in the taiga zone.

Generally, wolf predation does not appear to regulate barren-ground caribou subpopulations (Crête and Huot 1993, Messier 1995, Hayes and Russell 2000). Hayes and Russell (2000) estimated that the predation rate would have had to be near twice the observed level to cause the PCH to decline during their study. However, the limiting effect of predation increases as population size decreases, which can result in a cumulative effect with other limiting factors as the population declines (COSEWIC 2016).

6.2.6.3 Hunting

Human hunting of barren-ground caribou has occurred for centuries over much of the species range in North America (Sherry and Vuntut Gwitchin First Nation 1999, COSEWIC 2016). Although humans and caribou have co-existed for centuries, technological changes (e.g., high-powered rifles, snowmobiles, and aircraft) and social changes (e.g., commercial hunting) have changed the potential effects human hunting can have on some barren-ground caribou populations (COSEWIC 2016). Over the last half-century, there has been clear evidence of population-level impacts from harvesting. From 2008 to 2011 the estimated harvest rate on north Baffin Island was 41%. During the mid-2010s harvest rates of the Southampton population were considered well beyond sustainable limits (COSEWIC 2016). Harvest is more likely to pose a threat when population monitoring data is poor and/or harvest management decisions lag population declines. For example, in the Bathurst subpopulation, a constant harvesting level during a period of population decline resulted in an increase in the harvest rate (i.e., as a percent of population size) from 2–4% to 10–16% of abundance (Boulanger et al. 2011).

There is no simple, sustainable harvest level applicable to all barren-ground caribou populations. Effects of harvesting depend on herd size, population trend, and the proportion of females that are harvested (Boulanger and Adamczewski 2016). Harvesting may also interact with other limiting factors, such as predation and weather (Klein 1991). Most harvest plans target a total harvest rate of 0–5%, depending on herd status, and with restrictions on harvesting females (e.g., Environment and Natural Resources 2013).

Recognizing the importance of effective harvest management for both the conservation and continued long-term harvest of the Porcupine Caribou, the Porcupine Caribou Management Board led the development of a comprehensive *Harvest Management Plan for the Porcupine Caribou Herd in Canada* (HMP) in 2010 (Porcupine Caribou Management Board et al. 2010)[2]. Key components of the plan include the determination of specific management actions related to the estimated herd size and a set of general best hunting practices. Management actions are determined each year using a set of six population indicators: 1) estimated herd size, 2) harvest information, 3) adult cow survival, 4) calf birth rate, 5) calf survival to nine months, and 6) body condition. In addition, descriptive indicators from people on the land include caribou health, hunting success, and weather conditions that affect caribou. The results from the indicators are rolled up into a 4-class colour chart, and management actions are specified for each colour zone. Management actions become more restrictive across each zone once the herd falls below 115,000 animals, including ceremonial harvests only below 45,000 animals (Porcupine Caribou Management Board et al. 2010).

Implementation of the HMP is guided by a formal Implementation Plan (Porcupine Caribou Management Board 2016). Key components of the Implementation Plan are to 1) guide annual monitoring of the population indictors and harvest levels, 2) provide a forum for all the HMP Parties to review and discuss the population indicators and harvest levels and 3) provide an annual recommended harvest management colour zone plus any additional management actions that are deemed appropriate. Population indictors are monitored each year by the PCTC and summarized in an annual report (e.g., Porcupine Caribou Technical Committee 2021). Annual harvest levels are monitored by each Party or user group and are compiled by the PCTC into an annual report (e.g., Porcupine Caribou Technical Committee 2021b). Each year, the HMP Parties hold an annual meeting to discuss the results of the population and harvest monitoring and determine the harvest management zone for the following year and any additional management actions the Parties feel may be required.

Over the eight-year period, 2013–2014 to 2020–2021, the annual reported harvest rates of Porcupine Caribou have ranged from 749 to 3,367 caribou. The reported annual harvest rates are considered the minimum estimated harvest (Porcupine Caribou Management Board 2022). Due to reporting challenges faced by some Parties, significant harvest may be missed in some regions in some years. Notwithstanding the reporting challenges, the reported Canadian harvest is estimated to be between 1% and 2% of the 2017 population estimate of 218,000 caribou and is not considered a threat to population decline (Porcupine Caribou Management Board 2022). The comprehensive measures within the HMP to monitor and respond to declines in the PCH (i.e., by reducing harvest) provide a solid system to minimize the potential effects that harvesting could have on the herd.

[2] The HMP was agreed to by eight Parties with authorities and responsibilities managing the PCH within Canada, including Gwich'in Tribal Council, Inuvialuit Game Council, Vuntut Gwitch'in Government, Trʻondëk Hwëchʻin Government, First Nation of Na-Cho Nyäk Dun, Government of the Northwest Territories, Government of Yukon, and Government of Canada.

6.2.6.4 Parasites and Disease

Biting and parasitic insects, pathogens (i.e., viruses and bacteria) and internal parasites are important factors in caribou ecology and population dynamics (Gunn and Irvine 2003, Kutz et al. 2012, COSEWIC 2016).

Harassment by parasitic insects can be a key driver of behaviour, movement, and body condition of caribou during summer (Downes et al. 1986, Russell and Nixon 1990). Warble flies (*Hypoderma tarandi*) and nose botflies (*Cephenemyia trompe*), both of the family Oestridae, are the primary source of harassment for Arctic caribou, though mosquitoes (Culicidae), blackflies (Simuliidae), and horseflies (Tabanidae) also are known to cause harassment (Downes et al. 1986, Toupin et al. 1996, Witter et al. 2012a). There are two primary harmful effects of insects. The direct effects of the parasitic burden can result in decreased body condition and reproduction (Albon et al. 2002, Cuyler et al. 2012). Indirect effects include the behavioural response to avoid insects, which includes a reduction in time spent foraging, increased energy expenditure, and selection of low-quality habitats such as ridge tops, coastal regions, snow patches, and unvegetated areas (Downes et al. 1986, Russell and Nixon 1990, Walsh et al. 1992, Toupin et al. 1996, Witter et al. 2012a). These behavioural responses can result in reduced body condition going into the winter with negative implications for survival and fecundity (Russell et al. 1993, Cuyler et al. 2012).

The responses of caribou to disease and other parasites are less evident and less studied than responses to insects. Most occurrences of disease and internal parasites in caribou are at subclinical levels (not severe enough to produce observable symptoms) but can still result in reduced body condition and fitness (Gunn and Irvine 2003). A range of pathogens and parasites observed in caribou includes viruses, bacteria (e.g. brucellosis), helminths (e.g., roundworms, tapeworms, and flukes) and protozoa (Tessaro and Forbes 1986, Gunn and Irvine 2003, Kutz et al. 2012, COSEWIC 2016). Gunn and Irvine (2003) suggest that caribou may have evolved foraging strategies to minimize exposure to parasites. Similar to parasitic insects, internal parasites can reduce caribou body condition and pregnancy rates resulting in population-level impacts (Albon et al. 2002, Kutz et al. 2012).

6.2.6.5 Climate Change

Climate change can potentially affect barren-ground caribou populations negatively and positively through various mechanisms. A recent literature review on this topic identified five primary factors that affect caribou population dynamics that could be affected by climate change: (i) summer range conditions, (ii) parasites and disease, (iii) movement, migration, and distribution, (iv) extreme weather and icing events, and (v) winter range conditions (Mallory and Boyce 2018). The effects of these factors are likely to be complex and interact with climate and non-climate-related factors that will result in substantial local variation and uncertainty in potential outcomes to caribou (Cebrian et al. 2008, COSEWIC 2016).

On balance, climate change is predicted to have mostly positive effects on the summer range condition of barren-ground caribou. Increasing temperatures will likely lead to longer growing seasons, increases in plant productivity, and an earlier onset of spring. Pearson et al. (2013) predict dramatic increases of 29-68% in above-ground plant biomass in the arctic by 2050. These effects could increase caribou body condition and reproductive success by lengthening the summer period of food availability, by increasing the amount of

forage and providing earlier access to forage (i.e., relative to the energetically demanding periods of birthing and lactation) (Tews et al. 2007, Cebrian et al. 2008, Mallory and Boyce 2018). This prediction is supported by a 20-year study in Norway, 1994–2015, where reindeer body mass resulted from greater plant productivity associated with warmer summer temperatures (Albon et al. 2017). In the PCH, earlier and warmer springs over the last thirty years have resulted in more food available for nursing cows, correlated with higher early calf survival (Griffith et al. 2002). However, positive effects on caribou summer range may not occur uniformly across all ranges. Some researchers have suggested the potential for a trophic mismatch between the timing of caribou and vegetation phenologies (Vors and Boyce 2009). Also, a predicted shift to greater cover of woody shrubs may be negative to caribou because shrubs tend to have greater chemical and structural defenses against herbivory and lower available protein than other forage such as grasses, forbs and sedges (Thompson and Barboza 2014).

Most studies suggest that climate change is predicted to increase the potential effects of parasitic insects and disease on barren-ground caribou (Mallory and Boyce 2018). Warmer and longer summers are likely to increase the length and severity of insect harassment, leading to lower body condition of caribou, including lactating cows and calves (Witter et al. 2012b). Climate change is also predicted to increase parasitism by other taxa, such as protozoans and helminths, and the northern expansion of some parasitic species has already been observed (Kutz et al. 2013). Certain ungulate diseases are also expanding northward as the climate warms (Arifin et al. 2020). Arctic ecosystems and species may be more susceptible to the spread of parasites and diseases than southern populations because they have had less exposure and opportunity to develop resistance from an evolutionary perspective.

Extreme weather, such as icing events, large changes in snowfall patterns, and summer heat episodes, is predicted to increase with climate change and negatively affect caribou (Mallory and Boyce 2018). Restricted or total loss of access to forage due to icing in the winter range can significantly affect survival and body condition for barren-ground caribou (Tyler 2010, Hansen et al. 2014). These events tend to be more catastrophic in the high Arctic but have been reported broadly across caribou ranges; including within the VGFN territory where the refreezing of wet snow one winter restricted access to food and greatly affected the health of a caribou herd (Sherry and Vuntut Gwitchin First Nation 1999, p. 186). Ice crusts on snow can also negatively affect travel abilities, body condition, and predation risk of caribou (Griffith et al. 2002). Deep snowpacks can reduce the availability of terrestrial lichen forage in winter. The Porcupine Caribou are known to vary winter range use in response to regional weather patterns (Russell et al. 1993). Changes to regional snow patterns may make areas, such as Eagle Plains, less available to the herd (Russell and Gunn 2017).

Several studies have predicted that climate change could affect the movements, migration and distribution of barren-ground caribou (Mallory and Boyce 2018). Effects are predicted to be most dramatic for subpopulations that travel over ice during the winter and where warming temperatures are already reducing the extent and duration of ice (Poole et al. 2010). Changes in regional snow conditions predicted due to climate change can also affect the migration patterns and seasonal distributions of barren-ground caribou. Russell et al. (1993) observed that the PCH adjusted the concentration of winter range use in relation to winter snowpacks. Areas such as Eagle Plains, which receive the greatest use during low snow years may become less available if regional snowpacks increase. Other studies have indicated that snow depths and snow conditions

(e.g., crusting) affect the migration routes, behaviours, and energetic costs of Porcupine Caribou during spring migrations (Whitten 1996, Griffith et al. 2002).

During winter, many barren-ground caribou subpopulations forage primarily on terrestrial lichen. Climate change is predicted to reduce terrestrial lichen biomass due to increased productivity from other plants (notably shrubs) and, in the boreal/taiga forest, due to increased forest fires (Mallory and Boyce 2018). Some studies indicate the area burned each year in northern Canada could double by the end of the century (Wotton et al. 2010). The potential adverse effects of climate change on caribou winter range depend mainly on the assumption that caribou require lichen-rich diets in winter. Some researchers have long questioned the need for lichens during the winter (Bergerud 1974), and more recent studies suggest that winter diets dominated by graminoids rather than lichens were not detrimental to caribou populations (Heggberget et al. 2002, van der Wal 2006). However, in the Western Arctic Herd a decline in recruitment and abundance in the herd occurred when the winter diet showed increased graminoids and decreased lichens being consumed (Joly 2009). In the past, the conditions of winter range and winter weather were not considered to be limiting to the PCH (Russell et al. 1993, Porcupine Caribou Technical Committee 1993). However, the combination of reduced lichen forage, deeper snow in some areas, and extreme weather events that are predicted to occur with climate change has the potential to increase the limiting effect of the winter range on the PCH.

6.3 PORCUPINE CARIBOU HERD MANAGEMENT

There is a long history of co-management of the PCH among indigenous, state, territorial and federal governments, with international and national management boards formalizing in the mid-1980s. Canada and the United States of America co-manage the herd under the *Agreement Between the Government of Canada and the Government of the United States of America on the Conservation of the Porcupine Caribou Herd (1987)*. The International Porcupine Caribou Board (IPCB) is comprised of Canadian and American representatives. The Porcupine Caribou Management Board (PCMB) is a co-management board for the Canadian portion of the herd's range, formed under the *Porcupine Caribou Management Agreement (1985)*. The *Porcupine Caribou Management Agreement (1985)* was established to coordinate management efforts toward conserving the herd and maintaining and protecting special harvesting rights in the Porcupine Caribou for indigenous users while providing for other users to share in the harvest. The PCMB and IPCB have led or contributed to the development of several plans for the PCH, including:

- *Plan for the International Conservation of the Porcupine Caribou Herd (1987),*
- *Wildlife Conservation and Management Plan for Yukon North Slope (2002),*
- *Porcupine Caribou Harvest Management Plan (2010)* and an associated *Implementation Plan (2010, revised 2016),*
- *Porcupine Caribou Herd Strategic Framework 2015-16 to 2019-20.*

The international agreement also provided for a joint technical committee to coordinate research and monitoring activities and advise the IPCB on scientific matters surrounding the herd. This committee, known

as the "Porcupine Caribou Technical Committee" (PCTC), has been functioning since the 1970s. Over time, the PCTC has taken on the role of advising the Canadian PCMB and the IPCB. The PCTC comprises biologists and scientists from Yukon, Alaskan, Canadian and American government agencies, university researchers, and other caribou experts.

The PCTC leads most of the monitoring and research initiatives associated with the PCH on behalf of the PCMB and the IPCB. Core monitoring work that the PCTC does includes population abundance surveys (normally every two to five years depending on herd behaviour, funding, and logistics), population demographic monitoring (e.g., calf birth and survival rates and important age and sex ratios), seasonal movement monitoring (via GPS telemetry tracking), caribou body condition monitoring, habitat and human disturbance assessments, and annual snow surveys. Monitoring results are normally provided to the PCMB and the IPCB via annual reports (e.g., Porcupine Caribou Technical Committee 2019) and via presentations at the annual harvest meetings. The PCTC also intermittently conducts specific data analyses, such as habitat selection studies and seasonal range mapping, to support land use planning and other management initiatives.

6.3.1 PROTECTED AREAS AND MANAGEMENT AREAS AND PLANS

A network of parks protects the portion of the PCH annual range that occurs within Yukon, special management areas, conservation areas, wilderness areas, protected areas, ecological preserves, habitat protection areas, and IMA zones within the North Yukon Regional Land Use Plan and the Peel Watershed Regional Land Use Plan (Map 6-2). In total, 54% of the annual range of the PCH within Yukon falls within some type of protected area where industrial activity is prohibited, 36% of the annual range occurs within regional LUP IMA zones, and 9% of the annual range is not covered by any type of land management zonation. A summary of the overlap of different types of protected areas and management areas with the seasonal ranges of the PCH is provided in Table 6-2.

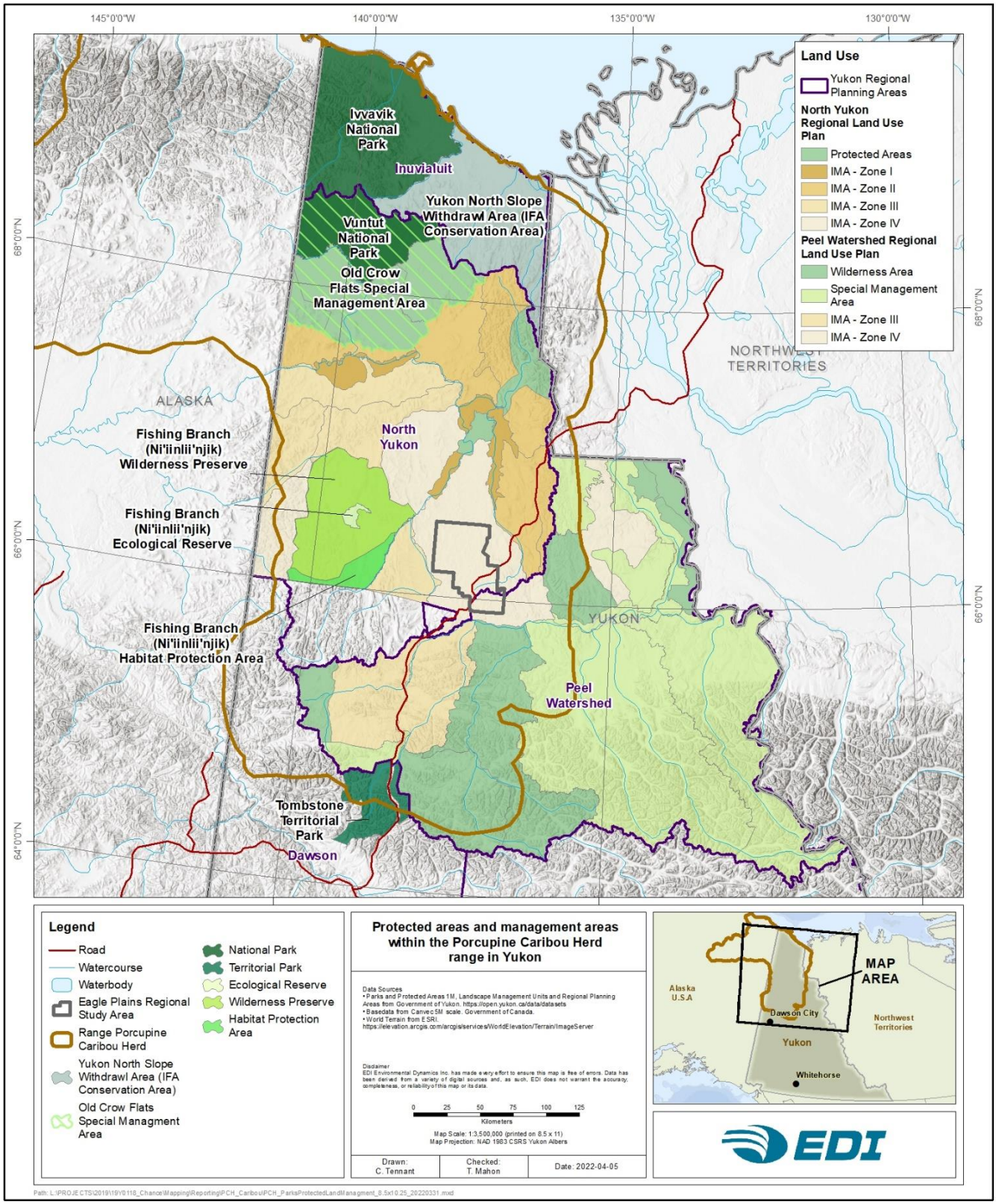
The Project is within the North Yukon Planning Region and Peel Watershed Planning Region and is subject to the NYLUP (Vuntut Gwitchin Government and Yukon Government 2009) and PWLUP (Peel Watershed Planning Commission 2019). The project falls within IMA Zone IV of both plans, a zone with lower ecological and cultural values and the highest permissible development of the four IMA zones. The NYLUP and PWLUP include management objectives and strategies to minimize the effects of human development activities on wildlife and wildlife habitat, generally, and specific objectives and strategies for caribou.

In addition to the Regional Land Use Plans, the Habitat Programs Section of the Yukon Department of Environment, Yukon Government maintains an inventory of important habitat areas for focal management species, including caribou, within the Wildlife Key Area Inventory (Environment Yukon 2014b). Wildlife Key Areas are specific geographic locations used by wildlife for critical, seasonal life functions, such as calving areas and mineral licks. No Wildlife Key Areas for caribou occur within the Project RSA (Government of Yukon 2015).

Table 6-2. Summary of the overlap of different types of protected areas and management areas with the seasonal ranges of the Porcupine Caribou Herd.

Season	Area (km²)	% of Seasonal Range					
		Protected Areas [1]	IMA I	IMA II	IMA III	IMA IV	Not Zoned
Early, Mid, Late Winter	58,090	37	2	8	19	18	15
Spring, Migration and Pre-calving	68,463	55	1	7	21	7	9
Calving	14,636	100	0	0	0	0	0
Post-Calving and Movement	7,622	100	0	0	0	0	0
Early Summer	5,901	100	0	0	0	0	0
Mid Summer	24,417	86	0	14	0	0	0
Late Summer and Fall Migration	57,928	60	4	15	13	8	0
Rut and Late Fall	65,249	31	3	10	23	13	20

[1] including parks, special management areas, conservation areas, wilderness areas, protected areas, ecological preserves, and habitat protection areas.



Map 6-2. Protected areas and management areas within the Porcupine Caribou Herd range in Yukon.

6.4 SEASONAL DISTRIBUTION

Considerable effort has been placed towards quantifying and mapping space use of PCH caribou in Yukon. Satellite-telemetry collaring programs have allowed for the tracking of individuals within the herd to delineate the herd's seasonal distributions. The PCTC supplied EDI with spatial polygons of PCH seasonal ranges spanning 37 years (1970–2016), which provided an opportunity to determine the amount of overlap between seasonal ranges and the RSA. Simple measures of overlap (%) can yield useful insight into the historical frequency of occupation and how PCH caribou are likely to interact with the Project.

The Project RSA overlaps a relatively small proportion of late fall (October 8 to November 30) and winter (December 1 to March 31) ranges. Most of the overlap occurs in portions of the ranges that are less frequently used on an annual basis. No overlap occurs with frequently used portions of late fall and winter ranges.

6.4.1 METHODS

The seasonal ranges used for this analysis consisted of mapped 'sensitive habitat' polygons provided by the PCTC that correspond to eight seasonal life cycle periods for the PCH (Porcupine Caribou Technical Committee 1993). Within each season, the PCTC identified four levels of use based on the frequency of overlap among annual estimates of seasonal home ranges computed for collared caribou, 1970–2016. The four use levels correspond to the proportion of years that home range estimates overlapped any given area: >40 %, 30–40 %, 20–30 %, and <20 %. The lowest category (<20 %) corresponds to very low use and is not considered part of the regular seasonal ranges of the PCH. The degree of overlap of the Project RSA with the PCH seasonal ranges was calculated in a GIS by measuring the overlap of the RSA with each 'frequency of use' category for each seasonal range. All eight life cycle periods were considered for the analysis, but only late fall (including rut, October 8 to November 30) and winter (December 1 to March 31) ranges overlapped the RSA. The overlap analysis was constrained to Yukon because fall and winter ranges in Yukon and Alaska are functionally discrete. Including the Alaskan ranges would dilute the degree of overlap of the RSA with the Yukon ranges.

6.4.2 RESULTS

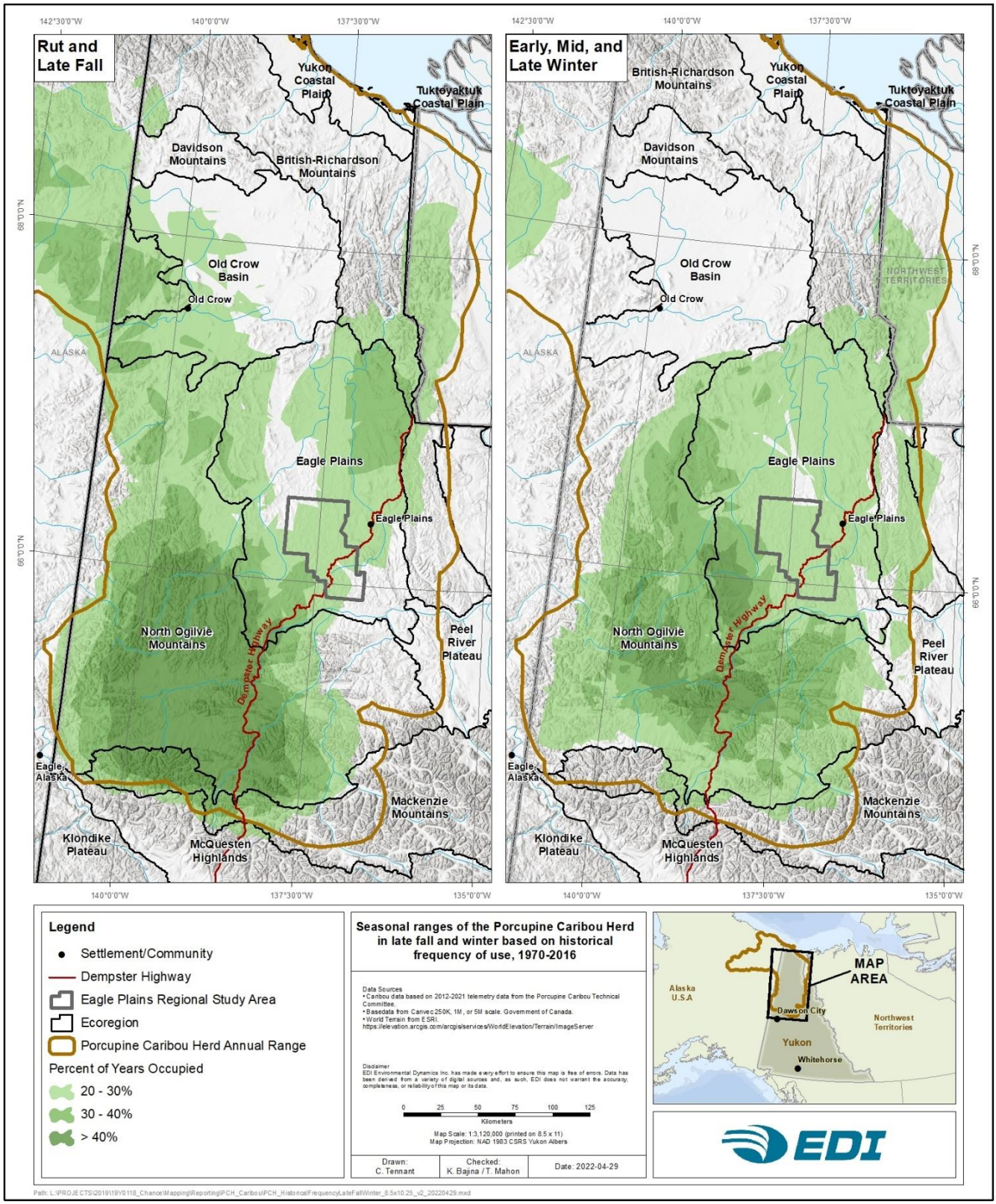
Only two seasonal life cycle periods had relatively frequent overlap (i.e., >20 % across years) with the RSA: (1) rut and late fall, and (2) early, mid, and late winter. For simplicity in this and subsequent analyses, these two periods are referred to as 'late fall' and 'winter' seasons. The RSA overlaps a relatively small portion of the seasonal ranges for both late fall and winter seasons: 5.97% in late fall and 6.54% in winter (Map 6-3). The greatest overlap occurred with the 20–30 % frequency of use areas; 5.90% and 6.12% of late fall and winter ranges, respectively (Table 6-3). No overlap occurred between the Project RSA and the most frequently used areas (>40 %) for either season.

PCH caribou have a wide-ranging distribution in late fall and winter and occupy a large portion of northern and central Yukon. Though some use occurs in the Project RSA and the broader Eagle Plains ecoregion, more frequent use occurs further southwest in the taiga cordillera of the North Ogilvie Mountains in late fall and

winter, and in the Richardson Mountains in late fall (Map 6-3). As discussed in the background sections, Section 6.2.2 *Seasonal Ranges and Movements* and Section 6.2.3.1 *Effects of Snow*, the distribution of the PCH in winter varies across four regions with different snow regimes: Yukon/Alaska border, Richardson Mountains, Ogilvie/Hart region, and the Whitestone/Eagle region (Russell et al. 1993). Use of the Whitestone/Eagle region is highest in years with lower than average snowpacks.

Table 6-3. Percent overlap of the Porcupine Caribou Herd late fall and winter ranges with the Project RSA based on the annual frequency of use by caribou, 1970–2016.

Seasonal Range	Annual Use by Caribou (%)	Percent Overlap with RSA (%)
Late Fall	< 20%	0.55
	20–30%	5.90
	30–40%	0.07
	> 40%	0.00
Winter	< 20%	0.07
	20–30%	6.12
	30–40%	0.42
	> 40%	0.00



Map 6-3. Annual frequency of use by the Porcupine Caribou Herd in late fall and winter ranges relative to the RSA, 1970–2016.

6.5 HABITAT USE

The general distribution of PCH caribou across seasons provides some context for their potential interaction with, and overlap of, the Project RSA. However, to caribou, all space on the landscape is not equivalent. Habitat needs to be considered to predict how often caribou might occur in the area based on the amount and distribution of necessary resources, such as forage. To better understand how PCH caribou use habitat across their late fall (including rut) and winter (i.e., early, mid, and late season) ranges, statistical models were developed to describe the relationship between caribou locations and relevant habitat components. These models considered habitat available to caribou broadly across their seasonal range. Habitat models were developed for late fall and winter using GPS location data (2012–2021) of satellite-collared caribou provided by the PCTC. Habitat model outputs were used to estimate the amount and distribution of habitat within the Project RSA and across the PCH's late fall and winter ranges.

The chosen models for late fall and winter performed reasonably well in predicting PCH caribou habitat selection based on several measures of model performance. Light macrolichen cover was the key driver of caribou habitat use in both seasons, though preference for lichen was strongest during winter. During late fall, caribou tended to select flat, mid-elevation regions near large waterbodies. During winter, caribou tended to select flat areas at low and high elevations while remaining distant from waterbodies. Caribou also avoided areas with dense conifer trees, shrub (deciduous and evergreen), forb, and graminoid cover. Base habitat models predicted the distribution and proportion of selected habitat in the Project RSA to be approximately equivalent during late fall and less during winter relative to the full extent of those seasonal ranges.

6.5.1 METHODS

6.5.1.1 Spatial Extent

Habitat modelling was conducted across the Yukon portion of the late fall and winter seasonal ranges defined in Section 6.5, *Seasonal Distribution* (i.e., areas with >20% frequency of annual use). Analyses were limited to the Yukon portion of late fall and winter ranges because of the potential differences in the ecology of caribou occupying Alaska versus Yukon. Using the full Yukon range yields the benefit of identifying broad patterns of habitat selection that affect the territory-wide distribution of the PCH. However, use of a broader scale may dilute patterns of habitat selection at local scales, e.g., only within Eagle Plains ecoregion. Whether such dilution leads to a loss of information depends on caribou habitat preferences in different ecoregions.

6.5.1.2 Data Preparation

The PCTC provided EDI with GPS location data (2012–2021) of satellite-collared PCH caribou. These data covered the entire annual range of the PCH and were reduced to include locations only within the late fall and winter range extents, as described above. The reduced data set consisted of 164 caribou in late fall and 172 caribou in winter. Most of these data (39.02% in late fall and 42.74% in winter) were attributed to locations collected in 2020–2021.

Spatial habitat data were acquired to relate caribou locations to environmental conditions within fall and winter seasonal ranges (as defined above) and, where appropriate, account for variation in conditions across time. For example, temporal changes (from 2010 to 2020) in the distribution of plant functional types (PFTs) due to grazing, fire, and climate-driven vegetation dynamics were captured using predicted top cover percentage (%) raster layers developed by Macander et al. (2022). Based on initial data exploration exercises, the PFTs that were considered ecologically relevant to habitat use of the PCH included light macrolichens (also see Macander et al. 2020), graminoids, forbs, evergreen shrubs, deciduous shrubs, and conifer trees. Data for topography on the landscape were acquired from a Digital Elevation Model (DEM; 1:250,000) for Yukon and were used to develop measures of absolute elevation (metres), slope percent (slope tool in the Spatial Analyst extension, ArcGIS 10.7; ESRI 2019), aspect (degrees), and a terrain ruggedness index (TRI; Sappington et al. 2007). A measure of relative elevation was created by combining absolute elevation and a simplified stream network (CanVec; nearest main watercourse from a 1:1,000,000 scale watercourse layer) and then employing the HAR tool from the Riparian Topography Toolbox in ArcGIS (Dilts 2015). A CanVec (1:1,000,000) waterbody layer was also used to map distances to waterbodies >1 ha. Caribou may use frozen waterbodies as an antipredator tactic to increase sightlines. They may also be mineral licks (Ferguson and Elkie 2005).

6.5.1.3 Statistical Models

Determining which resources (habitat features) are selected most often by animal populations is important because it provides information about how those animals meet fundamental requirements for survival and reproduction (Manly et al. 2002). Resource selection functions (RSF) are a statistical method that quantifies how resources are chosen by relating animal observations to resources available across the landscape. RSFs predict the probability of an animal occurring at specific locations (e.g., within a study extent) based on the combination of resources available at those locations. Results of a RSF can be mapped to identify important areas of resource selection for caribou and, therefore, can inform the conservation and management of the species.

Caribou observations were first overlayed with environmental spatial data layers to develop RSFs for PCH late fall and winter ranges. Environmental values were extracted for each known location of caribou plus ten times as many randomly sampled locations (spaced a minimum distance of 50 m apart). Availability was deemed global, so available locations were randomly selected within the late fall and winter study areas. Independence among observations of caribou was assumed by resampling caribou locations to a maximum of one per day. Available locations were compared to locations known to be occupied or 'used' by caribou to identify the combination of resource units preferred by caribou. Logistic regression was used to develop RSFs within a generalized linear mixed model framework. The general formula for logistic regression is as follows:

$$logit(P) = \beta_0 + \beta_1 x_1 \ldots \beta_n x_n + Y$$

where the predicted value P is dependent on the linear predictor ($\beta_0 + \beta_1 x_1 \ldots \beta_n x_n$) through a logit-link function, and x is the *i*-th environmental covariate and β is its associated coefficient. An interaction was included between Ecoregion and macrolichen cover to account for the varied distribution, and possibly selection, of lichen among ecoregions. An additional random effect term, Y, was added to account for (a) the

variation in habitat selection associated with each caribou year and (b) the unequal sample sizes among years. Large weights were applied to all available locations ($weight_{avail}$ = 1,000) relative to used locations ($weight_{used}$ = 1) to ensure that parameter estimates were not biased by the sampling ratio of used and available points (Muff et al. 2020). The linear predictor was used to calculate the probability of selection P:

$$P = \frac{e^{(\beta_0+\beta_1 x_1 \ldots \beta_n x_n+Y+E)}}{1+e^{(\beta_0+\beta_1 x_1 \ldots \beta_n x_n+Y+E)}}$$

where e is the natural exponential function and P is bounded by $0 < P < 1$.

6.5.1.4 Exploring Covariate Relationships

Before analyses, all continuous covariates, such as PFT top covers, elevation, slope, TRI, HAR, and distance to waterbodies, were standardized to have a mean of zero and a standard deviation of one. Standardizing the values across covariates ensures model convergence and improves the ability to rank the relative importance of each covariate in a model. The aspect was converted from continuous (degrees) to categorical (cardinal directions) based on 90° intervals. To prevent biased estimates of coefficients and inflated errors, multicollinearity among covariates was assessed using a correlation matrix (dropping variables with Pearson's product moment correlation $|r| > 0.7$ [see Dormann et al. 2013]) and variance inflation factor scores (dropping variables with VIF scores > 3 [Zuur et al. 2009]). For example, absolute and relative (HAR) elevation in winter were highly correlated (r = 0.69). The decision to choose one over the other was based on univariate response curves assessed using generalized additive modelling (GAM; see below). In other words, of the highly correlated covariates, the one with the greatest selection response (slope) was chosen. In this case, absolute elevation was retained over HAR.

Data exploration consisted of (1) univariate analyses with the response variable (i.e., used versus available), and (2) univariate and multivariate GAMs to assess the potential marginal effect of each covariate on the (non-linear) shape of the response curve (i.e., probability of use). These exercises informed model development. For example, rather than assuming a linear increase for percent light macrolichen cover, the variable was logarithmically transformed to fit the expectation that the probability of selection increased at incrementally smaller values as the quantity of lichen in a patch increased (Figure 6-2). Additionally, different patch sizes were considered for PFT covers by estimating the mean percent cover within 100 m, 500 m, and 1,000 m buffers around used and available points.

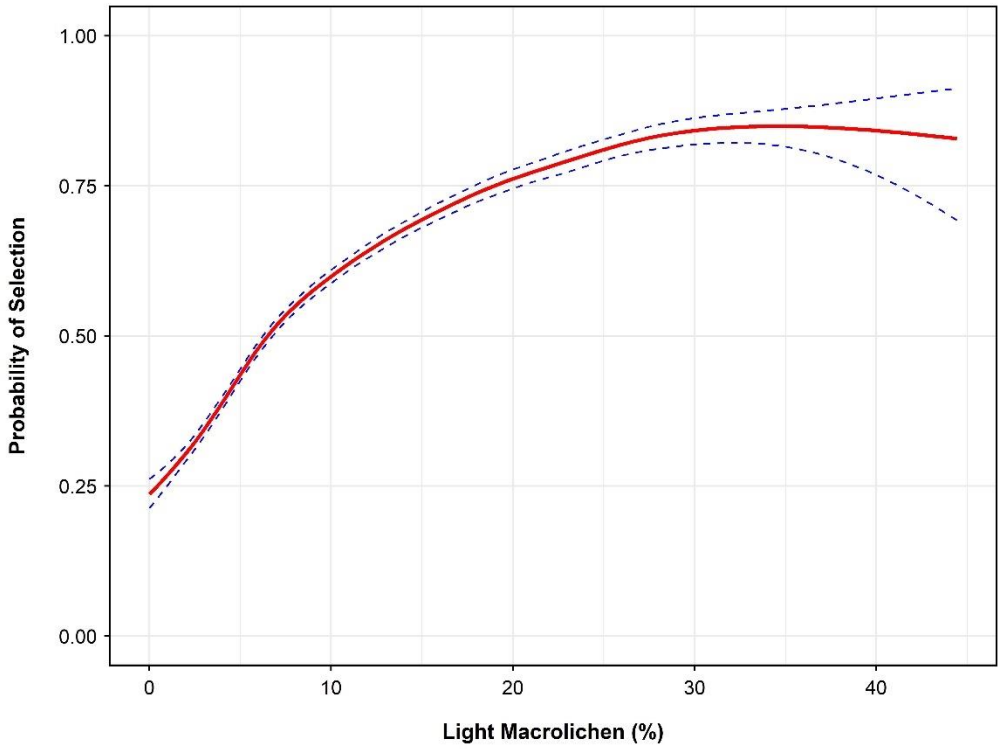


Figure 6-2. Generalized additive model assessing the probability of selection of light macrolichens by PCH during winter.

6.5.1.5 Model Selection and Validation

Habitat models were selected for late fall and winter by implementing 'full' models (with all relevant covariate terms) and assessing the variation explained by the inclusion of each covariate. The best models were chosen based on (1) statistical considerations using Akaike's information criterion (AIC; Burnham and Anderson 2002), which balances the trade-off in the amount of variance explained (i.e., model likelihood) with the number of parameters considered, and (2) ecological significance to caribou in the late fall and winter seasons. Since the goal of the model was prediction, as many covariates as necessary were retained. Thus, alternative candidate models were considered not by testing competing hypotheses but rather by dropping covariates with low magnitude (scaled) coefficients $< |0.1|$. Model diagnostics were run on simulated residuals to assess (a) goodness-of-fit (i.e., Kolmogorov-Smirnov test), (b) issues related to dispersion, (c) the frequency of outliers, (d) variance among categorical predictors, and (e) quantile regressions of observed versus expected residuals.

The predictive performance of late fall and winter models were assessed using a 5-fold cross-validation approach as per the steps outlined in Johnson et al. (2006). (1) The original data were partitioned into 5-fold groups. For each iteration of the evaluation procedures, four groups were combined into the training dataset. The remaining group was used as the testing dataset. (2) The RSF was estimated for each training dataset. (3) RSF values from the training dataset were predicted in a GIS and reclassified into 10 quantile rank bins. (4) Midpoint (median) values of raw RSF scores were calculated for each quantile bin. (5) Percent utilization was

calculated for each quantile bin using equation 4 in Johnson et al. (2006). (6) The number of used observations from the testing dataset that fell in each quantile bin were counted. (7) The number of expected observations from the testing dataset was calculated for each quantile bin using equation 5 in Johnson et al. (2006). (8) Observed versus expected counts and proportions from the testing dataset were compared and tested formally using linear regression, spearman's rank correlation, chi-square goodness-of-fit (i.e., observed versus expected counts), and tests of proportions for each quantile bin (i.e., chi-square observed versus expected proportions). These steps were repeated until each fold was used as the testing dataset. The 5-fold cross-validation procedure was implemented for several candidate models for both late fall and winter to determine whether simpler models yielded more accurate predictions.

6.5.1.6 Habitat Quality, Amount, and Distribution

Models selected for late fall and winter were used to generate predictive habitat maps across those seasonal ranges. These mapped predictions aimed to identify the amount and distribution of habitat available to PCH caribou. To facilitate the comparison of relative habitat quality across the study area, the RSF predictions were classified into four ordinal ratings: Very Low, Low, Moderate, and High. To help objectively define ecologically relevant classification of the RSF values we conducted a post-hoc selection-ratio test of the caribou locations against the RSF predictions. This approach identified the point within the RSF value range where values switch from avoided to being selected. The portion of the 'selected' RSF value range was divided at the midpoint into the Moderate and High ratings and the portion of the 'avoided' range was divided at the midpoint into the Very Low and Low ratings. For example, for RSF output with a range from 0 to 1, if the selection-ratio calculation determined the breakpoint between avoidance and selection occurred at 0.6, the habitat quality ratings would be Very Low = 0.0-0.3, Low = 0.3-0.6, Moderate = 0.6-0.8, and High = 0.8-1.0.

To determine the breakpoint within the RSF value range that switched from avoided to selected, the frequency distributions of mapped RSF predictions were partitioned into 50 quantile bins with each bin consisting of two-percentile intervals. Selection ratios were calculated for each quantile bin by associating mapped RSF predictions to used and available collar locations and then assigning each location to a quantile bin. The selection ratio for each bin was calculated as follows:

$$SR_{bin} = \frac{Used_{prop} - Avail_{prop}}{Avail_{prop}}$$

where $Used_{prop}$ and $Avail_{prop}$ are the proportion of used and available locations in each quantile bin. Selection ratios were used to categorize habitat quality into the discrete ratings discussed above (i.e., Very Low, Low, Moderate, and High). The bin at which selection ratios switched from negative to positive identified the threshold between Low and Moderate quality habitat. Very Low quality habitat was identified based on the midpoint between the smallest quantile bin and the Low/Moderate quality habitat threshold. Similarly, the midpoint between the Low/Moderate quality habitat threshold and the largest quantile bin differentiated Moderate and High quality habitat. For certain management questions or purposes, it may be adequate to just use two habitat classes—avoided or selected. Subdividing those into the four ratings provides further resolution for certain management questions or objectives. For example, when comparing different

road route options that must traverse an area of 'selected' habitat, potential impacts are expected to be minimized by locating the road in Moderate versus High habitat areas.

RSF frequency distributions were extremely right skewed so that very high RSF values were low in frequency. This issue arises when dealing with RSFs with 'infinitely weighted' available locations, which has become standard practice in recent years (e.g., Muff et al. 2020). In late fall and winter RSFs, the ratio of used to available locations was 1:10 with an additional large weight (i.e., 1,000) assigned to each available location. These large weights effectively reduce RSF predictions to very small decimal numbers and skews their distribution. To ensure that this skew did not underestimate the amount of High versus Moderate quality habitat, all RSF values equal to or greater than the 98th percentile were fixed at that value. Thus, there were effectively 49 quantile bins, in total, because all predictions in the 50th bin were assigned to the 49th bin.

To compare the amount and distribution of selected habitat within the Project RSA (~2,386 km^2) to the broader landscape, the amount of selected habitat was assessed within similar sized polygons across the seasonal ranges. A grid composed of 50 km x 50 km (2,500 km^2) cells was placed over the Yukon extent of the PCH ranges, and the proportion of selected habitat was assessed for each cell.

6.5.1.7 Statistical and Geospatial Software

All statistical analyses were completed in R software for Statistical Computing, version 4.1.0 (R Development Core Team 2020). Package 'mgcv' (Wood 2011) was used to develop and assess non-linearity in response-covariate relationships using generalized additive modelling. Package 'glmmTMB' (Brooks et al. 2017) was used to fit generalized mixed-effects models. In addition to visual assessment of covariate-response relationships, package 'DHARMa' (Hartig 2021) was used to assess simulated model residuals (e.g., goodness of fit, dispersion, outliers, heteroscedasticity). Package 'groupdata2' was used to partition data into training and testing datasets; it was especially useful for partitioning a consistent number of used and available locations among the data folds. All geospatial analyses were completed in R, version 4.1.0 (R Development Core Team 2020), QGIS (QGIS Development Team 2020), and ArcGIS, version 10.7 (ESRI 2020).

6.5.2 RESULTS AND DISCUSSION

6.5.2.1 Habitat Models

The selection of late fall and winter habitat models required an iterative model fitting, testing, and cross-validation process. The appropriate patch size (i.e., 100 m, 500 m, or 1,000 m) of each PFT was selected based on GAM plots to identify which patch size corresponded with the greatest change (slope) in selection. Initial model selection procedures determined that 'full' models, with all possible covariates, were the most parsimonious for late fall (No. 1 in Table 6-4) and winter (No. 1 in Table 6-5) RSFs. However, the 'full' model for late fall did not yield the best predictive performance based on the 5-fold cross-validation procedure. The best performing model for late fall excluded the effects of all PFTs except lichen (No. 3 in Table 6-4; Table 6-6), which yielded a better fit between observed and expected proportions across 10 quantile bins based on regression (i.e., higher R^2; intercepts closer to zero and slopes closer to one), tests of proportions

(i.e., greater number of equivalent observed/expected bins), and spearman rank correlations (i.e., larger correlation coefficients). See Section 5.6.1 for plots and summaries of 5-fold cross-validation results for the selected late fall RSF model. Regressions for each fold had very strong fits (all $R^2 > 0.93$) but did have intercepts that differed from zero and slopes that differed from one. The primary reason for this deviation was a greater number of observed proportions in the largest (10th) quantile bin, whereas all other bins were close to the line of unity (1:1 ratio). Spearman rank correlations were consistently very high (all $r > 0.98$ and $p < 0.001$). The mean number of bins in which observed proportions were no different than expected proportions, across all five folds, equalled 5.2 (low = 4, high = 8).

The best performing model for winter consisted of the full parameterization (No. 1 in Table 6-5; Table 6-7), which yielded a better fit between observed and expected proportions across 10 quantile bins based on regression (i.e., higher R^2; more intercepts closer to zero and slopes closer to one), tests of proportions (i.e., greater number of equivalent observed/expected bins), and spearman rank correlations (i.e., larger correlation coefficients) than any alternative candidate model. See Section 5.6.1 for plots and summaries of 5-fold cross-validation results for the selected winter RSF model. Regressions for each fold had strong fits (all $R^2 > 0.79$) and had intercepts that were no different than zero and slopes that were no different than one. Spearman rank correlations were consistently very high (all $r > 0.98$ and $p < 0.001$). The mean number of bins in which observed proportions were no different than expected proportions, across all five folds, equalled 5 (low = 3, high = 6). In conclusion, both late fall and winter model had a fair agreement between observed and expected proportions and had very high spearman rank correlations, which suggests that these models perform adequately for prediction (e.g., see Johnson and Russell 2014, White and Gregovich 2017, Johnson et al. 2020).

Habitat use varied moderately between late fall and winter. Although selection coefficients were highest for macrolichen cover and elevation in both seasons, the relationships varied somewhat, and the extent of Moderate and High rated habitat was reduced in winter compared to late fall. Selection (positive coefficient) for macrolichen cover, the most relevant plant functional type in either season, was greater in magnitude during winter (Table 6-7) than during late fall (Table 6-6). Though the magnitude of selection for macrolichen varied by ecoregion (i.e., interaction), the best-fitting patch size for the selection of macrolichen was consistently 100 m. However, patch size varied for other plant functional types considered during winter (Table 6-7; e.g., conifer tree cover versus forbs). During late fall, caribou selection (positive coefficients) of vegetation was solely driven by lichen cover. Meanwhile, during winter, caribou tended to avoid (negative coefficients) other PFTs such as conifer trees, forbs, graminoids, deciduous shrubs, and evergreen shrubs. The lack of selection/avoidance of other PFTs during late fall is likely the result of more diverse forage use in late fall than in winter and individual variation in habitat choice. Such variation is consistent with a broad habitat selection pattern at the population-level, which led to the poorer predictive performance of late fall models that included other PFT covers.

Preference of absolute elevation also varied between the seasons. Caribou occupied primarily mid elevations (approximately 750 m) during late fall (Table 6-6) but selected low and high elevations during winter (Table 6-7). Caribou also varied in their proximity to waterbodies >1 ha between seasons. Caribou tended to be closer to such waterbodies (negative coefficient) during late fall but remained farther (positive coefficient)

during winter. The ecological basis for these relationships to waterbodies is unclear, but the covariates were retained in the models because they improved predictive performance.

Coefficients associated with lichen cover were of the greatest magnitude, which suggests that the selection of lichen is the primary driver of habitat selection in late fall and winter. This pattern in vegetation use across both seasons is consistent with what is expected of PCH caribou diet and ecology (Thompson and McCourt 1981, Russell et al. 1993). Late fall and winter diets are mostly composed of lichens (and mosses). Though there is some evidence that caribou may forage on evergreen shrubs and deciduous shrubs during late fall (Russell et al. 1993), this pattern was weak, and these covariates were not included in the final model. Another similarity in selection among seasons was in terms of slope and aspect. Caribou avoided steep slopes (negative coefficients, logarithmic) and selected south- and west-facing aspects, which receive greater solar radiation than east- and north-facing aspects. This pattern could be attributed to productive lichen patches during both seasons and to decreased snow depth due to melt and wind during winter.i

Selection gradients (i.e., the degree of preference/avoidance) were greater during winter than late fall. This is likely because forage was more broadly available across different habitats due to lower snowpacks in late fall and because more locations in the late fall were likely associated with travelling than foraging. Though caribou distribution is broader in winter, there was clearly a stronger preference (positive coefficient) for light macrolichens and a stronger avoidance (negative coefficient) of areas with high cover of conifer trees. Stronger preference and avoidance in winter may result in more concentrated forage on lichen and from snow constraints on caribou distribution.

Temporal patterns of habitat selection also varied between late fall and winter. Habitat selection seemed to be fairly consistent across years in late fall but varied from winter to winter. A very small portion of the overall variance ($\sigma^2 = 0.00021$) in habitat selection could be explained by year effects during late fall. This model contributed little to the overall model likelihood and was penalized for an additional parameter ($AIC_\Delta = 2$); thus, year effects were not included for the late fall model. However, during winter, a year effect explained a sufficient amount of variation ($\sigma^2 = 0.013$) in habitat selection to warrant inclusion in the final model (i.e., $AIC_\Delta = -90.9$ with year effect). Variation among years was likely greater in winter due to the effects of snow across the landscape, which can broadly affect the distribution of PCH caribou and their foraging habits.

Snow accumulation and distribution is invariably an important factor affecting habitat selection by PCH caribou at multiple scales. At fine spatial scales, snow depth, density, and hardness can limit access to terrestrial lichens (Johnson et al. 2001). Although snow depth data were not available, elevation was considered as a suitable surrogate. In the winter RSF, caribou exhibited selection for low and high elevations and avoidance of mid elevations, where snowpacks are often deepest. Indeed, Pedersen et al. (2021) identified a significant correlation ($r > 0.6$) between elevation and snow depth in 33% of winters during their study of another barren-ground caribou herd, the Central Arctic Herd. The amount of snowfall and snowpack at broad spatial scales can cause the PCH to occupy different core wintering regions. For example, PCH caribou occupy the Ogilvie/Hart and Richardson Mountains regions on a rotational basis because these regions receive less snow than adjacent areas (Russell et al. 1993). This pattern is consistent with the current data, whereby GPS-collared PCH caribou occupied different ecoregions at different intensities (i.e., number of individuals and locations) across time.

Though snow depth could not be considered explicitly in habitat models, the variation estimated among years and differences in the use of ecoregions and elevations were considered to partially account for the influence of snow. These variables are considered coarse correlates of snowpack patterns across the landscape (Russell et al. 1993), yet, the exclusion of an explicit snowpack covariate does limit fine-scale predictions of how snow affects caribou resource selection. Ultimately, snow depth is probably the primary, ecologically relevant metric that would supplement the current covariate suite and provide greater insight on winter selection patterns. Available snow covariates were examined and deemed not to be useful. For example, information on snow prevalence, date of the first snow, or snow cover are not inherently useful because caribou (and other ungulates) are not constrained in their movements and foraging by shallow snow. Given these considerations, it was deemed more appropriate to account for the coarser effects of snow depth using ecoregion and elevation rather than using a snow cover that may be misleading both ecologically and mechanistically, resulting in a spurious correlation.

Table 6-4. Model selection of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during late fall.

No.	Model	*K*	AIC	Δ AIC
1	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_100m + Forbs_100m + Deciduous_Shrub_1000m + Graminoid_1000m + Evergreen_Shrub_100m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	22	167,637.4	0.0
2	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_100m + Deciduous_Shrub_1000m + Evergreen_Shrub_100m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	20	167,644.0	6.6
3*	~ Ecoregion * log(Lichen_100 + 1) + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	17	167,750.7	113.3
4	~ Ecoregion * log(Lichen_100 + 1) + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies	14	167,783.0	145.6
5	~ 1 (null model)	1	169,964.2	2,326.8

* Chosen model based on best predictive performance in 5-fold cross-validation.

Table 6-5. Model selection of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during winter.

No.	Model	*K*	AIC	Δ AIC
1*	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_1000m + Forbs_500m + Deciduous_Shrub_1000m + Graminoid_1000m + Evergreen_Shrub_100m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	21	255,398.7	0
2	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_1000m + Forbs_500m + Graminoid_1000m + Evergreen_Shrub_100m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	20	255,428.0	29.3
3	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_1000m + Forbs_500m + Deciduous_Shrub_1000m + Graminoid_1000m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	20	255,500.1	101.4
4	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_1000m + Forbs_500m + Graminoid_1000m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	19	255,538.9	140.2
5	~ 1 (null model)	1	265,758.0	10,359.3

* Chosen model based on best predictive performance in 5-fold cross-validation.

Table 6-6. Base habitat model of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during late fall.

Model Term	Estimate	Std. Error	*Z*-statistic	*P*
Intercept				
Eagle Plains & North *(Reference)*	-9.697	0.035	-273.568	<0.0001
Ecoregion (factor)				
North Ogilvie Mountains	-0.136	0.075	-1.803	0.0714
British-Richardson Mountains	0.533	0.047	11.312	<0.0001
Old Crow Basin	0.341	0.038	9.082	<0.0001
Davidson Mountains	0.666	0.041	16.132	<0.0001
Aspect (factor)				
South	0.099	0.032	3.147	0.00165
East	0.003	0.032	0.082	0.935
West	0.161	0.031	5.162	<0.0001
Ecoregion–Lichen_100m Interaction				
Eagle Plains * Lichen_100m Percent[1,2] *(Reference)*	0.694	0.029	23.880	<0.0001
North Ogilvie Mountains * Lichen_100m Percent[1,2]	0.062	0.063	0.990	0.322
British-Richardson Mountains * Lichen_100m Percent[1,2]	-0.311	0.043	-7.300	<0.0001
Old Crow Basin * Lichen_100m Percent[1,2]	-0.157	0.037	-4.216	<0.0001
Davidson Mountains * Lichen_100m Percent[1,2]	-0.224	0.042	-5.324	<0.0001
Digital Elevation Model				
Slope Percent[1,2]	-0.311	0.017	-18.006	<0.0001
Absolute Elevation[2] (linear)	0.865	0.073	11.907	<0.0001
Absolute Elevation[2] (quadratic)	-0.813	0.070	-11.661	<0.0001
Distances				
Distance to Waterbodies[2]	-0.184	0.016	-11.827	<0.0001

[1] covariate transformation = $\log_e(x + 1)$.

[2] covariate estimates based on standardized covariate values = (x – mean[x])/std. deviation(x).

Table 6-7. Base habitat model of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during winter.

Model Term	Estimate	Std. Error	*Z*-statistic	*P*
Intercept				
Eagle Plains & North *(Reference)*	-10.007	0.051	-195.485	<0.0001
Ecoregion (factor)				
North Ogilvie Mountains	0.616	0.040	15.502	<0.0001
British-Richardson Mountains	0.738	0.039	19.152	<0.0001
Old Crow Basin	0.281	0.034	8.229	<0.0001
Aspect (factor)				
South	0.196	0.025	7.671	<0.0001
East	0.030	0.026	1.154	0.249
West	0.329	0.025	13.294	<0.0001
Ecoregion– Lichen_100m Interaction				
Eagle Plains * Lichen_100m Percent[1,2] *(Reference)*	1.119	0.018	62.823	<0.0001
North Ogilvie Mountains * Lichen_100m Percent[1,2]	-0.154	0.034	-4.485	<0.0001
British-Richardson Mountains * Lichen_100m Percent[1,2]	-0.614	0.036	-17.203	<0.0001
Old Crow Basin * Lichen_100m Percent[1,2]	-0.123	0.034	-3.602	0.000316
Other Plant Functional Types				
Conifer_Tree_1000m Percent[2]	-0.256	0.009	-27.241	<0.0001
Forbs_500m Percent[2]	-0.166	0.010	-17.068	<0.0001
Deciduous_Shrub_1000m Percent[2]	-0.096	0.009	-10.137	<0.0001
Graminoid_1000m Percent[2]	-0.120	0.009	-12.706	<0.0001
Evergreen_Shrub_100m Percent[2]	-0.052	0.009	-5.580	<0.0001
Digital Elevation Model				
Slope Percent[1,2]	-0.216	0.012	-18.678	<0.0001
Absolute Elevation[2] (linear)	-1.369	0.056	-24.410	<0.0001
Absolute Elevation[2] (quadratic)	0.889	0.053	16.627	<0.0001
Distances				
Distance to Waterbodies[2]	0.201	0.010	20.321	<0.0001

[1] covariate transformation = $\log_e(x + 1)$.

[2] covariate estimates based on standardized covariate values = (x – mean[x])/std. deviation(x).

6.5.2.2 Predicted Habitat Distribution

Predicted habitat quality, amount, and distribution depended on the magnitude of resource selection and the distribution of habitat covariates across the landscape (i.e., primarily light macrolichen cover). Predictions from habitat models for late fall and winter were classified into four ordinal habitat quality ratings (i.e., Very Low, Low, Moderate, or High quality). See Section 6.9.2 for plots that demonstrate the switch from negative to positive selection ratios across quantile (two-percentile) bins for late fall (31st quantile bin [60th–62nd percentile]; Attachment Figure 11 and Attachment Figure 12) and winter (30th quantile bin [58th–60th percentile]; Attachment Figure 15 and Attachment Figure 16). Furthermore, Section 6.9.2 provides plots of (a) selection ratios associated with each habitat rating and (b) the proportion of the late fall and winter ranges composed of each habitat rating. In general, Very Low quality habitat had low, negative selection ratios while High quality habitat had high, positive selection ratios. Approximately 60% of the late fall and winter ranges consisted of avoided (Very Low and Low) habitat, and 40% consisted of selected (Moderate and High) habitat.

The distribution of habitat across the landscape differed between late fall (Map 6-4) and winter (Map 6-5) ranges. The proportion of selected late fall habitat in the Project RSA (0.404) was equivalent to the mean proportion in the broader late fall range when accounting for variance in that estimate (Table 6-8). In contrast, the proportion of selected winter habitat in the Project RSA (0.265) was substantially less than the mean proportion in the broader winter range (0.411) (Table 6-8). Though mean estimates of selected habitat in the broader late fall and winter ranges were approximately 0.40, there was considerable variation among the 50 km x 50 km cells used in the analyses. In the late fall range, the lowest and highest proportions of selected habitat were 0.140 and 0.881, respectively. Cells with the lowest proportions were located mostly along the western edge of the late fall range (i.e., high elevations in the North Ogilvie Mountains), and cells with the highest proportions were located mostly along the eastern edge of the late fall range (i.e., Eagle Plains ecoregion transitioning into Richardson Mountains). The lowest and highest proportions of selected habitat in the winter range were 0.106 and 0.764, respectively. Cells with the lowest proportions were located centrally in the winter range (i.e., Eagle Plains ecoregion) and cells with the highest proportions were located mostly along the eastern and southern edge of the winter range (i.e., Richardson mountains and North Ogilvie Mountains).

In the Project RSA, selected late fall habitat was concentrated at mid-elevation plateaus and depended on the amount of lichen cover. For example, a large patch of High quality habitat occurred adjacent (south side) to the Dempster Highway (inset in Map 6-4); this patch occurred on a large mid-elevation plateau, in proximity to waterbodies >1 ha in size, and relatively high amounts of lichen cover. In fact, several portions of the Dempster Highway intersected either Moderate or High quality habitat at mid-elevations and with moderate lichen cover. Across the broader landscape, the greatest amount of selected habitat occurred within the southern extent of the North Ogilvie Mountains ecoregion, the western extent of the British-Richardson Mountains ecoregion, and in large areas at the eastern extent of the Eagle Plains ecoregion (Map 6-4). Avoided habitat primarily occurred at low elevation valley bottoms or high elevations (> 750 m, e.g., at the peaks of British-Richardson Mountains) in areas with low lichen and vegetative cover.

Winter habitat occurred primarily at either valley bottoms with open stunted spruce or high elevations with sparse tree cover and high macrolichen cover. Selected habitat was also distant from large waterbodies and

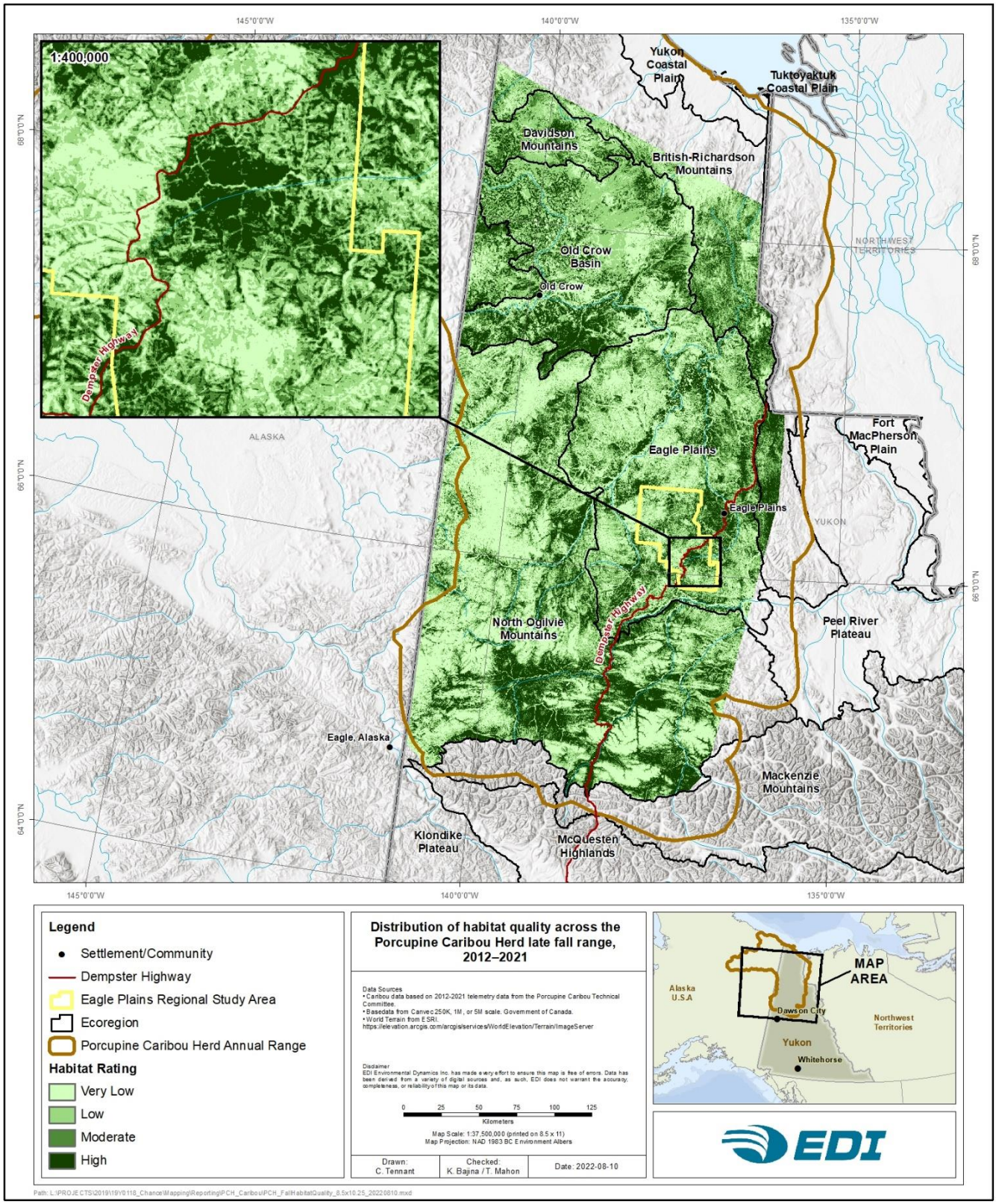
wet environments containing forbs and graminoids, as well as areas with high cover of deciduous or evergreen shrub. In the RSA, selected habitat was localized in specific regions. For example, a large extent of High quality habitat occurred at the northern extent of the RSA, on the west side of Chance creek (Map 6-5). This area is low in elevation and has relatively high lichen cover. Two other large patches of High quality habitat occur at the southern extent of the RSA, both associated with low elevation and very high lichen cover. Although mid-elevations have relatively lower RSF predictions, in general, certain mid-elevation areas with high lichen cover, such as the areas along the Dempster Highway for late fall habitat are also predicted to offer Moderate or High quality winter habitat (inset in Map 6-4). Across the broader landscape, large extents of selected habitat occurred in the Richardson Mountains, the Ogilvie Mountains, and northern extents of Eagle Plains ecoregion. The greatest amount of avoided habitat (Very Low and Low) also occurred in Eagle Plains due to large areas of recent wildfire and its vast mid-elevation plateaus.

The use of multiple habitat ratings, as opposed to a binary classification (e.g., suitable versus unsuitable), was necessary to retain high resolution information on the distribution of habitat quality. For example, there were stark differences in the amount of lichen cover in areas of Moderate versus High quality habitat, and this can have implications for timing and extent of Project operations. Map 6-6 provides a comparison between winter habitat quality ratings and macrolichen cover in the Project RSA. There is a clear distinction between areas of high versus low macrolichen cover. There are several High quality ratings that occur along circular and N-S oriented ridges at the southwest corner of the RSA. Adjacent areas of similar elevation but with low macrolichen cover, transition from Moderate to Very Low in quality. Since macrolichen cover is the strongest driver of resource selection by PCH caribou during winter, it is important to be able to distinguish these high-value regions for management purposes.

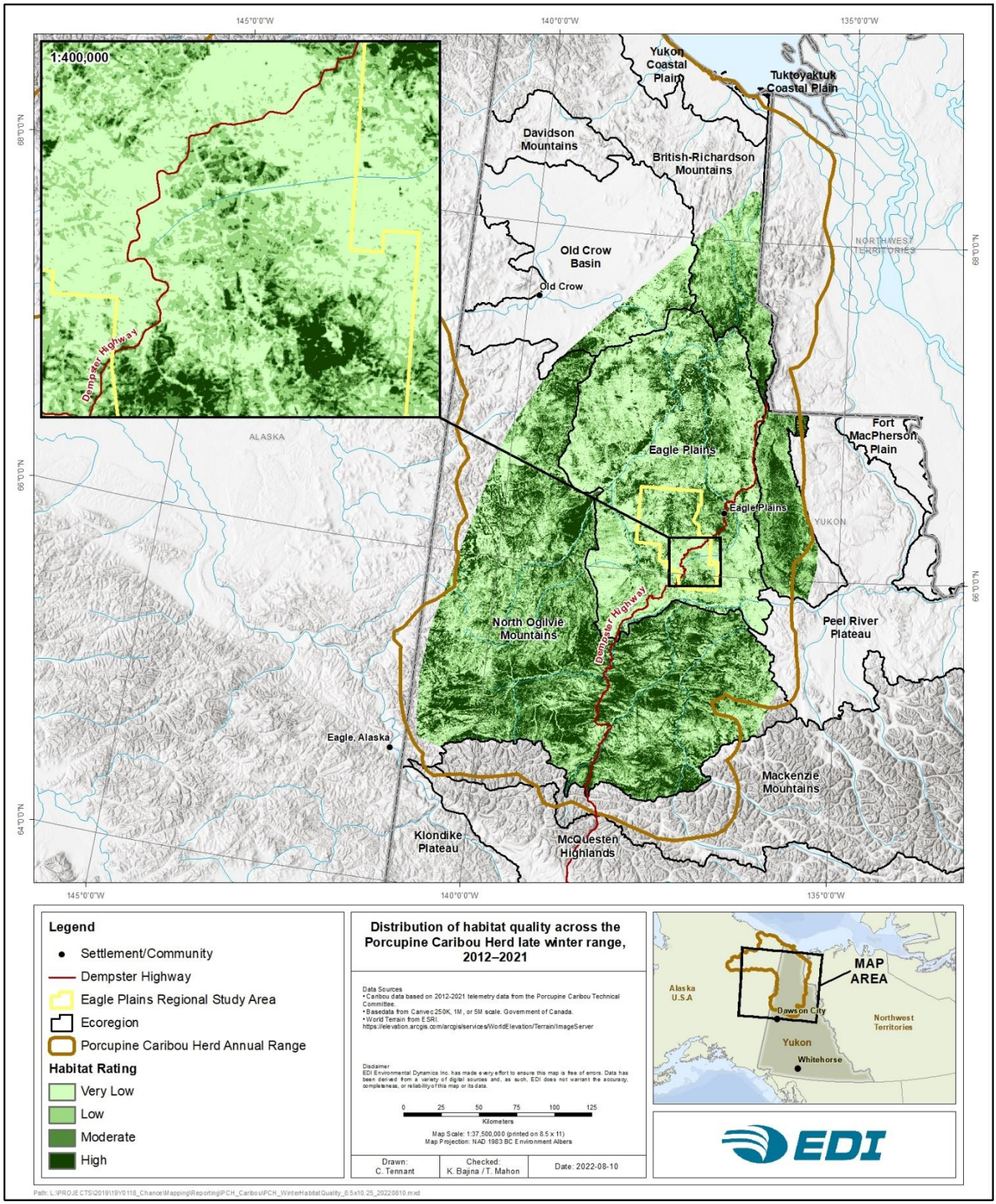
Table 6-8. Proportion of selected (Moderate and High) caribou habitat in the Project RSA relative to the mean (and std. error) of 50 km x 50 km cells covering late fall and winter range extents.

Season	Scale	Proportion of Moderate and High Quality Habitat	Std. Error
Late Fall	Project RSA (2,387 km² total)	0.404	–
	Late Fall Range (88,149 km²) [1] (2,500 km² per cell) – 53 cells total	0.415	± 0.025
Winter	Project RSA (2,387 km² total)	0.265	–
	Winter Range (65,077 km²) [1] (2,500 km² per cell) – 40 cells total	0.411	± 0.026

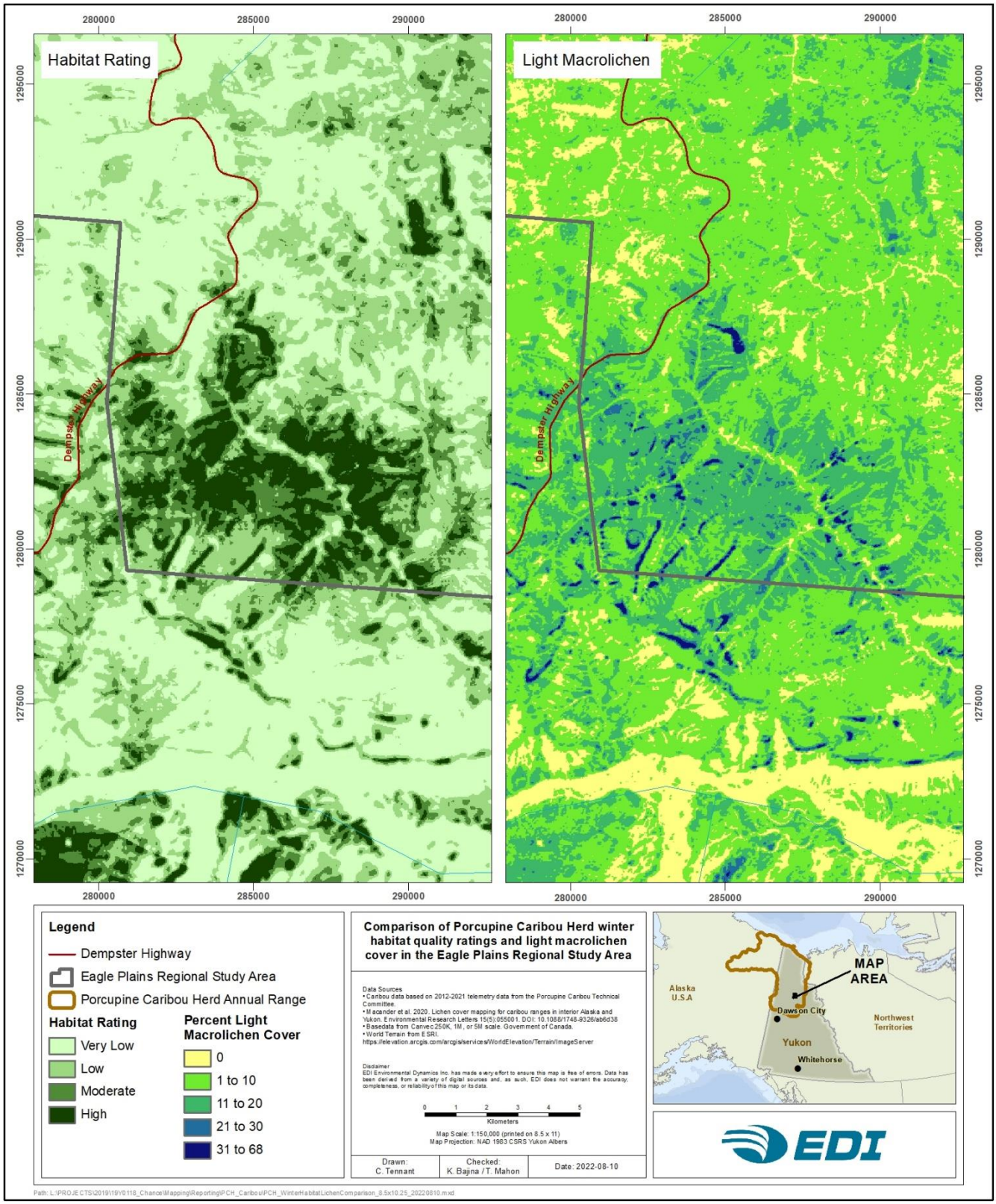
[1] Late fall and winter ranges were subsampled using 2,500 km² cells (approximately the same size and the RSA) to facilitate estimation of mean and variance.



Map 6-4. Distribution of habitat quality across the Porcupine Caribou Herd late fall range, 2012–2021.



Map 6-5. Distribution of habitat quality across the Porcupine Caribou Herd winter range, 2012–2021.



Map 6-6. Comparison of Porcupine Caribou Herd winter habitat quality ratings and light macrolichen cover in the Eagle Plains Regional Study Area.

6.6 MOVEMENT

In addition to habitat selection, movement patterns across the seasonal ranges and within the vicinity of the Project RSA are important to understanding how the PCH may interact with the Project. Metrics such as daily travel rates and duration of residency (i.e., how long caribou spend in an area before moving on) help quantify how caribou use the landscape and how they may react to features, such as the Dempster Highway. In addition to movement metrics, the spatial locations of travel movements can define areas of concentrated movement during migration. To better understand factors affecting PCH caribou movement, two analyses were conducted: (1) calculation of daily movement rates and residency times of caribou in the Project RSA relative to the broader landscape, and (2) delineation of movement paths to assess broad-scale movement patterns and the potential for caribou to interact with the Project.

The PCH typically exhibit movements of several kilometres per day in both late fall and winter. Late fall daily movements (8.7 km/day in the RSA) were substantially greater than those during winter (4.4 km/day in the RSA), and caribou tended to occupy portions of the landscape for shorter periods during late fall than during winter. Caribou residency times in both seasons were two-fold greater in the broader landscape than within the Project RSA, suggesting that, on average, the RSA, is used as more of a transitory area than other portions of the seasonal ranges. The locations and patterns of movement during late fall (i.e., the end of the fall migration period) was variable within and across years and, overall, there was little evidence of dedicated migration corridors. However, in late fall of 2015, several caribou made directed movements along the height of land parallel to the Dempster Highway, from the northeast to the southwest. Although a small number of movements crossed the Dempster Highway, most movements stayed north of the Dempster Highway, potentially reflecting avoidance of the Dempster Highway. However, this series of movements did cross numerous 2D seismic lines, winter roads and a large 3D seismic grid in the RSA.

6.6.1 METHODS

6.6.1.1 Daily Movement Rates and Residency Times

Daily movement rates and residency times were calculated for each radio-collared caribou that occurred in late fall and winter range extents. The locations of each caribou were resampled to obtain one GPS fix per day. Movement rates were calculated as the speed (km/day) travelled between consecutive relocations and residency time was calculated as the number of days within a specified area. Movement rates and residency times were calculated for caribou occurring within the Project RSA (2,387 km^2) and, to compare to the broader landscape, metrics were also calculated within 50 km x 50 km (2,500 km^2) grid cells that covered fall and winter ranges. Means and standard errors of movement rates and residency times were calculated for all 50 km x 50 km cells and compared to mean values in the Project RSA.

6.6.1.2 Migration Movements

Travel routes were delineated by developing occurrence-use polygons that assessed the trajectory of each collared caribou during late fall, 2012-2021. These polygons were created using Brownian bridge movement models (BBMMs), which account for autocorrelated movements in animal relocations and assume that an animal's trajectory follows a diffusion-based (Brownian motion) process (Horne et al. 2007). BBMMs were developed, and kernel density estimation was used to predict 95% utilization distributions (UDs) for each animal, assuming a GPS location error of 100 m and implementing a grid-cell size of 500 m. Analysis was bounded to a 100 km buffer around the RSA to identify spatially relevant movement trajectories. BBMMs and UD polygons were created using the R package 'adehabitatHR' (Calenge 2006).

6.6.2 RESULTS AND DISCUSSION

6.6.2.1 Daily Movement Rates and Residency Times

Mean daily movement rates and residency times varied considerably between late fall and winter and between the Project RSA and the broader landscape. On average, caribou tended to move faster during late fall than during winter, and this was evident both in the Project RSA and across the full late fall range. The movement rates between the Project RSA and the broader landscape were greatest during late fall, i.e., at least a two-fold difference in movement rates outside versus inside the RSA. A similar outcome was evident for residency time inside versus outside the Project RSA. In both seasons, the residency time was at least twice as long outside the RSA than within it (Table 6-9).

Patterns in movement and residency were consistent with what is known about PCH caribou ecology. Caribou are at their most dispersed in both late fall and winter. Except for cows during the calving period, daily movements are lowest in winter and second lowest in late fall (Russell and Gunn 2017). Normally, faster movement rates are associated with shorter residency periods, but this was not the case for the PCH in late fall (Table 6-9). During late fall, caribou in the RSA had slower movement rates but also had shorter residency periods compared to the broader late fall range. A review of the movement trajectories indicates that although travel rates were slower inside the RSA, those paths had greater directional bias (i.e., movement in a single direction) than paths outside the RSA, which exhibited much more tortuosity. These more directed movement paths resulted in shorter residency periods, despite the slower movement rates.

During winter, caribou movement rates inside the RSA were similar to the broader landscape, but, similar to late fall, their residency time inside the RSA was significantly shorter than in the broader late fall range. This suggests that similar to the pattern in late fall, caribou tended to pass through the RSA in winter more quickly than other portions of the broader winter range. This pattern may be explained by the lower predicted habitat quality within the RSA relative to the broader landscape (see Section 6.5.2.2, *Predicted Habitat Distribution*, above). The faster movements and shorter residency times in late fall compared to winter likely reflect the tail end of fall migration movements. Notwithstanding the important differences in movement patterns between late fall and winter, the key results of these analyses are that, in both late fall and winter, PCH caribou (1) travel

several kilometres per day, on average, and (2) the RSA (or similar sized areas outside the RSA) are used for a relatively short portion of the overall season.

Table 6-9. Mean daily movement rates and residency times of the Porcupine Caribou Herd in the Project RSA relative to the mean (and standard error) of 50 km x 50 km cells covering late fall and winter range extents.

Season	Scale[1]	Daily Movement (km/day)		Residency Time (days) [2]	
		Mean	Std. Error	Mean	Std. Error
Late Fall	Project RSA (2,387 km² total)	8.95	± 0.64	4.50 (8.33 %)	± 0.83
	Late Fall Range (88,149 km²) [1] (2,500 km² per cell) – 53 cells total	15.03	± 2.06	7.65 (14.17 %)	± 0.66
Winter	Project RSA (2,387 km² total)	4.02	± 0.64	15.69 (12.86 %)	± 5.11
	Winter Range (65,077 km²) [1] (2,500 km² per cell) – 40 cells total	4.77	± 0.51	25.93 (21.25 %)	± 2.13

[1] Late fall and winter ranges were subsampled using 2,500 km² cells (approximately the same size and the RSA) to facilitate estimation of mean and variance. Estimates of mean and variance within the RSA are derived from differences in rates and residencies of individual caribou.

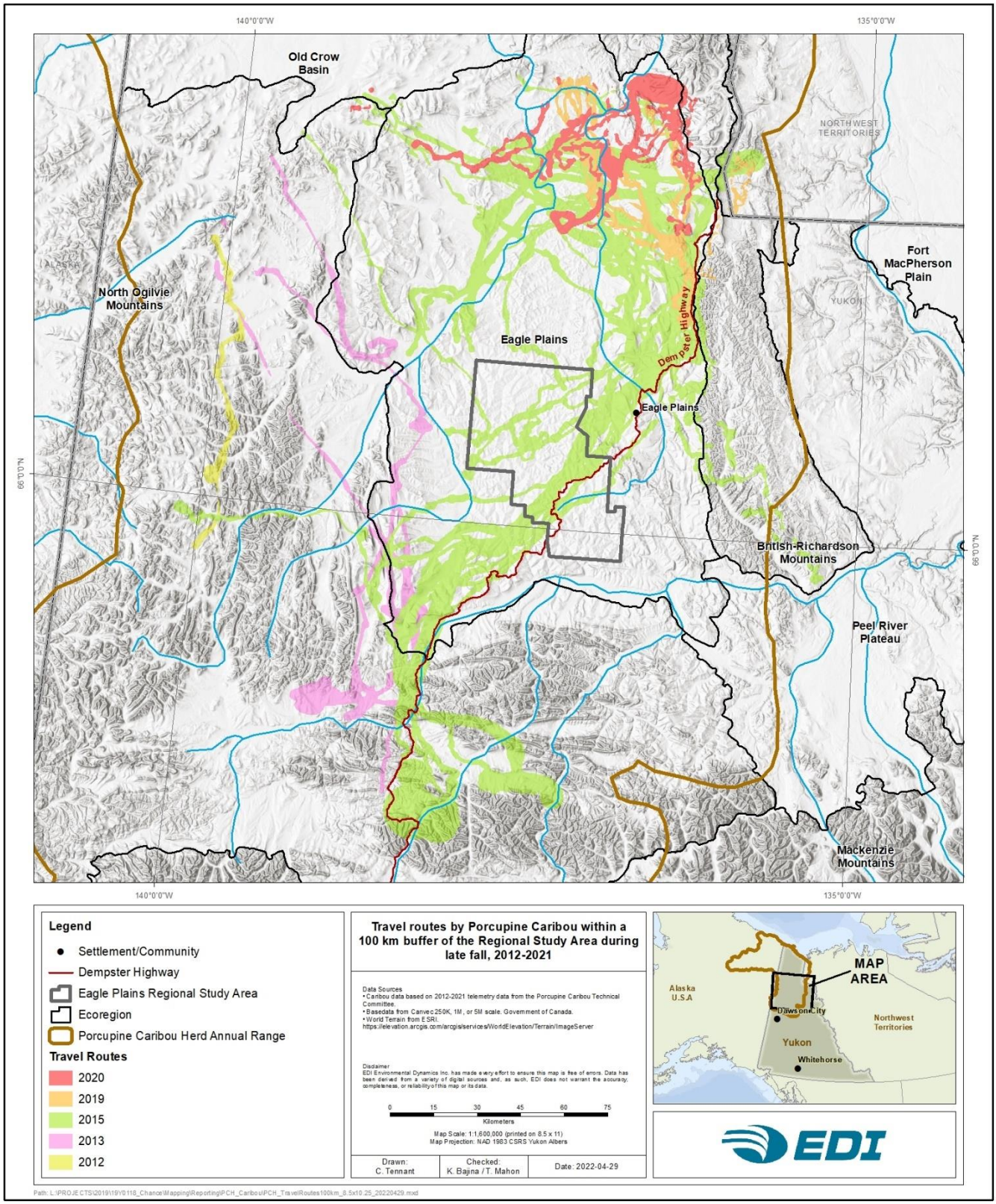
[2] Percent of the season indicated in brackets. Total days: late fall = 54 days, winter = 122 days.

6.6.2.2 Migration Movements

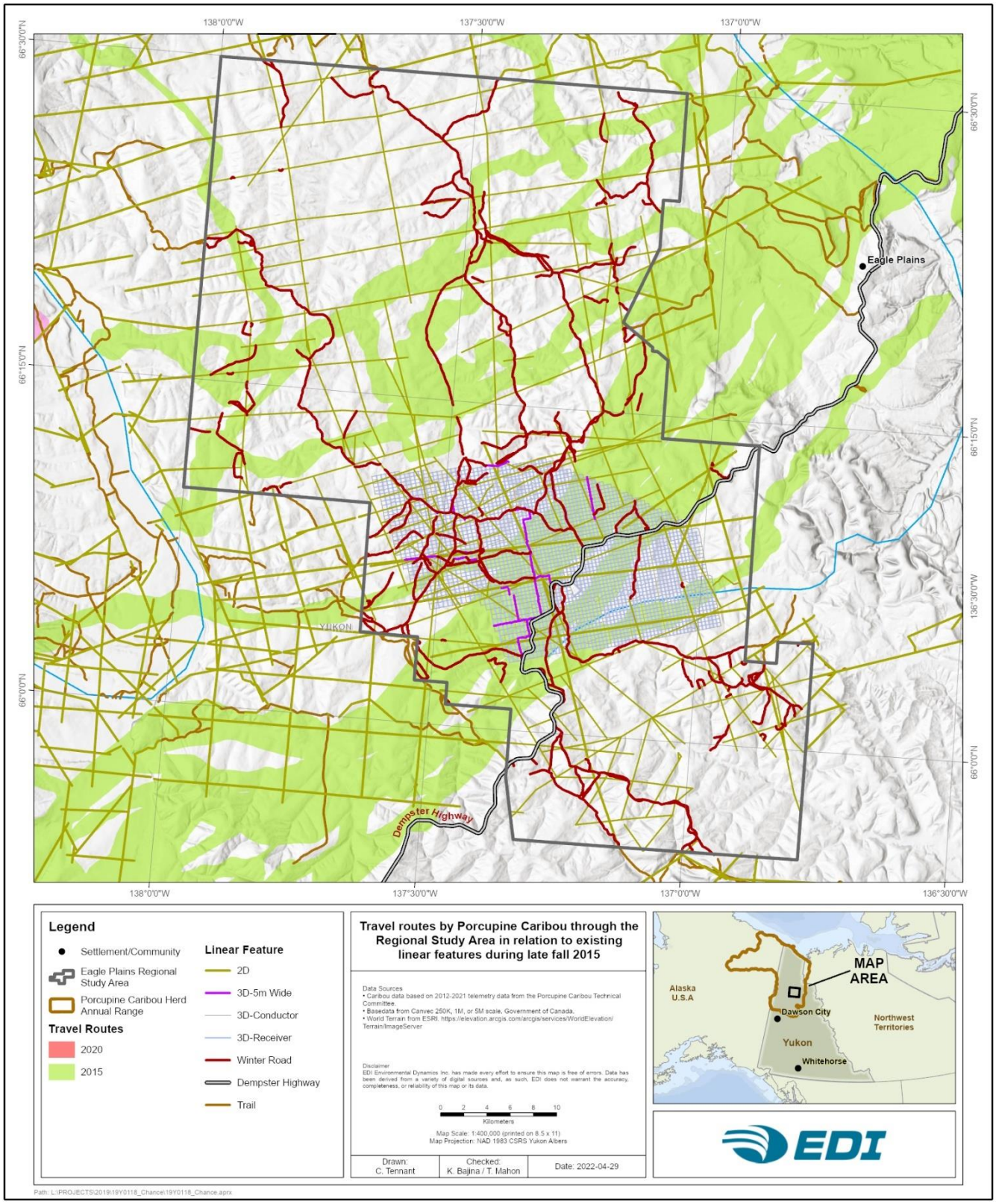
Travel routes through the Project RSA were only evident in late fall of 2015. At that time, 14 caribou travelled from the northeast quadrant of the Eagle Plains ecoregion to either the southwestern portions of that ecoregion or to the North Ogilvie Mountains, along the Dempster Highway (Map 6-7). Although two caribou did cross the highway in the vicinity of the RSA, most of the caribou (12) travelled parallel to the Dempster Highway, along its northwest side, before eventually crossing the highway south of the RSA in the Ogilvie Mountains (Map 6-7). The location of the movement routes in 2015 predominantly northwest of the Dempster Highway was previously noted by Russell and Gunn (2017), who suggested the caribou may have been avoiding crossing the highway. Although this is a valid hypothesis, supported by observations from VGFN elders (Sherry and Vuntut Gwitchin First Nation 1999, p. 288), it is important to note that the set of travel routes in 2015 did eventually cross the Dempster Highway south of the RSA in the Ogilvie Mountains. These crossings may be done at times of lower traffic such as nighttime, as elders had witnessed various unsuccessful attempts of herds to cross the Dempster as vehicles were passing during the day (Sherry and Vuntut Gwitchin First Nation 1999, p. 288). It is also important to note that travel routes in 2015 coincided with a broad, regional height of land (separating the Porcupine and Peel watersheds), which caribou sometimes travel on during migration movements (Russell et al. 1993). On an absolute scale, the height of land along the Dempster Highway, and proximate locations used by caribou as travel routes (~550–650 m), coincide with the mid elevations selected by caribou during fall (see Section 6.5.2.1, *Habitat Models*). The 12 caribou that

paralleled the Dempster Highway in the vicinity of the RSA did cross several inactive winter roads, numerous old 2D seismic lines, and a 350 km² area consisting of one-year-old 3D seismic exploration (Map 6-8).

Inferences about caribou movements are limited by the relatively small numbers of caribou that were collared (<0.1% of the herd annually) and the relatively small number of collared caribou that occurred within the RSA. Collared caribou only occurred in the Eagle Plains ecoregion in half of the years from 2012–2021; however, it is known from local knowledge that caribou occur in the ecoregion in most, if not all years. VGFN elders have discussed to importance of Eagle Plains for caribou winter habitat and noted that if caribou find a good feeding place with many trees, they will stay all winter (VGFN p185). During interviews in the late 1990's, they observed many caribou performing fighting, mating and rutting rituals around Blackstone Flats (Sherry and Vuntut Gwitchin First Nation 1999, p. 188). For the years when collared caribou were present in Eagle Plains, it is unknown how representative the collar locations are of the overall herd. For example, the concentration of travel routes through the RSA in 2015 suggests a potential movement corridor, but the proportion of caribou that is collared is too small to conclude this with confidence. The lack of movements in the same area in any other year does not support the idea that the cluster of movements in 2015 represent a regular travel corridor (but, again, this could reflect the small proportion of caribou collared).



Map 6-7. Travel routes identified for the Porcupine Caribou Herd within a 100 km buffer of the Project Regional Study Area during late fall, 2012–2021.



Map 6-8. Travel routes by Porcupine Caribou through the regional Study Area in relation to existing liner features during late fall 2015.

6.7 RELATIONSHIP TO LINEAR FEATURES

A key issue concerning the PCH is how anthropogenic development may alter caribou distribution, habitat use, and, ultimately, whether changes may influence population demography and access to the herd by First Nations and Inuvialuit harvesters. Linear features are the primary source of disturbance in the Project RSA and the broader Eagle Plains ecoregion. There is uncertainty about how caribou may respond to these features. To better understand the relationship between caribou and linear features, base habitat models were extended to assess the potential for habitat avoidance using a zone of influence (ZOI) framework. The ZOI delineates the area within which caribou behaviour is altered. ZOIs were estimated for three functionally distinct linear feature types (i.e., 2D seismic, winter roads and trails; 3D seismic; and the Dempster Highway). If ZOI estimates are statistically and ecologically significant (i.e., alter the selection of habitat and forage by caribou), they can be used to quantify effective habitat loss (i.e., perceived reduction in habitat quality by caribou due to avoidance) in the Project RSA and Eagle Plains ecoregion.

Statistical ZOIs were determined for 2D seismic lines (including winter roads and trails) in Eagle Plains in late fall and winter. However, confidence in those estimates is relatively low due to several factors. Statistical ZOIs were identified corresponding to 4 km avoidance of 2D seismic lines during late fall and 2 km avoidance of 2D seismic lines during winter. The analysis also identified that the PCH were attracted to the Dempster Highway and 3D seismic areas in both late fall and winter. Sufficient observations were associated with this pattern in relation to the Dempster Highway, but results for 3D seismic areas could be spurious due to a relatively low number of caribou locations in proximity to these features.

Although the analyses determined ZOIs associated with 2D seismic lines (and winter roads and trails), they should be interpreted with caution. (1) The magnitude of the ZOI effects was weak (i.e., including the ZOI effects in the habitat models had little effects on the habitat predictions). (2) Threshold distances estimated from ZOI analyses tend to be very sensitive to spatial and temporal contexts as well as the data and analytical methods used. Estimates of ZOIs can vary dramatically from year-to-year. This can include selecting to be closer to human features in some years and exhibiting dramatic difference in the threshold distances in years when human disturbances are thought to be avoided. The number of caribou locations in this study unevenly distributed with respect to the various linear features both spatially and across years. (3) The pattern of ZOI effects were not consistent with expectations and results from other studies. For example, having a 2 km ZOI for 2D lines and no ZOI for the Dempster Highway is counterintuitive. A previous study estimated a relatively large ZOIs for the Dempster (Johnson and Russell 2014). Based on these factors, it is recommended that these results not be used solely to estimate the effects of linear features on the PCH. Rather, it is recommended that the results be used in conjunction with results from other studies, adapted to the Eagle Plains setting and the ecology of the PCH, to develop a set of ZOIs for assessment and management purposes.

6.7.1 METHODS

A zone of influence framework evaluated the influence of linear features on PCH caribou distribution and habitat selection. Base habitat models developed for late fall and winter were extended by incorporating a 'distance to' covariate for each relevant linear feature and estimating the breakpoint beyond which the likelihood of observing caribou remained unchanged. If a ZOI was present, the likelihood of observing caribou would increase from linear feature footprint until the identified breakpoint. The primary method used to evaluate the presence and magnitude of a ZOI was a segmented regression approach (Boulanger et al. 2012, 2021).

Three functionally distinct types of linear features were considered based on their widths, densities, and extents in PCH fall and winter ranges: (1) 2D seismic, winter roads, and trails; (2) 3D seismic (grid); and (3) the Dempster Highway. The minimum distance between used/available locations and each feature was calculated and treated as a continuous covariate. To limit potential bias in ZOI estimates arising from broad-scale spatial patterns in distribution and habitat selection (see Boulanger et al. 2021, EDI Environmental Dynamics Inc. 2022b), GAMs were used to assess how the distribution of caribou changed at increasing distances from each linear feature type and to identify an 'iteration zone' to test for ZOIs. The iteration zone is defined as the boundary within which caribou distribution and habitat use are minimally affected by broad-scale patterns in climatic (e.g., snowfall) and biotic (e.g., caribou density and forage) processes. Practically, this refers to an initial range of distances (starting at 0 km) where selection is relatively flat (slope = 0) (see Boulanger et al. 2021). For example, during late fall, selection was fairly flat up to 100 km from the Dempster Highway, after which selection decreased sharply (see Attachment Figure 21 in Section 6.9.3). In other cases, such as the relationship to 2D lines during late fall, the slope was substantially greater than zero at very close distances (see Attachment Figure 19 in Section 6.9.3). Selection increased up until approximately 18 km, then sharply decreased until 25 km, and then, once again, sharply increased up until approximately 35 km. Given such non-linearity in the response, the iteration zone was identified within the first major bout of increase/decrease, i.e., within the first 25 km. This approach was taken in each case where a drastic, non-linear selection gradient occurred at very close distances to the linear feature.

Within the iteration zone, several distance thresholds were tested to identify a ZOI. The assumptions were that caribou presence would be reduced and resource selection altered within the threshold distance. We assigned all distances at or beyond the defined threshold the same distance value. For example, if a ZOI distance of 2 km was tested, then all distances up to 2 km retained their values (i.e., numbers ranging from 0 km to 1.99 km), but all distances at or greater than the ZOI were assigned a value of 2 km (e.g., 3 km or 4 km were assigned values of 2 km). A unique model was fit for each threshold tested, and the number of models corresponded to the outer boundary of the iteration zone identified for each linear feature type. In other words, if the iteration zone was deemed between 0 km and 25 km, then 25 models were tested — one for each kilometre interval. The best model, which corresponded with the most likely ZOI, was selected by evaluating the log-likelihoods of all models as a function of the distance thresholds. The highest log-likelihood corresponded with the model with the most statistical support (Boulanger et al. 2012). The magnitude of avoidance was estimated as the odds of caribou occurring at or beyond the ZOI relative to the odds of being on the linear feature (i.e., odds ratio = $e^{coefficient \times ZOI}$).

6.7.2 RESULTS AND DISCUSSION

The influence of linear features on PCH distribution and habitat selection varied between late fall and winter seasons and among functional linear feature types. ZOIs were detected for 2D seismic lines (including winter roads and trails) during late fall (4 km, Attachment Figure 25) and winter (2 km, Attachment Figure 28). These results were derived from analyses that considered only spatially relevant scales (i.e., iteration zones) (see GAM plots for 2D lines in Section 6.9.3). For example, relationships with 2D lines were evaluated only within the Eagle Plains ecoregion because most of these features occurred within this extent. The GAM plots in Section 6.9.3 also demonstrate that, though selection increased/decreased relative to 2D lines, these changes were low in magnitude. For example, within the iteration zones of 2D lines, there was an approximate 0.08 (or 8 %) increase in the probability of selection at far distances from these features. When estimated using a defined threshold, changes in the probability of selection necessarily increased (relative to GAMs) based on the imposed shape of the response (i.e., fitting a linear increase followed by a flat slope at distances equal to and beyond the ZOI). In practical terms, the odds of caribou occurring at distances equal to or beyond the ZOIs for 2D lines are 1.45 (odds ratio = $e^{0.000093 \times 4\ km}$) and 1.27 (odds ratio = $e^{0.00012 \times 2\ km}$) times greater, during late fall and winter, respectively, than the odds of caribou occurring on 2D lines. The ZOIs estimated for 2D lines in the current study were smaller than those previously estimated by Johnson and Russell (2014)—11 km from 1985–1998 and 6 km from 1999–2012 for wells, trails, winter roads, and seismic lines.

Although analysis of 2D seismic lines (including winter roads and trails) did identify statistically significant ZOIs, the results should be interpreted with caution. An important indicator to contextualize these results is whether estimated ZOIs influenced the selection of important habitat components. A comparison of coefficients between habitat models with and without ZOI terms provides a test of the ecological significance of estimated ZOIs (Boulanger et al. 2012). To accomplish this, predictions were made using the estimated ZOIs across the late fall and winter ranges to match the same spatial scale as base habitat models (see Table 6-10 and Table 6-11). During late fall, coefficients associated with macrolichen cover ($\beta_{lichen.base}$ = 0.694 ± 0.029 versus $\beta_{lichen.ZOI}$ = 0.689 ± 0.029) in Eagle Plains were invariant (Table 6-4 versus Table 6-10). Similarly, during winter, coefficients associated with lichen ($\beta_{lichen.base}$ = 1.119 ± 0.018 versus $\beta_{lichen.ZOI}$ = 1.114 ± 0.018) in Eagle Plains, and avoidance of other plant functional types, were consistent (Table 6-5 versus Table 6-11). So, even though ZOIs were determined for 2D lines, the magnitude of those effects was so small that it resulted in marginal changes to the habitat model predictions in both late fall and winter.

No ZOIs were detected for the Dempster Highway during either season. Instead, the segmented regression approach identified an attraction effect, rather than avoidance, for both late fall (9 km, Attachment Figure 27) and winter (11 km, Attachment Figure 30). Thus, caribou were more likely to occur within 9 km and 11 km of the Dempster Highway during late fall and winter, respectively, than beyond those distances. This result contradicts previous work by Johnson and Russell (2014), who identified ZOIs of major roads, including the Dempster Highway, to be as large as 30 km from 1985–1998 and 18.5 km during 1999–2012.

Similar to the results for the Dempster Highway, no ZOIs were determined for 3D seismic lines, but there is high uncertainty associated with those estimates due to the relatively small number of collared caribou that

interacted with the 3D seismic area. Attraction effects were found within 16 km and 4 km of 3D seismic lines during late fall (Attachment Figure 26) and winter (Attachment Figure 29), respectively. As with 2D lines, the magnitude of the attraction effect for Dempster Highway and 3D seismic lines was small relative to base habitat selection. Additionally, considering the potential mechanisms of effects that 3D lines could have on caribou, the apparent attraction of caribou to the 3D seismic lines is likely a spurious result. Based on other studies examining the effects of 3D lines on caribou and their primary predators, wolves, it was expected that the PCH would exhibit a neutral or weak avoidance response to 3D lines due to the potential for facilitated predation to occur.

In addition to the weak effects exhibited by ZOIs relative to base habitat selection, there are other factors that warrant cautious interpretation and use of these analytic results. (1) ZOI estimates and their magnitude of effect can be sensitive to (a) sample sizes and (b) spatial and temporal coverage of the data. Though numerous overall, the data used in this analysis had relatively modest sample sizes near linear features and were unevenly distributed in relation to linear features in Eagle Plains. (2) Caribou can exhibit dramatically different ZOIs from year to year. Collared caribou were only present in modest numbers in 2012/13, 2014/15, 2017/18, and 2018/19, so the data had to be lumped across years to estimate a single ZOI. (3) ZOIs estimated for the PCH in this analysis are substantially smaller than those estimated by Johnson and Russell (2014). The issues associated with these factors are discussed below.

The spatial and temporal context of ZOI studies can influence outcomes. Estimates of ZOIs are a consequence of broad- and fine-scaled space use, and these patterns of distribution can emerge from population demography, biotic interactions (e.g., density-dependent competition or predator-prey interactions), abiotic conditions (e.g., snowfall, forage availability), habitat selection, and potential sources of disturbance (e.g., dust fall, sensory disturbance) (Messier et al. 1988, Johnson et al. 2001, Mahoney and Schaefer 2002, Hinkes et al. 2005, Bowyer et al. 2014, Chen et al. 2017, Boulanger et al. 2021, Pedersen et al. 2021). These sources of variation in space use do not negate the importance of quantifying indirect effects of anthropogenic development, but they do point to underlying issues with the ZOI framework and its utility for management and mitigation. For example, Boulanger et al. (2021) documented ZOI responses by Bathurst caribou to the Ekati-Diavik mine complex (Northwest Territories) that have varied dramatically from year-to-year, which the authors attribute to changes in drought conditions. Similarly, Johnson et al. (2020) found that ZOIs around energy infrastructure (North Slope of Alaska, USA) reduced during periods of high mosquito activity for the Central Arctic Herd (CAH). In these examples, fine-scale changes in caribou space use was primarily driven by selection for areas adjacent to large, open bodies of water: Lac de Gras by Bathurst caribou and the Arctic Ocean by CAH caribou.

Another issue regarding the interpretation of ZOIs is their sensitivity to the data and analytical methods used. For example, Boulanger et al. (2021) found that GPS-collared caribou exhibited 'avoidance' (a ZOI) in only four out of nine years at the Ekati-Diavik mine complex (range = 6–13 km). In five of those nine years, caribou exhibited either no relationship or attraction to mine infrastructure. Additionally, when comparing an overlapping year (2012) between GPS data and aerial survey data for Bathurst caribou, a ZOI was identified using GPS collar data (ZOI = 7.09 km, odds ratio not overlapping zero; see Table 3 in publication) but was not identified using aerial survey data (ZOI = 11.4 km, odds ratio overlapping zero; see Table 4 in

publication). During the data exploration phase of the current study, ZOI results also varied considerably based on different subsets of the PCH data. For example, the estimates of a ZOI around 2D seismic lines (including winter roads and trails) changed by several kilometres when assessing not only different years but different spatial extents (e.g., ecoregions).

The ZOI analysis conducted by Johnson and Russell (2014) for the PCH used a similar approach to the current analysis and other studies, but yielded very different results for seismic lines and major roads. Johnson and Russell (2014) also caution against interpreting their results based on several factors, including a large change in the PCH's population size over their study duration, variation in animal behaviour across the range of development types, and relatively small effect sizes for caribou-disturbance responses. The potential reason for differences between the results in this study and those of Johnson and Russell (2014) are not apparent and may reflect the sensitivity of results to the differences in sample sizes and spatiotemporal patterns in the data used between the two studies. Landscape conditions and land use activities were similar between the two study periods and likely included some of the same data (e.g., winter 2012). Both Johnson and Russell (2014) and the current study dealt with trade-offs in spatial and temporal coverage. Though Johnson and Russell (2014) had data with longer temporal coverage (27 years), these data suffered from poorer spatial resolution associated with larger interval collar fixes (on average, once every seven days), smaller sample sizes (N = 2,127), and coarser habitat variables (i.e., landcover classification). In contrast, the current study used data with shorter temporal coverage (8 years) but had higher spatial resolution associated with collar fixes (on average, one per day), larger sample sizes (N_{fall} = 8,323 and N_{winter} = 13,014), and high resolution habitat variables (i.e., 30 m x 30 m plant functional type percent and digital elevation model). The current study had the advantage of higher spatial resolution, which is especially important for ZOIs, which are, by nature, a spatial phenomenon. A limitation to both this study and Johnson and Russell (2014) is the lack of sufficient interaction between caribou and linear features each year, which prevented the estimation of annual ZOIs.

ZOI analyses, including the analyses in this study, often do not explicitly test specific mechanisms that could be causing caribou to avoid anthropogenic features. It is assumed, correctly or incorrectly, that caribou avoid these areas because they perceive elevated predation risk (Frid and Dill 2002, Semeniuk et al. 2012). This can include avoidance due to direct sensory disturbances associated with the features and learned behaviours that could result in avoidance beyond sensory perception distances (Boulanger et al. 2021). Assuming the ZOIs detected in this study are 'real', potential mechanisms that cause caribou to avoid 2D seismic lines, winter roads, and trails are perceived mortality risk associated with human hunting (Wolfe et al. 2000, Plante et al. 2017) and facilitated predation by wolves (James and Stuart-Smith 2000, Dickie et al. 2017).

Ultimately, the purpose of measuring and testing caribou responses to linear features is to inform management and mitigation. Given the weak effects associated with the ZOIs generated here, and the analytical issues discussed above, it is recommended that these results not be used solely to estimate the effects of linear features on the PCH. Rather, it is recommended that the results be used in conjunction with results from other studies, adapted to the Eagle Plains setting and the ecology of the PCH, to develop a set of ZOIs for assessment and management purposes.

Table 6-10. Zone of influence habitat model of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during late fall.

Model Term	Estimate	Std. Error	*Z*-statistic	*P*
Intercept				
Eagle Plains & North *(Reference)*	-9.579	0.038	-254.424	<0.0001
Ecoregion (factor)				
North Ogilvie Mountains	-0.281	0.077	-3.649	0.000263
British-Richardson Mountains	0.357	0.051	7.033	<0.0001
Old Crow Basin	0.171	0.042	4.050	<0.0001
Davidson Mountains	0.462	0.047	9.814	<0.0001
Aspect (factor)				
South	0.103	0.032	3.251	0.00115
East	0.004	0.032	0.127	0.899
West	0.157	0.031	5.028	<0.0001
Ecoregion–Lichen_100m Interaction				
Eagle Plains * Lichen_100m Percent[1,2] *(Reference)*	0.689	0.029	23.628	<0.0001
North Ogilvie Mountains * Lichen_100m Percent[1,2]	0.065	0.063	1.041	0.298
British-Richardson Mountains * Lichen_100m Percent[1,2]	-0.296	0.043	-6.929	<0.0001
Old Crow Basin * Lichen_100m Percent[1,2]	-0.137	0.037	-3.665	0.000248
Davidson Mountains * Lichen_100m Percent[1,2]	-0.216	0.042	-5.117	<0.0001
Digital Elevation Model				
Slope Percent[1,2]	-0.309	0.017	-17.947	<0.0001
Absolute Elevation[2] (linear)	0.810	0.073	11.091	<0.0001
Absolute Elevation[2] (quadratic)	-0.785	0.070	-11.219	<0.0001
Distances				
Distance to Waterbodies[2]	-0.177	0.016	-11.402	<0.0001

[1] covariate transformation = $\log_e(x + 1)$.

[2] covariate estimates based on standardized covariate values = (x – mean[x])/std. deviation(x).

Note: the zone of influence estimate derived within the iteration zone was used to predict habitat selection across the late fall range for the purpose of comparing habitat coefficients only.

Table 6-11. Zone of influence habitat model of global–availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during winter.

Model Term	Estimate	Std. Error	*Z*-statistic	*P*
Intercept				
Eagle Plains & North *(Reference)*	-9.982	0.051	-196.452	<0.0001
Ecoregion (factor)				
North Ogilvie Mountains	0.569	0.040	14.207	<0.0001
British-Richardson Mountains	0.675	0.039	17.242	<0.0001
Old Crow Basin	0.242	0.034	7.018	<0.0001
Aspect (factor)				
South	0.192	0.025	7.536	<0.0001
East	0.032	0.026	1.223	0.221
West	0.324	0.025	13.074	<0.0001
Ecoregion– Lichen_100m Interaction				
Eagle Plains * Lichen_100m Percent[1,2] *(Reference)*	1.114	0.018	62.639	<0.0001
North Ogilvie Mountains * Lichen_100m Percent[1,2]	-0.154	0.034	-4.511	<0.0001
British-Richardson Mountains * Lichen_100m Percent[1,2]	-0.602	0.036	-16.842	<0.0001
Old Crow Basin * Lichen_100m Percent[1,2]	-0.119	0.034	-3.495	0.000474
Other Plant Functional Types				
Conifer_Tree_1000m Percent[2]	-0.253	0.009	-26.810	<0.0001
Forbs_500m Percent[2]	-0.165	0.010	-16.910	<0.0001
Deciduous_Shrub_1000m Percent[2]	-0.094	0.009	-9.980	<0.0001
Graminoid_1000m Percent[2]	-0.121	0.009	-12.829	<0.0001
Evergreen_Shrub_100m Percent[2]	-0.052	0.009	-5.607	<0.0001
Digital Elevation Model				
Slope Percent[1,2]	-0.220	0.012	-19.034	<0.0001
Absolute Elevation[2] (linear)	-1.441	0.056	-25.507	<0.0001
Absolute Elevation[2] (quadratic)	0.941	0.054	17.572	<0.0001
Distances				
Distance to Waterbodies[2]	0.206	0.010	20.711	<0.0001

[1] covariate transformation = $\log_e(x + 1)$.

[2] covariate estimates based on standardized covariate values = (x – mean[x])/std. deviation(x).

Note: the zone of influence estimate derived within the iteration zone was used to predict habitat selection across the winter range for the purpose of comparing habitat coefficients only.

6.8 SUMMARY

The PCH is known for large population aggregations, dramatic population fluctuations, lengthy migrations, and significant cultural and social value to northern Indigenous peoples. Within the NYLUP, the PCH is considered "…*the most significant and culturally important wildlife resource in the planning region.*" Habitat, food supply, predation, hunting, disease and climate range likely play interactive roles as limiting factors to the PCH population. Factors have limited potential to regulate the PCH, individually.

- The potential for food supply, especially lichen, to regulate the PCH is more limited than other barren ground caribou herds because of the PCH's very large annual and seasonal ranges and the diversity of habitats found within those ranges (e.g., including several ecoregions). Overall, the PCH winter range is relatively rich in lichen resources and is comparable to, or better than, those of other herds that winter in taiga regions.
- Predation does not seem to play a role in limiting PCH growth while the herd is at high numbers. One study suggested that the predation rate had to be near twice the observed level to cause the PCH to decline.
- The comprehensive measures within the Harvest Management Plan to monitor and respond to declines in the PCH (i.e., by reducing harvest) provide a solid system to minimize the potential effects that harvesting could have on the herd.

The portion of the PCH annual range that occurs within Yukon is protected by a network of parks, special management areas, conservation areas, wilderness areas, protected areas, ecological preserves, habitat protection areas, and IMA zones within the North Yukon Regional Land Use Plan and the Peel Watershed Regional Land Use Plan. In total, 54% of the annual range of the PCH within Yukon falls within some type of protected area where industrial activity is prohibited, 36% of the annual range occurs within Integrated Management Area zones where development is limited, and 9% of the annual range is not covered by any land management zonation. The Eagle Plains RSA occurs within IMA Zone IV, which permits the highest level of development.

The PCH have historically overlapped the Eagle Plains RSA in the rut/late fall and winter periods. However, the RSA constitutes only a small portion of those ranges — 6.0% of the late fall range and 6.5% of the winter range. The RSA does not overlap with the most frequently used portions of the late fall and winter ranges.

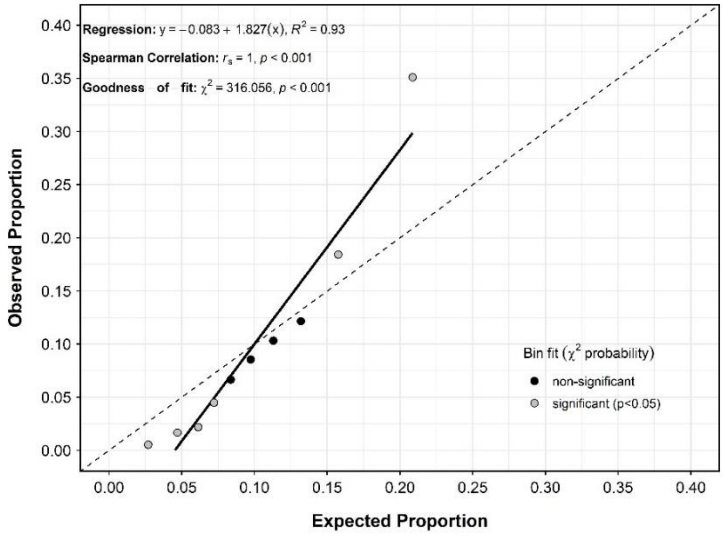
Habitat selection by the PCH in late fall and winter was estimated using resource selection functions. Selected habitats were dependent primarily on the distribution of macrolichen cover. Distance to linear features had a small effect on habitat model predictions. Overall, the strength of selection was greater in winter than late fall, which corresponds to broader movement patterns and use of more diverse habitats by the PCH in fall. In terms of regional habitat distribution, the RSA had similar proportions of selected habitat in fall as the full late fall range; however, the RSA had a much lower proportion of selected habitat in winter compared to the full winter range. Within the RSA, lichen distribution (and caribou use) was strongly affected by extensive recent burns, which had lower lichen cover than unburned areas.

The PCH typically exhibits movements of several kilometres per day in late fall and winter. Late fall daily movements (8.7 km/day in the RSA) were substantially greater than during winter (4.4 km/day). Caribou tended to occupy portions of the landscape for shorter periods during late fall than winter. Caribou residency times in both seasons were two-fold greater in the broader landscape than within the Project RSA, suggesting that, on average, the RSA is more of a transitory area than other portions of the seasonal ranges.

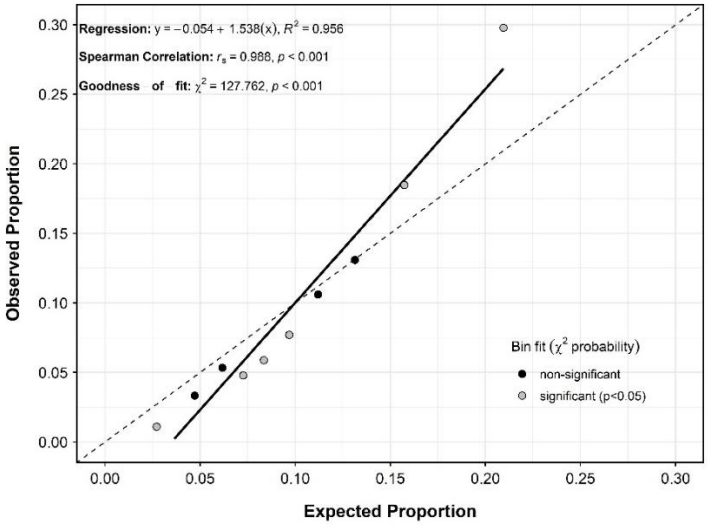
6.9 CARIBOU SECTION ATTACHMENTS

6.9.1 ATTACHMENT 6–A — 5-FOLD CROSS-VALIDATION

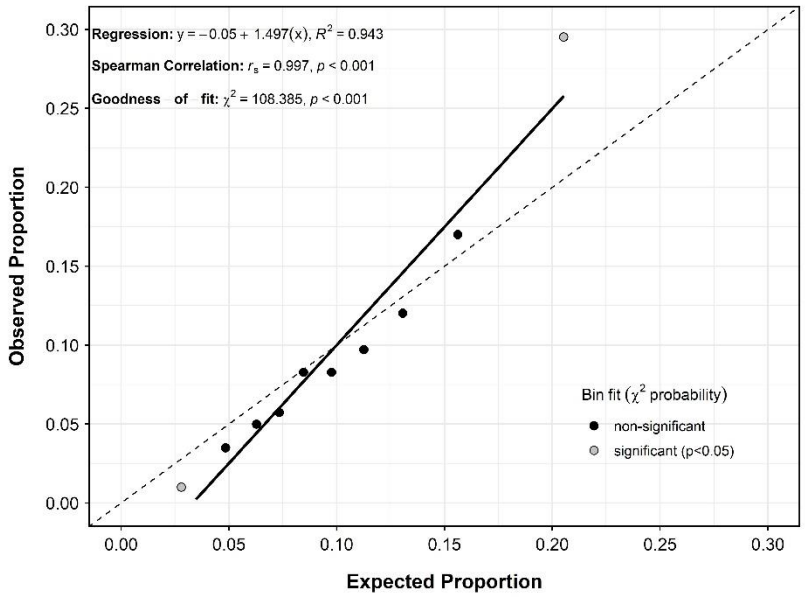
Late Fall



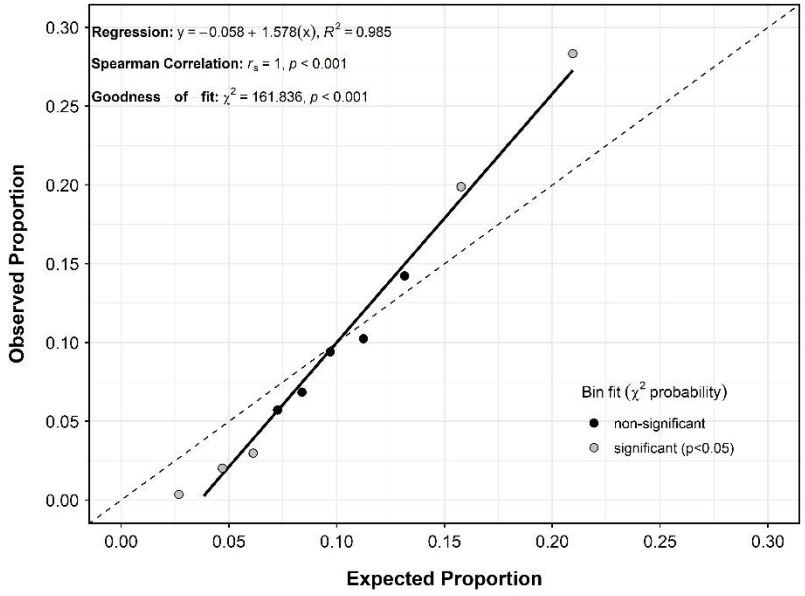
Attachment Figure 1. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 1). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



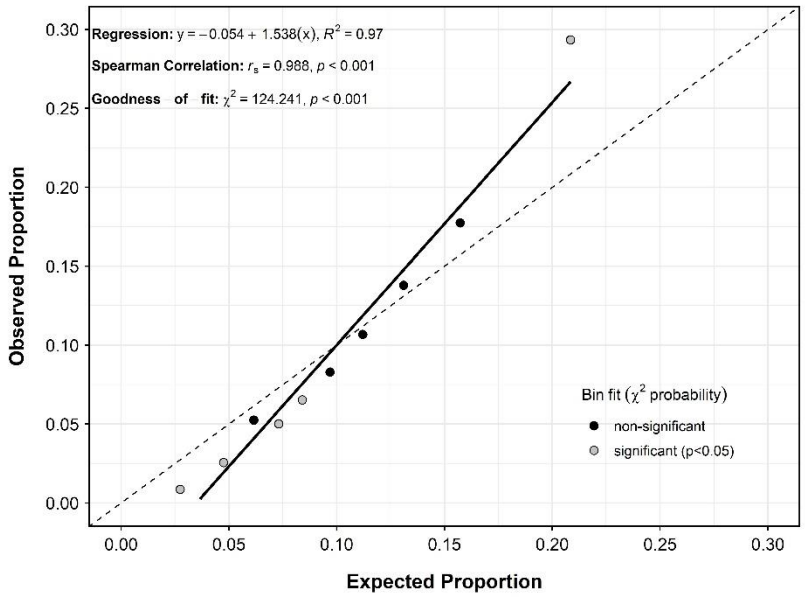
Attachment Figure 2. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 2). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



Attachment Figure 3. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 3). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.

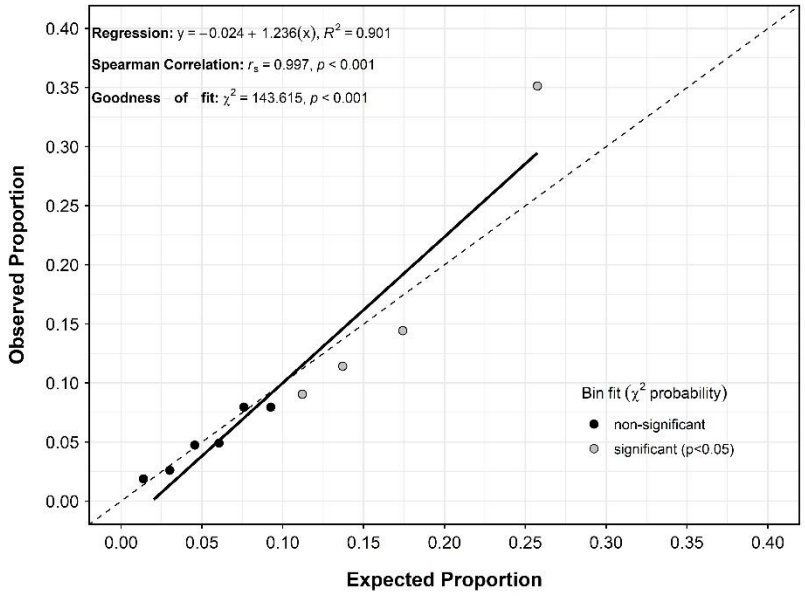


Attachment Figure 4. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 4). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.

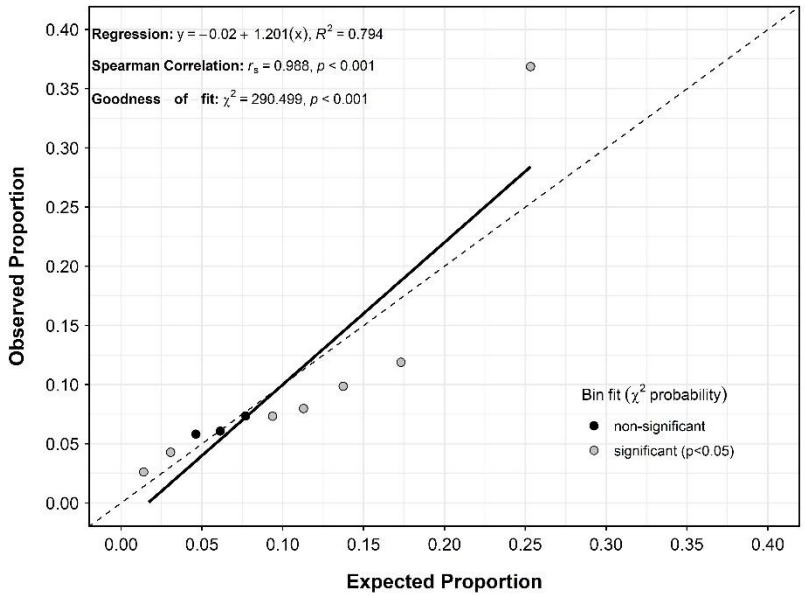


Attachment Figure 5. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 5). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.

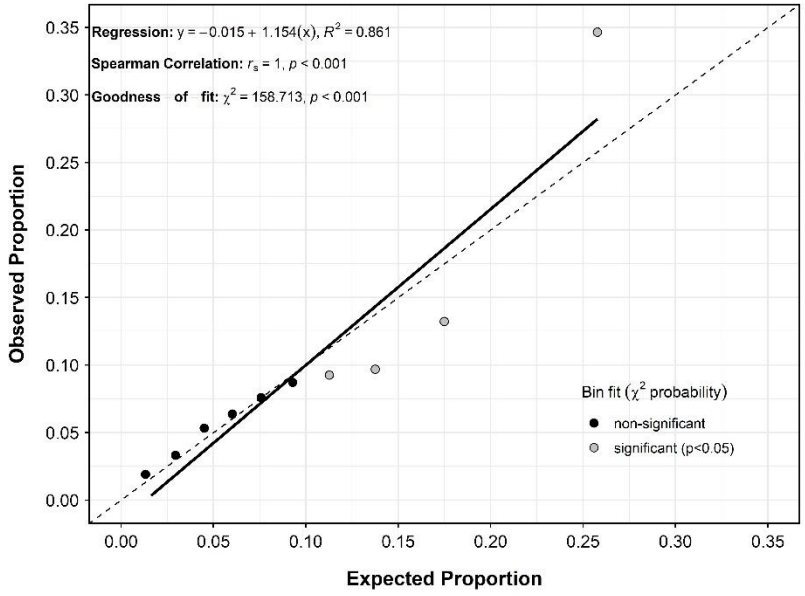
Winter



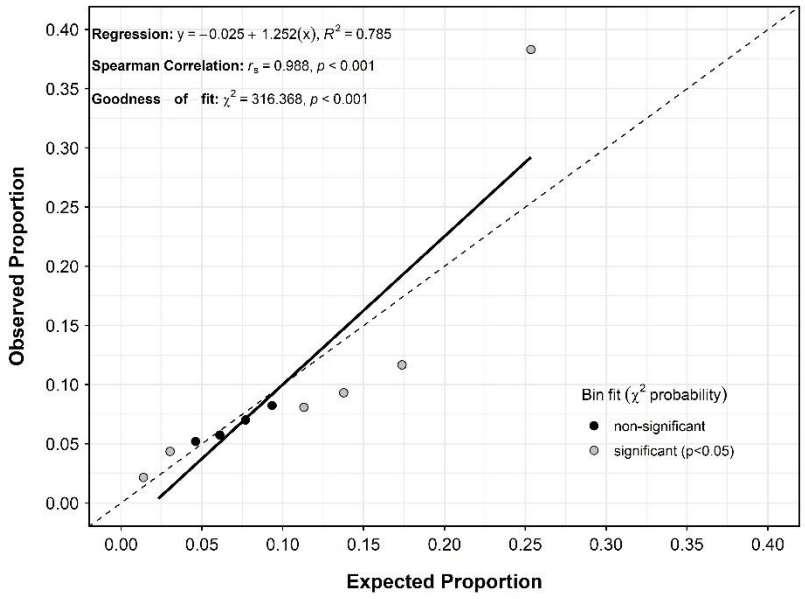
Attachment Figure 6. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 1). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



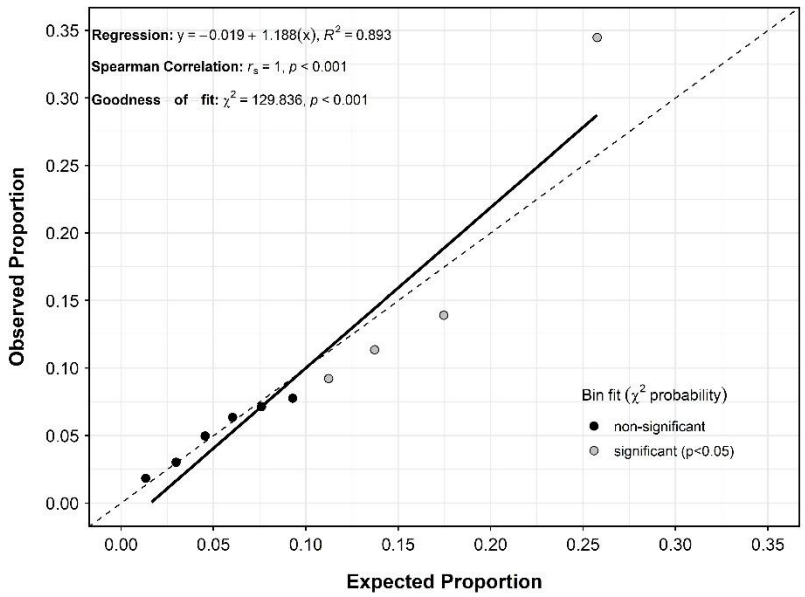
Attachment Figure 7. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 2). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



Attachment Figure 8. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 3). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



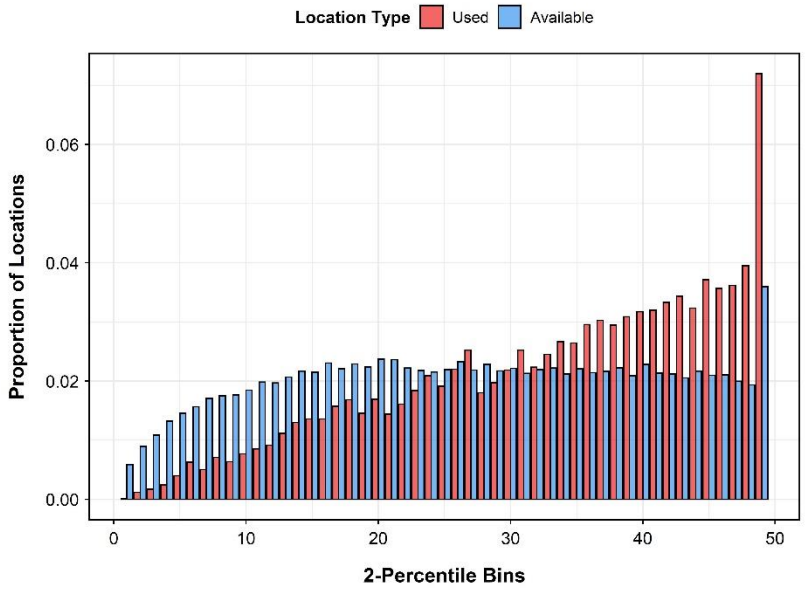
Attachment Figure 9. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 4). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



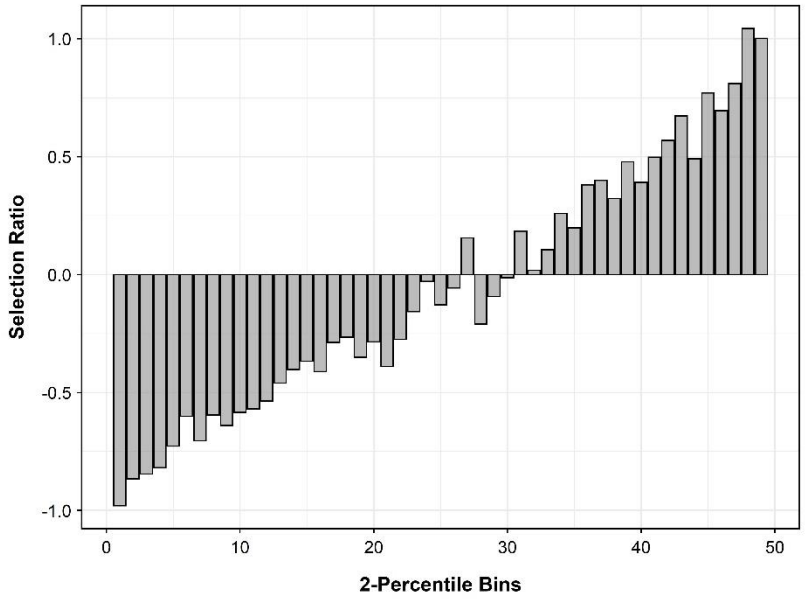
Attachment Figure 10. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 5). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.

6.9.2 ATTACHMENT 6–B — SELECTION RATIOS AND HABITAT RATINGS

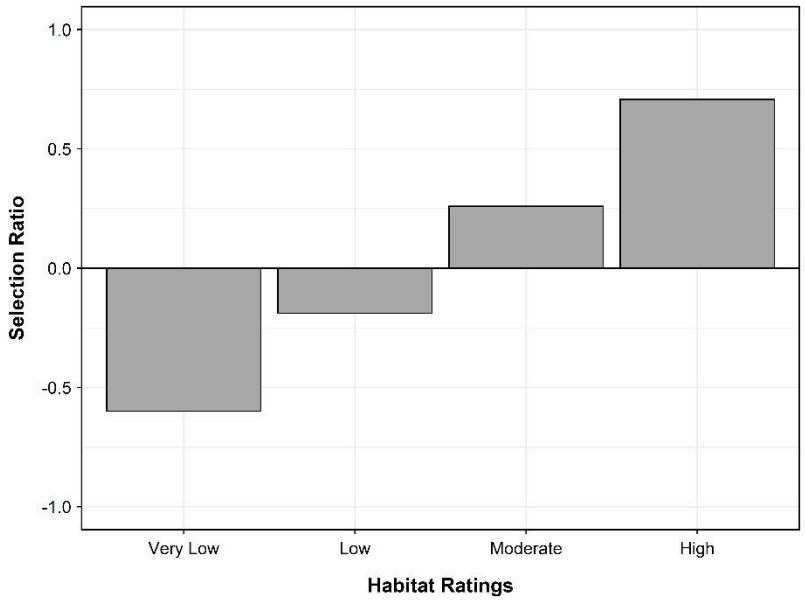
Late Fall



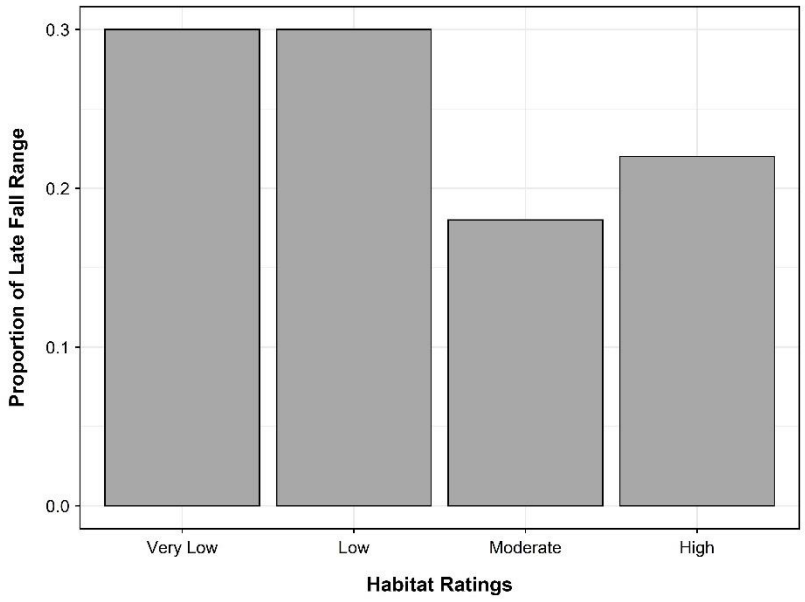
Attachment Figure 11. Proportions of used and available locations across 2-percentile (49 quantiles) interval bins of resource selection predictions during late fall, 2012–2021.



Attachment Figure 12. Selection ratios comparing the proportion of used to available locations across 2-percentile (49 quantiles) interval bins of resource selection predictions during late fall, 2012–2021.

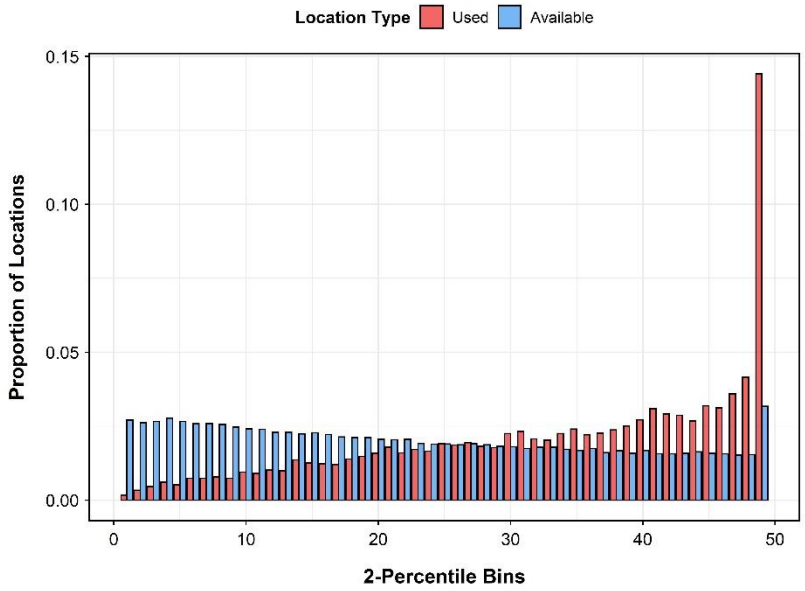


Attachment Figure 13. Selection ratios comparing the proportion of used to available locations across habitat rating classifications during late fall, 2012–2021.

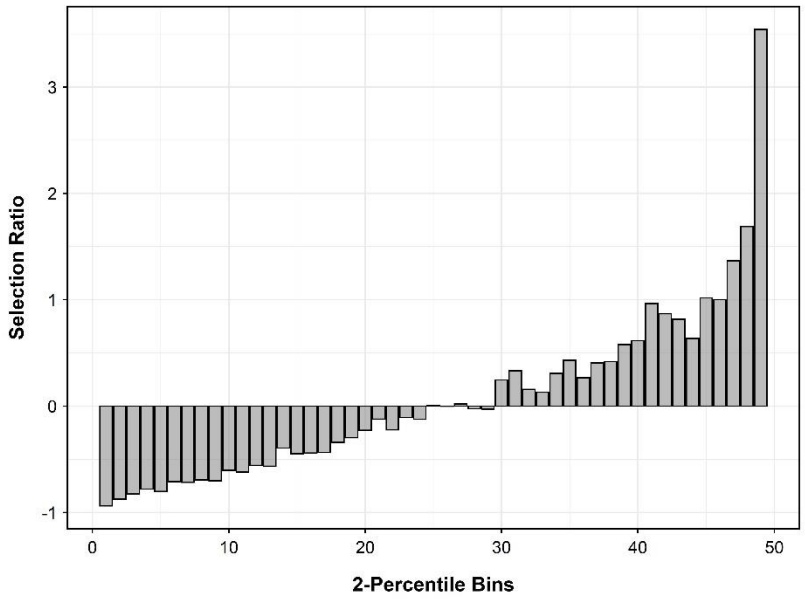


Attachment Figure 14. Proportion of the PCH late fall range composed by each habitat rating classification.

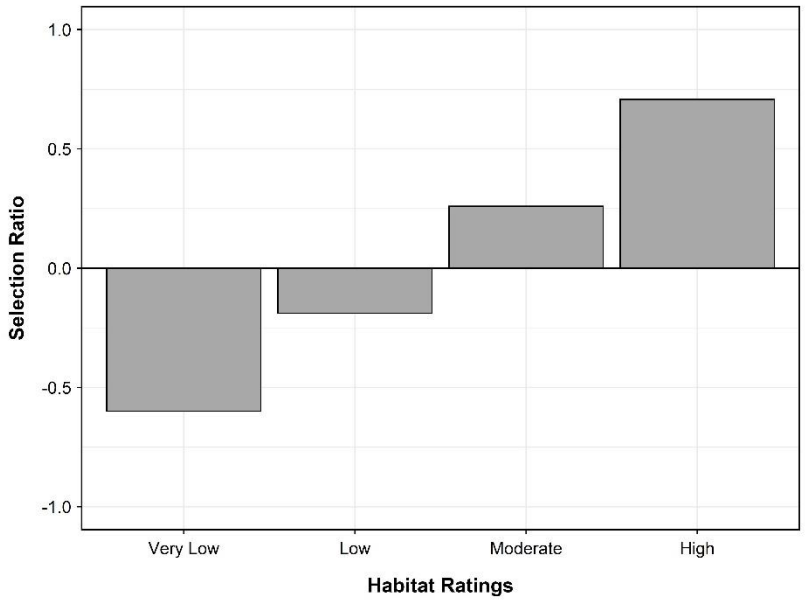
Winter



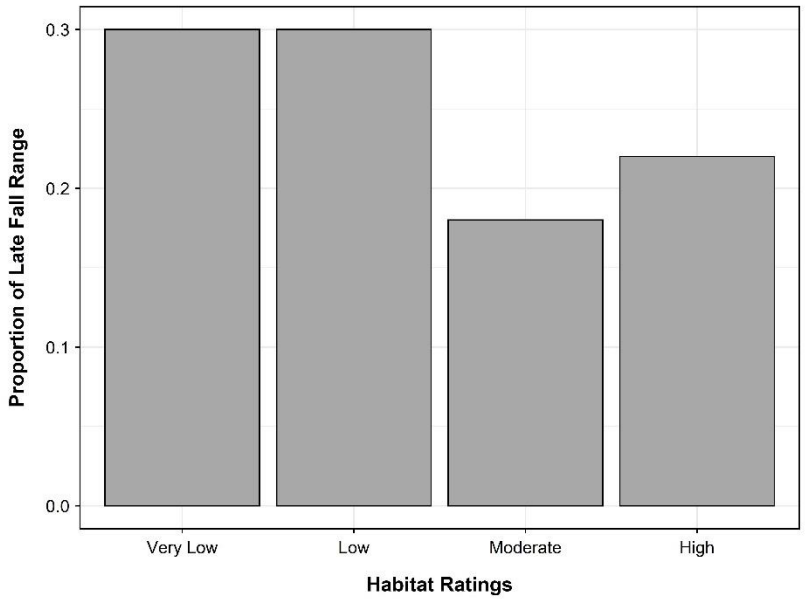
Attachment Figure 15. Proportions of used and available locations across 2-percentile (49 quantiles) interval bins of resource selection predictions during winter, 2012–2021.



Attachment Figure 16. Selection ratios comparing the proportion of used to available locations across 2-percentile (49 quantiles) interval bins of resource selection predictions during winter, 2012–2021.



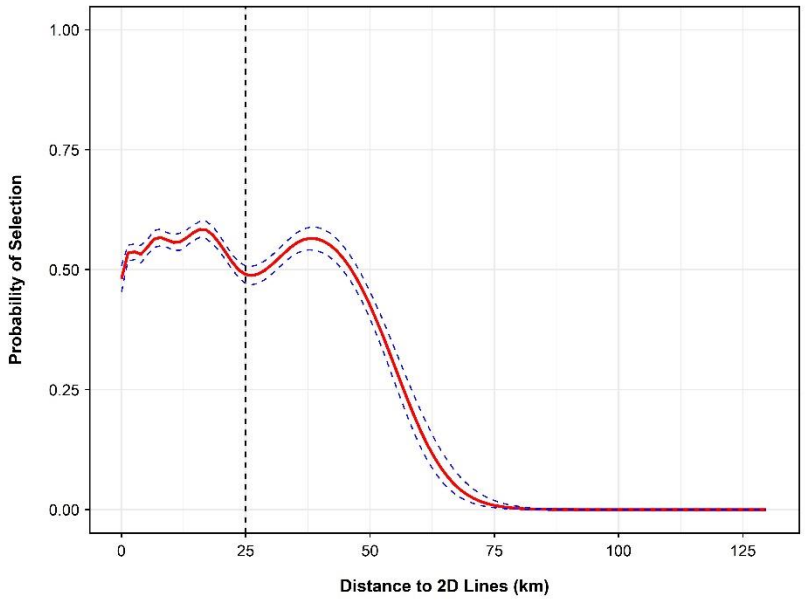
Attachment Figure 17. Selection ratios comparing the proportion of used to available locations across habitat rating classifications during winter, 2012–2021.



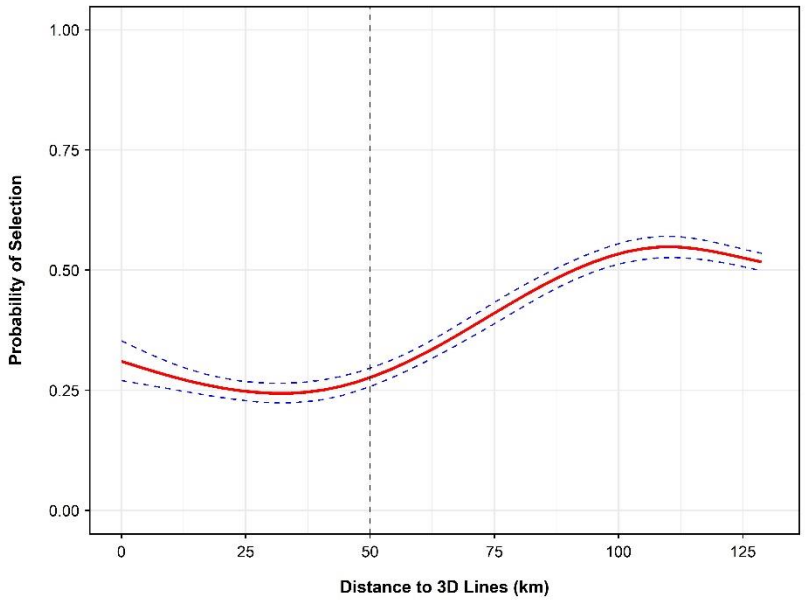
Attachment Figure 18. Proportion of the PCH winter range composed by each habitat rating classification.

6.9.3 ATTACHMENT 6–C — ZONE OF INFLUENCE ANALYSES

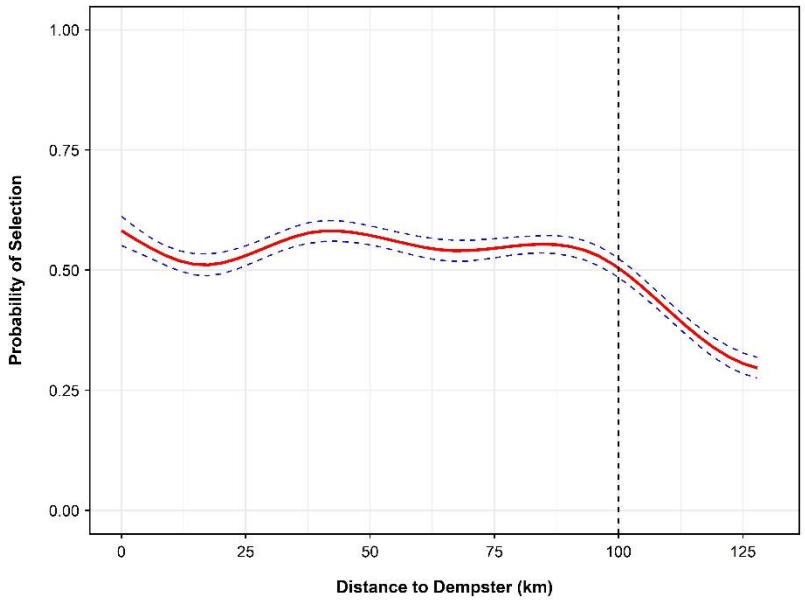
Late Fall



Attachment Figure 19. Marginal effect of distance to 2D seismic lines (including winter roads and trails) on the probability of selection by caribou during late fall (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

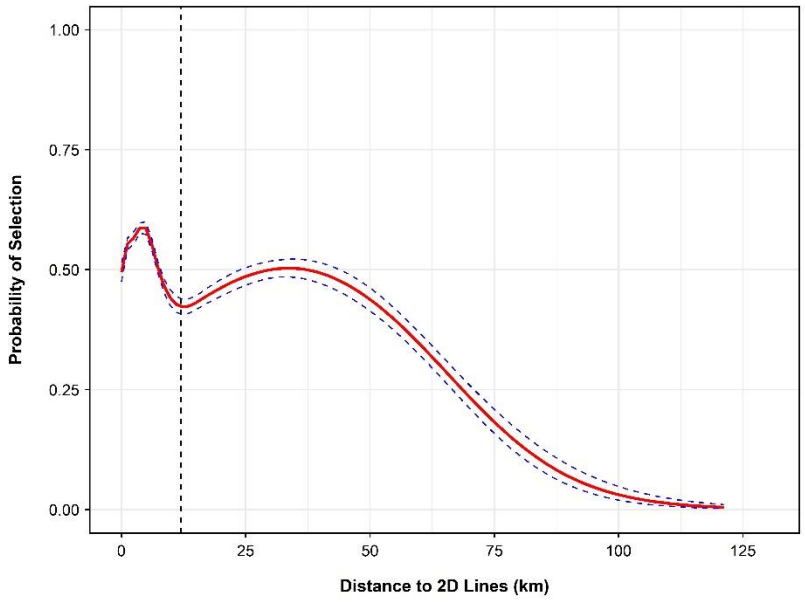


Attachment Figure 20. Marginal effect of distance to 3D seismic lines (single grid in Project RSA) on the probability of selection by caribou during late fall (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

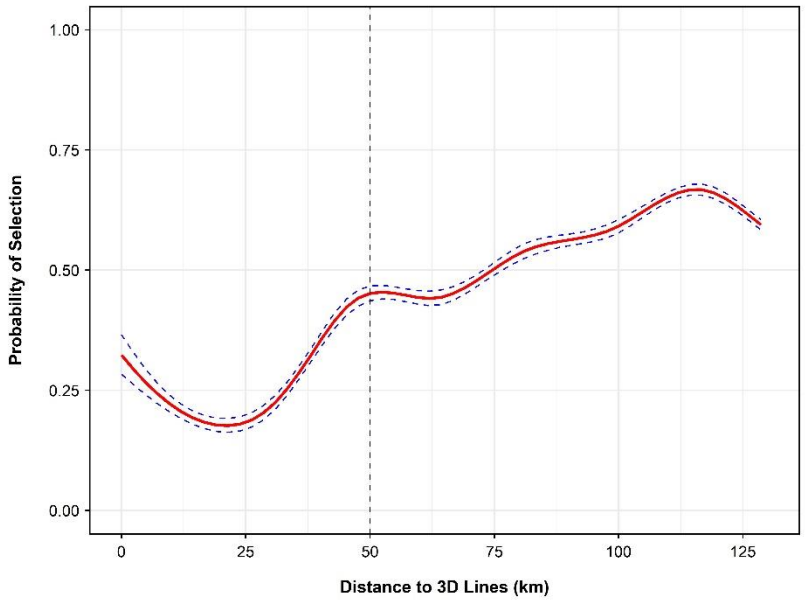


Attachment Figure 21. Marginal effect of distance to the Dempster Highway on the probability of selection by caribou during late fall (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

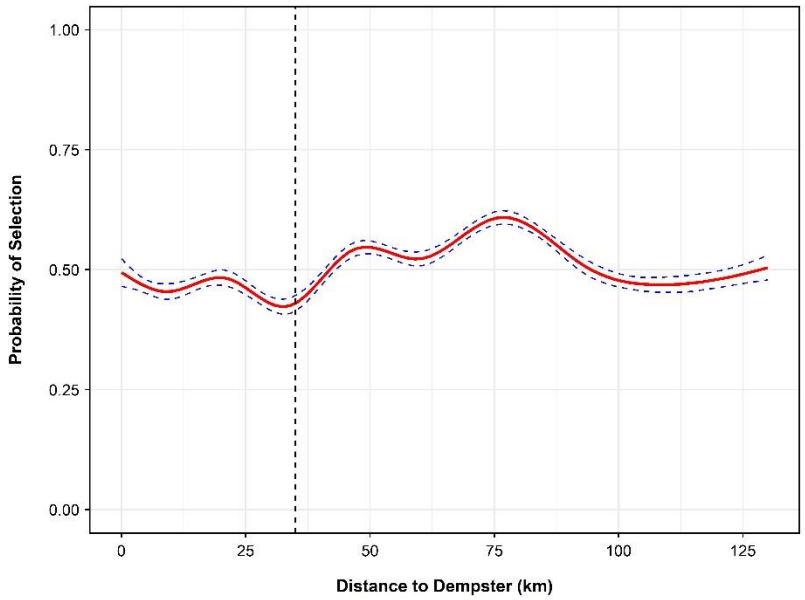
Winter



Attachment Figure 22. Marginal effect of distance to 2D seismic lines (including winter roads and trails) on the probability of selection by caribou during winter (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

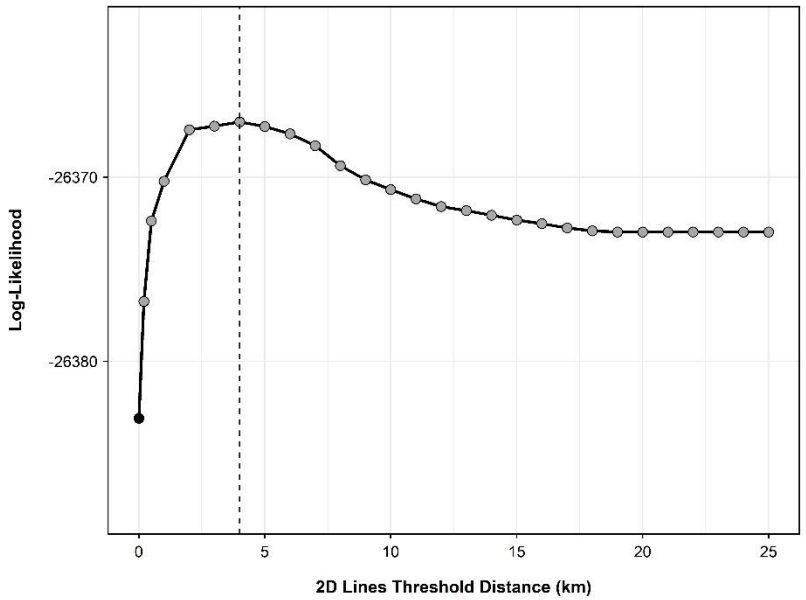


Attachment Figure 23. Marginal effect of distance to 3D seismic lines (single grid in Project RSA) on the probability of selection by caribou during winter (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

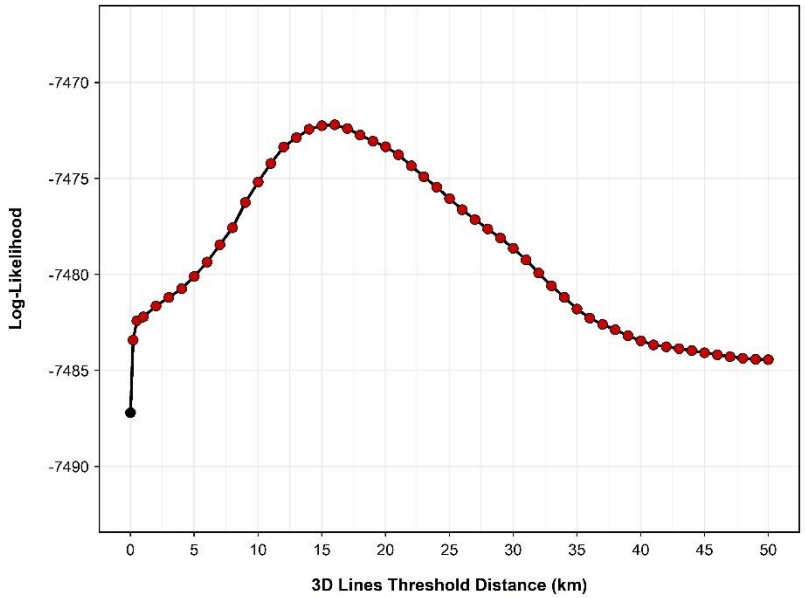


Attachment Figure 24. Marginal effect of distance to the Dempster Highway on the probability of selection by caribou during winter (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

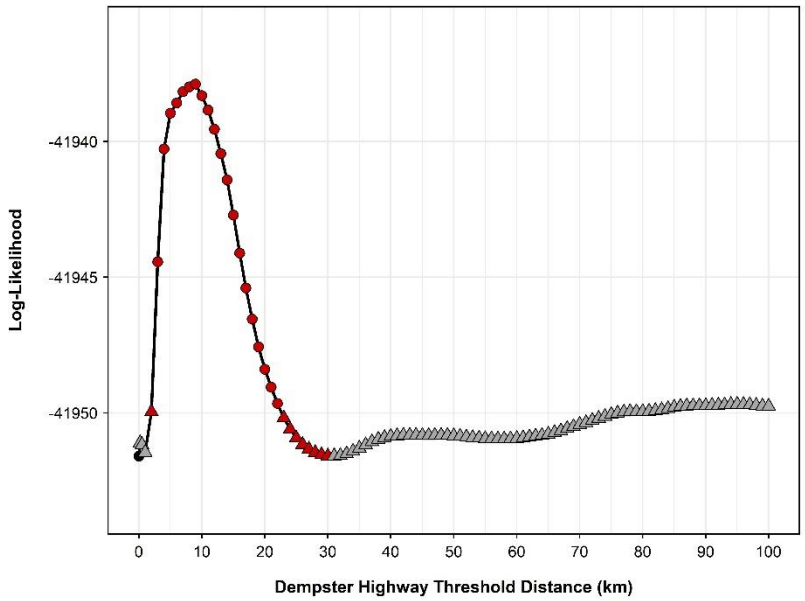
Late Fall



Attachment Figure 25. Segmented regression approach to estimating a zone of influence (ZOI) relative to 2D seismic lines (including winter roads and trails) using GPS collar data from PCH caribou during late fall, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively. Vertical dashed line indicates ZOI at 4 km.

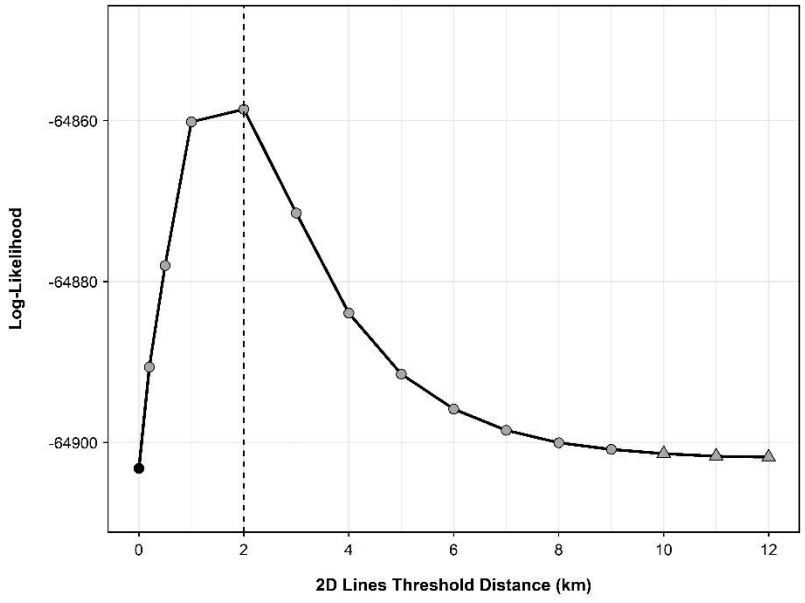


Attachment Figure 26. Segmented regression approach to estimating a zone of influence (ZOI) relative to the lone 3D seismic grid using GPS collar data from PCH caribou during late fall, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively.

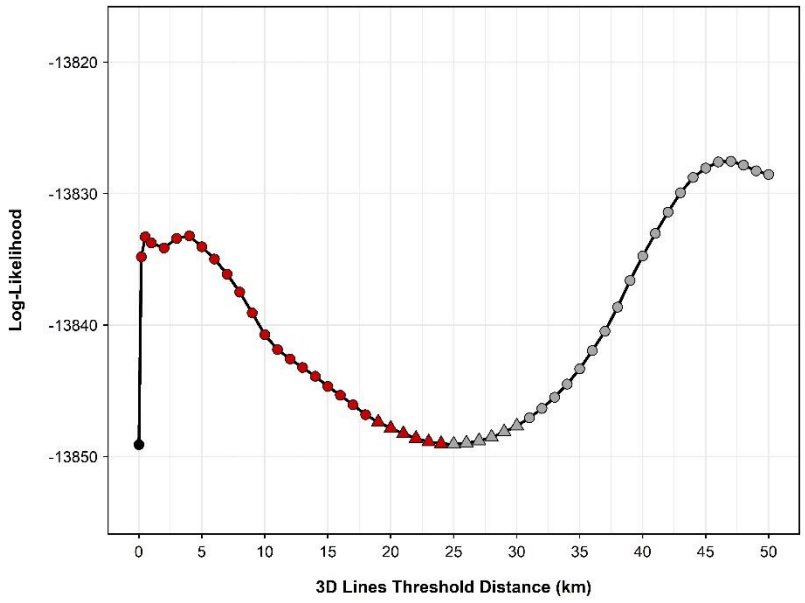


Attachment Figure 27. Segmented regression approach to estimating a zone of influence (ZOI) relative to the Dempster Highway using GPS collar data from PCH caribou during late fall, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively.

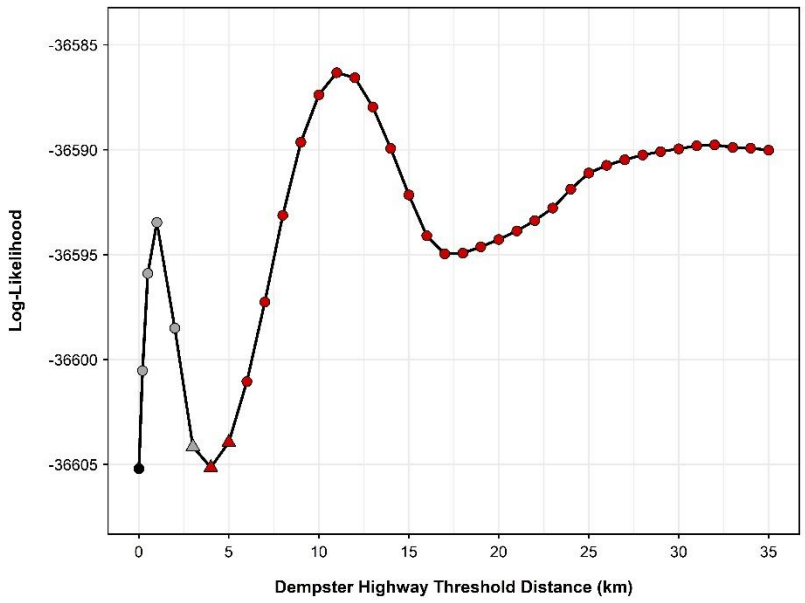
Winter



Attachment Figure 28. Segmented regression approach to estimating a zone of influence (ZOI) relative to 2D seismic lines (including winter roads and trails) using GPS collar data from PCH caribou during winter, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively. Vertical dashed line indicates ZOI at 2 km.



Attachment Figure 29. Segmented regression approach to estimating a zone of influence (ZOI) relative to the lone 3D seismic grid using GPS collar data from PCH caribou during winter, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively.



Attachment Figure 30. Segmented regression approach to estimating a zone of influence (ZOI) relative to the Dempster Highway using GPS collar data from PCH caribou during winter, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively.

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APPENDIX B. Linear Feature Study

Chance Oil and Gas, Eagle Plains Project: Linear Feature Study



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EXECUTIVE SUMMARY

The Eagle Plains Exploration Project (the Project) is an oil and gas exploration project located in north Yukon. Chance Oil and Gas Ltd. (Chance) intends to conduct exploratory activities to confirm the quality, quantity, and extent of hydrocarbons over ten years. Work will include seismic exploration and exploratory wells supported by an expanded winter road network. Oil and gas exploration activities create long, narrow clearings through natural vegetation, such as seismic lines and roads, collectively known as 'linear features.' Linear features can be a management challenge because they can affect how people and animals move and plants disperse within a landscape. For example, in southern parts of the boreal forest, linear features appear to affect predator-prey dynamics that can result in increased caribou mortality by wolves. The North Yukon and Peel Watershed Regional Land Use Plans identify mitigations to minimize the potential effects of linear features, including cautionary (0.75 km/km^2) and critical (1.0 km/km^2) indicator levels of linear disturbance.

Intermittent exploration activities in the Eagle Plains area from the 1950s to 2014 have created a network of winter roads, 2D seismic lines, and, most recently, 3D seismic lines in parts of the Regional Study Area (RSA). However, the extent of liner features that currently occur in the RSA, the structural, vegetation, and functional characteristics of different linear feature types, and their degree of regeneration are unknown. EDI Environmental Dynamics Inc. conducted a linear features study to characterize the structural, vegetation, and functional aspects of linear features in the RSA to address these information gaps. The study addressed three objectives: (1) comprehensive mapping and classification of existing linear feature footprints within the RSA; (2) quantification of structural aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and (3) quantification of regeneration pathways and structural stages of linear features. This combined information supports assessing potential effects of linear features in the Project application and refinement of mitigation measures for linear features to minimize possible effects.

The linear features inventory was compiled from multiple spatial datasets and was verified and supplemented using satellite imagery in a Geographic Information System. Linear feature densities were estimated for each linear feature type. Estimates were adjusted to account for (i) overlap with open habitats, such as recent burns, where vegetation heights were similar on and off the line, and (ii) for average rates of regeneration determined from field studies.

Site selection used a stratified random design to obtain a representative sample of different feature types across the RSA. Ground and aerial surveys measured specific structural, vegetation, and functional characteristics across the different line types. Measures included width, successional class, structural stage, vegetation composition and height, and sightline distances. A 'walk test' was used to index ease of movement for large mammals. A driving survey documented the visibility of seismic lines from the Dempster Highway (i.e., as an index of potential human access onto the seismic lines). An aerial winter track survey was conducted in March 2020 to assess ungulates' relative use of different linear feature types.

Four primary types of linear features occur in the RSA, totalling 4,269 km: 2D seismic (34%), 3D seismic (51%), winter roads (14%), and the Dempster Highway (1%). The unadjusted linear feature density for the RSA totalled 1.79 km/km^2. After accounting for burns, natural openings and regeneration, the adjusted linear

feature density for the RSA totalled 0.52 km/km², below the cautionary and critical indicator levels in the North Yukon and Peel Watershed Regional Land Use Plans.

Structural, vegetation, and functional characteristics differed substantially among linear feature types. 3D seismic accounts for the largest extent of linear features in the RSA and had the narrowest widths and limited functional effects (e.g., the proportion of features used by ungulates in the winter was less than a third of the rates of use on 2D and winter roads). Winter roads had the widest average widths and the greatest functional effects except for the Dempster Highway. However, a substantial portion (39%) had also regenerated into or past the Tall Shrub stage (which this study suggests may be the best criterion for functional recovery). Most 2D lines had substantial vegetation regeneration, resulting in the shortest average sightlines and slowest movement speeds. However, ungulates still appeared to select them to travel on during winter.

Except for the Dempster Highway, where walking speeds were near twice the rate of other linear feature types, there was relatively little difference in movement rates among linear feature types and control areas. The density of shrubs and trees primarily limited movement rates. 2D lines, which had the highest density of shrubby regeneration, had the slowest average movement rates. For other linear feature types, the combination of vegetation regeneration on linear features and the naturally open nature of most adjacent undisturbed areas did not convey a substantial increase in movement rates on linear features compared to undisturbed areas.

Sightline distances on 2D lines and winter roads were also affected mainly by the degree of vegetation regeneration. Where regeneration was limited, sightlines on 2D lines and winter roads regularly exceeded 150 m. On 3D lines, which have not had enough time since their creation for vegetation to regenerate to the height that restricts vision, sightlines were limited by meanders purposely constructed to reduce sightlines. The meanders employed on 3D lines were also effective in reducing the detectability of the lines from the Dempster Highway. In the blind test, where observers did not know the location of the 3D lines, only 5% (4 out of 74) crossings were spotted. With a map showing the crossing locations, only two additional 3D lines were detected.

These results provide information to assess the potential effects of linear features in the Project application and refine mitigation measures.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
2D	Two Dimensional
3D	Three Dimensional
AIC	Akaike's Information Criterion
asl	above sea level
BC	British Columbia
°C	degrees Celsius
ELC	Ecosystem and Landscape Classification
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectares
IMA	Integrated Management Area
km	kilometers
km^2	square kilometers
km/hr	kilometer per hour
LIS	Low Impact Seismic
LMU	Landscape Management Unit
m	meter
mm	millimeter
NND	Na-cho Nyäk Dun
NWT	Northwest Territories
NYRLUP	North Yukon Regional Land Use Plan
PCH	Porcupine Caribou Herd
OHV	Off-Highway Vehicle
PWRLUP	Peel Watershed Regional Land Use Plan
RSA	Regional Study Area
the Project	the Eagle Plains Project (proposed by Chance Oil and Gas Ltd.)
YLUPC	Yukon Land Use Planning Council

1 INTRODUCTION

1.1 PROJECT OVERVIEW

The Eagle Plains Project (the Project) encompasses a 2,386 km² area in north-central Yukon, approximately 605 km north of Whitehorse and 40 km south and west of Eagle Plains hotel, along the Dempster Highway (Map 1-1). The Project occurs within the Eagle Plains petroleum basin, north of the Ogilvie River and west of the Richardson Mountains. The basin contains proven natural gas and oil reserves (Peel Watershed Planning Commission 2019), including 4.6 billion m³ of gas and 3.2 million m³ of oil (Hannigan 2014).

The Regional Study Area (RSA) has had intermittent periods of oil and gas exploration since the 1950s. That activity has developed winter roads, seismic lines, and exploratory wells across parts of the current RSA. Approximately 40 exploration wells have been drilled at Eagle Plains. Eight wells are maintained in suspended status, and the remaining wells have been plugged and abandoned. Seismic exploration has included approximately 10,000 km of two-dimensional (2D) lines (mainly before 1985), and about 325 km² of three-dimensional (3D) seismic was conducted in 2013–2014 (Northern Cross (Yukon) Ltd. 2014).

The current exploration program will build on past exploration to better define the extent, amount and quality of oil and gas deposits. Under the current program, Chance Oil and Gas Ltd. proposes conducting additional 3D seismic over large extents of the RSA and drilling up to 30 exploratory wells. Depending on the drilling program results, extended flow testing over several months may be conducted at a subset of the wells to determine the quantity and quality of the oil and gas deposit. The existing winter road network will be expanded to support the seismic and drilling programs. Most work is expected to be conducted in the winter (e.g., seismic line clearing and drilling); however, seismic recordings and extended flow testing may also occur during summer.

Oil and gas exploration activities create long, narrow clearings through natural vegetation, such as seismic lines and roads, collectively known as 'linear features.' Linear features can be a management challenge because they can affect how people and animals move and plants disperse within a landscape. For example, in southern parts of the boreal forest, linear features appear to affect predator-prey dynamics that can result in increased caribou mortality by wolves. The North Yukon and Peel Watershed Regional Land Use Plans identify mitigations to minimize the potential effects of linear features. The Plans also include cautionary (0.75 km/km²) and critical (1.0 km/km²) linear density indicator levels.

1.2 PURPOSE AND OBJECTIVES

Intermittent exploration activities in the Eagle Plains area from the 1950s to 2014 have created a network of winter roads, 2D seismic lines, and, most recently, 3D seismic lines in parts of the RSA. However, the extent of liner features that currently occur in the RSA, the physical and functional characteristics of different linear feature types, and their degree of regeneration are unknown.

EDI Environmental Dynamics Inc. (EDI) conducted a linear features study to characterize the physical and functional aspects of linear features in the RSA to address these information gaps. The three objectives of this study were to: (1) conduct comprehensive mapping and classification of existing linear feature footprints within the RSA; (2) determine physical aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and, (3) quantify regeneration pathways and stages of linear features. The combined information forms the basis for assessing the potential effects of linear features in the RSA and refining mitigation measures for linear features.

1.3 STUDY AREA

The RSA for the Eagle Plains Project is approximately 2,386 km² (238,566 ha), centred in the Eagle Plains Ecoregion in north Yukon (Map 1-1). The area consists of subdued topography of rolling hills and sloping plains. The RSA is centred on a major watershed divide (denoted by the location of the Dempster Highway), with the northwestern two-thirds of the RSA draining into the Porcupine River watershed to the north, via Chance Creek, and west, via McParlon Creek and the Whitestone River. The southeastern third of the RSA drains into the Peel River watershed via Dalglish Creek.

Development in the RSA and the surrounding Eagle Plains is low. The Dempster Highway is the primary vehicle access corridor, running from approximately Dawson City, Yukon in the south to Inuvik, Northwest Territories in the north, and transiting the RSA. The Eagle Plains settlement is on the Dempster Highway, approximately 40 km northeast of the RSA and includes the Eagle Plains Hotel and the Government of Yukon's Highway Maintenance camp. The Eagle Plains area has had intermittent periods of oil and gas exploration since the 1950s. That activity has created winter roads, seismic lines, and exploratory wells across parts of the RSA. Approximately 40 exploration wells have been drilled at Eagle Plains. Eight wells are maintained in suspended status, and the remaining wells have been plugged and abandoned. Approximately 10,000 km of 2D lines have been developed across the Eagle Plains Ecoregion, mostly between 1961 and 1984 (Access Consulting Group and EBA Engineering Consultants Ltd. 2001, GEOTIR 2014). More recently, approximately 2,200 km of 3D LIS exploration was conducted in a 325 km² area between November 2013 and April 2014 (GEOTIR 2014). This 3D exploration grid is near the centre of the RSA, spanning north and south of the Dempster Highway.

1.3.1 REGIONAL ECOLOGICAL SETTING

The Eagle Plains Ecoregion is a 20,400 km² portion of the Taiga Cordillera Ecozone in north Yukon between the Richardson and Ogilvie Mountains. Unlike much of the mountainous Taiga Cordillera, most of the Eagle Plains Ecoregion occurs as low altitude rolling topography between 300 m and 600 m above sea level (masl), with few scattered peaks above and around 1,000 masl (Ecological Stratification Working Group 1995). Most of the ecoregion is unglaciated terrain, with surficial features formed due to permafrost and frozen ground-related processes, including thermokarst subsidence, soil creeps, cryoturbation, solifluction, and active layer detachment slides on shale (Yukon Ecoregions Working Group 2004).

The Eagle Plains Ecoregion experiences moderate precipitation, with annual amounts around 400 mm. Most precipitation falls as rain throughout the summer, averaging 50 to 80 mm per month, June through August. Precipitation is lighter through September to April and falls as snow, with average winter snowpacks of 80 cm peaking in April. The climate is strongly affected by latitude, with extended winter conditions from October to early May. There is a substantial variation in seasonal temperatures in the Eagle Plains, with cool short summers and long cold winters. Average winter temperatures are between −30°C and −25°C, with extremes as low as −60°C. Average summer temperatures are around 13°C, with extremes as high as 30°C. Due to the northern latitude, this region experiences continuous sun above and below the horizon, in summer and winter, respectively.

Most of the Ecoregion, including the northeast portion of the RSA, drains north into the Yukon River via the Whitestone, Porcupine and Eagle rivers. That part of the RSA includes the headwaters of the Eagle River and several other tributaries of the Porcupine River, along with the Chance and McParlon Creek subdrainages of the Whitestone River. The southeast corner of the Ecoregion drains east to the Mackenzie River via the Peel, Wind and Ogilvie Rivers. Dalglish and Enterprise creeks flow directly into the Peel River. The few lakes in the Ecoregion are generally oxbow or thermokarst lakes (Yukon Ecoregions Working Group 2004). Several wetland complexes are associated with larger creeks in the RSA.

The Eagle Plains Ecoregion is within the continuous permafrost zone where permafrost can be found up to 200 m thick. The Eagle Plains Ecoregion is dominated by the Cryosolic soils that occupy much of the northern third of Canada, characterized by near-surface permafrost. Turbic Cryosols predominate, exhibiting patterned ground formations and hummocks, and are often associated with open stands of black spruce (*Picea mariana*), tamarack (*Larix laricina*) and birch (*Betula* spp.). The active permafrost layer in these ecosystems generally ranges between 20 cm and 90 cm below the surface. The active layer depth is generally deeper directly under hummocks and shallower under inter-hummock areas (Yukon Ecoregions Working Group 2004).

The RSA is entirely within the Subarctic Bioclimate Zone (Environment Yukon 2014). Vegetation in the RSA is characterized by open-canopy, spruce-dominated habitats where permafrost and short cool growing seasons limit tree growth and often result in stunted, disclimax vegetation communities (Environment Yukon 2016). Hummocky, black and white spruce (*Picea glauca*) woodlands with well-developed shrub communities are common in upland areas. White spruce and ground lichens increase in abundance in well-drained sites. Areas with low slope gradients and fine-textured soils often have ground cover dominated by cottongrass tussocks beneath a shrub layer of birch, black spruce, Labrador tea (*Rhododendron groenlandicum*), and occasionally tamarack (*Larix laricina*) (Yukon Ecoregions Working Group 2004).

Forest fires are a common disturbance agent in the region, and burns of various ages occur throughout the RSA. Fires increase the depth of the active permafrost layer and changes in soil moisture and productivity, affecting vegetation regeneration and resulting in terrain disturbances, such as slope failures and erosion. Regenerating burns are dominated by shrubs, such as scrub birch (*Betula glandulosa*), willows (*Salix spp.*) and alder (*Alnus spp.*), with Alaskan paper-birch (*Betula neoalaskana*) often the first tree species to colonize burn areas. As burns regenerate into young and mature forest, black and white spruce typically become the dominant forest species. Residual Alaskan birch in spruce-dominated stands often defines the extent of old burns (Yukon Ecoregions Working Group 2004).

Mammal diversity is relatively low in the Eagle Plains Ecoregion due to its northern location and low productivity. Voles (*Microtus* spp., *Myodes* spp., *Phenacomys* spp.), American marten (*Martes americana*), ermine (*Mustela erminea*), and red fox (*Vulpes vulpes*) are common smaller mammals. Wolves (*Canis lupus*), wolverines (*Gulo gulo*), and both black and grizzly bears (*Ursus americanus* and *U. arctos*.) are present at low densities. Moose (*Alces alces*) inhabit the region year-round. The RSA overlaps a small portion of the winter range of the Porcupine caribou herd (PCH), a subpopulation of the barren-ground caribou (*Rangifer tarandus granti*). The PCH is an iconic species in north Yukon, with high cultural, social, economic, and ecological values. The PCH's population has been increasing over the last several decades and is currently estimated to consist of 202,106 to 234,808 caribou (Caikoski 2017, Porcupine Caribou Technical Committee 2018). The PCH is known to occupy portions of the Eagle Plains Ecoregion in fall and winter when they tend to occur in smaller groups over a larger area than during other seasons.

1.3.2 REGIONAL LAND USE PLANNING

The RSA overlaps four First Nation Traditional Territories. Most of the RSA is within the Traditional Territory of the Vuntut Gwitchin First Nation. The southeastern portion is in an area of overlapping Traditional Territories of Vuntut Gwitchin First Nation, the Tetlit Gwich'in Council, the First Nation of Na-cho Nyäk Dun, and Tr'ondëk Hwëchin. Although the RSA is located outside of any First Nation Settlement Lands, it does abut Vuntut Gwitchin First Nations Settlement Lands on parts of its east and southwest borders. Each First Nations government has provided input to, and approved of, the Regional Land Use Plan(s) on their Traditional Territory under the respective First Nation Final Agreements.

1.3.2.1 North Yukon Regional Land Use Plan

The RSA lies mainly within the North Yukon Planning Region and is subject to the North Yukon Regional Land Use Plan (NYRLUP) (Map 1-1). The NYRLUP was created to protect the natural and cultural resources of the region while allowing sustainable economic development opportunities (Vuntut Gwitchin Government and Yukon Government 2009). It provides management direction for using public and settlement lands based on four principles: sustainable development, precautionary principle, conservation, and adaptive management. The NYRLUP divides the Planning Region into 23 land management units classified into three categories: protected area, integrated management area (IMA), and community area. IMAs are further classified into four zones: Zone 1 (lowest development), Zone II (low development), Zone III (moderate development), and Zone IV (highest development). IMA zones are classified based on the area's sensitivity to landscape disturbance, ecological and cultural values, risk of significant impacts, and level of acceptable change. The RSA is a Zone IV IMA with lower ecological and cultural values in a moderately sensitive biophysical setting. Subsequently, Zone IV IMAs allows for the highest development level to occur.

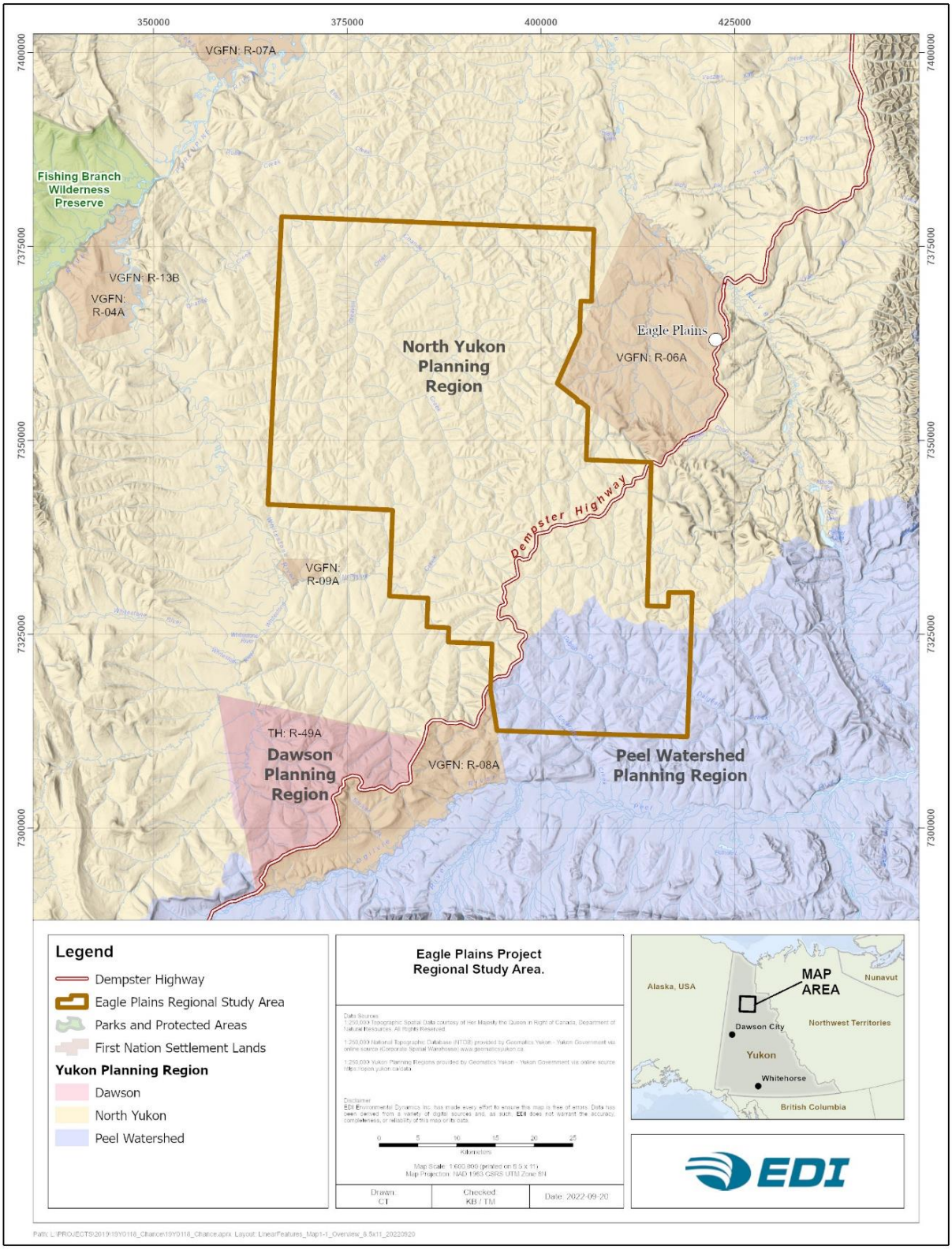
The NYRLUP encourages results-based management and uses cumulative effects indicators to determine if goals and objectives are met. Results-based management allows for innovation and creativity in land-use strategies and approaches. The two cumulative effects indicators included in the NYRLUP are direct surface disturbance and linear density. The NYRLUP guidelines for Zone IV IMAs are 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density (Vuntut Gwitchin Government and Yukon Government 2009).

However, as surface disturbances and linear features reach a level of functional recovery and become part of the continuous landscape, they can be subtracted from the total amount of disturbed area (Vuntut Gwitchin Government and Yukon Government 2009). The NYRLUP suggests using a height of 1.5 m for woody vegetation in forested areas, as vegetation above this height would likely no longer allow for travel or access by humans or wildlife and is, therefore, considered functionally recovered. Activities considered exempt from functional disturbance restrictions are (1) new linear features less than 1.5 m wide; (2) land-use activities that occur on frozen water bodies; (3) winter work with no required clearing of trees; and (4) winter work that uses existing disturbances and linear features.

1.3.2.2 Peel Watershed Regional Land Use Plan

The southeastern corner of the RSA lies within the Peel Watershed Planning Region (PWPR) and is subject to the Peel Watershed Regional Land Use Plan (PWRLUP) (Peel Watershed Planning Commission 2019) (Map 1-1). Like the NYRLUP, the PWRLUP was established to provide management direction and ensure long-term sustainable development in the Planning Region. The PWRLUP was founded on three main themes: environmental protection, social considerations, and economic development. It follows a similar framework as the NYRLUP. The PWPR is divided into 16 Landscape Management Units (LMU), which each share similar ecological characteristics, planning issues, and management intent. Each LMU is categorized by a land-use designation system. Conservation Areas are managed to protect ecological and cultural resources, while IMAs are 'working' landscapes where new development and surface disturbance may be allowed. IMAs are further classified into Zones, which correspond to the level of allowable development with comparable justification as the NYRLUP. The RSA is part of LMU 7 (Dalglish Creek), classified as an IMA Zone IV, allowing for the highest level of development.

Like the NYRLUP, the PWRLUP encourages results-based management and uses the same cumulative effects indicators, surface disturbance and linear density to inform decisions. The PWRLUP cautionary and critical indicators are identical to those of the NYRLUP: 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density. As surface disturbances reach a level of functional recovery and no longer enable travel or access by wildlife and people, they can be subtracted from the total amount of disturbed area. The PWRLUP suggests using a 1.5 m woody vegetation height as a threshold for functional recovery in forested or shrubland areas. In areas dominated by low-growing vegetation, a feature could be considered functionally recovered when covered by native species roughly the same height and composition as the surrounding vegetation. To be considered as "functionally recovered," features must have similar sediment and run-off compared to background levels, roughly match original contours, and have no human-brought materials on the site. Exceptions to the linear density calculation are identical to those outlined in the NYRLUP.



Map 1-1. Eagle Plains Project Regional Study Area.

2 BACKGROUND

The term "linear feature" refers to any narrow, linear clearings of vegetation on the landscape. They include roads, seismic lines, power lines, and pipelines. Seismic lines are the dominant linear feature class in northern Canada, accounting for approximately 46% of all linear features in the Canadian boreal region (Pasher et al. 2013). Seismic exploration detects underground oil and natural gas reservoirs by analyzing sound waves reflected from the underlying geology (Yukon Energy Mines and Resources 2006). Sound waves are emitted by detonating small charges in a series of drilled shot holes (up to 20 m deep) or by vibrating a heavy metal plate on the ground's surface using a truck-mounted vibrator (Yukon Energy Mines and Resources 2006). Both methods require cleared travel corridors for equipment transportation, which results in a network of seismic lines across the landscape where seismic exploration has occurred.

Until the late 1990s, conventional 2D was the primary form of seismic exploration used in North America. 2D seismic lines were created using bulldozers to clear all vegetation in straight swaths, approximately 5–10 m wide in their earliest form. These wide, straight lines were necessary to enable large, heavy equipment movement. This process resulted in significant physical disturbance, often removing most surface vegetation and roots and the top layer of soil (Bliss and Wein 1972). Progressive improvements in 2D seismic exploration methods reduced the environmental impact, such as clearing in winter instead of summer and raising and adding mushroom shoes to the bulldozer blade to reduce soil disturbance. Despite these improvements, many of the 2D seismic lines created in the 1960s and 1970s in northern Canada remain disturbed, with little evidence of ecological recovery (Lee and Boutin 2006, van Rensen et al. 2015).

3D seismic exploration provides more accurate subsurface geological structure data than 2D technology. 3D seismic exploration techniques were developed in the mid-1990s, and their use became widespread in the early 2000s (Dabros et al. 2018). At the same time as the transition to 3D, the seismic industry was transitioning to smaller and more specialized equipment that reduces cost, improves efficiency and reduces environmental impacts. Modern seismic equipment and methods typically use what is referred to as Low Impact Seismic (LIS) methods that minimize line widths and site disturbance and compaction. Typical 3D seismic lines are 2–3 m wide, constructed in 100–500 m spaced grids, and follow meandering rather than straight routes. There have been substantial improvements in the equipment used for 3D seismic line creation: low ground pressure mulchers, lighter equipment, ATV-mounted equipment, mushroom shoes and smear blades, and 'envirodrills' greatly reduce physical and vegetation disturbance (Dabros et al. 2018). These methods often leave the ground vegetation intact and only remove trees and tall shrubs, reducing overall disturbance and facilitating faster regeneration. The location of the seismic line can be adjusted on the fly in the field to minimize impacts, such as avoiding the cutting of large trees.

Continuous advancements in seismic exploration technology have improved geophysical accuracy while simultaneously reducing environmental impact. Numerous studies have examined the effects of linear disturbances on soil, hydrology, vegetation, regeneration, and wildlife responses (see Dabros et al. 2018 for a comprehensive review). Although the bulk of literature focuses on 2D seismic lines, as they have been part of the landscape for over 60 years, there have been several recent studies investigating the effects of LIS and 3D seismic lines (e.g., Kemper and Macdonald 2009a, Kansas et al. 2015, Golder Associates 2016).

Linear features have been associated with various environmental effects, including permafrost thaw, soil compaction and rutting, increased soil moisture and pooling, altered snow cover, temperature and wind patterns, and varied vegetation and wildlife responses (Dabros et al. 2018). In addition to the immediate loss of vegetation, linear features can create extensive edge effects, facilitate non-native or disturbance-induced species establishment, alter species composition, and positively and negatively affect wildlife (Dabros et al. 2018).

One of the most extensively studied effects of linear features in the southern boreal forest is the indirect effects that linear features can have on mortality risk to woodland caribou (*R. tarandus caribou*). Linear features can result in complex effects on populations dynamics that include (i) increases in secondary prey (moose and deer), which elevate wolf populations (apparent competition) and (ii) more efficient hunting by predators along linear features (facilitated predation) (Wittmer et al. 2007, Latham et al. 2011, Dickie et al. 2017a, Keim et al. 2019b, 2021). Research has also documented the responses of birds to linear features (Bayne et al. 2005, Machtans 2006, Lankau et al. 2013), bears (Tigner et al. 2014, Finnegan et al. 2018), and furbearers (Tigner et al. 2015).

Most studies investigating impacts and recovery of seismic lines and other linear features were conducted in southern boreal forest ecosystems (i.e., Boreal Plains Ecozone; e.g., Lee and Boutin 2006, Kansas et al. 2015, van Rensen et al. 2015, Dickie et al. 2017a). There are fundamental differences in the climate, vegetation communities, wildlife communities, and ecological processes in taiga ecosystems that may result in different patterns and responses to linear features. For example, regeneration patterns of linear features in taiga ecosystems over permafrost can follow different successional trajectories than those of southern boreal regions (Simpson 2008). The few studies that have examined linear features in taiga regions have found similarities and differences to southern studies revegetation (Kemper and Macdonald 2009, Dabros et al. 2018). One of the key objectives of this study was to collect local information from Eagle Plains that can be used to better contextualize or adapt the findings from other studies to the Eagle Plains Project.

3 METHODS

A GIS analyses and field surveys were conducted to characterize linear features within the RSA. The inventory of linear features in the RSA was developed in a GIS by compiling available spatial data and then verifying and updating that against satellite imagery. Field studies quantified the width, vegetation characteristics, ecological function (line-of-sight, large mammal ease of movement assessment), and visibility of lines from the Dempster Highway.

3.1 LINEAR FEATURES INVENTORY

The inventory of existing linear features in the RSA was developed in a GIS by compiling available spatial data and then verifying and updating that against satellite imagery. A preliminary linear feature database was first developed that was used to support field surveys (described below in this section). A second step linked the field data to the linear feature database and conducted a more thorough review and verification process using satellite imagery to produce a final linear feature dataset for the RSA (see details in section 3.5.1).

Linear feature spatial data were obtained from the following sources:

- Yukon Government Energy, Mines and Resources "Oil and Gas Seismic Lines" dataset (a combination of less detailed National Energy Board data pre-1999 and the more detailed company-submitted data post-1999) (Yukon Government 2019)
- Natural Resources Canada CanVec "Roads," "Trails," and "Cut Lines" 1:50,000 scale datasets (Natural Resources Canada 2019)

The two datasets were merged into one dataset of all linear features documented in Yukon and clipped to the RSA. Key attribute data included (if available) the linear feature type (i.e., 2D and 3D seismic lines, winter roads, trails, Dempster Highway), width, year of establishment, and data source. This preliminary linear feature dataset was compared against satellite imagery at a (minimum) 1:10,000 scale to verify its accuracy. Any linear features that did not correspond with features visible in satellite imagery were either corrected or deleted based on satellite imagery interpretation. In the case of duplicate features across datasets, the 'best' data were attributed to a single feature by considering the spatial accuracy and the amount and accuracy of attribute data, as assessed against satellite imagery. Where duplicate widths occurred in the two source datasets, the wider width was retained.

3.2 LINEAR FEATURE CHARACTERISTICS SURVEY

Field studies quantified the width, vegetation characteristics, line-of-sight, and large mammal ease of travel assessment across the linear feature types identified from the GIS inventory. One aspect of the field study was to compare vegetation, line-of-sight, and ease of movement on the linear features to undisturbed areas adjacent to the cleared lines. Three types of surveys collected data for the linear feature study: ground surveys

(finest level of detail), air surveys (medium level of detail), and air calls (coarsest level of detail). EDI crews collected field data between July 28 and August 8, 2019.

3.2.1 SITE SELECTION

All ground surveys and aerial surveys occurred at predetermined, random sites. Sample sites were selected using a clustered, random sampling approach. This approach balanced obtaining a random, representative sample across linear feature types with survey efficiency (i.e., without clustering sites, the travel time between points would have been substantially greater and resulted in smaller sample size). Survey sites were drawn from 5,000 points distributed randomly across the set of mapped linear features (minimum spacing of 200 m between points). Each point was randomly assigned a unique number.

Each survey cluster included options for both ground and air surveys. For ground surveys, the cluster used a 2 km radius designed to accommodate approximately four ground survey sites, intended to be surveyed within a half-day of work (and close enough so crews could walk between sites). The objective was that two ground clusters could be surveyed by a crew each day. For air surveys, a 4 km radius was used that generally provided at least ten random survey site options. The objective for air survey clusters was that they could be surveyed while transiting between ground survey clusters.

Survey sites were selected via a two-stage process. The first stage was randomly drawing 100 points from the 5,000-point dataset. These points defined the survey clusters and served as actual survey sites. In this first stage, site selection was stratified to obtain an approximately equal sample across 2D, 3D and winter roads. This overweighted sampling of 2D and winter roads, relative to their extents in the RSA, but those features had the highest uncertainty in terms of their widths, vegetation characteristics, and functional characteristics. Stratification was necessary to obtain sufficient sample sizes across these less-common features. The second site-selection stage selected additional random points from the 5,000-point dataset in proximity to the first point, using the 2 km radius for ground surveys and the 4 km radius for aerial surveys.

The RSA was divided into 10 work areas to implement the sample design, each corresponding to a day of surveys. Each day the survey crew selected clusters to survey using the ascending order of the random identification number of the first point used to define each cluster. Similarly, points within each cluster were prioritized in ascending order of the random identification number. Normally, at least two ground clusters and two air clusters were sampled each day. However, that varied somewhat depending on the number of sample sites available in each cluster and the availability of the helicopter.

3.2.2 LINEAR FEATURE CHARACTERISTICS AND SURVEY METHODS

3.2.2.1 Linear Feature Characteristics

A range of structural, vegetation, human use, and functional characteristics was assessed in the field. A list of the various characteristics examined, with a description of each, is provided in Table 3-1. Successional classes and structural stages of vegetation are defined in Table 3-2 and Table 3-3, respectively.

Table 3-1. Description of physical, ecological and function characteristics assessed in the Eagle Plains linear feature study.

Parameter	Description	Survey Measured [1]
Plot location	Latitude and longitude using WGS 1984, measured by Garmin GPS units to ~4 m accuracy.	G, AS, AC
Linear feature type	Dempster Highway, winter road, 2D, 3Dc (conductor lines), 3Dr (receiver lines), and 3D5 (3D lines used both for seismic and local equipment/vehicle travel.	G, AS, AC
Linear feature width	During ground surveys, measured to the nearest 0.05 m and replicated four times. During aerial surveys, they were visually estimated to the nearest 1 m.	G, AS
Percent mulch	Percent cover of mulch (wood chips) on the seismic line, estimated to the nearest 1% using visual estimates. In areas with dense trees or large shrubs, the thick mulch layer produced during line clearing can hinder vegetation regeneration.	G, AS
Successional class	Refers to the successional trajectory of vegetation regeneration on the linear feature. Includes normal, magnified, stagnated, retrogressive, no succession, or recent disturbance class following Simpson (2008)[1].	G, AS, AC
Burn status	Burnt or not burnt; based on visual assessment (i.e., burned trees, charred ground vegetation).	G, AS, AC
Structural stage	Categorical descriptor of the dominant vegetation life form in the plot following the *Field Manual for Describing Yukon Ecosystems* criteria (Environment Yukon 2017). Structural stage categories are defined in Table 3-3.	G, AS
Height and species of tallest vegetation	Measured to the nearest 0.1 m for the tallest vegetation layer, approximated by the 90th percentile height to exclude extreme heights of individual plants.	G
Cover and species of dominant trees	Percent cover was recorded to the nearest 1% if less than 10%, and to the nearest 5% if over 10%. One or two dominant tree species were recorded.	G, AS
Cover and species of dominant shrubs	Percent cover was recorded to the nearest 1% if less than 10%, and to the nearest 5% if over 10%. Up to five co-dominant shrub species were recorded. Ground shrubs were excluded.	G, AS
Ecosite	Ecosite was recorded using Predictive Ecosystem Mapping (PEM) Units, available at the time of the survey. However, separate vegetation surveys indicated that the accuracy of the PEM mapping was poor, and ecosites were not used in subsequent analyses.	G
Permafrost activity/degradation	Present or absent. Additional comments (i.e., type of activity, percent cover) were recorded if applicable.	G
Wildlife trails	Present or absent. If present, rated as poorly, moderately, or well defined.	G
Potential for Off-Highway Vehicle (OHV) passage	Present or absent. Based on professional judgment, a 4x4 side-by-side is summer, considering obstructing vegetation, ground conditions (e.g., wetlands, peatlands), and graminoid tussocks.	G, AS
Signs of human activity	Present or absent. If present, applicable comments were recorded.	G
Ground disturbance	Percent cover of visibly disturbed ground. If present, type and additional descriptive comments were recorded.	G

[1] G=Ground Survey, AS=Aerial Survey, AC=Air Call.

[2] Between 2006 and 2008, Yukon Government, Department of Energy, Mines, and Resources investigated the recovery status of linear features in the Eagle Plains, British Mountains, and Peel River Plateau Ecoregions (Simpson 2008). They found that linear features typically regenerated into one of six categories: normal succession, magnified succession, retrogressive succession, successional stagnation, no succession, and recent disturbance (Table 3-2).

Table 3-2. Descriptions of successional classes on linear features in the Eagle Plains area (following Simpson 2008).

Successional Class	Description
Normal succession	Vegetation is similar to the adjacent undisturbed area but often in an earlier seral stage. E.g., often young trees surrounded by early successional shrubs and forbs. The disturbance was likely limited to removing trees and shrubs, with little to no disturbance to soil or permafrost.
Magnified succession	Vegetation on the feature is taller than the adjacent undisturbed area. Deciduous species often dominate tree and shrub layers, but a similar pattern was also observed for coniferous trees on some sites. The response is likely due to increased site productivity (including increased soil moisture, nutrients, and temperature) due to soil disturbance or increased depth to permafrost. Most frequently, but not exclusively, observed in burns.
Retrogressive succession	Sites are typically moss or sedge-dominated (rarely forb or low shrub), with high moisture content, often including standing water (i.e., micro wetlands), that contrast to upland conditions in adjacent undisturbed areas. The condition appears to result from permafrost melting and water pooling associated with vegetation removal and removal/compaction of the peat layer and mostly associated with winter roads.
Successional stagnation	Vegetation is typically dominated by graminoids or shrubs and not progressing to more advanced successional stages. Disturbance to soil or permafrost is likely. The ground may have been compacted. Almost exclusively associated with winter roads.
No succession	No ecological differences between the linear feature and adjacent undisturbed areas except that there is no or very little tree or shrub regeneration on the line, other than what was left after creation of the feature. Disturbance appears to be limited to the removal of trees and shrubs, with little to no disturbance to ground vegetation, soil, or permafrost.
Recent disturbance	Newer seismic line where successional patterns could not be determined. Features in this class were most likely trending to 'normal succession' or 'no succession', but the degree of regeneration was too limited to classify confidently.

Table 3-3. Structural stage categories used in ground and air surveys for the Eagle Plains linear feature study.

Structural Stage Code	Structural Stage Name	Description
1	Non-vegetated	Very recent disturbance (e.g., fire or flood) and no vegetation or less than 5% vegetation.
2	Sparse/Cryptogram	Either the initial stages of primary succession or a cryptogram community maintained by environmental conditions (e.g., bedrock, talus). Sparse tree, shrub and herb cover. Either sparsely vegetated overall (low cover of vascular plants and cryptograms, if present) or dominated by cryptograms.
2a	Sparse	5–10% vegetation cover.
2b	Bryoid	Bryophyte-dominated.
2c	Lichen	Lichen-dominated.
3	Herb	Early successional stage (e.g., post-fire forest succession) or a herb community maintained by environmental conditions or disturbance. Vegetation is dominated by herbs, although if the site overall is sparsely vegetated, herb cover can be low as long as herbs characterize the vegetation. Trees and shrubs are usually sparse or absent; however, shrub cover and stature (compared to herb cover and stature) determine whether the site is considered herbaceous.
3a	Forb-dominated	Includes non-graminoid herbs and ferns.

Structural Stage Code	Structural Stage Name	Description
3b	Graminoid-dominated	Includes grasses, sedges, reeds, and rushes.
3c	Aquatic	Floating or submerged plants dominate.
3d	Ground shrub-dominated	Dominated by dwarf woody species such as kinnikinnick (*Arctostaphylos uva-ursi*) or dwarf willows.
4	Shrub	Early successional stage of a forest or a shrub community maintained by environmental conditions or disturbance. Dominated either by shrubby vegetation, including tree seedlings or saplings; or, if sparsely vegetated overall, dominated by shrubs, which characterize the community as a shrubland.
4a	Tall Shrub	Dominated by woody plants >2 m tall with diameter at breast height (dbh) ≤7 cm.
4b	Low Shrub	Dominated by woody plants <2 m tall.
5	Treed: Pole/Sapling	Trees >2 m tall and with dbh >7 cm, typically densely stocked. Self-thinning and vertical structure are not yet evident in the canopy. Younger stands are vigorous (usually >15 to 20 years old); older stagnated stands (up to 100 years old) are also included; time since disturbance usually <40 years; up to 100+ years for dense (5,000–15,000+ stems per ha) stagnant stands.
6	Treed: Young Forest	Self-thinning has become evident and the forest canopy has begun to differentiate into distinct layers. A more open stand than at the pole/sapling stage.
7	Treed: Mature Forest	Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understoreys become well developed as the canopy opens up.
8	Treed: Old Forest	Stands of old age with complex structure; patchy shrub and herb understoreys are typical; regeneration is usually of shade-tolerant species with a composition similar to the overstorey. Fire-maintained stands may have a single-storey appearance.
9	Treed: Very Old Forest	Very old stands with complex structures, abundant large trees, snags and coarse woody debris (CWD); snags and CWD occurring in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species, with well-established canopy gaps.

3.2.2.2 Survey Methods

Three types of surveys assessed linear feature characteristics: ground surveys (finest level of detail), air surveys (medium level of detail), and air calls (coarsest level of detail). The reason for using different survey types was to maximize the sample size obtained, recognizing that the ability to collect certain types of data, or the level of measurement precision, decreased from ground surveys to aerial surveys to air calls. The characteristics that were measured during each survey type are noted in Table 3-1. Surveys were conducted between July 28 and August 8, 2019.

Ground surveys collected the most information and had the highest measurement precision of the three survey methods. All parameters listed in Table 3-1 were recorded. Field measurements generally followed methods in *Field Manual for Describing Terrestrial Ecosystems* (BC MFLNRORD and BC MOE 2010) with parameter specific details noted in Table 3-1. Photographs were taken of representative on-line and off-line plots.

Air surveys collected moderate resolution data on linear features. Air surveys efficiently collected a larger quantity of more generalized data than ground surveys. The subset of parameters recorded for aerial surveys is noted in Table 3-1. The survey methods generally followed procedures outlined for helicopter-based 'visual checks' in *Standard for Terrestrial Ecosystem Mapping in British Columbia* (Resources Inventory Committee 1998). Data were collected by hovering in a helicopter approximately 30 m over the sample sites for approximately three minutes while field crews recorded data for the reduced set of variables. Like ground surveys, relevant data were collected for both on-line and off-line plots. Photographs were taken at representative air survey plots (Attachment A).

Air calls collected data at the coarsest resolution of the three survey types, and no off-line data were collected. The data collected during air calls were limited to linear feature type, successional class, and burn status. Air calls were opportunistically conducted when EDI crews were flying through the RSA and linear features were encountered.

A fundamental aspect of the field study was to compare linear feature characteristics to adjacent undisturbed areas. Hence, field surveys included paired on-line and off-line plots at each sample site (excluding sites assessed via air calls). Off-line plots were located 50 m off the linear feature, with the direction off the feature selected randomly at each site using a coin toss. Data collected for each sample site were recorded on tailored survey forms (Attachment B).

3.2.2.3 Line-of-Sight and Ease of Travel

In addition to the structural and vegetation measures noted above, line-of-site and ease-of-movement were assessed as functional characteristics of the linear features at each ground plot. The sightline, measured to the nearest metre, was calculated as the farthest line that could be sighted using a range finder at the height of 1.5 m off the ground. Two measurements were recorded, one in each direction along the linear feature. Sightline measurements were repeated using the same bearings in the off-line plot.

Ease of travel was assessed using a 'walk test,' as Keim et al. (2019a) described in a study assessing the functional recovery of linear features. They found that ease of travel, as measured by a walk test conducted by human researchers, positively correlated with the intensity of use by several wildlife species. One EDI crew member timed themselves to the nearest second for the walk test while walking an approximately 75 m transect, measured to the nearest metre using a hip chain. This walk test was repeated in both the on-line and off-line plots, the paired transects spaced in parallel, approximately 50 m apart. The same observer conducted both walk tests to minimize observer bias at each site.

3.3 VISIBILITY OF LINEAR FEATURES FROM THE DEMPSTER HIGHWAY

One of the management concerns associated with seismic exploration is that seismic lines create travel routes that humans use. The probability of human use of seismic lines to access the surrounding landscape likely increases if the seismic line is visible and accessible from roads. The intersections of seismic lines and winter roads with the Dempster Highway are the primary locations where this could originate. Driving surveys were conducted along the 47 km section of the Dempster Highway within the RSA to determine the number and

type of linear features that could be located and accessed by the public from the Dempster Highway. Two types of surveys were conducted: a blind search where the location of the linear features was unknown and a 'map search,' where the observers had a map of the linear features that showed where they occurred. Both surveys were conducted on August 8, 2019.

The blind search approximated the proportion and type of linear features that the public could locate and access without prior knowledge of their locations. An EDI field crew drove along Dempster Highway at 35 km/h and attempted to identify linear features by visual inspection alone, unaware of where they intersected the highway. When a linear feature was identified, the crew stopped to record the following parameters:

- linear feature type;
- sight line distance;
- evidence of human use;
- evidence of wildlife use; and
- potential for OHV passage.

Photographs were taken, and relevant comments were recorded for each linear feature intersection where applicable.

The map search was a targeted search designed to approximate the proportion and type of linear features the public could spot from the Dempster Highway with prior knowledge of their locations. Using a map of linear features present in the RSA, an EDI field crew drove along the Dempster Highway, slowing to 10 km/h and attempting to identify the linear features when passing a point where the map showed they intersected the highway. When a linear feature intersection was reached, the crew recorded whether the line was visible or not and the parameters listed above for the blind search where a line was detected.

3.4 WINTER TRACK SURVEY

An aerial survey was conducted to assess the relative frequency of use of different liner feature types by ungulates and humans in late winter (March 2020). The survey consisted of 11 transects spanning the width of the RSA. Three of the transects were established parallel to the Dempster Highway at 50 m, 1 km and 5 km off the highway. The remaining transects were spaced approximately 5 km apart across the remainder of the RSA.

Before the field survey, each transect was established in a GIS. Each intersection with a linear feature was given a unique identification point and used to generate a field form (i.e., with a row for each linear feature intersection). The field survey involved flying along each transect and recording the presence of ungulate tracks or human tracks (e.g., snowmobile tracks) at each linear feature that was traversed. Surveys were conducted via helicopter at approximately 70 km/h, 50 m above the ground, with one navigator/data recorder and one primary observer. The surveyors classified tracks to species and counted the number of unique tracks. However, overlapping tracks and dustings of new snow made track identification and counts uncertain in over

half the detections. Therefore, analyses defaulted to the simple presence/absence of ungulate tracks. The primary metric examined was the proportion of linear features with ungulate tracks.

The original survey plan was also to count tracks in undisturbed areas between linear features. However, tracks were so numerous that surveying the entire area between linear features would have required substantially reducing the aircraft speed. This would have reduced the number of transects that could have been surveyed. As a compromise, field crews subsampled the area between lines by surveying an approximate 200 m band of an undisturbed area adjacent to each linear feature.

In conjunction with winter fish habitat assessments, the transects were surveyed over six days (March 7–13, 2020). Each day, one or two transects were surveyed while transiting to/from the study area. No track-erasing snowfalls occurred during the survey period. Snow depths ranged from 65 to 80 cm.

3.5 DATA PREPARATION AND ANALYSIS

3.5.1 SPATIAL DATA

The project generated two primary spatial datasets — a point database corresponding to all field survey sites and the linear feature database. The Linear Feature Survey Point Database (ArcGIS point feature class) contains all location-specific (point coordinate) field data collected at sample sites in summer 2019. Several fields were added to this database based on calculations and spatial joins (e.g., year of linear feature establishment and most recent fire). Paired on-line and off-line plot data were recorded as part of the same sample site coordinate.

The Linear Feature Inventory (ArcGIS polyline feature class) is a compilation of all documented linear features within the RSA, verified by comparing the preliminary linear feature inventory to aerial and satellite imagery and ground-truthing results.

Several modifications were made to improve the accuracy and detail of the Linear Feature Inventory:

- Linear features were classified into the following categories:
  - 2D (historical seismic lines, typically >3m wide),
  - 3D5 (including 4–5 m wide 3D lines that were used for both seismic and local vehicle/equipment travel);
  - 3Dc (3 m wide 3D seismic conductor lines);
  - 3Dr (2 m wide 3D seismic receiver lines);
  - winter roads (any trails or limited use roads used by vehicle or equipment, generally wider than 5 m and often with an obviously curving path); and,
  - Dempster Highway.
- Overlapping features (within a 3 m tolerance) were addressed according to the following rules:

- If two linear features of the same or unknown age overlapped, the wider feature was saved and the narrower feature deleted.
- If two linear features of the same or unknown width overlapped, the more recent feature was saved and the older feature deleted.
- If a 3D line overlapped with a 2D line, both lines were saved. This is because the older 2D lines were often still evident on the landscape in some state of regeneration, as were the 3D lines. However, both were saved since it was unknown at what state each line was in (i.e., if the 2D line was still evident, or only the 3D line, or both in varying states of regeneration). This occurred for 33 km of linear features within the RSA.

The preliminary linear feature inventory within the RSA was compared against a recent high-resolution satellite or aerial imagery (generally, 0.5–1 m resolution) at a 1:10,000 (or finer) scale to verify the accuracy of the source data. Any features that were visibly offset from georeferenced imagery were corrected to match the imagery.

Some older (1960s and 1970s) 2D seismic lines included in the source databases did not appear in satellite imagery. These 2D lines were compared against the imagery along the length of the feature to search for any sign of linear disturbance and then cross-referenced with field surveys conducted along the line, if present. These unverified linear features were classified as 'not applicable' and excluded from analysis if there was no evidence of linear disturbance along the feature's length in the imagery, which could often be verified with associated surveys noting that the feature was 'not present,' 'not visible,' or 'completely regenerated.' Unverified linear features were retained if there was evidence of linear disturbance along any feature's length in the imagery or if associated surveys had noted that the feature was present and in some state of regeneration, even if the feature was not visible in the imagery. A total of 199,473 m of erroneous or regenerated linear features were deleted from the linear feature inventory within the RSA.

Some linear features were visible on the imagery that had not been included in any of the source databases. In these cases, the linear features were manually digitized and classified into linear feature types based on visual assessment and attributes of adjacent connecting features, if present. Digitized linear features were assigned a year if they were obviously a continuation of a documented feature or if they were surrounded by features of the same type and year. Otherwise, the year was not included. High-resolution imagery was not available for the southernmost portion of the RSA (approximately 25 km by 15 km). This area was compared against lower quality Google Earth imagery, but this was not detailed enough to detect undocumented linear features if any existed (Google Earth 2019). However, existing linear features were verified using this method. A total of 202,945 m of linear features were digitized within the RSA.

After the Linear Feature Inventory was verified and corrected to be consistent with imagery and field observations, it was spatially joined to the Linear Feature Survey Point Database. In cases where the survey point did not correspond with any nearby linear feature, or if a linear feature was deleted (following the methods described above), the data were retained in the survey point database, but the linear feature type was updated to 'not applicable' and excluded from data analysis. Ten survey plots were identified as 'not applicable' and excluded from analyses; thus, the corrected sample size for survey plots is n = 210.

3.5.2 FIELD DATA

After completing field sampling, data forms and field notes were reviewed for completeness and accuracy during an internal data quality-assurance process. All associated digital photographs and GPS coordinates were reviewed to correspond to the appropriate field plots. A summary of field plots by linear feature type and survey type is provided in Table 3-4. All recorded data were entered into MS Excel databases (Microsoft 2019). Spatial data were uploaded to the ArcGIS platform (ESRI 2019).

Field-collected data were summarized primarily using Excel spreadsheets (Microsoft 2019). More detailed statistical analyses were performed on select data using R Statistical Software (R Development Core Team 2020). For example, the variation in ease of travel and vegetation cover as a function of linear feature types, burn history, successional stage, or ecosite were explored. During formal analyses, standard assumptions of normality and homogeneity of variance were assessed, and variance-covariance structures were applied to model heterogeneity (of residuals) if required. For instance, the sightline distance (m) was fourth-root transformed to meet normality. In certain models, random effects were included to account for variance among different subjects. For example, observers were included as a random variable to account for observer bias (i.e., a random intercept model; package "nlme", Pinheiro et al. 2016). Corrected Akaike's Information Criteria (AICc) scores were used to compare sets of candidate models. Models with the lowest AICc score were selected because they yielded the best balance (parsimony) between explained variance and level of complexity.

Table 3-4. The number of sites surveyed using ground surveys, air surveys, and air calls for each linear feature type in the Eagle Plains RSA.

Linear Feature Type	Survey Type			
	Ground Survey	Air Survey	Air Call	Total
2D	31	32	44	107
3D-5m wide	5	0	0	5
3D-Conductor	26	3	0	29
3D-Receiver	23	1	0	24
Winter Road	18	17	8	43
Dempster Highway	2	0	0	2
Not Applicable	3	2	5	10
Total	108	55	57	220

3.5.3 LINEAR FEATURE DENSITY CALCULATION

Linear feature densities were calculated in two ways: (1) using the total linear feature extents, and (2) adjusting the extents to account for (a) lines through 'open' habitats, such as wetlands and recent burns, where the vegetation on the line did not differ from vegetation off the line, and (b) functionally recovered linear features such as 2D lines from the 1960s and 1970s that had advanced regenerated at least to the Tall Shrub structural stage. Adjustments were determined by intersecting the Linear Feature Inventory with a recently developed

Ecological Landscape Classification (ELC) map of the RSA (a companion Eagle Plains Project baseline report). The ELC map documented the type and structural stage of vegetation communities across the RSA. The extent of linear features in open habitats was determined by the lengths of linear features overlapping Low Shrub, Herb and Bryoid structural stages in the ELC maps. This includes seral habitats regenerating from burns and ecosystems that are maintained in those stages over time, such as wetlands and shrub-carrs. The extent of regenerated linear features was determined by integrating the proportion of regenerated lines observed from the field surveys (e.g., 61% for 2D lines) with the length of lines through non-open vegetation types in the ELC map. Adjustments were applied to generate functional linear feature densities for each linear feature type individually (i.e., to compare the relative extents of different feature types) and combined to provide an overall density for all linear feature types. For example, the linear feature density for 2D lines was calculated by starting with the total length of 2D lines in the RSA, reducing that by the length of lines through open vegetation types, then reducing the remaining extent by the average proportion of 2D lines that were observed to be regenerated, and then dividing the remaining total length of lines by the extent of the RSA.

4 RESULTS

4.1 LINEAR FEATURE INVENTORY AND DENSITIES

A total of 4,269 km of linear features were mapped and verified in the RSA (Map 4-1, Table 4-1). Winter roads and 2D seismic occur in varying densities across much of the RSA. The extent of 3D seismic is limited to the one area straddling the Dempster Highway in the centre of the RSA.

The total linear feature density in the RSA was 1.79 km/km², based on a total length of 4,269 km and the RSA area of 2,386 km². 3D seismic lines accounted for approximately half of the total length of linear features in the RSA, 2D seismic lines accounted for about one-third, followed by winter roads and the Dempster Highway (Table 4-1). Adjusting for open habitats (i.e., areas in structural stages Low Shrub, Herb, and Bryoid) and vegetation regeneration[1] resulted in substantially lower densities of 0.52 km/km² (Table 4-2). Relatively large extents of recent wildfires were the greatest factor reducing linear feature densities. The relative proportions of the different linear feature types were similar after adjustments, though the proportion of 3D increased and 2D decreased. This was mainly due to the greater degree of vegetation regeneration on 2D lines, consistent with their age since disturbance.

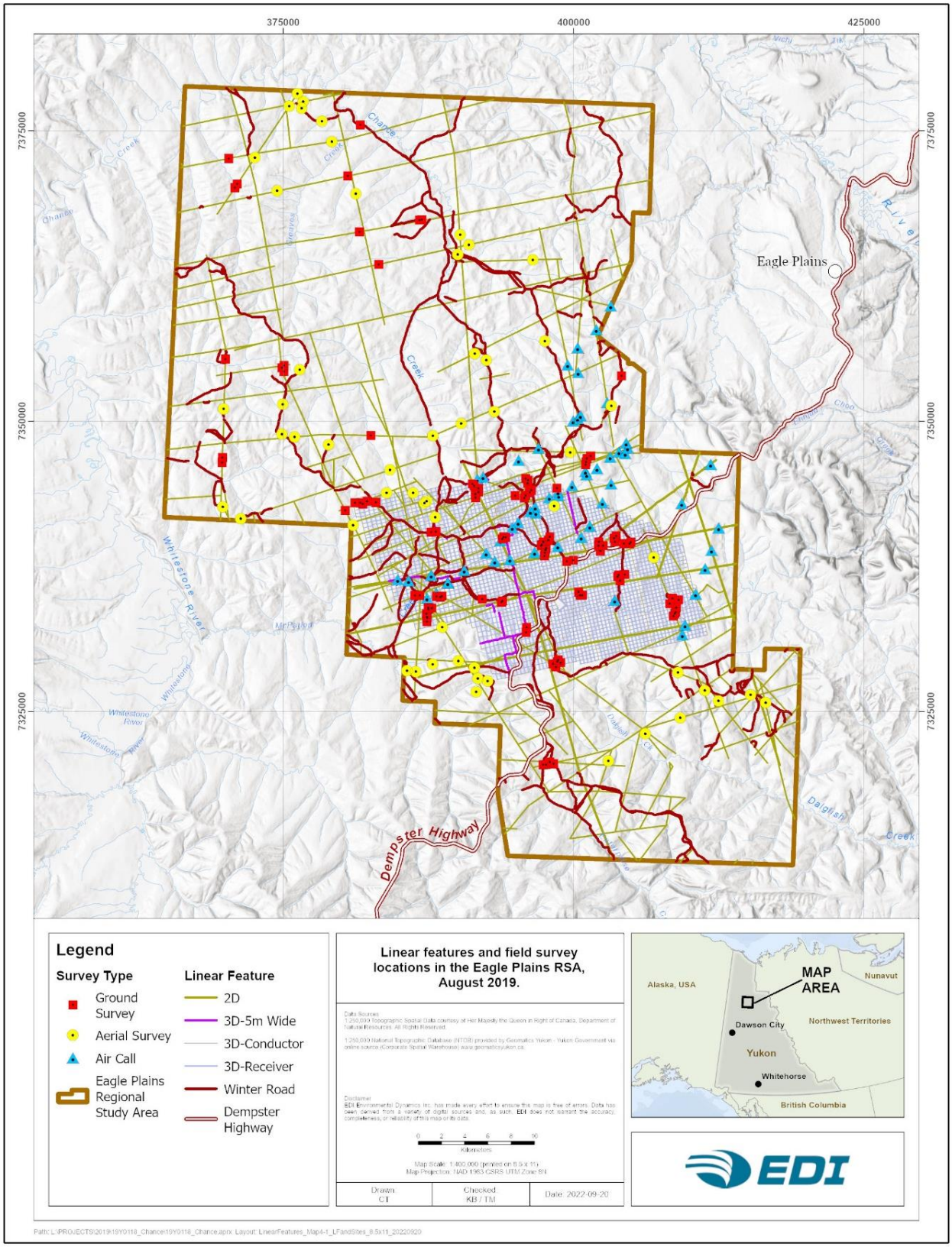
Table 4-1. Summary of total length and density of linear features documented in the Eagle Plains RSA.

Linear Feature Type	Total Length (km)	The Proportion of Total Length	Linear Feature Density (km/km²)
2D	1,452	34%	0.608
3D (combined)	2,165	51%	0.907
3D-5m wide	48	1%	0.020
3D-Conductor	1,189	28%	0.498
3D-Receiver	928	22%	0.389
Winter Road	596	14%	0.250
Dempster Highway	47	1%	0.020
Unknown	8	<1%	0.003
Total	**4,269**	**100%**	**1.788**

[1] See Section 5.5 Functional Recovery of Linear Features for details about vegetation regeneration criteria.

Table 4-2. Summary of total effective length and density of linear features in the Eagle Plains RSA adjusted for open habitat and vegetation regeneration.

Linear Feature Type	Total Length (km)	Proportion of Total Length	Linear Feature Density (km/km²)
2D	289	23%	0.121
3D (combined)	750	60%	0.314
3D-5m wide	21	<1%	0.009
3D-Conductor	401	32%	0.168
3D-Receiver	328	26%	0.138
Winter Road	171	14%	0.072
Dempster Highway	26	<1%	0.011
Unknown	8	<1%	0.003
Total	1,243	100%	0.521



Map 4-1. Linear features and field survey locations in the Eagle Plains RSA, August 2019.

4.2 LINEAR FEATURE CHARACTERISTICS

4.2.1 LINE WIDTHS

Line width varied by linear feature type. Mean line widths ranged from 1.96 m for the narrowest line type (3D receiver lines) to 33.75 m for the Dempster Highway (Table 4-3). Standard error around mean estimates were smallest for 3D seismic lines, which were cleared in the same season using the same equipment and methods, and greatest (by a large margin) for winter roads. The average difference in widths between 3D conductor (wider) and 3D receiver lines was 1.2 m.

Table 4-3. Widths of different linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Minimum mean width (m)	Maximum mean width (m)	Overall mean width (m)	Standard Error (m)
2D	107	3.97	8.5	5.42	0.11
3D-5m wide	5	5.30	6.40	5.68	0.22
3D-Conductor	29	2.50	4.80	3.17	0.13
3D-Receiver	24	1.63	2.53	1.96	0.04
Winter Road	43	2.53	17.97	7.42	0.66
Dempster Highway	2	33.00	34.50	33.75	0.75

4.2.2 MULCH COVER

Mulching of woody vegetation is common during seismic line clearing activities and was used in the 2013/14 3D program. In areas with thick tree or shrub cover, mulching can create a thick blanket of wood chips that inhibits vegetation regeneration (Golder Associates 2016). There was no evidence that this was an issue with any of the seismic lines within the RSA. On average, the percent cover of mulch was <1% on all line types.

4.2.3 HUMAN USE

No sign of human use was detected along linear features during the summer ground surveys (e.g., OHV tracks, ruts, water crossings, vegetation trampling/scarring, tree blazes, trap sets, garbage, and campsites), except for the two sites on the Dempster Highway.

On average, 42% of on-line sites were deemed passable to an OHV (a 4x4 side-by-side) during summer, considering obstructing vegetation, ground conditions (e.g., wetlands or peatlands), and the presence of graminoid tussocks (Table 4-4).

Table 4-4. Proportion of survey sites deemed passable to OHV in summer across different linear feature types in the Eagle Plains RSA.

Linear Feature Type	No. Survey Sites	% Passable
2D	55	9%
3D-5m wide	5	80%
3D-Conductor	29	59%
3D-Receiver	24	75%
Winter Road	29	55%
Dempster Highway	2	100%
Total	144	42%

4.2.4 SUCCESSIONAL CLASSES

Linear features surveys in the Eagle Plains RSA observed five of the six of the successional classes documented by Simpson (2008): normal succession, magnified succession, stagnated succession, no succession, and recent disturbance (Figure 4-1) (Attachment A). No retrogressive succession sites were observed at official survey sites. However, a small number of retrogressive sites were incidentally observed on winter roads while travelling through the RSA.

Most sites surveyed (79%) were undergoing normal succession. The next most common successional class was magnified succession, occurring in 11% of sites, followed by stagnated succession, occurring in 5% of sites. All 3D seismic lines surveyed followed a normal successional trajectory, except for one site that was classed as recently disturbed. Magnified succession was most common in 2D seismic lines (21%), while stagnated succession was most common in winter roads (19%). Successional classes were defined as 'not present' if the linear feature was not present in the field or had regenerated to a stage that was not discernable from the adjacent areas. The Dempster Highway was classified as recently disturbed due to the regular maintenance of the road.

Fire history appeared to influence some successional classes. Magnified succession was more common at burnt sites (19 burnt versus 5 unburnt). In contrast, stagnated succession was more common at unburnt sites (3 burnt versus 7 unburnt). Sites on a normal successional trajectory did not appear to have any relationship to burnt status. The remaining successional classes were too uncommon to draw any conclusions.

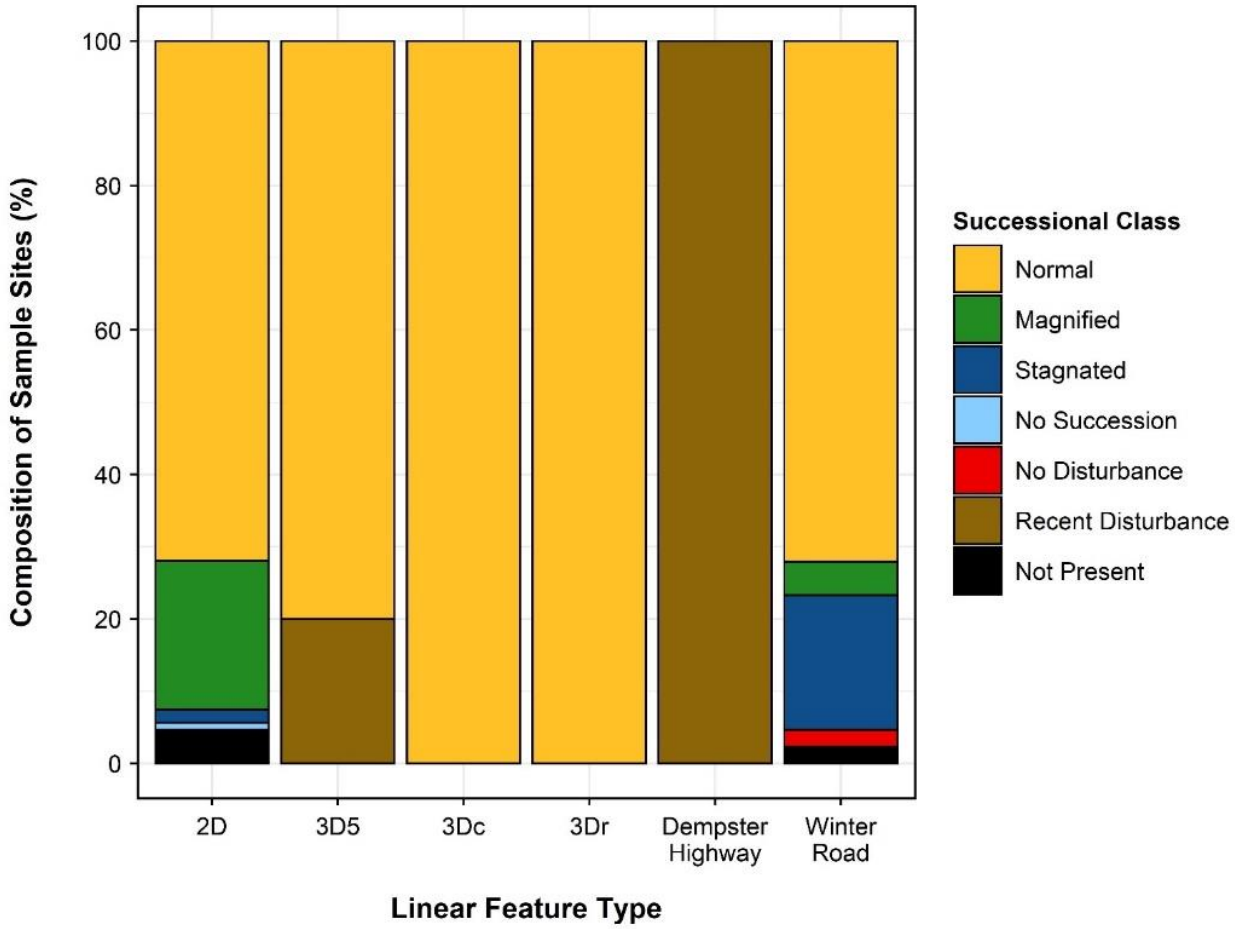


Figure 4-1. Summary of successional classes observed across different linear feature types in the Eagle Plains RSA.

4.2.5 STRUCTURAL STAGE

Most linear features were in a Low Shrub (56.1%) or Tall Shrub (29.0%) structural stage. However, the distribution of structural stages varied substantially across linear feature types (Table 4-5). Although herbaceous and forested stages occurred at some on-line plots, they were not common (less than 5%each). Nearly all forested structural stages were observed on 2D seismic lines and winter roads, reflecting the long time since they were created. Tall Shrub stages were almost twice as frequent in 2D seismic lines than any other linear feature type. Conversely, 83% of 3D linear features were in the Low Shrub structural stage, with most of the remaining in the Tall Shrub stage. The differences in structural stages between 2D and 3D lines appear to be primarily due to the time since disturbance. Winter roads were less consistent in their structural stages; herbaceous, shrubland and forested stages were all observed with moderate frequency. The two Dempster Highway plots were the only non-vegetated stages recorded.

Off-line plots were also mostly in Low Shrub and Tall Shrub stage, but they also included a higher proportion of Young Forest and Mature Forest compared to on-line plots (Table 4-5; Photos A-15 to A-20 in

Attachment A). For off-line plots, the Low Shrub sites were mostly burned areas, and the Tall Shrub sites were mostly stunted, open-canopy, black spruce forest 2–8 m tall.

Fire had a strong effect when comparing structural stages between paired on-line and off-line plots (Figure 4-2). The top two charts in Figure 4-2 show that the pattern of structural stages for burnt areas was very similar between on-line and offline plots. The bottom two charts show that the pattern of structural stages differs substantially between on-line and offline plots in unburnt areas. In unburnt areas, off-line plots had much lower numbers of sites in Low Shrub and much higher numbers of sites in Young Forest and Mature Forest than on-line plots. For burnt areas, the on-line and off-line plots at the same site were the same structural stage in 72% of cases, and within one structural stage of each other 91% of the time (e.g., Tall Shrub vs Pole Sapling). For areas that were not burnt, the on-line and off-line plots at the same site were the same structural stage in only 29% of cases. These results demonstrate that in the absence of fire, pronounced differences between linear disturbances and the surrounding community are evident in both recent (3D) and legacy (2D and winter road) linear feature types. But following a fire, the vegetation structure on-line and off-line are likely to be similar (Photos A-22 to A-24 in Attachment A).

Table 4-5. Vegetation structural stages observed on different linear feature types as a proportion of all plots sampled (n = 156) in the Eagle Plains RSA.

Linear Feature Type	No. Sites	Structural Stage[1]								
		Non-vegetated	Bryoid	Herb	Low Shrub	Tall Shrub	Pole-Sapling	Young forest	Mature forest	Old Forest
2D	62	0%	0%	2%	37%	47%	2%	8%	3%	2%
3D-5m wide	5	0%	0%	20%	80%	0%	0%	0%	0%	0%
3D-Conductor	29	0%	0%	0%	83%	14%	0%	3%	0%	0%
3D-Reciever	24	0%	4%	0%	83%	13%	0%	0%	0%	0%
Dempster Highway	2	100%	0%	0%	0%	0%	0%	0%	0%	0%
Winter Road	33	0%	0%	12%	48%	27%	3%	3%	6%	0%
Off-line	155	0%	1%	1%	33%	29%	1%	18%	17%	1%

[1] See Table 3-3 for structural stage codes and descriptions.

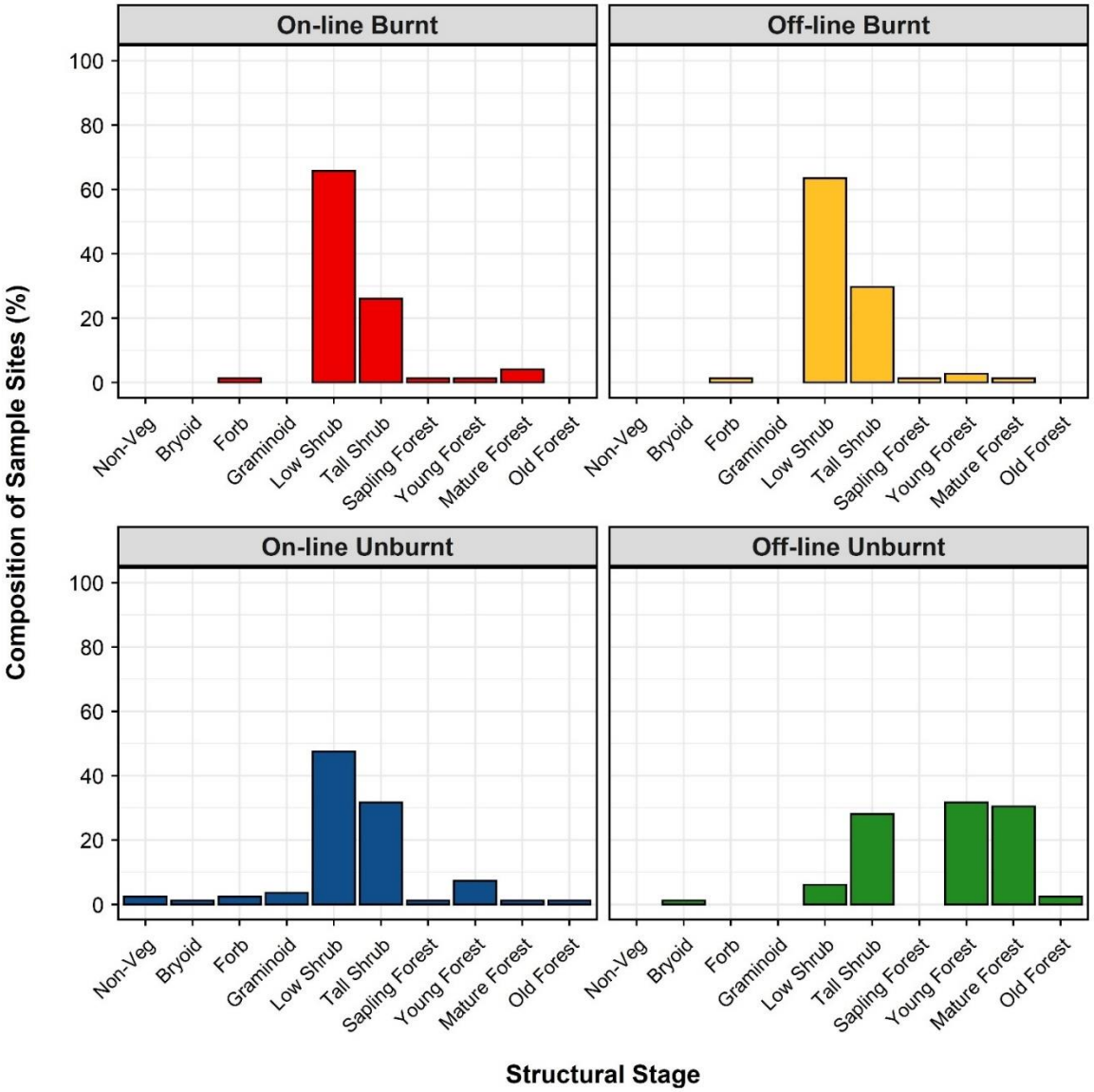


Figure 4-2. Comparison of structural stages on linear features to off-line plots in burnt and unburnt areas, in the Eagle Plains RSA.

4.2.6 VEGETATION HEIGHT

Based on the similarity of patterns in vegetation composition and structure, linear feature types were combined into two groups for assessment of patterns in height: (i) 2D and winter roads and (ii) 3D. A wide range of vegetation heights was recorded at both on-line and off-line plots in the RSA, from 0.3 m to 16 m. Collectively, off-line plots had a normal distribution of vegetation heights between 0 m and 4 m, and then a scattered distribution across heights up to 16 m (Figure 4-3). Plots with ≥4 m tall vegetation accounted for approximately 40% of all off-line reference plots.

In comparison, recovering 2D seismic lines and winter roads shared a relatively uniform distribution between 0 m and 4 m but with a peak occurring at vegetation heights measuring 1.5–2 m tall (Figure 4-4). Only 21% of 2D and winter roads contained dominant vegetation ≥4 m, and only 5% were ≥8 m tall. 3D seismic lines were rarely composed of vegetation ≥2 m, and most of the vegetation (67%) recovering on 3D lines was less than 1 m (Figure 4-5). This is very different from the off-line undisturbed height distribution. However, 3D lines were all only five years old at sampling, and shorter vegetation was expected.

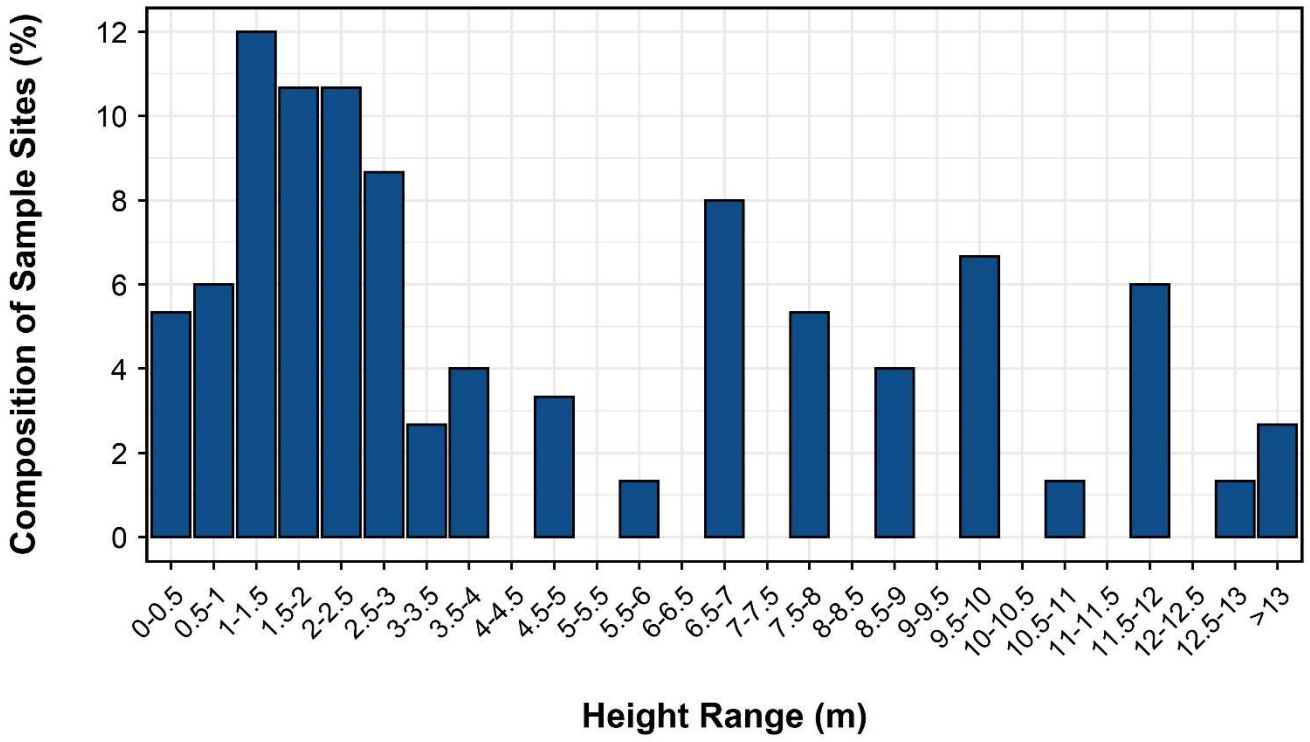


Figure 4-3. Vegetation height distribution of off-line reference plots in the Eagle Plains RSA.

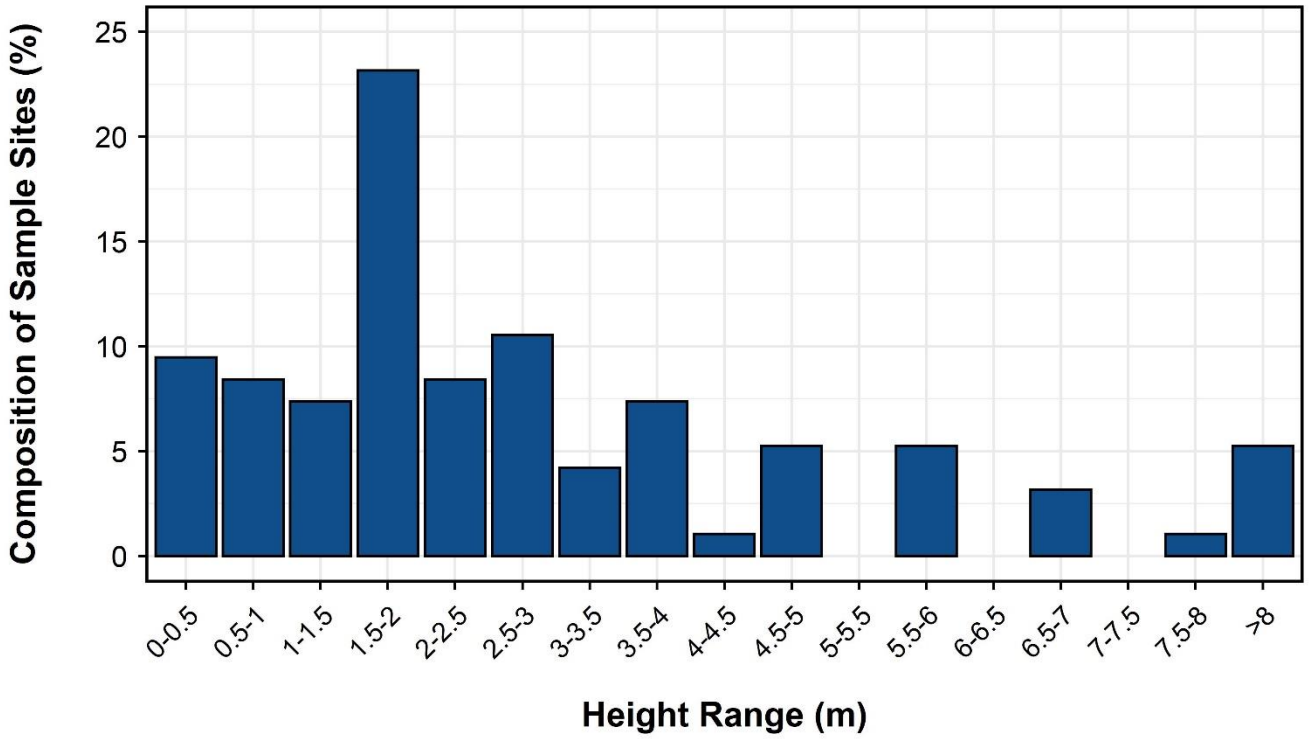


Figure 4-4. Vegetation height distribution of on-line 2D and winter road plots in the Eagle Plains RSA.

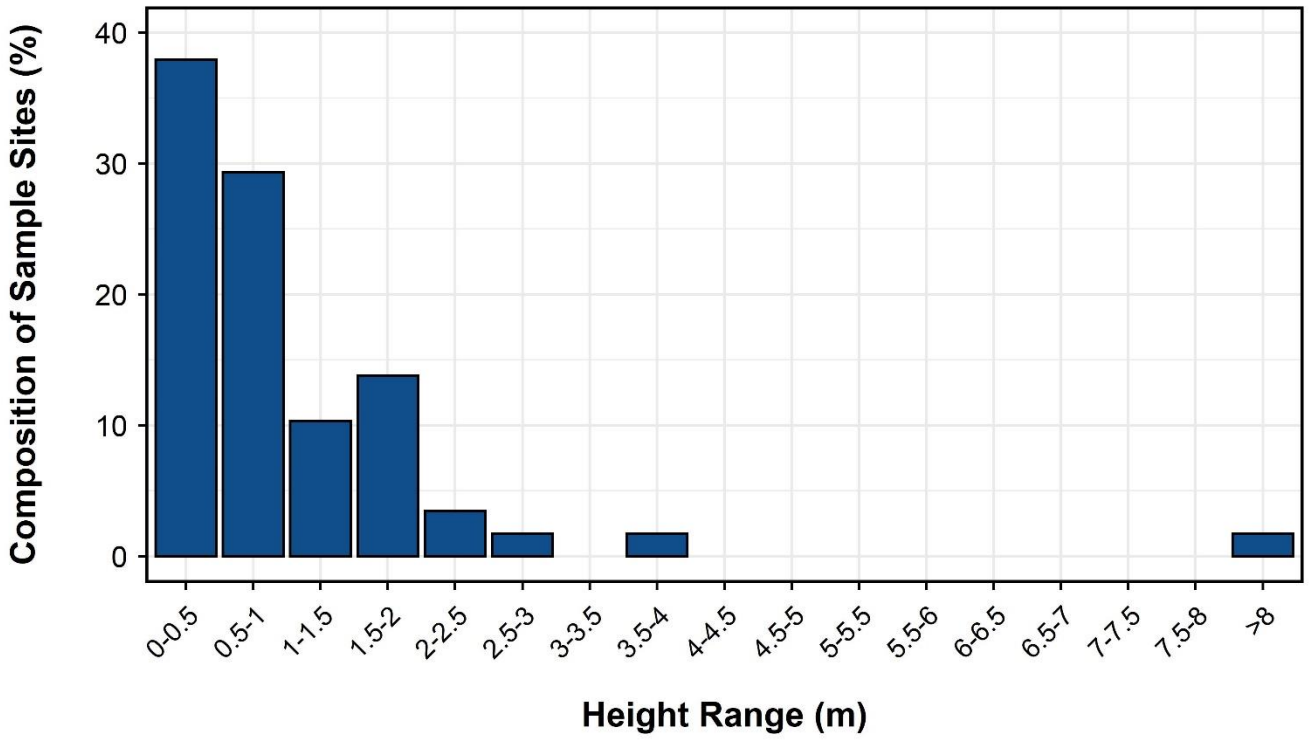


Figure 4-5. Vegetation height distribution of on-line 3D plots in the Eagle Plains RSA.

4.2.7 VEGETATION COVER

Tree and shrub cover varied between linear feature types and burn status (Table 4-6). Generally, tree cover was low on undisturbed reference plots (mean tree cover of 8% on unburnt and 2% on burnt sites). This is typical of the taiga cordillera landscape — forests are generally stunted and sparse due to poor nutrient regime and continuous permafrost conditions (Smith et al. 2004). Of the on-line plots, tree cover was greatest on 2D seismic lines and burnt winter roads (5% to 8%) and lowest on 3D seismic lines and the Dempster Highway (0%), regardless of burn status. This is likely due to the recently disturbed 3D seismic lines that are too young for trees to have re-established. Burnt 2D seismic lines and winter roads had greater tree cover than unburnt lines.

Shrub cover was much greater than tree cover overall. Shrub cover was typically 30–40% on unburnt off-line plots and 40–50% on burnt off-line plots. Shrub cover was highest on 2D seismic lines (~54%), regardless of burn status. Shrub cover was moderate on winter roads (38–45%) and lowest on unburnt 3D seismic lines (8–22%). Burnt 3D seismic lines had approximately twice as much shrub cover as unburnt 3D lines.

Table 4-6. Summary of the mean tree and shrub cover (%) between on-line and off-line, and burnt and unburnt plots surveyed in the Eagle Plains RSA.

Linear Feature Type	Burn Status	Mean Tree Cover (%)		Mean Shrub Cover (%)	
		On-line	Off-line	On-line	Off-line
2D	Burnt	7.0	3.5	54.0	36.0
	Unburnt	5.5	13.4	53.2	32.8
3D5	Burnt	0.0	0.3	41.7	60.0
	Unburnt	0.0	0.5	7.5	42.5
3Dc	Burnt	0.0	0.2	40.4	46.1
	Unburnt	0.4	6.0	21.5	34.3
3Dr	Burnt	0.0	0.7	35.0	51.9
	Unburnt	0.0	5.5	20.6	32.5
Winter Road	Burnt	7.7	1.0	45.0	43.8
	Unburnt	1.3	4.0	37.5	32.3
Dempster Highway	Unburnt	0.0	1.0	0.0	37.5

4.2.8 LINE-OF-SIGHT AND EASE OF TRAVEL

Line-of-sight (sightline) distance was examined primarily as a function of line type; however, vegetation height (the primary factor affecting sightlines) was also examined for on-line and off-line plots for each linear feature type using multiple linear regression. Mean sightlines varied significantly by linear feature type (Table 4-7, $F_{4,187} = 3.3$, $P = 0.01$). For reference, the average sightline distance for offline controls was 46.7 m. This relatively far distance reflects the open stand structure on most sites in the region. Burn status had little influence on sightlines (e.g., burnt off-line=50.2 m, unburnt offline=43.6 m). 2D lines had the shortest average sightline distances at 41.2 m. This was mainly due to the advanced stage of regenerating vegetation on the lines. Where regenerating vegetation was limited, sightline distances on 2D lines frequently exceeded 150 m.

On 3D lines, the time since clearing was too recent for regenerating vegetation to obscure sightlines. Instead, sightline distances on 3D lines were generally controlled by bends in the lines, which were specifically designed as mitigation measures to reduce sightlines. For 3D lines, sightline distances decreased from 3D5 to 3Dc to 3Dr lines. The reduction in sightline distances resulted from differences in line width and the average distance between bends across the feature types.

The regression analysis also found a significant interaction between on-line versus off-line occurrence and vegetation height ($F_{1,187}$ = 13.0, P = 0.0004), whereby on-line plots had, on average, more negative slopes than off-line plots. In other words, sightlines at on-line plots decreased more drastically than off-line plots with each incremental increase in vegetation height. This is consistent with the qualitative observations of field crews that the regenerating vegetation on lines was thicker than the vegetation off lines.

Similar to sightline distances, determining differences in ease of travel among line type the primary factor of interest for the walking speed tests. However, burn status, and the percent cover of trees and shrubs were expected to be the most important explanatory variables related to walk speeds, so they were included as secondary variables using a mixed-effects linear regression. Walking speeds across linear feature types and the differences between on- and off-line plots within linear feature types varied significantly (Table 4-8, $F_{5,170}$ = 3.4, P = 0.006). However, the magnitude of the difference between on-line and off-line plots was modest. Even the Dempster Highway only conveyed a 35% increase in walking speed over off-line plots. Other researchers, in other areas, often observed walk speeds on linear features were often at least twice as fast as off-line transects (Keim et al. 2019a).

Notwithstanding the modest magnitude of faster walking speeds on-lines, there were clear patterns in walking speed differences across linear feature types. 2D lines were the one feature type where walking speeds were slower on lines than off lines. This reflected the thick, shrub stage vegetation that had regenerated on most 2D lines, which impeded travel (similar to the effect that regenerating vegetation had on sightline distances in the previous section). Walk speeds decreased across the other feature types in relation to line width and the degree to which ground cover was levelled or compacted.

Statistical analyses indicated that both burn status ($F_{1,170}$ = 17.85, P < 0.0001) and percent cover of shrubs and trees (hereafter woody vegetation; $F_{5,170}$ = 5.29, P = 0.0002) affected walking speeds, both on and off lines. On average, walk speeds in burns were approximately 10% slower than in unburnt areas. This is partly related to thicker woody cover in most burns, which hinders walking speed because of the time it takes to push through or walk around it. Walking speeds significantly decreased, on average, by 0.04 (CI = 0.02–0.06) km/h and with every 10% increase in the percent of woody cover off-line and 0. 11 (0.07–0. 15) km/h on 2D lines.

Table 4-7. Average sightline distances along different linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Average Sightline Distance (m)	Comments
2D	30	41.2	Sightlines are frequently reduced by regenerating vegetation >1.5m tall
3D-5m	5	105.6	Has fewer bends than 3Dc and 3Dr
3D-Conductor	26	75.9	Sightlines limited by bends in lines; too recent for regenerating vegetation to impede sightlines
3D-Receiver	23	60.2	Sightlines limited by bends in lines; too recent for regenerating vegetation to impede sightlines
Dempster Highway	2	814.8	
Winter Road	17	106.2	
Off-Line Controls	103	46.7	

Table 4-8. Differences in walking speeds among linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Average Walk Speeds (km/h)		Difference (%)
		On-line	Off-line	
2D	28	2.5	2.8	-10%
3D5	5	3.8	3.0	30%
3Dc	23	3.5	3.1	13%
3Dr	23	3.2	2.9	10%
Dempster Highway	2	5.6	4.1	35%
Winter Road	16	3.6	3.1	17%
Off-Line Controls	97	n/a	2.9	

4.3 VISIBILITY OF LINEAR FEATURES FROM THE DEMPSTER HIGHWAY

Overall, the blind search identified 11 of 100 possible linear feature intersections with the Dempster Highway (Table 4-9). Five of the features were roads that were classified as winter roads in the GIS inventory, but most (four) were actually short, all-season roads leading to gravel pits or well sites. Two of the observed features were human truck/OHV trails that led to camp sites 100–200 m off the Dempster Highway, and four were 3D seismic lines. The map search detected two more 3D lines, one 2D line, and one old winter road. The 2D line and the old winter road had regenerated into Young Forest structural stages. Excluding the four short secondary roads into gravel pits and well sites, and the two human trails, only 8% of linear features that intersected the Dempster Highway were visible during the two driving surveys.

Only 6 of the 74 3D lines that crossed the Dempster were detected. The combination of construction design (i.e., creating a bend in the 3D line adjacent to the highway) and regenerating vegetation in the right-of-way made it difficult to detect the 3D lines. Evidence of human use (e.g., packed vegetation, tire tracks, rutting, garbage, campfire remnants, tree stumps, or tree blazes) was observed on four of the short, all-season roads

and the two trails. No evidence of human use was noted on any of the 2D or 3D seismic lines, or the three winter roads (including the Chance and Blackie winter roads). However, some types of human use do not leave sign during the snow-free season (e.g., snowmobile use in the winter).

Table 4-9. Summary of linear features identified and intersecting the Dempster Highway during a blind search test.

Linear Feature Type	No. Features Intersecting the Dempster	No. (%) Observed Blind Search	No. (%) Observed Map Search	Total No. (%) Observed	OHV Accessible	Sign of Human Use
2D	18	0 (0%)	1 (6%)	1 (6%)	0	0
3D	74	4 (5%)	2 (5%)	6 (8%)	4	0
Secondary Roads	8	5 (63%)	1 (13%)	6 (75%)	5	4
Trail	n/a	2 (n/a)		2	2	2
Total	100	11 (11%)	4 (4%)	15 (15%)	11	6

4.4 WINTER TRACKS

In total, 462 linear features were surveyed for winter tracks over 358 km along the 11 transects. No human sign was observed on any linear features, except the Dempster Highway. Ungulate tracks were frequently observed travelling along linear features. The proportion of linear features with tracks decreased with decreasing linear feature widths, from 29% on winter roads, 24% on 2D lines, 8% on 3D conductor lines, and 6% on 3D receiver lines (Figure 4-6).

The frequency of use in adjacent undisturbed areas, corrected to account for different survey extents between the linear features and the undisturbed areas, was 1%. As discussed in the methods, it was difficult to compare the frequency of use along linear features to use in undisturbed areas. The issue is that for the comparison to be relevant, the survey design needs to account for the size of the sample units (i.e., the extent of the undisturbed area needs to be comparable to the width of the linear features), and the two samples should be independent. These conditions were not achieved under the current survey design (i.e., the extent of the survey area in the undisturbed area was much larger than the width of the linear feature, and the location of the undisturbed area was spatially correlated to the linear feature). The estimated relative use rate of 1% in undisturbed areas adjusts the total counts within the 200 m survey area to 5 m (i.e., the average linear feature width); however, the adjustment fails to account for spatial correlation between the two samples. Therefore, the estimate of use in undisturbed areas could be biased. Notwithstanding this limitation in the estimate of travel rates in undisturbed areas, it is supported by qualitative observations of the survey crew that travel rates on even the least used linear features (i.e., 3D lines) are higher than undisturbed areas.

The relative use of linear features by ungulates also appeared to vary with distance from the Dempster Highway, with features within 1 km of the highway receiving lower use than features equal to or greater than 5 km from the highway (Figure 4-7). It is worth noting that the Highway and 1 km transects were completed on the first and second day of surveys, respectively, and the other transects were surveyed one to six days later, providing more time for tracks to accumulate. Snowfall data prior to the crew's arrival on site was not

available; however, road crews at Eagle Plains reported that there had not been a major snowfall in the area for at least a week. Based on this information, the issue of time since last snow has less potential to bias results than if a track-erasing snow event had recently occurred.

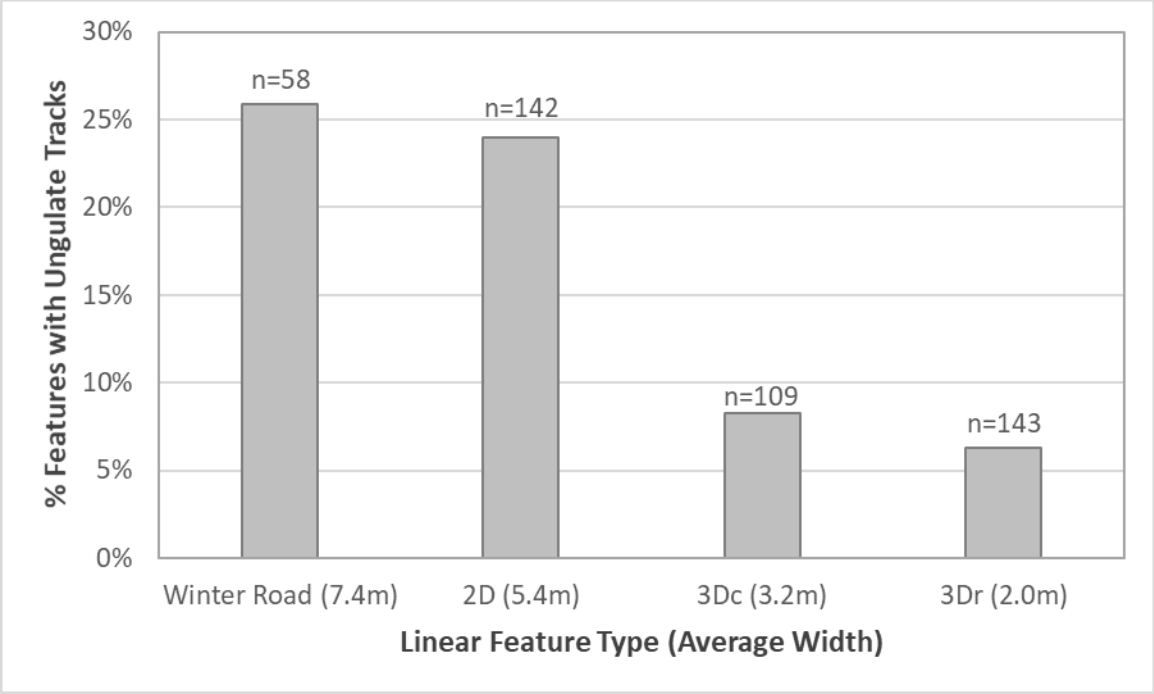


Figure 4-6. Relative use of different linear feature types by ungulates in the Eagle Plains RSA, March 2020.
The numbers above bars indicate the number of features surveyed.

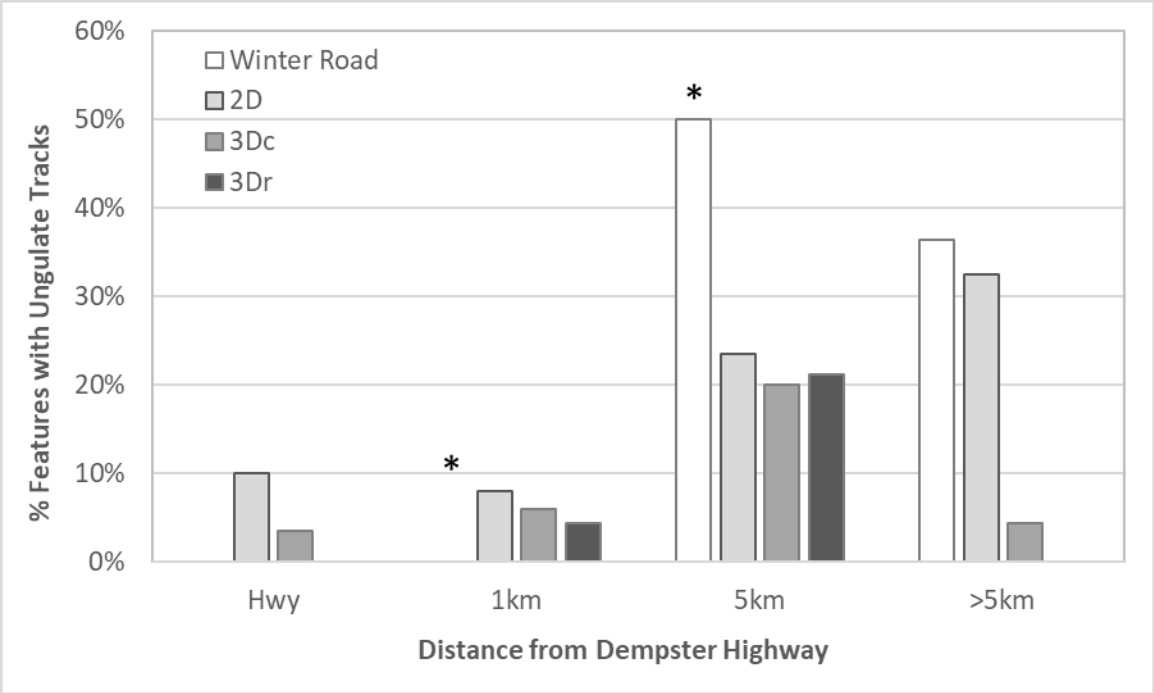


Figure 4-7. Relative use of different linear feature types by ungulates in relation to distance from the Dempster Highway in the Eagle Plains RSA, March 2020.

*The * indicates bars with small samples sizes (n=5-10); all other instances have at least 10 data points per feature type within each distance class*

5 DISCUSSION

5.1 SUMMARY OF LINEAR FEATURES IN THE EAGLE PLAINS RSA

Table 5-1 summarizes key characteristics across linear feature types in the Eagle Plains RSA.

Table 5-1. Summary of structural, ecological and functional characteristics of linear feature types in the Eagle Plains RSA.

Linear Feature Type	Mean Width (m)	Mean Sightlines (m)	Mean Movement Speed (km/h)	% Regenerated[1]	% Inhibited Regeneration[2]	Linear Feature Density (km/km²)	Adjusted Linear Feature Density (km/km²)[3]	% Ungulate Use[4]
3D seismic	2.6	71.98	3.36	14	0	0.91	0.31	7
2D seismic	5.4	41.17	2.53	61	4	0.61	0.12	24
Winter Roads	7.4	106.18	3.58	39	19	0.25	0.07	26
Dempster Highway	33.8	814.75	5.60	0	100	0.02	0.01	N/S
Off-line Controls	N/A	46.67	2.95	N/A	N/A	N/A	N/A	N/S

[1] as characterized by reaching a tall shrub stage, or greater.
[2] including stagnated and disturbed successional patterns.
[3] accounting for burns, natural openings, and regeneration.
[4] percent of lines with ungulate tracks during March 2020.

2D Seismic — 2D lines are, on average, the oldest features in the area and have had the longest time to regenerate. Most features were cleared before 1985, but some were developed in the early 2000s. Historical 2D lines were generally long and straight, with moderate widths of 4–8 m. Lines were typically constructed with bulldozers that cut into the moss layer and often included some patches of soil disturbance. The combination of site disturbance and wider widths generally resulted in a successional reset to pioneering vegetation (including early seral graminoids, forbs, and shrubs). Most sites were following a normal successional pathway (73%). However, 27% of sites exhibited atypical pathways, dominated by magnified succession (21%, mostly in burns), stagnated succession (3%) or no succession (1%). Sixty-one percent of the 2D sites had regenerated to a Tall Shrub or more advanced structural stage. 2D lines had the shortest sightlines and slowest walk test speeds of all feature types (including off-line controls), reflecting the regenerating vegetation's effect on these functional metrics. During winter, ungulates regularly used 2D lines to travel along.

3D Seismic — All 3D lines were created during the last exploration period, during the winter of 2013/14. 3D lines constitute the most extensive combined lengths of the different linear feature types, but their areal extent is limited to a relatively small portion of the RSA along the Dempster Highway. Due to their basic design, as well as specific mitigations, 3D lines minimize environmental effects compared to other linear feature types. They are narrow (averaging 3.2 m and 2.0 m for conductor and receiver, respectively), often

narrower than average tree spacing in the region. They were constructed during winter, over snow, using low-ground pressure equipment, which avoids ground disturbance and maintains vegetation in the moss, herb and low shrub layers. The lines were constructed with a meandering path, and strategically placed sharp angle dogleg bends to reduce the visibility of the lines from roads, reduce sightlines along them, and hamper travel by OHVs. All 3D lines that were surveyed were undergoing a normal successional pathway and were dominated by the same vegetation as in adjacent undisturbed areas. Regenerating vegetation was mostly in a Low Shrub structural stage, consistent with the relatively short six-year period since they were cleared. Sightlines and movement speeds were intermediate compared to other linear feature types, with sightlines primarily controlled by dogleg bends purposely designed to reduce sightline distances. Ungulates occasionally used 3D lines to travel on in winter, but at less than a third of the rate as 2D lines and winter roads.

Winter Roads — A network of winter roads across much of the RSA results from the historical exploration programs that have occurred. Although many of the winter roads were initially developed during the earliest exploration programs, vegetation has not had the same opportunity to regenerate as on 2D lines because the vegetation was re-cleared on several roads during subsequent exploration programs. The average width of winter roads was 7.4 m, but major roads, like the Chance road, were often 10–12 m wide. Historical winter roads were typically cleared with a bulldozer, and then snow was packed and graded to create a road surface. Similar to historical 2D seismic, the combination of site disturbance and wider widths (i.e., that increases solar exposure) generally resulted in a successional reset to pioneering vegetation (including early seral graminoids, forbs, and shrubs). Most sites were following a normal successional pathway (72%), but 26% of sites exhibited atypical pathways, dominated by stagnated succession (19%), magnified succession (6%) and no succession (1%); 2% of the sites were classified as no disturbance (indistinguishable from vegetation community off the road). Thirty-nine percent of the winter road sites had regenerated to a Tall Shrub or older structural stages. Winter roads had the longest sightlines and fastest walk test speeds of all feature types, other than the Dempster Highway, reflecting the variable levels of regenerating vegetation that occurred on winter roads. During winter, ungulates regularly used 2D lines for travel.

Dempster Highway — The Dempster Highway is the only all-season road in the RSA (except for short spurs off the Dempster to well sites and gravel pits). It is fundamentally different from all other linear features in the area in terms of wide width, surface material and maintenance, long sightlines, regular traffic, and base of access for human land use activities such as hunting, camping, and trapping.

5.2 LINEAR FEATURE CHARACTERISTICS

5.2.1 FIRE

The presence or absence of recent forest fires affected several linear feature characteristics, including linear feature width, successional class, structural stage, and vegetation height and cover. Mean measured linear features widths were 0.2–0.6 m wider at burnt sites than at unburnt sites. This may be due to the already shorter vegetation at burnt sites, which would reduce overgrowth occurring from forest edges and decrease the measured width between driplines (branches extending into the linear feature from either side of the line).

Magnified succession was nearly four times more common in burnt plots than unburnt plots, and stagnated succession was half as common. Fire likely facilitates magnified succession by increasing soil temperatures, accelerating decomposition, and releasing stored water and nutrients to promote vegetation growth (Seccombe-Hett and Walker-Larsen 2004, Simpson 2008). Stagnated succession is likely less common at burnt sites because the associated nutrient and water increase allows woody plant species to colonize more easily and advance through successional stages.

Overall structural stage distribution was very similar between burnt on-line and off-line plots, but was markedly different between unburnt on-line and off-line plots. Furthermore, when the structural stages were compared between paired on-line and off-line plots, they matched two to four times more frequently at burnt sites than at unburnt sites and were mismatched two to six more frequently at unburnt sites than at burnt sites. Nearly all burnt plots were in a low shrub, or tall shrub structural stage, which is expected as fires tend to remove overstory trees, and shrubs generally colonize rapidly post-fire (Seccombe-Hett and Walker-Larsen 2004).

Vegetation height was 4.4 m shorter in burnt than unburnt reference plots, and tree cover was approximately 6% less. These modest differences reflect the stunted and open nature of the taiga forest. There was little change in vegetation height between burnt and unburnt linear features, likely because there were very few linear disturbances in a forested structural stage; most of them, even in unburnt conditions, were already in a shrub-dominated stage due to the clearing of trees. For shrub cover, except for 2D seismic lines, the mean was approximately 10% to 20% greater at burnt plots than at unburnt plots. The increase in shrub cover at burnt sites was most prominent in 3D seismic lines due to their comparatively lower pre-fire shrub cover.

Post-burn vegetation was, on average, shorter and shrubbier than unburnt off-line plots, but taller and shrubbier than unburnt on-line plots. Furthermore, burnt paired plots were more similar in vegetation characteristics than unburnt paired plots. This evidence supports the theory that forest fires in taiga ecosystems resets the landscape to some extent and effectively erase signs of anthropogenic disturbance (Seccombe-Hett and Walker-Larsen 2004, Simpson 2008). Forest fire in the taiga returns ecosystems to an early successional stage (i.e., low shrub) and synchronizes baseline biophysical conditions on a landscape scale, allowing previously disturbed and undisturbed areas to recover at equal rates, as has been documented by Seccombe-Hett and Walker-Larsen (2004). Thus, most linear features that have experienced forest fires no longer create different ecological conditions or functional disturbances than the surrounding landscape.

5.2.2 SUCCESSIONAL CLASS

The idea that vegetation regeneration on linear features could follow different successional trajectories came out of work by the Yukon Government in the early 2000s (Simpson 2008). That work described six successional trajectory classes observed in the Eagle Plains area. However, that study did not quantify the relative extents of linear features that followed the different trajectories. This study used the classes that the Yukon Government work developed and quantified the proportion of linear features in each successional class across a random sample of linear features.

Successional classes in the Eagle Plains RSA varied according to linear feature type and burn status. However, one of the key findings was that normal succession was the dominant trajectory observed for all linear features except the Dempster Highway. All 3D seismic lines followed a normal successional trajectory, except for one recently disturbed site. This was likely attributable to the low impact methods used in 3D line creation that minimize ground and vegetation disturbance, creating conditions more likely to result in a normal successional trajectory (Yukon Energy Mines and Resources 2006, Golder Associates 2016). Magnified and stagnated succession were only observed in 2D seismic lines and winter roads. These linear features were generally wider and were created using methods that cause greater disturbance to soils, hydrology, and vegetation, leading to these alternative successional trajectories (Simpson 2008, Jorgenson et al. 2010, Dabros et al. 2018). Magnified succession is unique among the classes in that it results in accelerated vegetation regeneration. Magnified succession was most common on burned 2D seismic lines where the combination of site disturbance associated with the 2D lines and fire is suspected of causing accelerated soil warming, moisture availability, and nutrient flush, which increase on-line vegetation growth (Simpson 2008). Successional stagnation was most common on unburnt winter roads. Stagnation tends to occur on features that have experienced ground disturbance or have been seeded to agronomic species, which may have happened on winter roads in the RSA (Simpson 2008). Repeated disturbance associated with multiple exploration programs over time may also limit successional advancement and contribute to successional stagnation (Lee and Boutin 2006, Jorgenson et al. 2010).

Although some alternative successional pathways were observed in this study, most linear features in the Eagle Plains RSA are following a normal successional trajectory. This implies that most of these disturbances will recover to an ecological condition like that of the surrounding community with adequate time.

5.2.3 STRUCTURAL STAGE

The taiga forest in Eagle Plains presents a unique situation where the Tall Shrub stage is applied to two very different stand conditions. One condition, the more traditional, is of regenerating stands following a natural or anthropogenic disturbance. In this setting, the vegetation consists of deciduous shrubs and 2–8 m tall, 10–30 years old trees. The stage is transitional, with the vegetation expected to advance to the Pole-Sapling stage over time. The second condition where the Tall Shrub stage is applied is to stunted, old, black spruce stands in a disclimax state. In this setting, the vegetation consists of open, stunted, black spruce stands that are typically ≥50 years old and 2–8 m tall. Stands in this condition are expected to remain in the same condition over time(i.e., a disclimax state). Structurally, the stunted black spruce trees function more like shrubs than trees. Both Tall Shrub conditions (referred to as disturbance and disclimax forms hereafter) are widespread across the RSA in off-line sites. Only the disturbance form was observed on linear features.

The structural stage on linear features was predominantly Low Shrub or Tall Shrub, determined mainly by the time since line clearing and burn status. Less than 4% of surveyed features were in forested stages (Pole-Sapling or greater). Off-line plots had a higher proportion of forested structural stages (37%). However, they were still predominantly Low Shrub and Tall Shrub, resulting from extensive burns across the RSA and large extents in the disclimax form for Tall Shrub in un-burned areas.

The structural stage of on-line plots was also influenced by successional class. The small number of forested structural stages observed on features only occurred on sites undergoing normal succession. Stagnated succession was associated with only the Herb structural stage, which was expected as stagnation is defined by its high herbaceous species cover (among other factors) that limits the establishment of other structural groups. Magnified succession was the one atypical successional class with accelerated vegetation growth. Most structural stages on sites with magnified succession were in Tall Shrub and, occasionally, Pole/Sapling. Often the structural stage on magnified succession sites was one stage greater than the off-line plot.

5.2.4 VEGETATION HEIGHT

This study observed a range of vegetation heights across different feature types. Except for the 3D lines, the linear features' age was unknown, so it was impossible to estimate growth rates. Although some regenerating vegetation on 2D seismic lines and winter roads reached 8 m high, most were between 1.5 m and 2 m. Though the ages of specific features were mostly unknown, the minimum age for most was at least 35 years. Having most vegetation heights at only 1.5–2.0 m after this long period suggests regeneration growth rates on linear features may be quite slow. This pattern of slow vegetation growth on linear features may partly reflect the generally poor growing conditions in the taiga region. Still, it is also a pattern that has been observed on linear features in other studies in the southern boreal forest.

Interestingly, the vegetation heights on linear features in Eagle Plains are greater than reported in several other studies. For example, approximately 65% of sites on linear features in northeast Alberta had not advanced beyond a cover low forbs after 35 years (Lee and Boutin 2006). Key factors that have been linked to slow vegetation regeneration on linear features were continued human disturbance (e.g., OHV travel), ecosystem type (bogs and fens regenerated much slower than upland sites), competition from early seral and invasive graminoids and forbs, and soil or site degradation associated with feature construction (Lee and Boutin 2006, van Rensen et al. 2015, Finnegan et al. 2018).

There is limited data on vegetation regeneration in the taiga. A study from NWT found that vegetation regeneration on conventional seismic lines was affected by both a time lag for seedling establishment (as long as 17 years for black spruce) and slow growth rates (83 years to reach 5 m) (Seccombe-Hett and Walker-Larsen 2004). In burned areas, the seedling establishment delay was reduced to five years.

Although the 3D lines in Eagle Plains were only six years old when they were surveyed, a combination of field survey results and information from other studies suggests that vegetation recovery on 3D lines could be much faster than the previous examples for conventional 2D lines. This is because the undisturbed ground conditions and maintenance of the vegetation community in the moss, forb and low shrub layer provide both plants and growing conditions that support faster shrub and tree growth compared to sites beginning primary succession. In northeast British Columbia, Golder Associates (2016) found that in the first year following 3D seismic line creation, there were already black spruce seedlings exceeding 0.5 m in height. These seedlings were plants that were initially present on the site and that had survived line clearing. This is consistent with the results of this study, where nearly all of the 3D plots contained black spruce seedlings. Despite their relatively young age, most 3D seismic lines in Eagle Plains included shrubs and trees between 0.5 m and 1 m

tall. Although growth rates in Eagle Plains are not known, similar species that occur in Eagle Plains were observed to grow 5–10 cm per year on 3D lines in the boreal forest in northeastern British Columbia (Golder Associates 2016). If similar growth rates occur in Eagle Plains, regeneration on the 3D lines can be 2 m over the next 5–20 years.

5.3 HUMAN USE AND ACCESS ALONG LINEAR FEATURES

The NYRLUP and the PWRLUP indicate that one of the primary concerns about linear features is that they can increase human access into remote areas. This has been demonstrated in southern regions, and that access can have secondary effects of inhibiting vegetation regeneration (Lee and Boutin 2006) and, in winter, packing snow that can affect predator-prey dynamics (Latham et al. 2011, McKenzie et al. 2012, Keim et al. 2019a). In the boreal forest in northern Alberta, OHV travel was common on most conventional 2D seismic lines. After 35 years, approximately 20% of the lines were considered to have been converted to tracked access routes (Lee and Boutin 2006). In the same study, about 65% of the lines remained cleared after 35 years, and OHV use along the lines was identified as one factor contributing to the lack of vegetation regeneration. In contrast, there is little evidence of human use along linear features in the Eagle Plains RSA. No sign of human use was detected along linear features during the summer ground surveys (e.g., OHV tracks, ruts, water crossings, vegetation trampling/scarring, tree blazes, trap sets, garbage, campsites, etc.) or the winter track survey (e.g., snowmobile tracks). Although these surveys provided limited snapshots in time, and that some types of human activity leave little sign (e.g., evidence of snowmobile tracks have limited persistence during winter and leave no sign behind after snow melt), the results suggest that human use of the area is very limited outside of the Dempster Highway corridor. This is consistent with general comments from highway workers, staff at the Eagle Plains Hotel, pilots, and some First Nation residents that most areas beyond the Dempster Highway corridor receive very little human use. Specific instances of use of the area outside the Dempster Highway corridor include intermittent activity on the community trapline that occurs in Eagle Plains and occasional forays by hunters (First Nation and non-First Nation), mostly in winter.

People's limited use of the Eagle Plains area is likely due to its far distance from any human settlements and the difficulty of travel off the Dempster Highway. The network of winter roads in the area does provide access via specific types of OHVs in summer and snowmobiles in winter. However, there was no evidence observed that this occurs regularly. Travel along seismic lines, though possible in specific locations, would be hampered over any substantial distance by vegetation regeneration along the historical 2D lines, the narrow widths of and frequent dogleg bends in 3D lines and, during summer, difficult terrain (extensive peatlands and graminoid tussocks).

5.3.1 EFFECTIVENESS OF MITIGATION MEASURES FOR 3D SEISMIC LINES

In addition to the narrow widths of 3D lines, which hampers OHV travel, the 3D lines included regular bends in the lines, which were designed to limit the visibility of the lines at intersections with roads and other seismic lines, and to hamper OHV along the lines further. The driving survey along the Dempster found that this mitigation was very effective in reducing the visibility of the 3D lines from the road (i.e., only 6 of the 74 3D

lines intersecting the Dempster Highway were visible). Incidental observations during ground surveys observed similarly reduced visibility of 3D lines crossing winter roads. Regular bends in the 3D lines away from roads were also designed to limit human access by reducing sightlines and making travel more difficult along the line (i.e., needing to reduce speed to navigate the tight turns of a dogleg bend approximately every 70 m).

5.4 FUNCTIONAL CHARACTERISTICS OF LINEAR FEATURES

In addition to human travel, linear features can also affect how wildlife move within a landscape. Several studies in western Canada have documented the effects of linear features on the movements and population dynamics of large mammals, such as caribou, moose, deer, wolves and bears (Latham et al. 2011, McKenzie et al. 2012, Dickie et al. 2017b, Keim et al. 2019a). EDI focused on two established indicators of human and wildlife access and travel on linear features: sightline distance and ease of travel. These measurements act as a proxy for the functional recovery of disturbed areas. They are mainly dependent on vegetation height, cover, and terrain.

5.4.1 LINE-OF-SIGHT

Line-of-sight or sightline distance is how far one can see under normal conditions and was compared between linear features and paired reference plots. It has been proposed that humans and predators select linear disturbances because it is easier to travel and detect prey using those features (Finnegan et al. 2018). As vegetation grows taller and denser, sightlines diminish, and the use of linear features decreases (e.g., for wolves, Dickie et al. 2017a). This study found that average sightlines were farther on-line versus off-line for most linear feature types, but that sightlines varied substantially across line types. Sightlines were shorter on seismic lines than on roads, especially 2D lines which had more advanced vegetation regeneration than other feature types. On 3D lines, sightlines averaged approximately 30 m farther on lines than off lines. However, this difference probably provides little advantage to predators or human hunters because the increase is still within the olfactory and auditory detection zone for most large prey species. Average sightlines were 60 m farther on winter roads than surrounding forest, which may begin to confer more advantage to predators and hunters.

The range of sightlines observed on most linear features probably do not provide an advantage to detect prey species visually. For 2D lines and winter roads, sightline distances were primarily driven by the height and density of regenerating vegetation. The recovery period for 2D seismic lines appears to be sufficient to support vegetation that reduces visibility to a similar level as the surrounding habitats. The reason for longer sightlines on winter roads is that they are subject to intermittent re-activation, where the vegetation is cleared once again, which resets vegetation recovery and maintains longer sightlines. In contrast to 2D lines and winter roads, where sightlines were largely determined by vegetation regeneration, the sightlines on 3D lines were presently limited by the bends purposely constructed into the lines. Sightlines along all feature types will continue to diminish over time as vegetation regeneration continues.

5.4.2 EASE OF TRAVEL

Ease of travel is a fundamental indicator of functional recovery of linear features. Wolves, bears, and humans have been documented to select linear features with greater ease of travel, which is generally associated with lower and more sparse vegetation and stable, even terrain (Dickie et al. 2017b, Keim et al. 2019a). Access and travel resistance are the main determinants of predator and human use of linear features and the key concern of linear disturbances in the RSA (Vuntut Gwitchin Government and Yukon Government 2009, Peel Watershed Planning Commission 2019).

The walk test used in this study, as an index of ease of travel, found differences among linear feature types and between linear features and controls. However, the magnitude of the differences for both comparisons was modest. Even the Dempster Highway only conveyed a 35% increase in walking speed over off-line plots. Other researchers, in other areas, often observed walk speeds on linear features were often at least twice as fast as off-line transects (Keim et al. 2019a). Two conditions associated with the Eagle Plains area appear to limit the advantage of travelling on linear features. One is that the vegetation in most ecosites and structural stages is relatively open and has a limited effect on impeding movement. The second factor is that ground conditions limiting movement, including soft, thick peat and graminoid tussocks, were similar on both on-line and off-line plots for most linear feature types.

Notwithstanding the modest magnitude of faster walking speeds on-lines, there were clear patterns in walking speed differences across linear feature types. 2D lines were the one feature type where walking speeds were slower on lines than off lines. This reflected the thick, shrub stage vegetation that had regenerated on most 2D lines, which impeded travel (similar to the effect that regenerating vegetation had on sightline distances in the previous section). Walk speeds decreased across the other feature types in relation to line width and the degree to which ground cover was levelled or compacted. 3D seismic lines allowed slightly easier travel than paired off-line plots. They usually had lower vegetation cover and clearer route selection. As linear feature width decreased in 3D lines, walking speed also decreased. This implies that width may be related to functional recovery, with narrower lines having smaller impacts than wider lines, even within an already narrow linear feature type. Although ease of travel was greater in 3D seismic lines than surrounding community, it is expected that this will decrease in future years as vegetation increases in height and density.

5.5 FUNCTIONAL RECOVERY OF LINEAR FEATURES

Functional disturbance is defined in the NYRLUP and PWRLUP as "*physical land use disturbance that results in disruption of soil or hydrology, or that requires the cutting of trees*." One of the main concerns with linear disturbances under these land use plans is that such features can technically allow increased access to previously remote areas, potentially leading to a greater harvest of wildlife and fish, higher predation rates, and a change in how people and wildlife use the land (Vuntut Gwitchin Government and Yukon Government 2009). A disturbance can be considered functionally recovered and subtracted from the overall linear density when it no longer facilitates access or travel by humans or wildlife (Vuntut Gwitchin Government and Yukon Government 2009), or otherwise no longer functions as a surface disturbance (Peel Watershed Planning Commission 2019). Both plans use 1.5 m vegetation height as a threshold for functional recovery in forested communities. The

PWRLUP includes the following additional criterion for recovery "*in non-forested areas (dominated by vegetation under 1.5 m), when the disturbed area is covered by native species roughly the same height and composition as the surrounding dominant vegetation*" (Peel Watershed Planning Commission 2019):

One limitation of using height alone as a functional recovery criterion is that it does not consider vegetation density. Although regeneration may meet the recommended height criteria, if it is very sparse (as is often the case in the Eagle Plains Ecoregion), it may still facilitate access and travel by humans and wildlife. Attachment Photo A-25 provides an example in the Eagle Plains RSA where tall but sparse regeneration meets the 1.5 m criteria but does not inhibit access or travel.

The combined results of this study indicate that using regeneration to the Tall Shrub structural stage may be a more appropriate criterion for functional recovery. Attachment Photo A-3 and Attachment Photo A-10 provide examples of linear features that have regenerated to a tall shrub structural stage. Using the Tall Shrub criterion, 38% of all linear features in the RSA would be considered functionally recovered compared to 53% using the 1.5 m height criterion. For this study, the more conservative criterion of reaching the Tall Shrub structural stage was used to adjust (reduce) linear feature densities.

5.6 LINEAR FEATURE INVENTORY AND DENSITY

This study was successful in mapping all linear features within the RSA. The combined results of the mapping exercise and the field studies found that the extent of open habitats (burns and naturally open habitats like wetlands and shrublands), and the degree of vegetation regeneration, played a significant role in the effective density of linear features across the RSA. Before accounting for open areas and regeneration, the total linear feature density was 1.79 km/km². After accounting for open areas and vegetation regeneration (to the Tall Shrub structural stage), the effective linear feature density was 0.52 km/km². The NYRLUP and PWRLUP suggest cautionary levels for linear density of 0.75 km/km² and critical levels of 1.0 km/km² (Vuntut Gwitchin Government and Yukon Government 2009, Peel Watershed Planning Commission 2019).

The Yukon Land Use Planning Council (YLUPC) was conducting a pilot study of surface disturbance across the broader Eagle Plains Ecoregion (Skinner 2021) at the same time as this study. The methods they used consisted of mapping and attributing human-caused disturbances solely using high-resolution satellite imagery. The YLUPC classified vegetation into eight broad classes based on whether the surrounding area was forested or non-forested, the similarity of vegetation on-line to off-line, and the presence or absence of woody cover (i.e., shrubs or trees). The features were then classified as recovered or not-recovered based on the presence of woody cover (recovered) or, if woody cover was not present, the similarity to surrounding vegetation (i.e., if similar then recovered, if not similar, then not-recovered). Historical field data and photographs from the area (Simpson 2008) were used to verify interpretations.

The spatial data from the YLUPC work was not available to compare in detail to the linear feature inventory compiled in this study. However, the mapping linework is expected to be very similar because satellite imagery was used to verify and supplement the linear feature geospatial data compiled in this study (presumably the same satellite imagery that YLUPC used because the imagery was obtained from Yukon Geomatics). One

difference between the two products is that the YLUPC completed the inventory for the entire Eagle Plains Ecoregion, while this study was restricted to the RSA. Another difference is that the attribute data in this study is expected to be more detailed and more precise than the YLUPC data because (i) the original geospatial data includes some information, like date of creation, that would be impossible to estimate from imagery, and (ii) because this study linked field surveys to the mapping exercise to determine line widths and other characteristics more precisely.

Although it is impossible to directly compare the linear feature density estimates between the two studies, due to the different study extents, the general pattern of results is similar. The YLUPC estimated the linear density (accounting for recovery) to be 0.38 km/km² across the entire Eagle Plains Ecoregion. This is consistent with the estimate from this study for the RSA of 0.52 km/km² because the portion of the Ecoregion outside the RSA has lower linear feature density than the RSA.

6 CONCLUSION

This study successfully mapped all linear features within the RSA and measured a suite of structural, vegetation, and functional characteristics across different feature types. Generally, the effects associated with linear features (i.e., differences between conditions on-line and adjacent off-line areas) correlated to feature width and the degree of ground disturbance. In terms of combined effects across the range of feature types that occur in the Eagle Plains RSA, the ranks were:

Dempster Highway >>> Winter Roads > 2D Seismic > 3D-5m >> 3D Conductor > 3D Receiver[2]

The effects of 3D lines (both conductor and receiver lines) appear to be substantially lower than other feature types. This reduced magnitude of effects is important because 3D lines have the longest combined length of exiting linear features. They are also the predominant feature planned for the next exploration program. Important findings for 3D lines include:

- Relatively narrow line widths of 2–3 m are often smaller than natural tree spacing and minimize the potential for changes to microsite conditions (e.g., solar radiation, air and ground moisture) reported in other studies.
- Minimal ground disturbance and maintenance of the moss, herb, and low shrub layers, which retains the natural vegetation community and accelerates vegetation regeneration.
- Successful application of mitigations, notably dogleg bends that minimize sightlines, ease of human travel, and visibility of lines from roads.
- Ungulate use of 3D lines in winter was less than a third of the rate observed on 2D lines and winter roads.

The adverse effects of linear features in other areas are often caused or exacerbated by human use after the lines are initially constructed, including effects on vegetation regeneration and predator-prey dynamics. Human use does not appear to be a significant factor in Eagle Plains. No sign of human use was observed outside the Dempster Highway corridor.

Substantial vegetation regeneration has occurred on existing features in the Eagle Plains RSA. Previous work by the Yukon Government identified the potential for atypical successional trajectories to occur on linear features in the region. Although atypical succession occurred to a limited extent, this study determined that 81% of the sites exhibited a normal succession (100% on 3D lines). Only 5% exhibited inhibited regeneration trajectories (mostly stagnated succession on winter roads). Regarding functional recovery, 53% of sites met the NYRLUP and PWRLUP criterion of vegetation reaching 1.5 m, and 38% of sites met the criterion of attaining a Tall Shrub structural stage. Using the Tall Shrub structural stage as a criterion of functional recovery may be a more ecologically appropriate criterion to meet LUP objectives.

The extent of open habitats (e.g., burns, wetlands and shrublands) and the degree of regeneration on existing linear features (mostly the older 2D lines and winter roads) play an important role in calculating effective linear

[2] Relative magnitudes of effects: >>> large effect, >> moderate effect, > small effect.

feature density in the RSA. Before accounting for open areas and regeneration, the total linear feature density was 1.79 km/km². After accounting for open areas and vegetation regeneration (to the Tall Shrub structural stage), the effective linear feature density was 0.52 km/km².

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ATTACHMENTS

ATTACHMENT A EAGLE PLAINS PROJECT LINEAR FEATURES SURVEY PHOTOGRAPHS



Attachment Photo A-1. Air survey plot SL237, an unburnt 2D seismic line undergoing normal succession at a young forest structural stage when surveyed.



Attachment Photo A-2. Air survey plot SL269, an unburnt 2D seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-3. Ground survey plot SL310, an unburnt 2D seismic line undergoing normal succession at a tall shrub structural stage when surveyed.



Attachment Photo A-4. Aerial view of 3D seismic lines undergoing normal succession – meandering routes were used to mitigate some functional disturbance impacts.



Attachment Photo A-5. Ground survey plot SL357, a burnt 3D5 seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-6. Ground survey plot SL277, an unburnt 3Dc seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-7. Ground survey plot SL255, an unburnt 3Dr seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-8. Aerial view of a burnt 2D seismic line undergoing magnified succession at a tall shrub structural stage when observed.



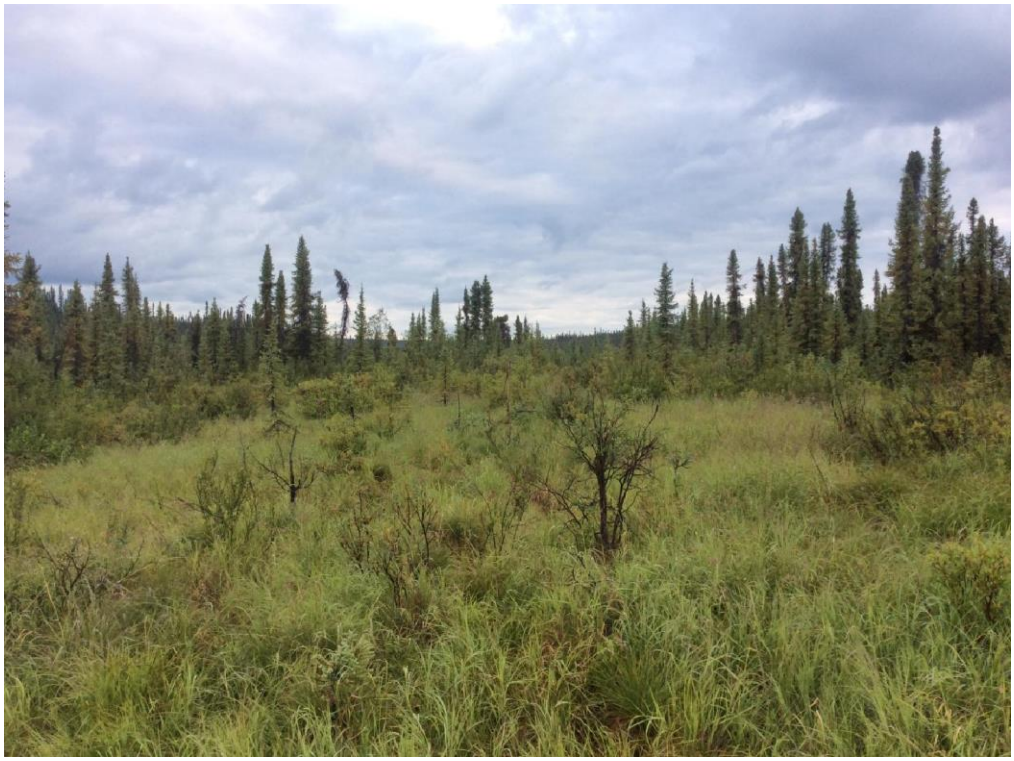
Attachment Photo A-9. Air survey plot SL234, an unburnt winter road undergoing magnified succession at a sapling forest structural stage when surveyed.



Attachment Photo A-10. Ground survey plot SL317, a burnt 2D seismic line undergoing magnified succession at a tall shrub structural stage when surveyed.



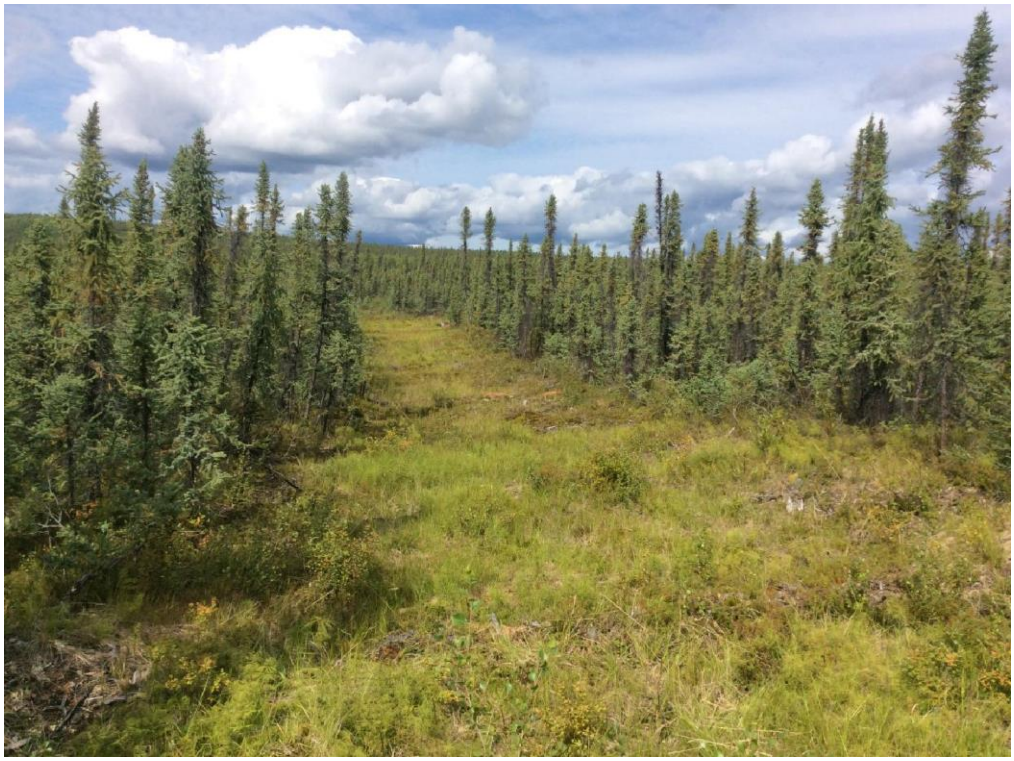
Attachment Photo A-11. Air survey plot SL238, an unburnt winter road undergoing stagnated succession at a forb-dominated herb structural stage when surveyed.



Attachment Photo A-12. Ground survey plot SL264, an unburnt winter road undergoing stagnated succession at a graminoid-dominated herb structural stage when surveyed.



Attachment Photo A-13. Ground survey plot SL226, a burnt 2D seismic line undergoing normal succession at a forb-dominated herb structural stage when surveyed.



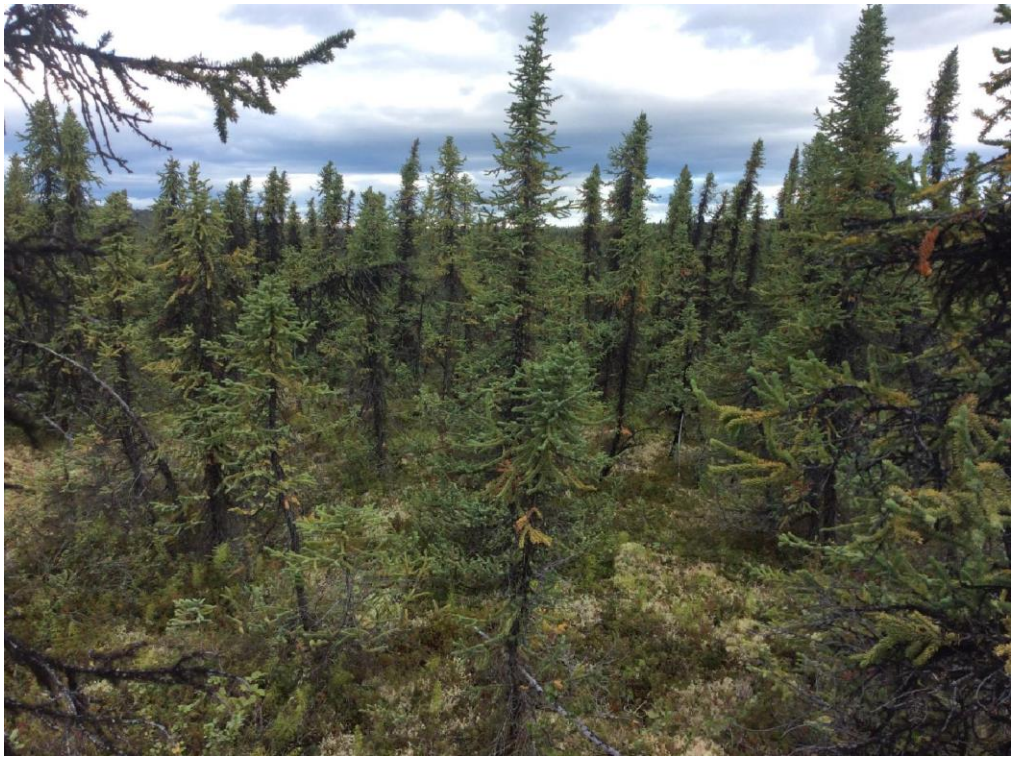
Attachment Photo A-14. Ground survey plot SL329, an unburnt 3D5 seismic line classified as recent disturbance at a forb-dominated herb structural stage when surveyed.



Attachment Photo A-15. Ground survey plot SL338, an unburnt, undisturbed reference plot at a low shrub structural stage when surveyed.



Attachment Photo A-16. Ground survey plot SL350, a burnt undisturbed reference plot at a low shrub structural stage when surveyed.



Attachment Photo A-17. Ground survey plot SL304, an unburnt undisturbed reference plot at a tall shrub structural stage when surveyed.



Attachment Photo A-18. Ground survey plot SL346, a burnt undisturbed reference plot at a tall shrub structural stage when surveyed.



Attachment Photo A-19. Ground survey plot SL3260, an unburnt undisturbed reference plot at a mature forest structural stage when surveyed.



Attachment Photo A-20. Ground survey plot SL264, an unburnt undisturbed reference plot at an old forest structural stage when surveyed.



Attachment Photo A-21. Ground survey plot SL243, a burnt winter road with melt pockets present, indicating permafrost degradation.



Attachment Photo A-22. Air survey plot SL228, a burnt 2D seismic line recovering at the same rate and stage as the surrounding community.



Attachment Photo A-23. Air survey plot SL326, a burnt winter road recovering at the same rate and stage as the surrounding community.



Attachment Photo A-24. Ground survey plot SL287, a burnt 3Dr seismic line recovering at the same rate and stage as the surrounding community.



Attachment Photo A-25. Ground survey plot SL216, a feature with regenerating trees over 1.5 m tall but very sparse, illustrating one of the limitations of the NYLUP and PWRLUP functional recovery threshold.

ATTACHMENT B DATA FORMS

Eagle Plains Linear Features Study

Surveyors: _____ **Date**: _____ **Type**: Air / Ground

Waypoint: _____ **Map Info**: _____

Line Widths: ____/____/____/____ **% Mulch**:_____

Succ. Class: Normal / No Succ / Magn / Stagn / Regress / Rcnt Dist

	On Line	Off Line
Struct. Stage		
Veg Ht / Spp	/	/
% Tree		
Tree Spp		
% Shrub		
Shrub Spp		
Ecosite		
Photos		
Sight Line (m)	/	/
Walk Test*	Dist: Time: Surveyor:	Dist: Time: Surveyor:

*Use same Surveyor for both walk tests.

Comments: _____

Eagle Plains Linear Features Study

Surveyors: _____ **Date**: _____ **Type**: Air / Ground

Waypoint: _____ **Map Info**: _____

Line Widths: ____/____/____/____ **% Mulch**:_____

Succ. Class: Normal / No Succ / Magn / Stagn / Regress / Rcnt Dist

	On Line	Off Line
Struct. Stage		
Veg Ht / Spp	/	/
% Tree		
Tree Spp		
% Shrub		
Shrub Spp		
Ecosite		
Photos		
Sight Line (m)	/	/
Walk Test*	Dist: Time: Surveyor:	Dist: Time: Surveyor:

*Use same Surveyor for both walk tests.

Comments: _____

Appendix A. Wildlife Baseline Studies

Chance Oil and Gas, Eagle Plains Project: Wildlife Baseline Studies



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EXECUTIVE SUMMARY

The Eagle Plains Project (the Project) is an oil and gas exploration program in north-central Yukon, approximately 605 km north of Whitehorse along the Dempster Highway. Chance Oil and Gas Ltd. intends to conduct exploratory activities over a 10-year period to confirm the quality, quantity, and areal extent of hydrocarbons. Project activities will include seismic exploration and exploratory wells supported by an expanded winter road network.

The Project's Regional Study Area (RSA) is approximately 2,400 km² and is spatially bounded by the Peel River and Ogilvie River to the south and the northern reaches of Chance Creek to the north. The Project is within the Eagle Plains ecoregion, an intermontane basin underlain by sedimentary rock. The regional land cover comprises subarctic coniferous forest with mixed forest and arctic/alpine tundra while also lying within a continuous permafrost zone.

For the Project to proceed, it must be evaluated under the *Yukon Environment and Socio-Economic Assessment Act*, which requires baseline wildlife information. As such, wildlife baseline studies were conducted to provide information about birds, American marten, grizzly bear, moose, and caribou to meet the information requirements to support a project proposal to the Yukon Environmental and Socio-economic Assessment Board. The following subsections provide an executive summary of each baseline study completed for the Project.

Birds

The purpose of the birds baseline study was to document the potential occurrence, relative abundance, and habitat associations of birds across the Project's RSA. This study consisted of a combination of a desktop assessment and field surveys. The desktop assessment included identifying ecosystem units across the RSA using predictive ecosystem mapping, collecting, and cleaning historic bird survey data in the broader area, and developing a comprehensive list of bird species with the potential for occurrence based on range and habitat requirements. Two types of field surveys were conducted, each targeted at broad habitat associations in the Project area: point count surveys (transects for terrestrial habitats) and wetland/pond surveys. The survey design followed a targeted, stratified habitat design to provide representative survey coverage across the range of habitat types that occur in the RSA. Point count stations were established along walking transects for efficient survey implementation, and sites were selected using a targeted, stratified habitat design. Ecosystem units for predictive ecosystem mapping were reclassified with field data to produce 32 ecosystem units that captured site-specific differences in vegetation. An average of 23 survey stations were located in each ecosystem unit, with a minimum of eight stations in uncommon habitats. Field surveys were conducted during the 2019 breeding season (June 25 to 30) by two experienced biologists.

To better explain broad patterns of habitat occupation by species of birds in the RSA, the initial 32 ecosystem units were consolidated into ten broad avian habitat types: Herb, Deciduous/Mixed Shrub, Tall Shrub – Black Spruce, Deciduous/Mixed Forest, Spruce Forest, Riparian/Wetland Deciduous Shrub, Riparian Coniferous Shrub, Riparian Spruce Forest, Open Water, and a classification ("Unknown") for distant (>100 m) or flyover observations that prevented associating birds with habitat.

Based on range and habitat, 128 bird species potentially occur in or adjacent to the RSA. Forty-eight bird species were recorded in adjacent areas during North American Breeding Bird Surveys. Possible species include eight listed either under the federal *Species at Risk Act* or identified in the Yukon *Wildlife Act*, and 67 are considered a priority and management concern under the federal *Bird Conservation Region 4 Plan*. Species listed in the *Species at Risk Act* include (with those in bold observed in the RSA): Horned Grebe (*Podiceps auritus*), Peregrine Falcon (*Falco peregrinus*), Short-eared Owl (*Asio flammeus*), **Red-necked Phalarope** (*Phalaropus lobatus*), **Common Nighthawk** (*Chordeiles minor*), **Olive-sided Flycatcher** (*Contopus cooperi*), Bank Swallow (*Riparia riparia*), and **Rusty Blackbird** (*Euphagus carolinus*).

During field surveys, nine hundred and seventy-nine birds from 53 species were observed in the RSA. Point counts identified 743 birds of 42 species, and wetland surveys identified 231 birds of 37 species. Five Swainson's Hawk (*Buteo swainsoni*) were also identified as incidental observations. Patterns of species relative abundance and richness (number of species) varied among the different habitat types. These patterns were consistent with regional habitat and known bird range-use and habitat requirements. Average relative abundance and species richness were greatest in Spruce Forest, Deciduous and Mixed Shrub, and Riparian/Wetland Deciduous Shrub habitats; and lowest in Herb and Tall Shrub – Black Spruce habitats. These patterns were generally related to the structural complexity and productivity of these different habitat types. However, the number of unique species in a given habitat did not depend on structural complexity. Many unique species were found in the Herb and Open Water habitats.

The general patterns of bird occurrence and habitat associations observed in this study are consistent with the limited information available for birds in the area.

Marten

Marten were selected as a Valued Component for the Project due to their value as a furbearer to the Vuntut Gwitchin First Nation and as an indicator species for mature and old forest values. Marten are a good species for assessing potential effects on habitat because they are more closely associated with habitat (mature forest) than many other species of medium-sized carnivore. However, little is known about basic marten ecology in northern boreal forest and taiga ecosystems. The RSA is located entirely within the Eagle Plains Ecoregion, where tree growth is limited by the presence of permafrost and short cool summers that limit the structural development of forests. The most common climax forest community is black spruce woodlands with open canopies and relatively small trees. The size and number of mature forest structures that marten use, such as large trees, snags, and coarse woody debris is much smaller than in forests used by marten in more southern latitudes. Therefore, indices of marten habitat suitability were evaluated in a relative context in this northern setting.

A habitat suitability index model was developed for marten to examine the amount, quality, and habitat distribution for the species in the RSA. Habitat was assigned a suitability ranking of High, Moderate, Low, or Nil/Very Low, relative to the range of habitat quality across the RSA. The rating categories correspond to qualitative predictions of the relative suitability of the habitat for supporting five life requisites of marten: reproduction, thermal cover, escape cover, foraging, and dispersal. High-quality habitat supports all five life requisites. Moderate-quality habitat supports escape cover, foraging, and dispersal. Low-quality habitat only

supports limited foraging and dispersal. Nil/Very Low-quality habitat does not contribute significantly to any life requisites; however, herb/shrub structural stages and stunted disclimax forest areas likely function as permeable barriers and allow intra-territorial movements within marten home ranges. Key habitat associations include selection for mature/old conifer structural stages and avoidance of herb/shrub structural stages (mostly resulting from fire), natural openings, wetlands, and stunted black spruce stands. The model also accounts for avoiding anthropogenic linear features, with greater rating reductions for wider linear features. The model uses two types of source information to provide a spatially explicit quantification of marten habitat across the RSA: vegetation mapping (Ecological and Landscape Classification mapping) and human disturbance, including the Dempster Highway, winter roads, and two types of seismic lines.

The model indicates a patchwork of High (16%), Moderate (23%), and Low (60%) quality marten habitats across the RSA. High-quality marten habitat is associated with mesic, spruce-dominant ecosites in mature to old structural stages. Concentrations of High-quality habitat include the southern portion of the study area, in the Enterprise and Dalglish Creeks watersheds, a band running east-west, north of the Dempster Highway, and the western portion of the northern half of the RSA. Moderate-quality habitat is associated with wetter and/or younger ecosystem units than High-quality habitat and is widespread across the RSA. High and Moderate quality habitat is also concentrated in narrow strips of mature/old riparian forests along some of the major watercourses in the RSA, including Chance and Greaves Creeks in the northwest and McParlon Creek west of the Dempster Highway. Low-quality habitat is associated with regenerating burns, wetlands, and stunted, open, black spruce areas. Concentrations of Low-quality habitat include recent burns on both sides of the Dempster Highway and wetlands and open, stunted spruce areas in valley bottoms in the lower reaches of the Chance watershed in the northwestern portion of the RSA. Nil/Very Low habitat constitutes only 1% of the RSA.

Linear features had a relatively minor effect on overall quality, amount, and distribution of potential habitat for marten in the RSA. This was due to the narrow width of linear features and small overall extent they comprise relative to the overall RSA. Though existing linear features result in reduced habitat quality at the site-level, their effects on habitat supply for marten at the home range scale are very limited.

Grizzly Bear

Grizzly bears (*Ursus arctos horribilis*) were selected as a Valued Component for the Project due to their conservation status and social, cultural, and economic value. Grizzly bears are Special Concern on Schedule 1 of the federal *Species at Risk Act*. The grizzly bear section provides baseline information about population trends, distribution, sources of mortality, diet, and habitat selection within the RSA. This section draws from multiple sources, including published and unpublished literature, personal communications with biologists, and traditional knowledge where available. Few studies on grizzly bears have been conducted in the Project area. Literature from surrounding regions was consulted when local information was not available.

Grizzly bear densities are thought to be low throughout the RSA. The most current grizzly bear population estimate for the broader Eagle Plains Ecoregion (which encompasses the RSA) is 184 individuals, based on expert opinion of grizzly bear habitat capacity from the 1980s. Little is known about seasonal grizzly bear distribution and movements within the RSA and surrounding areas. However, the Richardson and Ogilvie

Mountains (north and south of the RSA, respectively) are thought to have higher grizzly bear densities than the comparatively flat Eagle Plains Ecoregion. Grizzly bears congregate at the Fishing Branch River (20 km west of the RSA) in the fall to feed on spawning salmon. Grizzly bears may also follow the spring and fall migration of the Porcupine caribou herd to take advantage of the seasonal abundance of caribou as a food source.

Key threats to grizzly bear populations in the Yukon are human-wildlife conflict and harvest mortality. Licenced grizzly bear harvest rates are low in the RSA relative to other parts of the Yukon. Annual grizzly bear harvest in Game Management Zone 1 (which encompasses the RSA) has historically varied from zero to three bears per year. Other potential sources of grizzly bear mortality in the RSA include the defence of life and property kills, collisions with vehicles, and predation from other bears or large carnivores.

Seasonal grizzly bear diets reflect the phenological progression of key food resources such as herbaceous plants, roots, ungulate calves, berries, and fish. Terrestrial wildlife are likely an important food source for grizzly bears in northern Yukon, particularly barren-ground caribou (*Rangifer tarandus groenlandicus*) and arctic ground squirrels (*Spermophilus parryii*). The distribution of available food strongly influences habitat selection by grizzly bears during spring, summer, and fall seasons and the supply of suitable den sites in winter. Grizzly bears in the RSA may select habitats with abundant herbaceous vegetation, roots, or berries, such as riparian valleys and slopes. Grizzly bears may also travel to nearby mountain ranges to feed on ground squirrels, particularly in fall, as berry availability declines. Grizzly bears may follow caribou during spring and fall as they migrate to and from their calving grounds, targeting calves or opportunistically preying on adults.

Grizzly bears in northern Yukon hibernate in winter from approximately October to May. They prefer to den in mountainous regions; however, in areas with relatively flat topography (such as the RSA), grizzly bars will select small topographic features such as hills, steep riparian banks, or lakesides to excavate their dens. Grizzly bears in the taiga of northern Yukon have large home range sizes (females: 442–750 km^2, males: 760–1,250 km^2). They travel long distances to find suitable winter denning habitats in the mountains.

Moose

Moose (*Alces alces*) were selected as a Valued Component for the project's environmental assessment due to their value as a game species and their cultural values to local First Nations. The purpose of the moose study was to summarize existing baseline information for moose and develop a habitat model for the species within the Eagle Plains RSA. The habitat model quantifies the suitability, amount, and distribution of potential habitat for moose in the RSA. This information can be used to assess the Project's potential effects on moose and develop measures to mitigate effects if required.

There is limited incidental knowledge about moose population levels, distribution and habitat use within the Eagle Plain RSA. Formal population surveys of moose have not been conducted, but local knowledge suggests that, while moose densities in Eagle Plains are relatively low compared to areas in southern Yukon, they are relatively high compared to other areas in North Yukon. Information from two historical aerial surveys examining the distribution of moose (and other large mammals) indicates that moose occur across the RSA throughout the year, consistent with the relatively low elevation, subdued topography, and moderate

snowpacks that occur in the area. Several large, regenerating burns and smaller extents of riparian and wetland shrublands offer shrubby browse that moose depend on during winter.

The habitat model was developed specifically for the winter season because winter is the most limiting season for moose — forage is most limited, and energetic demands are greatest due to cold temperatures and the extra effort required to travel through snow. The model explicitly focussed on forage availability, which was believed to be the most significant factor affecting habitat selection in winter. During winter, moose feed almost exclusively on the stems and branches of certain shrubs. Vegetation surveys in the area found that several species of willows (*Salix spp.*) were the most abundant potential forage species and the species with the most frequent evidence of browsing by moose.

The habitat model included three variables, ecosystem type, structural stage, and fire disturbance status, all from recent vegetation mapping (Ecological and Landscape Classification mapping) conducted in the RSA. Habitat suitability ratings were developed for each combination of ecosystem type, structural stage, and fire disturbance based on the observed or potential abundance of willow. The highest-rated areas included natural shrublands, regenerating burns in riparian areas, and small extents of deciduous and mixed-wood ecosystems on mesic and moist sites. Moderate-rated areas were predominantly regenerating burns on mesic to wet sites. Low-rated sites were mostly undisturbed stands of open, stunted spruce on mesic to wet sites, ranging from tall shrub to old forest structural stages. Differentiating ratings between Moderate and Low areas was often difficult. Many burned and unburned sites had an average willow cover less than 15%, with high variation in cover among sites in the same ecosystem units. Generally, 7% willow cover was used as the threshold to differentiate between Moderate and Low sites. This is a relatively low value of willow cover but using a higher threshold would have resulted in large areas of regenerating burn being classified the same (Low) as undisturbed areas.

The habitat model indicates that High-suitability moose winter habitat is quite limited across the RSA, and Moderate habitat is widespread: High (12%), Moderate (43%), Low (44%), and Nil/Very Low (1%). Due to the scattered occurrence of High-suitability habitat across the RSA, some moose are expected to occur across the RSA in winter. However, local densities are likely to vary with the portions of Low and Moderate suitability habitats that form the matrix of habitat at a larger scale. This pattern of having extensive areas in Moderate suitability winter habitat is different than occurs in other parts of Yukon, especially in more mountainous regions, where suitable winter habitat (i.e., High and Moderate) are often constrained by elevation and broad vegetation patterns to a relatively small proportion of the landscape (e.g., <25%). In Eagle Plains, a substantial amount of winter forage occurs within large areas with relatively low willow cover (i.e., the Moderate suitability areas).

Caribou

The Porcupine Caribou Herd (PCH) is a subpopulation of barren-ground caribou (*Rangifer tarandus*), known for large population aggregations, dramatic population fluctuations, lengthy migrations, and significant cultural and social value to northern Indigenous peoples. Within the North Yukon Land Use Plan, the PCH is considered "the most significant and culturally important wildlife resource in the planning region." The PCH has been assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada, but the

subspecies is not listed on Schedule 1 of the federal *Species at Risk Act*. Within Yukon, barren-ground caribou are considered Vulnerable/Apparently Secure.

The specific objectives of this study were to:

- summarize existing information about the ecology of the PCH,

and, use telemetry data and analysis outputs from the Porcupine Caribou Technical Committee to:

- quantify the degree of seasonal range overlap by the PCH with the Eagle Plains Oil and Gas Exploration Project RSA during late fall and winter, when seasonal range use overlaps the RSA.
- quantify habitat use patterns and selection by the PCH during late fall and winter.
- quantify movement rates and residency periods of the PCH during late fall and winter.
- quantify potential effects of exiting linear features on the occurrence and movements of the PCH.

There is a long history of co-management of the PCH among indigenous, state, territorial and federal governments in Canada and the United States. In Canada, management initiatives are led by the Porcupine Caribou Management Board with technical support from the Porcupine Caribou Technical Committee. The Porcupine Caribou Technical Committee leads most monitoring and research work on the PCH, including population and demographic monitoring, seasonal movement monitoring (via GPS telemetry tracking), caribou body condition monitoring, habitat and human disturbance assessments, and annual snow surveys. The portion of the PCH annual range that occurs within Yukon is protected by a network of parks, special management areas, conservation areas, wilderness areas, protected areas, ecological preserves, habitat protection areas, and Integrated Management Area zones within the North Yukon Regional Land Use Plan and the Peel Watershed Regional Land Use Plan. In total, 54% of the annual range of the PCH within Yukon falls within some type of protected area where industrial activity is prohibited, 36% of the annual range occurs within regional land use plan Integrated Management Area zones where development is limited, and 9% of the annual range is not covered by any land management zonation.

Although most barren-ground caribou subpopulations are declining, the PCH numbers have increased over the last two decades. Since the first survey in 1972, the PCH has had two periods of population growth, with an interceding decline. The last successful population survey in 2017 estimated a record high of 218,457 caribou.

Like most barren-ground caribou subpopulations, the PCH has a large annual range and makes long-distance migrations, hundreds or thousands of kilometres, among different seasonal ranges. After calving on the north slope and Arctic coastal plains, the PCH typically splits in two, with portions of the herd moving southwest in Alaska and southeast in Yukon. Animals in the Yukon typically follow a clockwise movement through the seasonal ranges from the calving grounds on the north slope, to the British Mountains in summer, to the Richardson Mountains in late summer, dispersing widely and variably across northern Yukon (as far south as the Ogilvie Mountains) in fall and winter, before returning north to the coastal plains in spring. The PCH has historically overlapped the RSA in the rut/late fall and winter periods. However, the RSA overlaps a small

portion of those ranges — 6.0% of the late fall range and 6.5% of the winter range, and the RSA does not overlap with the most frequently used portions of those ranges.

Habitat selection by the PCH for late fall and winter was estimated using resource selection functions using GPS collar data from 2012 to 2021 for 164 caribou in late fall and 172 caribou in winter. Spatial habitat data included a set of plant functional type layers (light macrolichens, graminoids, forbs, evergreen shrubs, deciduous shrubs, and conifer trees), elevation, aspect, slope, terrain ruggedness, and distance to waterbodies >1 ha. PCH caribou tended to select and avoid similar resources in both late fall and winter. Key covariates in models for both seasons that were statistically significant (i.e., $P < 0.05$) included macrolichen cover (positive coefficient), conifer tree cover (negative coefficient), slope percent (negative coefficient), elevation (variable in fall and winter), and aspect (greater selection for south- and west-facing). Coefficients associated with lichen cover were of the greatest magnitude, suggesting that the selection of lichen is the primary driver of habitat selection in late fall, especially in winter. The resource selection function models were used to derive habitat quality maps with four ratings (Very Low, Low, Moderate, and High), which were determined by assessing selection ratios across resource selection function predictions. The distribution and proportion of selected habitat (Moderate and High) was then examined within the RSA and broader seasonal ranges. The proportion of selected habitat was equivalent between the RSA (0.404) and the broader range during late fall (0.415 ± 0.025) but was less in the RSA (0.265) than the broader range during winter (0.411 ± 0.026). Selected habitat, especially areas of High quality, were mostly dependent on the amount and distribution of macrolichen cover.

The potential for linear features (i.e., the Dempster Highway, winter roads, 2D seismic and 3D seismic) to mediate the base habitat model via avoidance of those features was assessed using a zone of influence (ZOI) framework. Although ZOIs were determined for some features, confidence in the outcomes was low because (i) the magnitude of the ZOI effects were weak (i.e., including the ZOI effects in the habitat models had little effects on the habitat predictions); (ii) the ZOI distance estimates were sensitive to the data and analytical methods used; (iii) the pattern of ZOI effects were not consistent with other studies and basic understanding of the PCH ecology. Developing ZOIs for assessment and management purposes will integrate results from other studies adapted to the Eagle Plains setting and the ecology of the PCH.

To better understand factors affecting PCH caribou movement, two analyses were conducted: (1) a comparison of daily movement rates and residency times of caribou in the Project RSA relative to the broader landscape, and (2) a delineation of movement paths to assess broad-scale movement patterns and the potential for caribou to interact with the Project. The PCH typically exhibits movements of several kilometres per day in late fall and winter. Late fall daily movements (8.7 km/day in the RSA) were substantially greater than during winter (4.4 km/day), and caribou tended to occupy portions of the landscape for shorter periods during late fall than during winter. Caribou residency times in both seasons were two-fold greater in the broader landscape than within the Project RSA, suggesting that, on average, the RSA is used as more of a transitory area than other portions of the seasonal ranges. There were relatively few collared caribou that travelled through the RSA during late fall. However, in the fall of 2015, 14 collared caribou made clear, directed movements along the height of land parallel to the Dempster Highway, from the northeast to the southwest. Most caribou appeared to avoid crossing the Dempster Highway while travelling through the Eagle Plains

region, but all animals eventually crossed the highway farther south, in the Ogilvie Mountains. The movements through Eagle Plains crossed numerous 2D seismic lines, winter roads and a large 3D seismic grid within the RSA.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
2D	Two Dimensional
3D	Three Dimensional
AIC	Akaike's Information Criterion
asl	above sea level
BBMM	Brownian Bridge Movement Model
BC	British Columbia
BCR	Bird Conservation Region
BMU	Bear Management Unit
°C	degrees Celsius
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CWCS	Canadian Wetland Classification System
CWD	Coarse Woody Debris
CWS	Canadian Wildlife Service
DBH	Diameter at Breast Height
DEM	Digital Elevation Model
DLP	Defence of Life and Property Kill
ELC	Ecosystem and Landscape Classification
GAM	Generalized Additive Modelling
GIS	Geographic Information System
GMS	Game Management Subzone
GMZ	Game Management Zone
GPS	Global Positioning System
ha	hectares
HSI	Habitat Suitability Index
HMP	Harvest Management Plan
IMA	Integrated Management Area
IPCB	International Porcupine Caribou Board
km	kilometers
km^2	square kilometers
LF	Linear Feature
LIS	Low Impact Seismic
m	meter
mm	millimeter
NABBS	North American Breeding Bird Survey
NND	Na-cho Nyäk Dun
NWT	Northwest Territories
NYLUP	North Yukon Land Use Plan

PCH	Porcupine Caribou Herd
PCMB	Porcupine Caribou Management Board
PCTC	Porcupine Caribou Technical Committee
PEM	Predictive Ecosystem Mapping
PFT	Plant Functional Type
PWLUP	Peel Watershed Land Use Plan
RISC	Resources Information Standards Committee
RSA	Regional Study Area
RSF	Resource Selection Function
SARA	*Species at Risk Act*
the Project	the Eagle Plains Project (proposed by Chance Oil and Gas Ltd.)
TGC	Tetlit Gwich'in Council
THFN	Tr'ondëk Hwëchin First Nation
TRI	Terrain Ruggedness Index
VC	Valued Component
VGFN	Vuntut Gwitchin First Nation
YESAA	*Yukon Environmental and Socio-Economic Assessment Act*
YESAB	Yukon Environmental and Socio-Economic Assessment Board
ZOI	Zone of Influence

1 INTRODUCTION

Baseline wildlife information and data are required for proposed oil and gas projects submitted to the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee for screening under the *Yukon Environment and Socio-Economic Assessment Act* (YESAA), as well as applications submitted for an Industrial Licence and Type A Water Licence from the Yukon Water Board, among other permits and licences. To receive authorization for the Eagle Plains Project to proceed, the Project must be evaluated under YESAA. Specific wildlife objectives, as identified in YESAB's Proponent's Guide to Information Requirements for Executive Committee Project Proposal Submissions (2005), are to:

- describe the abundance and distribution characteristics of major wildlife species within the project area and vicinity;
- describe the habitat classifications used in the project area and any implications concerning the distribution and abundance of habitat types that may influence the project;
- provide a map showing the spatial arrangement of habitats of special interest, if applicable;
- identify and describe the transportation corridor and critical, key, and sensitive habitats;
- identify any species listed on the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and Species at Risk lists;
- describe any special management requirements due to vulnerability, threatened, or endangered status; and,
- identify and describe any ongoing studies and monitoring programs concerning wildlife in the project area and vicinity.

1.1 PROJECT OVERVIEW

The Eagle Plains Project (the Project) encompasses a 2,386 km² area in north-central Yukon, centred approximately 605 km north of Whitehorse and 40 km south and west of Eagle Plains hotel, along the Dempster Highway. The Project occurs within the Eagle Plains sedimentary basin, north of the Ogilvie River and west of the Richardson Mountains. The basin contains proven natural gas and oil reserves (Peel Watershed Planning Commission 2019), including 4.6 billion m³ of gas and 3.2 million m³ of oil (Hannigan 2014).

The Regional Study Area (RSA) has had intermittent periods of oil and gas exploration since the 1950s. That activity has established winter roads, seismic lines, and exploratory well sites across parts of the current RSA. Approximately 40 exploration wells have been drilled in the Eagle Plains sedimentary basin. Eight (8) wells are currently being maintained in suspended status, and the remaining wells have been plugged and abandoned. Seismic exploration has included approximately 10,000 km of two-dimensional (2D) lines (mostly before 1985), and about 325 km² of three-dimensional (3D) seismic was conducted in 2013/2014 (Northern Cross (Yukon) Ltd. 2014).

The current exploration program will build on past exploration to better define the extent, amount and quality of oil and gas deposits in the area. Under the current program, Chance Oil and Gas Ltd. proposes conducting additional 2D and 3D seismic data acquisition programs over large extents of the RSA and drilling up to 30 exploratory wells. Depending on the drilling program results, extended flow testing lasting up to two years may be conducted at wells where crude oil and/or natural gas are discovered to determine the quantity, quality and extent of the oil and gas deposit(s). The existing winter road network will be expanded to support the seismic, drilling, and flow testing programs. Most work is expected to be conducted in the winter (e.g., seismic line clearing and drilling); however, seismic recordings and extended flow testing may also occur during summer or year-round.

1.2 STUDY AREA

The Eagle Plains Project Regional Study Area (RSA; Map 1-1) is 2,386 km² (238,566 ha), centred in the Eagle Plains Ecoregion in north Yukon. The area consists of subdued topography of rolling hills and sloping plains. The Dempster Highway crosses the RSA along the local height of land. From there, the area drains into the Porcupine River watershed to the north (via Chance Creek) and west (via McParlon Creek and the Whitestone River) and into the Peel River watershed to the southeast (via Dalglish Creek).

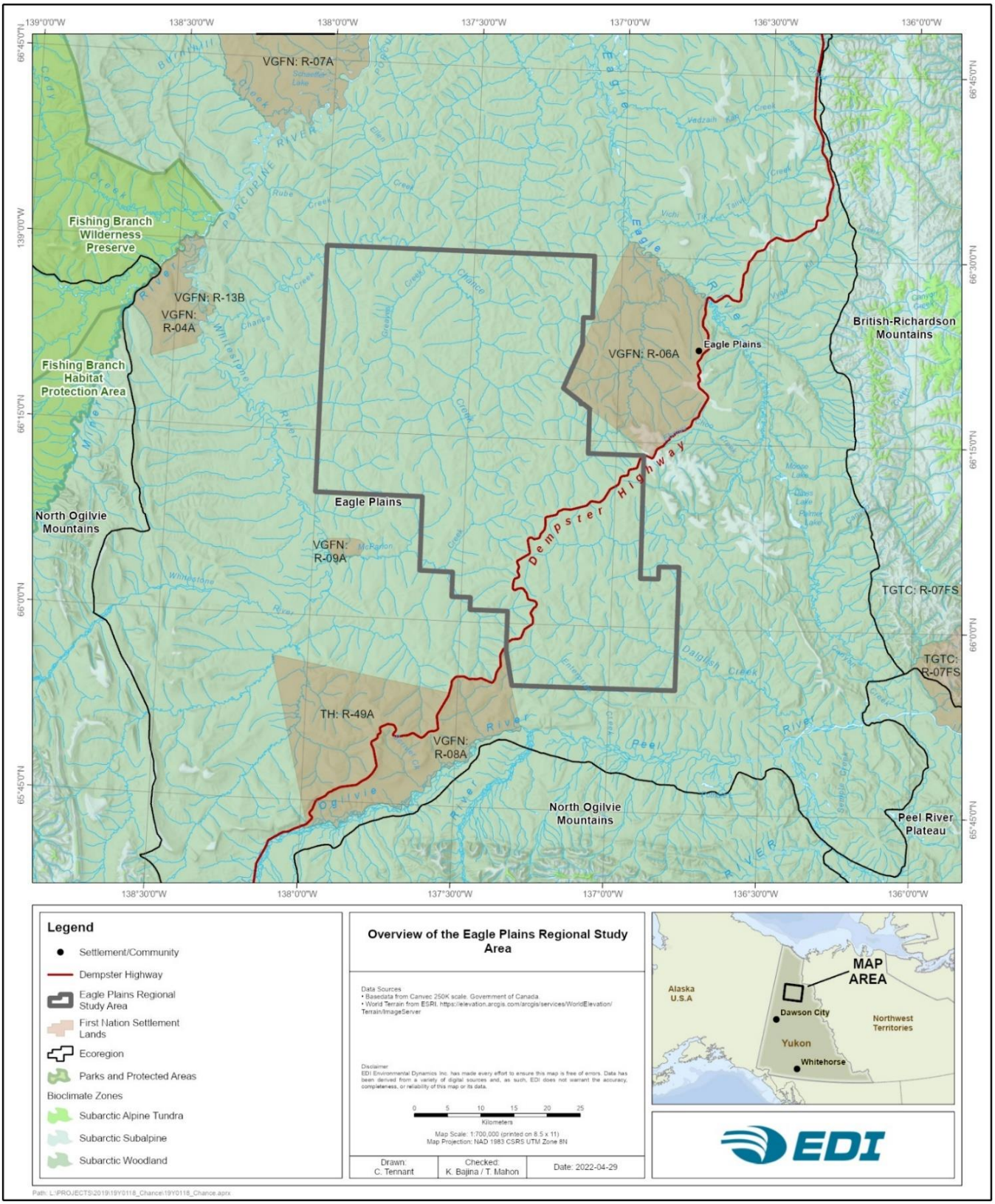
The RSA overlaps four First Nation Traditional Territories. Most of the RSA is within the Vuntut Gwitchin First Nation (VGFN) Traditional Territory. The southeastern portion is in an area of overlapping Traditional Territories of VGFN, the Tetlit Gwich'in Council (TGC), the First Nation of Na-cho Nyäk Dun (NND), and Tr'ondëk Hwëchin First Nation (THFN). Although the RSA is outside any First Nation Settlement Lands, it adjoins VGFN Settlement Lands on parts of its east and southwest borders.

Development in the RSA and the surrounding Eagle Plains is low. The Dempster Highway is the main vehicle access corridor, running from approximately Dawson City, Yukon in the southwest to Inuvik, Northwest Territories (NWT) to the northeast and transiting the RSA along the way. Several winter access roads also branch off the Dempster Highway. A network of seismic lines (Photo 1-1) from historical exploration are found in the RSA. The Eagle Plains settlement is located on the Dempster Highway, approximately 30 km east of the RSA boundary and consists of the Eagle Plains Hotel and the Government of Yukon's Highway Maintenance camp.

The Project is within the North Yukon Planning Region and Peel Watershed Planning Region. Therefore, it is subject to the North Yukon Land Use Plan (NYLUP) and Peel Watershed Land Use Plan (PWLUP). The project falls within the Integrated Management Area (IMA) Zone IV of both plans, a zone with lower ecological and cultural values and the highest permissible development of the four IMA zones.



Photo 1-1. Seismic lines from historical exploration activities within the Regional Study Area.



Map 1-1. Overview of the Eagle Plains Regional Study Area.

1.3 ECOLOGICAL OVERVIEW

The Project falls within the Eagle Plains Ecoregion (Map 1-1), a 20,400 km² region in north Yukon between the Richardson and Ogilvie Mountains. The ecoregion consists of low-altitude rolling topography between 300 m and 600 m above sea level (masl), with few scattered peaks above and around 1,000 masl (Ecological Stratification Working Group 1995).

The Eagle Plains Ecoregion experiences moderate precipitation, with annual amounts around 400 mm. Most precipitation falls as rain throughout the summer, averaging 50 to 80 mm per month, from June through August. Precipitation is lighter through September to April and falls as snow, with average winter snowpacks of 80 cm peaking in April. The climate in this region is strongly affected by its latitude, with extended winter conditions that usually last from October through to early May. There is a substantial variation in seasonal temperatures in the Eagle Plains, with cool short summers and long cold winters. Average winter temperatures are between −30°C and −25°C, with extremes as low as −60°C. Average summer temperatures are around 13°C, with extremes as high as 30°C. Due to the northern latitude, this region experiences brief periods of continuous sun above and below the horizon in summer and winter, respectively.

Most of the Ecoregion, including the northeast portion of the RSA, drains north into the Yukon River via the Whitestone, Porcupine and Eagle rivers. That part of the RSA includes the headwaters of the Eagle River and several other tributaries of the Porcupine River, along with the Chance and McParlon Creek subdrainages of the Whitestone River. The southeast corner of the Ecoregion drains east to the Mackenzie River via the Peel, Wind and Ogilvie Rivers. Dalglish and Enterprise creeks flow directly into the Peel River. The few lakes in the Ecoregion are generally oxbow or thermokarst lakes (Yukon Ecoregions Working Group 2004a). Several wetland complexes are found to be associated with larger creeks in the RSA.

The Eagle Plains Ecoregion is dominated by the Crysolic soils that occupy much of the northern third of Canada, characterized by near-surface permafrost. Turbic Cryosols predominate, exhibiting patterned ground formations and hummocks, and are often associated with open stands of black spruce (*Picea mariana*), tamarack (*Larix laricina*) and birch (*Betula* spp.). The active permafrost layer in these ecosystems generally ranges between 20 cm and 90 cm below the surface. The active layer depth is generally deeper under hummocks and shallower under inter-hummock areas (Yukon Ecoregions Working Group 2004a).

The RSA is entirely within the Subarctic Bioclimate Zone (Environment Yukon 2014a). Vegetation in the RSA is characterized by open-canopy, spruce-dominated habitats where permafrost generally limits tree growth and results in stunted, disclimax vegetation communities (Environment Yukon 2016a). Hummocky, black spruce and white spruce (*Picea glauca*) woodlands with well-developed shrub communities are common in upland areas, with white spruce and ground lichens increasing in abundance in well-drained sites. Areas with low slope gradients and fine-textured soils often have ground cover dominated by cottongrass tussocks beneath a shrub layer of birch, black spruce, Labrador tea (*Rhododendron groenlandicum*), and occasionally tamarack (Yukon Ecoregions Working Group 2004a).

Evidence of forest fires can be observed throughout the RSA (Photo 1-2 and Photo 1-3). Alaskan paper-birch (*Betula neoalaskana*) is often the first tree species to colonize burn areas, and the extent of old burns is generally

correlated with young black spruce – Alaskan paper birch woodlands (Yukon Ecoregions Working Group 2004a). Fires increase the depth of the active permafrost layer, causing slope failures and changes in ecosystem moisture regimes.



Photo 1-2. Example of a regenerating moist forest stand after a fire within the RSA.



Photo 1-3. Example of a recently burnt area of the RSA.

2 BIRDS

2.1 PURPOSE AND OBJECTIVES

This section documents the occurrence, relative abundance, and habitat associations of birds occurring or likely occurring in the RSA. It includes a desktop assessment to collect and summarize existing information about birds; and field surveys to document the occurrence, relative abundance, and habitat associations of birds within the RSA. Field surveys were recommended by the regulator responsible for migratory birds (Environment and Climate Change Canada — Canadian Wildlife Service [CWS]) because no systematic bird surveys have been previously conducted in the Project area. Surveys in adjacent areas were limited and mainly were road-based surveys, which had limited or no coverage of particular habitat types. Two field survey types were used to provide representative coverage of broad avian habitat types and associated avian communities: (1) point count surveys and (2) pond and wetland surveys.

2.2 BIRD HABITAT OVERVIEW

The Project falls within Bird Conservation Region 4 (BCR 4), the Northwestern Interior Forest (Environment Canada 2013a). BCR 4 is home to 211 regularly occurring bird species, including 31 waterfowl species, 19 water bird species, 23 shorebird species, and 138 land bird species (Environment Canada 2013a). Most species are breeding season migrants, few are year-round residents. The Project is also within ~30 km of two other bird conservation regions: region 3 (BCR 3), the Arctic Plains and Mountains, and region 6 (BCR 6), the Boreal Taiga Plains. BCR 3 habitats are influenced by a short growing season and continuous permafrost; upland habitats range from heavily vegetated heath communities to sparse cryptobiotic crusts, lichens, and moss; in the southern end, dwarfed spruce trees are often found in restricted patches (Environment Canada 2013b). BCR 6 is primarily characterized by gently rolling or undulating landscapes, vegetation dominated by the boreal forest and interspersed with wetlands and several major river systems (Environment Canada 2013c). In total, BCR 3 has 159 species of birds, while BCR 6 has 288. This current study did not find species uniquely associated with either of these two conservation regions.

The RSA has three predominant bird habitat types: black spruce upland, willow and scrub birch shrubland, and scrub fens and bogs. Upland forests provide potential breeding habitat for resident Northern Goshawk (*Accipiter gentilis*), Spruce Grouse (*Canachites canadensis*), Northern Hawk Owl (*Surnia ulula*), American Three-toed Woodpecker (*Picoides dorsalis*), Canada Jay (*Perisoreus canadensis*), Boreal Chickadee (*Poecile hudsonicus*), White-winged Crossbill (*Loxia leucoptera*), and Common Redpoll (*Acanthis flammea*) (Frisch 1987, YEWG 2004, Environment Canada 2013). Migrants that breed in upland forests include Swainson's Thrush (*Catharus ustulatus*), Gray-cheeked Thrush (*Catharus minimus*), Varied Thrush (*Ixoreus naevius*), Bohemian Waxwing (*Bombycilla garrulus*), Yellow Warbler (*Setophaga petechia*), Yellow-rumped Warbler (*Setophaga coronata*), American Tree Sparrow (*Spizelloides arborea*), and Dark-eyed Junco (*Junco hyemalis*) (Frisch 1987, YEWG 2004). American Kestrel (*Falco sparverius*), Say's Phoebe (*Sayornis saya*), American Robin (*Turdus migratorius*), Orange-crowned Warbler (*Leiothlypis celata*), and Chipping Sparrow (*Spizella passerina*), as well as other species of thrush, warbler,

and sparrow, can be found in more open forests with a well-developed shrub layer, or shrublands with tall shrub and dwarfed spruce (Frisch 1987, YEWG 2004). A frequently occurring species in the Eagle Plains ecoregion, though rare elsewhere in Yukon, is Swainson's Hawk (*Buteo swainsoni*). This species is associated with isolated stands of productive white spruce for nesting habitat, mostly found in narrow riparian strips surrounded by open bogs and shrublands where they regularly forage.

Aquatic habitats for birds consist of open bodies of water (e.g., ponds, lakes), wetlands (mostly bogs and fens) and riparian zones dominated by sedges and shrubs. Open water bodies are limited in the RSA and are thus potentially inhabited by relatively few Tundra Swan (*Cygnus columbianus*), Greater White-fronted Goose (*Anser albifrons*), Canada Goose (*Branta canadensis*), American Wigeon (*Mareca americana*), Green-winged Teal (*Anas crecca*), and Bufflehead (*Bucephala albeola*) (Frisch 1987, YEWG 2004, Environment Canada 2013). Shorebirds such as Lesser Yellowlegs (*Tringa flavipes*), Solitary Sandpiper (*Tringa solitaria*), and Wilson's Snipe (*Gallinago delicata*) remain along the water's edge and in riparian zones consisting of coniferous and deciduous vegetation. Riparian zones also provide potential breeding habitat for Willow Ptarmigan (*Lagopus lagopus*), Alder Flycatcher (*Empidonax alnorum*), Yellow Warbler, Wilson's Warbler (*Cardellina pusilla*), American Tree Sparrow, and Lincoln's Sparrow (*Melospiza lincolnii*) (Frisch 1987, YEWG 2004). Spotted Sandpiper (*Actitis macularius*), Herring and Short-billed Gulls (*Larus argentatus* and *L. brachyrhynchus*), Belted Kingfisher (*Megaceryle alcyon*), Bank Swallows (*Riparia riparia*), and Cliff Swallows (*Petrochelidon pyrrhonota*) can be found along rivers (Frisch 1987, YEWG 2004).

Alpine/subalpine areas are absent from the RSA. Species that inhabit the alpine/subalpine in other parts of the ecoregion include Golden Eagle (*Aquila chrysaetos*), Rock Ptarmigan (*Lagopus muta*), Horned Lark (*Eremophila alpestris*), American Pipit (*Anthus rubescens*), Gray-crowned Rosy Finch (*Leucosticte tephrocotis*), Upland Sandpiper (*Bartramia longicauda*), and Townsend's Solitaire (*Myadestes townsendi*) (Frisch 1987, YEWG 2004).

The Project RSA does not include cliffs or bluffs that could be used by cliff-nesting raptors, such as Golden Eagle, Peregrine Falcon (*Falco peregrinus*) or Gyrfalcon (*Falco rusticolus*). These species' nearest suitable nesting cliffs are along the Porcupine River and Eagle River (Hayes and Mossop 1978).

Data on birds in the Project area are currently limited. The first evaluation of bird occurrences in Eagle Plains was *Birds by the Dempster* (Frisch 1987). Birds of the Yukon Territory (Sinclair et al. 2003) provided a more detailed description of species occurrences, habitat, and relative abundances. More recently, a general account of birds within the region was presented by Environment and Climate Change Canada in their report, *Bird Conservation Strategy for Bird Conservation Region 4 in Canada: Northwestern Interior Forest* (Environment Canada 2013a). The North American Breeding Bird Survey (NABBS) is the best local data source. Two NABBS routes along the Dempster Highway (routes 78 and 79) are close to the Project.

2.3 METHODS

This study consisted of two components: a desktop assessment to collect and summarize existing information about birds relevant to the Project area and field surveys to document the occurrence, relative abundance, and habitat associations of birds across the Project RSA. This approach, field survey design, and methods details

were discussed with CWS representatives during the project planning stage. The methods used considered specific recommendations provided by CWS representatives and a broader set of recommendations in *A Framework for the Scientific Assessment of Potential Project Impacts on Birds* (Hanson et al. 2009). The methods selected and reporting herein also comply with the the ten key considerations identified in the DRAFT updated guidelines *Canadian Wildlife Service Guidance Regarding Information Needed to Support Assessment of Project Effects on Birds* (ECCC-CWS 2022).

2.3.1 DESKTOP ASSESSMENT

A list of bird species that had the potential to occur in the Project RSA was developed from a combination of historical occurrence data in adjacent areas, a territorial field guide, and a national bird conservation assessment.

Historical data were gathered from the NABBS database for two routes (routes 78 and 79) that run along the Dempster Highway in the Eagle Plains region (Pardieck et al. 2019). The NABBS is a long-term, large-scale monitoring program that began in 1966 to track trends in avifauna. It consists of annual (one day a year) standardized roadside surveys, during the peak breeding season, by skilled observers making 50 stops spaced 0.8 km apart, along 39.4 km long routes. Observers record the number of bird species heard from any distance or seen within a 0.4 km radius of each stop during a three-minute observation period. These data are then compiled and made freely available to analyze trends in relative abundance and species composition. From 2014 to 2018, NABBS identified 48 species along Eagle Plains' two routes (above) (Pardieck et al. 2019).

General information about bird species occurrences was obtained from *Birds by the Dempster* (Frisch 1987), *Birds of Yukon* (Sinclair et al. 2003), and the Federal conservation assessment, *Bird Conservation Strategy for Bird Conservation Region 4 in Canada: Northwestern Interior Forest* (Environment Canada 2013a). These sources ranked species as 'Likely' or 'Possible' in the RSA based on habitat requirements, range boundaries, and occurrence information. Likely species were those whose range overlapped with the RSA, and suitable habitat occurred in the RSA. Possible species included (1) those with suitable habitat in the RSA, but whose range was on the edge of the RSA, and (2) those whose range overlapped with the RSA, but for which the availability of suitable habitat was in question.

2.3.1.1 Conservation Status

The conservation status of bird species was identified based on the most recent recommendations by COSEWIC (COSEWIC 2018) and current lists in the *Species at Risk Act* (SARA) registry (i.e., the most recent amendment, Environment and Climate Change Canada 2019) and BCR 4 plan. The SARA registry groups species into one of three schedules:

- Schedule 1 — the official list of species at risk in Canada includes species that are either Extirpated, Endangered, Threatened or of Special Concern;
- Schedule 2 — species designated as Endangered or Threatened, but that have yet to be re-assessed by COSEWIC under the revised criteria; and,

- Schedule 3 — species designated as Special Concern but have yet to be re-assessed by COSEWIC under the revised criteria.

Birds that fall under conservation categories of Special Concern or higher were identified. All bird species of conservation concern, identified through the designation and ranking processes described above, were evaluated against their species conservation status assessment found in the national bird conservation strategy for BCR 4 (Environment Canada 2013a). The BCR 4 strategy outlines conservation planning and priorities to support the implementation of migratory bird conservation programs. The BCR species assessment considered population size, population trend, regional abundances and densities, and species and habitat threats to designate species warranting "Concern and Stewardship at the Regional, National, or Continental level". Stewardship species are based on "having a large proportion of their world population within BCR 4". Species managed by Environment Yukon under the Yukon *Wildlife Act* were also noted.

2.3.2 HABITAT STRATIFICATION

A broad avian habitat classification system was developed to provide representative survey coverage across the RSA. A habitat stratification approach was applied to site selection for all survey sites before field surveys. Avian habitat types were initially developed using Predictive Ecosystem Mapping (PEM), later verified with Ecological and Landscape Classification (ELC) mapping for habitat-related analyses. Two key components of the initial PEM mapping to define avian habitat types were: ecosystem units and structural stage, described below.

2.3.2.1 Ecosystem Units (Ecosites)

The North Yukon PEM was used to classify 16 ecosystem units in the Project RSA. However, the PEM model was unsatisfactory when assessing ecosite predictions in the field because of its low accuracy. The PEM ecosite codes were used to guide each survey location, but adjustments were made to the classifications according to the dominant vegetation. These changes were supplemented with detailed notes and descriptions of plant and tree species (i.e., lichen cover, percent shrubs, tree height and canopy closure), as well as photographs, with the intent of reclassification.

The purpose of reclassifying PEM ecosystem units was to describe site-specific vegetation at a finer resolution and, ultimately, develop more accurate associations between species of birds and habitat in the Project RSA. A detailed review was conducted of all point count and wetland survey forms, including a review of notes on species of vegetation and structural stage (Table 2-1) and analyzing each survey station's photographs. Deciduous and coniferous (i.e., primarily black spruce) vegetation were distinguished based on their relative densities at ecosites previously classified as mixed wood. Patterns of bird occupation were then analyzed to determine whether deciduous and mixed vegetation warranted separate ecosite codes. Shrub-stage and mature-stage spruce stands were differentiated based on tree height and the degree of canopy closure. Separating these two structurally distinct stands yields two ecological communities with different bird assemblages, e.g., species requiring mature trees for nest cavities, such as owls and woodpeckers, are unlikely to be found in shrub-stage forests. These new ecosites were summarized along with their previous PEM codes

and descriptions of key vegetation characteristics. In total, 32 distinct ecosystem units were developed from the PEM model (Table 2-2).

Table 2-1. Structural and successional stages of vegetation associated with ecosystem units in the Eagle Plains Project Regional Study Area.[1]

Code	Structural Stage	Description
1	Non-vegetated	Very recent disturbance and no vegetation (or <5% vegetation).
2a	Sparse	Initial stages of primary and secondary succession with 5–10% vegetation cover maintained by environmental conditions.
2b	Cryptogram (Bryoid-dominated)	Bryophyte-dominated community maintained by environmental conditions.
3a	Herb (Forb-dominated)	Early successional stage of herbaceous communities maintained by environmental conditions or disturbance. Includes non-graminoid herbs and ferns.
3b	Herb (Graminoid-dominated)	Early successional stage of herbaceous communities maintained by environmental conditions or disturbance. Includes grasses, sedges, reeds, and rushes.
3c	Herb (Aquatic)	Early successional stage of herbaceous communities maintained by environmental conditions or disturbance. Dominated by floating or submerged plants.
4a	Tall Shrub	Early successional stage of forest or shrub communities dominated by shrub layer vegetation > 2 m tall.
4b	Low Shrub	Early successional stage of forest or shrub communities dominated by shrub layer vegetation <2 m tall.
5	Pole/Sapling	Trees >2 m tall and typically densely stocked. Vertical structure and layering not yet evident.
6	Young Forest	Forest canopy with distinct layers and somewhat open stand.
7	Mature Forest	Mature trees and well-developed understories at canopy openings.
8	Old Forest	Old and structurally complex stands composed mainly of shade-tolerant and regenerating tree species.

[1] Modified from Environment Yukon 2017.

Table 2-2. Modified predictive ecosystem mapping ecosites relative to original ecosites in the Eagle Plains Project Regional Study Area.

Modified PEM	PEM	*N*[1]	Vegetation Description
211-D	211	7	Wet deciduous shrub; predominantly willow and scrub birch. Structural stage 4b.
211-SB	211, 213	3	Wet black spruce shrub (peat bog). Structural stages 4a–6.
211-SB-ML	211, 213	2	Wet black spruce shrub with moderate lichen cover. Structural stages 4a–6.
213-tp	213	2	Wet black spruce dominant forest; tall and productive stands. Structural stages 6 and 8.
221	221	1	Moist mixed shrub; black spruce and deciduous (scrub birch and willow). Structural stage 4b.

Modified PEM	PEM	*N*[1]	Vegetation Description
221-D	221	12	Moist deciduous shrub; predominantly scrub birch and willow. Structural stages 4a–b.
221-SB	221, 223	18	Moist black spruce shrub. Structural stages 4a-6.
221-SB-LL	221, 223	3	Moist black spruce shrub with low lichen cover. Structural stage 4a.
221-SB-ML	223	2	Moist black spruce shrub with moderate lichen cover. Structural stage 6.
221-SB-HL	221	1	Moist black spruce shrub with high lichen cover. Structural stage 4a.
222	222	6	Moist mixed forest; spruce and deciduous (birch and/or alder). Structural stages 5-8.
222-D	222	1	Moist deciduous forest; birch dominant. Structural stage 6.
223-tp	222, 223	4	Moist black spruce forest; sometimes mixed with white spruce. Structural stages 6-7.
223-LL-tp	223	2	Moist black spruce forest; sometimes mixed with white spruce; low lichen cover. Structural stages 6-7.
230	230	1	Mesic herb with <15% shrub cover. Structural stages 2b and 4b.
231-D	231	4	Mesic deciduous shrub; predominantly willow and scrub birch. Structural stages 4a–b.
231-D-ML	231	1	Mesic deciduous shrub; predominantly willow and scrub birch; moderate lichen cover. Structural stage 4a.
231-SB	231, 233	7	Mesic black spruce shrub. Structural stages 4a–6.
231-SB-HL	233	3	Mesic black spruce shrub with high lichen cover. Structural stages 4a–6.
232	232	3	Mesic mixed forest; black spruce and deciduous (paper birch and/or trembling aspen). Structural stages 5–6.
232-D	232	3	Mesic deciduous forest; predominantly paper birch and willow. Structural stages 5–6.
233-tp	233	5	Mesic black spruce forest sometimes mixed with white spruce; tall and productive stands. Structural stages 6-7.
233-LL-tp	233	1	Mesic black spruce forest with some black spruce shrubs; low lichen cover; tall and productive stands. Structural stages 4b, 6–7.
233-HL-tp	233	1	Mesic black spruce forest; high lichen cover; tall and productive stands. Structural stage 6.
310	310	4	Riparian herb with little to no shrub cover. Structural stages 3b–c.
311-D	311	22	Riparian deciduous shrub; predominantly scrub birch and willow. Structural stages 4a-b.
311-SB	311, 313	4	Riparian black spruce shrub. Structural stages 4a–6.
311-SB-T	311	4	Riparian black spruce and tamarack shrub. Structural stages 4a–6.
313	313	11	Riparian spruce forest; mix of black and white spruce, as well as hybrids. Structural stages 6–8.
400	400	4	Wetland herb. Structural stage 3b.
401-D	401	1	Wetland deciduous shrub; predominantly scrub birch and willow. Structural stage 4b.
500	500	17	Open water.

[1] Sample size, the number of survey stations (point count or pond) within each modified PEM ecosite.

2.3.2.2 Bird Habitat Types

Once ecosystem units were reclassified, they were grouped according to vegetation and structural stage similarities. Mixed and deciduous vegetation, while ecologically distinct, did not differ in their use by birds; therefore, they were grouped in a single category. Ultimately, 32 ecosystem units were consolidated into ten broad avian habitat types: Herb, Deciduous/Mixed Shrub, Tall Shrub – Black Spruce, Deciduous/Mixed Forest, Spruce Forest, Riparian/Wetland Deciduous Shrub, Riparian Coniferous Shrub, Riparian Spruce Forest, Open Water, and a classification ('Unknown') for distant (>100 m) or flyover observations that prevented associating birds with habitat (Table 2-3). As a post hoc exercise, ELC ecosite types were assigned to broad habitat types based on the spatial overlap with survey sites with the ELC map and verified using field-based habitat descriptions (Table 2-3). For a complete list of ELC codes, names, and descriptions, see Attachment Table 1 in Section 2.6.1 (Attachment 2-A).

Table 2-3. Avian habitat types developed by grouping modified Predictive Ecosystem Mapping ecosites, based on their similarities in vegetation and structural stages, in the Eagle Plains Project Regional Study Area. *A posteriori* classified ELC ecosites are provided for each habitat type.

Avian Habitat Type	Modified PEM Ecosite	ELC Ecosite[1]	Structural Stages	*N*[2]	Vegetation Description
Herb	230, 310, 400	31, 33, 42, B2	2b, 3b, 3c, 4b	9	Herb dominant sites found along crests and upper slopes, riparian zones, and wetlands; <20% shrub cover.
Deciduous and Mixed Shrub	211-D, 221, 221-D, 231-D, 231-D-ML	06, 22, 23, 31, 33, 34, 35, 42, B2	4a-b	24	Predominantly scrub birch and/or willow vegetation, sometimes with a mix of black spruce; lichen cover possible.
Tall Shrub – Black Spruce	211-SB, 211-SB-ML, 221-SB, 221-SB-LL, 221-SB-ML, 221-SB-HL, 231-SB, 231-SB-HL	05, 06, 14, 20, 23, 33, 34, 42	2b, 4a-b, 6	35	Tall shrub/dwarfed black spruce dominated area often with low to high lichen cover.
Deciduous and Mixed Forest	222, 222-D, 232, 232-D	04, 05, 06, 33, 34	5, 6, 7, 8	13	Birch dominant forest or mix of spruce and deciduous (e.g., birch, aspen, and alder) stands.
Spruce Forest	213-tp, 223-tp, 223-LL-tp, 233-tp, 233-LL-tp, 233-HL-tp	05, 33, 42, B1	6, 7, 8	14	Black spruce dominant forest, sometimes mixed with white spruce, and often with low to high lichen cover. Ranges from intermediate height stands with open canopy to tall and closed canopy forest.
Riparian/Wetland Deciduous Shrub	311-D, 401-D	20, 23, 31, 33, 35, 42, 43, 44	2b, 3b, 4a-b	23	Predominantly scrub birch and willow shrub along riparian zones and wetlands.
Riparian Coniferous Shrub	311-SB, 311-SB-T	22, 33, 35, 42, 43, B1	2b, 4a-b, 6	8	Black spruce and tamarack dominant riparian shrub.
Riparian Spruce Forest	313	22, 23, 31, 35, 42, 43, B2	6, 7, 8	11	Dominated by mix of black and white spruce, as well as spruce hybrids.
Open Water	500	LA, PD	1	17	Non-vegetated open water.
Unknown	UNK	UNK	UNK	74	Unknown habitat due to distant observations (>100 m) or flyovers.

[1] Broad ELC polygons within which survey stations were located.

[2] Sample size, the number of survey stations (point count or pond) within each habitat group.

2.3.3 OCCURRENCE AND DISTRIBUTION SURVEYS

Two experienced bird biologists conducted field surveys in the Project RSA between June 25 to 30, 2019. Each biologist had more than 15 years of experience conducting point count surveys and could reliably identify all bird species by sight and vocalizations that had the potential to occur. All surveys employed a targeted, stratified habitat design to provide sampling across all broad avian habitat types.

2.3.3.1 Breeding Bird Point Count Surveys

'Point count' surveys were conducted in terrestrial habitats following standardized survey methods (Ralph et al. 1995, Resources Inventory Committee 1999a, Matsuoka et al. 2014). Point count stations were visited along walking transects to facilitate efficient survey productivity (i.e., versus individual point counts spaced more widely, which would have resulted in longer travel time and a lower number of survey stations). Point count survey stations were established within a Geographic Information System (GIS) using guided site selection to provide coverage across all avian habitat types and broad spatial coverage across the RSA (Map 2-1). Random site selection approaches were explored but ultimately not used because of challenges associated with safety (steep terrain), logistics (access), and reduced sample sizes (i.e., randomization resulted in much smaller sample sizes due to greater travel times to transect starting stations and between stations). Site selection targeted a minimum of four stations in each habitat type. The location of existing and proposed development features was also considered to ensure the surveys covered those areas. Stations were spaced approximately 500 m apart, with a minimum spacing of 400 m, to avoid counting the same birds from multiple stations. Point count locations were chosen in two ways to associate bird occurrences with habitat types: (1) locating stations within one PEM polygon, at least 100 m from the polygon edge; and (2) locating the station on the boundary between two PEM polygons where the location of birds in different habitat types could be reliably determined (e.g., on the transition between shrubland and forest type). Each point count station was surveyed once to maximize the number of sampled sites.

Survey methods followed standard point count survey methodologies (Ralph et al. 1995, Resources Inventory Committee 1999a, Matsuoka et al. 2014). Surveys used a 10-minute detection period and an unlimited recording distance. Biologists conducted surveys during the dawn chorus (i.e., a half-hour before dawn to ~8:30) when territorial singing rates are highest. Upon arriving at the predetermined survey station location, surveyors evaluated the station location and, where appropriate, revised the location by up to 50 m to aid in accurately plotting bird locations in their associated habitat types. Once on station, surveyors waited two minutes to allow any birds disturbed by the surveyor's arrival to settle and resume their activities. Once the official observation period began, surveyors recorded all birds detected (visual or auditory) during the 10-minute detection period by plotting their locations on a point count map form and recording the standardized four-letter species name abbreviation, time of detection, sex, age, number, behaviour, and the habitat type in which they occurred (i.e., ecosystem unit and structural stage). Surveyors assigned birds estimated to be >100 m distant at a distance of 101 m due to the high uncertainty of estimates at those distances. Following the surveys, a bearing and distance were measured on the point count map from the

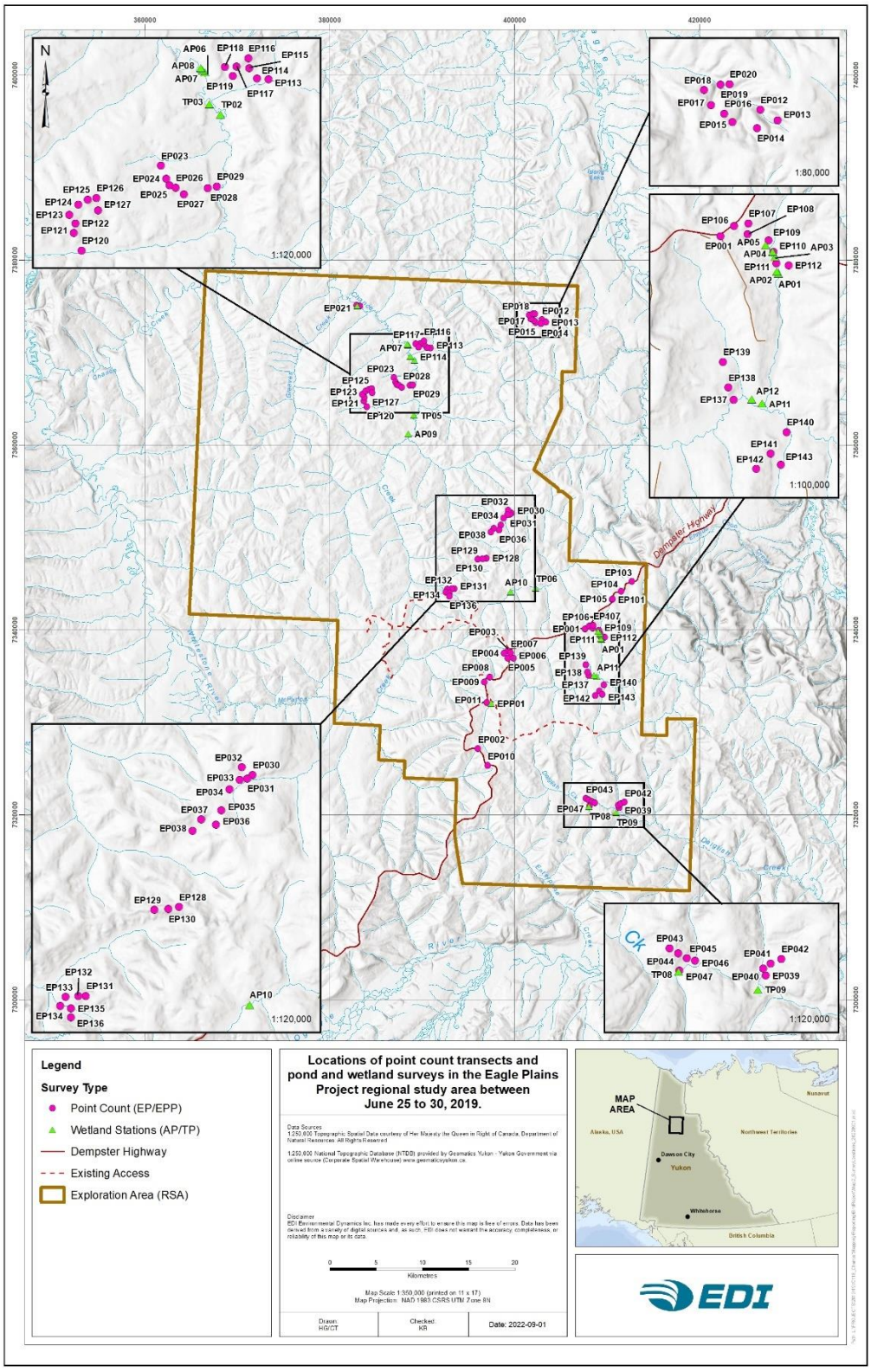
station location for each bird observation (<100 m) used to calculate coordinates for each observation. A total of 91 point count stations were surveyed over six days.

2.3.3.2 Pond and Wetland Surveys

For wetland surveys, protocols were adapted from the BC RISC Standards *Inventory Methods for Waterfowl and Allied Species* (Resources Inventory Committee 1999b). Before surveys, ponds and open water wetlands within 3 km of existing or proposed project development were identified using the PEM map. Shoreline surveys were conducted at 19 unique ponds, and observations were made from stations along the shoreline using binoculars and scopes. The number of stations varied from one to five, depending on the size and shape of the ponds. Approximately half of a pond's total perimeter was traversed along a section of shoreline parallel to the longest axis of the feature to provide complete visual coverage of the waterbody. Surveyors approached waterbodies covertly and began surveys behind screening vegetation to avoid flushing birds from the ponds before they were tallied. Ground-based surveys were thought to provide a census of birds present at each pond. However, a few birds obscured by shoreline vegetation may not have been counted. Biologists recorded the following information for each pond for all detected birds: species, sex, age, number, and habitat associations.

2.3.3.3 Cliff-nesting Raptors Habitat Assessment

Cliff-nesting raptors, including Peregrine Falcon, Gyrfalcon, and Golden Eagle, are relatively common in parts of North Yukon with suitable cliffs, such as the Ogilvie Mountains, south of Eagle Plains. Nesting occurrences of these species are not known in the Eagle Plains area. Due to the subdued topography of the Eagle Plains area, suitable nesting cliffs are likely to be uncommon or non-existent. We systematically assessed the potential for suitable nesting cliffs across the study area by mapping areas with a slope >30 degrees (the lowest gradient in which EDI Environmental Dynamics Inc. (EDI) staff have found cliff nests in other parts of the Yukon). This mapping exercise did not identify any suitable cliffs in the area. Therefore, targeted field surveys for this species group were not conducted.



Map 2-1. Locations of point count transects and pond and wetland surveys in the Eagle Plains Project Regional Study Area between June 25 to 30, 2019.

2.4 RESULTS AND DISCUSSION

2.4.1 DESKTOP ASSESSMENT

Based on range and habitat requirements, 128 species can occur in the Eagle Plains Project RSA. This includes 99 'Likely' species (52 confirmed by surveys and incidental observations presented in this report) and 29 'Possible' species. These 'Possible' species included Common Nighthawk (*Chordeiles minor*) observed once in the RSA during these surveys. Despite the confirmed occurrence, the species is still considered 'Possible' because it is outside its regular range, and none were observed during NABBS between 2014 and 2018 (i.e., the single observation during these surveys could have been an extralimital record). A summary of these potential species and conservation statuses, ordered by species groups, is provided in Table 2-4. A more detailed discussion of the species identified within the Project RSA is provided in Section 2.4.2. For an exhaustive list of all potential bird species, see Attachment Table 2 in Section 2.6.2 (Attachment 2-B).

The NABBS database is a valuable information source for the occurrence and distribution of bird species in the region because they are a recent and systematic survey. Of the two survey routes near the Project area (i.e., routes 78 and 79), route 79 was surveyed annually between 2014 and 2018, and route 78 was surveyed in each of those years except 2016. In total, observers who participated in these surveys identified 1,945 birds from 48 species (Table 2-4). Though these data are useful in identifying species common to the region, road-side surveys introduce bias in estimating species occurrences and relative abundances, especially when extrapolating to off-road areas (Sólymos et al. 2020). This may explain why 'Possible' species (e.g., Harlequin Duck [*Histrionicus histrionicus*], Surfbird [*Calidris virgata*], and Golden-crowned Sparrow [*Zonotrichia atricapilla*]) were recorded on the NABBS routes but not within the RSA, and why 18 species confirmed during surveys within the RSA (e.g., Red-necked Phalarope [*Phalaropus lobatus*], Great Gray Owl [*Strix nebulosa*], and American Three-toed Woodpecker), were not detected over five years of road-side surveys.

Overall, species occurrence and relative abundance patterns differed among years in both NABBS routes. The total number of detections decreased from 2014 to 2018, and this pattern was consistent for most bird species. This may partly correspond to the survey effort. The number of species identified and the number of birds detected were similar between route 78 (920 counts from 34 species) and route 79 (1,025 counts from 39 species) during the five-year period. No species-specific trends were evident in the data.

The NABBS data also included three species (six detections) federally designated as Special Concern: Short-eared Owl (*Asio flammeus*; one occurrence in both 2015 and 2016, and two occurrences in 2018), Rusty Blackbird (*Euphagus carolinus*; one occurrence in 2015), and Olive-sided Flycatcher (*Contopus cooperi*; one occurrence in 2018).

Table 2-4. Total number of potential (likely and possible) bird species in the Eagle Plains Project Regional Study Area, June 2019, grouped by higher-order classification. North American Breeding Bird Survey (2014–2018) confirmed species and counts are provided.

Order	Likely	Possible	Likely + Possible (Total)	NABBS Confirmed (2014–2018)[1]
Grebes – Podicipediformes	2	0	2	0
Loons – Gaviiformes	3	0	3	0
Waterfowl – Anseriformes	17	7	24	6 (24)
Shorebirds – Charadriiformes	12	9	21	3 (13)
Grouse – Galliformes	2	4	6	2 (2)
Diurnal Birds of Prey – Accipitriformes	9	0	9	4 (5)
Falcons – Falconiformes	4	0	4	1 (1)
Owls – Strigiformes	5	0	5	2 (6)
Rails – Gruiformes	1	0	1	0
Kingfishers – Coraciiformes	1	0	1	0
Nightjars – Caprimulgiformes	0	1	1	0
Woodpeckers – Piciformes	2	1	3	0
Songbirds – Passeriformes	41	7	48	30 (1,894)
Jays, Crows and Allies	2	0	2	2 (59)
Blackbirds	1	0	1	1 (1)
Thrushes and Allies	6	1	7	6 (381)
Shrikes and Vireos	1	0	1	0
Flycatchers and Allies	4	0	4	2 (2)
Swallows	3	1	4	0
Sparrows, Finches and Allies	11	3	14	10 (1,204)
Chickadees, Nuthatches and Wrens	2	1	3	0
Warblers	8	1	9	8 (245)
Others	3	0	3	1 (2)
Totals	**99**	**29**	**128**	**48 (1,945)**
SARA Schedule 1	**7**	**1**	**8**	**3**
BCR 4 Priority	**51**	**12**	**63**	**20**

[1] Count of individual bird observations for each group in brackets.

2.4.2 OCCURRENCE AND RELATIVE ABUNDANCE

A total of 974 birds from 52 species were detected during the breeding bird surveys (i.e., point count transects and wetland/pond surveys). One raptor species not included in these counts—Swainson's Hawk—was identified, incidentally, on four separate occasions between June and August 2019, totalling five individuals. These additional observations bring the number of total detections to 979 birds from 53 species.

Songbirds (*Passeriformes*) were the most diverse and abundant group of birds, while falcons (*Falconiformes*), owls (*Strigiformes*), and nightjars (*Caprimulgiformes*) were the least diverse and abundant (Table 2-5). Proportionally, more waterfowl and shorebirds were identified during wetland/pond surveys, and more songbirds and raptors were identified during point count transects. More birds were counted during point count transects (743 versus 231), but a similar number of species were identified during point counts transects and wetland/pond surveys (42 in point counts and 37 in wetlands; Table 2-5).

Table 2-5. Total counts and species of birds observed during point count transects and wetland/pond surveys in the Eagle Plains Project Regional Study Area, June 2019, grouped by higher-order classification.

Order	Point Count Transects		Wetland/Pond Surveys		Combined	
	Count	No. Species	Count	No. Species	Count	No. Species
Waterfowl – Anseriformes	3	2	99	7*	102	7
Shorebirds – Charadriiformes	18	4	38	7*	56	7
Diurnal Birds of Prey – Accipitriformes	2	2	0	0	2	2
Falcons – Falconiformes	1	1	0	0	1	1
Owls – Strigiformes	1	1	1	1*	2	1
Nightjars – Caprimulgiformes	1	1	0	0	1	1
Woodpeckers – Piciformes	3	1	0	0	3	1
Songbirds – Passeriformes	714	30	93	22*	807	32
Jays, Crows and Allies	52	2	6	1*	58	2
Blackbirds	3	1	16	1*	19	1
Thrushes and Allies	155	5	12	3*	167	5
Flycatchers and Allies	16	3	3	2*	19	3
Swallows	0	0	3	1	3	1
Sparrows, Finches and Allies	340	10	33	8*	373	10
Chickadees, Nuthatches and Wrens	9	2	0	0	9	2
Warblers	139	7	16	5*	155	7
Others	0	0	4	1	4	1
Totals	743	42	231	37*	**974**	**52**

* Number of species from wetland/pond surveys were not all unique from those in point count transects.

2.4.3 SPECIES AND HABITAT ASSOCIATIONS

Analyses of the association between bird species and habitat type controlled for survey effort (i.e., average counts per point count station). The average number of birds (i.e., relative abundance) and the average number of species varied considerably among survey stations and the different avian habitat types (Figure 2-1; Table 2-6). The average relative abundance was greatest in Open Water, Deciduous and Mixed Shrub, Riparian/Wetland Deciduous Shrub, and Spruce Forest habitats; it was lowest in Riparian Spruce Forest, Herb, and Tall Shrub – Black Spruce habitats. Among habitat types, the proportion of (average) detections to the (average) number of species was consistent, with a higher relative abundance being associated with a greater number of species. In general, this pattern was related to the structural complexity and productivity of the various habitat types. For example, Herb habitat is less structurally complex and consists exclusively of graminoid ground cover; it had the fewest species (but had a relatively high number of unique species; see Figure 2-2). In contrast, Spruce Forest habitat can be structurally complex due to variations in canopy cover, understory, and ground cover, and older stands may contain a variety of forest structures that provide habitat for a variety of bird species and life requisites including nesting (e.g., Yellow-rumped Warbler), perching (e.g., Olive-sided Flycatcher), and insect foraging (either on the ground [e.g., Gray-cheeked Thrush] or on live/dead trees [e.g., American Three-toed Woodpecker]). Consequently, Spruce Forest had the greatest species richness of all avian habitat types. The exception to the general association between relative abundance and species richness was Open Water habitat, which had the highest relative abundance but one of the lowest average number of species.

The number of species (i.e., species richness) and the number of unique species (i.e., species exclusive to a habitat type) were summarized for each avian habitat type. Unequal survey effort across habitat types could bias such comparisons of species totals across habitat types; however, it does provide a useful approach to examine general patterns of bird occurrence and assemblages within and across habitat types. Spruce Forest, Riparian/Wetland Deciduous Shrub, and Deciduous and Mixed Shrub habitat types had the greatest species richness, while Herb and Open Water habitat types had the least species richness (Figure 2-2). Patterns of species richness may, in part, be due to the distribution of survey stations in each habitat type, especially in Herb habitat (only nine stations). The Open Water habitat also had low species richness despite surveys at 17 survey stations. This may reflect the limited availability of waterbodies and wetlands in the broader region (i.e., relatively few water-associated bird species occur because the habitat is so limited and dispersed).

No clear association was found between species richness and the number of unique species. For example, Open Water was one of the least species-rich habitat types but had the most unique species. This is not surprising because Open Water is a unique habitat compared to the other terrestrial habitats, and a different complement of bird species occurs there. Other habitat types with many species (e.g., 21 species in Deciduous and Mixed Shrub) had no species unique to those habitats. Likely, riparian habitat types did not have unique species because species that occupy riparian habitat often have broad, rather than specific, requirements. For example, Rusty Blackbird and Lesser Yellowlegs were found in Riparian Coniferous Shrub, Riparian/Wetland Deciduous Shrub, and Herb habitat types.

Patterns of bird occurrences were analyzed in terms of species-specific detection rates (Table 2-6). Songbird species had the highest detection rates overall because these species consistently occupied several different habitat types. Only 15 species occupied a single habitat, and the remaining 47 species occupied multiple habitats (most frequently two or three habitats; Figure 2-3). Species that occupied four or more habitat types were exclusively songbirds and had the highest detection rates. This included species groups such as thrushes, sparrows, and their respective allies. Only 10 species occurred in six or more habitats: Canada Jay, American Robin, Gray-cheeked Thrush, Swainson's Thrush, Common Redpoll, Fox Sparrow (*Passerella iliaca*), White-crowned Sparrow (*Zonotrichia leucophrys*), American Tree Sparrow, Lincoln's Sparrow, and Yellow Warbler. Overall, species with high detection rates included a combination of habitat specialists and habitat generalists. Waterfowl and obligatory wetland species (e.g., Red-necked Phalarope), which were restricted to Open Water habitat, had high detection rates in that habitat (Table 2-6).

In contrast, thrushes (e.g., Gray-cheeked Thrush) and warblers (e.g., Yellow Warbler), which occupied several different habitat types, had high detection rates in many of the habitats they occupied (Table 2-6). The five species with the highest overall (average) detection rates (i.e., across all 110 survey stations in the RSA) were Canada Jay, Swainson's Thrush, Lincoln's Sparrow, White-crowned Sparrow and Yellow-rumped Warbler. For a general overview of bird species assemblages within each habitat type, ordered by highest to lowest detection rates, see Table 2-7. General patterns of frequency and use of habitat types by species in the RSA are consistent with expectations and correspond to patterns reported in other studies (Schieck and Song 2006, Mahon et al. 2016).

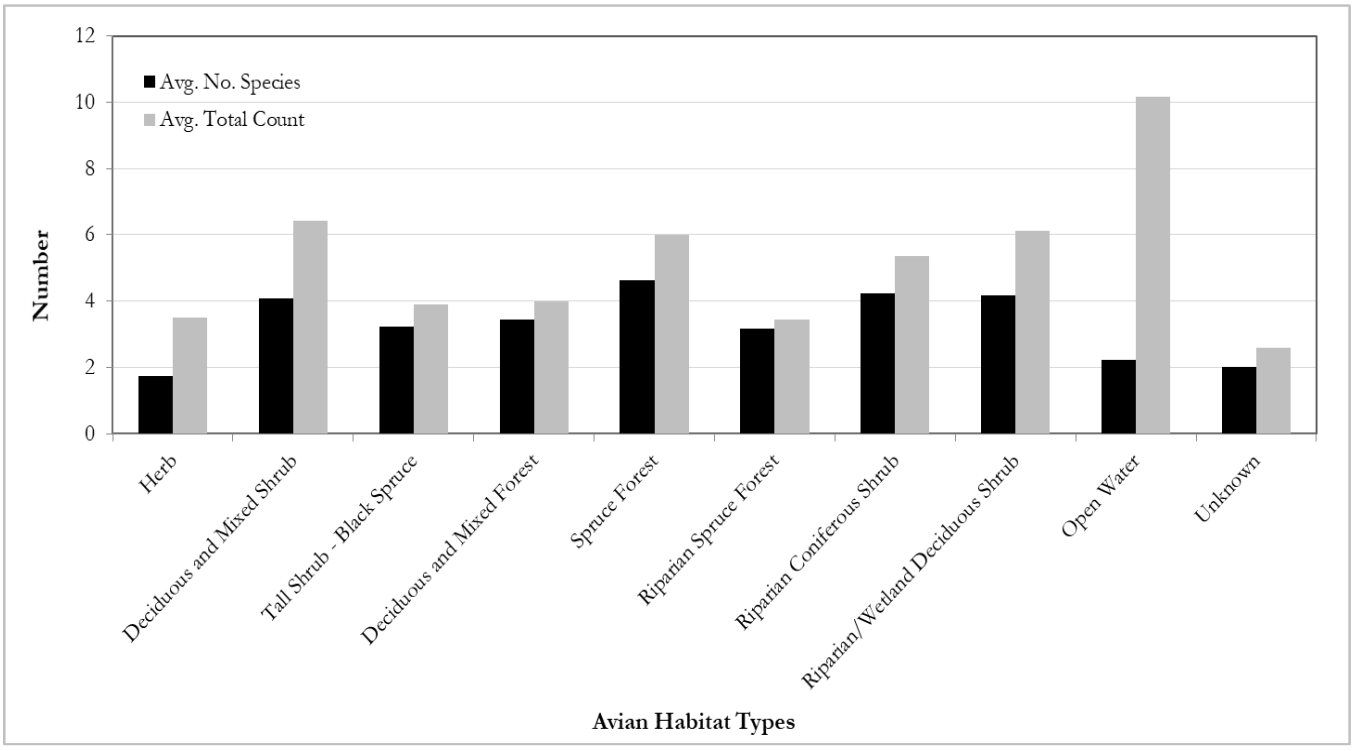


Figure 2-1. The average number of species and average total counts of birds observed among the avian habitat types in the Eagle Plains Project Regional Study Area, June 2019.

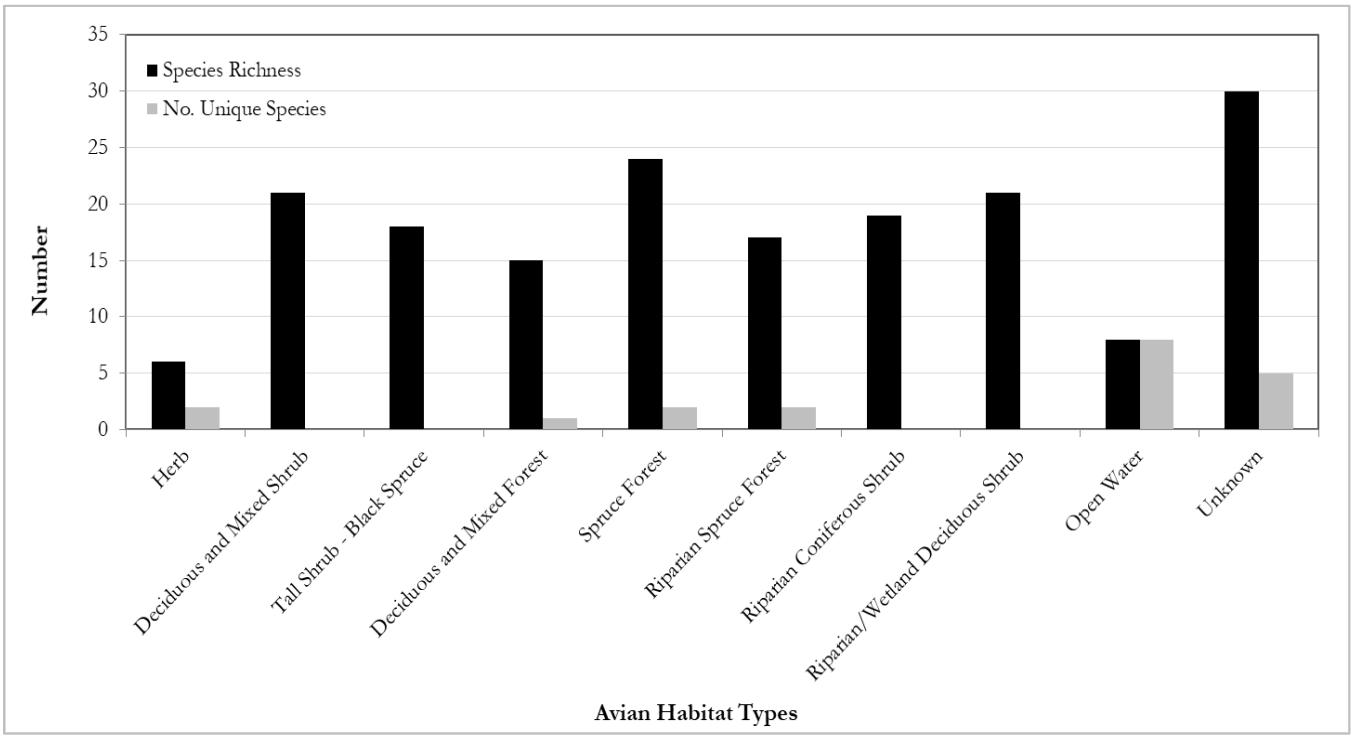


Figure 2-2. Species richness and number of unique birds observed among the avian habitat types in the Eagle Plains Project Regional Study Area, June 2019.

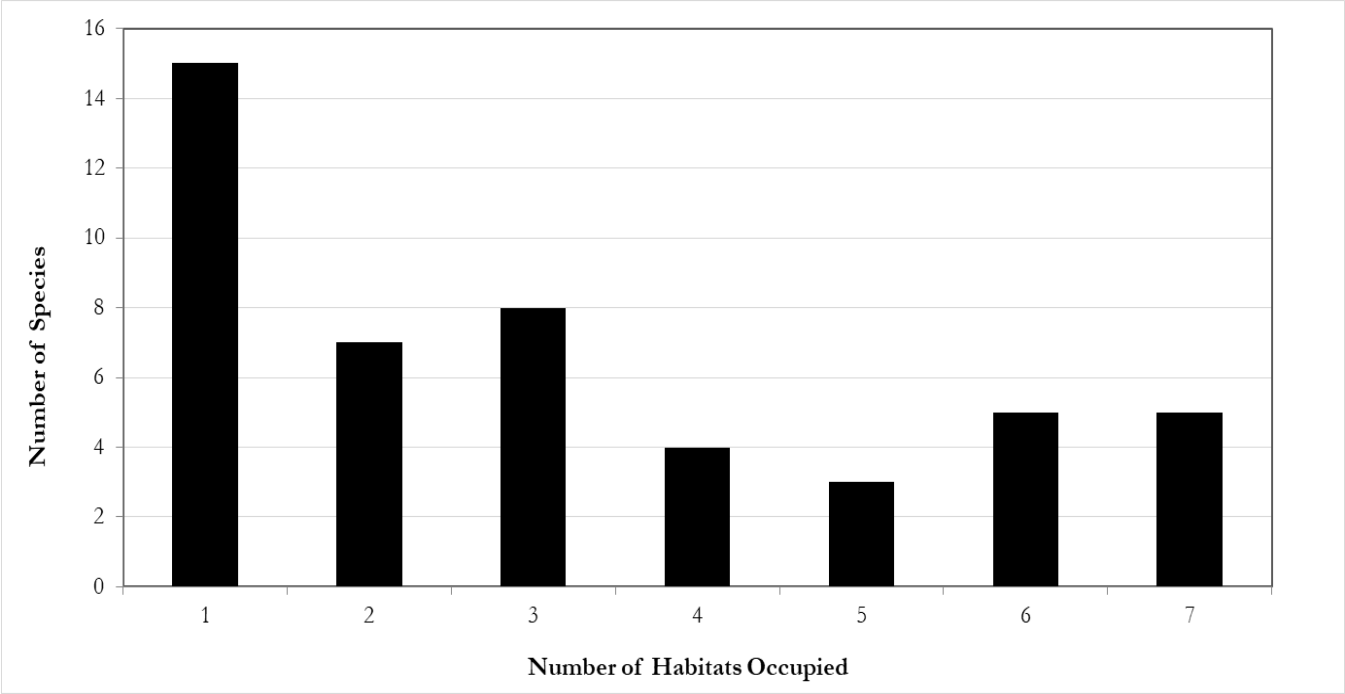


Figure 2-3. Frequency distribution of the number of habitats occupied by bird species in the Eagle Plains Project Regional Study Area, June 2019.

Table 2-6. Average detection rates (birds per survey station) for 52 bird species across 10 avian habitat types in the Eagle Plains Project Regional Study Area, June 2019.[1]

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
Waterfowl													
American Wigeon	*Mareca americana*									1.29		0.20	22
Mallard	*Anas platyrhynchos*									0.29		0.05	5
Northern Shoveler	*Spatula clypeata*									0.65		0.10	11
Northern Pintail	*Anas acuta*									0.47		0.07	8
American Green-winged Teal	*Anas crecca*									2.47		0.38	42
Lesser Scaup	*Aythya affinis*									0.41		0.06	7
Bufflehead	*Bucephala albeola*									0.41		0.06	7
Shorebirds													
Red-necked Phalarope	*Phalaropus lobatus*									0.88		0.14	15
Spotted Sandpiper	*Actitis macularius*	0.22										0.02	2
Solitary Sandpiper	*Tringa solitaria*							0.13	0.13		0.01	0.05	5
Lesser Yellowlegs	*Tringa flavipes*	1.44						0.13	0.09		0.01	0.15	17
Baird's Sandpiper	*Calidris bairdii*										0.03	0.02	2

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
Least Sandpiper	*Calidris minutilla*	0.22										0.02	2
Wilson's Snipe	*Gallinago delicata*	0.22	0.04						0.09		0.11	0.12	13
Diurnal Birds of Prey													
Northern Harrier	*Circus hudsonius*										0.01	0.01	1
Red-tailed Hawk	*Buteo jamaicensis*										0.01	0.01	1
Falcons													
Merlin	*Falco columbarius*				0.08							0.01	1
Owls													
Great Gray Owl	*Strix nebulosa*				0.08	0.07						0.02	2
Nightjars													
Common Nighthawk	*Chordeiles minor*						0.09					0.01	1
Woodpeckers													
American Three-toed Woodpecker	*Picoides dorsalis*					0.14		0.13				0.03	3
Songbirds — Jays, Crows and Allies													
Canada Jay	*Perisoreus canadensis*		0.38	0.57	0.69	0.79	0.18	0.25	0.09		0.01	0.51	56
Common Raven	*Corvus corax*										0.03	0.02	2

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
Songbirds — Blackbirds													
Rusty Blackbird	*Euphagus carolinus*	0.78						0.25	0.39		0.01	0.17	19
Songbirds — Thrushes and Allies													
American Robin	*Turdus migratorius*		0.13	0.20	0.31	0.21		0.50	0.13		0.03	0.24	26
Gray-cheeked Thrush	*Catharus minimus*		0.46	0.43		0.14	0.27	0.25	0.04		0.16	0.42	46
Swainson's Thrush	*Catharus ustulatus*		0.25	0.31	0.85	0.79	0.36	0.13	0.09		0.55	0.79	87
Hermit Thrush	*Catharus guttatus*						0.09					0.01	1
Varied Thrush	*Ixoreus naevius*				0.08	0.14					0.05	0.06	7
Songbirds — Flycatcher and Allies													
Olive-sided Flycatcher	*Contopus cooperi*		0.08			0.07	0.09	0.13			0.01	0.05	6
Yellow-bellied Flycatcher	*Empidonax flaviventris*		0.13	0.03				0.13				0.05	5
Alder Flycatcher	*Empidonax alnorum*		0.17			0.07		0.13	0.09			0.07	8
Songbirds — Swallows													
Tree Swallow	*Tachycineta bicolor*										0.04	0.03	3
Songbirds — Sparrows, Finches and Allies													
Pine Grosbeak	*Pinicola enucleator*			0.03		0.14		0.13			0.01	0.05	5

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
American Tree Sparrow	*Spizelloides arborea*		0.54	0.09	0.08	0.07	0.09	0.13	0.39		0.04	0.29	32
Chipping Sparrow	*Spizella passerina*			0.14		0.14					0.04	0.09	10
Savannah Sparrow	*Passerculus sandwichensis*	0.22	0.25					0.13	0.70		0.01	0.24	26
Fox Sparrow	*Passerella iliaca*		0.38	0.09		0.21	0.09	0.38	0.35		0.08	0.30	33
Lincoln's Sparrow	*Melospiza lincolnii*		0.92	0.17	0.08	0.36	0.18	1.50	1.09		0.03	0.68	75
White-crowned Sparrow	*Zonotrichia leucophrys*		1.08	0.29		0.14	0.09	0.63	0.52		0.24	0.67	74
Dark-eyed Junco	*Junco hyemalis*		0.08	0.37	0.15	0.07			0.09		0.08	0.24	26
White-winged Crossbill	*Loxia leucoptera*			0.23		0.36					0.43	0.41	45
Common Redpoll	*Acanthis flammea*		0.25	0.20	0.08	0.07	0.36		0.26		0.30	0.43	47
Songbirds — Chickadees, Nuthatches and Wrens													
Boreal Chickadee	*Poecile hudsonicus*		0.04	0.06		0.21	0.09					0.06	7
Red-breasted Nuthatch	*Sitta canadensis*				0.08		0.09					0.02	2
Songbirds — Warblers													
Ruby-crowned Kinglet	*Corthylio calendula*			0.11	0.23	0.29	0.18		0.04		0.07	0.17	19
Northern Waterthrush	*Parkesia noveboracensis*		0.21				0.36		0.57		0.01	0.21	23
Orange-crowned Warbler	*Leiothlypis celata*		0.25		0.31			0.13			0.03	0.12	13

Species Common Name	Species Scientific Name	Herb (9)	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)	Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)	Unknown (74)	Average Species Detection Rate	Total Species Detections
Yellow Warbler	*Setophaga petechia*		0.17	0.03	0.38	0.14	0.55	0.25	0.57		0.03	0.32	35
Blackpoll Warbler	*Setophaga striata*					0.07						0.01	1
Yellow-rumped Warbler	*Setophaga coronata*		0.25	0.51	0.46	0.79			0.17		0.04	0.44	48
Wilson's Warbler	*Cardellina pusilla*		0.38				0.09		0.26			0.15	16
Songbirds — Others													
Bohemian Waxwing	*Bombycilla garrulus*					0.29						0.04	4
Total Habitat Detections		28	154	135	51	81	36	43	141	117	188	-	**974**

[1] Brackets in column headings indicate the number of survey stations in each avian habitat type. Birds are ordered taxonomically, first by species group then by species. Shaded cells indicate five most abundant species in each habitat (some have up to eight shaded cells due to equivalent detection rates).

Table 2-7. Bird associations for the 10 primary avian habitat types within the Eagle Plains Regional Study Area, June 2019.[1]

Herb (9)[2]	Deciduous/Mixed Shrub (24)	Tall Shrub – Black Spruce (35)	Deciduous/Mixed Forest (13)	Spruce Forest (14)
Lesser Yellowlegs - 1.44	White-crowned Sparrow - 1.08	Canada Jay - 0.57	Swainson's Thrush - 0.85	Canada Jay - 0.79
Rusty Blackbird - 0.78	Lincoln's Sparrow - 0.92	Yellow-rumped Warbler - 0.51	Canada Jay - 0.69	Swainson's Thrush - 0.79
Spotted Sandpiper - 0.22	American Tree Sparrow - 0.54	Gray-cheeked Thrush - 0.43	Yellow-rumped Warbler - 0.46	Yellow-rumped Warbler - 0.79
Least Sandpiper - 0.22	Gray-cheeked Thrush - 0.46	Dark-eyed Junco - 0.37	Yellow Warbler - 0.38	Lincoln's Sparrow - 0.36
Wilson's Snipe - 0.22	Canada Jay - 0.38	Swainson's Thrush - 0.31	American Robin - 0.31	White-winged Crossbill - 0.36
Savannah Sparrow - 0.22	Fox Sparrow - 0.38	White-crowned Sparrow - 0.29	Orange-crowned Warbler - 0.31	Bohemian Waxwing - 0.29
	Wilson's Warbler - 0.38	White-winged Crossbill - 0.23	Ruby-crowned Kinglet - 0.23	Ruby-crowned Kinglet - 0.29
	Swainson's Thrush - 0.25	American Robin - 0.20	Dark-eyed Junco - 0.15	American Robin - 0.21
	Orange-crowned Warbler - 0.25	Common Redpoll - 0.20	Merlin - 0.08	Fox Sparrow - 0.21
	Yellow-rumped Warbler - 0.25	Lincoln's Sparrow - 0.17	Great Gray Owl - 0.08	Boreal Chickadee - 0.21
	Savannah Sparrow - 0.25	Chipping Sparrow - 0.14	Varied Thrush - 0.08	American Three-toed Woodpecker - 0.14
	Common Redpoll - 0.25	Ruby-crowned Kinglet - 0.11	American Tree Sparrow - 0.08	Gray-cheeked Thrush - 0.14
	Northern Waterthrush - 0.21	American Tree Sparrow - 0.09	Lincoln's Sparrow - 0.08	Varied Thrush - 0.14
	Alder Flycatcher - 0.17	Fox Sparrow - 0.09	Common Redpoll - 0.08	Pine Grosbeak - 0.14
	Yellow Warbler - 0.17	Boreal Chickadee - 0.06	Red-breasted Nuthatch - 0.08	Chipping Sparrow - 0.14
	American Robin - 0.13	Yellow-bellied Flycatcher - 0.03		White-crowned Sparrow - 0.14
	Yellow-bellied Flycatcher - 0.13	Pine Grosbeak - 0.03		Yellow Warbler - 0.14
	Olive-sided Flycatcher - 0.08	Yellow Warbler - 0.03		Great Gray Owl - 0.07
	Dark-eyed Junco - 0.08			Olive-sided Flycatcher - 0.07
	Wilson's Snipe - 0.04			Alder Flycatcher - 0.07
	Boreal Chickadee - 0.04			American Tree Sparrow - 0.07
				Dark-eyed Junco - 0.07
				Common Redpoll - 0.07
				Blackpoll Warbler - 0.07

Riparian Spruce Forest (11)	Riparian Coniferous Shrub (8)	Riparian/Wetland Deciduous Shrub (23)	Open Water (17)
Yellow Warbler - 0.55	Lincoln's Sparrow - 1.50	Lincoln's Sparrow - 1.09	American Green-winged Teal - 2.47
Swainson's Thrush - 0.36	White-crowned Sparrow - 0.63	Savannah Sparrow - 0.70	American Wigeon - 1.29
Common Redpoll - 0.36	American Robin - 0.50	Northern Waterthrush - 0.57	Red-necked Phalarope - 0.88
Northern Waterthrush - 0.36	Fox Sparrow - 0.38	Yellow Warbler - 0.57	Northern Shoveler - 0.65
Gray-cheeked Thrush - 0.27	Canada Jay- 0.25	White-crowned Sparrow - 0.52	Northern Pintail - 0.47
Canada Jay - 0.18	Rusty Blackbird - 0.25	Rusty Blackbird - 0.39	Lesser Scaup - 0.41
Lincoln's Sparrow - 0.18	Gray-cheeked Thrush - 0.25	American Tree Sparrow - 0.39	Bufflehead - 0.41
Ruby-crowned Kinglet - 0.18	Yellow Warbler - 0.25	Fox Sparrow - 0.35	Mallard - 0.29
Common Nighthawk - 0.09	Solitary Sandpiper - 0.13	Common Redpoll - 0.26	
Hermit Thrush - 0.09	Lesser Yellowlegs - 0.13	Wilson's Warbler - 0.26	
Olive-sided Flycatcher - 0.09	American Three-toed Woodpecker - 0.13	Yellow-rumped Warbler - 0.17	
American Tree Sparrow - 0.09	Swainson's Thrush - 0.13	Solitary Sandpiper - 0.13	
Fox Sparrow - 0.09	Olive-sided Flycatcher - 0.13	American Robin - 0.13	
White-crowned Sparrow - 0.09	Yellow-bellied Flycatcher - 0.13	Lesser Yellowlegs - 0.09	
Boreal Chickadee - 0.09	Alder Flycatcher - 0.13	Wilson's Snipe - 0.09	
Red-breasted Nuthatch - 0.09	Pine Grosbeak - 0.13	Canada Jay - 0.09	
Wilson's Warbler - 0.09	American Tree Sparrow - 0.13	Swainson's Thrush - 0.09	
	Savannah Sparrow - 0.13	Alder Flycatcher - 0.09	
	Orange-crowned Warbler - 0.13	Dark-eyed Junco - 0.09	
		Gray-cheeked Thrush - 0.04	
		Ruby-crowned Kinglet - 0.04	

[1] Birds listed in descending order of average detection rate (values after the bird names) in each avian habitat type.

[2] Values in the column headings indicate the number of samples per habitat type.

2.4.4 SPECIES OF CONSERVATION CONCERN

Four species observed in the Project RSA (Red-necked Phalarope, Common Nighthawk, Olive-sided Flycatcher, and Rusty Blackbird) were federally listed as either Special Concern or Threatened (Table 2-8). These species are either of regional, national, or continental concern, and two are designated with regional stewardship in BCR 4. The conservation statuses of all potential bird species in the Project area are listed in Attachment Table 2 in Section 2.6.2 (Attachment 2-B). Of those species, three additional species of Conservation Concern are likely to occur in the Project RSA, including Horned Grebe (*Podiceps auritus)*, Short-eared Owl, and Bank Swallow (Table 2-8). Two cliff-nesting raptors listed as 'specially protected' species under the Yukon *Wildlife Act*, Peregrine Falcon and Gyrfalcon, can occur in the broader region but are unlikely to occur in the Project RSA because of a lack of appropriate cliffs. Another 'specially protected' species, Trumpeter Swan (*Cygnus buccinator*; not listed below), is exclusive to southern Yukon and Alaska during the breeding season and, thus, is unlikely to occur in the Project RSA.

Table 2-8. The conservation status and counts of bird species in the Eagle Plains Project RSA.

Species Common Name	COSEWIC[4]	SARA[5]	BCR 4 Priority[6]	Yukon *Wildlife Act*	RSA Count	NABBS Count (2014–2018)
Horned Grebe[1]	SC (Apr 2009)	1 – SC	R – stewardship N/C – concern	No	0	0
Red-necked Phalarope	SC (Nov 2014)	1 – SC	N/C – concern	No	15	0
Peregrine Falcon[2]	NAR (Nov 2017)	–	R – stewardship N/C – concern	Yes	0	0
Gyrfalcon[2]	NAR (Apr 1987)	–	–	Yes	0	0
Short-eared Owl[1]	T (May 2021)	1 – SC	N/C – concern	No	0	4
Common Nighthawk[3]	SC (Apr 2018)	1 – T	N/C – concern	No	1	0
Olive-sided Flycatcher	SC (Apr 2018)	1 – T	R – stewardship R/N/C – concern	No	6	1
Bank Swallow[1]	T (May 2013)	1 – T	–	No	0	0
Rusty Blackbird	SC (Apr 2017)	1 – SC	R – stewardship R/N/C – concern	No	19	1
			Totals		**41**	**6**

[1] Species that are 'Likely' to occur in the Eagle Plains Project RSA.

[2] Cliff-nesting raptors that are 'Likely' to occur in the broader region, but do not have suitable habitat in the Eagle Plains Project RSA.

[3] A species that is 'Possible' in the Eagle Plains Project RSA because of its range limits. One occurrence was observed but status remains uncertain.

[4] Most recent COSEWIC assessments; E = Endangered, NAR = Not at Risk, SC = Special Concern, T = Threatened.

[5] SARA statuses from the latest amended list in May 2023 (Legislative Services Branch 2023); Schedule 1 codes equivalent to COSEWIC.

[6] Priorities, concerns, and stewardships from BCR 4 2013 report; C = Continental, N = National, R = Regional.

2.4.5 ADEQUACY OF ONE YEAR OF SURVEYS

The official guidance provided by the Canadian Wildlife Service for avian baseline studies usually is to conduct at least two years of field surveys (Hanson et al. 2009), and the DRAFT 2022 guidelines emphasize a statistical review of the power to detect changes (ECCC-CWS 2022). Repeat surveys account for annual variation in patterns of bird occurrences and distribution and imperfect detectability associated with bird survey methods. During our initial consultation with CWS we proposed conducting a single year of surveys, dependent on the outcome of the surveys. CWS indicated that they always prefer to see multiple years of data collected. However, they may not raise objections to the Project Proposal if significant avian conservation concerns or information uncertainties do not occur. In our opinion, the one year of multi-species field surveys that we conducted, in combination with the desktop assessment, provides sufficient baseline information about bird species to proceed with the Project Proposal.

2.5 SUMMARY

The purpose of this study was to document the potential occurrence, relative abundance, and habitat associations of birds across the Project's RSA. This study consisted of a combination of a desktop assessment and field surveys. The information presented in this report was collected by Professional Biologists and qualified environmental practitioners, following generally accepted scientific survey designs and methods. The field survey design used a targeted, stratified habitat design to provide a representative sample across the RSA.

Based on range and habitat, 128 species potentially occur in or adjacent to the RSA. Forty-eight (48) were recorded from the North American Breeding Bird Survey data in adjacent areas. Possible species include eight listed under the SARA or identified in the Yukon *Wildlife Act*, and 67 are considered a priority and management concern under the federal Bird Conservation Region 4 Plan. Birds listed under the SARA observed during surveys included Red-necked Phalarope, Common Nighthawk, Olive-sided Flycatcher, and Rusty Blackbird.

Field surveys observed 53 species in the RSA. Point counts identified 42 species, and wetland surveys identified 37 species. Swainson's Hawk was identified via incidental sightings and is an interesting species. It has a disjunct breeding range in North Yukon separated by several hundred kilometres from their primary range to the south. Patterns of species relative abundance and richness (number of species) varied among the different habitat types. Average relative abundance and species richness were the greatest in Spruce Forest, Deciduous and Mixed Shrub, Riparian/Wetland Deciduous Shrub habitats, and lowest in Herb and Tall Shrub – Black Spruce habitats. These patterns were generally related to the structural complexity and productivity of these different habitat types. However, the number of unique species in each habitat did not depend on structural complexity. Many unique species were found in the Herb and Open Water habitats. General patterns of bird occurrence and habitat associations in the RSA are consistent with expectations and correspond with the limited existing information about birds in the area.

2.6 BIRD SECTION ATTACHMENTS

2.6.1 ATTACHMENT 2–A — ECOLOGICAL AND LANDSCAPE CLASSIFICATION ECOSYSTEM UNITS

Ecological and Landscape Classification (ELC) Ecosystem Units (Ecosites)

Codes, names, and descriptions of ecosites assigned *a posteriori* to habitat groups in the Project RSA are listed below.

Attachment Table 1. Ecological Landscape Classification ecosystem units developed for the Eagle Plains Project Regional Study Area.

Code	Name	Description and typical situation
10	Sparsely Vegetated	Vegetative cover <10%.
11	Dry Herb	Area dominated with herbaceous vegetation with very low shrub cover (<5%).
12	Dry Lichen	*Cladonia* sp. (i.e., caribou forage species) dominated areas with very low shrub cover (<5%) typically on south facing slopes.
13	Dry Mix Shrub	Dry shrub dominated areas with very low *Cladonia* sp. (i.e., caribou forage species) cover (<10%); disclimax community.
14	Dry Shrub/ Spruce – Lichen	Dry areas with spruce cover >5% and *Cladonia* sp. (i.e., caribou forage species) cover >10%.
15	Dry Shrub/ Aspen – Lichen	Dry areas with aspen cover >5% and *Cladonia* sp. (i.e., caribou forage species) cover >10%.
16	Dry Spruce – Birch – Lichen	Dry areas with either white spruce, black spruce, and/or Alaskan paper birch cover; spruce, scrub birch, and *Cladonia* sp. (i.e., caribou forage species) cover >10%.
17	Dry Aspen	Dry areas with aspen dominant canopy and very low *Cladonia* (i.e., caribou forage species) cover (<5%).
01	Mesic Herb	Area dominated by herbaceous vegetation with very low shrub cover (<5%); neither disclimax nor successional pathway known. No distinct mottles or seepage present; some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
02	Mesic Birch – Willow	Area has a history of anthropogenic disturbance; regeneration is dominated by either Alaskan paper birch and/or willow species. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
03	Mesic White Spruce – Alaskan Paper Birch – Alder	Area dominated by Alaskan paper birch with mixed-wood understory (i.e., white spruce and alder). Usually found along upper slope to crest positions on gentle to moderate slopes. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
04	Mesic Black Spruce – Alaskan Paper Birch	Area dominated by black spruce and Alaskan paper birch with >30% shrub cover; mid-slope position. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
05	Mesic Alaskan Paper Birch	Area dominated by Alaskan paper birch stands with > 30% shrub cover; mid- to upper-slope position. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).
06	Mesic Black Spruce – Labrador Tea	Area dominated by black spruce with Labrador tea shrub layer; level or mid- to upper-slope position on gentle slopes. No distinct mottles or seepage present, some sites may have permafrost (frozen layer contains no ice crystals or ice layers).

Code	Name	Description and typical situation
20	Shrubby Riparian Birch – Willow	Shrubby riparian area dominated by scrub birch, tea-leaved willow, or diamond leaved willow and bog cranberry; disclimax community.
21	Riparian White Spruce – Prickly Rose	Treed riparian zone dominated by white spruce with a mixture of shrub species; rose usually present.
22	Riparian Spruce – Birch – Willow	Treed riparian zone dominated by white and black spruce, possibly some Alaskan paper birch, and a mixture of shrub species such as scrub birch and willow.
30	Moist Herb	Area dominated with herbaceous vegetation with very low shrub cover (<5%) on gentle to moderate slopes. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths; some ice crystals can be observed in frozen layer.
31	Moist Shrub/ Scrub Birch – Labrador Tea – Willow	Area dominated by scrub birch and Labrador tea with <10% spruce cover; shrub layer has tea-leaved willow. Typically found at level or mid- to upper-slope position on gentle slopes. Successional pathway unknown but considered a shrub disclimax site. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present; some ice crystals can be observed in frozen layer.
32	Moist Shrub/ Spruce – Scrub Birch – Labrador Tea	Area dominated by >10% spruce cover, <5% willow cover, and >15% lowbush cranberry. Typically found at mid to upper slope position on gentle slopes; disclimax community. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths; some ice crystals can be observed in frozen layer.
33	Moist Spruce – Labrador Tea	Area dominated by >15% spruce tree cover. Presence of *Cladonia* sp. (i.e., caribou forage species). Typically found at level or upper-slope position on gentle slopes. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths due to frost boils; some ice crystals can be observed in frozen layer.
34	Moist Spruce – Alder – Labrador Tea	Area dominated by >15% spruce tree cover; alder and *Cladonia* sp. (i.e., caribou forage species) present. Typically found at mid-slope position on gentle slopes. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths due to frost boils; some ice crystals can be observed in frozen layer.
35	Moist Spruce – Scrub Birch – Labrador Tea	Area dominated by <15% spruce tree cover with *Cladonia* sp. (i.e., caribou forage species) present. Typically found at level or gentle slopes. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths due to frost boils; some ice crystals can be observed in frozen layer.
36	Moist Birch – Willow	Area dominated by willow and birch trees, often associated with old anthropogenic disturbances; successional pathway unknown. Faint to distinct mottles can be observed; no seepage or slight seepage present. Permafrost is present but at variable depths due to frost boils; some ice crystals can be observed in frozen layer.
40	Wet Herb	Area dominated with herbaceous vegetation with very low shrub cover (<5%) on level to lower-slope positions. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
41	Wet Shrub – Tamarack	Area with >5% tamarack; low presence of *Cladonia* sp. (i.e., caribou forage species) and high presence of *Sphagnum* sp. or glow moss. Scrub birch and Labrador tea present. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
42	Wet Shrub – Black Spruce – Tussock Cottongrass	Area dominated by >5% black spruce and >10% tussock cottongrass. Labrador tea, scrub birch, *Sphagnum* sp. and *Cladonia* sp. (i.e., caribou forage species) present. Typically found on level ground but also from toe to mid-slope positions; disclimax community. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.

Code	Name	Description and typical situation
43	Wet Shrub – Black Spruce – Sphagnum	Area dominated by >5% black spruce, <10% tussock cottongrass, and >25% *Sphagnum* sp.; disclimax community. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
44	Wet Shrub – Scrub Birch – Tussock Cottongrass	Area dominated by <5% black spruce, >10% scrub birch, and >30% tussock cottongrass; disclimax community. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
45	Wet Shrub – Scrub Birch – Graminoid	Burned area composed of <5% black spruce; dominant shrub is scrub birch, while dominant graminoid is either spruce muskeg sedge or bluejoint reedgrass; disclimax community. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
46	Wet Black Spruce – Labrador Tea – Cladonia	Area with >15% black spruce, >20% *Cladonia* sp. (i.e., caribou forage species), and <5% tussock cottongrass. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
47	Wet Black Spruce – Tussock Cottongrass – Sphagnum	Area with >15% Labrador tea and <10% *Cladonia* sp. (i.e., caribou forage species). Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
48	Wet Black Spruce – Carex	Area dominated by either a spruce muskeg sedge or bluejoint reedgrass herbaceous layer; shrub layer is a mixture of Labrador tea, scrub birch, and willow species with >30% cover. Distinct to prominent mottles; seepage present; permafrost near surface. Ice layer present within or above frozen soil or frozen organic layer.
B1	Bog – Black Spruce – Lichen	Treed or shrubby peatland ecosystem unit with poor nutrient regime within the rooting zone. Stunted black spruce with <50% *Sphagnum* sp. and >10% *Cladonia* sp. (i.e., caribou forage species) ground cover.
B2	Bog – Black Spruce – Sphagnum	Treed or shrubby peatland ecosystem unit with poor nutrient regime within the rooting zone. Stunted black spruce with >50% *Sphagnum* sp. ground cover.
F	Fen	Treed, shrubby, or graminoid peatland ecosystem unit where groundwater inflow maintains relatively high mineral content within the rooting zone. Graminoid fen has >20% *Sphagnum* sp. or moss cover.
M	Marsh	Shallowly flooded mineral wetland ecosystem dominated by emergent vegetation. Area dominated by graminoids and has less than 10% Sphagnum or moss cover.
S	Swamp	Treed or shrubby mineral wetland ecosystem unit with a flowing or fluctuating, semi-permanent, near-surface water table.
W	Shallow Water	Shallow water ecological communities dominated by rooted, water submerged, and floating aquatic plants.
AN	Anthropogenic	An area of anthropogenic disturbance not included in other definitions (e.g., areas cleared for camps).
ES	Exposed Soil	Any area of exposed soil not included in other definitions. Includes areas of recent disturbance (e.g., terrain slides) and human-made disturbances where vegetation cover is <5%.
Fa	Flood Active Channel	Ecological communities scoured by river floodwaters for prolonged periods. Usually dominated by annuals or herbs that can re-sprout from underground structures.
LA	Lake	A body of water >2 m deep or large enough to be classified as a lake (>8 ha).
PD	Pond	A small body of water greater than 2 m deep, but not large enough to be classified as a lake (<8 ha).

Code	Name	Description and typical situation
Rc	Rock Cliff	Ecological communities of vertical rocky sites commonly with some bryophyte cover (rock crusts); small pockets of soils may support vascular vegetation. Also used to map non-vegetated cliffs.
RI	River	A watercourse formed when water flows between continuous, definable banks. The flow may be intermittent or perennial.
Ro	Rock Outcrop	Bluffs and knobs of solid rock with limited soil development and high cover of exposed rock; drought tolerant cryptogams often prominent.
Rt	Rock Talus	Active and inactive talus (i.e., large rocks) and scree (i.e., smaller rocks and more soil); small pockets of soils may support some vascular plants.
RZ	Road	An area cleared and compacted for the purpose of transporting goods and services by vehicle.

2.6.2 ATTACHMENT 2–B — LIST OF ALL POTENTIAL BIRD SPECIES AND THEIR CONSERVATION STATUSES

All bird species with the potential to occur in the Project area:

Names, federal conservation statuses (SARA, COSEWIC), BCR 4 priority, territorial status (i.e., species highlighted by Environment Yukon and those considered of conservation concern in the Yukon Conservation Data Centre track list), and indication of occurrence in the Project RSA for all 128 bird species, are listed below:

Attachment Table 2. List of species with the potential to occur in the Eagle Plains Project Regional Study Area.

Species Common Name[1]	Documented in RSA[2]	COSEWIC[3]	SARA[4]	Environment Yukon (YCDC Track List)[5]	BCR 4 Priority Species[6]
Horned Grebe [L]		SC (Apr 2009)	1 – SC	*	R – stewardship N/C – concern
Red-necked Grebe [L]					R – stewardship
Red-throated Loon [L]					
Pacific Loon [L]					R – stewardship N/C – concern
Common Loon [L]					C – stewardship N/C – concern
American Wigeon [L]	✓				R – stewardship R/N/C – concern
Mallard [L]	✓				R – stewardship N/C – concern
Blue-winged Teal [P]					N/C – concern
Northern Shoveler [L]	✓				R – stewardship
Northern Pintail [L]	✓				R – stewardship N/C – concern
Green-winged Teal [L]	✓				R – stewardship
Canvasback [L]					R – stewardship N/C – concern
Ring-necked Duck [P]					
Greater Scaup [L]					
Lesser Scaup [L]	✓				R – stewardship R/N/C – concern
Harlequin Duck [P]				✓	R – stewardship
Surf Scoter [L]					R – stewardship N/C – concern
White-winged Scoter [L]					R – stewardship N/C – concern
Long-tailed Duck [L]					N/C – concern
Bufflehead [L]	✓				R – stewardship
Common Goldeneye [L]					N/C – concern
Barrow's Goldeneye [L]					R – stewardship

Species Common Name[1]	Documented in RSA[2]	COSEWIC[3]	SARA[4]	Environment Yukon (YCDC Track List)[5]	BCR 4 Priority Species[6]
Red-breasted Merganser [L]					
Greater White-fronted Goose [L]					C – stewardship
Snow Goose [P]				✓	
Brant [P]				✓	
Cackling Goose [P]					
Canada Goose [L]					
Tundra Swan [P]				✓	R – stewardship
Ruffed Grouse [P]					
Spruce Grouse [L]					
Sharp-tailed Grouse [P]				✓	
Willow Ptarmigan [L]					
Rock Ptarmigan [P]					
White-tailed Ptarmigan [P]					R – stewardship
Bald Eagle [L]					
Golden Eagle [L]					R – stewardship
Osprey [L]				✓	
Northern Harrier [L]	✓				
Sharp-shinned Hawk [L]					
Northern Goshawk [L]					R – stewardship
Swainson's Hawk [L]	✓			✓	N/C – concern
Red-tailed Hawk [L]	✓				
Rough-legged Hawk [L]					
Gyrfalcon [L]					
Peregrine Falcon [L]		NAR (Nov 2017)		✓*	R – stewardship N/C – concern
American Kestrel [L]				✓	R – stewardship
Merlin [L]	✓				
Great Horned Owl [L]					
Northern Hawk Owl [L]					R – stewardship
Great Gray Owl [L]	✓				R – stewardship
Short-eared Owl [L]		T (May 2021)	1 – SC	✓*	N/C – concern
Boreal Owl [L]					R – stewardship
American Golden-Plover [P]					N/C – concern
Semipalmated Plover [L]					N/C – concern
Wandering Tattler [P]				✓	R – stewardship
Whimbrel [P]				✓	N/C – concern
Surfbird [P]				✓	R – stewardship N/C – concern
Long-billed Dowitcher [P]					
Red-necked Phalarope [L]	✓	SC (Nov 2014)	1 – SC	*	N/C – concern

Species Common Name[1]	Documented in RSA[2]	COSEWIC[3]	SARA[4]	Environment Yukon (YCDC Track List)[5]	BCR 4 Priority Species[6]
Spotted Sandpiper [L]	✓				R – stewardship
Solitary Sandpiper [L]	✓				R – stewardship N/C – concern
Lesser Yellowlegs [L]	✓				R – stewardship R/N/C – concern
Upland Sandpiper [L]					N/C – concern
Baird's Sandpiper [L]	✓				
Least Sandpiper [L]	✓				
Pectoral Sandpiper [P]					
Semipalmated Sandpiper [P]					
Wilson's Snipe [L]	✓				N/C – concern
Long-tailed Jaeger [P]					
Bonaparte's Gull [P]					R/C – stewardship N/C – concern
Short-billed Gull [L]					R – stewardship
Herring Gull [L]					N/C – concern
Arctic Tern [L]					N/C – concern
Sandhill Crane [L]				✓	
Belted Kingfisher [L]					
Common Nighthawk [P]	✓	SC (Apr 2018)	1 – T	✓*	N/C – concern
Hairy Woodpecker [P]					
American Three-toed Woodpecker [L]	✓				R – stewardship
Northern Flicker [L]					
Olive-sided Flycatcher [L]	✓	SC (Apr 2018)	1 – T	*	R – stewardship R/N/C – concern
Yellow-bellied Flycatcher [L]	✓				
Alder Flycatcher [L]	✓				C – stewardship
Say's Phoebe [L]					
Northern Shrike [L]					R – stewardship
Canada Jay [L]	✓				C – stewardship
Common Raven [L]	✓				
Horned Lark [L]					
Tree Swallow [L]	✓				
Violet-green Swallow [L]					
Bank Swallow [L]		T (May 2013)	1 – T	✓*	
Cliff Swallow [P]					
Boreal Chickadee [L]	✓				R/C – stewardship
Gray-headed Chickadee [P]				✓	R – stewardship
Red-breasted Nuthatch [L]	✓				
American Dipper [P]					

Species Common Name[1]	Documented in RSA[2]	COSEWIC[3]	SARA[4]	Environment Yukon (YCDC Track List)[5]	BCR 4 Priority Species[6]
Ruby-crowned Kinglet [L]	✓				
Northern Waterthrush [L]	✓				
Orange-crowned Warbler [L]	✓				
Yellow Warbler [L]	✓				
Blackpoll Warbler [L]	✓				R – stewardship
Palm Warbler [P]					
Yellow-rumped Warbler [L]	✓				
Townsend's Warbler [L]					R – stewardship
Wilson's Warbler [L]	✓				R – stewardship
American Robin [L]	✓				
Townsend's Solitaire [L]					
Gray-cheeked Thrush [L]	✓				
Swainson's Thrush [L]	✓				
Hermit Thrush [L]	✓				
Varied Thrush [L]	✓				R – stewardship
American Pipit [L]					
Bohemian Waxwing [L]	✓				R/C – stewardship
Lapland Longspur [L]					
Snow Bunting [P]					
Pine Grosbeak [L]	✓				R/C – stewardship
American Tree Sparrow [L]	✓				
Chipping Sparrow [L]	✓				
Savannah Sparrow [L]	✓				
Fox Sparrow [L]	✓				
Lincoln's Sparrow [L]	✓				
Harris's Sparrow [P]		SC (Apr 2017)			
White-crowned Sparrow [L]	✓				R – stewardship
Golden-crowned Sparrow [P]					R – stewardship
Dark-eyed Junco [L]	✓				
Rusty Blackbird [L]	✓	SC (Apr 2017)	1 – SC	✓*	R – stewardship R/N/C – concern
White-winged Crossbill [L]	✓				C – stewardship
Common Redpoll [L]	✓				

[1] Species identified as either 'Likely' (L) or 'Possible' (P) in the Project RSA.

[2] (✓) species observed during surveys or as incidental observations.

[3] Most recent COSEWIC assessments; E = Endangered, NAR = Not at Risk, SC = Special Concern, T = Threatened.

[4] SARA statuses from 2023; Schedule 1 codes equivalent to COSEWIC.

[5] (✓) Yukon Conservation Data Centre 2019 track list species; (*) species at risk highlighted by Environment Yukon

[6] Priorities, concerns, and stewardships from BCR 4 2013 report; C = Continental, N = National, R = Regional.

3 MARTEN

3.1 PURPOSE AND OBJECTIVES

American marten (*Martes americana*; hereafter marten) were selected as a Valued Component (VC) for the Project due to their value as a furbearer, as well as their relevance as an indicator species for mature and old forest values (Buskirk and Ruggiero 1994, Suffice et al. 2017). The VGFN have a community trapline within the RSA and value marten as a furbearer for its economic value, social values associated with trapping, and environmental values as a component of the regional wildlife community.

This section provides a summary of marten ecology in the subarctic taiga. That information is used to develop a habitat model to quantify the quality, amount, and distribution of potential marten habitat across the RSA. A Habitat Suitability Index (HSI) model was developed using relevant environmental data in a GIS to quantify the amount of marten habitat into relative quality categories (i.e., High, Moderate, Low, and Nil/Very Low).

3.2 TRAPPING

According to trapping records, marten were the most heavily trapped species in the two group trapping concessions that overlap the RSA between 2012 and 2018 (Figure 3-1,). Between 2012 and 2018, 715 marten were reported from the two concessions (i.e., 401, 402) overlapping the RSA. The number of marten reported varied widely among the trapping seasons: the greatest harvest was 240 marten reported in 2015 compared to the lowest harvest of 0 marten the following year. Unfortunately, trapping records from 2019 onwards were unavailable for those concessions.

Trapping mortality in marten is biased towards males and juveniles, and harvests that include a high proportion of adult females indicate potential overharvesting (Strickland and Douglas 1987, Hodgman et al. 1994, Fortin and Cantin 2005). Exhaustive trapping removes resident adult marten from the population and allows juveniles to establish home ranges in vacant areas, thus lowering the overall age of the population. Juveniles have lower reproductive output relative to adults; therefore, this change in age structure can lower population fecundity and growth rates (Archibald and Jessup 1984, Fortin and Cantin 2005). Without knowledge of the age and sex structure of harvested marten, it is not possible to assess the sustainability of trapping in the RSA.

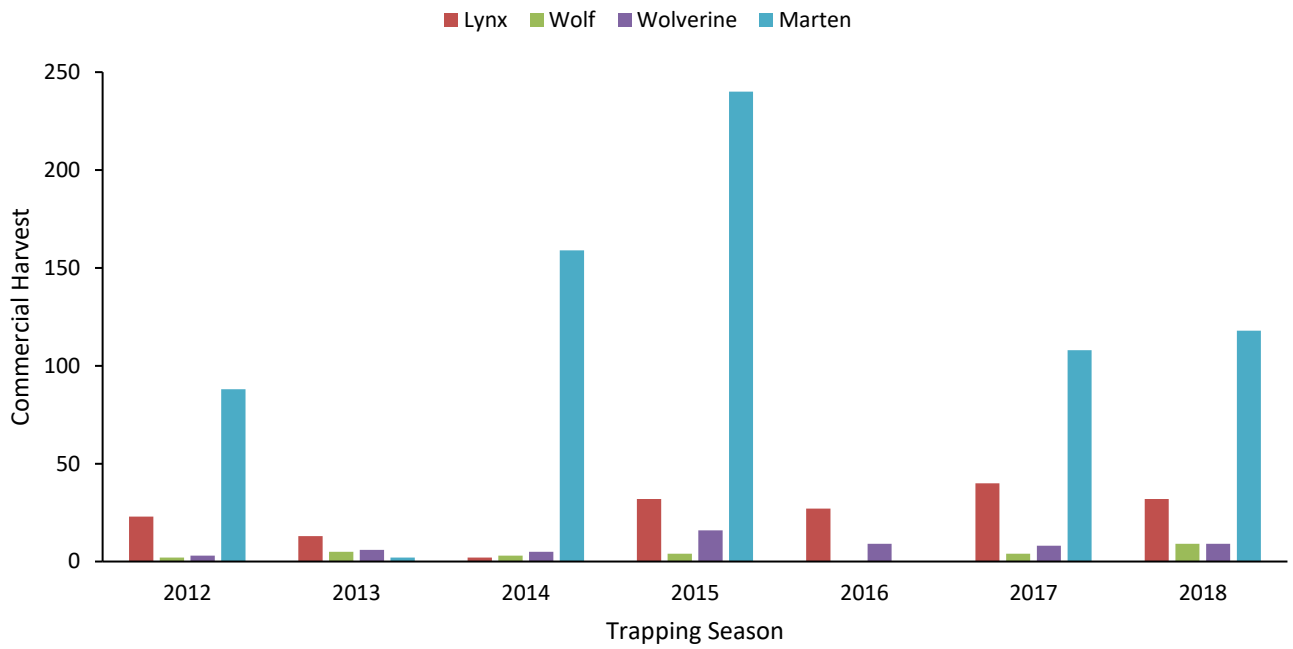
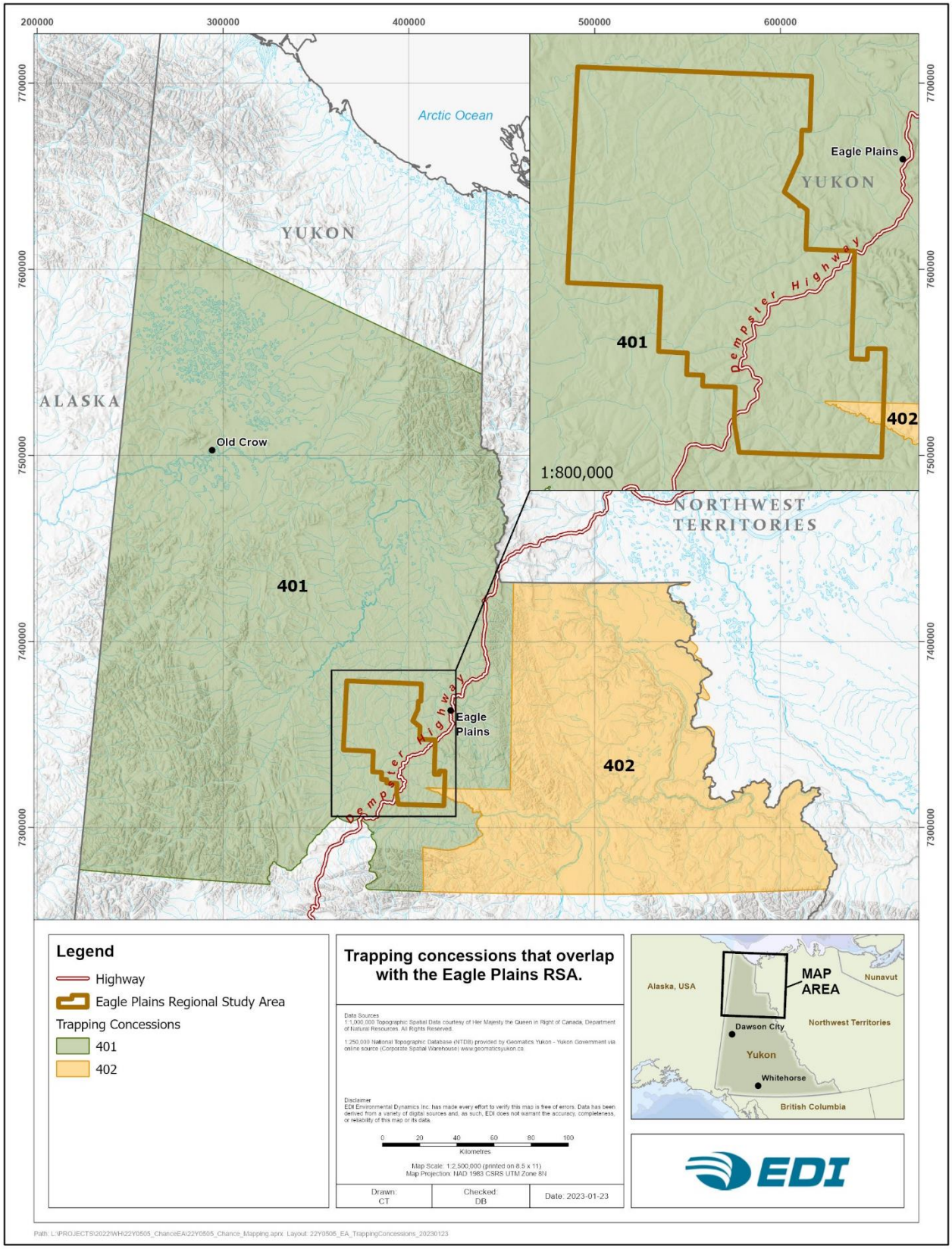


Figure 3-1. Commercial harvest returns for group trapping concessions overlapping the RSA for which records were available.



Map 3-1. Trapping concessions that overlap with the Eagle Plains RSA.

3.3 GENERAL HABITAT ECOLOGY OF MARTEN

The RSA occurs in the boreal taiga, at the northern limit of marten range (Buskirk and Ruggiero 1994, Yukon Ecoregions Working Group 2004a). While marten occur over a contiguous range across northern North America from Labrador to Alaska (Snyder and Bissonette 1987, Buskirk and Ruggiero 1994, Drew 1995, Paragi et al. 1996), little is known about their basic ecology in northern boreal forest and taiga ecosystems (Latour et al. 1994). In more productive forests to the south, marten are often associated with mature forest structures, such as large trees, snags, and coarse woody debris (CWD; Buskirk and Ruggiero 1994, Thompson et al. 2012). However, there is some evidence that in northern boreal forests, marten exploit structural stages with short, stunted trees that are sparsely distributed (Latour et al. 1994, Paragi et al. 1996). Marten in the Alaskan taiga selected habitat types with the greatest amount of CWD and the greatest abundance of vole, rather than canopy cover (Paragi et al. 1996). Across the Yukon forest-to-tundra ecotone, marten preferred open taiga areas rather than boreal forest, and were positively associated with small mammal (i.e., taiga vole [*Microtus xanthognatus*], and red-backed vole [*Myodes* spp.]) biomass (Pretzlaw 2006). Therefore, occurrence and habitat selection patterns for marten in northern boreal and taiga ecosystems can differ from those described elsewhere in North America (Pretzlaw 2006).

During 2015 and 2016, EDI performed snow tracking surveys to quantify the presence and distribution of furbearers and ungulates south of Dawson, Yukon (EDI Environmental Dynamics Inc. 2017). Snow tracking transects covered various habitat types, including 49% shrub, 13% coniferous, 10% herbs, 8% exposed land, 7% frozen rivers, and 13% other classes (i.e., broadleaf, mixedwood, rock/rubble, wetland). Marten tracks occurred in shrubland 51% of the time, coniferous forest 15% of the time, and herb sites 10% of the time. These results indicate that marten occurred across all major vegetated habitat types approximately in proportion to their availability on the landscape (EDI Environmental Dynamics Inc. 2017).

Home ranges of marten in the taiga are larger than in other regions of North America (Latour et al. 1994). In the Mackenzie Valley, NWT, mean home range sizes of adult males were 1,420 ha, and those of adult females were 680 ha. Overall, mean home range size of adult marten was 1,110 ha (Latour et al. 1994). In contrast, the average size of a marten home range in British Columbia (BC) is 525 ha for males and 316 ha for females, and in Ontario, the size of a typical marten home range is between 390 and 660 ha (Lofroth 1993, Manlick et al. 2017a). Marten density in the taiga (the carrying capacity) is likely limited by the availability of arboreal cavities for natal denning, subnivean CWD sites and underground shelters, small mammal abundance, predation, and intraguild competition (Brainerd et al. 1995). The estimated minimum density of marten was 0.0016/ha in the Mackenzie Valley, NWT (Latour et al. 1994), and 0.0025/ha in the Alaskan taiga (Paragi et al. 1996). The estimated fall density of resident adults in the northern boreal region of the Yukon was 0.006/ha (Archibald and Jessup 1984).

3.3.1 FORAGING

Marten habitat selection in the Eagle Plains Ecoregion may depend largely on prey distribution and availability (Paragi et al. 1996). Taiga vole are the prey most selected by marten in the Alaskan taiga, likely due to their larger size (mean weight = 54 g) relative to red-backed vole (mean weight = 20 g; Paragi et al. 1996). Potential

and confirmed mammalian prey in the taiga includes snowshoe hare (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*), red-backed vole, taiga vole, lemmings (*Lemmus* spp., *Dicrostonyx* spp.), and to a lesser extent, deer mice (*Peromyscus maniculatus*) (Paragi et al. 1996). Non-migratory grouse, including willow ptarmigan and spruce grouse, are available year-round and are likely prey for marten in the taiga (Paragi et al. 1996). However, marten are dietary generalists and their diet fluctuates seasonally with the breeding cycles of small mammal prey, bird migration and nesting periods, and fruiting periods of understory plants (Ben-David et al. 1997, Carlson et al. 2014, Twining et al. 2019).

In northern latitudes, marten foraging and population dynamics are influenced by fluctuations in the abundance of small mammal prey (Zielinski 2000). Multiple scat analyses in the NWT and Alaska found that small rodents, including vole and lemming, were the most important diet item for marten (Buskirk and Ruggiero 1994). Small rodents in northern regions undergo relatively large periodic fluctuations in population size (Krebs 1996). Marten populations are likely tightly coupled with these small mammal population cycles due to the relatively low diversity of mammalian prey species in the Eagle Plains Ecoregion (Yukon Ecoregions Working Group 2004a, Roth et al. 2007). Marten abundance and fecundity are correlated with temporal variability in the abundance of preferred prey, likely due to nutritionally demanding processes associated with reproduction and juvenile recruitment (Carlson et al. 2014, Flynn and Schumacher 2016).

Previous research has shown berries to be most important for marten diet during the summer and fall (July–November) when fruit availability is greatest (Baker 1992, Schaumann and Heinken 2002, Twining et al. 2019). Further, there is recent evidence that *Vaccinium* fruit are also an important winter food item for marten in coastal areas where they remain accessible year-round (Banner et al. 2014, Eriksson et al. 2019). Similarly, common juniper (*Juniperus communis*) berries are an important winter food item for marten in other regions (Hargis and McCullough 1984). Therefore, marten in the RSA likely consume fruit from several species of shrub depending on habitat and season, including blueberry and lowbush cranberry in upland woodlands, and crowberry (*Empetrum nigrum*), lingonberry, cloudberry (*Rubus chamaemorus*), and bog cranberry (*Vaccinium oxycoccos*) in lowland black spruce-shrub sites (Yukon Ecoregions Working Group 2004a).

The diet of marten in interior regions of North America is typically dominated by species of voles associated with structurally complex forests (Thompson and Colgan 1994, Poole et al. 2004, Eriksson et al. 2019). Habitat structures normally associated with old forests, including stumps, snags, and large pieces of downed wood, provide subnivean access to small mammal prey in areas with deep snow (Zielinski et al. 1983, Baker 1992, Delheimer et al. 2019). However, within the Yukon, red-backed voles are present across all vegetation types and appear to be more abundant in subalpine shrub habitats than lower elevation boreal forests (Pretzlaw 2006, EDI Environmental Dynamics Inc. 2017). Taiga vole are restricted to the taiga and avoid forest cover (Pretzlaw 2006). Taiga vole in Alaska appear to select post-fire structural stages and are found in black spruce forests, birch forests, forest-grassland edge, and grasslands (Wolff and Lidicker Jr. 1980). Provided there is sufficient understory shrub cover, habitat used for foraging is probably directly associated with increased prey availability regardless of forest age or structural stage (Keim et al. 2011, Vigeant-Langlois and Desrochers 2011).

3.3.2 COVER

Across much of their distribution, marten select home ranges with old or late-mature forests and avoid recently cut forests (Chapin et al. 1998, Bridger et al. 2017, Suffice et al. 2017). Older forests contain complex woody structures, including mature trees, stumps, snags, and large pieces of CWD that marten require to meet many life history requirements, including thermal cover and escape cover from predators (Zielinski et al. 1983, Mowat 2006a, Andruskiw et al. 2008). Shrub cover can also be an important factor influencing marten habitat quality, as marten use understory shrubs as cover from aerial predators such as Northern Goshawk (*Accipiter gentilis*; Poole et al. 2004, Zielinski et al. 2005, Slauson et al. 2007).

Important habitat features typically associated with old forests, including stumps, snags, and large pieces of downed wood, provide subnivean access to winter denning in areas with deep snow (Zielinski et al. 1983, Baker 1992, Delheimer et al. 2019). A winter den is a structure that may be used repeatedly for resting for prolonged periods (Birks et al. 2005). Natal dens are used for parturition and kit rearing during the breeding season, and may be used as resting sites in other seasons (Birks et al. 2005). A scarcity of tree cavities leads marten to use denning sites that provide suboptimal thermal cover and escape from predators (Birks et al. 2005). Marten dens may be found in tree branches, bird nests, rock crevices, underground burrows, occupied houses, nest boxes, or barns (Birks et al. 2005). Therefore, marten may use a range of below or above-ground structures for winter denning in the RSA, regardless of forest age or structural stage.

3.3.2.1 Thermal Cover

In winter, marten possess limited energy reserves and must reduce energetic costs by seeking insulated resting sites (Spencer 1987, Buskirk et al. 1989, Brainerd et al. 1995). Marten are shown to be more dependent on subnivean resting sites at more northern latitudes (Brainerd et al. 1995). Marten's choice of resting above or below snow cover depends on the ambient air temperature relative to the temperature in a microenvironment; in other words, marten are more likely to rest wherever is warmest (Buskirk et al. 1989). In Scandinavia, marten seek underground or subnivean resting sites instead of arboreal sites when the ambient air temperature is very low (Brainerd et al. 1995). Any subnivean spaces not entirely surrounded by snow are suitable; however, CWD is best in terms of thermal properties (Buskirk et al. 1989). Therefore, thermal cover generally increases with increased coniferous cover and associated CWD. Rock provides some protection from digging predators; however, rock provides poor insulation than wood, and rock dens may contain organic bedding for insulation (Buskirk et al. 1989, Birks et al. 2005).

3.3.2.2 Escape Cover

As a mesocarnivore, pressure from competition and predation can play an important role in the population dynamics of marten populations (Kiseleva 2012, Manlick et al. 2017b). Aside from marten, wolf (*Canis lupus*), red fox (*Vulpes vulpes*), lynx (*Lynx canadensis*), and wolverine (*Gulo gulo*) are the primary mammalian predators in the Eagle Plains Ecoregion. Marten likely select habitat with sufficient escape cover (e.g., medium-sized coniferous trees and CWD) to avoid risk of intraguild predation by these species (Slauson et al. 2007, Eriksson

et al. 2019). Furthermore, marten within the Eagle Plains Ecoregion compete with least weasel (*Mustela nivalis*), lynx, and red fox for shared small mammal prey (Slough and Jung 2007).

Marten in North America select home ranges that contain vertical forest or understory shrub cover where they perceive lower risk of predation from aerial predators as well as larger carnivores that, depending on the system they occupy, includes mustelid, canid, and felid species (Slauson et al., 2007; Eriksson et al., 2019). Red fox are the most generalist and widespread carnivore in the northern boreal-tundra ecotone, and may limit marten populations through intraguild predation (Lindström et al. 1995, Birks et al. 2005, Pretzlaw 2006). Therefore, fox predation may force marten to remain arboreal and den above ground (Birks et al. 2005). Aerial predators include Northern Goshawk and Great Horned Owl (*Bubo virginianus*), both of which are predators of marten in other regions and occur year-round in forests in the Yukon (Bull and Heater 2001, Doyle and Smith 2001, Sinclair et al. 2003). Golden Eagle also occur in northern Yukon during the breeding season and may be predators of marten. However, marten may perceive a lower risk of predation in open woodlands and shrublands of the Eagle Plains due to the absence of several predators of marten in more southern biomes, including bobcat (*Lynx rufus*) and coyote (*Canis latrans*; Thompson and Colgan 1994, Bull and Heater 2000, Moriarty et al. 2016).

3.3.3 REPRODUCTION

Natal dens are used for the parturition and rearing of neonates and are critical for recruitment and population viability (Buskirk and Ruggiero 1994). Across North America, most natal dens are found in structurally complex sites (Buskirk and Ruggiero 1994). Marten prefer arboreal cavities for parturition and rearing neonates due to the shelter they provide from terrestrial predators, including red fox (Spencer 1987, Brainerd et al. 1995). Marten kits are very vulnerable to fox predation when kits move out of arboreal dens (Brainerd et al. 1995). However, scarcity of arboreal cavities may force marten to use alternative structures for natal denning (Birks et al. 2005). For example, arboreal cavities are rarely used as resting sites in Finland and northern Russia (Brainerd et al. 1995). In the NWT, an adult female marten denned and produced young within a 21-year-old burn (Latour et al. 1994). Therefore, a better understanding of habitat selection by adult female marten in the taiga is needed (Paragi et al. 1996).

3.3.4 DISPERSAL

North American marten are sensitive to forest fragmentation and are found across landscapes with greater amounts of contiguous forest (Thompson et al. 2012). Previous studies show that 5 km of nonforested habitat between forest patches is an effective barrier to dispersal for marten (Buskirk and Ruggiero 1994). Timber harvesting and extensive road networks increase the density of forest edges and generally reduce habitat connectivity for species such as marten adapted to forest interiors (Robitaille and Aubry 2000, Mowat 2006b). However, marten use narrow strips of forest and abandoned roads as movement corridors between more suitable patches of mature forest (Potvin and Bertrand 2004, Breault et al. 2021).

Furthermore, there is evidence that in regions with sparse forest cover, marten may be adapted to meet certain resource requirements in nonforested habitats. For example, in Scotland, forest habitat is limited and pine

marten (*Martes martes*) consistently use matrix habitats, including scrub and tussock grassland, to meet life history requirements (Caryl et al. 2012). Intensively managed forests in Scotland lack resources such as den sites and important prey (e.g., short-tailed field vole [*Microtus agrestis*]), abundant in grasslands long thought to be impermeable to marten movement or at best suboptimal marten habitat (Caryl et al. 2012).

Cold temperatures and high seasonality result in different patterns of habitat use among marten in North America (Zielinski et al. 1983). Marten habitat selection was investigated in the Alaskan taiga in a landscape composed of mature coniferous forests of black spruce and larch (*Larix laricina*) from 5–20 cm diameter at breast height (DBH) 100–115 years post-fire, as well as dense, young forests 30 years post-fire, and tall shrub and pole sapling forests with some moss and herb structural stages 10 years post-fire (Paragi et al. 1996). Marten abundance, hunting intensity (based on snow-tracking), and CWD density were the greatest in 10-year burns relative to 30-year burns and mature forests (Paragi et al. 1996).

However, this study found that juveniles were more common in recent burns than in mature stands, and recent burns were likely used only by nonbreeding marten (Paragi et al. 1996). Non-transient marten used coniferous forest more often than transient adult and juvenile marten, which were more likely to use scrub habitat (Paragi et al. 1996). For natal denning, resources are limited in herb and shrub structural stages and prey populations are unpredictable relative to mature forests (Paragi et al. 1996). Therefore, post-fire clearings may be only suitable for dispersing juveniles and transient adult marten (Paragi et al. 1996). Herb and shrub structural stages may function as population sinks for immature and transient marten dispersing from contiguous mature forest (Paragi et al. 1996). Previous HSI models for marten in the taiga have ranked nonforested habitats, including post-fire clearing and shrubland as low-suitability habitat (EDI Environmental Dynamics Inc. 2018). However, habitat requirements of breeding marten in the taiga are not well-understood (Paragi et al. 1996).

3.3.5 DISTURBANCE

3.3.5.1 Fire

Marten are dietary generalists and are not limited to prey associated with mature/old forest structural stages (Baker 1992, Paragi et al. 1996, Poole et al. 2004). Marten in the Alaskan taiga use snags and windthrown trees as winter cover in recent burns before coniferous regeneration occurs (Paragi et al. 1996). Trappers in Alaska view fire as beneficial to furbearer populations. Rodent prey, including red-backed vole, tundra vole (*Microtus oeconomus*), meadow vole (*Microtus drummondii*), and taiga vole, are abundant in dense herbaceous vegetation growth following recent fires (Stephenson 1984). Extensive use of post-fire clearings occurred by marten 1– 3 years post-fire. High population abundance occurs within 3–10 years post-burn, with activity centred in unburned inclusions and burn edges (Stephenson 1984).

In the Alaskan taiga, marten abundance, frequency of investigations, hunting intensity, and CWD density were greatest in 10-year burns relative to older burns and mature forest (Paragi et al. 1996). Subnivean access based on tracks was greatest in 10-year burns relative to mature forests and 30-year burns (Paragi et al. 1996). Small mammal biomass and diversity were greatest in the 10-year burn. This structural stage provided a more stable

prey base due to greater diversity of rodents and more stable populations of red-backed vole (Paragi et al. 1996). Young forests 30 years post-fire had the least stable small mammal populations and lacked taiga voles, the prey most selected by marten in this study (Paragi et al. 1996). The suitability of post-fire clearings for marten may be low at first and increase 6–10 years post-fire as ground cover recovers and small mammals occupy the habitat (Paragi et al. 1996). Suitability begins to decrease 15–20 years post-fire and reaches minimum suitability 25–30 years post-fire when CWD has fully decayed and young forests establish. These forests lack near-ground structures for subnivean foraging, escape cover, denning, and resting sites (Paragi et al. 1996).

Adult marten in the NWT were more likely to have home ranges in unburned stands than burned stands (Latour et al. 1994). Unburned forests were open, 90-year-old black spruce-herb, or black spruce-bog forests with average tree height from 5–10 m, and average DBH from 4–14 cm (Latour et al. 1994). Burned stands were characterized by regeneration of open to sparse deciduous vegetation (40% bare ground), a primarily willow shrub layer, and a birch/balsam fir canopy (Latour et al. 1994). Wet areas were characterized by moss, lichen, and Labrador-tea in the understory with sparse, stunted black spruce in the tree layer (Latour et al. 1994). Long-term use by adult marten within home ranges indicated greater use of unburned forests relative to burned forests (Latour et al. 1994). In burns, most snags remained standing and deadfall lay directly on the ground; therefore, burns did not provide access to subnivean spaces, and hunting was mostly on the surface of snow with little protection from predation (Latour et al. 1994). However, an adult female marten with a home range partially within a burn, denned and produced young within the 21-year-old burn (Latour et al. 1994). Furthermore, home ranges of 1 adult and 1 juvenile tracked for 14 and 15 months were entirely within the burns (Latour et al. 1994). Using post-fire structural stages by breeding marten in the taiga is not well understood and should be explored in future studies (Paragi et al. 1996).

3.3.5.2 Roads

The Dempster Highway runs roughly southwest to northeast through the southern half of the RSA. The RSA includes numerous winter roads (15 m average width) from previous exploration activities dating back to the 1960s. Project activities will be accessed via existing and new winter roads. Generally, marten avoid open areas and areas of high human disturbance, including roads (Hargis et al. 1999, Potvin et al. 2000). Marten in North America generally avoid roads due to increased predation risk and lower availability of preferred prey; however, predation risk is assumed to be low in the RSA because primary predators of adult marten are absent or at low density in the Eagle Plains Ecoregion (Yukon Ecoregions Working Group 2004a, Moriarty et al. 2011, 2015, Joyce 2018). Therefore, marten may perceive a lower risk of predation along roads within the RSA due to the absence of several predators of marten in more southern biomes (Bull and Heater 2001, Mowat 2006a, Thompson et al. 2012). Further, abandoned roads (5 m average width) may provide easier pathways for marten movement than undisturbed forest and greater cover from aerial predators than openings (Breault et al. 2021). However, extensive road networks may fragment woodland and shrubland, reducing habitat connectivity and limiting marten dispersal (Caryl et al. 2012).

3.3.5.3 Seismic Lines

The RSA contains numerous 2D seismic lines (range = 5–8 m wide, mean = 5.4 m wide) from previous exploration activities dating back to the 1960s. Most 2D exploration occurred between 1961 and 1984, with new 2D exploration in 2001 incorporating Low Impact Seismic (LIS) techniques(Access Consulting Group and EBA Engineering Consultants Ltd. 2001, GEOTIR 2014). Approximately 2,200 km of new 3D LIS exploration (1.5–3 m wide) was conducted in a 32,500 ha area between November 2013 and April 2014 (GEOTIR 2014). This new 3D exploration is located near the RSA's centre, north and south of the Dempster Highway. The entire RSA, including legacy and contemporary seismic lines, was assessed as a linear feature study. There were signs of normal and magnified succession on 2D and 3D seismic lines. Among 2D lines, 89% had growth >1.5 m height and were considered fully recovered, and 22% of 2D lines made in the 1950s and 1960s showed magnified succession. All 3D lines were made in 2014 and showed normal succession.

In the northern boreal forest (i.e., southwest NWT, northeast BC, and northwest Alberta), marten use of seismic lines is strongly influenced by line width and state of regeneration (Tigner et al. 2015). In this study, forests were open black spruce bogs in lowlands, and upland white spruce-aspen with dense shrubs. Remote wildlife cameras were used to quantify marten use of seismic lines relative to adjacent interior forests. Marten were detected in open lines >3 m wide up to 90% less than forest interiors, but were detected in open lines <2 m wide or lines >6 m with at least partially recovery roughly equally to forest interiors (Tigner et al. 2015). Use of seismic lines is thought to be driven by the perceived risk of predation; marten avoid open habitats but use disturbed habitats following sufficient recovery of overhead and lateral cover (Tigner et al. 2015).

3.3.6 HABITAT SUMMARY

In more productive forests to the south, marten are often associated with mature forest structures, such as large trees, snags, and CWD (Buskirk and Ruggiero 1994, Thompson et al. 2012). Marten select habitats with structural complexity which provides subnivean access to small mammal prey, thermal cover, escape cover from predators, as well as natal denning sites (Spencer et al. 1983, Buskirk and Ruggiero 1994, Latour et al. 1994, Paragi et al. 1996). Within the Subarctic Bioclimate Region, characterized by stunted, open canopy spruce-dominated habitats, tree growth is often limited by the presence of permafrost resulting in disclimax vegetation communities with tall and low shrub structural stages. Therefore, patterns of habitat selection of marten in the RSA may differ from those in southern biomes (Pretzlaw 2006).

Habitat quality in the RSA should be evaluated within the context of reduced availability of old forest structures and lack of contiguous, coniferous forests in the Eagle Plains Ecoregion. Marten select habitat types with the most large pieces of downed wood and the largest standing live and dead trees available at the landscape scale (Zielinski et al. 1983, Baker 1992, Delheimer et al. 2019). Trees, snags, and CWD >30 cm in diameter are associated with older structural stages within the RSA. These structures would be considered too small to provide thermal cover and support natal denning requirements for marten elsewhere in North America (Buskirk et al. 1989, Delheimer et al. 2019). However, these structures are likely large enough to provide thermal cover and support natal denning requirements for marten in the northern context of the RSA (Spencer 1987, Brainerd et al. 1995).

3.4 METHODS

An HSI model was used to estimate habitat quality across the RSA (U.S. Fish and Wildlife Service 1980). An HSI model, also referred to as a knowledge-based habitat suitability model (Clarke 2012), is a common method for assessing habitat quality for wildlife species, and a method adapted for use in environmental impact assessments (U.S. Fish and Wildlife Service 1980). Habitat is defined as the particular place occupied by a specific population within a community and usually characterized by the dominant plant form or physical characteristics (U.S. Fish and Wildlife Service 1980). Each species requires habitat to supply space, food, cover, water, and other requirements for survival (U.S. Fish and Wildlife Service 1980). Suitability is defined as the habitat's ability, in its current structural stage, to provide the life requisites of the species (Resources Inventory Committee 1999c).

3.4.1 HABITAT SUITABILITY MODELLING

HSI modelling uses spatial datasets such as land cover, disturbance history, and topography. It ranks available habitats according to their ability to support a selected species. The habitat rankings can be based on various sources, including ecological survey data, local knowledge, expert knowledge, and traditional knowledge. HSI models can be based on suitability ratings for one habitat variable or the combination of ratings for multiple variables to quantify the quality, amount and distribution of potential habitat for the species (Dijak and Rittenhouse 2009).

3.4.1.1 Rating Scheme

Habitat ranking schemes reflect knowledge of the species' habitat use and ecology (Resources Inventory Committee 1999). A 4-class system was chosen to rank habitat suitability in this study because there is an intermediate level of knowledge of habitat quality for marten in the taiga (Resources Inventory Committee 1999, EDI Environmental Dynamics Inc. 2018). Thus, habitat was assigned a suitability ranking of High (H), Moderate (M), Low (L), or Nil/Very Low (N/VL) relative to the range of habitat quality across the RSA. Using a mathematical equation, the HSI score was produced by combining suitability ratings for several specific habitat variables (e.g., vegetation community type) into one final HSI score.

The developed habitat model produced HSI scores ranging from 0 to 1. Scores were used rather than classes to combine scores and adjustments from multiple variables into a final HSI score. Scores were categorized into four qualitative categories: High (>0.75 to 1.0), Moderate (>0.50 to 0.75), Low (>0.25 to 0.50), Nil/Very Low (>0.0 to 0.25; Resources Inventory Committee 1999). The rating categories correspond to qualitative predictions of the relative suitability of the habitat for supporting five life requisites of marten: reproduction, thermal cover, escape cover, foraging, and dispersal. High-quality habitat supports all five life requisites. Moderate-quality habitat supports escape cover, foraging, and dispersal. Low-quality habitat only supports limited foraging and dispersal. Nil/Very Low-quality habitat does not contribute significantly to any life requisites; however, herb and shrub structural stages and stunted disclimax forest areas likely function as permeable barriers and allow intra-territorial movements within marten home ranges (Caryl et al. 2012). Habitat conditions and suitability interpretations for each rating class are provided in Table 3-1.

Table 3-1. Description of habitat rating classes used in the marten HSI model.

HSI Score	Habitat Rating	Description
>0.75 to 1.0	High	Suitable (optimal). Provides conditions for natal denning (large live conifer trees, large snags, large CWD), thermal cover (medium/large-sized elevated CWD subnivean), escape cover, foraging, and dispersal.
>0.50 to 0.75	Moderate	Suitable (suboptimal). Provides conditions for escape cover (small/medium-sized live or dead conifer trees, and/or small CWD, and/or dense shrub cover), foraging, and dispersal.
>0.25 to 0.50	Low	Limited Suitability. Provides conditions for foraging (i.e., any size or species of tree that would support prey species and CWD large enough for subnivean access; grass and/or horsetails for hare, voles, birds, and/or berries for prey or marten), and dispersal (i.e., some herb or sparse deciduous/shrub cover).
>0.0 to 0.25	Nil/Very Low	Unsuitable. Non-vegetated areas, such as alpine, water, or highways, that do not provide conditions to support any life requisites for marten. Non-vegetated areas may be used for intra-territorial movements.

3.4.1.2 Habitat Variables

Habitat variables were identified as potentially important for describing marten habitat (Table 3-2). Variables were evaluated for inclusion based on the strength of relationships found in other studies, the ecological relevance to marten in the Eagle Plains Ecoregion, and the availability of the variable in GIS databases for the RSA. Based on these criteria, ELC and Linear Feature (LF) data were included in marten habitat modelling.

Distance to riparian areas was considered for inclusion in the model. Riparian areas are important foraging habitat for marten in North America (Spencer et al. 1983, Ben-David et al. 1997), and elder members of the VGFN observed good marten habitat in the area where the Blackstone and Peel rivers meet (Sherry and Vuntut Gwitchin First Nation 1999, p. 140). Riparian areas generally have greater prey availability relative to the surrounding landscape due to higher densities of prey and greater volumes of CWD, which increase access to subnivean spaces (Buskirk et al. 1989). ELC data accurately represent increased habitat quality in mature/old riparian forests found as narrow strips along most major watercourses in the RSA, including Chance Creek in the northwest and Dalglish Creek in the southeast. Therefore, a variable for distance to riparian was redundant with the ELC mapping and was not included in the model.

The history of fire disturbance has influenced marten distribution and was considered for inclusion in the model. However, the nature of the relationship between fire history and patterns of use by marten is unclear for the taiga biome. Recent burns and post-fire clearings are generally considered suboptimal habitat. They are used mainly by nonbreeding and dispersing juvenile marten (Paragi et al. 1996). In the NWT, adult martens were likelier to locate home ranges in unburned stands than burned ones (Latour et al. 1994). However, recent burns may provide foraging opportunities not present in older burns or mature forests (Paragi et al. 1996). Furthermore, fire history was explicitly accounted for in the structural stage of the ELC mapping. Therefore,

a separate variable for fire history was determined to be redundant with ELC mapping and was not included in the model.

Elevation was considered as a variable for inclusion in the model. Marten generally occur at higher elevations than similarly-sized mesocarnivores, due to adaptations for travelling over snowpack and hunting in subnivean spaces (Grinnell et al. 1937, Zielinski et al. 2005, 2017). However, elevation within the rolling topography of the RSA does not vary substantially (range = 343–752 m asl) and was likely not a significant driver of marten distribution. Therefore, elevation was not included as a variable in the model.

Table 3-2. Summary of habitat variables commonly associated with marten habitat quality from published literature relevant to the Regional Study Area.

Variable	Included in model?	Rationale
Ecosite (ELC)	Yes	Marten select conifer-dominated stands with dense shrub cover.
Structural Stage (ELC)	Yes	Marten select mature/old forests with complex structure.
Distance to Riparian	No	Most ecosites defined by permafrost rather than riparian. ELC data more accurately represent increased habitat quality in mature/old riparian forests than distance to riparian.
Linear Features	Yes	Generally, marten avoid linear features due to increased predation risk. It is included as a habitat modifier/downgrade to adjacent habitat.
Fire History	No	Different patterns of use by marten depending on study. Fire may affect habitat quality positively or negatively, dependent on ecosite and time since disturbance. Fire history was explicitly accounted for in the structural stage of the ELC mapping. Therefore, it would be redundant to include it in the model.
Elevation	No	Range in elevation within RSA (343–752 m asl) is not enough to affect marten distribution.

Ecological and Landscape Classification

ELC mapping refers to an integrated approach to mapping and classifying land units according to their ecological similarity (Environment Yukon 2016a). As part of another study in the RSA (EDI Environmental Dynamics Inc 2021), field plots were used to establish preliminary classification units and site/soil conditions across various ecological communities. The vegetation association organization and ecosite and coding system follows the Yukon ELC Mapping Guidelines (Environment Yukon 2016a). Non-forested and sparsely/non-vegetated ecosystem were assigned to group/realm following *Biogeoclimatic Ecosystem Classification of Non-forested Ecosystems in British Columbia* (BC MFLNRORD and BC MOE 2010, Mackenzie 2012), and anthropogenic units were classified following *Standards for Terrestrial Ecosystem Mapping in British Columbia* (Resources Inventory Committee 1998a). Wetland sites were classified according to the Canadian Wetland Classification System for class, form, subform, type and subtype.

The remaining ecosites were coded with a two-digit number that indicates, by its number series, a certain range of soil moisture conditions: 10s are dry sites, 00s are mesic sites, 20s are riparian sites, 30s are moist

sites, and 40s are wet sites. Ecosite names reflect plant species that are important indicators of the vegetation found within the ecosite (e.g., 33 – Moist Spruce – Labrador Tea).

Biologists delineated ELC polygons in a GIS based on discernible differences among vegetation, topography, terrain, soils, gradients, and patterns (relationship patterns between ecosystem units, polygon shape and orientation). Three or fewer ecosystem units (i.e., ecosites) were entered per polygon. Each ecosite had an associated structural stage modifier (e.g., pole sapling) and decile, representing the percent area of the polygon in each ecosite (i.e., all deciles sum to 100%).

A subsample (n = 97) of ELC field plots were used to describe habitat suitability rankings for marten within the context of the Eagle Plains Ecoregion. Field plots were identified as High (n = 10), Moderate/high (n = 21), Moderate (n = 20), Moderate/low (n = 44), and Low (n = 2). No field plots were in Nil/Very Low habitat suitability. ELC ecosites and structural stages were used to generalize habitat rankings from field plots to ELC GIS data (Table 3-3).

Every combination of ecosite and structural stage was assigned an initial HSI score of High (HSI >0.67 to 1.0), Moderate (HSI >0.33 to 0.67), Low (HSI >0 to 0.33), or Nil/Very Low (HSI = 0). Only ecosites and structural stages represented in the RSA were included in habitat modelling. All non-vegetated ecosites (AN, ES, Fa, LA, PD, RI, RZ) were ranked as Nil/Very Low (0.0). Vegetated ecosites in the non-vegetated structural stage (1) were ranked as Nil/Very Low (0.0). Ecosite 10 (sparsely vegetated) was ranked as Nil/Very Low (0.0) regardless of structural stage. All other vegetated ecosites with Sparse/cryptogram (2/2a) or Herb/graminoid-dominated (3/3b) structural stage were all ranked as Low quality (0.1). Vegetated ecosites in Low shrub (4b) structural stage were ranked as Low quality (0.33) and ranks increased with structural stage to a maximum of 1.0 (High quality) for conifer/mixedwood ecosites, and a maximum of 0.67 (Moderate quality) for deciduous/shrub ecosites, and 0.33 (Low quality) for wetland (bog, marsh, fen) ecosites.

Linear Features

Linear features (LF) were surveyed in the RSA as a companion study for the exploration project proposal (EDI Environmental Dynamics Inc., unpublished study). LFs were classified as 2D, 3D, winter roads (any trails or limited use roads with an obviously curving path), and the Dempster Highway. A subsample (n = 64) of field plots from the LF surveys were used to investigate habitat suitability for marten on-line and off-line. Determining the relative level of impact of various types of LFs established empirical evidence for modelling.

No linear features contained high suitability habitat; the average difference between off-line and on-line habitat suitability rankings across all types of LFs was 0.81 (SD = 0.79, range = 0–3, n = 64). All 2D lines (average width = 5.4 m, n = 27) were moderate-low habitat suitability on-line, and when compared to off-line habitat, the average difference in suitability ranking was 0.85 (off – on), (SD = 0.82, range = 0–2). 3D lines (width range = 1.75–5 m, n = 27) were mostly moderate-low habitat suitability (n = 24), and the average difference between off-line and on-line suitability was 0.63 (SD = 0.69, range = 0–2). The average difference among winter roads (average width = 5 m, n = 8) was 0.88 (SD = 0.64, range = 0–2). Along the Dempster Highway (average width = 15 m, n = 2), the average difference was 2.5 (SD = 0.71, range = 2–3). The average difference in HSI between off-line and on-line field plots was scaled to a score from 0–1 for downgrading:

- Dempster Hwy (30.0 m wide) = (2.5*0.25) = 0.625
- Winter Roads and 2D lines (10.0 m wide) = (0.87*0.25) = 0.218
- 3D lines (10.0 m wide) = (0.63*0.25) = 0.158

2D and 3D lines were mapped using a 10 m width due to limitations of the spatial scale of modelling (10 m raster). The 2D lines are wider than 3D lines and thus have a greater local effect on marten habitat suitability. The difference in effect between 2D and 3D lines on marten habitat was accounted for by applying a greater value for downgrading 2D lines (–0.218) compared to 3D lines (–0.158).

Table 3-3. HSI ratings for marten habitat quality in the Eagle Plains RSA based on an assessment of ELC field plots.

Ecosite Name	Ecosite Code	Structural Stage											
		Non-vegetated	Sparse / cryptogram	Sparse (5–10% cover)	Herb	Graminoid dominated	Low shrub	Shrub	Tall shrub	Pole sapling	Young Forest	Mature Forest	Old Forest
		1	2	2a	3	3b	4b	4	4a	5	6	7	8
Mesic Birch - Willow	2	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Mesic White Spruce – Alaska Paper Birch - Alder	3	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Mesic Black Spruce – Alaska Paper Birch (mixedwood)	4	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Mesic Alaska Paper Birch (Deciduous)	5	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Mesic Black Spruce – Labrador Tea (Conifer)	6	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Sparsely Vegetated	10	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Dry Spruce-Lichen (Conifer)	14	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Dry Aspen-Lichen (Deciduous)	15	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Dry Spruce-Birch-Lichen (mixedwood)	16	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Dry Aspen (Deciduous)	17	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Shrubby Riparian Birch – Willow	20	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Riparian White Spruce – Prickly Rose	21	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Riparian Spruce – Birch - Willow	22	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Drainage Shrubby Riparian	23	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60

Ecosite Name	Ecosite Code	Structural Stage											
		Non-vegetated	Sparse / cryptogram	Sparse (5–10% cover)	Herb	Graminoid dominated	Low shrub	Shrub	Tall shrub	Pole sapling	Young Forest	Mature Forest	Old Forest
		1	2	2a	3	3b	4b	4	4a	5	6	7	8
Moist Shrub \ Scrub Birch – Labrador Tea – Willow	31	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Moist Spruce – Labrador Tea	33	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Moist Spruce – Alder – Labrador Tea	34	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Moist Spruce – Scrub birch – Labrador Tea	35	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Moist Birch – Willow	36	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Tamarack	41	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Black Spruce – Tussock Cottongrass	42	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Black Spruce - Sphagnum	43	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Scrub Birch – Tussock Cottongrass	44	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Shrub – Scrub Birch - Graminoid	45	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.50	0.60	0.60	0.60
Wet Black Spruce – Labrador Tea – Cladonia	46	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Wet Black Spruce – Tussock Cottongrass - Sphagnum	47	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Wet Black Spruce – Carex	48	0.00	0.10	0.10	0.10	0.10	0.35	0.40	0.45	0.60	0.75	0.90	1.00
Anthropogenic	AN	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Bog – Black spruce – Lichen	B1	0.00	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25	0.25

Ecosite Name	Ecosite Code	Structural Stage											
		Non-vegetated	Sparse / cryptogram	Sparse (5–10% cover)	Herb	Graminoid dominated	Low shrub	Shrub	Tall shrub	Pole sapling	Young Forest	Mature Forest	Old Forest
		1	2	2a	3	3b	4b	4	4a	5	6	7	8
Bog – Black Spruce – Sphagnum	B2	0.00	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Exposed Soil	ES	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fen	F	0.00	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Flood Active Channel	Fa	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lake	LA	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Marsh	M	0.00	0.10	0.10	0.10	0.10	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Pond	PD	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
River	RI	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Road	RZ	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

3.4.1.3 Model Structure

Each ELC polygon contains up to three ecosites with deciles indicating percent cover relative to the total area of the polygon. A weighted average HSI score was calculated for each polygon using the following equation:

$$ELC_r = \frac{\sum_{i=1}^{n} d_i h_i}{\sum_{i=1}^{n} d_i}$$

where ELC_r is the initial weighted average, d_i is the decile value, and h_i is the HSI score for each ecosite. HSI polygons were converted to a 10x10 m resolution raster, and linear feature adjustments were applied to the initial HSI scores for each cell:

$$HSI = ELC_r - LF_r$$

where LF_r is the LF adjustment.

3.5 RESULTS AND DISCUSSION

The model indicated a patchwork of High, Moderate, and Low-quality marten habitat, across the RSA (Table 3-4; Map 3-1). High-quality marten habitat is associated with mesic, spruce-dominant ecosites in mature to late structural stages. It includes some of the most common ecosystem units in the RSA, including Moist Spruce – Labrador Tea (33), Moist Spruce – Alder – Labrador Tea (34), and Mesic Black Spruce – Alaska Paper Birch (04; Figure 3-1). Concentrations of High-quality habitat include Enterprise and Dalglish Creeks watersheds in the south, a band running east-west north of the Dempster Highway, and the western part of the northern half of the RSA. Moderate-quality habitat is associated with wetter or younger ecosystem units than High-quality habitat and is widespread across the RSA. High and Moderate-quality habitat is also concentrated in narrow strips of mature/old riparian forests along some of the major watercourses in the RSA, including Chance and Greaves Creeks in the northwest and McParlon Creek west of the Dempster Highway.

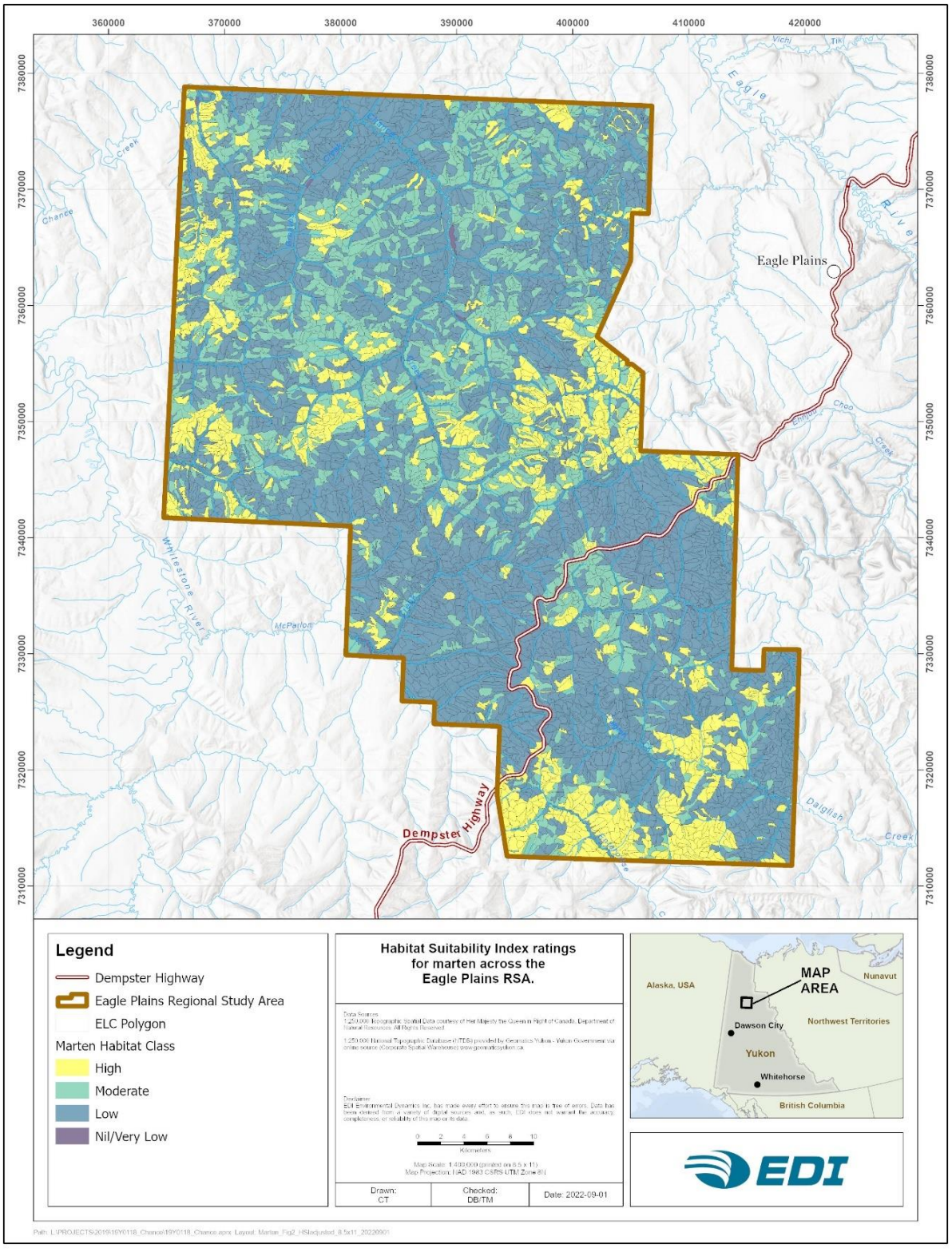
There is extensive Low-quality habitat, represented by vegetation communities in tall and low shrub structural stages found throughout the RSA (Figure 3-1). These habitats generally lack mature forest structures, such as large trees, snags, and CWD, which marten require for subnivean foraging, escape/thermal cover, and denning (Buskirk and Ruggiero 1994, Thompson et al. 2012). Low-quality habitat was associated with shrubby wetlands and stunted black spruce sites in low valley bottoms in the Chance watershed in the northwestern portion of the RSA and regenerating fire-disturbed areas on both sides of the Dempster Highway in the southern part. Completely non-vegetated areas are rare in the RSA; thus, there is almost no Nil/Very Low-quality habitat (Table 3-4; Map 3-1).

Linear features had a relatively minor effect on the overall quality, amount, and distribution of potential habitat for marten. The effect of linear features on habitat suitability for marten is mainly limited to site-level effects (Map 3-2). This effect was due to the narrow width of linear features (Moriarty et al. 2016, 2017) and their small extent relative to the overall RSA. Though existing linear features reduce habitat quality at the site level,

their effects are negligible to habitat supply at the home range scale for marten (Table 3-4). The Dempster Highway was likely the only linear feature in the RSA that could limit the movement of marten. Marten avoid crossing open areas due to increased predation risk relative to areas that provide escape cover (Slauson et al. 2017). However, the highway likely functions as a barrier, not an obstacle or constraint to their movement (Beyer et al. 2016). Therefore, it is likely that marten can and will cross the highway, so the potential barrier limits to their movement likely do not affect habitat availability at the home range scale.

Table 3-4. Relative availability of marten habitat in the Eagle Plains RSA.

Habitat Rating	HSI Scores	Area (ha)	Area (%)
High	>0.75 to 1.0	38,049.63	15.94
Moderate	>0.50 to 0.75	55,202.05	23.12
Low	>0.25 to 0.50	142,484.78	59.68
Nil/Very Low	>0.0 to 0.25	3,015.79	1.26
Total		238,752.25	100



Map 3-2. Habitat Suitability Index model ratings for marten across the Eagle Plains RSA.

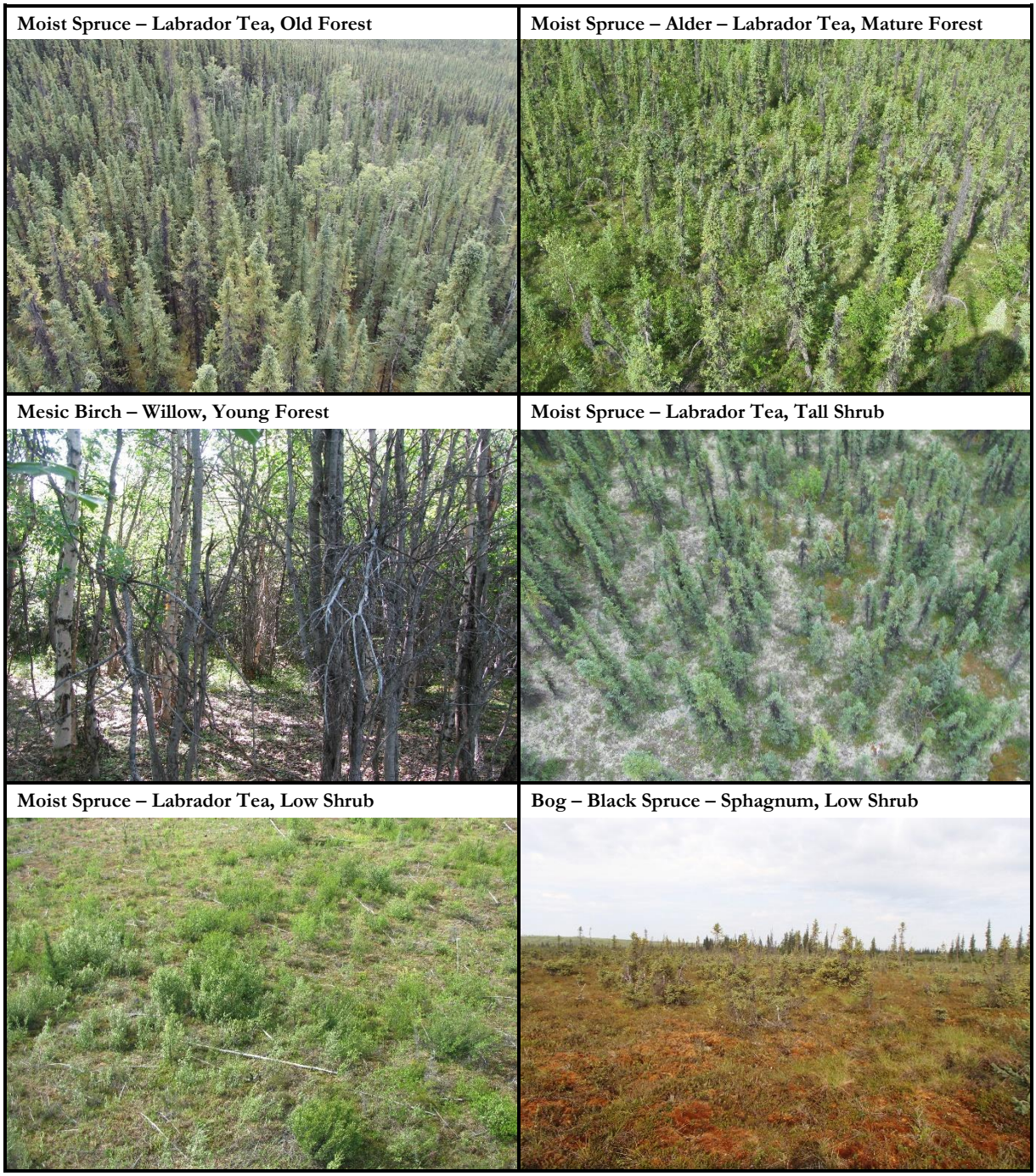
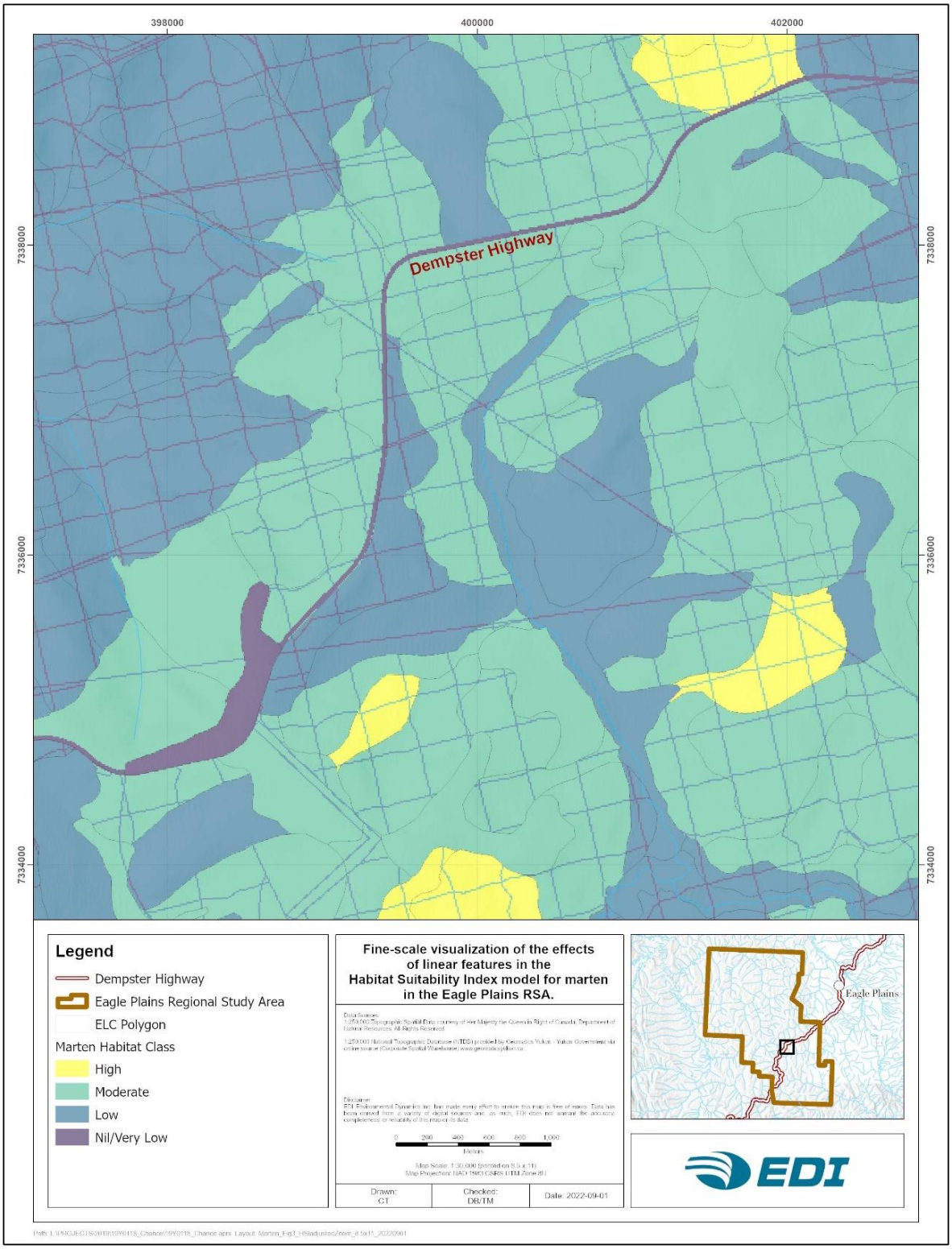


Figure 3-2. Examples of High (top row), Moderate (middle row), and Low (bottom row) quality marten habitat in the Eagle Plains RSA.



Map 3-3. Fine-scale visualization of the effects of linear features in the Habitat Suitability Index model for marten in the Eagle Plains RSA.

3.5.1 MODEL VERIFICATION AND CONFIDENCE

The frequency of use of habitat by marten in the RSA is expected to correlate to the ordinal habitat classes used in the model. However, independent marten occurrence data were not available to test that expectation. The overall confidence in the model is moderate based on moderate knowledge of marten in northern ecosystems and the lack of local field verification.

3.6 SUMMARY

The quality, amount, and distribution of potential habitat for marten were quantified across the RSA using a Habitat Suitability Index model. Ecosite and vegetation structural stages were used to assign areas an initial HSI score, which was then modified based on the presumed adverse effects of linear features on marten habitat. The HSI model indicates a patchwork of High (16%), Moderate (23%), and Low (60%) quality marten habitat across the RSA. High-quality marten habitat occurred in relatively large areas of contiguous mature/old spruce forests and narrow strips of mature/old riparian forests along major watercourses. The RSA contains extensive Low-quality habitat, associated with vegetation communities in tall and low shrub structural stages, including regenerating burns and open, stunted black spruce forest. Non-vegetated areas that constitute Nil/Very Low habitat are a minor component of the RSA. Linear features reduce habitat quality at the site level, but their effects on habitat supply at the scale of a marten's home range are limited.

4 GRIZZLY BEAR

4.1 PURPOSE AND OBJECTIVES

Grizzly bears (*Ursus arctos horribilis*) were selected as a VC for the Project due to their conservation status and social, cultural, and economic value. Grizzly bear have been assessed as a species of Special Concern in Canada, indicating their populations are at risk of becoming threatened if not adequately managed (COSEWIC 2007). Grizzly bears have cultural significance for Indigenous people of Yukon, some of which have traditional uses for their fur, fat, and meat (Benson 2014, Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a). In addition, grizzly bears are managed as a Big Game species in Yukon (Government of Yukon 2002) and harvested by Yukon residents and non-residents (i.e., outfitting operations) throughout much of the territory. Grizzly bear are considered an iconic Yukon species and the opportunity to view grizzly bears attracts tourists from around the world (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a).

This section summarizes the current state of knowledge about grizzly bear ecology in the Project and broader areas, including population trends, distribution, habitat selection, diet, and sources of mortality. This report emphasizes grizzly bear ecology specific to the Taiga Cordillera Ecozone where the Project is located. The behavioural ecology and population characteristics of grizzly bears in the taiga are likely distinct from bears inhabiting coastal, boreal, and arctic barren-ground ecosystems, given substantial variation in habitat and food availability across these regions (Mowat and Heard 2006, Mowat et al. 2013). This report draws from multiple sources, including published and unpublished literature, personal communications with biologists, and traditional knowledge where available. Few studies on grizzly bears have been conducted in the region and the broader Taiga Cordillera. Thus, literature from surrounding regions was consulted when local information was unavailable.

4.2 POPULATION STATUS AND DISTRIBUTION

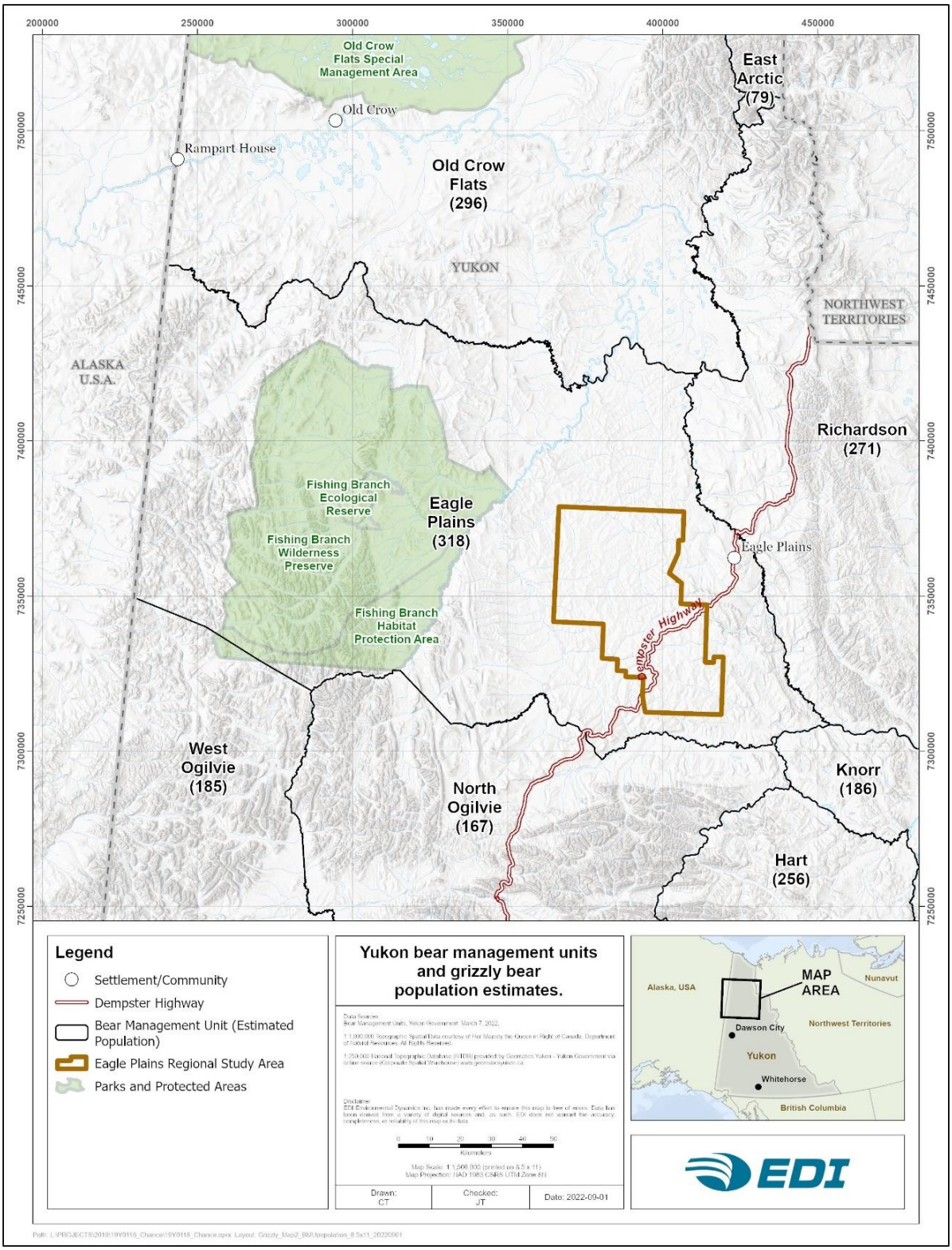
4.2.1 POPULATION

Yukon's grizzly bear population is estimated at 6,000 to 7,000 individuals, comprising approximately 25% of Canada's total grizzly bear population (COSEWIC 2007). The Yukon population estimate was derived from expert-opinion-based estimates of grizzly bear densities in each Yukon Ecoregion, using habitat information and local knowledge collected in the 1980s (Smith and Osmond-Jones 1990, Yukon Grizzly Bear Conservation and Management Plan Working Group 2019b). The exceptions are the Southern Lakes Region and Yukon North Slope, where more recent estimates are available from population assessments using genetic mark-recapture methods (Yukon Fish and Wildlife Branch 2016, 2017). The RSA is located within the Eagle Plains Ecoregion, which has a grizzly bear population estimate of 184 individuals (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019b).

Yukon's grizzly bear populations are managed within bear management units (BMU), generally delineated by outfitting concession boundaries. The Inuvialuit Settlement Region is an exception, where grizzly bears are managed under a separate co-management agreement (WMAC [NS] and WMAC [NWT] 1998). Population estimates for each BMU were derived from the original expert-based Ecoregion estimates (except the Southern Lakes Region and North Slope). Population estimates for BMUs range from 43 to 503 bears; with variation attributed to differences in habitat quality and the sizes of BMUs.

The Eagle Plains BMU, which encompasses the RSA, has a population estimate of 318 bears (Map 4-1). However, the population estimate for the Eagle Plains BMU includes Ni'iinli Njik (Fishing Branch) Territorial Park, which likely has much higher grizzly bear densities than the RSA due to abundant salmon and winter denning habitat (Vuntut Gwitchin Government and Environment Yukon 2010). Grizzly bear densities are considered low throughout the RSA, although limited information is available (Pongracz and Suitor, pers. comm., 2022). Population densities for the adjacent Richardson Mountains are estimated at approximately 23 bears per 1,000 km^2 (Clarkson et al. 1993), but grizzly bears are more abundant in the mountains than the taiga plains that characterize the RSA (Benson 2014).

Grizzly bear population trends in Yukon are primarily tracked through harvest monitoring. The Yukon population is stable (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a). There is minimal data on population trends within the Eagle Plains BMU, given low grizzly bear harvest rates (refer to Section 3.1), but traditional knowledge provides some insight. Gwich'in knowledge holders suggest that grizzly bears in the Gwitch'in Settlement Area have a generally stable population (Benson 2014). However, elders noted that grizzly bears have declined in some areas from 1940 to the early 2000s due to increased hunting pressure, the opening of the Dempster Highway, increased use of snow machines, and a general northward range shift towards the Inuvialuit Settlement Region.



Map 4-1. Yukon bear management units and grizzly bear population estimates.

4.2.2 DISTRIBUTION

Grizzly bears occur throughout the Yukon, ranging from the BC/Yukon border to the Arctic coast. They are generalist omnivores that may live in various habitat types (Mowat et al. 2013), and they occur in all Ecoregions within Yukon.

In northern Yukon, seasonal grizzly bear distribution generally tracks the availability of key food resources such as berries, fish, ungulate calves, and ground squirrels (MacHutchon and Wellwood 2003). Very little information exists about grizzly bear distribution within the RSA. The Whitestone River adjacent to the RSA (Map 1-1) is an area of higher grizzly bear concentration in the region (Pongracz and Suitor, pers. comm., 2022). During the fall, grizzly bears congregate in Ni'iinli Njik (Fishing Branch) Territorial Park, approximately 20 km west of the RSA, to feed on spawning salmon in the Fishing Branch River (Vuntut Gwitchin Government and Environment Yukon 2010).

In and adjacent to the Gwitch'in Settlement Region, grizzly bears are more common in the Richardson Mountains, the Ogilvie Mountains, and the barren arctic coast than in the flat, low-elevation taiga that overlaps the RSA (Benson 2014). These distributional patterns are attributed to a lack of ground squirrels and other key food sources in the moist, hummocky spruce forest that characterizes much of the RSA.

4.2.3 CONSERVATION STATUS AND THREATS

COSEWIC has assessed grizzly bears as a species of Special Concern (COSEWIC 2007). The Western Canadian grizzly bear population is listed under Schedule 1 of the SARA, which requires measures to prevent grizzly bears from becoming Threatened or Endangered. Within Yukon, grizzly bears are not currently considered a species of conservation concern (Yukon Conservation Data Centre 2019), although a conservation plan was developed for grizzly bears in 2019 to promote healthy and viable grizzly bear populations into the future (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a).

The greatest threats to the Canadian grizzly bear population are considered to be 1) human-caused mortality, including illegal and legal hunting, conflict kills, and railway or road mortalities, and 2) habitat loss and fragmentation (COSEWIC 2007). Members of the VGFN had observed in the late 1990s that Grizzly bears did not come near to the Dempster highway but were concerned with the old garbage dump areas along the highway possibly attracting bears (Sherry and Vuntut Gwitchin First Nation 1999, p. 286, 289). Key threats to grizzly bear populations in the Yukon are human-wildlife conflict and harvest mortality, although habitat loss and climate-related changes to food availability may also be significant (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a). Northern grizzly bear populations cannot sustain high mortality rates due to their low reproductive rates and low densities (Nagy et al. 1983). Sources of mortality in the RSA and surrounding region are discussed in detail in Section 4.4.

4.3 MORTALITY AND HARVEST

Grizzly bears are managed as a big game species in Yukon (Government of Yukon 2002), and harvest is permitted in most parts of the territory outside of National Parks, including resident, non-resident, and subsistence harvest. The overall mortality management system is based on estimated total sustainable mortality rates of ≤ 2% of the female population, ≤ 6% of the male population, and ≤ 4% of the total population (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a). Total allowable mortality rates account for mortality from harvest, and other sources, including vehicle collisions and defence of life and property (DLP) kills (i.e., conflict kills).

Yukon grizzly bear harvest is managed within BMUs, although harvest rates are often reported at the scale of Game Management Subzones (GMS) or broader Game Management Zones (GMZ). The bag limit is one grizzly bear every three years in open subzones, and hunters must report all bear kills (Government of Yukon 2021). The RSA is located within GMZ 1, with the lowest licenced grizzly bear harvest rates in the Yukon. Between 1980 and 2014, the annual grizzly bear harvest in GMZ 1 varied from zero to three bears (Milligan 2018). More specifically, within the Eagle Plains BMU (Map 4-1), only two grizzly bears were harvested from 1995 to the present (Pongracz and Suitor, pers. comm., 2022). The Eagle Plains BMU does not overlap any outfitter concessions (i.e., no non-resident harvest), so reported harvest rates are attributed to licenced resident harvest.

Other sources of grizzly bear mortality include DLP kills, collisions with vehicles, and predation from other bears or large carnivores. Grizzly bear mortality rates in the Eagle Plains BMU are low relative to other BMUs in the territory, with an annual average mortality density of < 0.1 bears per 1,000 km², based on records from 2005 to 2016 (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019b). Mortality rates tend to be higher in southern Yukon, where both the human population and road densities are comparatively high, with mortality densities up to 0.6 bears per 1,000 km² in some BMUs (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019b). However, these rates do not account for unreported human-caused mortality (e.g., unreported DLP kills) or natural sources of mortality. Reported DLP kills accounted for an average of 11 grizzly bear mortalities per year in Yukon from 1980 to 2016. DLP mortality rates are very low within the Eagle Plains BMU; from 1995 to 2021, only one grizzly bear DLP kill was reported (Pongracz and Suitor, pers. comm., 2022).

The correlation between road density and grizzly bear mortality has been well documented in other parts of western North America (McLellan 1990, Mace et al. 1996, Boulanger and Stenhouse 2014, Proctor et al. 2019). Most historical grizzly bear mortalities in central BC and Alberta were related to human activity and occurred within 500 m of a road (Ciarniello et al. 2004, Boulanger and Stenhouse 2014). In BC, grizzly bear mortality rates are known to increase in areas where road densities exceed 0.6 km/km² (Lamb et al. 2018). Mortalities were caused by higher rates of legal harvest, poaching, and conflict kills near roads, in addition to direct mortalities from road collisions. Roadside hunting of grizzly bears is currently permitted in Yukon, although this is under review in some local areas (Yukon Grizzly Bear Conservation and Management Plan Working Group 2019a).

Grizzly bear mortalities from vehicle collisions are rare in Yukon. Fifteen grizzly bear mortalities resulted from collisions with vehicles from 2003 to 2014 on all Yukon Highways (EDI Environmental Dynamics Inc. 2015). Collisions tended to occur in spring and summer when grizzly bears were foraging on roadside vegetation. Most collisions occurred on the Alaska Highway (60%), which has higher traffic volumes than other roads in the territory. The only major road in the RSA is the Dempster Highway, which has comparatively low traffic volumes and is unpaved. From 2003 to 2014, only one bear collision was reported on the Dempster Highway near Dawson City. The bear species was unidentified.

Predation is a source of mortality for grizzly bears, but predation rates are generally unknown in the Yukon. Male grizzly bears occasionally prey on females and cubs on the North Slope (Clarkson and Liepins 1994). Wolves in packs have also been known to kill grizzly bears in northern Yukon (Benson 2014).

4.4 REGIONAL HABITAT ECOLOGY AND DIET

The distribution of available forage strongly influences habitat selection by grizzly bears during spring, summer, and fall seasons (Nielsen et al. 2010, Milakovic et al. 2012) and the supply of suitable den sites in winter (Smereka et al. 2017). Security and thermal cover are also important (McLellan 1990). However, they are generally selected with nearby foraging habitats (Milakovic et al. 2012).

Much of the available information on seasonal grizzly bear habitat selection and diet comes from the interior mountains and coastal regions of western North America (e.g., Hamilton 1978, McCormick 1999, McLellan and Hovey 2001, Ciarniello et al. 2007, Maraj 2007, Nielsen et al. 2010, Milakovic et al. 2012, McClelland et al. 2020). However, the ecological characteristics of these populations may differ substantially from that of grizzly bears in northern Yukon. At a finer spatial scale, grizzly bear ecology within the RSA differs from grizzly bears elsewhere in northern Yukon, such as the Yukon North Slope or the nearby Ogilvie and Richardson Mountains (Pongracz and Suitor, pers. comm., 2022), but very little information exists about grizzly bears within the RSA. Literature and traditional knowledge from similar ecosystems in northern Yukon have been summarized to the extent possible, including the Taiga Cordillera and adjacent Taiga Plains Ecozones. When information specific to the region was unavailable, literature from other parts of the Yukon or western North America was consulted.

4.4.1 SEASONAL DIET

Grizzly bears have broad omnivorous diets, including plants, fish, terrestrial wildlife, and insects (MacHutchon and Wellwood 2003, Ciarniello and River 2018). Grizzly bear diets differ among regions due to variations in food availability across local climates (Mowat and Heard 2006, McLellan 2011, Coogan et al. 2014). Individual grizzly bear diets are also highly variable and dependent on seasonal and annual availability of food items within their home ranges (MacHutchon and Wellwood 2003, McClelland et al. 2020).

Seasonal grizzly bear diets generally reflect the phenological progression of key food resources such as herbaceous plants, ungulate calves, berries, and fish (Hamer and Herrero 1987, MacHutchon and Wellwood 2003, McClelland et al. 2020). Vegetation is a major component of grizzly bear diet in northern Yukon; for

example, vegetation comprised more than 30% of grizzly bear diet in the Richardson Mountains (Koizumi 2012). During spring, important plant foods for grizzly bears in the Taiga Cordillera include the roots of alpine hedysarum (*Hedysarum alpinum*), sedges (*Carex* spp.), grasses, horsetail (*Equisetum spp.),* and berries leftover from winter such as kinnikinnik (*Arctostaphalos uva-ursi*), bearberry (*Arctostaphalos rubra* or *A. alpina*), and crowberry (MacHutchon 2000, MacHutchon and Wellwood 2003). In summer and early fall, grizzly bear diet in northern Yukon includes a variety of berries such as blueberry (*Vaccinium uliginosum*), soapberry (*Shepherdia canadensis*), crowberry, bearberry, kinnikinnik, cranberry (*Vaccinium vitis-idaea*), and cloudberry (MacHutchon 2000, MacHutchon and Wellwood 2003). When berries are unavailable, grizzly bears may forage on herbaceous vegetation such as sedges, grasses, and horsetails. As berry availability declines in late fall, grizzly bears may dig for alpine hedysarum more frequently (MacHutchon and Wellwood 2003).

In northern Yukon, grizzly bear diets incorporate a relatively high proportion of terrestrial wildlife, comprising up to 70% of their diet (Mowat and Heard 2006, Koizumi 2012). Mammals are likely an important food source throughout the spring, summer, and fall whenever they are available, including caribou (*Rangifer tarandus*), moose (*Alces alces*), arctic ground squirrels (*Spermophilus parryii*), and small rodents (MacHutchon 2000, MacHutchon and Wellwood 2003, Koizumi 2012). Arctic ground squirrels are an important food source, and grizzly bears may spend increasing effort pursuing them as berry availability declines in late fall (MacHutchon and Wellwood 2003). Arctic ground squirrels tend to select slopes with well-drained soils and avoid wet, flat, or hummocky terrain (Barker and Derocher 2010), which characterizes much of the RSA. Thus, grizzly bears with home ranges that overlap the RSA may rely heavily on other food sources (e.g., alpine hedysarum or ungulates). Traditional knowledge suggests that bears may travel to the nearby Richardson Mountains to forage on ground squirrels in fall (Benson 2014).

Ungulates may be a particularly important food source in spring, when grizzly bears in northern Yukon and Alaska prey on caribou and moose calves (Boertje et al. 1988, MacHutchon 2000, MacHutchon and Wellwood 2003). Barren-ground caribou (*Rangifer tarandus groenlandicus*) are a focal food source for grizzly bears in northern Yukon during caribou calving and seasonal migration periods (MacHutchon and Wellwood 2003). Grizzly bears may follow caribou as they migrate to and from their calving grounds (Reynolds and Garner 1987, Benson 2014), targeting calves or opportunistically preying on adults (MacHutchon and Wellwood 2003). Northern grizzly bear populations that prey on caribou during calving or migration have higher reproductive rates and population densities than those that do not overlap caribou range (Reynolds and Garner 1987). Grizzly bear diet has not been studied within the RSA, and there is no scientific data on the relative importance of caribou as a food source. However, the Porcupine caribou herd migrates through the RSA en route to calving grounds on the arctic coastal plain and again during their return to winter range in the Richardson and Ogilvie mountains (Russell et al. 1993, Ryder et al. 2007). Grizzly bears within the RSA likely use caribou during spring and fall migration.

Salmon, trout, and char are important seasonal foods for grizzly bears (Mowat and Heard 2006, Adams et al. 2017). During fall, grizzly bears congregate at the Fishing Branch River in Ni'iinlii Njik Territorial Park to feed on chum salmon (*Oncorhynchus keta*) (Vuntut Gwitchin Government and Environment Yukon 2010). Grizzly bears on the north slope are also known to feed on Dolly Varden trout (*Salvelinus malma*) (MacHutchon and Wellwood 2003). Baseline fish inventories for the Project found that salmon and trout were absent within the

RSA (EDI Environmental Dynamics Inc. 2022a). Arctic grayling (*Thymallus arcticus*) were the most common fish species, although longnose sucker (*Catostomus catostomus*) and round whitefish (*Prosopium cylindraceum*) were also present. Grizzly bear in the Richardson Mountains have been observed feeding on arctic grayling (Benson 2014), and whitefish and sucker are known food sources in the central Canadian arctic (Gau et al. 2002, Barker 2011).

4.4.2 FORAGING HABITAT

The availability, abundance, and distribution of important grizzly bear forage directly influence grizzly bear abundance and distribution during the growing season (McLoughlin et al. 2002a, Nielsen et al. 2017, McClelland et al. 2020). Grizzly bear populations in the subarctic and arctic are generally considered limited by food (McLoughlin et al. 2002a). Grizzly bears may balance the selection of high-quality food patches with avoidance of landscape features associated with high mortality risk, such as areas with dense human developments and roads (Nielsen et al. 2010, Proctor et al. 2017). However, given the relatively low harvest rates and low levels of human development in the RSA, it is likely that grizzly bear habitat selection is driven by food availability.

The literature on grizzly bear foraging habitat selection in the mountains, boreal forest, and coastal regions of western North America is extensive (e.g., Hamilton 1978, McCormick 1999, McLellan and Hovey 2001, Ciarniello et al. 2007, Maraj 2007, Nielsen et al. 2010, Milakovic et al. 2012, McClelland et al. 2020), but far less is known about habitat use in northern ecosystems. Studies in northern Yukon, Alaska, and NWT have focused mainly on arctic barren-ground grizzly bears (Phillips 1987, MacHutchon 1996, Gau 1998, McLoughlin et al. 2002a, Barker 2011), leaving a substantial knowledge gap about grizzly bear ecology in the Taiga Cordillera (particularly non-mountainous areas such as the Eagle Plains Ecoregion).

Grizzly bear distribution was clumped in the Richardson Mountains rather than uniform; bear densities were comparatively high in habitats with abundant food such as riparian valleys and low in flat tundra plains (Clarkson et al. 1993). Local traditional knowledge suggests that mountains are better grizzly bear habitat than taiga or barren-ground plains due to the abundance of berries and ground squirrels, and the earlier snowmelt on windblown and south-facing slopes in spring (Benson 2014). Grizzly bears in northern Yukon have large home range sizes (up to 1,250 km^2) and travel long distances to reach suitable foraging habitat (MacHutchon 2000). Thus, grizzly bears in the RSA may travel to the Richardson or Ogilvie Mountains for seasonal forage. This is consistent with the knowledge that grizzly bears have low densities in the RSA, and their behaviour is characterized by seasonal movements through the area (Pongracz and Suitor, pers. comm., 2022).

In the central Canadian arctic, barren-ground grizzly bears selected eskers, shrubby riparian zones, and tussock tundra throughout the spring, summer, and fall, corresponding with the spatial and temporal availability of food (Phillips 1987, McLoughlin et al. 2002a). Esker slopes support a relatively high abundance of berry-producing shrubs and arctic ground squirrels (Gau 1998, Barker and Derocher 2010, Barker 2011), whereas riparian zones and tussock tundra may provide herbaceous forage such as horsetails, sedges, and cotton grasses (*Eriophorum* spp.) (Gau 1998, Gau et al. 2002). Barren-ground grizzly bears also selected habitat with abundant lichen, which may attract caribou (McLoughlin et al. 2002a). During the Porcupine caribou

migration on the Yukon north slope, grizzly bears travelled along river channels or selected hillsides with long sight-lines, presumably to increase their chances of detecting caribou (MacHutchon 2001).

4.4.3 COVER (SECURITY AND THERMAL HABITAT)

Security habitat includes areas of dense vegetation that provide visual screening from other grizzly bears or humans (Mace and Waller 1997). Security cover may be particularly important for sub-adult male bears and sows with cubs to avoid adult males defending their territories or killing cubs to bring females into estrus (LeFranc et al. 1987, McLellan 2005). Female grizzly bears may select lower-quality foraging habitat if it provides high security values or spatial separation from potentially aggressive male bears (Pearson 1975, McLellan and Shackleton 1988). For example, female grizzly bears in the arctic are thought to occupy the Mackenzie Delta to avoid male bears in adjacent mountain ranges (Benson 2014).

Thermal cover includes habitat that provides relief from the elements, such as solar exposure or extreme weather. Cover from heat and solar exposure is provided by various habitats such as open water (e.g., rivers, streams, lakes), permanent snow patches, steep north aspects, and mature forest patches with high canopy closure (Pearson 1975, LeFranc et al. 1987). Grizzly bears may also select forests with high canopy closure for day beds to seek shelter from heavy rains (Pearson 1975, Munro et al. 2006). The importance of thermal cover for grizzly bears in the Taiga Cordillera has not been studied.

4.4.4 WINTER DENNING HABITAT

Grizzly bears in northern Yukon hibernate in winter from approximately October to May (Nagy et al. 1983, MacHutchon 2000), although the timing for den entry and emergence depends on annual weather patterns. Grizzly bears will enter their dens as late as mid-November and emerge as early as March if the weather is warm (Benson 2014).

No records exist of grizzly bears dens within the RSA, although grizzly bears are known to den in the mountains of Ni'iinli Njik (Fishing Branch) Territorial Park, approximately 20 km west of the RSA (Pongracz and Suitor, pers. comm., 2022). Grizzly bears in the arctic and subarctic typically excavate their dens in locations with suitable soil, such as sand, gravel, or glacier-deposited rock (MacHutchon 2000, Smereka et al. 2017). Grizzly bears in Vuntut National Park in northern Yukon preferentially select den sites in the mountainous regions of the park and avoid denning in Old Crow Flats, which is characterized by flat topography, large wetland complexes, and spruce forests (MacHutchon 2000). Denning within Old Crow Flats is likely limited to dry, steep riverbank slopes (MacHutchon 2000). Grizzly bears throughout the Gwitch'in Settlement Area are known to prefer denning in the mountains; however, in areas with flat topography (such as the RSA), grizzly bears will select small topographical features such as hills, steep riparian banks, or lakesides to excavate their dens (Benson 2014). Grizzly bears in northern Yukon have large home ranges (Section 4.5.5) and may travel long distances to reach winter den sites (up to 65 km; Craighead 1976). Thus, some grizzly bears with home ranges overlapping the RSA may travel to nearby mountain ranges (Richardson Mountains, Ogilvie Mountains, or Ni'iinli Njik Territorial Park) to hibernate.

In arctic barren-ground ecosystems, grizzly bears select river banks, lakesides, or eskers with silty or sandy soil for denning (Harding 1976, Mueller 1995) and avoid open spruce forest (Smereka et al. 2017). Grizzly bears prefer to excavate their dens on steep south-facing slopes with abundant shrub cover in the arctic (Mueller 1995, McLoughlin et al. 2002b) and the boreal forest of southern Yukon (Libal et al. 2012). The root structures of tall shrubs such as willow (*Salix* spp) and dwarf birch (*Betula glandulosa*) may provide support to the ceilings of excavated grizzly bear dens (McLoughlin et al. 2002b).

4.4.5 HOME RANGE AND SEASONAL MOVEMENTS

Grizzly bear home range sizes are variable and have an inverse relationship with food availability (Nagy and Haroldson 1990, McLoughlin et al. 2000). Thus, grizzly bear home ranges in productive coastal or interior mountain habitats of BC are typically smaller and have greater overlap than those in less productive boreal, taiga, or arctic barren-ground ecosystems (McLoughlin et al. 2000, Edwards et al. 2009, Hamilton et al. 2018). Additionally, the size of individual home ranges may vary annually in response to fluctuations in the quality and abundance of food (McLoughlin et al. 2000). The largest recorded grizzly bear home range sizes in North America were in the central Canadian Arctic, where mean home range sizes for female and male bears were 2,100 km² and 7,245 km², respectively (McLoughlin et al. 2003).

No data on grizzly bear home range sizes within the RSA are available, but studies conducted in other parts of the Taiga Cordillera provide some insight. Grizzly bear home range sizes in the Old Crow flats of Vuntut National Park were estimated at 650 – 750 km² for females and 1,150 – 1,250 km² for males (MacHutchon 2000). In the Richardson Mountains north of the RSA, female grizzly bears had mean annual home ranges of 442 km² and males had home ranges of 760 km² (Koizumi 2012). The smaller home ranges in the Richardson Mountains may be attributed to more food resources, such as berries and ground squirrels relative to the taiga plains (Benson 2014).

Grizzly bears have low fidelity to home ranges in unproductive arctic ecosystems, where food distribution is spatially and temporally heterogenous, and grizzly bear population densities are low (Edwards et al. 2009). Under these conditions, it is beneficial for grizzly bears to adjust the size and location of their home ranges to maximize forage availability. For example, in northern Yukon and Alaska, grizzly bears may travel long distances to follow the seasonal migration of barren-ground caribou (Reynolds and Garner 1987, MacHutchon 2001). Grizzly bears in northern Yukon are also thought to travel long distances to find suitable winter denning habitat in the mountains (Benson 2014).

4.5 SUMMARY

Available data suggest that a low density of grizzly bears are distributed throughout the RSA. Rates of recorded harvest mortality are low within the Eagle Plains BMU, but other sources of mortality are largely unknown and unrecorded. Grizzly bear diet in the RSA and surrounding region predominantly consists of vegetation (berries, roots, and herbaceous plants) and terrestrial wildlife, including caribou, moose, and arctic ground squirrels. Grizzly bears may rely heavily on caribou (particularly calves) during the seasonal migration of the Porcupine caribou herd through the region. Habitat quality in the RSA is generally poor compared to the adjacent mountain ranges, where berries and ground squirrels are more abundant. Lastly, grizzly bears in the RSA may excavate their winter dens in riverbanks, lakesides, and hills where suitable soil can be found, or they may travel to nearby mountain ranges to den on steep south-facing slopes. Most of the information presented in this review was based on scientific studies.

5 MOOSE

5.1 PURPOSE AND OBJECTIVES

Moose (*Alces alces*) were selected as a VC for the Project due to their importance as a managed game species, and their cultural values to First Nations living in the Yukon. Winter, and especially the late winter season, is often a difficult time for moose due to the limited availability of forage and increased energetic demands to move through crusted or deep snow. A winter habitat suitability map was developed for moose in the RSA to identify high-suitability winter forage habitat areas. The map quantifies the winter forage habitat in each habitat class (high, moderate, low/nil/very low) within the RSA.

This section summarizes information and data on moose use and ecology in the subarctic taiga that was used to develop habitat suitability mapping to quantify the suitability, amount, and distribution of potential habitat for moose in the RSA.

5.2 GENERAL HABITAT ECOLOGY OF MOOSE

5.2.1 EXISTING INFORMATION

There is limited knowledge of moose within the RSA. In 2001, Anderson Resources Ltd submitted a project application and a mitigation plan for an Eagle Plains 2001–2003 Seismic Survey Program (Access Consulting Group and EBA Engineering Consultants Ltd. 2001). This report describes moose knowledge of the area as being limited and incidental. The authors reviewed the existing data and had discussions with local wildlife biologists and other resource users about winter usage patterns by moose in the general vicinity of the Eagle Plains project area. At that time, moose were only superficially studied in the Eagle Plains Area (Access Consulting Group and EBA Engineering Consultants Ltd. 2001).

The 2001 project application report stated that an approximate moose density of about 0.05 moose/km² was estimated for the project area based on general habitat assessment. The application also provided the following information:

> "*Within the project area, moose are not commercially exploited and there are no outfitting concessions. There is limited off-road access and the moose population density within the project area is known to be low, hence the subsistence harvest is minor. YTG Renewable Resources harvest data show that, in the last twenty years, only 13 moose have been harvested in the Dempster Corridor subzones (Game Management Zone 1-55 and 1-56).*
>
> *Anderson conducted a post-rut moose survey in early November of 2000, to augment the currently very limited knowledge regarding moose populations in the project area. The survey was conducted to provide baseline information on the level of range usage by moose within the project area. During the course of the 2-day survey, 30 moose were observed and an additional 64 sets of tracks were encountered. In general, moose were more frequently associated with the higher elevations (between 400 m and 700 m above sea level), but were widely dispersed throughout all of project*

area's drainages. From the survey results, an overall population of approximately 60-90 moose was estimated (Access Consulting Group and EBA Engineering Consultants Ltd. 2001)."

These observations of greater moose abundance at higher elevations are consistent with observations from VGFN elders around the same time (Sherry and Vuntut Gwitchin First Nation 1999, p. 7). They discussed that Eagle Plains was an important moose range, but that some animal populations had changed their land use after the Dempster highway was built and there was low density near the highway (Sherry and Vuntut Gwitchin First Nation 1999, p. 287, 299).

In 2001, an aerial survey was completed from June 18–22 within the 2001 project area. During that survey, 19 moose were incidentally observed, with most observations noted in the South Eagle River and Dalglish Creek area. A general point of interest was that moose calving was expected in several drainages, but was particularly noteworthy in the South Eagle River (Access Consulting Group and EBA Engineering Consultants Ltd. 2001).

In 2013 Environment Yukon conducted an 'Eagle Plains Mammal Occupancy Aerial Survey' from March 19 to March 24, 2013 (Environment Yukon, unpublished data). The survey aimed to assess the occurrence and distribution of large mammals within the broader Eagle Plains Ecoregion. Over the 6 survey days, 64 moose were observed, including cow and calf observations. The data indicated that moose were widely distributed within the Eagle Plains area, but the area was not comprehensively surveyed, and formal analyses/reporting were not included with the data.

From October 2014 through August 2016, Yukon Environment deployed 37 (2014) to 48 (2015) pairs of remote cameras in the Eagle Plains area (Burden 2016). The objective was to assess the use of linear features by medium to large mammals (wolves, caribou, and moose) by comparing the use of wildlife on and off seismic lines by placing cameras at random locations on seismic lines, and camera locations off seismic lines. The report is a data summary with no statistical analysis, and the results are non-standardized (e.g., lacking a catch per unit effort reporting metric). Regardless, there was some information collected for moose relevant to this study. Over the two years of study, moose encounters were infrequent and varied slightly among years (0.33 moose/100 camera days in 2014–2015, 0.43 moose/100 camera days in 2015–2016). Moose were found in the study area throughout the year but were observed more often from May through November (spring through fall). No statistical analyses or apparent trends were used to determine moose associations with linear disturbances.

EDI did not complete other population or distribution surveys for moose as part of the current baseline studies. Efforts focused on developing a winter habitat model to quantify habitat suitability, amount, and distribution across the RSA.

5.2.2 HABITAT ECOLOGY OF MOOSE

Moose are one of the most widely distributed ungulates and range from the Arctic coasts of North America, Europe, and Asia down to the southern limits of the boreal forest and farther south where suitable montane biomes are located exist. In the Yukon, moose densities generally range between 100 and 250 moose for every 1,000 km^2 of suitable moose habitat (Environment Yukon 2016b). The Regional Biologist has indicated that,

based on his observations, moose densities in Eagle Plains are relatively low compared to some parts of the southern Yukon, but that moose densities in Eagle Plains are high compared to other parts of North Yukon (Mike Suitor, pers comm).

Moose make seasonal movements to various habitats such as calving, summer, rutting, and winter habitats. These seasonal movements may range from a few to many kilometres (Clarke et al. 2017, Government of Yukon 2022). Changing environmental conditions can affect the quality, quantity, distribution, and accessibility of cover and forage over a landscape. Key habitat requirements are rarely distributed evenly over space or time, so moose move to access various resources as availability changes. Periodic disturbances, such as wildfire and vegetation clearing change the abundance and availability of moose cover and forage. Moose are generally not evenly distributed across the landscape; they concentrate in particular habitats offering higher forage opportunities(Government of Yukon 2022). Moose with access to large quantities of forage are known to travel less than those in areas where forage is less abundant (McCulley et al. 2017). There is a wide variation in home range sizes for moose across the boreal forest and between seasons (Phillips et al. 1973, Addison et al. 1980, Clarke et al. 2017, McCulley et al. 2017). Moose that frequent the Old Crow Flats wetland complexes in northern Yukon are known to spend summer months within this area and then migrate 250 km to spend the winter within the Alaska Arctic National Wildlife Refuge (McCulley et al. 2017).

Moose habitat selection patterns vary among populations, individuals, seasons, and sexes (Clarke et al. 2017, McLeod and Clarke 2017). Furthermore, habitat use by moose can differ depending on the type of land cover and the availability of resources in a particular area. In northern Yukon, moose appear to frequent narrow strips of forest along the rivers (Photo 5-1), and VGFN elders have observed good moose habitat just south of the RSA along the Blackstone and Ogilvie rivers and the wetlands of the Blackstone Uplands (Sherry and Vuntut Gwitchin First Nation 1999, p. 303). In the south, moose frequent the treeline in the subalpine shrub zone. Moose in the Yukon also tend to concentrate in recent burns and along waterways with interconnecting ponds, marshes and meandering streams (Government of Yukon 2022).

Moose inhabit numerous stand-cover types and structural stages. Conifer stands are generally used primarily as cover to moderate extremes of cold, wind, heat, deep snow, and security from predators (Timmermann and McNicol 1988, McCulley et al. 2017). Early seral areas are usually shrub-dominated and used by moose because shrub species comprise more than 60% of a moose's annual diet (Renecker and Schwartz 2007). During the spring and summer, moose forage primarily on the leaves of woody plants, aquatic plants, and forbs. During winter, the diet shifts to highly lignified woody stems, resulting in higher ruminating times (Renecker and Hudson 1986). Plant form and twig diameter have also been shown to affect digestion rates, influencing moose winter foraging (Vivas et al. 1991). Some preferred moose forage species include:

- Willows (*Salix* spp.)
- Red-osier dogwood (*Cornus sericea*)
- Saskatoon serviceberry (*Amelanchier alnifolia*)
- Highbush cranberry (*Viburnum edule*)
- Mountain ash (*Sorbus sitchensis*)
- Scrub birch (*Betula glandulosa / nana*)

- Trembling aspen (*Populus tremuloides*)
- Lodgepole pine (*Pinus contorta*)
- Paper birch (*Betula papyrifera*)

These browse species may be used preferentially due to their height and growth form (Baker 1990, Van Ballenberghe et al. 1989). The palatability of shrub species can also vary from region to region. Soopolallie (*Shepherdia canadensis*) was recorded as an important forage species for moose on the Kenai Peninsula, Alaska (Edwards 1940) but appears to be unpalatable in other parts of the boreal forest (Rolley and Keith 1980). In northeast Alberta, the preferred browse species was Saskatoon serviceberry; even in areas where it was uncommon, the species was still heavily used when it was present (Nowlin 1978). In the Peace-Athabasca Delta, moose feed primarily on willow, red-osier dogwood, paper birch and balsam poplar. In one study done in the taiga region ranging from northwestern Manitoba to Great Slave Lake NWT, winter moose diet was mainly composed of *Betula papyrifera* bark (Thomas 1990). Risenhoover (1989) found that willows accounted for more than 94% of the winter moose diet in Denali National Park and Preserve.

Within the RSA, willows and scrub birch are the dominant browse species available for moose. Willows often form the predominant diet in other northern areas. Willows are well adapted to wetter soils and are commonly found in wetland and riparian habitats (Photo 5-2). Willows are also an early successional species and are often abundant in early seral habitats resulting from forest fires and human-disturbed areas (e.g., seismic lines, cutblocks, and road rights-of-way). Moose have been reported selecting previously burned habitats and areas within 100 m of streams and waterbodies, presumably due to the abundant forage (Wasser et al. 2011). In habitats with low availability of twigs and leaves, moose sometimes use a foraging technique called 'bark-stripping' where long, linear strips of bark are peeled from certain trees, such as aspen (LeResche and Davis 1973, Miquelle and Van Ballenberghe 1989). However, the bark is usually a relatively small component of moose diets (Miquelle and Van Ballenberghe 1989). It is unlikely to be a significant food source in Eagle Plains due to the dominance of spruce, whose bark is non-palatable.

Across Canada, heavily used areas by moose include wetlands, floodplains of major rivers, riparian areas, regenerating cut blocks and burns, and avalanche chutes. Their preferred habitat types include recent burns, logged areas, lake and river shores, willow and alder swamps and other wetland areas MacCracken et al. 1997). Food (including forage quality) and climate are considered important aspects of habitat for moose (Franzmann 1981). Analyses of moose range commonly stress the abundance, production, and use of woody shrubs as important characteristics when describing moose habitat requirements (LeResche and Davis 1973; Jung et al. 2009).

In Labrador, moose can be observed more often in riparian areas and hardwood stands and less often in string bogs, open conifer-lichen stands, barren hilltops than expected based on the availability of those habitat types during the winter (Jung et al. 2009). Riparian areas are often high suitability habitats for moose in winter due to the availability of high-quality forage species such as willows. Willows and birch found within the riparian shrub communities are often adjacent to a strip of closed-canopy conifer-dominated forest that provides thermal cover and snow interception. The combination of shrub communities and closed-canopy mature riparian forests offer a highly suitable habitat mosaic for moose (Jung et al. 2009).

During the winter, moose are influenced by snow depth, snow density and hardness. Moose movements begin to be impeded at snow depths of 70 cm, and moose strongly avoid areas with >100 cm of snow. Moose generally winter in areas where snow depths are less than 70 cm (Coady 1974, Franzmann 1981). In mountainous areas, where snow accumulation can vary substantially, this can result in strong patterns of seasonal range use, with moose avoiding mid an upper elevation where snow accumulation is higher. For example, in the Pelly-Macmillan River area (Central Yukon), moose concentrated along the major river valleys during late winter, where the combination of shallower snow under mature forest canopies and dense willows in wetland areas provided moose with optimal habitat (O'Donoghue 2005). However, snow is not expected to strongly influence the distribution or habitat selection in the RSA in most years. This is due to the relatively modest elevation range within the RSA. The average maximum snow depths of approximately 80 cm are just on the edge of the range that moose avoid (EDI Environmental Dynamics Inc. 2021). Over much of the winter, snow depths are less than 70 cm.

Predation is recognized as a major factor affecting the dynamic of moose populations (Gasaway et al. 1992, Ballard and Van Ballenberghe 2007). In general, prey species select security habitats at multiple scales based on various factors that can affect their perceived predation risk. Perceived security is also a dynamic factor that varies over time and is dependent on the density and behaviour of predators, including humans. Moose population growth and density in Yukon are thought to be limited by wolves (Hayes et al. 2003). Consequently, moose may avoid habitats that increase the potential for wolf encounters. However, predator avoidance may be a more prominent factor in habitat selection at the landscape scale than within a home range (Dussault et al. 2005). Habitat types with taller and denser vegetation likely provide some protection from wolves during winter. Habitat types that provide cover from predators may also contain taller trees that intercept snow, reducing snow depth and reducing the energy required to move.

At a minimum, security habitat should conceal a moose from predators. It can be assumed the security habitat for moose can be provided by any forest stand of adequate density with trees and shrubs taller than 2 m. Security cover for moose is most critical during spring calving when cow moose seek out islands and gravel bars on river floodplains for calving. At calving time, cow moose and calves can find secure habitat in dense deciduous or mixedwood stands, or tall shrubs with canopy cover >50% (MacCracken et al. 1997). During winter, deep, and persistent snow has been shown to have a greater impact on the physical condition of moose and thus increasing its risk of predation. Within one study (Dickie et al. 2020), moose seem to select riparian areas to facilitate movement instead of selecting them only for foraging opportunities. In the RSA, most wildlife trails were observed adjacent to riparian areas.



Photo 5-1. A moose observed adjacent to a narrow treed riparian area in the RSA (Photo provided by Palmer Environmental 2019).



Photo 5-2. Shrubby riparian area, on the edge of a burn, where willows have been browsed by moose.

5.2.3 DISTURBANCE

5.2.3.1 Fire

Burns are often a major factor affecting the distribution and abundance of moose across the boreal forest, with densities peaking 20 to 25 years after fire (LeResche 1974). Studies have shown that moose populations are often denser in burned areas where browse is of higher quality and greater abundance than adjacent, unburned areas (Gasaway et al. 1989). Moose have been reported selecting previously burned habitats that are 10–30 years old (Maier et al. 2005) and less than 40 years old (Wasser et al. 2011). Overall, fire creates favourable forage conditions for moose when regenerating shrubs are available for browse.

Several large wildfires have affected the RSA, occurring between 1959 and 2018. Areas that were affected by fire, and are still regenerating, were labelled with a fire disturbance code in the ELC vegetation maps. For older burn areas, the adjacent non-burned area was compared to the burn area to see if there was a noticeable difference in vegetation. Areas that did not have a noticeable difference were not characterized as fire disturbed as they were considered regenerated. The appropriate structural stage was assigned to reflect the stage of regeneration.

The post-fire successional pathways for many of the ecosystem units in the RSA were the same or very similar, making the differentiation of ecosystem units based on revegetation difficult. For example, almost all ecosystem units regenerate initially with deciduous shrubs (willow and scrub birch) and a mix of spruce and deciduous trees (primarily paper birch), and, as succession progresses, the prominence of spruce increases and deciduous shrubs and trees decreases. Often the post-fire succession also varied within an ecosystem unit depending on several factors, including the number and frequency of fires, the intensity of the fire, and the amount of permafrost present before and after the fire. Field observations suggest that hot fires likely melted a larger portion of the permafrost, permanently altering the moisture regime of the affected area; therefore, site moisture regimes are altered, and some sites do not return to the same ecosystem unit that had been established before the fire. From a moose habitat perspective, the result is that, except for some ecosystem units in riparian areas, the abundance of browse species is affected more by regeneration status and structural stage than ecosystem unit type.

The current structural stage for some of the more recent fire-disturbed areas was difficult to determine due to the range in age and variety of the imagery. To be consistent, the mappers assigned a shrub structural stage to all fire disturbed areas unless there was strong evidence suggestion another structural stage (i.e., a plot stating it was graminoid dominant, Photo 5-3).



Photo 5-3. Recent burn in a graminoid structural stage. Generally, regenerating shrubs become available as browse to moose about 10 years after fire disturbance.

5.2.3.2 Linear Features

Linear features are the primary type of anthropogenic disturbance in the Project area. However, there are many uncertainties regarding the extent, impacts, and recovery status of linear features in the area. Linear features include narrow, linear clearings on the landscape, typically used for transportation and seismic exploration activities. The Project area has numerous 2D seismic lines (e.g., Photo 5-4) and winter roads from previous exploration activities dating back to the 1960s. The majority of 2D exploration occurred between 1961 and 1984. Some 2D exploration occurred in 2001 that incorporated LIS techniques (Access Consulting Group and EBA Engineering Consultants Ltd. 2001, GEOTIR 2014). More recently, approximately 2,200 km of 3D low-impact seismic (LIS) exploration was conducted in a 325 km² area between November 2013 and April 2014 (GEOTIR 2014). This 3D exploration grid is near the centre of the Project area, spanning north and south of the Dempster Highway.

Linear features can affect predation risk on moose. Facilitated predation operates by increasing the spatiotemporal overlap and interactions between wolves and prey species (Serrouya et al. 2016, Dickie et al. 2020). The magnitude and extent of such overlap are dependent on the extent and use of linear features across the contiguous woodland habitat. Linear features may enhance predation rates by increasing predator abundance via travel corridors and, ultimately, by optimizing hunting efficiency (Serrouya et al. 2016, Dickie et al. 2017, DeMars and Boutin 2018). The degree to which facilitated predation operates and affects prey species is context dependent. The primary features possibly associated with facilitated predation in the Project area are winter roads/trails, 2D and 3D seismic lines, and the Dempster Highway. In winter, clearing and compaction of snow on linear features by plowing or snowmobiles can elevate predator movements (Keim et al. 2019b), further exacerbating predation risk.

The Dempster Highway runs roughly southwest to northeast through the southern half of the RSA. The RSA includes numerous winter roads (15 m average width) from previous exploration activities dating back to the 1960s. The Project will be accessed via existing and new winter roads. Moose have been shown to avoid human development and activity, but response varies by season, sex, and population. Reduced use by moose has been documented near roads (Rolley and Keith 1980).

Moose use of seismic lines is variable. In a study completed in northern Alberta by Dickie et al. (2020), moose selected to be closer to riparian areas and avoided being closer to linear features. Another study demonstrated that seismic lines could increase encounter rates between prey and predator by facilitating predator movement (McKenzie et al. 2012). Moose, wolves and even people tend to move faster on linear features since these features create a path with less visual and physical resistance to movement but in some cases the ease of movement can increase the risk of prey species encountering a predator. Dickie et al. (2020) noted that moose had tendency to move faster while on linear features which could support the theory that moose perceive LFs as a risk to wolf encounters.

Many uncertainties surrounding the ecological impacts and recovery potentials for linear features, particularly of 2D and 3D seismic lines, in the taiga ecosystem that characterizes Eagle Plains. EDI completed a linear feature study. The purpose of that study was to systematically describe and quantify the current conditions of linear features across the RSA by providing a baseline inventory and assessing the successional and functional status of linear features. Six types of successional pathways were defined on linear features in the Eagle Plains area (Table 5-1; after Simpson 2008).

Most sites surveyed (79%) were undergoing normal succession, and that vegetation was either in a low shrub (56.1%) or tall shrub (29.0%) structural stage along the linear features sampled. Almost all 3D plots were at a low shrub structural stage (67% less than 1 m), while 2D plots and winter roads were distributed more evenly through low shrub, tall shrub, and forested structural stages (21% greater than 4 m and 5% greater than 8 m). The analyses suggested that 2D seismic lines regenerate to a more shrub-dominated community relative to pre-disturbance conditions, 3D seismic lines had lower woody cover than off-line plots after five years of regeneration, and fire has the potential to increase shrub and tree growth on linear disturbances. Sightlines along linear features decreased substantially as the height of vegetation increased, and ease of travel along linear features decreased with the amount of woody cover. Fire played an important role in shaping functional recovery by increasing the amount of woody cover and the structural stage of vegetation.

Under normal succession, 2D seismic lines had 12% to 19% greater mean shrub cover than the corresponding off-line sites in burnt and unburnt conditions, respectively. In unburnt conditions, 2D seismic lines had considerably shorter and sparser trees than paired off-line plots, but in burnt conditions, the 2D lines showed denser trees. Burn status appeared to influence some successional classes. Magnified succession was more common at burnt sites (19 burnt versus 5 unburnt), while stagnated succession was more common at unburnt sites (3 burnt versus 7 unburnt). Sites on a normal successional trajectory did not appear to have any relationship to burnt status, while other successional classes were too uncommon to draw any conclusions.

Studies focusing on the use of linear features by moose are limited. However, Keim et al. (2019a) found that moose used 3D seismic lines the least and used well-defined 2D seismic lines and pipelines the most.



Photo 5-4. Example of a low shrub 2D seismic line within the RSA.

Table 5-1. Descriptions of successional classes documented in the RSA (Simpson 2008).

Successional Class	Description
Normal succession	Similar to adjacent forest, but at an earlier seral stage. E.g., young trees that may be surrounded by early successional shrub and forb or graminoid species. Disturbance is likely only the removal of trees and shrubs, with little to no disturbance to soil or permafrost.
Magnified succession	Increased moisture and nutrient availability due to soil disturbance. Often new seral species due to removal of original trees and shrubs. Resulting vegetation is likely shrub or deciduous tree dominant, typically with more productive growth than adjacent sites. Disturbance is likely the removal of trees and shrubs, with significant disturbance to soil or permafrost.
Retrogressive succession	Removal of insulating peat layer causes a change in the soil thermal regime. Active permafrost layer depth increases, releasing water content. Resulting habitat is likely moss, graminoid, forb, or low shrub dominated, with high moisture content. Disturbance includes the complete removal of trees and shrubs, and soil or active permafrost layer.
Successional stagnation	Suspension of succession at herb or low shrub stage. Likely dominated by graminoids; area may have been seeded. Check line age to differentiate from normal succession. Disturbance to soil or permafrost is likely. Ground may have been compacted.
No succession	No ecological differences except that the forest opening is linear instead of random. Disturbance is likely only the removal of trees and shrubs, with little to no disturbance to soil or permafrost.
Recent disturbance	Newer seismic line where successional patterns cannot yet be determined. Line age was checked to differentiate from other successional patterns.

5.2.4 HABITAT SUMMARY

The late winter season is often a difficult time for moose due to the limited availability of forage and increased energetic demands to move through crusted or deep snow. A winter habitat suitability map was developed for moose in the RSA to identify high-suitability winter forage habitat areas. Moose select winter habitat based on three criteria: food availability, snow conditions, and predator avoidance (Dussault et al. 2005). Within the RSA, moose primarily select winter habitat based on browse availability.

The development of the moose habitat model will focus on the following key points:

- Habitat use is believed to be driven by forage availability.
- Winter is the most limiting season for forage availability.
- Winter forage in the RSA is primarily willow species.
- Areas with high willow cover in the RSA are riparian areas, burn areas and some mesic and moist ecosystem units with moderate willow understory.
- Elevation and snow are not likely a significant factor given the limited topography within the RSA; and
- Linear features like seismic lines and trails may provide small patches with elevated willow cover, but their extent are too small to affect habitat selection.

Willows are the primary winter food for moose and signs of moose browsing were commonly observed in the areas that contain abundant willow during the Project baseline surveys. As willow is an early succession species, the shrub is most abundant in disturbed areas such as burns. Anthropogenic disturbances in the RSA, such as 2D seismic lines, may also have a high willow cover, but the extent of these areas is too small to provide significant forage opportunities to moose. Outside of regenerating areas, the high cover of willows is mainly associated with riparian shrublands along streams and disclimax shrublands within the RSA.

5.2.5 HABITAT SUITABILITY MAPPING

Habitat suitability mapping identifies the current ability of an ecosystem unit to provide certain life requisites for a given wildlife species or provide the environmental conditions needed for cover, food and space. A habitat suitability rating is a value given to each structural stage of each ecosystem unit in a project area. The rating is the suitability value assigned to a habitat for its potential to support a particular species for a specified season and activity. It is often expressed as a percentage of the best habitat. It also reflects the species' expected use of a habitat (Resources Inventory Committee 1999c). Habitat ratings are a product of knowledge and assumptions.

The important role of vegetation is incorporated into any wildlife habitat evaluation. Biophysical factors which are considered to influence wildlife habitats can include vegetation type, slope, aspect, and other geographic features. Since vegetation cover type is an expression of various biophysical conditions such as soil moisture, aspect, and relief, it generally offers a current and valid prediction of habitat for many terrestrial wildlife species, at least at broad scales.

The wildlife habitat evaluation is essentially a modelling process that has two primary requirements:

1. Good knowledge of the habitat needs of a species, and how these habitat needs relate to the described ecosystem units; and
2. A standard approach to establishing wildlife species-habitat relationships and ratings for ecosystem units consistently.

The suitability maps use ecosystem attributes for assigning suitability values to a polygon. Wildlife habitat suitability ratings are a widely applicable method of wildlife habitat assessments. While there are recognized limitations to any habitat evaluation and assessment procedure, suitability ratings using ecosystem unit classification have the following advantages (Resources Inventory Committee 1999c):

1. It is predictive.
2. The methodology is consistent.
3. Large areas can be covered.
4. It is flexible and can be applied to a range of map scales, wildlife species, and general to detailed habitat assessments.
5. It provides strategic planning for habitat management.
6. It ties the wildlife resource to other resource uses (e.g., forestry, recreation, and corridor analyses).

The results of this type of model can provide information on the suitability, amount and distribution of potential moose foraging habitat within the RSA.

5.3 METHODS

The moose habitat suitability model was based on habitat suitability mapping standards and methodology (Resources Inventory Committee 1999c). This methodology is commonly used in habitat assessment. The habitat suitability methodology involves three key steps:

1. Selection of relevant habitat variables to include in the model.
2. Development of rating scores for each habitat variable.
3. Building a relationship among the variables to produce overall habitat suitability scores.

A moose winter forage habitat suitability model was developed based on professional opinion and the availability of suitable datasets. Land cover datasets (vegetation, linear disturbances, and fire history) were considered for the suitability modelling. Other variables were considered but not included in the model. They were assumed to correlate with the vegetation cover types and associated structural stages.

5.3.1 RATING SCHEME

This model uses a categorical rating scheme where each category represents an ordinal measure of habitat suitability. The number of categories used in a rating scheme reflects knowledge of the species' ecology and habitat use (Resources Inventory Committee 1999c). For species like moose, where our understanding of the

species and the availability of relevant base environmental data to support habitat modelling is relatively good, 4- and 6-class schemes are typically used. A 6-class system was initially chosen to rank the base habitat units because the 6-class system facilitated finer differentiation of ratings across the numerous habitat types that occur in the RSA (Table 5-2). However, for interpretive purposes, the ratings were generalized into a 4-class system for most model outputs. In the 4-class system, High and Moderately-High were combined into one category (High) and Nil and Very Low were combined into one category (Nil/Very Low).

High and Moderately High suitability habitat provides some of the best winter foraging opportunities for moose within the RSA. Moderate suitability habitat provides some winter foraging opportunities. Low and very low-quality habitat has limited winter foraging opportunities for moose in the RSA. Nil suitability habitat provides no winter foraging opportunities. It is often associated with features without vegetation (e.g., rivers, streams, roads) or with very sparse vegetation cover.

Within the RSA, the highest rated areas included natural shrublands and regenerating burns in riparian areas, as well as small extents of deciduous and mixed-wood ecosystems on mesic and moist sites. Moderate rated areas were predominantly regenerating burns on mesic to wet sites. Low rated sites were mostly undisturbed stands of open, stunted spruce on mesic to wet sites, ranging from tall shrub to old forest structural stages. Differentiating ratings between Moderate and Low areas was often difficult. Many sites, both burned and unburned, had average willow cover less than 15%, with high variation in cover among sites in the same ecosystem units. Generally, 7% willow cover was used as the threshold to differentiate between Moderate and Low sites. This is a relatively low value of willow cover but using a higher threshold would have resulted in large areas of regenerating burn being classified the same (Low) as undisturbed areas. In Eagle Plains, a substantial amount of total winter forage appears to occur within large areas with relatively low willow cover (i.e., the Moderate suitability areas).

Although the vegetation field data confirmed that the amount of shrubby browse (i.e., willow cover) was greater in fire disturbed areas than undisturbed areas, the amount of browse in regenerating burns was not as high as reported in some other studies. For example, the percent cover of willow in burns in the most common ecosystem unit, EU33-Moist Spruce Labrador Tea, was 11% compared to 7% in unburned areas. As a result of this pattern, areas with fire disturbance attributes in the ecosystem mapping database were generally rated one class higher than the same ecosystem unit that was not burned (mostly Moderate for burns and Low for unburned areas).

Table 5-2. Rating scheme used to rate moose habitat suitability.

Rating	Code	HS Score	Description
High	1	95	Suitable. Conditions at optimal. The best foraging opportunities for moose are expected to be found in these areas of the RSA. Willow percent cover is greater than 15%. Includes both disclimax and seral shrublands areas.
Moderately High	2	75	Suitable. Conditions near optimal. Above average foraging opportunities for moose is expected to be found in these areas. Willow percent cover also typically greater than 15% but, on average, less than High.
Moderate	3	50	Suitable. Suitability is lower than optimal conditions but meet minimum requirements from an energy balance perspective. Willow percent cover generally ranges between 7% to 15%.

Rating	Code	HS Score	Description
			Although willow cover is moderate to low in absolute terms, the large extent in this rating category contributes a substantial amount of the total available forage across the RSA.
Low	4	30	Suitability Unknown. Areas in this rating class offer some forage but the amount is so low and dispersed that the energetic return of using these areas are, on average, mostly negative. Willow species present but typically less than 7% cover.
Very Low	5	10	Unsuitable. Willow species presence and cover is usually less than 2%. Moose are expected to strongly avoid these areas.
Nil	6	0	Unsuitable. Willow presence not expected.

5.3.2 SELECTION OF RELEVANT HABITAT VARIABLES

Potentially relevant foraging habitat variables were identified from published literature, other habitat models, and personal experience. A suite of different habitat variables was identified as candidates in this habitat model, based on their known importance to winter foraging ecology (Table 5-3). The variables were evaluated for inclusion based on availability in GIS database, the ecological relevance to moose in the RSA, and relationships found in other studies. Based on these criteria, ecosystem unit, structural stage data and fire disturbance, all from the ELC mapping database, were included in the moose habitat modelling. Other variables were not included in the model as they were not expected to play a major role in winter habitat use by moose or because they were correlated with one of the three selected variables.

Distance to riparian areas was considered for inclusion in the model. Riparian areas are important foraging habitats for moose (Clarke et al. 2017, McCulley et al. 2017). Within the RSA, riparian areas generally contain abundant browse species relative to the adjacent ecological units. The ELC developed ecosystem units specific to riparian habitats. The ecosystem unit data accurately represent increased habitat suitability in riparian areas found as narrow strips along most watercourse and drainages in the RSA. Therefore, a variable for distance to riparian was redundant and was not included in the model.

Elevation was considered as a variable for inclusion in the model. In winter, moose generally occur at lower elevations to minimize the energetic costs of travelling through deep snow. Moose generally start avoiding areas with >70 cm of snow and rarely occur in areas with >100 cm. However, elevation within the rolling topography of the RSA does not vary substantially (range = 343–752 masl) and was likely not a significant driver of moose distribution. Therefore, elevation was not included as a variable in the model.

Slope was considered as a variable for inclusion in the model. Moose avoid very steep slopes (i.e., generally >35 degrees). In more southerly locations, moose will select moderately steep, south aspect slopes in winter where the combination of slope and aspect reduces snow depth and favours shrubby browse cover. However, steep slopes >35 degrees do not occur in the area, and south aspect slopes do not play a significant role in snow depths at this northern latitude. Therefore, slope was not included as a variable in the model.

Linear features were considered for inclusion in the model. LFs were surveyed in the RSA as a companion study for exploration project proposal (EDI Environmental Dynamics, unpublished study). LFs that were classified as 2D had an average width of 5.4 m and, under normal succession, had greater mean shrub cover than the corresponding off-line sites. The 3D lines had narrower widths and were not as shrubby, or shrubs

were not consistent in shrub cover and species present. The few winter roads also were not consistent in available browse species. The greater shrub cover does not signify the presence of higher quality browse species such as willows. The combination of shrub species cover found within LFs, and the small extent of LF did not warrant including them as a variable in the model because these two factors would not substantially affect habitat use by moose.

Table 5-3. Summary of habitat variables commonly associated with moose habitat suitability from published literature relevant to the Regional Study Area.

Habitat Variable	Ecological Rational	Included in Model (Yes or No)
Ecosystem Unit (ELC)	Ecosystems units have specific vegetation communities associated with them and are the best predictor of winter browse species occurrence.	Yes
Structural Stage (ELC)	Moose typically select shrub structural stages or open mature forest habitats as forage habitat.	Yes
Distance to Riparian	Any shrubby feature influenced by a creek or stream was given a riparian code in the ELC. ELC data more accurately represent increased habitat quality in riparian forests than the distance to riparian	No
Elevation	Elevation can strongly affect snowpack depth, with depths >70 cm limiting winter movements by moose. The limited range in elevation within RSA (343 – 752 m), combined with average winter snowpacks just reaching critical depths for moose, is assumed to be insufficient to affect moose distribution in winter.	No
Slope	Moose avoid steep slopes (>35%) and prefer south-facing slopes. A combination of slope and aspect reduces snow depth and favors shrubby browse cover. However, steep slopes >35 degrees do not occur in the area, and south aspect slopes do not play a significant roll in snow depths at this northern latitude.	No
Fire History (ELC)	Fire may increase forage habitat quality for moose, but it is dependent on time since the disturbance and ecosystem unit. The ELC mapping accounts for the fire history by using the structural stage and a disturbance code.	Yes
Linear features	Moose may avoid linear features due to increased predation risk depending on the region. Linear features may provide foraging opportunities. Linear features within the RSA may affect habitat quality positively or negatively, dependent on ecosystem unit and time since disturbance.	No

5.3.2.1 Ecological and Landscape Classification Based Variables

Ecosystems units have specific vegetation communities associated with them and are the best predictor available of winter browse species occurrence. Moose typically select shrub structural stages or open mature forest habitats as forage habitats. The ecosystem unit and structural stage variables are based on the recently completed ELC mapping of the RSA. A summary of ELC methods and results are presented here. Refer to

the separate baseline report for more detailed information about the ELC mapping (EDI Environmental Dynamics Inc 2021).

Ecosystem Unit Variable

ELC mapping refers to an integrated approach to mapping and classifying units of land according to their ecological similarity (Environment Yukon 2016a). ELC mapping aims to provide information on the biological and physical characteristics of various landscape components to facilitate a range of interpretations and assist in sustainable management (Rowe and Sheard 1981, Environment Yukon 2016a). For example, defining ecosystem units (i.e., ecosites, ecological communities) with similar vegetation, site and soil characteristics can provide information on the current condition of vegetation, can facilitate the development of vegetation mitigation measures during infrastructure development and aid in assessing habitat suitability for wildlife across a landscape.

To best meet the needs of the Project, a manual ELC mapping approach was completed, where mappers examine and interpret digital ortho-imagery to delineate and attribute polygons with ecological information manually. Using existing GIS datasets, this method typically provides a higher level of detail and accuracy than predictive modelling approaches. The mapping and classification methodology conforms to the Yukon Ecological and Landscape Classification and Mapping Guidelines, Version 1.0 (Environment Yukon 2016a), and the Standard for Terrestrial Ecosystem Mapping in British Columbia (Resources Inventory Committee 1998b) were used as guidelines.

To complete the ELC mapping of the RSA, new broad-ecosystem classification units were developed that had similar floristic composition and clearly interpretable ecological context in terms of site-scale climate, landscape position, substrate, hydrology conditions, and moisture and nutrient regimes. The goal was to develop Project-specific ecosystem units representing the range of ecological communities within the RSA while being reliably and repeatedly identifiable from a mapping perspective. The final ELC system used for the Project merged the methodology outlined by the YBEC system with aspects of the BEC system used in BC and referenced some of the existing units.

The most common ecosystem unit mapped in the RSA is Moist Spruce – Labrador Tea (Code 33) (44%) followed by Moist Spruce – Alder – Labrador Tea (Code 34) (12%) and Mesic Black Spruce – Alaska Paper Birch (Code 04) (9%) (Table 5-4). The least common (0%) ecosystem units mapped in the RSA are Dry Sparsely Vegetation (Code 10) and Mesic Birch – Willow (Code 02), and Moist Birch – Willow (Code 36). Both Birch – Willow ecosystem units are influenced by anthropogenic disturbances. Other less common ecosystem units that occur more naturally are Dry Aspen (Code 17), Mesic White Spruce – Alaska Paper Birch – Alder (Code 03), and Wet Shrub Scrub Birch – Graminoid (Code 45).

Table 5-4. Ecosystem units mapped in the Eagle Plains RSA.

Code	Name	Total Area (ha)	% of RSA	Average percent cover of *Salix* sp.
10	Sparsely Vegetated	2.6	0.0	No data
14	Dry Spruce-Lichen (Conifer)	1,826.5	0.8	5.3%
15	Dry Aspen-Lichen (Deciduous)	280.8	0.1	No data
16	Dry Spruce-Birch-Lichen (Mixedwood)	2,103.6	0.9	4.5%
17	Dry Aspen (Deciduous)	80.1	0.0	No data
02	Mesic Birch - Willow	90.5	0.0	22.0%
03	Mesic White Spruce – Alaska Paper Birch – Alder	98.3	0.0	No data
04	Mesic Black Spruce – Alaska Paper Birch (Mixedwood)	21,150.0	8.9	4.6%
05	Mesic Alaska Paper Birch (Deciduous)	11,496.0	4.8	12.5%
06	Mesic Black Spruce – Labrador Tea (Conifer)	7,463.5	3.1	12.2%
20	Shrubby Riparian Birch – Willow	860.2	0.4	27.6%
21	Riparian White Spruce – Prickly Rose	192.1	0.1	12.0%
22	Riparian Spruce – Birch - Willow	674.4	0.3	15.3%
23	Drainage Shrubby Riparian	4,454.2	1.9	57.0%
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	9,129.9	3.8	14.2%
33	Moist Spruce – Labrador Tea	103,696.5	43.5	6.6%
34	Moist Spruce – Alder – Labrador Tea	27,428.6	11.5	6.0%
35	Moist Spruce – Scrub birch – Labrador Tea	12,163.3	5.1	5.5%
36	Moist Birch – Willow	33.4	0.0	39.0%
41	Wet Shrub – Tamarack	177.3	0.1	1.7%
42	Wet Shrub – Black Spruce – Tussock Cottongrass	14,517.0	6.1	4.3%
43	Wet Shrub – Black Spruce - Sphagnum	3,315.6	1.4	5.6%
44	Wet Shrub – Scrub Birch – Tussock Cottongrass	6,844.7	2.9	8.3%
45	Wet Shrub – Scrub Birch – Graminoid	98.7	0.0	10.0%
46	Wet Black Spruce – Labrador Tea – Cladonia	2,498.0	1.0	7.0%
47	Wet Black Spruce – Tussock Cottongrass – Sphagnum	4,232.3	1.8	4.0%
48	Wet Black Spruce – Carex	196.6	0.1	14.0%
B1	Bog – Black spruce – Lichen	764.7	0.3	0.0%
B2	Bog – Black Spruce – Sphagnum	1,960.9	0.8	2.0%

Code	Name	Total Area (ha)	% of RSA	Average percent cover of *Salix* sp.
F	Fen	42.5	0.0	9.0%
M	Marsh	59.5	0.0	3.2%
AN	Anthropogenic	34.9	0.0	0
ES	Exposed Soil	14.5	0.0	0
Fa	Flood Active Channel	5.1	0.0	No data
LA	Lake	6.5	0.0	0
PD	Pond	130.4	0.1	0
RI	River	457.1	0.2	0
RZ	Road	58.9	0.0	0
	Total Area	238,640		

Structural Stage Variable

Within the ELC database, the structural stage attribute (Table 5-5) describes the appearance of a stand or vegetation community and defined by the codes and criteria listed in the Field Manual for Describing Yukon Ecosystems (Environment Yukon 2017).

Most of the RSA is mapped in a Shrub structural stage (74%), with 45% of the RSA in a Low Shrub structural stage (Table 5-5). Approximately 1% of the RSA is in an Old Forest structural stage, and 21% is in a Mature Forest structural stage.

Table 5-5. Structural stages mapped in the Eagle Plains RSA.

Code	Structural Stage	Criteria	Area (ha)	% of RSA
1	Non-vegetated	No vegetation or less than 5% established vegetation, often due to recent disturbance (e.g., placer mining) or unvegetated rock.	8.0	0
2	Sparse / cryptogram	Either the initial stages of primary and secondary succession or a cryptogram community maintained by environmental conditions; sparsely vegetated or dominated by bryophytes and lichens; may be prolonged where there is little or no soil development (e.g., bedrock).	76.9	0.03
2a	Sparse (5–10% vegetation cover)	5–10% vegetation cover.	2.6	0
2b	Bryoid	Bryophyte-dominated	0	0
2c	Lichen	Lichen-dominated	0	0

Code	Structural Stage	Criteria	Area (ha)	% of RSA
3	Herb	Early successional stage or herbaceous communities maintained by environmental conditions or disturbance (e.g., wetlands, post-fire forest succession); herb dominated, including forbs, graminoids and ferns; some invading or residual shrubs and trees may be present but are usually sparse or absent; many herbaceous communities are continually maintained in this stage.	7.8	0
3a	Forb - dominated	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by non-graminoid herbs, including ferns.	0	0
3b	Graminoid – dominated	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by grasses, sedges, reeds and rushes.	161.1	0.07
3c	Aquatic	Herbaceous communities dominated (greater than 1/2 of the total herb cover) by floating or submerged aquatic plants; does not include sedges growing in marshes with standing water.	0	0
3d	Dwarf shrub	Communities dominated (greater than 1/2 of the total herb cover) by dwarf woody species, such as kinnikinnick or dwarf willows.	0	0
4	Shrub	Early successional stage or shrub communities maintained by environmental conditions or disturbance (e.g., wetlands, flooding, post-fire forest succession); dominated by shrubby vegetation; either dominated by shrubby vegetation, including tree seedlings/saplings, or if sparsely vegetated overall, the dominance of shrubs characterizes the community as a shrubland. This may include sites where trees are stunted due to the presence of permafrost, preventing the stand from reaching a higher structural stage.	10,196.7	4.3
4a	Tall shrub	Communities dominated by tall shrub layer vegetation - woody plants > 2m tall and ≤ 7 cm dbh; may be a successional stage or may be in this stage perpetually due to environmental conditions or disturbance.	57,934.3	24.3
4b	Low shrub	Communities dominated by low shrub layer vegetation - woody plants < 2m tall; may be a successional stage or may be in this stage perpetually due to environmental conditions or disturbance.	107,861.2	45.2
5	Pole sapling	Trees > 5m tall and > 7 cm dbh, typically densely stocked. Self-thinning and vertical structure are not yet evident in the canopy. Younger stands are vigorous (usually > 15–20 years old); older stagnated stands (up to 100 years old) are also included; time since disturbance usually < 40 years; up to 100+ years for dense (5000 – 15000+ stems per ha) stagnant stands.	554.8	0.2
6	Young Forest	Self-thinning has become evident, and the forest canopy has begun to differentiate into distinct layers. A more open stand than the pole/sapling stage.	8,322.6	3.5

Code	Structural Stage	Criteria	Area (ha)	% of RSA
7	Mature Forest	Trees established after the last stand-replacing disturbance have matured; a second cycle of shade tolerant trees may have become established; shrub and herb understories become well developed as the canopy opens up.	50,518.9	21.2
8	Old Forest	Stands of old age with complex structure; patchy shrub and herb understories are typical; regeneration is usually of shade-tolerant species with composition similar to the overstory. Fire maintained stands may have a 'single-storied' appearance. Very old stands having complex structure with abundant large-sized trees, snags and CWD; snags and CWD occurring in all stages of decomposition; stands are comprised entirely of shade-tolerant overstory species with well-established canopy gaps.	2,302.7	1.0
n/a	Not Applicable (River, etc.)		692.4	0.3
	Total RSA		**238,640**	

5.3.2.2 Fire History

Fire disturbance was considered as a variable in the model. Numerous studies in boreal and sub-boreal regions have found that moose select areas regenerating from fires. Recent burns and post-fire clearings are generally considered optimal foraging habitat for moose. Forest fires are a significant component of the landscape ecology of the Eagle Plains Ecoregion. Typically, regenerating burns contain higher cover of shrubby browse species than undisturbed areas. This includes both deciduous shrubs like willow, as well as sapling deciduous trees like aspen and paper birch. Although burns are classified as Low and Tall Shrub in the ELC, structural stage alone does not uniquely identify them. Large extents of disclimax, stunted black and white spruce ecosystem unit types were also classified as Tall Shrub.

Numerous studies and data from the ELC mapping, indicate that fire disturbance results in increased shrubby browse cover during the Low and Tall Shrub structural stages of regeneration, and that regenerating burns are selected by moose in winter. Therefore, fire disturbance was included in the model.

5.3.3 WILDLIFE HABITAT RATINGS

Qualitative, categorical habitat suitability ratings were developed for each combination of ecosystem unit and structural stage in a lookup table format. For the Shrub structural stages separate ratings were provided depending on whether the area was recently burned or not. The difference in the amount of browse cover was minimal in other structural stages according to burn status and burned and unburned areas were rated equivalently. The development of ratings was based on expert opinion and primarily by the following assumptions:

- Winter habitat suitability is primarily driven by the amount of shrubby browse species that are predicted to occur and especially the percent cover of willow species. The average percent cover

of willow species by ecosystem unit per structural stage was calculated using vegetation data collected during baseline surveys (Section 5.6.1).

- Low shrub structural stages, including disclimax shrublands (wetlands and shrubby drainages) and regenerating burns, generally offer the highest value forage and are generally rated High.
- The suitability of tall shrub areas depends on disturbance status. Tall shrub areas regenerating from fire disturbance are also rated Moderate (mostly) to High, depending on the ecosystem unit. However, Tall shrub stages also include extensive areas of disclimax stunted spruce (including multiple EUs) that generally offer low to moderate browse species, which are rated accordingly.
- Older structural stages (5–8) can have similar browse and are mostly rated depending on the EU (Table 5-4). On average stage 7 and 8 tend to have slightly more browse than stages 5 and 6.

Every combination of ecosystem unit and structural stage was assigned in initial habitat suitability score based on a 6-class rating scheme (Table 5-6). If there was no structural stage listed for an ecosystem unit, it received a rating of 6 (Nil) for moose winter forage.

The extent of areas with high cover of preferred browse species (mostly willow) is limited in the RSA. The ecosystem unit by structural stage combinations with >15% willow cover was generally rated High (1) and Moderately High (2) and account for only 12% of the extent in the RSA (Photo 5-5 to Photo 5-9). Large extents of the RSA have relatively low willow cover of 5–15% and were rated as Moderate (3) and Low (4) (Photo 5-10 to Photo 5-14). Differentiating the classifications between Low and Moderate was difficult because the differences in willow presence among different sites were not consistent, and variation in willow cover within the same site type was large (i.e., resulting in overlapping confidence intervals across sites). The basis for classifying sites as Low or Moderate considered (i) average cover of willow from field plots (>7% favouring classification to Moderate), (ii) fire history (fire disturbance within 40 years favouring classification to Moderate), and (iii) a qualitative assessment of the potential for each EU and structural stage combination to support willow and other browse species.

Although Moderate and Low rated habitats have relatively low cover of willow in an absolute sense, they likely provide a substantial proportion of total winter forage for moose in the RSA due to the large extents that Moderate and Low suitability habitats cover. That is, in Eagle Plains the overall, total availability of winter forage for moose appears to be distributed in relatively low levels across large portions of the RSA, versus being concentrated in relatively small portions of the landscape, which is typical in more mountainous portions of Yukon.

Overall, EUs in sparsely vegetated or herbaceous structural stages, non-vegetated EUs and certain wetland EUs were assigned Very Low (5) or Nil (6) ratings unless the presence of willow cover was observed (Photo 5-15 and Photo 5-16).

The effect of fire disturbance in boreal ecosystems in enhancing moose browse as the stand regenerates through the low shrub and tall shrub structural stages are well documented. Although evidence of this was observed in Eagle Plains, the degree to which regenerating burns resulted in an elevated cover of browse

species was somewhat muted compared to values reported in other studies. For example, for the most extensive EU, Moist Spruce-Labrador Tea (code 33) (comprising 43% of the RSA), the average percent cover of willow was 11% in burns compared to 6% in unburned areas (Photo 5-11 and Photo 5-12). Similar patterns were evident for most other moist and wet EUs. On average, fire disturbance resulted in a modest increase in willow cover. As a result, areas with fire disturbance within the last 40 years were generally rated one class higher than unburned areas. Most frequently, this resulted in a rating change from Low to Moderate.

Table 5-6. Moose Habitat Ratings Table.

Map Code	Ecosystem Unit Name	Structural Stage														
		1	**2**	**2a**	**3**	**3b**	**4**	**4a**	**4b**	4_F	4a_F	4b_F	**5**	**6**	**7**	**8**
02	Mesic Birch – Willow	6	6	6	6	4	1	1	1	1	1	1	2	2	3	3
03	Mesic White Spruce – Alaska Paper Birch – Alder	6	6	6	6	5	3	3	3	3	3	3	4	4	3	3
04	Mesic Black Spruce – Alaska Paper Birch	6	6	6	6	5	3	3	3	3	3	3	4	4	3	3
05	Mesic Alaska Paper Birch	6	6	6	6	5	2	2	2	2	2	2	3	2	2	2
06	Mesic Black Spruce – Labrador Tea	6	6	6	6	5	3	3	3	2	2	2	4	4	4	3
10	Sparsely Vegetated	6	6	6	6	5	4	4	4	4	4	4	5	5	5	5
14	Dry Spruce – Lichen	6	6	6	6	5	4	4	4	3	3	3	4	4	3	3
15	Dry Aspen – Lichen	6	6	6	6	5	3	3	3	3	3	3	4	4	3	3
16	Dry Spruce – Birch – Lichen	6	6	6	6	5	4	4	4	3	3	3	4	4	3	3
17	Dry Aspen	6	6	6	6	5	3	3	3	3	3	3	4	4	3	3
20	Shrubby Riparian Birch – Willow	6	6	6	6	4	1	1	1	1	1	1	2	2	2	2
21	Riparian White Spruce – Prickly Rose	6	6	6	6	4	1	1	1	1	1	1	2	2	2	2
22	Riparian Spruce – Birch – Willow	6	6	6	6	4	1	1	1	1	1	1	2	2	1	1
23	Drainage Shrubby Riparian	6	6	6	6	4	1	1	1	1	1	1	2	2	2	2
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	6	6	6	6	4	2	2	2	2	2	2	3	3	3	3
33	Moist Spruce – Labrador Tea	6	6	6	6	4	4	4	4	3	3	3	3	3	3	3
34	Moist Spruce – Alder – Labrador Tea	6	6	6	6	5	4	4	4	3	3	3	4	4	4	4
35	Moist Spruce – Scrub Birch – Labrador Tea	6	6	6	6	5	4	4	4	3	3	3	4	4	4	4
36	Moist Birch - Willow	6	6	6	6	4	1	1	1	1	1	1	2	2	3	3
41	Wet Shrub – Tamarack	6	6	6	6	5	5	5	5	4	4	4	5	5	5	5
42	Wet Shrub \ Black Spruce – Tussock Cottongrass	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
43	Wet Shrub \ Black Spruce – Sphagnum	6	6	6	6	5	4	4	4	3	3	3	4	4	4	4

Map Code	Ecosystem Unit Name	Structural Stage														
		1	**2**	**2a**	**3**	**3b**	**4**	**4a**	**4b**	4_F	4a_F	4b_F	**5**	**6**	**7**	**8**
44	Wet Shrub \ Scrub Birch – Tussock Cottongrass	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
45	Wet Shrub \ Scrub Birch – Graminoid	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
46	Wet Black Spruce – Labrador Tea – Cladonia	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
47	Wet Black Spruce – Tussock Cottongrass – Sphagnum	6	6	6	6	4	4	4	4	3	3	3	4	4	4	4
48	Wet Black Spruce - Carex	6	6	6	6	4	3	3	3	3	3	3	4	4	3	3
B1	Bog – Black Spruce – Lichen	6	6	6	6	5	5	5	5	4	4	4	5	5	5	5
B2	Bog – Black Spruce – Sphagnum	6	6	6	6	5	5	5	5	4	4	4	5	5	5	5
F	Fen	6	6	6	6	4	5	5	5	4	4	4	5	5	5	5
M	Marsh	6	6	6	6	5	5	5	5	5	5	5	5	5	5	5
AN	Anthropogenic	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
ES	Exposed Soil	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Fa	Flood Active Channel	6	6	6	6	4	3	3	3	3	3	3	4	4	4	4
LA	Lake	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
PD	Pond	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
RI	River	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
RZ	Road	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6



Photo 5-5. Low shrub – shrubby riparian birch – willow habitat (code 20) rated as High winter forage habitat.



Photo 5-6. Low shrub – drainage shrubby riparian habitat (code 23) rated as High winter forage habitat.



Photo 5-7. Tall shrub – moist birch – willow habitat (code 36) rated as High moose winter forage.



Photo 5-8. Low shrub – moist shrub\scrub birch – Labrador tea – willow habitat (code 31) rated as Moderately High moose winter forage.



Photo 5-9. Young forest – mesic Alaska paper birch habitat (code 05) rated as Moderately High moose winter forage.



Photo 5-10. Mature forest – wet black spruce – carex habitat (code 48) rated as Moderate moose winter forage.



Photo 5-11. Shrubby burnt – moist spruce – Labrador tea habitat (code 33) rated as Moderate moose winter forage habitat (note that this is not rated higher than Moderate because much of the shrub cover is less preferred scrub birch).



Photo 5-12. Unburnt – moist spruce – Labrador tea habitat (code 33), in Tall Shrub structural stage, was rated as low moose winter forage habitat.



Photo 5-13. Tall shrub – wet black spruce – tussock cottongrass – Sphagnum habitat (code 47) rated as low moose winter forage habitat.



Photo 5-14. Mature forest – mesic black spruce – Labrador tea habitat (code 06) rated as low moose winter forage



Photo 5-15. Low shrub – bog – black spruce – Sphagnum habitat (code B2) rated as very low moose winter forage.



Photo 5-16. Low shrub – bog – black spruce – lichen habitat (code B1) rated as very low moose winter forage.

5.3.4 MODEL STRUCTURE

In the ELC map, each polygon contains up to three components. For example, a polygon could contain 80% EU34-Moist Spruce – Alder – Labrador Tea and 20% EU22-Shrubby Riparian Birch – Willow. These composite polygons occur because the pattern of ecosystem distribution occurs as a set of small patches that are too small to map as separate individual polygons. To account for this issue of composite polygons, habitat ratings were applied in two ways (1) an area weighted average of the habitat suitability scores for the components within each polygon, and (2) the proportion of High suitability habitat in each polygon.

The area-weighted average score was calculated using the habitat suitability scores from Table 5-2 and the decile proportion for each polygon component, following equation:

$$ELC_r = \frac{\sum_{i=1}^{n} w_i X_i}{\sum_{i=1}^{n} w_i}$$

Where ELC_r is the weighted average score, w_i is the decile proportion for each polygon component, and X_i is the habitat rating for each polygon component from Table 5-2. An example is provided in Table 5-7 for a polygon with two components:

Although this weighted average approach is a good approach for summarizing average habitat suitability across the study area, it has the disadvantage that, with the averaging process, you lose track of the occurrence of small extents of High suitability areas. This issue is addressed in the second version of model outputs, mapping the proportion of High suitability habitats within each polygon.

The two types of outputs compliment each other for assessment and management at different scales. The weighted average output is intended to be used for strategic assessments and planning, such as assessing the overall effects of the Project on moose habitat, or to compare the relative suitability of moose habitat in one sub-watershed to another. The proportion of High suitability habitat can be used to support finer-scale operational measures, such as locating roads and well sites to avoid high suitability winter moose habitat.

Although the initial habitat ratings for each ecosystem unit/structural stage/fire disturbance combination used a 6-class rating scheme, the composite ratings of the ELC polygon scores were generalized to a 4-class system for simpler interpretation, essentially combining Moderately High and High, and Nil and Very Low.

Due to the small size of many of the High and Moderately High habitats areas, they were frequently formed the second or third component of composite ELC polygons. Consequently, these areas of High were often 'lost' when calculating the weighted average rating for the polygon (i.e., the polygon they were in ended up being rated Moderate or even Low overall). To account for this issue, the amount and location of High and Moderately High areas were examined separately from the polygon weighted average score. This was done by mapping the amount of High and Moderately High areas in each polygon. For example, a polygon with a weighted average habitat score of Low, might contain 20% High+Moderately High.

Table 5-7. An example of a multiple component polygon habitat scoring.

Component	Proportion	Ecosystem Unit	Structural stage	Burn Status	Habitat Score
1	0.8	Moist Spruce – Alder – Labrador Tea	Tall Shrub	Not Burnt	30
2	0.2	Shrubby Riparian Birch – Willow	Low Shrub	Not Burnt	95

ELCr = 0.8*30 + 0.2*95 = 43, which corresponds to an overall categorical rating of Low

5.4 RESULTS AND DISCUSSION

The amounts of predicted moose winter habitat in the RSA are presented for the finer-scale 6-class rating scheme before averaging scores within ELC polygons in Table 5-8, and the consolidated 4-class rating scheme after averaging scores within ELC polygons, in Table 5-9. As mentioned in the Methods, the 4-class scheme essentially combines the High and Moderately High classes and the Nil and Very Low from the 6-class scheme. The 6-class scheme was originally used because it was assumed that there would be greater amounts of areas in the high and low ends of the habitat suitability gradient. However, since the amounts of highest and lowest suitability habitat are so low (i.e., 2.5% High and 0.4% Nil) it makes sense to use the 4-class scheme from this point forward.

The model results indicate that High-suitability winter moose habitat (12%) is limited, and that the remaining area is approximately split between Moderate and Low, with Nil/Very Low areas only accounting for approximately 1% of the RSA. The distribution of winter moose habitat shows clear spatial patterns across the RSA, when examining the average habitat suitability scores across ELC polygons (Map 5-1) and the percent of High-suitability habitats occurring in each polygon (Map 5-2 and Map 5-3). In the map of the average suitability scores (Map 5-1), areas of Moderate suitability are concentrated in the southern half and along the western and northern boundary in the northern portion of the RSA. These areas often correspond to regenerating burns. In the northern half of the RSA, much of the Chance Creek watershed is rated Low, corresponding to a lack of fire disturbance and dominance of open canopy, stunted spruce ecosystems, which offer limited browse for moose. High-suitability winter habitat is found scattered across the RSA, generally in much smaller patches than areas of Moderate and Low. High suitability areas are often in narrow riparian strips along streams and non-confined drainage areas (Map 5-2), but also includes certain deciduous and mixed-wood ecosystem units, like the Mesic Alaska Paper Birch (code 05), which accounts for the concentration of High suitability habitats in the northwest portion of Map 5-3.

This pattern of having a relatively large portion of the landscape in Moderate suitability winter habitat is different than occurs in other parts of Yukon, especially in more mountainous areas, where suitable winter habitat (i.e., High and Moderate suitability) are often constrained by elevation, snow depths and greater distribution of diverse vegetation communities (McCulley et al. 2017). In Eagle Plains, a substantial amount (74%) of the RSA is in a shrub structural stage mostly dominated by scrub birch and Labrador tea and almost half (44%) of the RSA is described as the Moist Spruce – Labrador tea ecological unit which are large areas with relatively low willow cover (i.e., the Moderate suitability areas).

The pattern of winter habitat across the RSA is likely to affect the broad distribution of moose. Due to the scattered occurrence of High suitability habitat across the RSA, some moose are expected to occur across the RSA. However, local densities are likely to be vary in relation to the portions of Low and Moderate that form the matrix of habitat at a larger scale. Where most of the habitat matrix is Low, such as across most of the Chance watershed, moose densities are expected to be relatively low and habitat use is expected to be largely constrained to the scattered patches of High. Where most of the habitat matrix is Moderate, such as the southern half of the RSA, moose densities are expected to be substantially higher; and, although moose use is

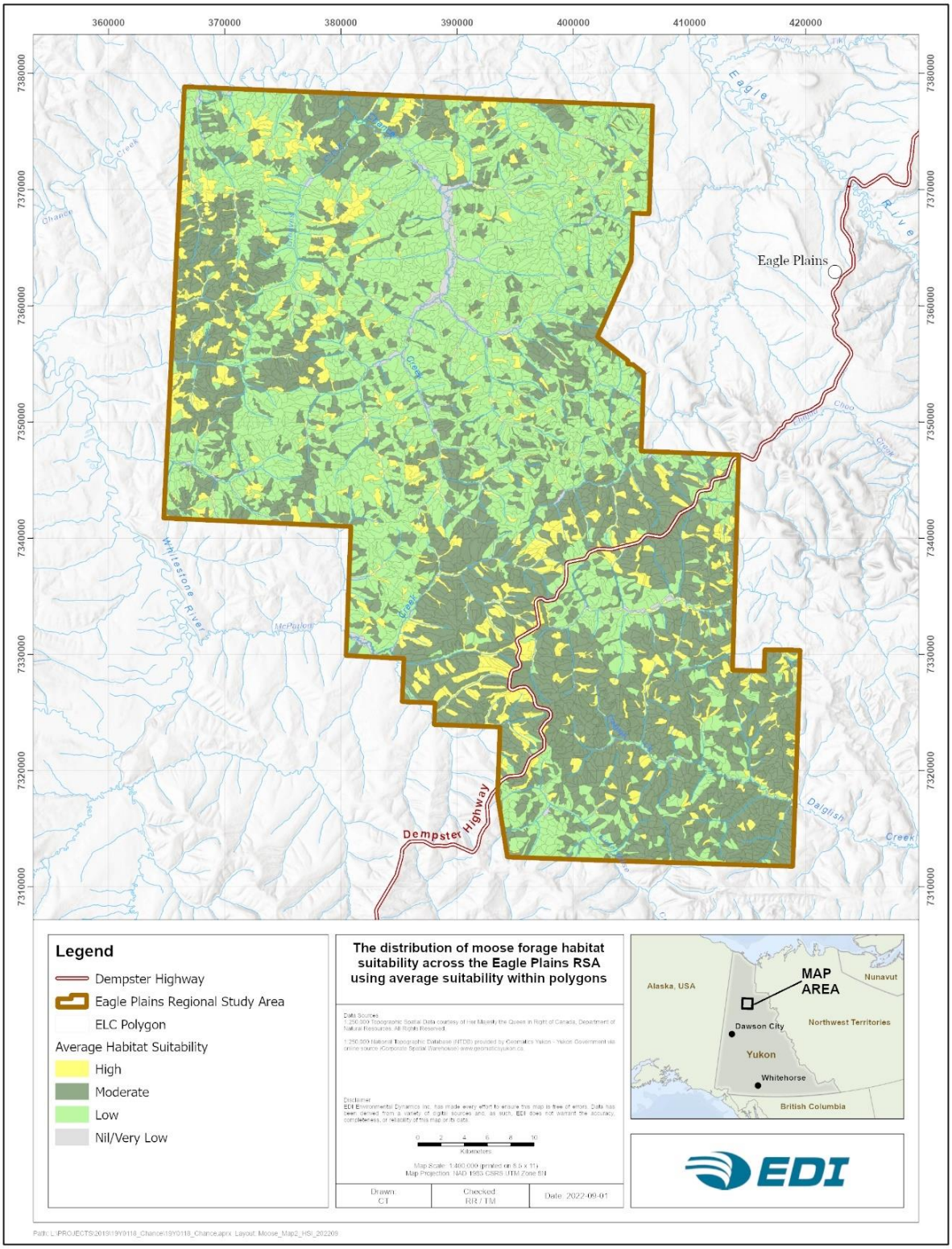
expected to still be relatively higher in the High habitats, considerable use of the Moderate suitability matrix is also expected.

Table 5-8. Estimated amounts of moose winter forage habitat across the Eagle Plains RSA using a 6-class rating scheme.

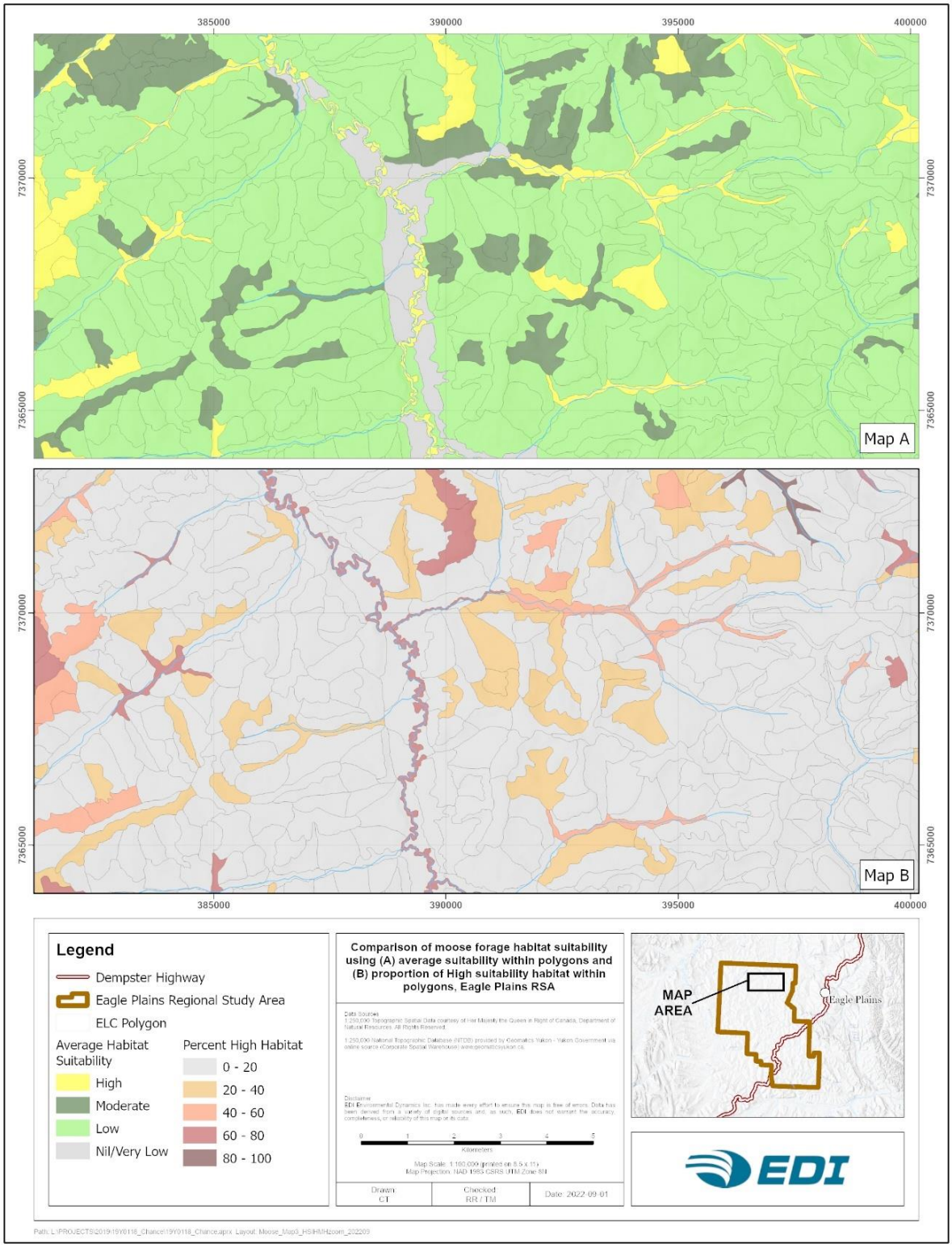
Habitat Rating	Area (ha)	Area (% of RSA)
High	5,961.9	2.5%
Moderately High	23,736.7	9.9%
Moderate	111,561.7	46.7%
Low	94,068.2	39.4%
Very Low	2,492.4	1.0%
Nil	842.6	0.4%
Total Area	238,663.5	100%

Table 5-9. Estimated amounts of moose winter forage habitat across Eagle Plains RSA averaging suitability scores within ELC polygons and generalizing to a 4-class rating scheme.

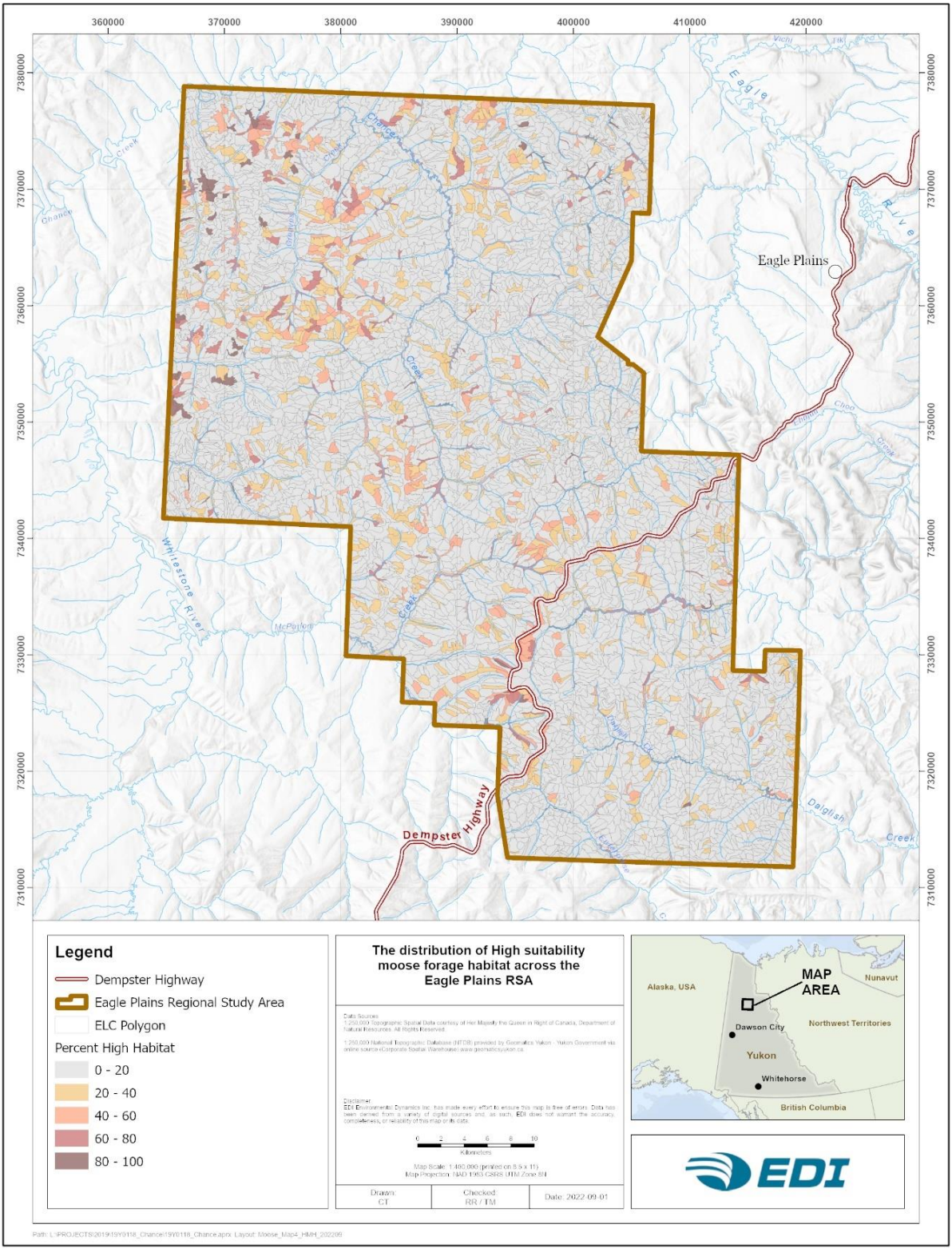
Average Habitat Suitability	Area (ha)	Area (% of RSA)
High	16,944.4	7.10%
Moderate	145,394.1	60.92%
Low	74,514.5	31.22%
Nil/Very Low	1,810.5	0.76%
Total	238,663.5	100%



Map 5-1. The distribution of moose forage habitat suitability across the Eagle Plains RSA using average suitability within polygons.



Map 5-2. Comparison of moose forage habitat suitability using (A) average suitability within polygons and (B) proportion of High suitability habitat within polygons, Eagle Plains RSA.



Map 5-3. The distribution of High suitability moose forage habitat across the Eagle Plains RSA.

5.5 SUMMARY

The suitability, amount, and distribution of potential habitat for moose were quantified across the RSA using a habitat suitability model. The habitat model was for foraging habitat during winter because this life requisite and season are believed to be the most limiting to moose in the RSA. The model consisted of qualitative ratings applied to combinations of three variables from the ELC mapping: ecosystem unit, structural stage and fire disturbance. High suitability habitats consisted of disclimax shrublands, most commonly associated with riparian areas. Moderate suitability habitats were dominated by regenerating burns but also included small areas of mixed and deciduous forests with shrubby understories. Low suitability habitats were mostly open canopy, stunted spruce forests. High-suitability moose winter foraging habitat is limited across the RSA (12%), but Moderate habitat is extensive (43%). Although moose are expected to select the High-suitability areas preferentially, a substantial amount of total winter forage appears to occur within large areas with relatively low willow cover (i.e., the Moderate suitability areas). Due to the scattered occurrence of High-suitability habitat across the RSA, some moose are expected to occur across the RSA in winter. However, local densities are likely to vary with the portions of Low and Moderate habitats that form the habitat matrix at a larger scale.

5.6 MOOSE SECTION ATTACHMENTS

5.6.1 ATTACHMENT 5–A — WILLOW SPECIES PERCENT COVER

Attachment Table 3. Calculated percent willow cover for each ecosystem unit by structural stage based on collected vegetation baseline data. In some cases, no data was collected (NDC) since no ground plots were established within the EU or within a specific structural stage.

Map Code	Ecosystem Unit Name	Structural Stage											Total #Plots
		1	2	2a	3	3b	4a	4b	5	6	7	8	
02	Mesic Birch – Willow	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	22.0 n=2	NDC	2
03	Mesic White Spruce – Alaska Paper Birch – Alder	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	0
04	Mesic Black Spruce – Alaska Paper Birch	NDC	NDC	NDC	NDC	0.0 n=1	5.0 n=1	4.0 n=3	NDC	0.0 n=2	5.2 n=9	4.4 n=6	22
05	Mesic Alaska Paper Birch	NDC	NDC	NDC	NDC	NDC	9.5 n=2	NDC	NDC	13.7 n=3	13.3 n=5	NDC	10
06	Mesic Black Spruce – Labrador Tea	NDC	NDC	NDC	NDC	NDC	38.0 n=3	12.6 n=5	1.0 n=1	0.0 n=2	3.5 n=6	5.0 n=1	18
10	Sparsely Vegetated	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	0
13		NDC	NDC	NDC	NDC	NDC	7.0 n=1	8.5 n=2	NDC	NDC	NDC	0.0 n=1	4
14	Dry Spruce – Lichen	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	2.0 n=3	6.0 n=5	8.0 n=4	12
15	Dry Aspen – Lichen	NDC	0.0 n=1	NDC	NDC	NDC	0.0 n=1	NDC	NDC	NDC	NDC	NDC	2
16	Dry Spruce – Birch – Lichen	NDC	NDC	NDC	NDC	NDC	NDC	NDC	8.0 n=2	0.0 n=1	1.0 n=1	NDC	4
17	Dry Aspen	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	0.0 n=1	NDC	NDC	1
20	Shrubby Riparian Birch – Willow	NDC	NDC	NDC	NDC	NDC	33.0 n=1	26.3 n=4	NDC	NDC	NDC	NDC	5
21	Riparian White Spruce – Prickly Rose	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	12.0 n=6	6
22	Riparian Spruce – Birch – Willow	NDC	NDC	NDC	NDC	NDC	NDC	NDC	1.0 n=1	NDC	26.7 n=4	5.5 n=2	7
23	Drainage Shrubby Riparian	NDC	NDC	NDC	NDC	NDC	NDC	57.0 n=1	NDC	NDC	NDC	NDC	1
31	Moist Shrub \ Scrub Birch – Labrador Tea – Willow	NDC	NDC	NDC	NDC	NDC	NDC	14.2 n=6	NDC	NDC	NDC	NDC	6
33	Moist Spruce – Labrador Tea	NDC	NDC	NDC	NDC	4.0 n=1	3.2 n=11	8.6 n=12	NDC	9.0 n=2	7.1 n=21	6.3 n=3	38
34	Moist Spruce – Alder – Labrador Tea	NDC	NDC	NDC	NDC	NDC	11.0 n=3	5.5 n=4	NDC	NDC	3.2 n=7	0.0 n=1	15
35	Moist Spruce – Scrub Birch – Labrador Tea	NDC	NDC	NDC	NDC	NDC	7.0 n=4	7.3 n=3	NDC	NDC	4.2 n=9	NDC	16

Map Code	Ecosystem Unit Name	Structural Stage											Total #Plots
		1	2	2a	3	3b	4a	4b	5	6	7	8	
36	Moist Birch - Willow	NDC	NDC	NDC	NDC	NDC	43.0 n=1	NDC	NDC	35.0 n=1	NDC	NDC	2
41	Wet Shrub – Tamarack	NDC	NDC	NDC	NDC	NDC	NDC	1.7 n=5	NDC	NDC	0.0 n=1	NDC	6
42	Wet Shrub \ Black Spruce – Tussock Cottongrass	NDC	NDC	NDC	NDC	3.0 n=1	3.0 n=5	4.8 n=13	NDC	NDC	NDC	NDC	19
43	Wet Shrub \ Black Spruce – Sphagnum	NDC	NDC	NDC	NDC	NDC	5.0 n=4	6.5 n=9	NDC	NDC	NDC	NDC	13
44	Wet Shrub \ Scrub Birch – Tussock Cottongrass	NDC	NDC	NDC	NDC	NDC	NDC	8.3 n=19	NDC	NDC	NDC	NDC	19
45	Wet Shrub \ Scrub Birch – Graminoid	NDC	NDC	NDC	NDC	NDC	NDC	10.0 n=1	NDC	NDC	NDC	NDC	1
46	Wet Black Spruce – Labrador Tea – Cladonia	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	6.3 n=5	8.5 n=2	7
47	Wet Black Spruce – Tussock Cottongrass – Sphagnum	NDC	NDC	NDC	NDC	NDC	NDC	NDC	NDC	5.0 n=1	3.0 n=1	NDC	2
48	Wet Black Spruce - Carex	NDC	NDC	NDC	NDC	NDC	NDC	10.0 n=2	NDC	NDC	22.0 n=1	NDC	3
B1	Bog – Black Spruce – Lichen	NDC	NDC	NDC	NDC	NDC	NDC	0.0 n=8	NDC	NDC	NDC	NDC	8
B2	Bog – Black Spruce – Sphagnum	NDC	NDC	NDC	NDC	NDC	NDC	2.0 n=11	NDC	NDC	NDC	NDC	11
F	Fen	NDC	NDC	NDC	NDC	9.0 n=7	NDC	0.0 n=1	NDC	NDC	NDC	NDC	8
M	Marsh	NDC	NDC	NDC	NDC	3.2 n=6	NDC	NDC	NDC	NDC	NDC	NDC	6

6 CARIBOU

The Porcupine Caribou Technical Committee (PCTC) provided telemetry data and seasonal range polygons for the Porcupine Caribou Herd (PCH). Technical discussions and feedback provided by the PCTC also helped align subsequent analyses conducted in this section. This section and much of the technical content reflect responses to their detailed technical review.

6.1 PURPOSE AND OBJECTIVES

Caribou were selected as a VC for the Project due to their importance to the Gwich'in people for subsistence hunting and their cultural and ecological values. The Project occurs exclusively within the range of the PCH, which is a subpopulation of the barren-ground subspecies of caribou (*Rangifer tarandus groenlandicus*). Within the North Yukon Land Use Plan, the PCH is considered "the most significant and culturally important wildlife resource in the planning region" (Vuntut Gwitchin Government and Yukon Government 2009). The herd has been the mainstay of Gwich'in culture for centuries. It is considered a keystone species whose presence or absence influences the composition and dynamics of the wildlife communities and ecosystems in North Yukon. The PCH is a migratory herd with an extensive annual range that spans most of North Yukon and a large area in north-eastern Alaska. The PCH overlaps the Project area primarily during the rut/late fall and winter seasons.

This section summarizes existing information about the ecology of the PCH, and, using telemetry data and analysis outputs to: i) Quantify the degree of seasonal range overlap by the PCH with the RSA during fall and winter, when seasonal range use overlaps the RSA; ii) Quantify habitat use patterns and selection by the PCH during fall and winter; iii) Quantify movement rates and residency periods of the PCH during fall and winter; and, iv) Quantify the potential effects of linear features on the occurrence and movements of the PCH.

6.1.1 SPATIAL BOUNDARIES

Three spatial extents were considered as part of this study:

- The Eagle Plains Project RSA (2,386 km²)
- The Eagle Plains Ecoregion (20,400 km²), and
- The Yukon portion of the PCH's rut and late fall and winter seasonal ranges (65,000 km² and 58,000 km², respectively).

The Eagle Plains Project RSA includes all proposed exploration areas. The RSA has relatively similar patterns of vegetation communities and historical exploration disturbances across it. The Eagle Plains Ecoregion (see Section 1.3) encompasses the Project RSA and provides an ecologically similar area, beyond the proposed exploration areas, that allows certain comparisons between the RSA and adjacent undisturbed areas (e.g., habitat distribution and within-season movement patterns).

The Yukon portion of the PCH's fall and winter seasonal ranges is the largest extent and covers much of North Yukon. This area occurs predominantly within the Taiga Cordillera Ecozone. This Ecozone covers most of the northern Yukon and the southwest corner of the NWT. The Taiga Cordillera includes mountainous areas (e.g., British Mountains, Richardson Mountains, and North Ogilvie Mountains) separated by subdued basins (e.g., Eagle Plains, Old Crow Flats, and Old Crow Basin). The area consists of glaciated and unglaciated terrain and continuous permafrost. The climate in the Taiga Cordillera is variable from its northern to southern extent, with summers ranging from cool to warm with extended periods of daylight, while winters are generally long, cold, and dark. The vegetation in the taiga is dominated by stunted, open spruce forests, which result from short, cool growing seasons, and poor soils over permafrost (Ecological Stratification Working Group 1995). This extent was used to reference spatially broad questions, such as the PCH's seasonal distribution and movement patterns.

6.2 GENERAL ECOLOGY OF THE PORCUPINE CARIBOU HERD

6.2.1 CONSERVATION STATUS

The PCH is a subpopulation of barren-ground caribou in Canada, known for large aggregations of individuals, dramatic population fluctuations, lengthy migrations, and significant cultural and social value to northern Indigenous peoples and other Canadians (COSEWIC 2016). All caribou belong to one species, *Rangifer tarandus*. Within Canada, caribou populations are classified within 12 "Designatable Units" based on a suite of biological, genetic, and evolutionary traits (COSEWIC 2011). All 14–15 subpopulations of barren-ground caribou are considered part of one Designatable Unit (DU 3). Barren-ground caribou were assessed as Threatened by COSEWIC (COSEWIC 2016). The subspecies is not listed on Schedule 1 of the federal SARA. Within Yukon, barren-ground caribou are considered Vulnerable/Apparently Secure (Yukon Government 2020).

6.2.2 SEASONAL RANGES AND MOVEMENTS

Like most barren-ground caribou subpopulations, the PCH has a large annual range and makes long-distance migrations, hundreds or thousands of kilometres, among different seasonal ranges. Often, seasonal ranges vary across and within years in response to variation in forage availability, snow cover, and predation or parasite risk (Russell et al. 1993). The PCH's annual range extends approximately 250,000 km² from Alaska, through Yukon, and into the western edge of NWT. The herd undertakes long-distance migrations across seasonal ranges necessary for key aspects of their life cycle. Eight (8) primary life cycle periods occur for the PCH (Porcupine Caribou Technical Committee 1993). Key information for the eight periods are summarized in Table 6-1 (using information from Russell et al. 1993, Porcupine Caribou Technical Committee 1993, Ryder et al. 2007). The Porcupine Caribou Technical Committee (1993) assessed the relative importance of seasonal ranges using six criteria: energy balance, reproductive contribution, tolerance to disturbance, escape requirements, the intensity of use, and whether alternative habitats are available. Although all seasons are important to meeting the annual life requisites of the PCH, the calving and post-calving seasons are considered

of highest importance and fall and winter are considered of lowest importance (Porcupine Caribou Technical Committee 1993).

Key information associated with each of the eight seasons is provided below, elaborating on summary information in Table 6-1, and including a combination of scientific knowledge (Russell et al. 1993, Porcupine Caribou Technical Committee 1993, Ryder et al. 2007) and traditional ecological knowledge (Sherry and Vuntut Gwitchin First Nation 1999, Ryder et al. 2007). Typical patterns of seasonal range use are shown in Map 6-1. After calving on the north slope and Arctic coastal plains, the PCH typically splits in two, with portions of the herd moving southwest in Alaska and southeast in Yukon. Animals in the Yukon typically follow a clockwise movement through the seasonal ranges from the calving grounds on the north slope, to the British Mountains in summer, to the Richardson Mountains in late summer, dispersing widely and variably across northern Yukon (as far south as the Ogilvie Mountains) in fall and winter, before returning north to the coastal plains in spring. The PCH can potentially overlap the RSA primarily in the rut/late fall and winter periods.

During the Calving and Post-Calving periods cows and bulls tend to occupy different habitats and exhibit different movement patterns, so their ranges are described separately for these periods. During the relatively short calving period (June 1–10), cows occur in the Arctic coastal plains and adjacent uplands and foothills in Alaska and Yukon. Concentrated use often occurs in the Jago Uplands between the Hulahula and Aichilik rivers in Alaska. The calving season is one of the seasons of greatest importance (rank 1) (Porcupine Caribou Technical Committee 1993). Adult females are generally in their poorest body condition and have the largest energy deficits. The calving period is critical to the survival and development of calves (i.e., the source of initial annual population recruitment). The herd occurs in a relatively concentrated range, which appears to offer reduced predation risk and abundant forage that coincides with the timing of calving, and no alternative areas of similar value are available.

During the Post-Calving and Movement period (June 11–30) cows (and new calves) travel away from the calving areas. Cows that calved in the Yukon tend to move west into Alaska. Often, movements are higher into the foothills and uplands, following melting snow and newly emerging vegetation. However, the herd can occur anywhere from the coastline well into the foothills during this period. Selection of local habitats to avoid insect harassment is often a factor by the end of June. The Post-Calving period is also considered a period of highest importance (rank 1) (Porcupine Caribou Technical Committee 1993). Lactating females have their highest energy demands. Movement rates and group sizes increase through June, and cow/calf groups are believed to be relatively intolerant to disturbance.

During the calving to post-calving movement period (June 1–30) most bulls, juveniles, and non-productive cows occur in north Yukon between the Babbage and Firth rivers across a range of habitats within the coastal plains and the British Mountains. Animals tend to be quite mobile and follow plant emergence across habitats and elevations as spring progresses. This period is considered to have relatively low importance (rank 3) for bulls and non-productive cows (Porcupine Caribou Technical Committee 1993) because they are not tending young-of-the-year, high-quality forage is becoming abundant, and insect harassment is limited.

During Early Summer (July 1–15), both cows and bulls remain concentrated in the general north slope area, but the overall range continues to expand. Group sizes increase to the tens of thousands, and movement rates can average 25 km per day. Early summer often marks the beginning of the split of the herd between Alaska and Canada. In Alaska, distribution is widespread into the Brooks Range, and, in Canada, animals typically move into the southern British Mountains by mid-July. Local habitat use is driven by both selection for high-quality forage and insect avoidance. Insect avoidance strategies include using coastal areas adjacent to the Beaufort Sea (often primarily females) and higher elevation snow patches and barren ground in the Brooks Ranges and British Mountains (mostly males). Early summer is considered to have an importance rank of 2. Though food is generally abundant, the energy balance is limited by insect avoidance, resulting in reduced feeding times and selection of areas with less forage. Animals are still susceptible to disturbance, but tolerance is higher than during the calving and post-calving periods (e.g., calves have greater mobility, and more range is available due to snow melt).

By mid-summer (July 16–August 7), the majority of the PCH has left the coastal plains. Animals in Alaska have moved into the southern portion of the Brooks Range, and animals in Yukon have moved southeast into, or are en route to, the northern Richardson Mountains. Daily movement rates remain high through the mid-summer period, and though group sizes are often still large, groups are often breaking up and more dispersed than the aggregations that occur during post-calving and early summer. Mid-summer has an importance rating of 2 for the same reasons identified for early summer. Mid-summer is the period of potentially highest insect harassment, and, similar to early summer, habitat selection may favour insect avoidance over areas with the highest forage. Lactating females suffering insect harassment may be in an energy deficit.

During late summer and fall migration (August 8–October 7), insect harassment declines dramatically. Forage quality and abundance also begin to decline but are generally still abundant. Caribou exhibit high feeding rates during this period and gain fat reserves for the winter. During this period, the herd breaks up into smaller groups and disperses widely across North Yukon, mostly staying north of the treeline for most of the period. Fall migration often follows terrain features like ridges and valleys, but movement routes are unpredictable from year to year. Late-summer and fall migration is considered to have less importance (rank 3) due to the abatement of insect harassment, the relative abundance of forage across a variety of habitat types, the dispersed distribution of the herd, and relatively high tolerance to disturbance (Porcupine Caribou Technical Committee 1993).

The rut and late fall (October 8–November 30) continue to be a period of broad distribution and movement by the PCH, including widespread movement south of the treeline. In Yukon, the rut can occur from the Richardson Mountains to the southern Ogilvie Mountains. The areas where the rut occurs do not appear to have affinity from year to year. Rather, the rut appears to occur wherever the herd happens to be at that time along the fall migration. The rut and late fall period has the lowest level of importance(rank 4), due to the lack of insects, large range extent, ample food, the dispersed distribution of the herd, and relatively high tolerance to disturbance (Porcupine Caribou Technical Committee 1993).

During early, mid, and late winter (December 1–March 31), the PCH is at its most dispersed stage, both in terms of the extent of the range it uses and group aggregations. Average daily movement distances (2 km per

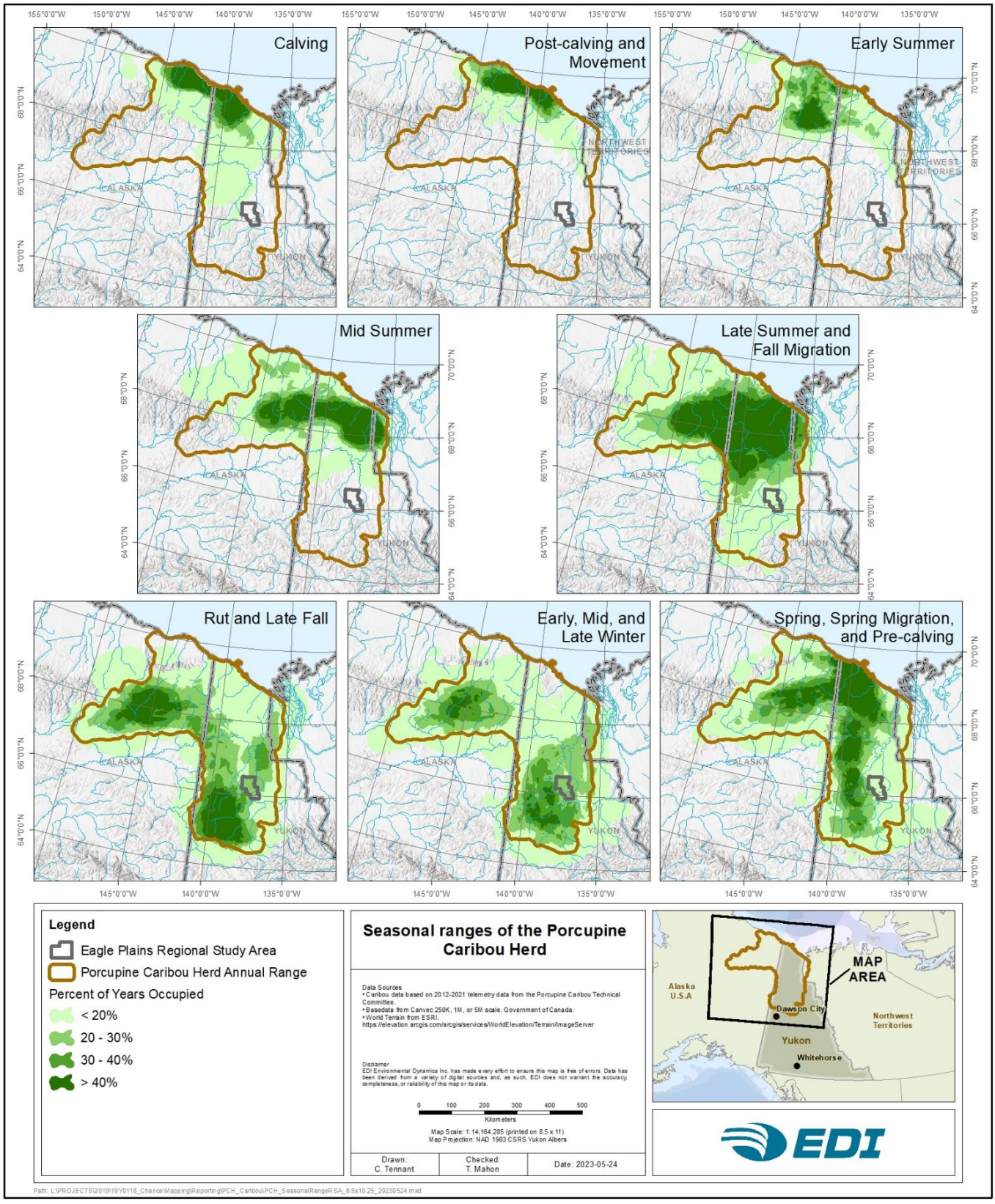
day [km/day] to 5 km/day) (Russell and Gunn 2017) are lower than in other seasons, except for cows during calving (Russell and Gunn 2017). Winter range use varies from year to year, depending on snow depth and condition. In Yukon, during deep snow years, use is concentrated in the Richardson Mountains and the Ogilvie-Hart basins. The Whitestone River and Eagle Plains areas are used more in low snow years. Forage during winter consists primarily of lichens. Unlike reports for some other caribou herds, winter habitat is generally not considered limiting for the PCH (Russell et al. 1993). In shallow to average snow years, the caribou maintain neutral to surplus energy balances (Russell et al. 1993). The PCH is relatively tolerant to human activity during the winter (Porcupine Caribou Technical Committee 1993). Similar to the rut and late fall period, winter has the lowest level of importance (rank 4) due to the lack of insects, large range extent, ample food, the dispersed distribution of the herd, and relatively high tolerance to disturbance (Porcupine Caribou Technical Committee 1993).

During the spring, spring migration, and pre-calving season, (April 1–May 31) caribou begin moving north toward the calving grounds. Average daily movement rates increase from approximately 6 km/day at the start of the season to approximately 24 km/day through May. Similar to the fall migration, no well-defined migration corridors are used consistently from year-to-year during spring migration, but certain terrain feature types like ridges and valleys are regularly used. During spring migration, local snow conditions often affect movement patterns and routes. In years or locations with low snow levels, migration tends to be more dispersed. In years or locations with high snow levels, movements tend to be more concentrated along trail networks on ridges (Porcupine Caribou Technical Committee 1993). Caribou, especially pregnant cows, typically enter an energy deficit during spring due to reduced forage availability as they leave the lichen-rich taiga and before forbs have emerged; in addition, higher energy expenditure is associated with migration. Spring is rated as higher in importance than winter, but still relatively low overall (rank 3), due to lack of association with specific habitats, relatively low threats from predators, and lack of insect harassment (Porcupine Caribou Technical Committee 1993).

Table 6-1. Key life cycle periods for the Porcupine Caribou Herd (after Porcupine Caribou Technical Committee 1993). The Porcupine Caribou Herd overlaps the Project Regional Study Area during Rut and Late Fall and Early, Mid, and Late Winter.

Season	Dates	Characteristics	Importance*
Early, Mid, and Late Winter	Dec. 1 – Mar. 31	The herd is at its most dispersed at this time across 2 winter ranges: in Yukon, mostly south of the Porcupine River in boreal taiga and in Alaska, centred in the Chandalar River/Arctic Village area. Winter range use varies from year to year, depending on snow depth and condition. Caribou at this time of year are relatively tolerant to human activity. In shallow to normal snow years, animals can gain weight.	4
Spring, Spring Migration, and Pre-Calving	Apr. 1 – May 31	Herd distribution varies depending on snowmelt; migration routes vary yearly. Pregnant females are typically in an energy deficit due to reduced forage once they leave the lichen-rich taiga.	3
Calving (cows)	June 1 – 10	Calving occurs on the coastal plain of NE Alaska and, to a lesser degree, NW Yukon. This area offers reduced predators and abundant spring forage; no alternative range is available. Cows are at the lowest point of physical condition and are least tolerant to human disturbance.	1
Post-Calving and Movement (cows)	June 11 – 30	As calves develop over the first two weeks of life, the cows and calves tend to aggregate into larger groups and increase movement rates to track plant green-up. The post-calving period imposes high energetic demands on lactating females, and cow/calf groups are relatively intolerant of disturbance. The post-calving range is primarily in Alaska, and cows that calved in Yukon tend to move west along the foothills into Arctic National Wildlife Refuge. Insect avoidance can affect distribution by the end of June.	1
Calving to Movement (bulls)	June 1 – 30	Bulls, non-pregnant cows, and subadults tend to concentrate east of the calving grounds in northern Yukon. Animals track the progression of green-up from the coastal plains to the northern foothills and into intermountain regions.	3
Early Summer	July 1 – 15	Cows continue to require a high-energy intake for milk production, but insect avoidance also drives distribution. Key areas selected for insect avoidance are the coastal plain adjacent to the Beaufort Sea (mostly cows/calves) and mountains in the Brooks and British Mountains (mostly bulls and cows without calves). Long-distance movements during this period are also an insect avoidance behaviour.	2
Mid Summer	July 16 – Aug. 7	Mid-summer continues to be a period of high insect harassment. Two areas are consistently used – the northern Richardson Mountains in Yukon and the southern portion of the Brooks Range in Alaska. Females with cows may be in energy deficit.	2
Late Summer and Fall Migration	Aug. 8 – Oct. 7	As insect activity declines, the herd disperses widely but mostly stays north of the tree line until the latter part of the period – in Alaska south of the Brooks Range and in Yukon north of the Porcupine River. Animals exhibit high feeding rates and gain fat for the winter.	3
Rut and Late Fall	Oct 8 – Nov. 30	The region where rut occurs has no affinity from year to year; rut occurs wherever the herd happens to be along fall migration. In Yukon, distribution can occur from the southern Ogilvie Mountains to the Richardson Mountains.	4

* 1 = highest importance, 4 = lowest.



Map 6-1. Seasonal ranges of the Porcupine Caribou Herd from 2012–2021.

6.2.3 DIET AND HABITAT

Barren-ground caribou are generalist foragers who feed on grasses, sedges, forbs, lichens, and shrubs during the growing season. During winter lichens constitute the primary forage of most barren-ground caribou populations (Photo 6-1 and Photo 6-2). Over three winters, the composition of PCH fecal samples was similar, consisting of, on average, 64% fruticose lichens, 11% evergreen shrubs, 8% moss, 6% horsetails, and 5% foliose lichens (Russell et al. 1993).

Russell et al. (1993) surveyed lichen distribution across the Yukon portion of the PCH range. Fruiticose lichens were widespread across survey plots and overall biomass estimates were similar to values reported in other western barren-ground caribou ranges (Joly and Cameron 2018). Within the PCH's Yukon range, lichen biomass varied across regions, habitat (range) types and stand ages. Average lichen biomass varied substantially among regions, with the highest biomass occurring in Eagle Plains (78.3 g/m^2), followed by North Fork Pass (45.0 g/m^2), Chapman Lake (33.6 g/m^2), Ogilvie Valley (32.5 g/m^2), and Richardson Mountains (29.9 g/m^2). In terms of habitat type, lichen biomass varied over three-fold across the seven habitats (range) that Russell et al. (1993) surveyed. Open conifer forest types had the greatest lichen biomass, and the forb herbaceous type had the lowest.

In terms of stand age, the generally accepted theory is that lichen biomass is greatly reduced following a fire, increases in abundance up to 125–175 years, and decreases as lichens are overtaken by mosses and shrubs (Klein 1982). Field surveys by Russell et al. (1993) found that lichen biomass in the PCH range was actually highest in stands <50 years since fire, and that lichen biomass decreased across all subsequent older age classes, to a nearly 50% reduction in the oldest age class (>270 years) (Photo 6-3). This local data suggests that younger stands may make a greater contribution to lichen forage than previously believed. Russell et al. (1993) emphasizes the importance of a mosaic of stand age classes, resulting primarily from wildlife, to maintaining lichen biomass at the regional level over time.

Although habitat selection is often driven by forge availability, especially in winter, reducing predation risk (Latham et al. 2011) and minimizing exposure to insect harassment during summer (Russell and Nixon 1990) also factor into habitat selection by caribou.

6.2.3.1 Effects of Snow

The regional patterns of PCH distribution in winter vary among years, often related to snow accumulation, which can limit forage availability (Russell et al. 1993). During the 1970s and 1980s, the distribution of the PCH in winter varied in a regular pattern across four regions with different snow regimes: Yukon/Alaska border, Richardson Mountains, Ogilvie/Hart region, and the Whitestone/Eagle region (Russell et al. 1993).

On average, the Ogilvie/Hart region had the lowest mean snow accumulation. During winters when most animals occupied this region snow depths were normal to high across the overall winter range. Heavy snows in the north early in the season seemed to emphasize concentrated use in this region, pushing animals to the south during the fall migration and rut. Once animals moved into the Ogilvie/Hart basin they typically remained in the region, taking advantage of the comparatively shallow snows, until spring migration.

During the winters when most Yukon wintering animals occupied the Richardson Mountains, snow depths tended to be normal to above normal. Strong winds in the Richardson Mountains resulted in uneven snow distribution, with many areas having reduced snowpacks, including some areas being blown completely bare. During the winters when most Yukon wintering animals occupied the Whitestone/Eagle area, snowpacks were invariably below normal. This area generally had the highest lichen biomass, but snow depths appeared prohibitive during years with normal to deep snow. In the two years when most of the Yukon wintering animals occupied the Yukon/Alaska border area (overlapping with the Fortymile Herd), snows were deeper than average in all other wintering areas.



Photo 6-1. Mesic, mature forest, with mat-forming terrestrial lichens in the Eagle Plains RSA.



Photo 6-2. Lichen communities are often diverse in Eagle Plains. This lichen mat includes *Cladonia spp.* (lighter green) that are preferred forage for caribou, as well as *Stereocaulon spp.* (darker grey) and *Flavocetraria spp.*, which are both also eaten by caribou but less preferred.



Photo 6-3. Lichen cover is generally reduced in regenerating burns. However, EDI observed high lichen abundance in some regenerating burns, consistent with previous work by other researchers (Russell et al. 1993).

6.2.4 POPULATION LEVELS AND TREND

Although most barren-ground caribou subpopulations are declining (COSEWIC 2016), the PCH numbers have increased over the last two decades. The last successful population survey in 2017 estimated the population at 218,457 (95% CI = 202,106 – 234,808) caribou (Porcupine Caribou Technical Committee 2019). Population surveys of the PCH began in the 1970s. The objective is to survey the herd every two to three years, but that period is sometimes extended depending on herd behaviour (aggregation patterns), funding, and logistical issues. Since the first survey in 1972, the PCH has had two periods of population growth, with an interceding decline (Figure 6-1). From 1972 to 1979 the population was relatively stable at just over 100,000 animals. By 1989 the herd had increased to approximately 178,000. Over the next 12 years, the herd declined by 55,000 to 123,000 in 2001. By 2010, the herd had recovered to 169,000 and increased to 218,000 in the last survey in 2017. During the latest growth phase, 2010 to 2017, the estimated population growth rate of 3.7% is almost identical to the growth rate during the 1972 to 1989 growth phase (Porcupine Caribou Technical Committee 2019).

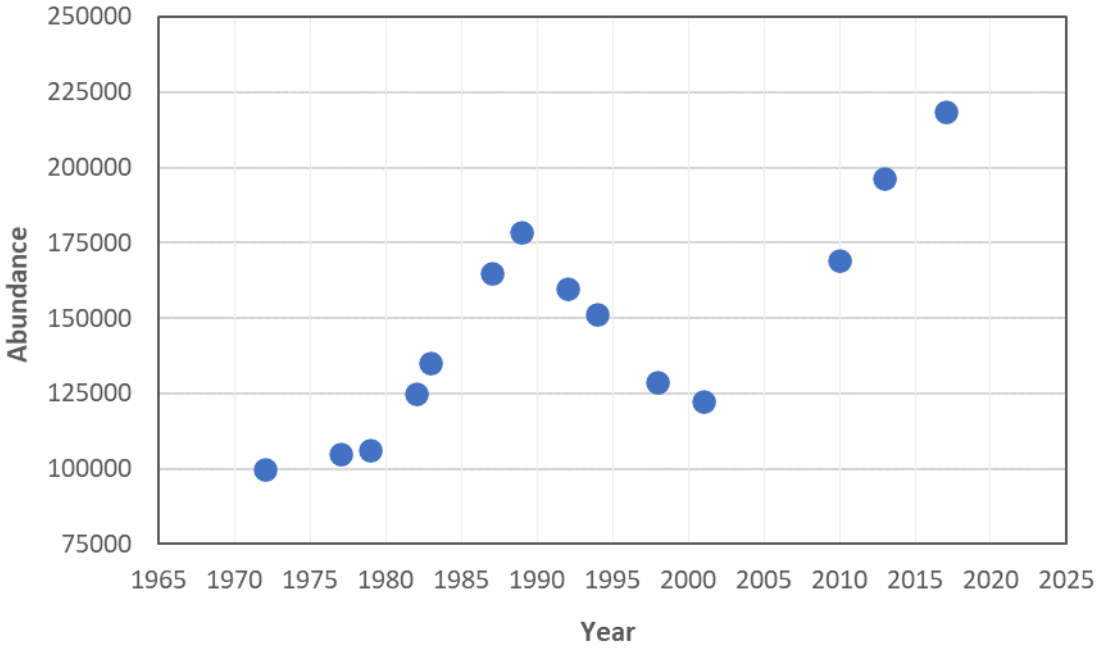


Figure 6-1. The population size of the Porcupine Caribou Herd from 1972 to 2017 (Porcupine Caribou Technical Committee 2019).

6.2.5 POPULATION DYNAMICS

Large magnitude population fluctuations are a key ecological trait of barren-ground caribou. Subpopulations (herds) often experience declines of >80% and increases >500%, which occur over several decades and caribou generations (COSEWIC 2016). Based on scientific studies and Indigenous Traditional Knowledge, the interval between population highs varies from approximately 30–80 years among subpopulations (Ferguson et al. 1998, Gunn 2003, COSEWIC 2016). There has long been debate about whether the intervals

between population highs and lows, and the population levels that occur at highs and lows, are regular enough to be considered cycles (Gunn 2003, COSEWIC 2016, Bongelli et al. 2020). A recent analytical study found that historical population fluctuations of the barren-ground caribou population overall and 9 of 11 sub-populations fit a sine-cyclic model with periods ranging from 26–55 years (Bongelli et al. 2020). However, COSEWIC (2016) points out that cumulative changes in the environment, habitat, climate, and harvest regimes for many caribou subpopulations are without historical precedent, and therefore it is uncertain whether future populations patterns will follow historical patterns.

Despite large magnitude changes in the abundance of barren-ground caribou, there is still a poor understanding of how limiting factors regulate population change. Predation, human harvest[1], parasites and disease, and food supply are all considered limiting factors of barren-ground caribou (COSEWIC 2016); however, no single factor has been conclusively demonstrated as a primary limiting factor across subpopulations and over time. Despite strong advocacy for certain factors by certain researchers (e.g., for predation by Bergerud (1996)), the weight of evidence is that population dynamics involve complex interactions among limiting factors that vary over time and among subpopulations (Klein 1991, Whitten 1996). Over the 50 years that the PCH has been monitored, the population has not exhibited population fluctuations as large as other barren-ground caribou populations (COSEWIC 2016). This may be due to the large annual and seasonal ranges and diversity of habitats across ranges (Russell et al. 1993, Whitten 1996). Whitten (1996) suggests that periods of decline are caused by nutritional stress and predation exacerbated by adverse weather. Population growth during periods of favourable weather is dampened by a combination of poor nutrition, predation, and human harvest and disease. No true density dependent regulation or equilibrium was observed for the PCH from the 1970s to early 1990s (Whitten 1996).

6.2.6 LIMITING FACTORS

6.2.6.1 Food Supply and Overgrazing

The amount and distribution of forage have implications for population distribution and demography of barren-ground caribou (COSEWIC 2016). In general, food limitation is most prevalent during winter, when caribou diet consists primarily of lichen, and does not pose a constraint to caribou from late-spring through fall when graminoids, forbs, and deciduous shrubs are bountiful and predominate their diet (Thompson and McCourt 1981, Russell et al. 1993). Lichen availability depends on both density-dependent and density-independent factors, but the degree to which either is a limiting factor depends on ecological context. For example, density-dependent competition for forage, when local densities are high, and competition is intense, can cause overgrazing of lichen and reduce its abundance (Ferguson et al. 2001, Joly 2009). Recovery of lichen communities following overgrazing can take more than 20 years (Klein 1987).

[1]Human harvest is considered a natural population factor for barren-ground caribou because hunting has occurred for centuries (Sherry and Vuntut Gwitchin First Nation 1999, COSEWIC 2016). However, it is recognized that the nature of hunting has dramatically changed over the last century with the advent of high-powered rifles and snowmobiles.

The potential for lichen supply to regulate caribou herd size and demography is most likely for herds with small ranges on low productivity tundra islands (e.g., Klein 1987). For large, widely-distributed herds, it is more likely that density-independent factors, such as climate and natural disturbance, contribute to limitations in lichen supply that affect caribou distribution (Gunn et al. 2011). Lichen is a slow-growing food source; its distribution is affected by fire (see Joly 2009) and its accessibility depends on regional snow conditions, such as snow hardness and depth (Collins and Smith 1991, COSEWIC 2016). Therefore, caribou tend to shift winter ranges and foraging locations based on burn and snow conditions so that they may access areas with higher lichen abundance (Jandt et al. 2008, Pedersen et al. 2021). In the PCH, annual variation in the distribution of caribou during winter is thought to be a result of caribou tracking available and accessible lichen patches (Russell et al. 1993, WMAC 2009).

The potential for food supply, especially lichen, to regulate the PCH is limited because of their large annual and seasonal ranges and the diversity of habitats (e.g., several broad ecoregions) found within those ranges. Variation in distribution and range use may counteract any limitations on food supply at local scales (Hinkes et al. 2005). PCH migration from the tundra, at the northern extent of their range, to the taiga cordillera, at the southern extent of their range, may serve as a strategy to maximize the available food supply. Overall, the PCH winter range is relatively rich in lichen resources and is comparable to, or better than, those of other herds that winter in taiga regions (Russell et al. 1993).

Forest Fires

Forest fires are a significant natural disturbance agent in taiga forests and play a substantial role in the availability of caribou forage, especially lichen. Occasional fires are important to maintaining lichen biomass at a landscape level. Peak lichen biomass is generally associated with forests 125-1750 years old before lichen volumes decrease due to competition from other species like moss and shrubs (Klein 1982). However, frequent fires can reduce the extent of mature and old forests where productive lichen biomass occurs. For example, forest fires in the winter range of the Bathurst Herd reduced the area of forest by 30% between 1990 and 2000 (Chen et al. 2013). More broadly, the average area burned by large fires in Canada's taiga has increased since the 1960s (Krezek-Hanes et al. 2010). Climate change modelling suggests a further increase in fire extent of 25% by 2030 and 75% by the end of the century (Wotton et al. 2010). Generally, caribou avoid burned areas in winter for several decades until lichen biomass increases to the point where it is favourable for caribou to forage. Changes in landscape vegetation patterns due to fire are believed to affect regional seasonal use areas and migration routes of caribou (Gunn et al. 2011).

The PCTC monitors the extent of burn areas across the forested portion of the PCH annual range; since 1960, 18% of the area has burned (Porcupine Caribou Technical Committee 2021a). The five-year average of the area burned in the Yukon portion of the PCH annual range is 1,552 km² (Porcupine Caribou Technical Committee 2021a).

6.2.6.2 Predation

Wolves are the primary predators of barren-ground caribou (COSEWIC 2016). However, grizzly bears can also be significant predators of caribou, especially calves (Gau et al. 2002). Predation is an important factor

affecting many facets of caribou ecology, as caribou movements and habitat choices are often made to minimize exposure to predators (Bergerud 1996). One of the hypotheses about why barren-ground caribou migrate is that it reduces predation risk. The idea is that moving throughout the year limits the numerical response of wolves (Hayes and Russell 2000). In the NWT, wolf densities in the arctic tundra calving grounds were only 22% compared to wolf densities in the taiga, where the herd wintered. However, as caribou numbers increase, their range expands, causing some caribou to return earlier to the ranges of taiga denning wolves, which results allows wolf numbers to increase (Heard et al. 1996).

A study of wolf predation on the PCH estimated that wolves killed about 7,600 adult caribou each year, regardless of herd size (Hayes and Russell 2000). In 1992 this corresponded to a predation rate of 5.8%, or about one-third of adult mortality. As the PCH declined through the 1990s, the predation rate by wolves increased from 5.8% to 7.4%. Migratory movements effectively reduced wolf predation during the calving through summer seasons due to the combination of smaller ranges and lower densities of wolves in the arctic tundra. Only 16% of the mortality occurred during the calving/summer seasons compared to 84% during the fall and winter seasons, when wolves were predominantly in the taiga zone.

Generally, wolf predation does not appear to regulate barren-ground caribou subpopulations (Crête and Huot 1993, Messier 1995, Hayes and Russell 2000). Hayes and Russell (2000) estimated that the predation rate would have had to be near twice the observed level to cause the PCH to decline during their study. However, the limiting effect of predation increases as population size decreases, which can result in a cumulative effect with other limiting factors as the population declines (COSEWIC 2016).

6.2.6.3 Hunting

Human hunting of barren-ground caribou has occurred for centuries over much of the species range in North America (Sherry and Vuntut Gwitchin First Nation 1999, COSEWIC 2016). Although humans and caribou have co-existed for centuries, technological changes (e.g., high-powered rifles, snowmobiles, and aircraft) and social changes (e.g., commercial hunting) have changed the potential effects human hunting can have on some barren-ground caribou populations (COSEWIC 2016). Over the last half-century, there has been clear evidence of population-level impacts from harvesting. From 2008 to 2011 the estimated harvest rate on north Baffin Island was 41%. During the mid-2010s harvest rates of the Southampton population were considered well beyond sustainable limits (COSEWIC 2016). Harvest is more likely to pose a threat when population monitoring data is poor and/or harvest management decisions lag population declines. For example, in the Bathurst subpopulation, a constant harvesting level during a period of population decline resulted in an increase in the harvest rate (i.e., as a percent of population size) from 2–4% to 10–16% of abundance (Boulanger et al. 2011).

There is no simple, sustainable harvest level applicable to all barren-ground caribou populations. Effects of harvesting depend on herd size, population trend, and the proportion of females that are harvested (Boulanger and Adamczewski 2016). Harvesting may also interact with other limiting factors, such as predation and weather (Klein 1991). Most harvest plans target a total harvest rate of 0–5%, depending on herd status, and with restrictions on harvesting females (e.g., Environment and Natural Resources 2013).

Recognizing the importance of effective harvest management for both the conservation and continued long-term harvest of the Porcupine Caribou, the Porcupine Caribou Management Board led the development of a comprehensive *Harvest Management Plan for the Porcupine Caribou Herd in Canada* (HMP) in 2010 (Porcupine Caribou Management Board et al. 2010)[2]. Key components of the plan include the determination of specific management actions related to the estimated herd size and a set of general best hunting practices. Management actions are determined each year using a set of six population indicators: 1) estimated herd size, 2) harvest information, 3) adult cow survival, 4) calf birth rate, 5) calf survival to nine months, and 6) body condition. In addition, descriptive indicators from people on the land include caribou health, hunting success, and weather conditions that affect caribou. The results from the indicators are rolled up into a 4-class colour chart, and management actions are specified for each colour zone. Management actions become more restrictive across each zone once the herd falls below 115,000 animals, including ceremonial harvests only below 45,000 animals (Porcupine Caribou Management Board et al. 2010).

Implementation of the HMP is guided by a formal Implementation Plan (Porcupine Caribou Management Board 2016). Key components of the Implementation Plan are to 1) guide annual monitoring of the population indictors and harvest levels, 2) provide a forum for all the HMP Parties to review and discuss the population indicators and harvest levels and 3) provide an annual recommended harvest management colour zone plus any additional management actions that are deemed appropriate. Population indictors are monitored each year by the PCTC and summarized in an annual report (e.g., Porcupine Caribou Technical Committee 2021). Annual harvest levels are monitored by each Party or user group and are compiled by the PCTC into an annual report (e.g., Porcupine Caribou Technical Committee 2021b). Each year, the HMP Parties hold an annual meeting to discuss the results of the population and harvest monitoring and determine the harvest management zone for the following year and any additional management actions the Parties feel may be required.

Over the eight-year period, 2013–2014 to 2020–2021, the annual reported harvest rates of Porcupine Caribou have ranged from 749 to 3,367 caribou. The reported annual harvest rates are considered the minimum estimated harvest (Porcupine Caribou Management Board 2022). Due to reporting challenges faced by some Parties, significant harvest may be missed in some regions in some years. Notwithstanding the reporting challenges, the reported Canadian harvest is estimated to be between 1% and 2% of the 2017 population estimate of 218,000 caribou and is not considered a threat to population decline (Porcupine Caribou Management Board 2022). The comprehensive measures within the HMP to monitor and respond to declines in the PCH (i.e., by reducing harvest) provide a solid system to minimize the potential effects that harvesting could have on the herd.

[2] The HMP was agreed to by eight Parties with authorities and responsibilities managing the PCH within Canada, including Gwich'in Tribal Council, Inuvialuit Game Council, Vuntut Gwitch'in Government, Trʻondëk Hwëchʻin Government, First Nation of Na-Cho Nyäk Dun, Government of the Northwest Territories, Government of Yukon, and Government of Canada.

6.2.6.4 Parasites and Disease

Biting and parasitic insects, pathogens (i.e., viruses and bacteria) and internal parasites are important factors in caribou ecology and population dynamics (Gunn and Irvine 2003, Kutz et al. 2012, COSEWIC 2016).

Harassment by parasitic insects can be a key driver of behaviour, movement, and body condition of caribou during summer (Downes et al. 1986, Russell and Nixon 1990). Warble flies (*Hypoderma tarandi*) and nose botflies (*Cephenemyia trompe*), both of the family Oestridae, are the primary source of harassment for Arctic caribou, though mosquitoes (Culicidae), blackflies (Simuliidae), and horseflies (Tabanidae) also are known to cause harassment (Downes et al. 1986, Toupin et al. 1996, Witter et al. 2012a). There are two primary harmful effects of insects. The direct effects of the parasitic burden can result in decreased body condition and reproduction (Albon et al. 2002, Cuyler et al. 2012). Indirect effects include the behavioural response to avoid insects, which includes a reduction in time spent foraging, increased energy expenditure, and selection of low-quality habitats such as ridge tops, coastal regions, snow patches, and unvegetated areas (Downes et al. 1986, Russell and Nixon 1990, Walsh et al. 1992, Toupin et al. 1996, Witter et al. 2012a). These behavioural responses can result in reduced body condition going into the winter with negative implications for survival and fecundity (Russell et al. 1993, Cuyler et al. 2012).

The responses of caribou to disease and other parasites are less evident and less studied than responses to insects. Most occurrences of disease and internal parasites in caribou are at subclinical levels (not severe enough to produce observable symptoms) but can still result in reduced body condition and fitness (Gunn and Irvine 2003). A range of pathogens and parasites observed in caribou includes viruses, bacteria (e.g. brucellosis), helminths (e.g., roundworms, tapeworms, and flukes) and protozoa (Tessaro and Forbes 1986, Gunn and Irvine 2003, Kutz et al. 2012, COSEWIC 2016). Gunn and Irvine (2003) suggest that caribou may have evolved foraging strategies to minimize exposure to parasites. Similar to parasitic insects, internal parasites can reduce caribou body condition and pregnancy rates resulting in population-level impacts (Albon et al. 2002, Kutz et al. 2012).

6.2.6.5 Climate Change

Climate change can potentially affect barren-ground caribou populations negatively and positively through various mechanisms. A recent literature review on this topic identified five primary factors that affect caribou population dynamics that could be affected by climate change: (i) summer range conditions, (ii) parasites and disease, (iii) movement, migration, and distribution, (iv) extreme weather and icing events, and (v) winter range conditions (Mallory and Boyce 2018). The effects of these factors are likely to be complex and interact with climate and non-climate-related factors that will result in substantial local variation and uncertainty in potential outcomes to caribou (Cebrian et al. 2008, COSEWIC 2016).

On balance, climate change is predicted to have mostly positive effects on the summer range condition of barren-ground caribou. Increasing temperatures will likely lead to longer growing seasons, increases in plant productivity, and an earlier onset of spring. Pearson et al. (2013) predict dramatic increases of 29-68% in above-ground plant biomass in the arctic by 2050. These effects could increase caribou body condition and reproductive success by lengthening the summer period of food availability, by increasing the amount of

forage and providing earlier access to forage (i.e., relative to the energetically demanding periods of birthing and lactation) (Tews et al. 2007, Cebrian et al. 2008, Mallory and Boyce 2018). This prediction is supported by a 20-year study in Norway, 1994–2015, where reindeer body mass resulted from greater plant productivity associated with warmer summer temperatures (Albon et al. 2017). In the PCH, earlier and warmer springs over the last thirty years have resulted in more food available for nursing cows, correlated with higher early calf survival (Griffith et al. 2002). However, positive effects on caribou summer range may not occur uniformly across all ranges. Some researchers have suggested the potential for a trophic mismatch between the timing of caribou and vegetation phenologies (Vors and Boyce 2009). Also, a predicted shift to greater cover of woody shrubs may be negative to caribou because shrubs tend to have greater chemical and structural defenses against herbivory and lower available protein than other forage such as grasses, forbs and sedges (Thompson and Barboza 2014).

Most studies suggest that climate change is predicted to increase the potential effects of parasitic insects and disease on barren-ground caribou (Mallory and Boyce 2018). Warmer and longer summers are likely to increase the length and severity of insect harassment, leading to lower body condition of caribou, including lactating cows and calves (Witter et al. 2012b). Climate change is also predicted to increase parasitism by other taxa, such as protozoans and helminths, and the northern expansion of some parasitic species has already been observed (Kutz et al. 2013). Certain ungulate diseases are also expanding northward as the climate warms (Arifin et al. 2020). Arctic ecosystems and species may be more susceptible to the spread of parasites and diseases than southern populations because they have had less exposure and opportunity to develop resistance from an evolutionary perspective.

Extreme weather, such as icing events, large changes in snowfall patterns, and summer heat episodes, is predicted to increase with climate change and negatively affect caribou (Mallory and Boyce 2018). Restricted or total loss of access to forage due to icing in the winter range can significantly affect survival and body condition for barren-ground caribou (Tyler 2010, Hansen et al. 2014). These events tend to be more catastrophic in the high Arctic but have been reported broadly across caribou ranges; including within the VGFN territory where the refreezing of wet snow one winter restricted access to food and greatly affected the health of a caribou herd (Sherry and Vuntut Gwitchin First Nation 1999, p. 186). Ice crusts on snow can also negatively affect travel abilities, body condition, and predation risk of caribou (Griffith et al. 2002). Deep snowpacks can reduce the availability of terrestrial lichen forage in winter. The Porcupine Caribou are known to vary winter range use in response to regional weather patterns (Russell et al. 1993). Changes to regional snow patterns may make areas, such as Eagle Plains, less available to the herd (Russell and Gunn 2017).

Several studies have predicted that climate change could affect the movements, migration and distribution of barren-ground caribou (Mallory and Boyce 2018). Effects are predicted to be most dramatic for subpopulations that travel over ice during the winter and where warming temperatures are already reducing the extent and duration of ice (Poole et al. 2010). Changes in regional snow conditions predicted due to climate change can also affect the migration patterns and seasonal distributions of barren-ground caribou. Russell et al. (1993) observed that the PCH adjusted the concentration of winter range use in relation to winter snowpacks. Areas such as Eagle Plains, which receive the greatest use during low snow years may become less available if regional snowpacks increase. Other studies have indicated that snow depths and snow conditions

(e.g., crusting) affect the migration routes, behaviours, and energetic costs of Porcupine Caribou during spring migrations (Whitten 1996, Griffith et al. 2002).

During winter, many barren-ground caribou subpopulations forage primarily on terrestrial lichen. Climate change is predicted to reduce terrestrial lichen biomass due to increased productivity from other plants (notably shrubs) and, in the boreal/taiga forest, due to increased forest fires (Mallory and Boyce 2018). Some studies indicate the area burned each year in northern Canada could double by the end of the century (Wotton et al. 2010). The potential adverse effects of climate change on caribou winter range depend mainly on the assumption that caribou require lichen-rich diets in winter. Some researchers have long questioned the need for lichens during the winter (Bergerud 1974), and more recent studies suggest that winter diets dominated by graminoids rather than lichens were not detrimental to caribou populations (Heggberget et al. 2002, van der Wal 2006). However, in the Western Arctic Herd a decline in recruitment and abundance in the herd occurred when the winter diet showed increased graminoids and decreased lichens being consumed (Joly 2009). In the past, the conditions of winter range and winter weather were not considered to be limiting to the PCH (Russell et al. 1993, Porcupine Caribou Technical Committee 1993). However, the combination of reduced lichen forage, deeper snow in some areas, and extreme weather events that are predicted to occur with climate change has the potential to increase the limiting effect of the winter range on the PCH.

6.3 PORCUPINE CARIBOU HERD MANAGEMENT

There is a long history of co-management of the PCH among indigenous, state, territorial and federal governments, with international and national management boards formalizing in the mid-1980s. Canada and the United States of America co-manage the herd under the *Agreement Between the Government of Canada and the Government of the United States of America on the Conservation of the Porcupine Caribou Herd (1987)*. The International Porcupine Caribou Board (IPCB) is comprised of Canadian and American representatives. The Porcupine Caribou Management Board (PCMB) is a co-management board for the Canadian portion of the herd's range, formed under the *Porcupine Caribou Management Agreement (1985)*. The *Porcupine Caribou Management Agreement (1985)* was established to coordinate management efforts toward conserving the herd and maintaining and protecting special harvesting rights in the Porcupine Caribou for indigenous users while providing for other users to share in the harvest. The PCMB and IPCB have led or contributed to the development of several plans for the PCH, including:

- *Plan for the International Conservation of the Porcupine Caribou Herd (1987),*
- *Wildlife Conservation and Management Plan for Yukon North Slope (2002),*
- *Porcupine Caribou Harvest Management Plan (2010)* and an associated *Implementation Plan (2010, revised 2016),*
- *Porcupine Caribou Herd Strategic Framework 2015-16 to 2019-20.*

The international agreement also provided for a joint technical committee to coordinate research and monitoring activities and advise the IPCB on scientific matters surrounding the herd. This committee, known

as the "Porcupine Caribou Technical Committee" (PCTC), has been functioning since the 1970s. Over time, the PCTC has taken on the role of advising the Canadian PCMB and the IPCB. The PCTC comprises biologists and scientists from Yukon, Alaskan, Canadian and American government agencies, university researchers, and other caribou experts.

The PCTC leads most of the monitoring and research initiatives associated with the PCH on behalf of the PCMB and the IPCB. Core monitoring work that the PCTC does includes population abundance surveys (normally every two to five years depending on herd behaviour, funding, and logistics), population demographic monitoring (e.g., calf birth and survival rates and important age and sex ratios), seasonal movement monitoring (via GPS telemetry tracking), caribou body condition monitoring, habitat and human disturbance assessments, and annual snow surveys. Monitoring results are normally provided to the PCMB and the IPCB via annual reports (e.g., Porcupine Caribou Technical Committee 2019) and via presentations at the annual harvest meetings. The PCTC also intermittently conducts specific data analyses, such as habitat selection studies and seasonal range mapping, to support land use planning and other management initiatives.

6.3.1 PROTECTED AREAS AND MANAGEMENT AREAS AND PLANS

A network of parks protects the portion of the PCH annual range that occurs within Yukon, special management areas, conservation areas, wilderness areas, protected areas, ecological preserves, habitat protection areas, and IMA zones within the North Yukon Regional Land Use Plan and the Peel Watershed Regional Land Use Plan (Map 6-2). In total, 54% of the annual range of the PCH within Yukon falls within some type of protected area where industrial activity is prohibited, 36% of the annual range occurs within regional LUP IMA zones, and 9% of the annual range is not covered by any type of land management zonation. A summary of the overlap of different types of protected areas and management areas with the seasonal ranges of the PCH is provided in Table 6-2.

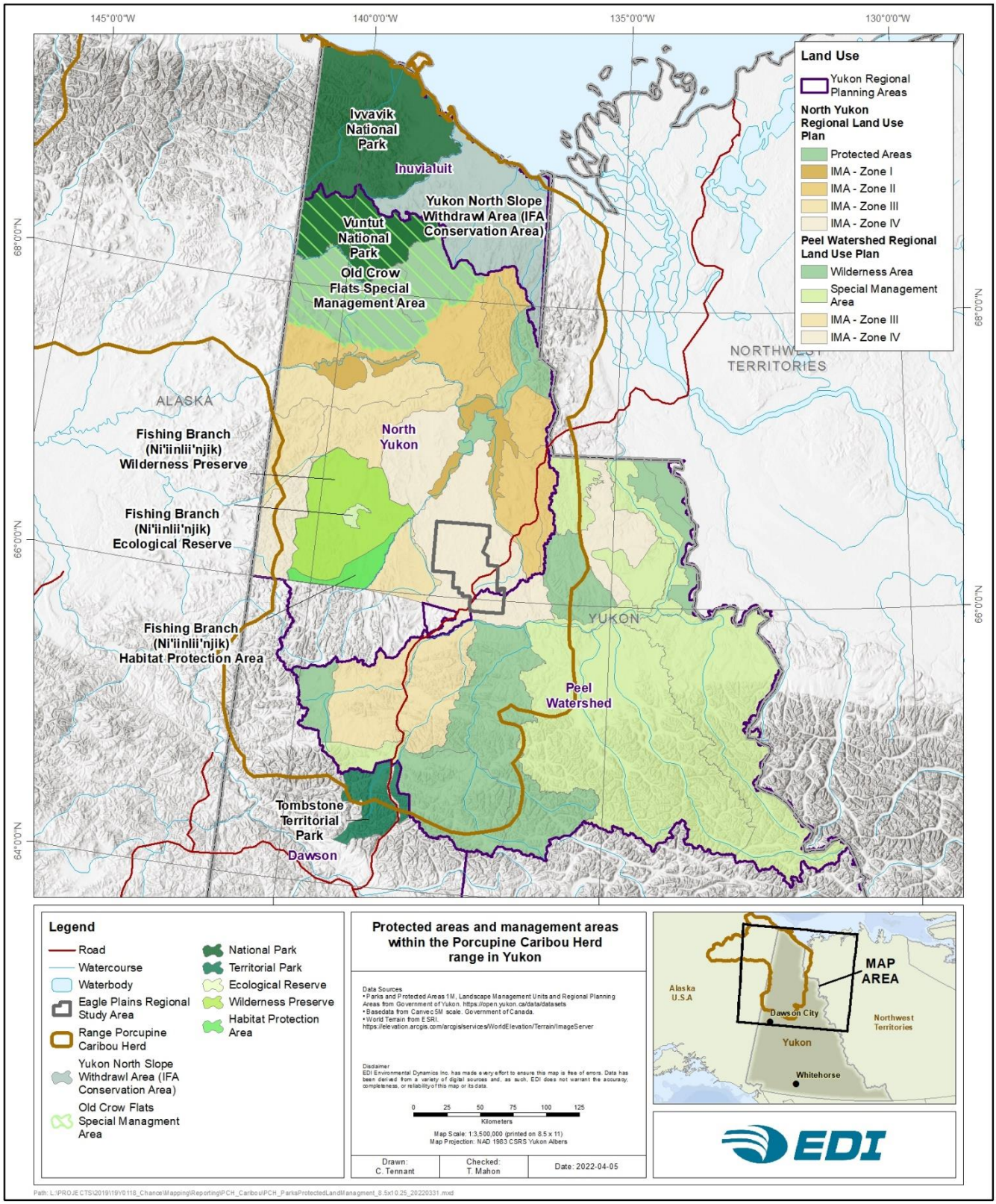
The Project is within the North Yukon Planning Region and Peel Watershed Planning Region and is subject to the NYLUP (Vuntut Gwitchin Government and Yukon Government 2009) and PWLUP (Peel Watershed Planning Commission 2019). The project falls within IMA Zone IV of both plans, a zone with lower ecological and cultural values and the highest permissible development of the four IMA zones. The NYLUP and PWLUP include management objectives and strategies to minimize the effects of human development activities on wildlife and wildlife habitat, generally, and specific objectives and strategies for caribou.

In addition to the Regional Land Use Plans, the Habitat Programs Section of the Yukon Department of Environment, Yukon Government maintains an inventory of important habitat areas for focal management species, including caribou, within the Wildlife Key Area Inventory (Environment Yukon 2014b). Wildlife Key Areas are specific geographic locations used by wildlife for critical, seasonal life functions, such as calving areas and mineral licks. No Wildlife Key Areas for caribou occur within the Project RSA (Government of Yukon 2015).

Table 6-2. Summary of the overlap of different types of protected areas and management areas with the seasonal ranges of the Porcupine Caribou Herd.

Season	Area (km²)	% of Seasonal Range					
		Protected Areas [1]	IMA I	IMA II	IMA III	IMA IV	Not Zoned
Early, Mid, Late Winter	58,090	37	2	8	19	18	15
Spring, Migration and Pre-calving	68,463	55	1	7	21	7	9
Calving	14,636	100	0	0	0	0	0
Post-Calving and Movement	7,622	100	0	0	0	0	0
Early Summer	5,901	100	0	0	0	0	0
Mid Summer	24,417	86	0	14	0	0	0
Late Summer and Fall Migration	57,928	60	4	15	13	8	0
Rut and Late Fall	65,249	31	3	10	23	13	20

[1] including parks, special management areas, conservation areas, wilderness areas, protected areas, ecological preserves, and habitat protection areas.



Map 6-2. Protected areas and management areas within the Porcupine Caribou Herd range in Yukon.

6.4 SEASONAL DISTRIBUTION

Considerable effort has been placed towards quantifying and mapping space use of PCH caribou in Yukon. Satellite-telemetry collaring programs have allowed for the tracking of individuals within the herd to delineate the herd's seasonal distributions. The PCTC supplied EDI with spatial polygons of PCH seasonal ranges spanning 37 years (1970–2016), which provided an opportunity to determine the amount of overlap between seasonal ranges and the RSA. Simple measures of overlap (%) can yield useful insight into the historical frequency of occupation and how PCH caribou are likely to interact with the Project.

The Project RSA overlaps a relatively small proportion of late fall (October 8 to November 30) and winter (December 1 to March 31) ranges. Most of the overlap occurs in portions of the ranges that are less frequently used on an annual basis. No overlap occurs with frequently used portions of late fall and winter ranges.

6.4.1 METHODS

The seasonal ranges used for this analysis consisted of mapped 'sensitive habitat' polygons provided by the PCTC that correspond to eight seasonal life cycle periods for the PCH (Porcupine Caribou Technical Committee 1993). Within each season, the PCTC identified four levels of use based on the frequency of overlap among annual estimates of seasonal home ranges computed for collared caribou, 1970–2016. The four use levels correspond to the proportion of years that home range estimates overlapped any given area: >40 %, 30–40 %, 20–30 %, and <20 %. The lowest category (<20 %) corresponds to very low use and is not considered part of the regular seasonal ranges of the PCH. The degree of overlap of the Project RSA with the PCH seasonal ranges was calculated in a GIS by measuring the overlap of the RSA with each 'frequency of use' category for each seasonal range. All eight life cycle periods were considered for the analysis, but only late fall (including rut, October 8 to November 30) and winter (December 1 to March 31) ranges overlapped the RSA. The overlap analysis was constrained to Yukon because fall and winter ranges in Yukon and Alaska are functionally discrete. Including the Alaskan ranges would dilute the degree of overlap of the RSA with the Yukon ranges.

6.4.2 RESULTS

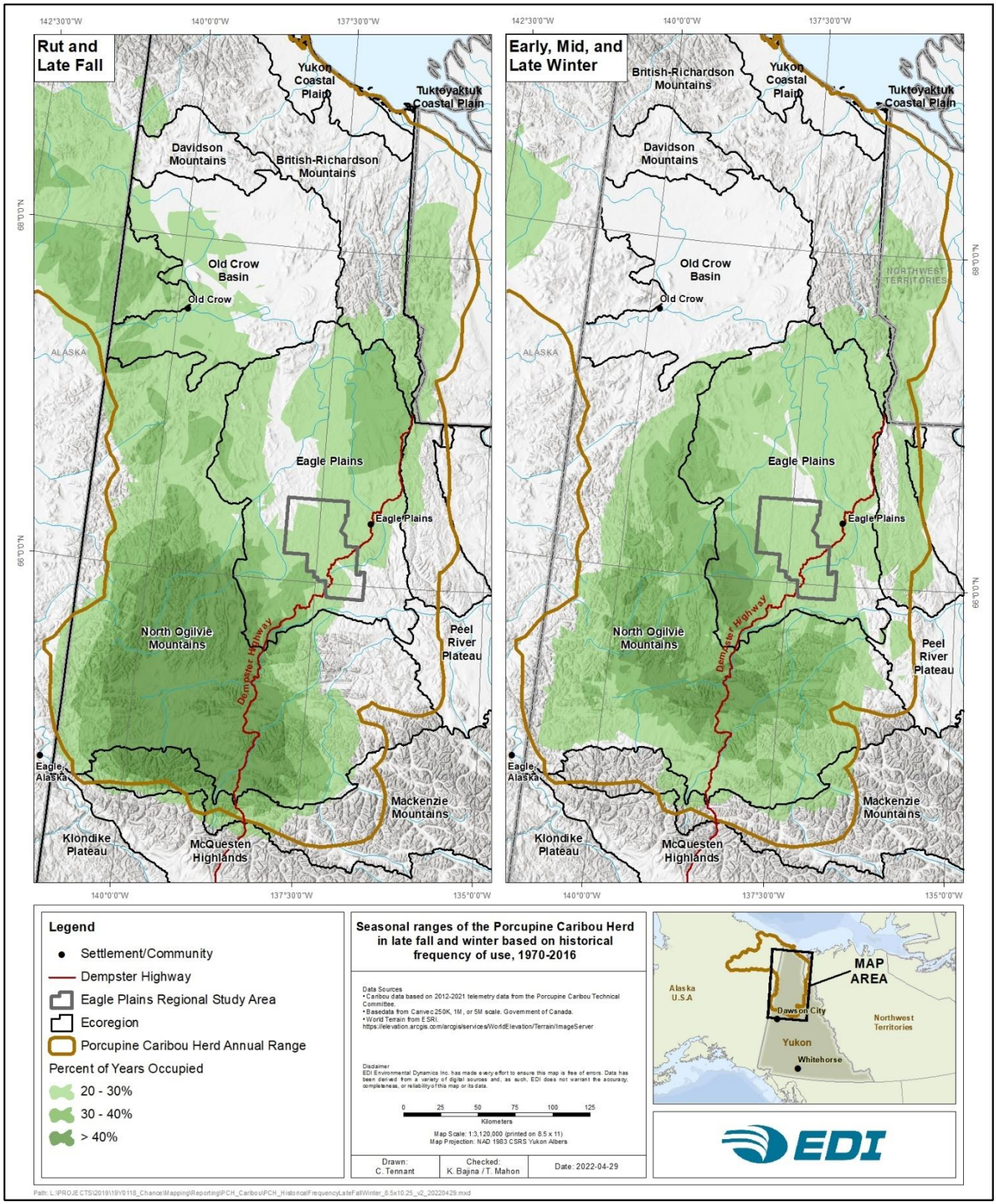
Only two seasonal life cycle periods had relatively frequent overlap (i.e., >20 % across years) with the RSA: (1) rut and late fall, and (2) early, mid, and late winter. For simplicity in this and subsequent analyses, these two periods are referred to as 'late fall' and 'winter' seasons. The RSA overlaps a relatively small portion of the seasonal ranges for both late fall and winter seasons: 5.97% in late fall and 6.54% in winter (Map 6-3). The greatest overlap occurred with the 20–30 % frequency of use areas; 5.90% and 6.12% of late fall and winter ranges, respectively (Table 6-3). No overlap occurred between the Project RSA and the most frequently used areas (>40 %) for either season.

PCH caribou have a wide-ranging distribution in late fall and winter and occupy a large portion of northern and central Yukon. Though some use occurs in the Project RSA and the broader Eagle Plains ecoregion, more frequent use occurs further southwest in the taiga cordillera of the North Ogilvie Mountains in late fall and

winter, and in the Richardson Mountains in late fall (Map 6-3). As discussed in the background sections, Section 6.2.2 *Seasonal Ranges and Movements* and Section 6.2.3.1 *Effects of Snow*, the distribution of the PCH in winter varies across four regions with different snow regimes: Yukon/Alaska border, Richardson Mountains, Ogilvie/Hart region, and the Whitestone/Eagle region (Russell et al. 1993). Use of the Whitestone/Eagle region is highest in years with lower than average snowpacks.

Table 6-3. Percent overlap of the Porcupine Caribou Herd late fall and winter ranges with the Project RSA based on the annual frequency of use by caribou, 1970–2016.

Seasonal Range	Annual Use by Caribou (%)	Percent Overlap with RSA (%)
Late Fall	< 20%	0.55
	20–30%	5.90
	30–40%	0.07
	> 40%	0.00
Winter	< 20%	0.07
	20–30%	6.12
	30–40%	0.42
	> 40%	0.00



Map 6-3. Annual frequency of use by the Porcupine Caribou Herd in late fall and winter ranges relative to the RSA, 1970–2016.

6.5 HABITAT USE

The general distribution of PCH caribou across seasons provides some context for their potential interaction with, and overlap of, the Project RSA. However, to caribou, all space on the landscape is not equivalent. Habitat needs to be considered to predict how often caribou might occur in the area based on the amount and distribution of necessary resources, such as forage. To better understand how PCH caribou use habitat across their late fall (including rut) and winter (i.e., early, mid, and late season) ranges, statistical models were developed to describe the relationship between caribou locations and relevant habitat components. These models considered habitat available to caribou broadly across their seasonal range. Habitat models were developed for late fall and winter using GPS location data (2012–2021) of satellite-collared caribou provided by the PCTC. Habitat model outputs were used to estimate the amount and distribution of habitat within the Project RSA and across the PCH's late fall and winter ranges.

The chosen models for late fall and winter performed reasonably well in predicting PCH caribou habitat selection based on several measures of model performance. Light macrolichen cover was the key driver of caribou habitat use in both seasons, though preference for lichen was strongest during winter. During late fall, caribou tended to select flat, mid-elevation regions near large waterbodies. During winter, caribou tended to select flat areas at low and high elevations while remaining distant from waterbodies. Caribou also avoided areas with dense conifer trees, shrub (deciduous and evergreen), forb, and graminoid cover. Base habitat models predicted the distribution and proportion of selected habitat in the Project RSA to be approximately equivalent during late fall and less during winter relative to the full extent of those seasonal ranges.

6.5.1 METHODS

6.5.1.1 Spatial Extent

Habitat modelling was conducted across the Yukon portion of the late fall and winter seasonal ranges defined in Section 6.5, *Seasonal Distribution* (i.e., areas with >20% frequency of annual use). Analyses were limited to the Yukon portion of late fall and winter ranges because of the potential differences in the ecology of caribou occupying Alaska versus Yukon. Using the full Yukon range yields the benefit of identifying broad patterns of habitat selection that affect the territory-wide distribution of the PCH. However, use of a broader scale may dilute patterns of habitat selection at local scales, e.g., only within Eagle Plains ecoregion. Whether such dilution leads to a loss of information depends on caribou habitat preferences in different ecoregions.

6.5.1.2 Data Preparation

The PCTC provided EDI with GPS location data (2012–2021) of satellite-collared PCH caribou. These data covered the entire annual range of the PCH and were reduced to include locations only within the late fall and winter range extents, as described above. The reduced data set consisted of 164 caribou in late fall and 172 caribou in winter. Most of these data (39.02% in late fall and 42.74% in winter) were attributed to locations collected in 2020–2021.

Spatial habitat data were acquired to relate caribou locations to environmental conditions within fall and winter seasonal ranges (as defined above) and, where appropriate, account for variation in conditions across time. For example, temporal changes (from 2010 to 2020) in the distribution of plant functional types (PFTs) due to grazing, fire, and climate-driven vegetation dynamics were captured using predicted top cover percentage (%) raster layers developed by Macander et al. (2022). Based on initial data exploration exercises, the PFTs that were considered ecologically relevant to habitat use of the PCH included light macrolichens (also see Macander et al. 2020), graminoids, forbs, evergreen shrubs, deciduous shrubs, and conifer trees. Data for topography on the landscape were acquired from a Digital Elevation Model (DEM; 1:250,000) for Yukon and were used to develop measures of absolute elevation (metres), slope percent (slope tool in the Spatial Analyst extension, ArcGIS 10.7; ESRI 2019), aspect (degrees), and a terrain ruggedness index (TRI; Sappington et al. 2007). A measure of relative elevation was created by combining absolute elevation and a simplified stream network (CanVec; nearest main watercourse from a 1:1,000,000 scale watercourse layer) and then employing the HAR tool from the Riparian Topography Toolbox in ArcGIS (Dilts 2015). A CanVec (1:1,000,000) waterbody layer was also used to map distances to waterbodies >1 ha. Caribou may use frozen waterbodies as an antipredator tactic to increase sightlines. They may also be mineral licks (Ferguson and Elkie 2005).

6.5.1.3 Statistical Models

Determining which resources (habitat features) are selected most often by animal populations is important because it provides information about how those animals meet fundamental requirements for survival and reproduction (Manly et al. 2002). Resource selection functions (RSF) are a statistical method that quantifies how resources are chosen by relating animal observations to resources available across the landscape. RSFs predict the probability of an animal occurring at specific locations (e.g., within a study extent) based on the combination of resources available at those locations. Results of a RSF can be mapped to identify important areas of resource selection for caribou and, therefore, can inform the conservation and management of the species.

Caribou observations were first overlayed with environmental spatial data layers to develop RSFs for PCH late fall and winter ranges. Environmental values were extracted for each known location of caribou plus ten times as many randomly sampled locations (spaced a minimum distance of 50 m apart). Availability was deemed global, so available locations were randomly selected within the late fall and winter study areas. Independence among observations of caribou was assumed by resampling caribou locations to a maximum of one per day. Available locations were compared to locations known to be occupied or 'used' by caribou to identify the combination of resource units preferred by caribou. Logistic regression was used to develop RSFs within a generalized linear mixed model framework. The general formula for logistic regression is as follows:

$$logit(P) = \beta_0 + \beta_1 x_1 \ldots \beta_n x_n + Y$$

where the predicted value P is dependent on the linear predictor ($\beta_0 + \beta_1 x_1 \ldots \beta_n x_n$) through a logit-link function, and x is the *i*-th environmental covariate and β is its associated coefficient. An interaction was included between Ecoregion and macrolichen cover to account for the varied distribution, and possibly selection, of lichen among ecoregions. An additional random effect term, Y, was added to account for (a) the

variation in habitat selection associated with each caribou year and (b) the unequal sample sizes among years. Large weights were applied to all available locations ($weight_{avail}$ = 1,000) relative to used locations ($weight_{used}$ = 1) to ensure that parameter estimates were not biased by the sampling ratio of used and available points (Muff et al. 2020). The linear predictor was used to calculate the probability of selection P:

$$P = \frac{e^{(\beta_0+\beta_1 x_1 \ldots \beta_n x_n+Y+E)}}{1+e^{(\beta_0+\beta_1 x_1 \ldots \beta_n x_n+Y+E)}}$$

where e is the natural exponential function and P is bounded by $0 < P < 1$.

6.5.1.4 Exploring Covariate Relationships

Before analyses, all continuous covariates, such as PFT top covers, elevation, slope, TRI, HAR, and distance to waterbodies, were standardized to have a mean of zero and a standard deviation of one. Standardizing the values across covariates ensures model convergence and improves the ability to rank the relative importance of each covariate in a model. The aspect was converted from continuous (degrees) to categorical (cardinal directions) based on 90° intervals. To prevent biased estimates of coefficients and inflated errors, multicollinearity among covariates was assessed using a correlation matrix (dropping variables with Pearson's product moment correlation $|r| > 0.7$ [see Dormann et al. 2013]) and variance inflation factor scores (dropping variables with VIF scores > 3 [Zuur et al. 2009]). For example, absolute and relative (HAR) elevation in winter were highly correlated (r = 0.69). The decision to choose one over the other was based on univariate response curves assessed using generalized additive modelling (GAM; see below). In other words, of the highly correlated covariates, the one with the greatest selection response (slope) was chosen. In this case, absolute elevation was retained over HAR.

Data exploration consisted of (1) univariate analyses with the response variable (i.e., used versus available), and (2) univariate and multivariate GAMs to assess the potential marginal effect of each covariate on the (non-linear) shape of the response curve (i.e., probability of use). These exercises informed model development. For example, rather than assuming a linear increase for percent light macrolichen cover, the variable was logarithmically transformed to fit the expectation that the probability of selection increased at incrementally smaller values as the quantity of lichen in a patch increased (Figure 6-2). Additionally, different patch sizes were considered for PFT covers by estimating the mean percent cover within 100 m, 500 m, and 1,000 m buffers around used and available points.

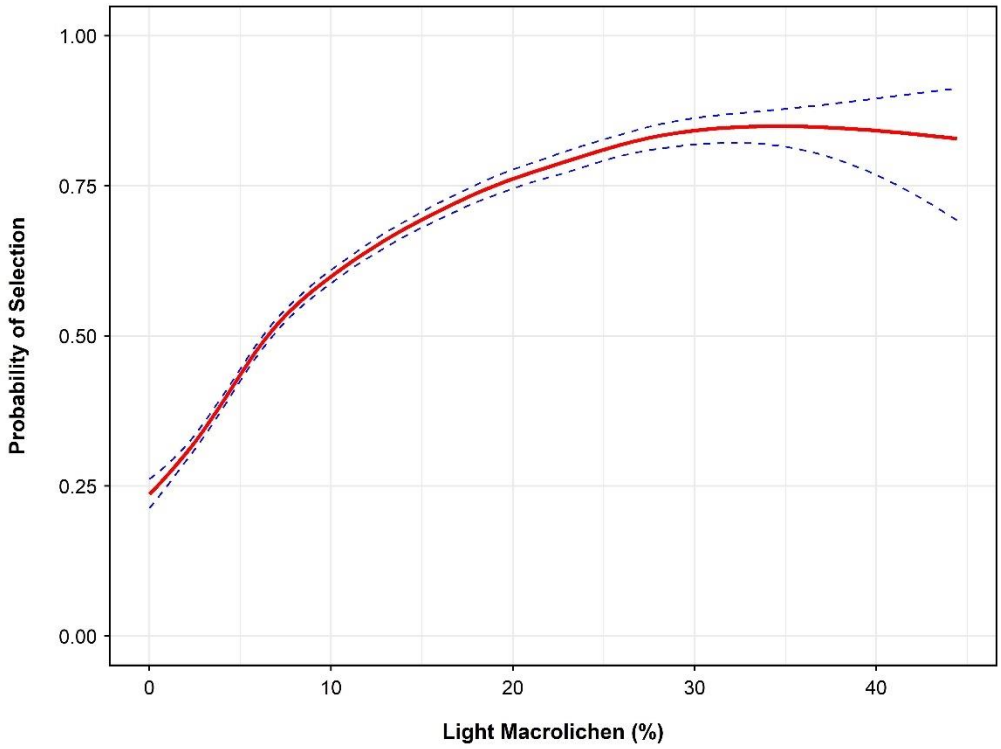


Figure 6-2. Generalized additive model assessing the probability of selection of light macrolichens by PCH during winter.

6.5.1.5 Model Selection and Validation

Habitat models were selected for late fall and winter by implementing 'full' models (with all relevant covariate terms) and assessing the variation explained by the inclusion of each covariate. The best models were chosen based on (1) statistical considerations using Akaike's information criterion (AIC; Burnham and Anderson 2002), which balances the trade-off in the amount of variance explained (i.e., model likelihood) with the number of parameters considered, and (2) ecological significance to caribou in the late fall and winter seasons. Since the goal of the model was prediction, as many covariates as necessary were retained. Thus, alternative candidate models were considered not by testing competing hypotheses but rather by dropping covariates with low magnitude (scaled) coefficients $< |0.1|$. Model diagnostics were run on simulated residuals to assess (a) goodness-of-fit (i.e., Kolmogorov-Smirnov test), (b) issues related to dispersion, (c) the frequency of outliers, (d) variance among categorical predictors, and (e) quantile regressions of observed versus expected residuals.

The predictive performance of late fall and winter models were assessed using a 5-fold cross-validation approach as per the steps outlined in Johnson et al. (2006). (1) The original data were partitioned into 5-fold groups. For each iteration of the evaluation procedures, four groups were combined into the training dataset. The remaining group was used as the testing dataset. (2) The RSF was estimated for each training dataset. (3) RSF values from the training dataset were predicted in a GIS and reclassified into 10 quantile rank bins. (4) Midpoint (median) values of raw RSF scores were calculated for each quantile bin. (5) Percent utilization was

calculated for each quantile bin using equation 4 in Johnson et al. (2006). (6) The number of used observations from the testing dataset that fell in each quantile bin were counted. (7) The number of expected observations from the testing dataset was calculated for each quantile bin using equation 5 in Johnson et al. (2006). (8) Observed versus expected counts and proportions from the testing dataset were compared and tested formally using linear regression, spearman's rank correlation, chi-square goodness-of-fit (i.e., observed versus expected counts), and tests of proportions for each quantile bin (i.e., chi-square observed versus expected proportions). These steps were repeated until each fold was used as the testing dataset. The 5-fold cross-validation procedure was implemented for several candidate models for both late fall and winter to determine whether simpler models yielded more accurate predictions.

6.5.1.6 Habitat Quality, Amount, and Distribution

Models selected for late fall and winter were used to generate predictive habitat maps across those seasonal ranges. These mapped predictions aimed to identify the amount and distribution of habitat available to PCH caribou. To facilitate the comparison of relative habitat quality across the study area, the RSF predictions were classified into four ordinal ratings: Very Low, Low, Moderate, and High. To help objectively define ecologically relevant classification of the RSF values we conducted a post-hoc selection-ratio test of the caribou locations against the RSF predictions. This approach identified the point within the RSF value range where values switch from avoided to being selected. The portion of the 'selected' RSF value range was divided at the midpoint into the Moderate and High ratings and the portion of the 'avoided' range was divided at the midpoint into the Very Low and Low ratings. For example, for RSF output with a range from 0 to 1, if the selection-ratio calculation determined the breakpoint between avoidance and selection occurred at 0.6, the habitat quality ratings would be Very Low = 0.0-0.3, Low = 0.3-0.6, Moderate = 0.6-0.8, and High = 0.8-1.0.

To determine the breakpoint within the RSF value range that switched from avoided to selected, the frequency distributions of mapped RSF predictions were partitioned into 50 quantile bins with each bin consisting of two-percentile intervals. Selection ratios were calculated for each quantile bin by associating mapped RSF predictions to used and available collar locations and then assigning each location to a quantile bin. The selection ratio for each bin was calculated as follows:

$$SR_{bin} = \frac{Used_{prop} - Avail_{prop}}{Avail_{prop}}$$

where $Used_{prop}$ and $Avail_{prop}$ are the proportion of used and available locations in each quantile bin. Selection ratios were used to categorize habitat quality into the discrete ratings discussed above (i.e., Very Low, Low, Moderate, and High). The bin at which selection ratios switched from negative to positive identified the threshold between Low and Moderate quality habitat. Very Low quality habitat was identified based on the midpoint between the smallest quantile bin and the Low/Moderate quality habitat threshold. Similarly, the midpoint between the Low/Moderate quality habitat threshold and the largest quantile bin differentiated Moderate and High quality habitat. For certain management questions or purposes, it may be adequate to just use two habitat classes—avoided or selected. Subdividing those into the four ratings provides further resolution for certain management questions or objectives. For example, when comparing different

road route options that must traverse an area of 'selected' habitat, potential impacts are expected to be minimized by locating the road in Moderate versus High habitat areas.

RSF frequency distributions were extremely right skewed so that very high RSF values were low in frequency. This issue arises when dealing with RSFs with 'infinitely weighted' available locations, which has become standard practice in recent years (e.g., Muff et al. 2020). In late fall and winter RSFs, the ratio of used to available locations was 1:10 with an additional large weight (i.e., 1,000) assigned to each available location. These large weights effectively reduce RSF predictions to very small decimal numbers and skews their distribution. To ensure that this skew did not underestimate the amount of High versus Moderate quality habitat, all RSF values equal to or greater than the 98th percentile were fixed at that value. Thus, there were effectively 49 quantile bins, in total, because all predictions in the 50th bin were assigned to the 49th bin.

To compare the amount and distribution of selected habitat within the Project RSA (~2,386 km^2) to the broader landscape, the amount of selected habitat was assessed within similar sized polygons across the seasonal ranges. A grid composed of 50 km x 50 km (2,500 km^2) cells was placed over the Yukon extent of the PCH ranges, and the proportion of selected habitat was assessed for each cell.

6.5.1.7 Statistical and Geospatial Software

All statistical analyses were completed in R software for Statistical Computing, version 4.1.0 (R Development Core Team 2020). Package 'mgcv' (Wood 2011) was used to develop and assess non-linearity in response-covariate relationships using generalized additive modelling. Package 'glmmTMB' (Brooks et al. 2017) was used to fit generalized mixed-effects models. In addition to visual assessment of covariate-response relationships, package 'DHARMa' (Hartig 2021) was used to assess simulated model residuals (e.g., goodness of fit, dispersion, outliers, heteroscedasticity). Package 'groupdata2' was used to partition data into training and testing datasets; it was especially useful for partitioning a consistent number of used and available locations among the data folds. All geospatial analyses were completed in R, version 4.1.0 (R Development Core Team 2020), QGIS (QGIS Development Team 2020), and ArcGIS, version 10.7 (ESRI 2020).

6.5.2 RESULTS AND DISCUSSION

6.5.2.1 Habitat Models

The selection of late fall and winter habitat models required an iterative model fitting, testing, and cross-validation process. The appropriate patch size (i.e., 100 m, 500 m, or 1,000 m) of each PFT was selected based on GAM plots to identify which patch size corresponded with the greatest change (slope) in selection. Initial model selection procedures determined that 'full' models, with all possible covariates, were the most parsimonious for late fall (No. 1 in Table 6-4) and winter (No. 1 in Table 6-5) RSFs. However, the 'full' model for late fall did not yield the best predictive performance based on the 5-fold cross-validation procedure. The best performing model for late fall excluded the effects of all PFTs except lichen (No. 3 in Table 6-4; Table 6-6), which yielded a better fit between observed and expected proportions across 10 quantile bins based on regression (i.e., higher R^2; intercepts closer to zero and slopes closer to one), tests of proportions

(i.e., greater number of equivalent observed/expected bins), and spearman rank correlations (i.e., larger correlation coefficients). See Section 5.6.1 for plots and summaries of 5-fold cross-validation results for the selected late fall RSF model. Regressions for each fold had very strong fits (all $R^2 > 0.93$) but did have intercepts that differed from zero and slopes that differed from one. The primary reason for this deviation was a greater number of observed proportions in the largest (10th) quantile bin, whereas all other bins were close to the line of unity (1:1 ratio). Spearman rank correlations were consistently very high (all $r > 0.98$ and $p < 0.001$). The mean number of bins in which observed proportions were no different than expected proportions, across all five folds, equalled 5.2 (low = 4, high = 8).

The best performing model for winter consisted of the full parameterization (No. 1 in Table 6-5; Table 6-7), which yielded a better fit between observed and expected proportions across 10 quantile bins based on regression (i.e., higher R^2; more intercepts closer to zero and slopes closer to one), tests of proportions (i.e., greater number of equivalent observed/expected bins), and spearman rank correlations (i.e., larger correlation coefficients) than any alternative candidate model. See Section 5.6.1 for plots and summaries of 5-fold cross-validation results for the selected winter RSF model. Regressions for each fold had strong fits (all $R^2 > 0.79$) and had intercepts that were no different than zero and slopes that were no different than one. Spearman rank correlations were consistently very high (all $r > 0.98$ and $p < 0.001$). The mean number of bins in which observed proportions were no different than expected proportions, across all five folds, equalled 5 (low = 3, high = 6). In conclusion, both late fall and winter model had a fair agreement between observed and expected proportions and had very high spearman rank correlations, which suggests that these models perform adequately for prediction (e.g., see Johnson and Russell 2014, White and Gregovich 2017, Johnson et al. 2020).

Habitat use varied moderately between late fall and winter. Although selection coefficients were highest for macrolichen cover and elevation in both seasons, the relationships varied somewhat, and the extent of Moderate and High rated habitat was reduced in winter compared to late fall. Selection (positive coefficient) for macrolichen cover, the most relevant plant functional type in either season, was greater in magnitude during winter (Table 6-7) than during late fall (Table 6-6). Though the magnitude of selection for macrolichen varied by ecoregion (i.e., interaction), the best-fitting patch size for the selection of macrolichen was consistently 100 m. However, patch size varied for other plant functional types considered during winter (Table 6-7; e.g., conifer tree cover versus forbs). During late fall, caribou selection (positive coefficients) of vegetation was solely driven by lichen cover. Meanwhile, during winter, caribou tended to avoid (negative coefficients) other PFTs such as conifer trees, forbs, graminoids, deciduous shrubs, and evergreen shrubs. The lack of selection/avoidance of other PFTs during late fall is likely the result of more diverse forage use in late fall than in winter and individual variation in habitat choice. Such variation is consistent with a broad habitat selection pattern at the population-level, which led to the poorer predictive performance of late fall models that included other PFT covers.

Preference of absolute elevation also varied between the seasons. Caribou occupied primarily mid elevations (approximately 750 m) during late fall (Table 6-6) but selected low and high elevations during winter (Table 6-7). Caribou also varied in their proximity to waterbodies >1 ha between seasons. Caribou tended to be closer to such waterbodies (negative coefficient) during late fall but remained farther (positive coefficient)

during winter. The ecological basis for these relationships to waterbodies is unclear, but the covariates were retained in the models because they improved predictive performance.

Coefficients associated with lichen cover were of the greatest magnitude, which suggests that the selection of lichen is the primary driver of habitat selection in late fall and winter. This pattern in vegetation use across both seasons is consistent with what is expected of PCH caribou diet and ecology (Thompson and McCourt 1981, Russell et al. 1993). Late fall and winter diets are mostly composed of lichens (and mosses). Though there is some evidence that caribou may forage on evergreen shrubs and deciduous shrubs during late fall (Russell et al. 1993), this pattern was weak, and these covariates were not included in the final model. Another similarity in selection among seasons was in terms of slope and aspect. Caribou avoided steep slopes (negative coefficients, logarithmic) and selected south- and west-facing aspects, which receive greater solar radiation than east- and north-facing aspects. This pattern could be attributed to productive lichen patches during both seasons and to decreased snow depth due to melt and wind during winter.i

Selection gradients (i.e., the degree of preference/avoidance) were greater during winter than late fall. This is likely because forage was more broadly available across different habitats due to lower snowpacks in late fall and because more locations in the late fall were likely associated with travelling than foraging. Though caribou distribution is broader in winter, there was clearly a stronger preference (positive coefficient) for light macrolichens and a stronger avoidance (negative coefficient) of areas with high cover of conifer trees. Stronger preference and avoidance in winter may result in more concentrated forage on lichen and from snow constraints on caribou distribution.

Temporal patterns of habitat selection also varied between late fall and winter. Habitat selection seemed to be fairly consistent across years in late fall but varied from winter to winter. A very small portion of the overall variance ($\sigma^2 = 0.00021$) in habitat selection could be explained by year effects during late fall. This model contributed little to the overall model likelihood and was penalized for an additional parameter ($AIC_\Delta = 2$); thus, year effects were not included for the late fall model. However, during winter, a year effect explained a sufficient amount of variation ($\sigma^2 = 0.013$) in habitat selection to warrant inclusion in the final model (i.e., $AIC_\Delta = -90.9$ with year effect). Variation among years was likely greater in winter due to the effects of snow across the landscape, which can broadly affect the distribution of PCH caribou and their foraging habits.

Snow accumulation and distribution is invariably an important factor affecting habitat selection by PCH caribou at multiple scales. At fine spatial scales, snow depth, density, and hardness can limit access to terrestrial lichens (Johnson et al. 2001). Although snow depth data were not available, elevation was considered as a suitable surrogate. In the winter RSF, caribou exhibited selection for low and high elevations and avoidance of mid elevations, where snowpacks are often deepest. Indeed, Pedersen et al. (2021) identified a significant correlation ($r > 0.6$) between elevation and snow depth in 33% of winters during their study of another barren-ground caribou herd, the Central Arctic Herd. The amount of snowfall and snowpack at broad spatial scales can cause the PCH to occupy different core wintering regions. For example, PCH caribou occupy the Ogilvie/Hart and Richardson Mountains regions on a rotational basis because these regions receive less snow than adjacent areas (Russell et al. 1993). This pattern is consistent with the current data, whereby GPS-collared PCH caribou occupied different ecoregions at different intensities (i.e., number of individuals and locations) across time.

Though snow depth could not be considered explicitly in habitat models, the variation estimated among years and differences in the use of ecoregions and elevations were considered to partially account for the influence of snow. These variables are considered coarse correlates of snowpack patterns across the landscape (Russell et al. 1993), yet, the exclusion of an explicit snowpack covariate does limit fine-scale predictions of how snow affects caribou resource selection. Ultimately, snow depth is probably the primary, ecologically relevant metric that would supplement the current covariate suite and provide greater insight on winter selection patterns. Available snow covariates were examined and deemed not to be useful. For example, information on snow prevalence, date of the first snow, or snow cover are not inherently useful because caribou (and other ungulates) are not constrained in their movements and foraging by shallow snow. Given these considerations, it was deemed more appropriate to account for the coarser effects of snow depth using ecoregion and elevation rather than using a snow cover that may be misleading both ecologically and mechanistically, resulting in a spurious correlation.

Table 6-4. Model selection of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during late fall.

No.	Model	*K*	AIC	Δ AIC
1	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_100m + Forbs_100m + Deciduous_Shrub_1000m + Graminoid_1000m + Evergreen_Shrub_100m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	22	167,637.4	0.0
2	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_100m + Deciduous_Shrub_1000m + Evergreen_Shrub_100m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	20	167,644.0	6.6
3*	~ Ecoregion * log(Lichen_100 + 1) + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	17	167,750.7	113.3
4	~ Ecoregion * log(Lichen_100 + 1) + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies	14	167,783.0	145.6
5	~ 1 (null model)	1	169,964.2	2,326.8

* Chosen model based on best predictive performance in 5-fold cross-validation.

Table 6-5. Model selection of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during winter.

No.	Model	*K*	AIC	Δ AIC
1*	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_1000m + Forbs_500m + Deciduous_Shrub_1000m + Graminoid_1000m + Evergreen_Shrub_100m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	21	255,398.7	0
2	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_1000m + Forbs_500m + Graminoid_1000m + Evergreen_Shrub_100m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	20	255,428.0	29.3
3	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_1000m + Forbs_500m + Deciduous_Shrub_1000m + Graminoid_1000m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	20	255,500.1	101.4
4	~ 1 + Ecoregion * log(Lichen_100 + 1) + Conifer_Tree_1000m + Forbs_500m + Graminoid_1000m + log(Slope Percent + 1) + Absolute Elevation + (Absolute Elevation)² + Distance to Waterbodies + Aspect	19	255,538.9	140.2
5	~ 1 (null model)	1	265,758.0	10,359.3

* Chosen model based on best predictive performance in 5-fold cross-validation.

Table 6-6. Base habitat model of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during late fall.

Model Term	Estimate	Std. Error	*Z*-statistic	*P*
Intercept				
Eagle Plains & North *(Reference)*	-9.697	0.035	-273.568	<0.0001
Ecoregion (factor)				
North Ogilvie Mountains	-0.136	0.075	-1.803	0.0714
British-Richardson Mountains	0.533	0.047	11.312	<0.0001
Old Crow Basin	0.341	0.038	9.082	<0.0001
Davidson Mountains	0.666	0.041	16.132	<0.0001
Aspect (factor)				
South	0.099	0.032	3.147	0.00165
East	0.003	0.032	0.082	0.935
West	0.161	0.031	5.162	<0.0001
Ecoregion–Lichen_100m Interaction				
Eagle Plains * Lichen_100m Percent[1,2] *(Reference)*	0.694	0.029	23.880	<0.0001
North Ogilvie Mountains * Lichen_100m Percent[1,2]	0.062	0.063	0.990	0.322
British-Richardson Mountains * Lichen_100m Percent[1,2]	-0.311	0.043	-7.300	<0.0001
Old Crow Basin * Lichen_100m Percent[1,2]	-0.157	0.037	-4.216	<0.0001
Davidson Mountains * Lichen_100m Percent[1,2]	-0.224	0.042	-5.324	<0.0001
Digital Elevation Model				
Slope Percent[1,2]	-0.311	0.017	-18.006	<0.0001
Absolute Elevation[2] (linear)	0.865	0.073	11.907	<0.0001
Absolute Elevation[2] (quadratic)	-0.813	0.070	-11.661	<0.0001
Distances				
Distance to Waterbodies[2]	-0.184	0.016	-11.827	<0.0001

[1] covariate transformation = $\log_e(x + 1)$.

[2] covariate estimates based on standardized covariate values = (x – mean[x])/std. deviation(x).

Table 6-7. Base habitat model of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during winter.

Model Term	Estimate	Std. Error	*Z*-statistic	*P*
Intercept				
Eagle Plains & North *(Reference)*	-10.007	0.051	-195.485	<0.0001
Ecoregion (factor)				
North Ogilvie Mountains	0.616	0.040	15.502	<0.0001
British-Richardson Mountains	0.738	0.039	19.152	<0.0001
Old Crow Basin	0.281	0.034	8.229	<0.0001
Aspect (factor)				
South	0.196	0.025	7.671	<0.0001
East	0.030	0.026	1.154	0.249
West	0.329	0.025	13.294	<0.0001
Ecoregion– Lichen_100m Interaction				
Eagle Plains * Lichen_100m Percent[1,2] *(Reference)*	1.119	0.018	62.823	<0.0001
North Ogilvie Mountains * Lichen_100m Percent[1,2]	-0.154	0.034	-4.485	<0.0001
British-Richardson Mountains * Lichen_100m Percent[1,2]	-0.614	0.036	-17.203	<0.0001
Old Crow Basin * Lichen_100m Percent[1,2]	-0.123	0.034	-3.602	0.000316
Other Plant Functional Types				
Conifer_Tree_1000m Percent[2]	-0.256	0.009	-27.241	<0.0001
Forbs_500m Percent[2]	-0.166	0.010	-17.068	<0.0001
Deciduous_Shrub_1000m Percent[2]	-0.096	0.009	-10.137	<0.0001
Graminoid_1000m Percent[2]	-0.120	0.009	-12.706	<0.0001
Evergreen_Shrub_100m Percent[2]	-0.052	0.009	-5.580	<0.0001
Digital Elevation Model				
Slope Percent[1,2]	-0.216	0.012	-18.678	<0.0001
Absolute Elevation[2] (linear)	-1.369	0.056	-24.410	<0.0001
Absolute Elevation[2] (quadratic)	0.889	0.053	16.627	<0.0001
Distances				
Distance to Waterbodies[2]	0.201	0.010	20.321	<0.0001

[1] covariate transformation = $\log_e(x + 1)$.

[2] covariate estimates based on standardized covariate values = (x – mean[x])/std. deviation(x).

6.5.2.2 Predicted Habitat Distribution

Predicted habitat quality, amount, and distribution depended on the magnitude of resource selection and the distribution of habitat covariates across the landscape (i.e., primarily light macrolichen cover). Predictions from habitat models for late fall and winter were classified into four ordinal habitat quality ratings (i.e., Very Low, Low, Moderate, or High quality). See Section 6.9.2 for plots that demonstrate the switch from negative to positive selection ratios across quantile (two-percentile) bins for late fall (31st quantile bin [60th–62nd percentile]; Attachment Figure 11 and Attachment Figure 12) and winter (30th quantile bin [58th–60th percentile]; Attachment Figure 15 and Attachment Figure 16). Furthermore, Section 6.9.2 provides plots of (a) selection ratios associated with each habitat rating and (b) the proportion of the late fall and winter ranges composed of each habitat rating. In general, Very Low quality habitat had low, negative selection ratios while High quality habitat had high, positive selection ratios. Approximately 60% of the late fall and winter ranges consisted of avoided (Very Low and Low) habitat, and 40% consisted of selected (Moderate and High) habitat.

The distribution of habitat across the landscape differed between late fall (Map 6-4) and winter (Map 6-5) ranges. The proportion of selected late fall habitat in the Project RSA (0.404) was equivalent to the mean proportion in the broader late fall range when accounting for variance in that estimate (Table 6-8). In contrast, the proportion of selected winter habitat in the Project RSA (0.265) was substantially less than the mean proportion in the broader winter range (0.411) (Table 6-8). Though mean estimates of selected habitat in the broader late fall and winter ranges were approximately 0.40, there was considerable variation among the 50 km x 50 km cells used in the analyses. In the late fall range, the lowest and highest proportions of selected habitat were 0.140 and 0.881, respectively. Cells with the lowest proportions were located mostly along the western edge of the late fall range (i.e., high elevations in the North Ogilvie Mountains), and cells with the highest proportions were located mostly along the eastern edge of the late fall range (i.e., Eagle Plains ecoregion transitioning into Richardson Mountains). The lowest and highest proportions of selected habitat in the winter range were 0.106 and 0.764, respectively. Cells with the lowest proportions were located centrally in the winter range (i.e., Eagle Plains ecoregion) and cells with the highest proportions were located mostly along the eastern and southern edge of the winter range (i.e., Richardson mountains and North Ogilvie Mountains).

In the Project RSA, selected late fall habitat was concentrated at mid-elevation plateaus and depended on the amount of lichen cover. For example, a large patch of High quality habitat occurred adjacent (south side) to the Dempster Highway (inset in Map 6-4); this patch occurred on a large mid-elevation plateau, in proximity to waterbodies >1 ha in size, and relatively high amounts of lichen cover. In fact, several portions of the Dempster Highway intersected either Moderate or High quality habitat at mid-elevations and with moderate lichen cover. Across the broader landscape, the greatest amount of selected habitat occurred within the southern extent of the North Ogilvie Mountains ecoregion, the western extent of the British-Richardson Mountains ecoregion, and in large areas at the eastern extent of the Eagle Plains ecoregion (Map 6-4). Avoided habitat primarily occurred at low elevation valley bottoms or high elevations (> 750 m, e.g., at the peaks of British-Richardson Mountains) in areas with low lichen and vegetative cover.

Winter habitat occurred primarily at either valley bottoms with open stunted spruce or high elevations with sparse tree cover and high macrolichen cover. Selected habitat was also distant from large waterbodies and

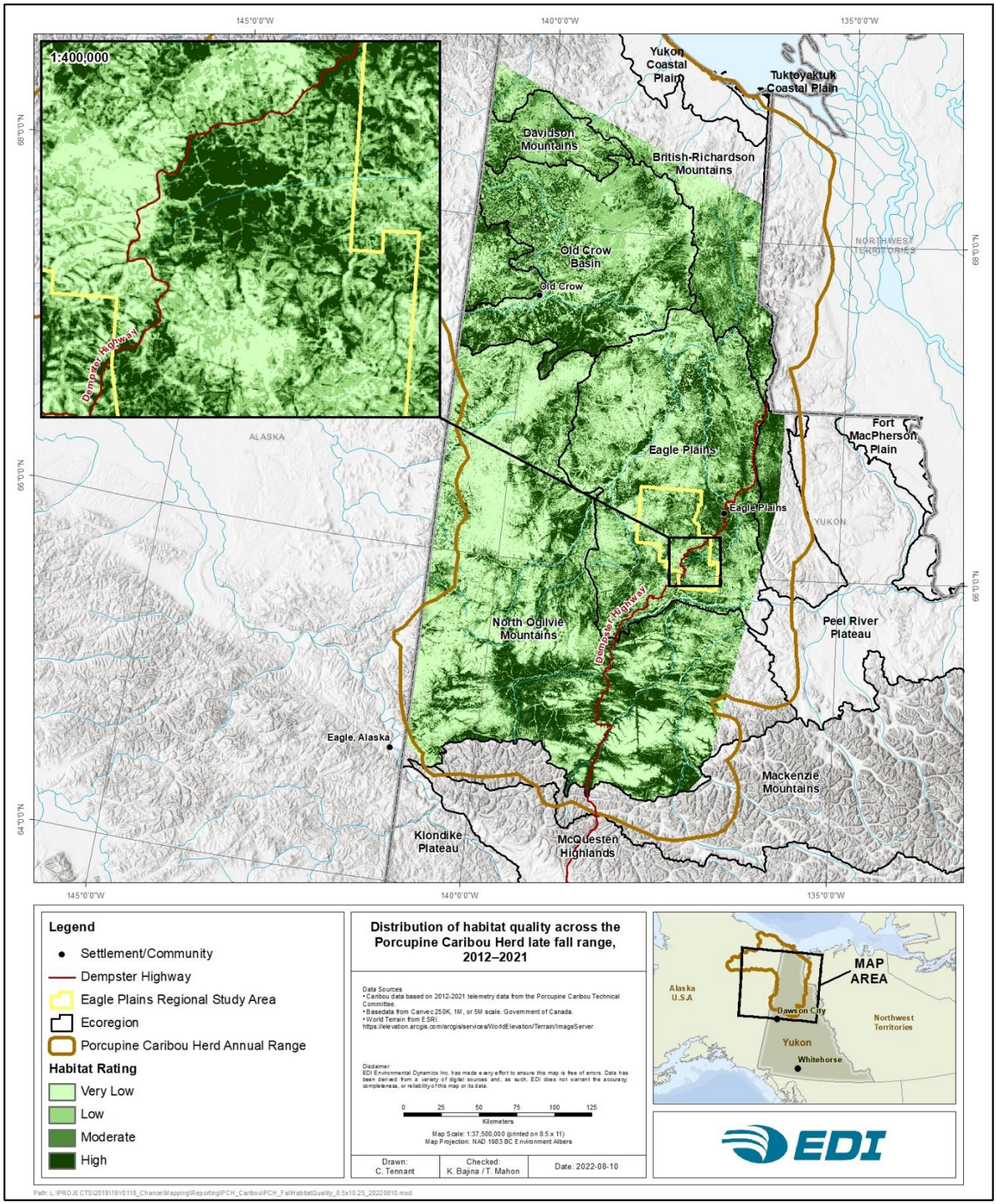
wet environments containing forbs and graminoids, as well as areas with high cover of deciduous or evergreen shrub. In the RSA, selected habitat was localized in specific regions. For example, a large extent of High quality habitat occurred at the northern extent of the RSA, on the west side of Chance creek (Map 6-5). This area is low in elevation and has relatively high lichen cover. Two other large patches of High quality habitat occur at the southern extent of the RSA, both associated with low elevation and very high lichen cover. Although mid-elevations have relatively lower RSF predictions, in general, certain mid-elevation areas with high lichen cover, such as the areas along the Dempster Highway for late fall habitat are also predicted to offer Moderate or High quality winter habitat (inset in Map 6-4). Across the broader landscape, large extents of selected habitat occurred in the Richardson Mountains, the Ogilvie Mountains, and northern extents of Eagle Plains ecoregion. The greatest amount of avoided habitat (Very Low and Low) also occurred in Eagle Plains due to large areas of recent wildfire and its vast mid-elevation plateaus.

The use of multiple habitat ratings, as opposed to a binary classification (e.g., suitable versus unsuitable), was necessary to retain high resolution information on the distribution of habitat quality. For example, there were stark differences in the amount of lichen cover in areas of Moderate versus High quality habitat, and this can have implications for timing and extent of Project operations. Map 6-6 provides a comparison between winter habitat quality ratings and macrolichen cover in the Project RSA. There is a clear distinction between areas of high versus low macrolichen cover. There are several High quality ratings that occur along circular and N-S oriented ridges at the southwest corner of the RSA. Adjacent areas of similar elevation but with low macrolichen cover, transition from Moderate to Very Low in quality. Since macrolichen cover is the strongest driver of resource selection by PCH caribou during winter, it is important to be able to distinguish these high-value regions for management purposes.

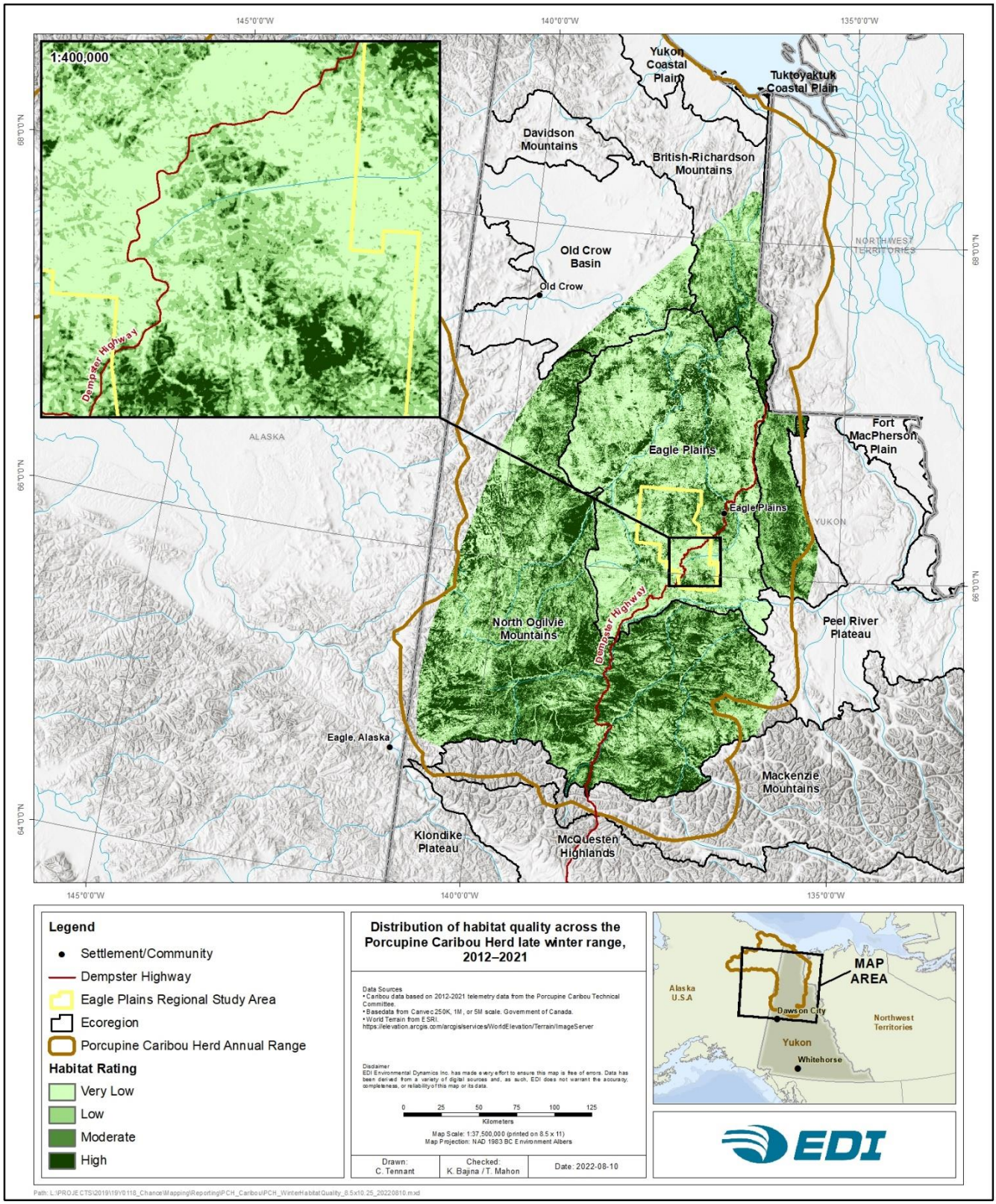
Table 6-8. Proportion of selected (Moderate and High) caribou habitat in the Project RSA relative to the mean (and std. error) of 50 km x 50 km cells covering late fall and winter range extents.

Season	Scale	Proportion of Moderate and High Quality Habitat	Std. Error
Late Fall	Project RSA (2,387 km² total)	0.404	–
	Late Fall Range (88,149 km²) [1] (2,500 km² per cell) – 53 cells total	0.415	± 0.025
Winter	Project RSA (2,387 km² total)	0.265	–
	Winter Range (65,077 km²) [1] (2,500 km² per cell) – 40 cells total	0.411	± 0.026

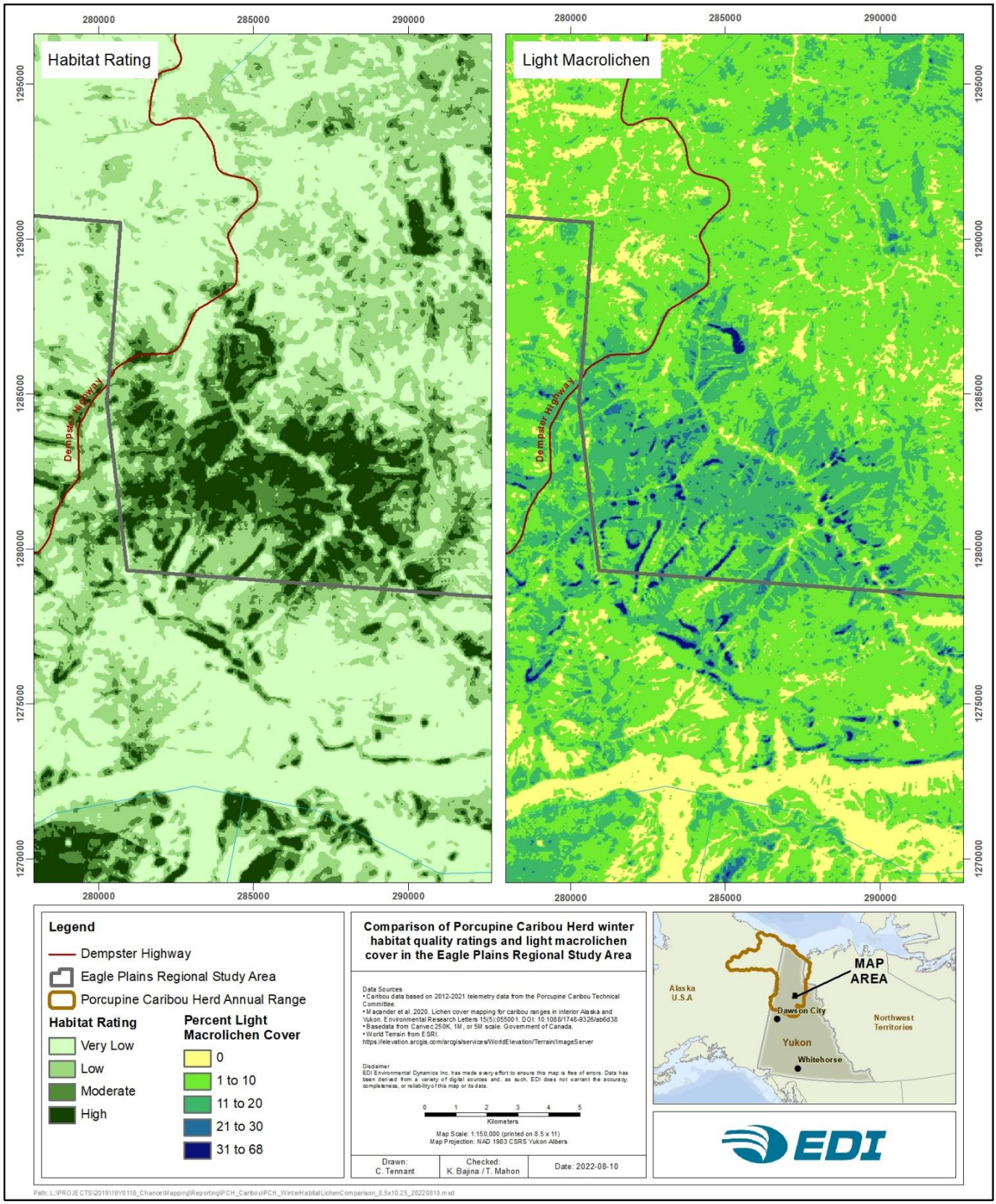
[1] Late fall and winter ranges were subsampled using 2,500 km² cells (approximately the same size and the RSA) to facilitate estimation of mean and variance.



Map 6-4. Distribution of habitat quality across the Porcupine Caribou Herd late fall range, 2012–2021.



Map 6-5. Distribution of habitat quality across the Porcupine Caribou Herd winter range, 2012–2021.



Map 6-6. Comparison of Porcupine Caribou Herd winter habitat quality ratings and light macrolichen cover in the Eagle Plains Regional Study Area.

6.6 MOVEMENT

In addition to habitat selection, movement patterns across the seasonal ranges and within the vicinity of the Project RSA are important to understanding how the PCH may interact with the Project. Metrics such as daily travel rates and duration of residency (i.e., how long caribou spend in an area before moving on) help quantify how caribou use the landscape and how they may react to features, such as the Dempster Highway. In addition to movement metrics, the spatial locations of travel movements can define areas of concentrated movement during migration. To better understand factors affecting PCH caribou movement, two analyses were conducted: (1) calculation of daily movement rates and residency times of caribou in the Project RSA relative to the broader landscape, and (2) delineation of movement paths to assess broad-scale movement patterns and the potential for caribou to interact with the Project.

The PCH typically exhibit movements of several kilometres per day in both late fall and winter. Late fall daily movements (8.7 km/day in the RSA) were substantially greater than those during winter (4.4 km/day in the RSA), and caribou tended to occupy portions of the landscape for shorter periods during late fall than during winter. Caribou residency times in both seasons were two-fold greater in the broader landscape than within the Project RSA, suggesting that, on average, the RSA, is used as more of a transitory area than other portions of the seasonal ranges. The locations and patterns of movement during late fall (i.e., the end of the fall migration period) was variable within and across years and, overall, there was little evidence of dedicated migration corridors. However, in late fall of 2015, several caribou made directed movements along the height of land parallel to the Dempster Highway, from the northeast to the southwest. Although a small number of movements crossed the Dempster Highway, most movements stayed north of the Dempster Highway, potentially reflecting avoidance of the Dempster Highway. However, this series of movements did cross numerous 2D seismic lines, winter roads and a large 3D seismic grid in the RSA.

6.6.1 METHODS

6.6.1.1 Daily Movement Rates and Residency Times

Daily movement rates and residency times were calculated for each radio-collared caribou that occurred in late fall and winter range extents. The locations of each caribou were resampled to obtain one GPS fix per day. Movement rates were calculated as the speed (km/day) travelled between consecutive relocations and residency time was calculated as the number of days within a specified area. Movement rates and residency times were calculated for caribou occurring within the Project RSA (2,387 km^2) and, to compare to the broader landscape, metrics were also calculated within 50 km x 50 km (2,500 km^2) grid cells that covered fall and winter ranges. Means and standard errors of movement rates and residency times were calculated for all 50 km x 50 km cells and compared to mean values in the Project RSA.

6.6.1.2 Migration Movements

Travel routes were delineated by developing occurrence-use polygons that assessed the trajectory of each collared caribou during late fall, 2012-2021. These polygons were created using Brownian bridge movement models (BBMMs), which account for autocorrelated movements in animal relocations and assume that an animal's trajectory follows a diffusion-based (Brownian motion) process (Horne et al. 2007). BBMMs were developed, and kernel density estimation was used to predict 95% utilization distributions (UDs) for each animal, assuming a GPS location error of 100 m and implementing a grid-cell size of 500 m. Analysis was bounded to a 100 km buffer around the RSA to identify spatially relevant movement trajectories. BBMMs and UD polygons were created using the R package 'adehabitatHR' (Calenge 2006).

6.6.2 RESULTS AND DISCUSSION

6.6.2.1 Daily Movement Rates and Residency Times

Mean daily movement rates and residency times varied considerably between late fall and winter and between the Project RSA and the broader landscape. On average, caribou tended to move faster during late fall than during winter, and this was evident both in the Project RSA and across the full late fall range. The movement rates between the Project RSA and the broader landscape were greatest during late fall, i.e., at least a two-fold difference in movement rates outside versus inside the RSA. A similar outcome was evident for residency time inside versus outside the Project RSA. In both seasons, the residency time was at least twice as long outside the RSA than within it (Table 6-9).

Patterns in movement and residency were consistent with what is known about PCH caribou ecology. Caribou are at their most dispersed in both late fall and winter. Except for cows during the calving period, daily movements are lowest in winter and second lowest in late fall (Russell and Gunn 2017). Normally, faster movement rates are associated with shorter residency periods, but this was not the case for the PCH in late fall (Table 6-9). During late fall, caribou in the RSA had slower movement rates but also had shorter residency periods compared to the broader late fall range. A review of the movement trajectories indicates that although travel rates were slower inside the RSA, those paths had greater directional bias (i.e., movement in a single direction) than paths outside the RSA, which exhibited much more tortuosity. These more directed movement paths resulted in shorter residency periods, despite the slower movement rates.

During winter, caribou movement rates inside the RSA were similar to the broader landscape, but, similar to late fall, their residency time inside the RSA was significantly shorter than in the broader late fall range. This suggests that similar to the pattern in late fall, caribou tended to pass through the RSA in winter more quickly than other portions of the broader winter range. This pattern may be explained by the lower predicted habitat quality within the RSA relative to the broader landscape (see Section 6.5.2.2, *Predicted Habitat Distribution*, above). The faster movements and shorter residency times in late fall compared to winter likely reflect the tail end of fall migration movements. Notwithstanding the important differences in movement patterns between late fall and winter, the key results of these analyses are that, in both late fall and winter, PCH caribou (1) travel

several kilometres per day, on average, and (2) the RSA (or similar sized areas outside the RSA) are used for a relatively short portion of the overall season.

Table 6-9. Mean daily movement rates and residency times of the Porcupine Caribou Herd in the Project RSA relative to the mean (and standard error) of 50 km x 50 km cells covering late fall and winter range extents.

Season	Scale[1]	Daily Movement (km/day)		Residency Time (days) [2]	
		Mean	Std. Error	Mean	Std. Error
Late Fall	Project RSA (2,387 km² total)	8.95	± 0.64	4.50 (8.33 %)	± 0.83
	Late Fall Range (88,149 km²) [1] (2,500 km² per cell) – 53 cells total	15.03	± 2.06	7.65 (14.17 %)	± 0.66
Winter	Project RSA (2,387 km² total)	4.02	± 0.64	15.69 (12.86 %)	± 5.11
	Winter Range (65,077 km²) [1] (2,500 km² per cell) – 40 cells total	4.77	± 0.51	25.93 (21.25 %)	± 2.13

[1] Late fall and winter ranges were subsampled using 2,500 km² cells (approximately the same size and the RSA) to facilitate estimation of mean and variance. Estimates of mean and variance within the RSA are derived from differences in rates and residencies of individual caribou.

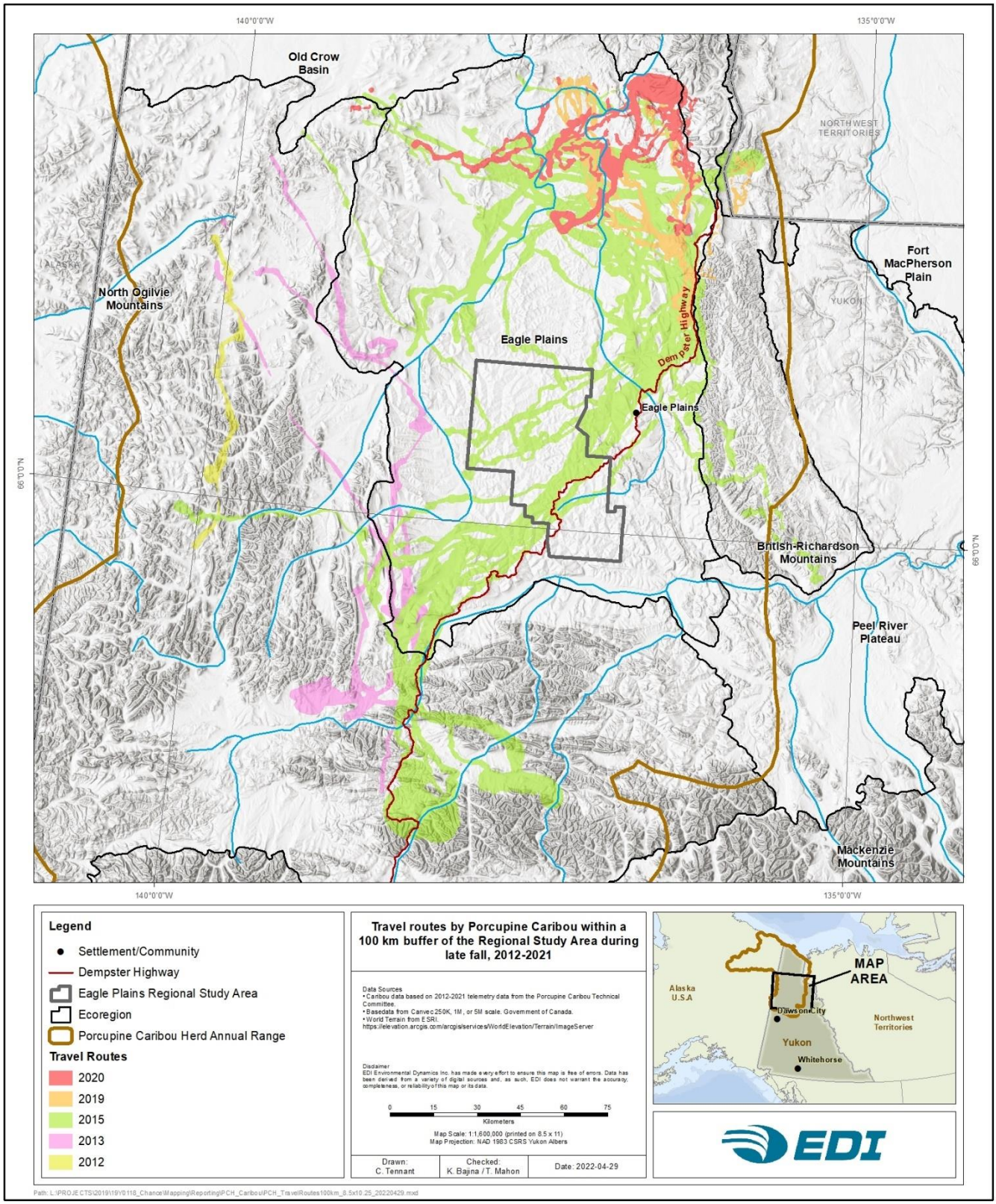
[2] Percent of the season indicated in brackets. Total days: late fall = 54 days, winter = 122 days.

6.6.2.2 Migration Movements

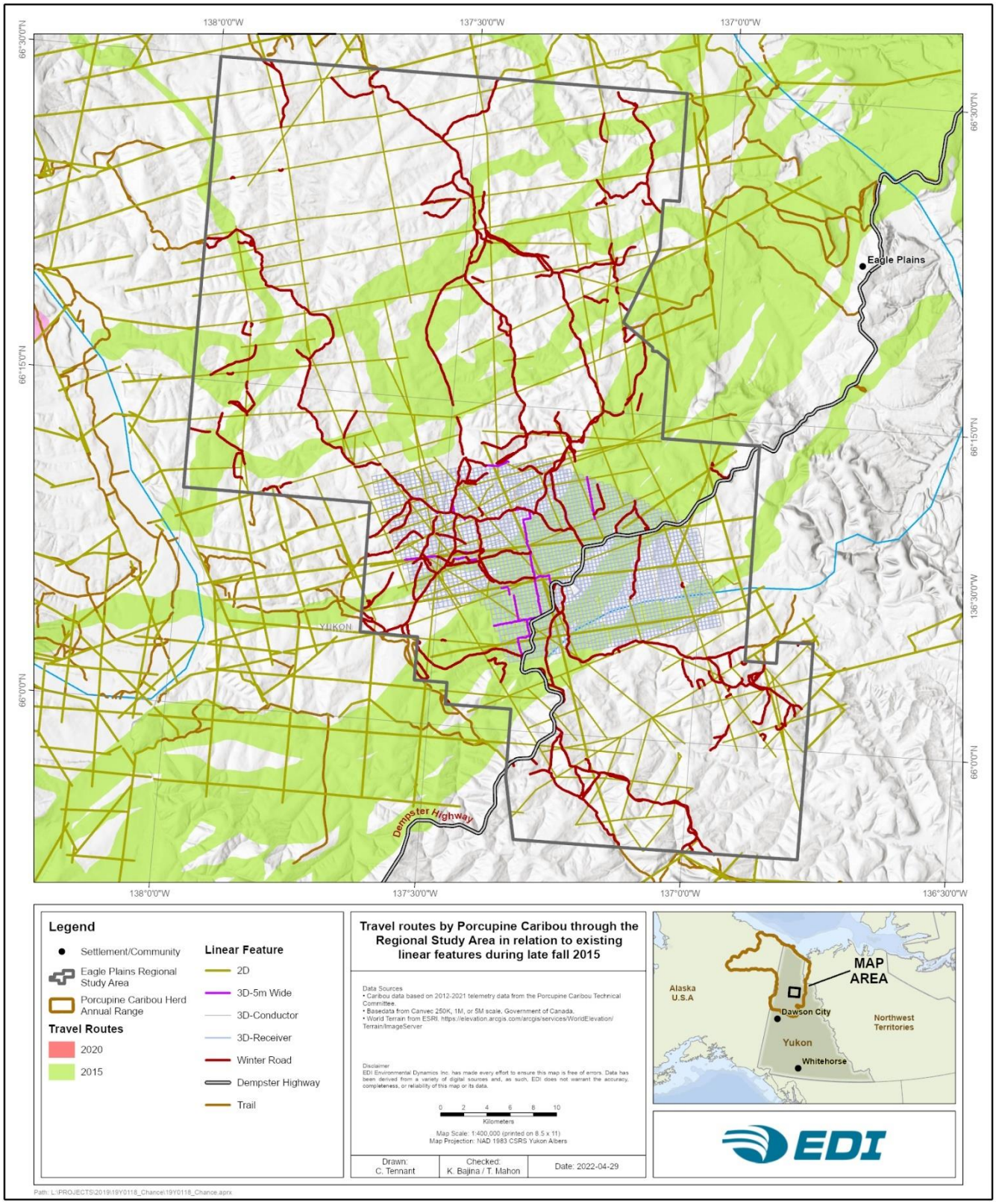
Travel routes through the Project RSA were only evident in late fall of 2015. At that time, 14 caribou travelled from the northeast quadrant of the Eagle Plains ecoregion to either the southwestern portions of that ecoregion or to the North Ogilvie Mountains, along the Dempster Highway (Map 6-7). Although two caribou did cross the highway in the vicinity of the RSA, most of the caribou (12) travelled parallel to the Dempster Highway, along its northwest side, before eventually crossing the highway south of the RSA in the Ogilvie Mountains (Map 6-7). The location of the movement routes in 2015 predominantly northwest of the Dempster Highway was previously noted by Russell and Gunn (2017), who suggested the caribou may have been avoiding crossing the highway. Although this is a valid hypothesis, supported by observations from VGFN elders (Sherry and Vuntut Gwitchin First Nation 1999, p. 288), it is important to note that the set of travel routes in 2015 did eventually cross the Dempster Highway south of the RSA in the Ogilvie Mountains. These crossings may be done at times of lower traffic such as nighttime, as elders had witnessed various unsuccessful attempts of herds to cross the Dempster as vehicles were passing during the day (Sherry and Vuntut Gwitchin First Nation 1999, p. 288). It is also important to note that travel routes in 2015 coincided with a broad, regional height of land (separating the Porcupine and Peel watersheds), which caribou sometimes travel on during migration movements (Russell et al. 1993). On an absolute scale, the height of land along the Dempster Highway, and proximate locations used by caribou as travel routes (~550–650 m), coincide with the mid elevations selected by caribou during fall (see Section 6.5.2.1, *Habitat Models*). The 12 caribou that

paralleled the Dempster Highway in the vicinity of the RSA did cross several inactive winter roads, numerous old 2D seismic lines, and a 350 km² area consisting of one-year-old 3D seismic exploration (Map 6-8).

Inferences about caribou movements are limited by the relatively small numbers of caribou that were collared (<0.1% of the herd annually) and the relatively small number of collared caribou that occurred within the RSA. Collared caribou only occurred in the Eagle Plains ecoregion in half of the years from 2012–2021; however, it is known from local knowledge that caribou occur in the ecoregion in most, if not all years. VGFN elders have discussed to importance of Eagle Plains for caribou winter habitat and noted that if caribou find a good feeding place with many trees, they will stay all winter (VGFN p185). During interviews in the late 1990's, they observed many caribou performing fighting, mating and rutting rituals around Blackstone Flats (Sherry and Vuntut Gwitchin First Nation 1999, p. 188). For the years when collared caribou were present in Eagle Plains, it is unknown how representative the collar locations are of the overall herd. For example, the concentration of travel routes through the RSA in 2015 suggests a potential movement corridor, but the proportion of caribou that is collared is too small to conclude this with confidence. The lack of movements in the same area in any other year does not support the idea that the cluster of movements in 2015 represent a regular travel corridor (but, again, this could reflect the small proportion of caribou collared).



Map 6-7. Travel routes identified for the Porcupine Caribou Herd within a 100 km buffer of the Project Regional Study Area during late fall, 2012–2021.



Map 6-8. Travel routes by Porcupine Caribou through the regional Study Area in relation to existing liner features during late fall 2015.

6.7 RELATIONSHIP TO LINEAR FEATURES

A key issue concerning the PCH is how anthropogenic development may alter caribou distribution, habitat use, and, ultimately, whether changes may influence population demography and access to the herd by First Nations and Inuvialuit harvesters. Linear features are the primary source of disturbance in the Project RSA and the broader Eagle Plains ecoregion. There is uncertainty about how caribou may respond to these features. To better understand the relationship between caribou and linear features, base habitat models were extended to assess the potential for habitat avoidance using a zone of influence (ZOI) framework. The ZOI delineates the area within which caribou behaviour is altered. ZOIs were estimated for three functionally distinct linear feature types (i.e., 2D seismic, winter roads and trails; 3D seismic; and the Dempster Highway). If ZOI estimates are statistically and ecologically significant (i.e., alter the selection of habitat and forage by caribou), they can be used to quantify effective habitat loss (i.e., perceived reduction in habitat quality by caribou due to avoidance) in the Project RSA and Eagle Plains ecoregion.

Statistical ZOIs were determined for 2D seismic lines (including winter roads and trails) in Eagle Plains in late fall and winter. However, confidence in those estimates is relatively low due to several factors. Statistical ZOIs were identified corresponding to 4 km avoidance of 2D seismic lines during late fall and 2 km avoidance of 2D seismic lines during winter. The analysis also identified that the PCH were attracted to the Dempster Highway and 3D seismic areas in both late fall and winter. Sufficient observations were associated with this pattern in relation to the Dempster Highway, but results for 3D seismic areas could be spurious due to a relatively low number of caribou locations in proximity to these features.

Although the analyses determined ZOIs associated with 2D seismic lines (and winter roads and trails), they should be interpreted with caution. (1) The magnitude of the ZOI effects was weak (i.e., including the ZOI effects in the habitat models had little effects on the habitat predictions). (2) Threshold distances estimated from ZOI analyses tend to be very sensitive to spatial and temporal contexts as well as the data and analytical methods used. Estimates of ZOIs can vary dramatically from year-to-year. This can include selecting to be closer to human features in some years and exhibiting dramatic difference in the threshold distances in years when human disturbances are thought to be avoided. The number of caribou locations in this study unevenly distributed with respect to the various linear features both spatially and across years. (3) The pattern of ZOI effects were not consistent with expectations and results from other studies. For example, having a 2 km ZOI for 2D lines and no ZOI for the Dempster Highway is counterintuitive. A previous study estimated a relatively large ZOIs for the Dempster (Johnson and Russell 2014). Based on these factors, it is recommended that these results not be used solely to estimate the effects of linear features on the PCH. Rather, it is recommended that the results be used in conjunction with results from other studies, adapted to the Eagle Plains setting and the ecology of the PCH, to develop a set of ZOIs for assessment and management purposes.

6.7.1 METHODS

A zone of influence framework evaluated the influence of linear features on PCH caribou distribution and habitat selection. Base habitat models developed for late fall and winter were extended by incorporating a 'distance to' covariate for each relevant linear feature and estimating the breakpoint beyond which the likelihood of observing caribou remained unchanged. If a ZOI was present, the likelihood of observing caribou would increase from linear feature footprint until the identified breakpoint. The primary method used to evaluate the presence and magnitude of a ZOI was a segmented regression approach (Boulanger et al. 2012, 2021).

Three functionally distinct types of linear features were considered based on their widths, densities, and extents in PCH fall and winter ranges: (1) 2D seismic, winter roads, and trails; (2) 3D seismic (grid); and (3) the Dempster Highway. The minimum distance between used/available locations and each feature was calculated and treated as a continuous covariate. To limit potential bias in ZOI estimates arising from broad-scale spatial patterns in distribution and habitat selection (see Boulanger et al. 2021, EDI Environmental Dynamics Inc. 2022b), GAMs were used to assess how the distribution of caribou changed at increasing distances from each linear feature type and to identify an 'iteration zone' to test for ZOIs. The iteration zone is defined as the boundary within which caribou distribution and habitat use are minimally affected by broad-scale patterns in climatic (e.g., snowfall) and biotic (e.g., caribou density and forage) processes. Practically, this refers to an initial range of distances (starting at 0 km) where selection is relatively flat (slope = 0) (see Boulanger et al. 2021). For example, during late fall, selection was fairly flat up to 100 km from the Dempster Highway, after which selection decreased sharply (see Attachment Figure 21 in Section 6.9.3). In other cases, such as the relationship to 2D lines during late fall, the slope was substantially greater than zero at very close distances (see Attachment Figure 19 in Section 6.9.3). Selection increased up until approximately 18 km, then sharply decreased until 25 km, and then, once again, sharply increased up until approximately 35 km. Given such non-linearity in the response, the iteration zone was identified within the first major bout of increase/decrease, i.e., within the first 25 km. This approach was taken in each case where a drastic, non-linear selection gradient occurred at very close distances to the linear feature.

Within the iteration zone, several distance thresholds were tested to identify a ZOI. The assumptions were that caribou presence would be reduced and resource selection altered within the threshold distance. We assigned all distances at or beyond the defined threshold the same distance value. For example, if a ZOI distance of 2 km was tested, then all distances up to 2 km retained their values (i.e., numbers ranging from 0 km to 1.99 km), but all distances at or greater than the ZOI were assigned a value of 2 km (e.g., 3 km or 4 km were assigned values of 2 km). A unique model was fit for each threshold tested, and the number of models corresponded to the outer boundary of the iteration zone identified for each linear feature type. In other words, if the iteration zone was deemed between 0 km and 25 km, then 25 models were tested — one for each kilometre interval. The best model, which corresponded with the most likely ZOI, was selected by evaluating the log-likelihoods of all models as a function of the distance thresholds. The highest log-likelihood corresponded with the model with the most statistical support (Boulanger et al. 2012). The magnitude of avoidance was estimated as the odds of caribou occurring at or beyond the ZOI relative to the odds of being on the linear feature (i.e., odds ratio = $e^{coefficient \times ZOI}$).

6.7.2 RESULTS AND DISCUSSION

The influence of linear features on PCH distribution and habitat selection varied between late fall and winter seasons and among functional linear feature types. ZOIs were detected for 2D seismic lines (including winter roads and trails) during late fall (4 km, Attachment Figure 25) and winter (2 km, Attachment Figure 28). These results were derived from analyses that considered only spatially relevant scales (i.e., iteration zones) (see GAM plots for 2D lines in Section 6.9.3). For example, relationships with 2D lines were evaluated only within the Eagle Plains ecoregion because most of these features occurred within this extent. The GAM plots in Section 6.9.3 also demonstrate that, though selection increased/decreased relative to 2D lines, these changes were low in magnitude. For example, within the iteration zones of 2D lines, there was an approximate 0.08 (or 8 %) increase in the probability of selection at far distances from these features. When estimated using a defined threshold, changes in the probability of selection necessarily increased (relative to GAMs) based on the imposed shape of the response (i.e., fitting a linear increase followed by a flat slope at distances equal to and beyond the ZOI). In practical terms, the odds of caribou occurring at distances equal to or beyond the ZOIs for 2D lines are 1.45 (odds ratio = $e^{0.000093 \times 4\ km}$) and 1.27 (odds ratio = $e^{0.00012 \times 2\ km}$) times greater, during late fall and winter, respectively, than the odds of caribou occurring on 2D lines. The ZOIs estimated for 2D lines in the current study were smaller than those previously estimated by Johnson and Russell (2014)—11 km from 1985–1998 and 6 km from 1999–2012 for wells, trails, winter roads, and seismic lines.

Although analysis of 2D seismic lines (including winter roads and trails) did identify statistically significant ZOIs, the results should be interpreted with caution. An important indicator to contextualize these results is whether estimated ZOIs influenced the selection of important habitat components. A comparison of coefficients between habitat models with and without ZOI terms provides a test of the ecological significance of estimated ZOIs (Boulanger et al. 2012). To accomplish this, predictions were made using the estimated ZOIs across the late fall and winter ranges to match the same spatial scale as base habitat models (see Table 6-10 and Table 6-11). During late fall, coefficients associated with macrolichen cover ($\beta_{lichen.base}$ = 0.694 ± 0.029 versus $\beta_{lichen.ZOI}$ = 0.689 ± 0.029) in Eagle Plains were invariant (Table 6-4 versus Table 6-10). Similarly, during winter, coefficients associated with lichen ($\beta_{lichen.base}$ = 1.119 ± 0.018 versus $\beta_{lichen.ZOI}$ = 1.114 ± 0.018) in Eagle Plains, and avoidance of other plant functional types, were consistent (Table 6-5 versus Table 6-11). So, even though ZOIs were determined for 2D lines, the magnitude of those effects was so small that it resulted in marginal changes to the habitat model predictions in both late fall and winter.

No ZOIs were detected for the Dempster Highway during either season. Instead, the segmented regression approach identified an attraction effect, rather than avoidance, for both late fall (9 km, Attachment Figure 27) and winter (11 km, Attachment Figure 30). Thus, caribou were more likely to occur within 9 km and 11 km of the Dempster Highway during late fall and winter, respectively, than beyond those distances. This result contradicts previous work by Johnson and Russell (2014), who identified ZOIs of major roads, including the Dempster Highway, to be as large as 30 km from 1985–1998 and 18.5 km during 1999–2012.

Similar to the results for the Dempster Highway, no ZOIs were determined for 3D seismic lines, but there is high uncertainty associated with those estimates due to the relatively small number of collared caribou that

interacted with the 3D seismic area. Attraction effects were found within 16 km and 4 km of 3D seismic lines during late fall (Attachment Figure 26) and winter (Attachment Figure 29), respectively. As with 2D lines, the magnitude of the attraction effect for Dempster Highway and 3D seismic lines was small relative to base habitat selection. Additionally, considering the potential mechanisms of effects that 3D lines could have on caribou, the apparent attraction of caribou to the 3D seismic lines is likely a spurious result. Based on other studies examining the effects of 3D lines on caribou and their primary predators, wolves, it was expected that the PCH would exhibit a neutral or weak avoidance response to 3D lines due to the potential for facilitated predation to occur.

In addition to the weak effects exhibited by ZOIs relative to base habitat selection, there are other factors that warrant cautious interpretation and use of these analytic results. (1) ZOI estimates and their magnitude of effect can be sensitive to (a) sample sizes and (b) spatial and temporal coverage of the data. Though numerous overall, the data used in this analysis had relatively modest sample sizes near linear features and were unevenly distributed in relation to linear features in Eagle Plains. (2) Caribou can exhibit dramatically different ZOIs from year to year. Collared caribou were only present in modest numbers in 2012/13, 2014/15, 2017/18, and 2018/19, so the data had to be lumped across years to estimate a single ZOI. (3) ZOIs estimated for the PCH in this analysis are substantially smaller than those estimated by Johnson and Russell (2014). The issues associated with these factors are discussed below.

The spatial and temporal context of ZOI studies can influence outcomes. Estimates of ZOIs are a consequence of broad- and fine-scaled space use, and these patterns of distribution can emerge from population demography, biotic interactions (e.g., density-dependent competition or predator-prey interactions), abiotic conditions (e.g., snowfall, forage availability), habitat selection, and potential sources of disturbance (e.g., dust fall, sensory disturbance) (Messier et al. 1988, Johnson et al. 2001, Mahoney and Schaefer 2002, Hinkes et al. 2005, Bowyer et al. 2014, Chen et al. 2017, Boulanger et al. 2021, Pedersen et al. 2021). These sources of variation in space use do not negate the importance of quantifying indirect effects of anthropogenic development, but they do point to underlying issues with the ZOI framework and its utility for management and mitigation. For example, Boulanger et al. (2021) documented ZOI responses by Bathurst caribou to the Ekati-Diavik mine complex (Northwest Territories) that have varied dramatically from year-to-year, which the authors attribute to changes in drought conditions. Similarly, Johnson et al. (2020) found that ZOIs around energy infrastructure (North Slope of Alaska, USA) reduced during periods of high mosquito activity for the Central Arctic Herd (CAH). In these examples, fine-scale changes in caribou space use was primarily driven by selection for areas adjacent to large, open bodies of water: Lac de Gras by Bathurst caribou and the Arctic Ocean by CAH caribou.

Another issue regarding the interpretation of ZOIs is their sensitivity to the data and analytical methods used. For example, Boulanger et al. (2021) found that GPS-collared caribou exhibited 'avoidance' (a ZOI) in only four out of nine years at the Ekati-Diavik mine complex (range = 6–13 km). In five of those nine years, caribou exhibited either no relationship or attraction to mine infrastructure. Additionally, when comparing an overlapping year (2012) between GPS data and aerial survey data for Bathurst caribou, a ZOI was identified using GPS collar data (ZOI = 7.09 km, odds ratio not overlapping zero; see Table 3 in publication) but was not identified using aerial survey data (ZOI = 11.4 km, odds ratio overlapping zero; see Table 4 in

publication). During the data exploration phase of the current study, ZOI results also varied considerably based on different subsets of the PCH data. For example, the estimates of a ZOI around 2D seismic lines (including winter roads and trails) changed by several kilometres when assessing not only different years but different spatial extents (e.g., ecoregions).

The ZOI analysis conducted by Johnson and Russell (2014) for the PCH used a similar approach to the current analysis and other studies, but yielded very different results for seismic lines and major roads. Johnson and Russell (2014) also caution against interpreting their results based on several factors, including a large change in the PCH's population size over their study duration, variation in animal behaviour across the range of development types, and relatively small effect sizes for caribou-disturbance responses. The potential reason for differences between the results in this study and those of Johnson and Russell (2014) are not apparent and may reflect the sensitivity of results to the differences in sample sizes and spatiotemporal patterns in the data used between the two studies. Landscape conditions and land use activities were similar between the two study periods and likely included some of the same data (e.g., winter 2012). Both Johnson and Russell (2014) and the current study dealt with trade-offs in spatial and temporal coverage. Though Johnson and Russell (2014) had data with longer temporal coverage (27 years), these data suffered from poorer spatial resolution associated with larger interval collar fixes (on average, once every seven days), smaller sample sizes (N = 2,127), and coarser habitat variables (i.e., landcover classification). In contrast, the current study used data with shorter temporal coverage (8 years) but had higher spatial resolution associated with collar fixes (on average, one per day), larger sample sizes (N_{fall} = 8,323 and N_{winter} = 13,014), and high resolution habitat variables (i.e., 30 m x 30 m plant functional type percent and digital elevation model). The current study had the advantage of higher spatial resolution, which is especially important for ZOIs, which are, by nature, a spatial phenomenon. A limitation to both this study and Johnson and Russell (2014) is the lack of sufficient interaction between caribou and linear features each year, which prevented the estimation of annual ZOIs.

ZOI analyses, including the analyses in this study, often do not explicitly test specific mechanisms that could be causing caribou to avoid anthropogenic features. It is assumed, correctly or incorrectly, that caribou avoid these areas because they perceive elevated predation risk (Frid and Dill 2002, Semeniuk et al. 2012). This can include avoidance due to direct sensory disturbances associated with the features and learned behaviours that could result in avoidance beyond sensory perception distances (Boulanger et al. 2021). Assuming the ZOIs detected in this study are 'real', potential mechanisms that cause caribou to avoid 2D seismic lines, winter roads, and trails are perceived mortality risk associated with human hunting (Wolfe et al. 2000, Plante et al. 2017) and facilitated predation by wolves (James and Stuart-Smith 2000, Dickie et al. 2017).

Ultimately, the purpose of measuring and testing caribou responses to linear features is to inform management and mitigation. Given the weak effects associated with the ZOIs generated here, and the analytical issues discussed above, it is recommended that these results not be used solely to estimate the effects of linear features on the PCH. Rather, it is recommended that the results be used in conjunction with results from other studies, adapted to the Eagle Plains setting and the ecology of the PCH, to develop a set of ZOIs for assessment and management purposes.

Table 6-10. Zone of influence habitat model of global-availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during late fall.

Model Term	Estimate	Std. Error	*Z*-statistic	*P*
Intercept				
Eagle Plains & North *(Reference)*	-9.579	0.038	-254.424	<0.0001
Ecoregion (factor)				
North Ogilvie Mountains	-0.281	0.077	-3.649	0.000263
British-Richardson Mountains	0.357	0.051	7.033	<0.0001
Old Crow Basin	0.171	0.042	4.050	<0.0001
Davidson Mountains	0.462	0.047	9.814	<0.0001
Aspect (factor)				
South	0.103	0.032	3.251	0.00115
East	0.004	0.032	0.127	0.899
West	0.157	0.031	5.028	<0.0001
Ecoregion–Lichen_100m Interaction				
Eagle Plains * Lichen_100m Percent[1,2] *(Reference)*	0.689	0.029	23.628	<0.0001
North Ogilvie Mountains * Lichen_100m Percent[1,2]	0.065	0.063	1.041	0.298
British-Richardson Mountains * Lichen_100m Percent[1,2]	-0.296	0.043	-6.929	<0.0001
Old Crow Basin * Lichen_100m Percent[1,2]	-0.137	0.037	-3.665	0.000248
Davidson Mountains * Lichen_100m Percent[1,2]	-0.216	0.042	-5.117	<0.0001
Digital Elevation Model				
Slope Percent[1,2]	-0.309	0.017	-17.947	<0.0001
Absolute Elevation[2] (linear)	0.810	0.073	11.091	<0.0001
Absolute Elevation[2] (quadratic)	-0.785	0.070	-11.219	<0.0001
Distances				
Distance to Waterbodies[2]	-0.177	0.016	-11.402	<0.0001

[1] covariate transformation = $\log_e(x + 1)$.

[2] covariate estimates based on standardized covariate values = (x – mean[x])/std. deviation(x).

Note: the zone of influence estimate derived within the iteration zone was used to predict habitat selection across the late fall range for the purpose of comparing habitat coefficients only.

Table 6-11. Zone of influence habitat model of global–availability resource selection (RSF) by Porcupine Caribou Herd caribou in Eagle Plains during winter.

Model Term	Estimate	Std. Error	*Z*-statistic	*P*
Intercept				
Eagle Plains & North *(Reference)*	-9.982	0.051	-196.452	<0.0001
Ecoregion (factor)				
North Ogilvie Mountains	0.569	0.040	14.207	<0.0001
British-Richardson Mountains	0.675	0.039	17.242	<0.0001
Old Crow Basin	0.242	0.034	7.018	<0.0001
Aspect (factor)				
South	0.192	0.025	7.536	<0.0001
East	0.032	0.026	1.223	0.221
West	0.324	0.025	13.074	<0.0001
Ecoregion– Lichen_100m Interaction				
Eagle Plains * Lichen_100m Percent[1,2] *(Reference)*	1.114	0.018	62.639	<0.0001
North Ogilvie Mountains * Lichen_100m Percent[1,2]	-0.154	0.034	-4.511	<0.0001
British-Richardson Mountains * Lichen_100m Percent[1,2]	-0.602	0.036	-16.842	<0.0001
Old Crow Basin * Lichen_100m Percent[1,2]	-0.119	0.034	-3.495	0.000474
Other Plant Functional Types				
Conifer_Tree_1000m Percent[2]	-0.253	0.009	-26.810	<0.0001
Forbs_500m Percent[2]	-0.165	0.010	-16.910	<0.0001
Deciduous_Shrub_1000m Percent[2]	-0.094	0.009	-9.980	<0.0001
Graminoid_1000m Percent[2]	-0.121	0.009	-12.829	<0.0001
Evergreen_Shrub_100m Percent[2]	-0.052	0.009	-5.607	<0.0001
Digital Elevation Model				
Slope Percent[1,2]	-0.220	0.012	-19.034	<0.0001
Absolute Elevation[2] (linear)	-1.441	0.056	-25.507	<0.0001
Absolute Elevation[2] (quadratic)	0.941	0.054	17.572	<0.0001
Distances				
Distance to Waterbodies[2]	0.206	0.010	20.711	<0.0001

[1] covariate transformation = $\log_e(x + 1)$.

[2] covariate estimates based on standardized covariate values = (x – mean[x])/std. deviation(x).

Note: the zone of influence estimate derived within the iteration zone was used to predict habitat selection across the winter range for the purpose of comparing habitat coefficients only.

6.8 SUMMARY

The PCH is known for large population aggregations, dramatic population fluctuations, lengthy migrations, and significant cultural and social value to northern Indigenous peoples. Within the NYLUP, the PCH is considered "…*the most significant and culturally important wildlife resource in the planning region.*" Habitat, food supply, predation, hunting, disease and climate range likely play interactive roles as limiting factors to the PCH population. Factors have limited potential to regulate the PCH, individually.

- The potential for food supply, especially lichen, to regulate the PCH is more limited than other barren ground caribou herds because of the PCH's very large annual and seasonal ranges and the diversity of habitats found within those ranges (e.g., including several ecoregions). Overall, the PCH winter range is relatively rich in lichen resources and is comparable to, or better than, those of other herds that winter in taiga regions.
- Predation does not seem to play a role in limiting PCH growth while the herd is at high numbers. One study suggested that the predation rate had to be near twice the observed level to cause the PCH to decline.
- The comprehensive measures within the Harvest Management Plan to monitor and respond to declines in the PCH (i.e., by reducing harvest) provide a solid system to minimize the potential effects that harvesting could have on the herd.

The portion of the PCH annual range that occurs within Yukon is protected by a network of parks, special management areas, conservation areas, wilderness areas, protected areas, ecological preserves, habitat protection areas, and IMA zones within the North Yukon Regional Land Use Plan and the Peel Watershed Regional Land Use Plan. In total, 54% of the annual range of the PCH within Yukon falls within some type of protected area where industrial activity is prohibited, 36% of the annual range occurs within Integrated Management Area zones where development is limited, and 9% of the annual range is not covered by any land management zonation. The Eagle Plains RSA occurs within IMA Zone IV, which permits the highest level of development.

The PCH have historically overlapped the Eagle Plains RSA in the rut/late fall and winter periods. However, the RSA constitutes only a small portion of those ranges — 6.0% of the late fall range and 6.5% of the winter range. The RSA does not overlap with the most frequently used portions of the late fall and winter ranges.

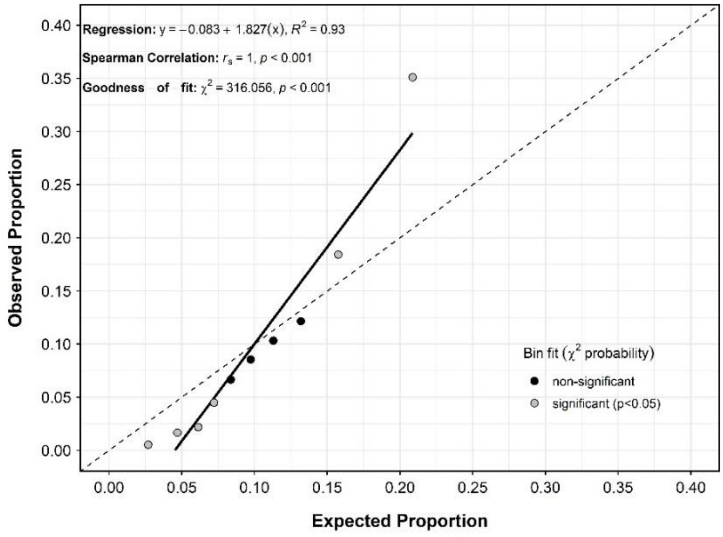
Habitat selection by the PCH in late fall and winter was estimated using resource selection functions. Selected habitats were dependent primarily on the distribution of macrolichen cover. Distance to linear features had a small effect on habitat model predictions. Overall, the strength of selection was greater in winter than late fall, which corresponds to broader movement patterns and use of more diverse habitats by the PCH in fall. In terms of regional habitat distribution, the RSA had similar proportions of selected habitat in fall as the full late fall range; however, the RSA had a much lower proportion of selected habitat in winter compared to the full winter range. Within the RSA, lichen distribution (and caribou use) was strongly affected by extensive recent burns, which had lower lichen cover than unburned areas.

The PCH typically exhibits movements of several kilometres per day in late fall and winter. Late fall daily movements (8.7 km/day in the RSA) were substantially greater than during winter (4.4 km/day). Caribou tended to occupy portions of the landscape for shorter periods during late fall than winter. Caribou residency times in both seasons were two-fold greater in the broader landscape than within the Project RSA, suggesting that, on average, the RSA is more of a transitory area than other portions of the seasonal ranges.

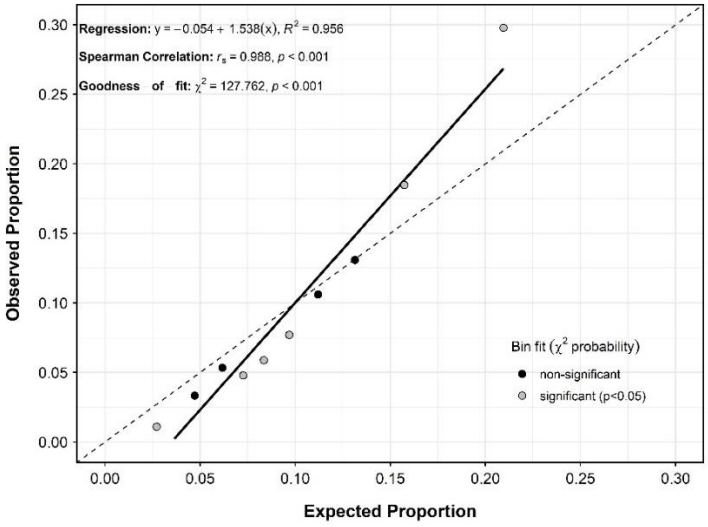
6.9 CARIBOU SECTION ATTACHMENTS

6.9.1 ATTACHMENT 6–A — 5-FOLD CROSS-VALIDATION

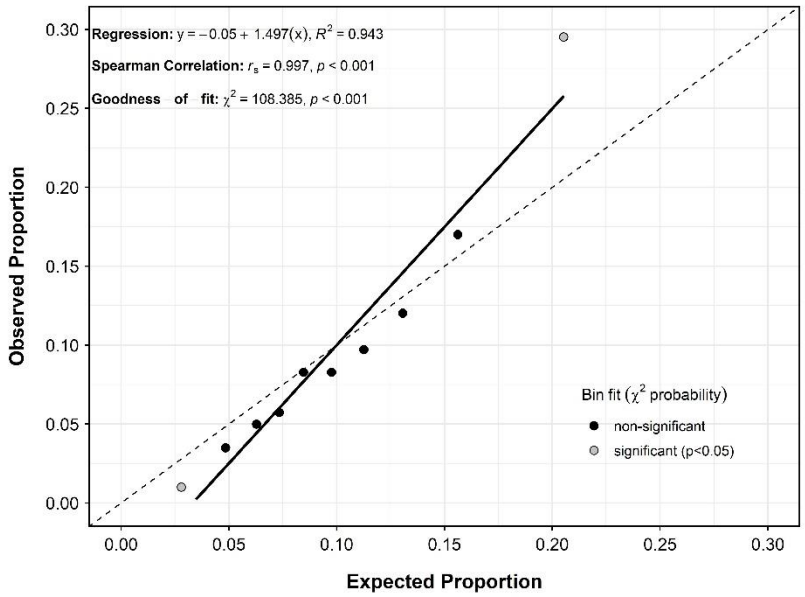
Late Fall



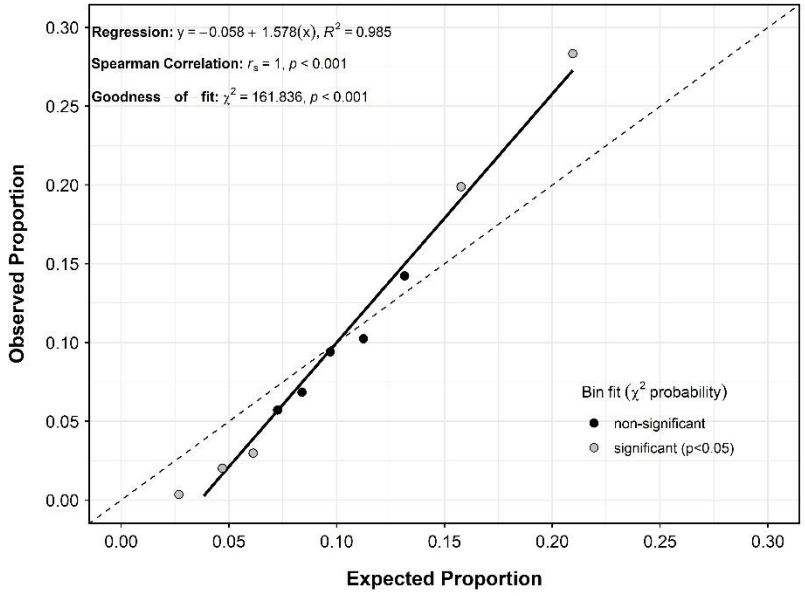
Attachment Figure 1. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 1). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



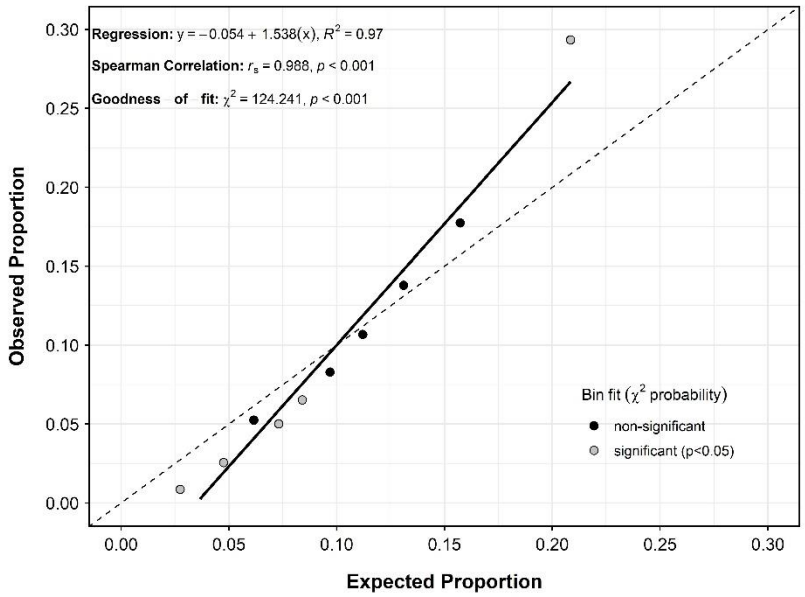
Attachment Figure 2. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 2). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



Attachment Figure 3. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 3). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.

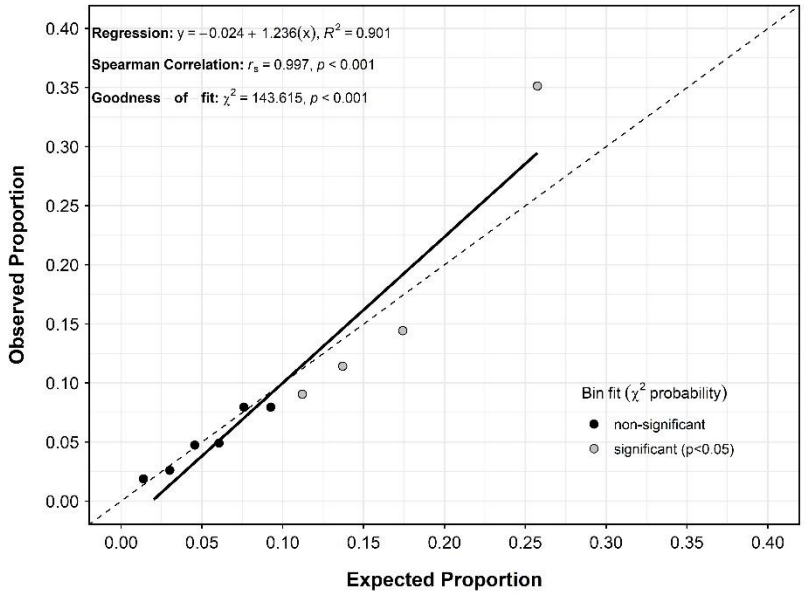


Attachment Figure 4. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 4). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.

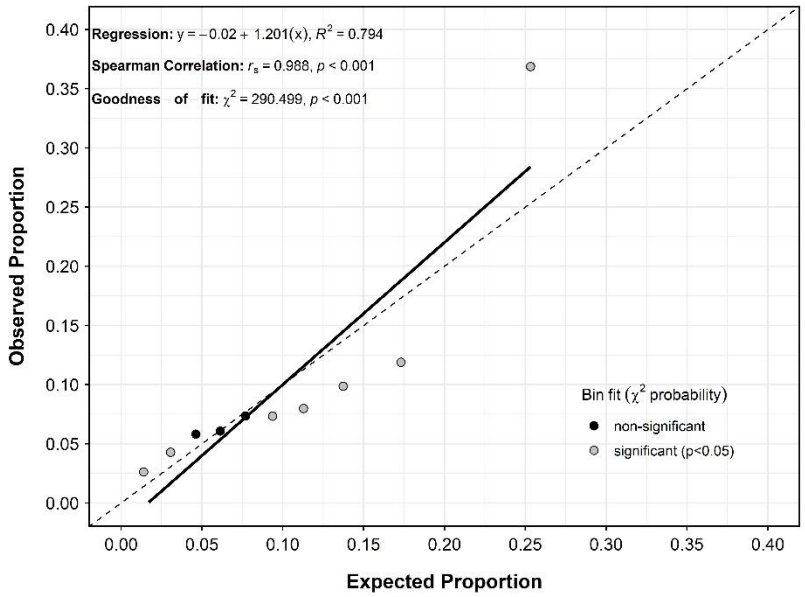


Attachment Figure 5. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 18,310) of caribou during late fall across 10 quantile bins (Fold 5). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.

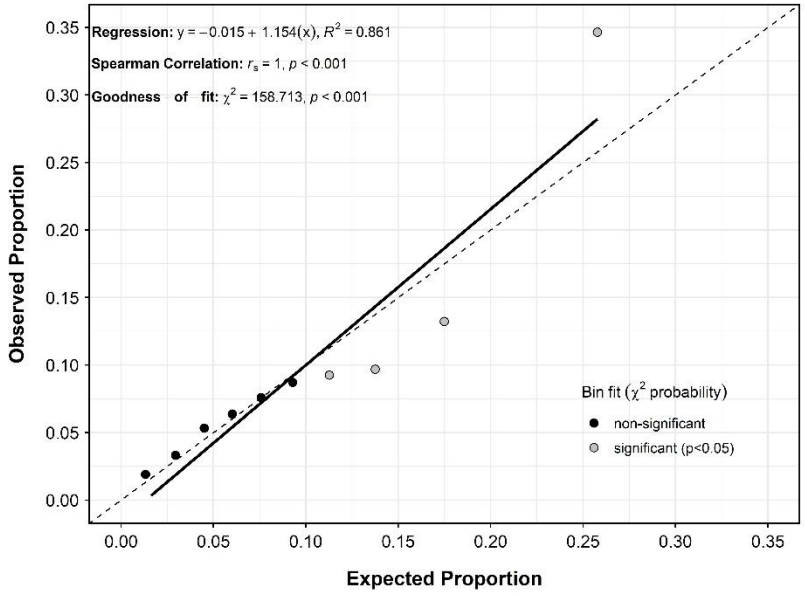
Winter



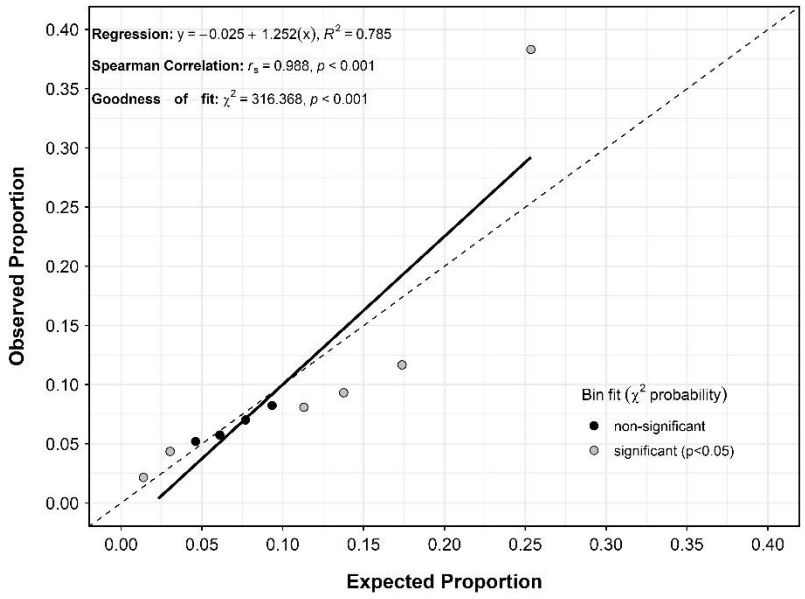
Attachment Figure 6. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 1). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



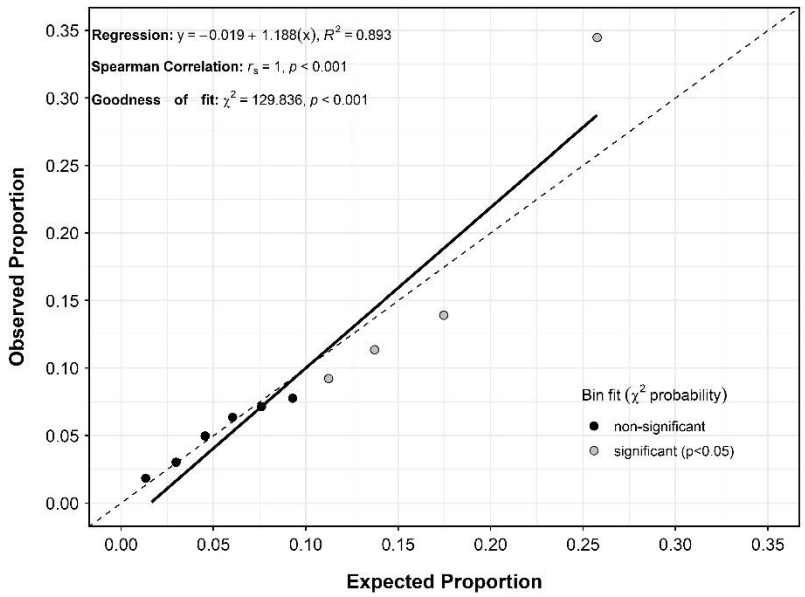
Attachment Figure 7. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 2). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



Attachment Figure 8. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 3). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



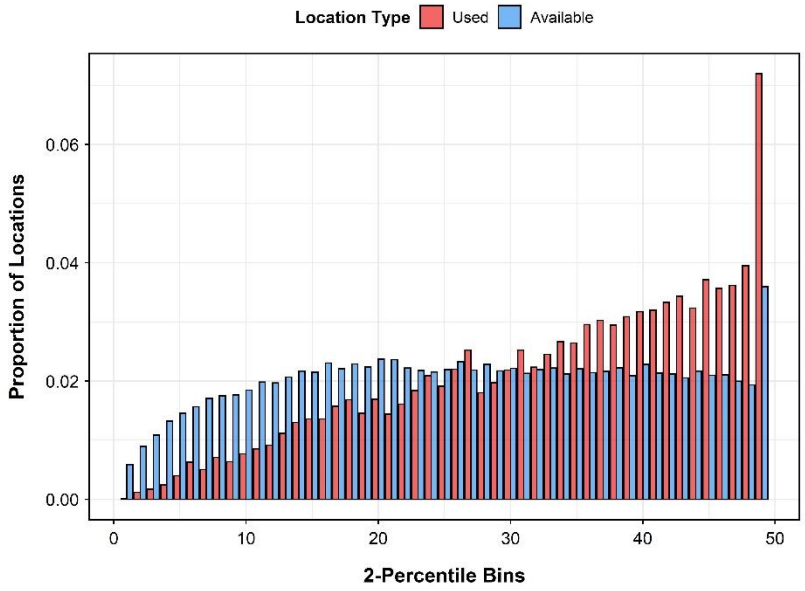
Attachment Figure 9. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 4). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.



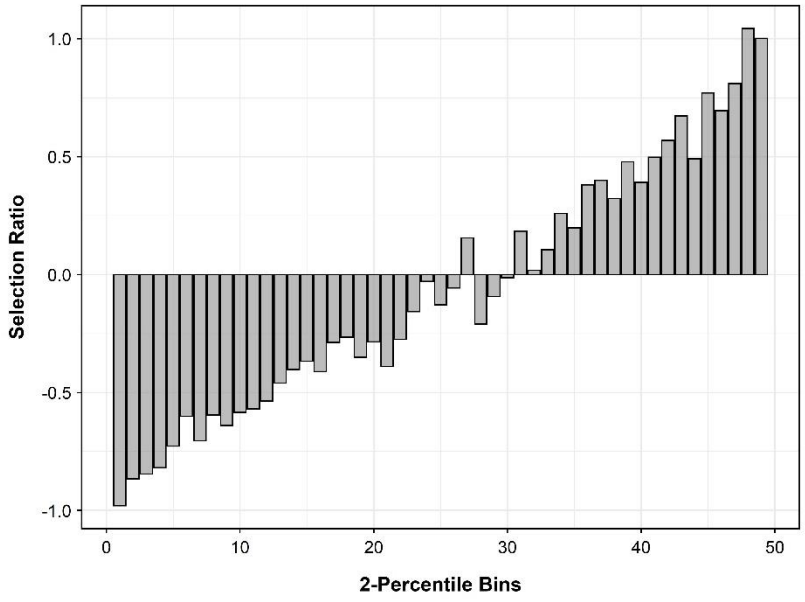
Attachment Figure 10. Cross-validation results comparing expected versus observed proportion of GPS telemetry observations (n = 28,630) of caribou during winter across 10 quantile bins (Fold 5). Dashed line shows the line of unity (observed = expected). Black line shows the fitted regression; points are either black (not statistically different than expected) or grey (statistically different from expected) for each bin.

6.9.2 ATTACHMENT 6–B — SELECTION RATIOS AND HABITAT RATINGS

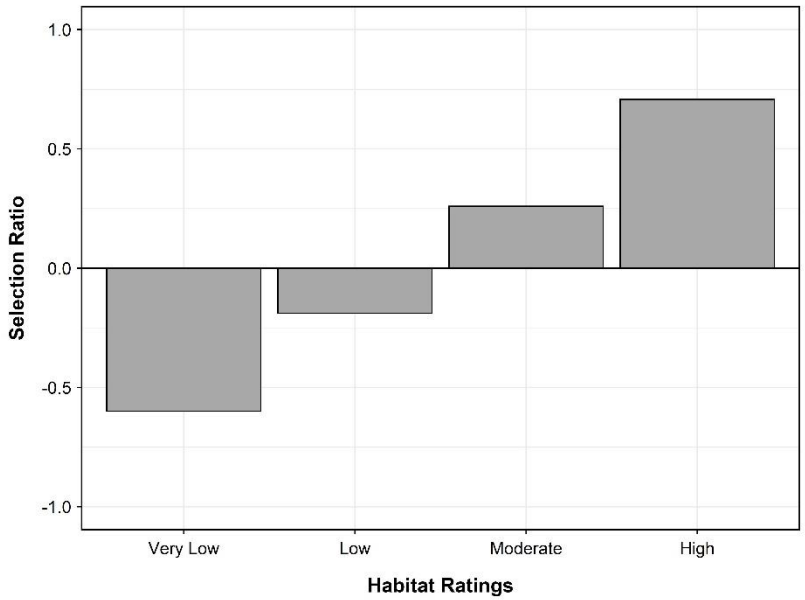
Late Fall



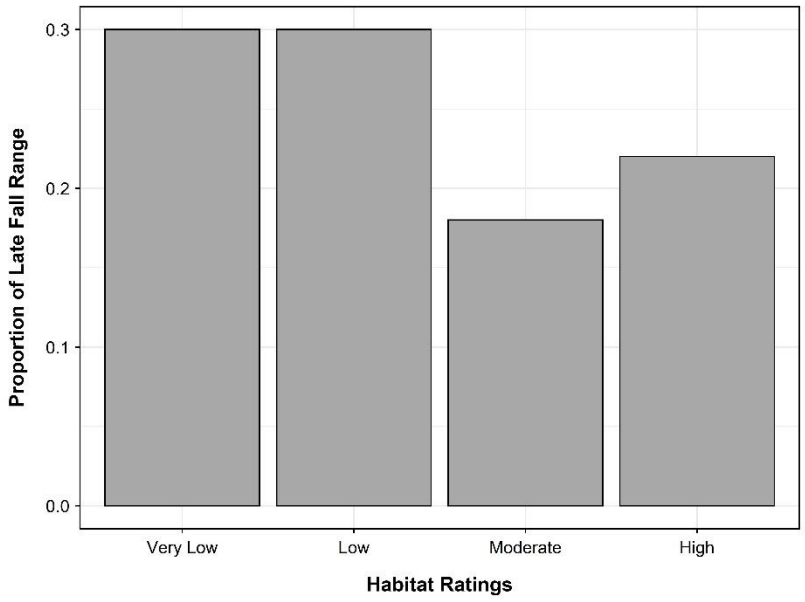
Attachment Figure 11. Proportions of used and available locations across 2-percentile (49 quantiles) interval bins of resource selection predictions during late fall, 2012–2021.



Attachment Figure 12. Selection ratios comparing the proportion of used to available locations across 2-percentile (49 quantiles) interval bins of resource selection predictions during late fall, 2012–2021.

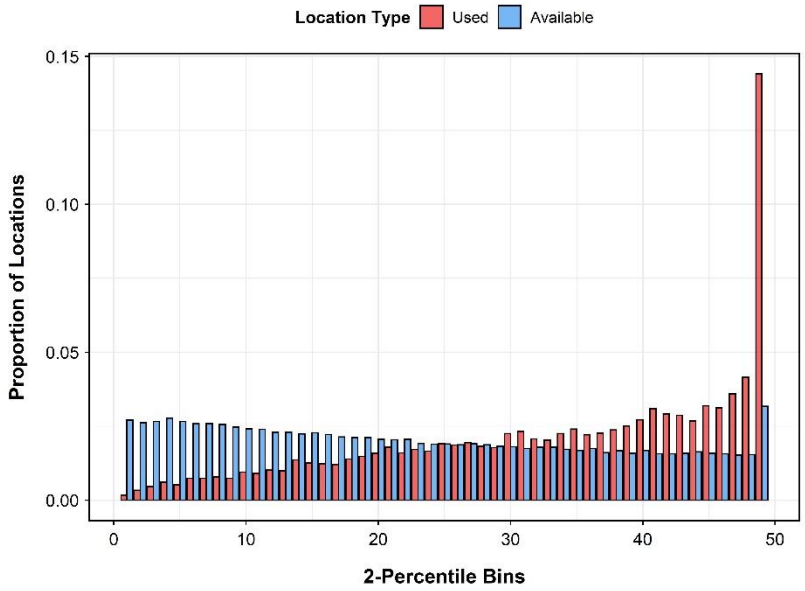


Attachment Figure 13. Selection ratios comparing the proportion of used to available locations across habitat rating classifications during late fall, 2012–2021.

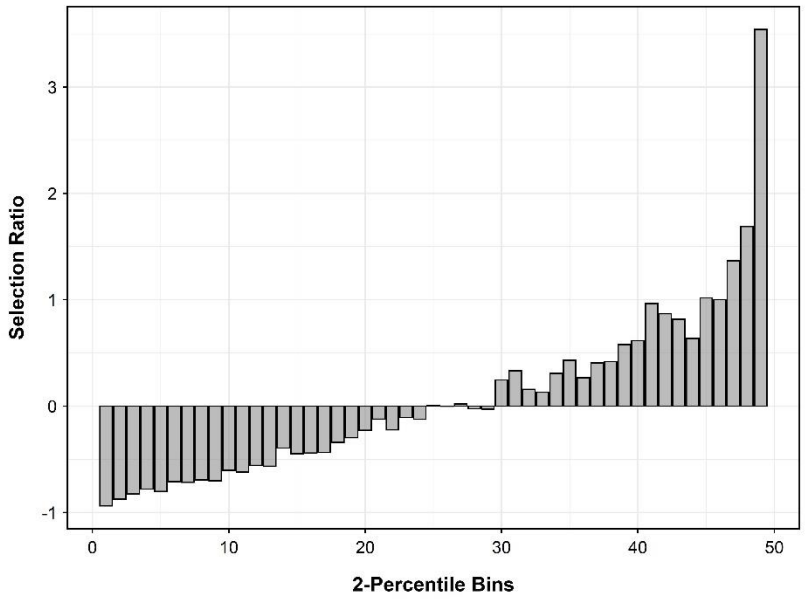


Attachment Figure 14. Proportion of the PCH late fall range composed by each habitat rating classification.

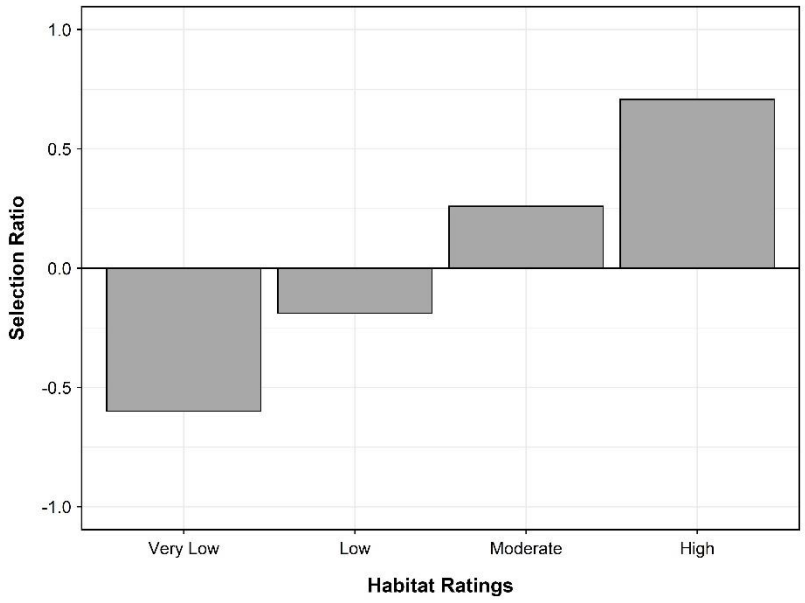
Winter



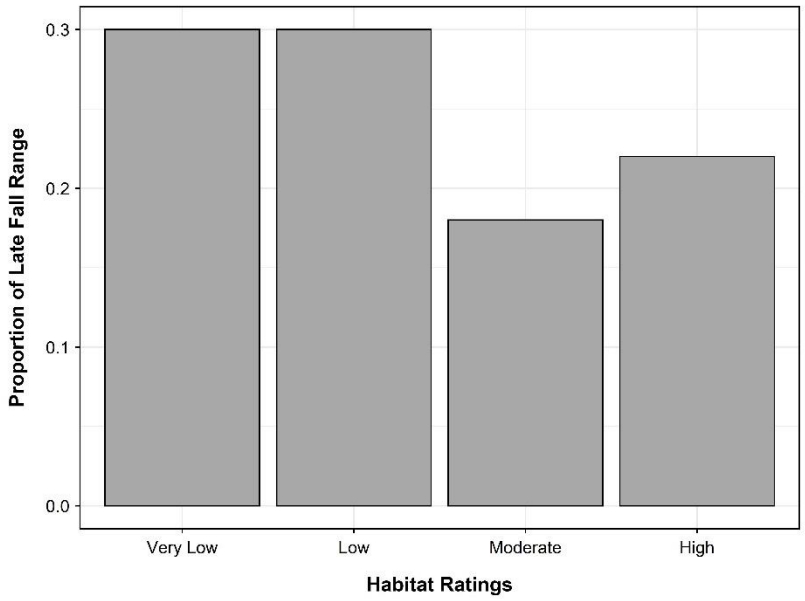
Attachment Figure 15. Proportions of used and available locations across 2-percentile (49 quantiles) interval bins of resource selection predictions during winter, 2012–2021.



Attachment Figure 16. Selection ratios comparing the proportion of used to available locations across 2-percentile (49 quantiles) interval bins of resource selection predictions during winter, 2012–2021.



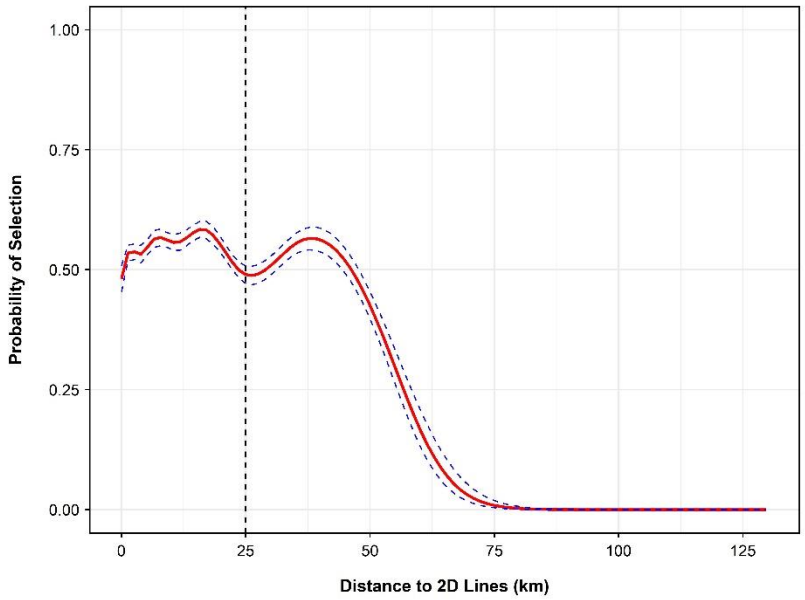
Attachment Figure 17. Selection ratios comparing the proportion of used to available locations across habitat rating classifications during winter, 2012–2021.



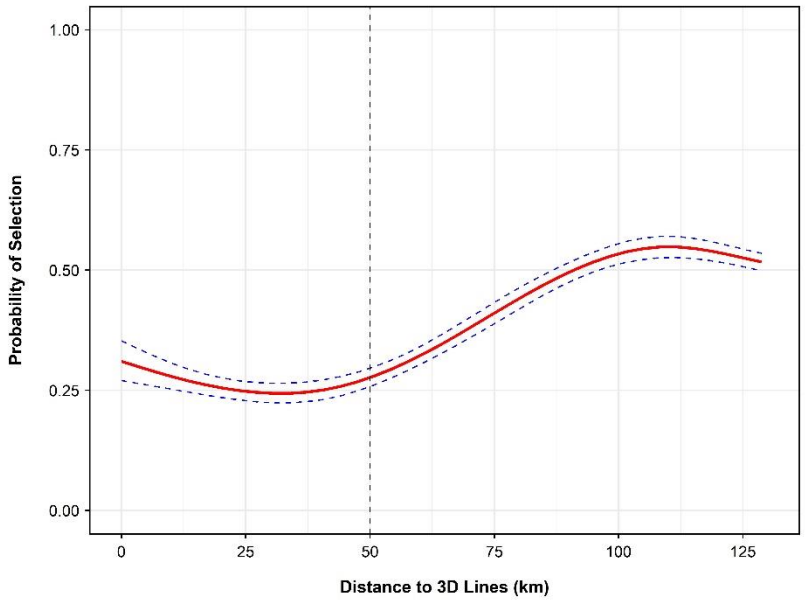
Attachment Figure 18. Proportion of the PCH winter range composed by each habitat rating classification.

6.9.3 ATTACHMENT 6–C — ZONE OF INFLUENCE ANALYSES

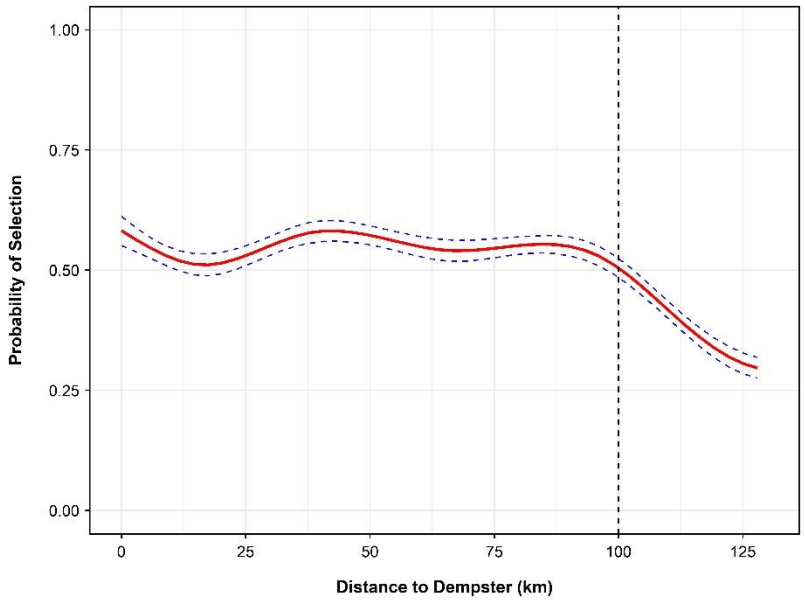
Late Fall



Attachment Figure 19. Marginal effect of distance to 2D seismic lines (including winter roads and trails) on the probability of selection by caribou during late fall (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

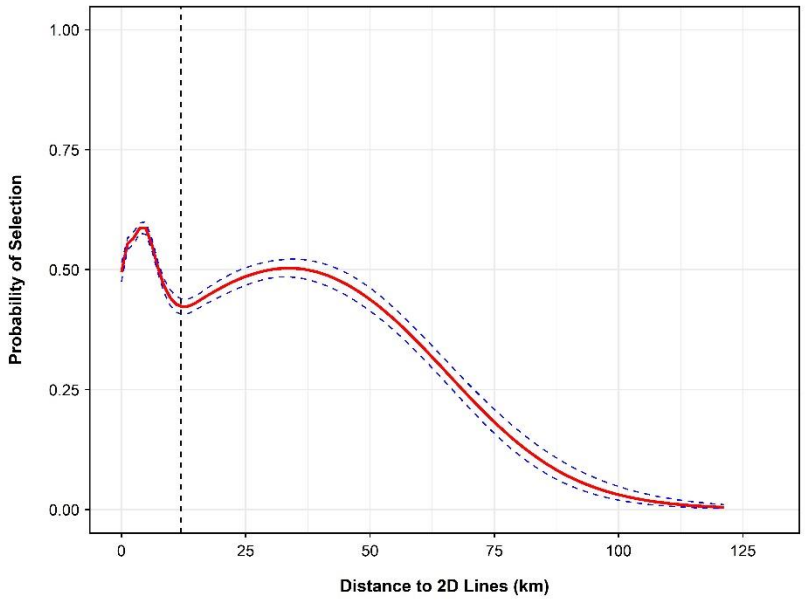


Attachment Figure 20. Marginal effect of distance to 3D seismic lines (single grid in Project RSA) on the probability of selection by caribou during late fall (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

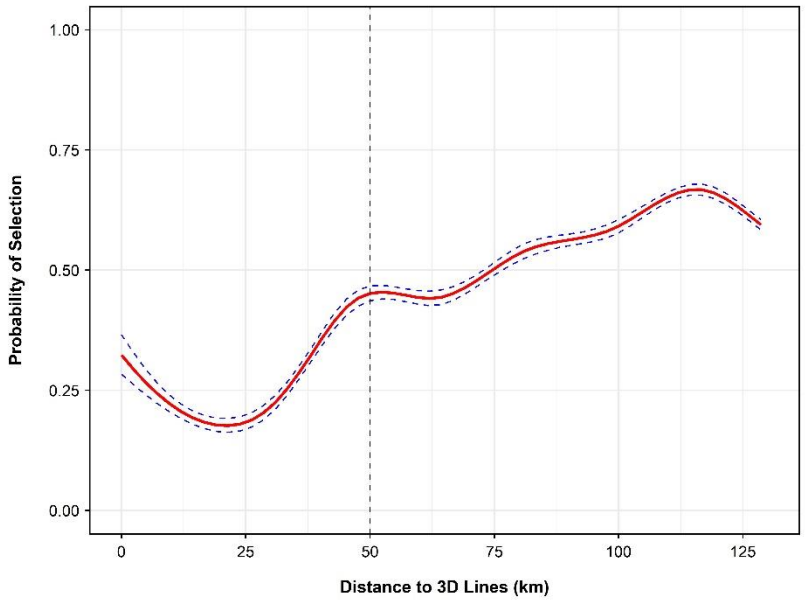


Attachment Figure 21. Marginal effect of distance to the Dempster Highway on the probability of selection by caribou during late fall (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

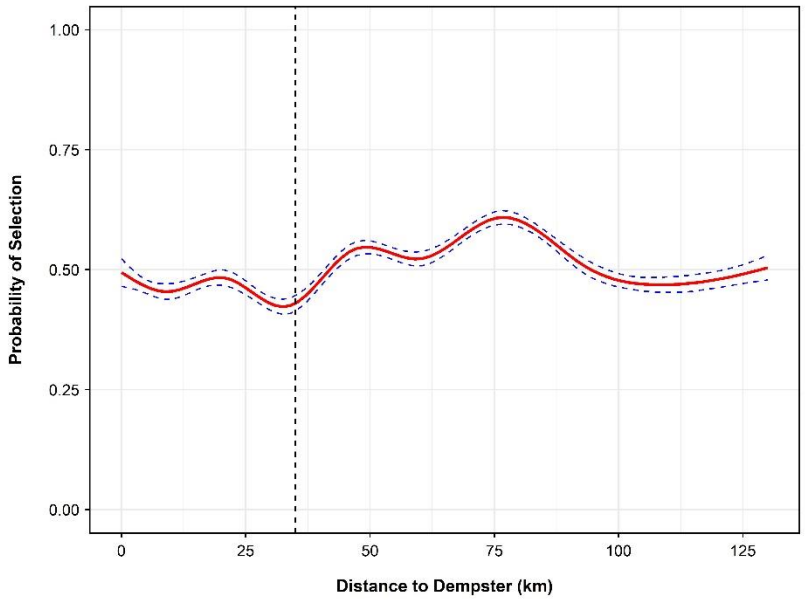
Winter



Attachment Figure 22. Marginal effect of distance to 2D seismic lines (including winter roads and trails) on the probability of selection by caribou during winter (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

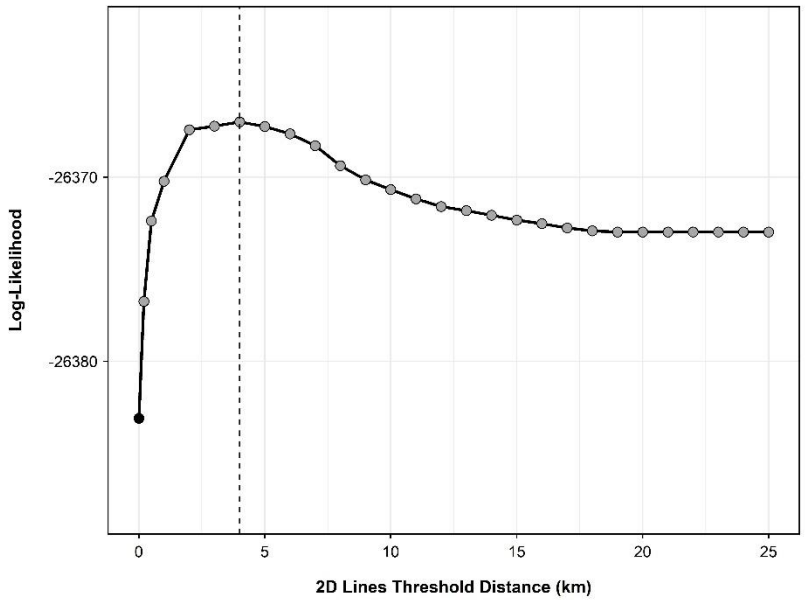


Attachment Figure 23. Marginal effect of distance to 3D seismic lines (single grid in Project RSA) on the probability of selection by caribou during winter (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

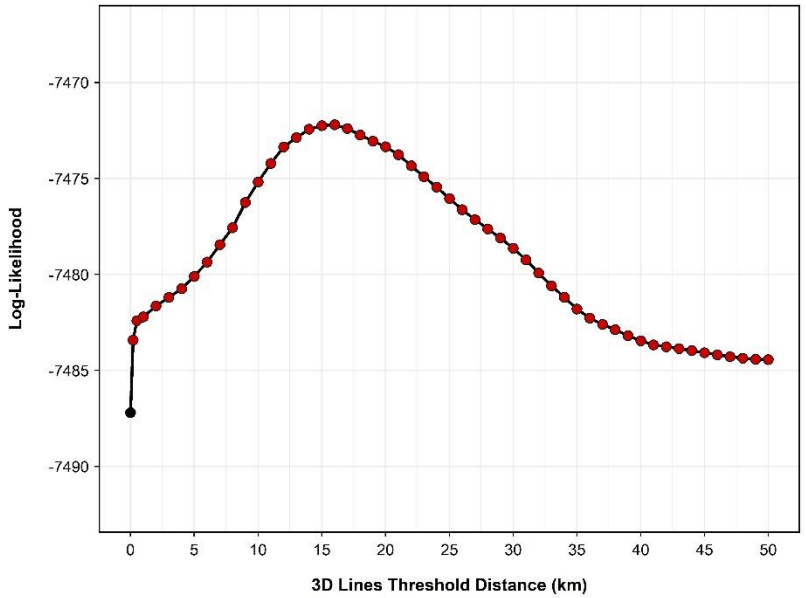


Attachment Figure 24. Marginal effect of distance to the Dempster Highway on the probability of selection by caribou during winter (2012–2021) based on a generalized additive model with cubic regression splines. Solid red and dashed blue lines are the fitted mean and 95% confidence intervals, respectively. Vertical dashed line indicates iteration zone cut-off.

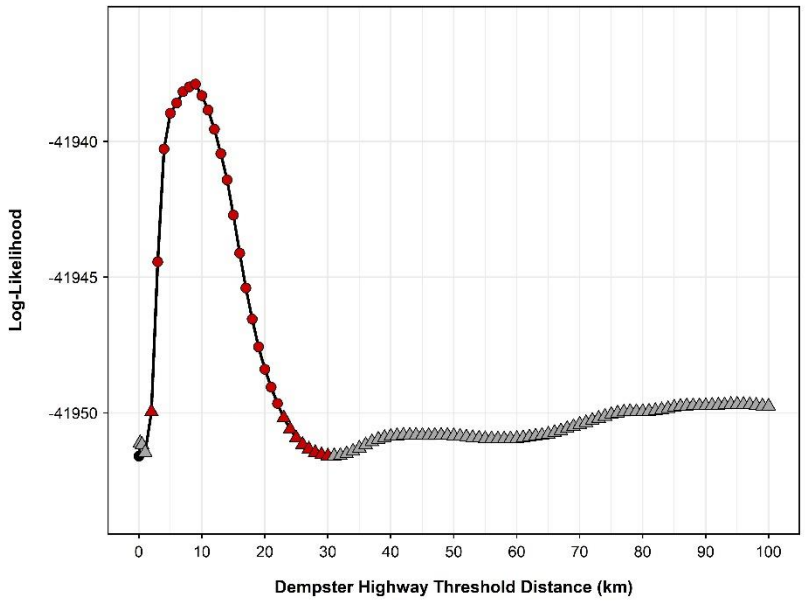
Late Fall



Attachment Figure 25. Segmented regression approach to estimating a zone of influence (ZOI) relative to 2D seismic lines (including winter roads and trails) using GPS collar data from PCH caribou during late fall, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively. Vertical dashed line indicates ZOI at 4 km.

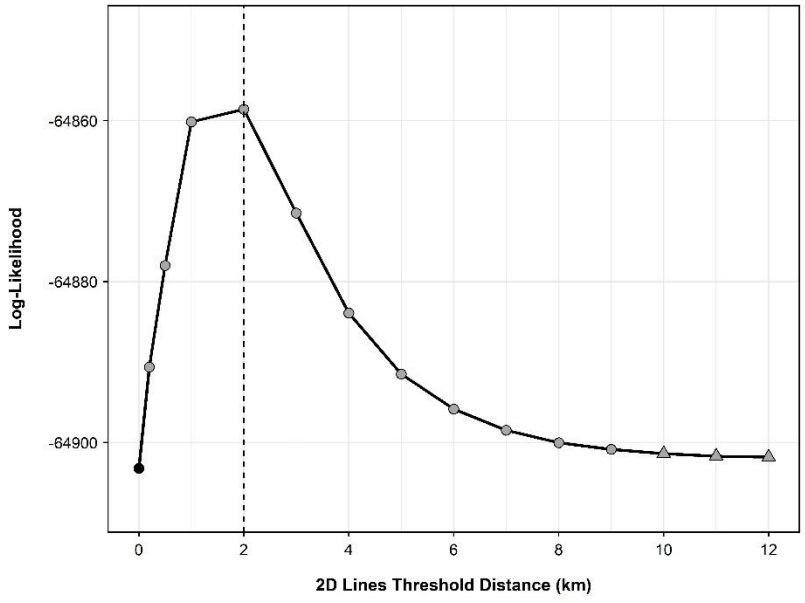


Attachment Figure 26. Segmented regression approach to estimating a zone of influence (ZOI) relative to the lone 3D seismic grid using GPS collar data from PCH caribou during late fall, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively.

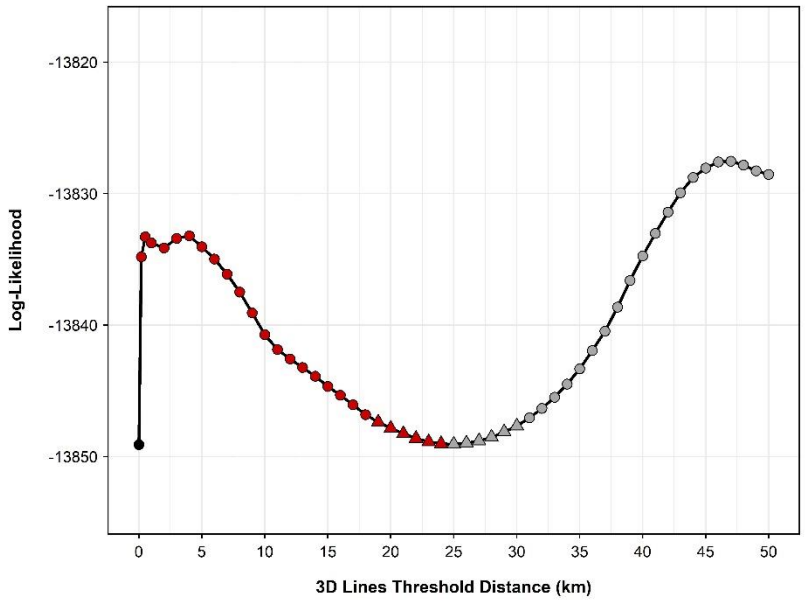


Attachment Figure 27. Segmented regression approach to estimating a zone of influence (ZOI) relative to the Dempster Highway using GPS collar data from PCH caribou during late fall, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively.

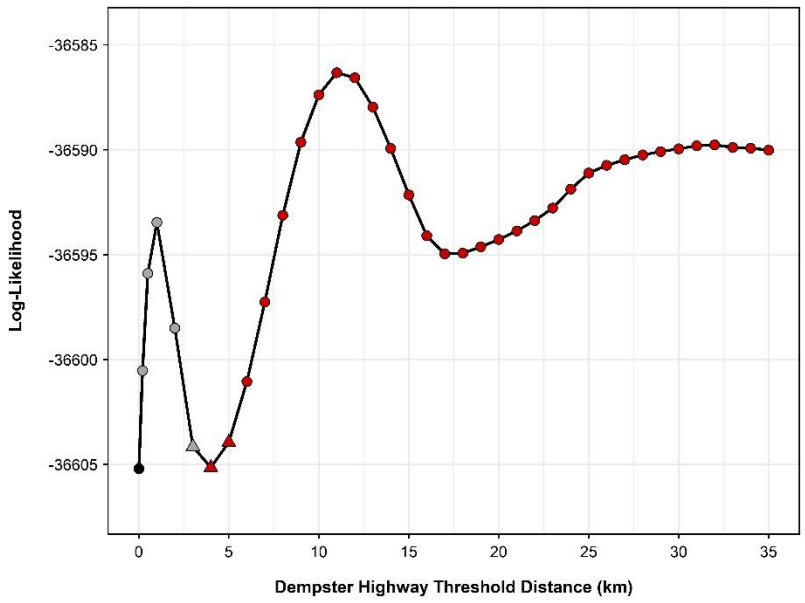
Winter



Attachment Figure 28. Segmented regression approach to estimating a zone of influence (ZOI) relative to 2D seismic lines (including winter roads and trails) using GPS collar data from PCH caribou during winter, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively. Vertical dashed line indicates ZOI at 2 km.



Attachment Figure 29. Segmented regression approach to estimating a zone of influence (ZOI) relative to the lone 3D seismic grid using GPS collar data from PCH caribou during winter, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively.



Attachment Figure 30. Segmented regression approach to estimating a zone of influence (ZOI) relative to the Dempster Highway using GPS collar data from PCH caribou during winter, 2012–2021. The threshold distance with the highest log-likelihood corresponds with the most likely ZOI. Circles and triangles indicate statistically significant and non-significant ZOI distances, respectively. Grey and red fills indicate positive and negative coefficients, respectively.

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Appendix B. Linear Feature Study

Chance Oil and Gas, Eagle Plains Project: Linear Feature Study



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EXECUTIVE SUMMARY

The Eagle Plains Exploration Project (the Project) is an oil and gas exploration project located in north Yukon. Chance Oil and Gas Ltd. (Chance) intends to conduct exploratory activities to confirm the quality, quantity, and extent of hydrocarbons over ten years. Work will include seismic exploration and exploratory wells supported by an expanded winter road network. Oil and gas exploration activities create long, narrow clearings through natural vegetation, such as seismic lines and roads, collectively known as 'linear features.' Linear features can be a management challenge because they can affect how people and animals move and plants disperse within a landscape. For example, in southern parts of the boreal forest, linear features appear to affect predator-prey dynamics that can result in increased caribou mortality by wolves. The North Yukon and Peel Watershed Regional Land Use Plans identify mitigations to minimize the potential effects of linear features, including cautionary (0.75 km/km^2) and critical (1.0 km/km^2) indicator levels of linear disturbance.

Intermittent exploration activities in the Eagle Plains area from the 1950s to 2014 have created a network of winter roads, 2D seismic lines, and, most recently, 3D seismic lines in parts of the Regional Study Area (RSA). However, the extent of liner features that currently occur in the RSA, the structural, vegetation, and functional characteristics of different linear feature types, and their degree of regeneration are unknown. EDI Environmental Dynamics Inc. conducted a linear features study to characterize the structural, vegetation, and functional aspects of linear features in the RSA to address these information gaps. The study addressed three objectives: (1) comprehensive mapping and classification of existing linear feature footprints within the RSA; (2) quantification of structural aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and (3) quantification of regeneration pathways and structural stages of linear features. This combined information supports assessing potential effects of linear features in the Project application and refinement of mitigation measures for linear features to minimize possible effects.

The linear features inventory was compiled from multiple spatial datasets and was verified and supplemented using satellite imagery in a Geographic Information System. Linear feature densities were estimated for each linear feature type. Estimates were adjusted to account for (i) overlap with open habitats, such as recent burns, where vegetation heights were similar on and off the line, and (ii) for average rates of regeneration determined from field studies.

Site selection used a stratified random design to obtain a representative sample of different feature types across the RSA. Ground and aerial surveys measured specific structural, vegetation, and functional characteristics across the different line types. Measures included width, successional class, structural stage, vegetation composition and height, and sightline distances. A 'walk test' was used to index ease of movement for large mammals. A driving survey documented the visibility of seismic lines from the Dempster Highway (i.e., as an index of potential human access onto the seismic lines). An aerial winter track survey was conducted in March 2020 to assess ungulates' relative use of different linear feature types.

Four primary types of linear features occur in the RSA, totalling 4,269 km: 2D seismic (34%), 3D seismic (51%), winter roads (14%), and the Dempster Highway (1%). The unadjusted linear feature density for the RSA totalled 1.79 km/km^2. After accounting for burns, natural openings and regeneration, the adjusted linear

feature density for the RSA totalled 0.52 km/km², below the cautionary and critical indicator levels in the North Yukon and Peel Watershed Regional Land Use Plans.

Structural, vegetation, and functional characteristics differed substantially among linear feature types. 3D seismic accounts for the largest extent of linear features in the RSA and had the narrowest widths and limited functional effects (e.g., the proportion of features used by ungulates in the winter was less than a third of the rates of use on 2D and winter roads). Winter roads had the widest average widths and the greatest functional effects except for the Dempster Highway. However, a substantial portion (39%) had also regenerated into or past the Tall Shrub stage (which this study suggests may be the best criterion for functional recovery). Most 2D lines had substantial vegetation regeneration, resulting in the shortest average sightlines and slowest movement speeds. However, ungulates still appeared to select them to travel on during winter.

Except for the Dempster Highway, where walking speeds were near twice the rate of other linear feature types, there was relatively little difference in movement rates among linear feature types and control areas. The density of shrubs and trees primarily limited movement rates. 2D lines, which had the highest density of shrubby regeneration, had the slowest average movement rates. For other linear feature types, the combination of vegetation regeneration on linear features and the naturally open nature of most adjacent undisturbed areas did not convey a substantial increase in movement rates on linear features compared to undisturbed areas.

Sightline distances on 2D lines and winter roads were also affected mainly by the degree of vegetation regeneration. Where regeneration was limited, sightlines on 2D lines and winter roads regularly exceeded 150 m. On 3D lines, which have not had enough time since their creation for vegetation to regenerate to the height that restricts vision, sightlines were limited by meanders purposely constructed to reduce sightlines. The meanders employed on 3D lines were also effective in reducing the detectability of the lines from the Dempster Highway. In the blind test, where observers did not know the location of the 3D lines, only 5% (4 out of 74) crossings were spotted. With a map showing the crossing locations, only two additional 3D lines were detected.

These results provide information to assess the potential effects of linear features in the Project application and refine mitigation measures.

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EDI Environmental Dynamics Inc. (EDI) completed the work within the traditional territories of the Vuntut Gwitchin First Nation (VGFN), First Nation of the Na-Cho Nyäk Dun, and the Tetlit Gwich'in Council (Secondary Use Area). Tyrel Kassi, a VGFN citizen, played an active role in the field components of the project. We thank him for his diligence and shared perspectives during the project.

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ACRONYMS AND ABBREVIATIONS

Acronym/Abbreviation	Definition
2D	Two Dimensional
3D	Three Dimensional
AIC	Akaike's Information Criterion
asl	above sea level
BC	British Columbia
°C	degrees Celsius
ELC	Ecosystem and Landscape Classification
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectares
IMA	Integrated Management Area
km	kilometers
km^2	square kilometers
km/hr	kilometer per hour
LIS	Low Impact Seismic
LMU	Landscape Management Unit
m	meter
mm	millimeter
NND	Na-cho Nyäk Dun
NWT	Northwest Territories
NYRLUP	North Yukon Regional Land Use Plan
PCH	Porcupine Caribou Herd
OHV	Off-Highway Vehicle
PWRLUP	Peel Watershed Regional Land Use Plan
RSA	Regional Study Area
the Project	the Eagle Plains Project (proposed by Chance Oil and Gas Ltd.)
YLUPC	Yukon Land Use Planning Council

1 INTRODUCTION

1.1 PROJECT OVERVIEW

The Eagle Plains Project (the Project) encompasses a 2,386 km² area in north-central Yukon, approximately 605 km north of Whitehorse and 40 km south and west of Eagle Plains hotel, along the Dempster Highway (Map 1-1). The Project occurs within the Eagle Plains petroleum basin, north of the Ogilvie River and west of the Richardson Mountains. The basin contains proven natural gas and oil reserves (Peel Watershed Planning Commission 2019), including 4.6 billion m³ of gas and 3.2 million m³ of oil (Hannigan 2014).

The Regional Study Area (RSA) has had intermittent periods of oil and gas exploration since the 1950s. That activity has developed winter roads, seismic lines, and exploratory wells across parts of the current RSA. Approximately 40 exploration wells have been drilled at Eagle Plains. Eight wells are maintained in suspended status, and the remaining wells have been plugged and abandoned. Seismic exploration has included approximately 10,000 km of two-dimensional (2D) lines (mainly before 1985), and about 325 km² of three-dimensional (3D) seismic was conducted in 2013–2014 (Northern Cross (Yukon) Ltd. 2014).

The current exploration program will build on past exploration to better define the extent, amount and quality of oil and gas deposits. Under the current program, Chance Oil and Gas Ltd. proposes conducting additional 3D seismic over large extents of the RSA and drilling up to 30 exploratory wells. Depending on the drilling program results, extended flow testing over several months may be conducted at a subset of the wells to determine the quantity and quality of the oil and gas deposit. The existing winter road network will be expanded to support the seismic and drilling programs. Most work is expected to be conducted in the winter (e.g., seismic line clearing and drilling); however, seismic recordings and extended flow testing may also occur during summer.

Oil and gas exploration activities create long, narrow clearings through natural vegetation, such as seismic lines and roads, collectively known as 'linear features.' Linear features can be a management challenge because they can affect how people and animals move and plants disperse within a landscape. For example, in southern parts of the boreal forest, linear features appear to affect predator-prey dynamics that can result in increased caribou mortality by wolves. The North Yukon and Peel Watershed Regional Land Use Plans identify mitigations to minimize the potential effects of linear features. The Plans also include cautionary (0.75 km/km²) and critical (1.0 km/km²) linear density indicator levels.

1.2 PURPOSE AND OBJECTIVES

Intermittent exploration activities in the Eagle Plains area from the 1950s to 2014 have created a network of winter roads, 2D seismic lines, and, most recently, 3D seismic lines in parts of the RSA. However, the extent of liner features that currently occur in the RSA, the physical and functional characteristics of different linear feature types, and their degree of regeneration are unknown.

EDI Environmental Dynamics Inc. (EDI) conducted a linear features study to characterize the physical and functional aspects of linear features in the RSA to address these information gaps. The three objectives of this study were to: (1) conduct comprehensive mapping and classification of existing linear feature footprints within the RSA; (2) determine physical aspects (e.g., widths) and functional aspects (ease of travel and sightlines) of linear features; and, (3) quantify regeneration pathways and stages of linear features. The combined information forms the basis for assessing the potential effects of linear features in the RSA and refining mitigation measures for linear features.

1.3 STUDY AREA

The RSA for the Eagle Plains Project is approximately 2,386 km² (238,566 ha), centred in the Eagle Plains Ecoregion in north Yukon (Map 1-1). The area consists of subdued topography of rolling hills and sloping plains. The RSA is centred on a major watershed divide (denoted by the location of the Dempster Highway), with the northwestern two-thirds of the RSA draining into the Porcupine River watershed to the north, via Chance Creek, and west, via McParlon Creek and the Whitestone River. The southeastern third of the RSA drains into the Peel River watershed via Dalglish Creek.

Development in the RSA and the surrounding Eagle Plains is low. The Dempster Highway is the primary vehicle access corridor, running from approximately Dawson City, Yukon in the south to Inuvik, Northwest Territories in the north, and transiting the RSA. The Eagle Plains settlement is on the Dempster Highway, approximately 40 km northeast of the RSA and includes the Eagle Plains Hotel and the Government of Yukon's Highway Maintenance camp. The Eagle Plains area has had intermittent periods of oil and gas exploration since the 1950s. That activity has created winter roads, seismic lines, and exploratory wells across parts of the RSA. Approximately 40 exploration wells have been drilled at Eagle Plains. Eight wells are maintained in suspended status, and the remaining wells have been plugged and abandoned. Approximately 10,000 km of 2D lines have been developed across the Eagle Plains Ecoregion, mostly between 1961 and 1984 (Access Consulting Group and EBA Engineering Consultants Ltd. 2001, GEOTIR 2014). More recently, approximately 2,200 km of 3D LIS exploration was conducted in a 325 km² area between November 2013 and April 2014 (GEOTIR 2014). This 3D exploration grid is near the centre of the RSA, spanning north and south of the Dempster Highway.

1.3.1 REGIONAL ECOLOGICAL SETTING

The Eagle Plains Ecoregion is a 20,400 km² portion of the Taiga Cordillera Ecozone in north Yukon between the Richardson and Ogilvie Mountains. Unlike much of the mountainous Taiga Cordillera, most of the Eagle Plains Ecoregion occurs as low altitude rolling topography between 300 m and 600 m above sea level (masl), with few scattered peaks above and around 1,000 masl (Ecological Stratification Working Group 1995). Most of the ecoregion is unglaciated terrain, with surficial features formed due to permafrost and frozen ground-related processes, including thermokarst subsidence, soil creeps, cryoturbation, solifluction, and active layer detachment slides on shale (Yukon Ecoregions Working Group 2004).

The Eagle Plains Ecoregion experiences moderate precipitation, with annual amounts around 400 mm. Most precipitation falls as rain throughout the summer, averaging 50 to 80 mm per month, June through August. Precipitation is lighter through September to April and falls as snow, with average winter snowpacks of 80 cm peaking in April. The climate is strongly affected by latitude, with extended winter conditions from October to early May. There is a substantial variation in seasonal temperatures in the Eagle Plains, with cool short summers and long cold winters. Average winter temperatures are between −30°C and −25°C, with extremes as low as −60°C. Average summer temperatures are around 13°C, with extremes as high as 30°C. Due to the northern latitude, this region experiences continuous sun above and below the horizon, in summer and winter, respectively.

Most of the Ecoregion, including the northeast portion of the RSA, drains north into the Yukon River via the Whitestone, Porcupine and Eagle rivers. That part of the RSA includes the headwaters of the Eagle River and several other tributaries of the Porcupine River, along with the Chance and McParlon Creek subdrainages of the Whitestone River. The southeast corner of the Ecoregion drains east to the Mackenzie River via the Peel, Wind and Ogilvie Rivers. Dalglish and Enterprise creeks flow directly into the Peel River. The few lakes in the Ecoregion are generally oxbow or thermokarst lakes (Yukon Ecoregions Working Group 2004). Several wetland complexes are associated with larger creeks in the RSA.

The Eagle Plains Ecoregion is within the continuous permafrost zone where permafrost can be found up to 200 m thick. The Eagle Plains Ecoregion is dominated by the Cryosolic soils that occupy much of the northern third of Canada, characterized by near-surface permafrost. Turbic Cryosols predominate, exhibiting patterned ground formations and hummocks, and are often associated with open stands of black spruce (*Picea mariana*), tamarack (*Larix laricina*) and birch (*Betula* spp.). The active permafrost layer in these ecosystems generally ranges between 20 cm and 90 cm below the surface. The active layer depth is generally deeper directly under hummocks and shallower under inter-hummock areas (Yukon Ecoregions Working Group 2004).

The RSA is entirely within the Subarctic Bioclimate Zone (Environment Yukon 2014). Vegetation in the RSA is characterized by open-canopy, spruce-dominated habitats where permafrost and short cool growing seasons limit tree growth and often result in stunted, disclimax vegetation communities (Environment Yukon 2016). Hummocky, black and white spruce (*Picea glauca*) woodlands with well-developed shrub communities are common in upland areas. White spruce and ground lichens increase in abundance in well-drained sites. Areas with low slope gradients and fine-textured soils often have ground cover dominated by cottongrass tussocks beneath a shrub layer of birch, black spruce, Labrador tea (*Rhododendron groenlandicum*), and occasionally tamarack (*Larix laricina*) (Yukon Ecoregions Working Group 2004).

Forest fires are a common disturbance agent in the region, and burns of various ages occur throughout the RSA. Fires increase the depth of the active permafrost layer and changes in soil moisture and productivity, affecting vegetation regeneration and resulting in terrain disturbances, such as slope failures and erosion. Regenerating burns are dominated by shrubs, such as scrub birch (*Betula glandulosa*), willows (*Salix spp.*) and alder (*Alnus spp.*), with Alaskan paper-birch (*Betula neoalaskana*) often the first tree species to colonize burn areas. As burns regenerate into young and mature forest, black and white spruce typically become the dominant forest species. Residual Alaskan birch in spruce-dominated stands often defines the extent of old burns (Yukon Ecoregions Working Group 2004).

Mammal diversity is relatively low in the Eagle Plains Ecoregion due to its northern location and low productivity. Voles (*Microtus* spp., *Myodes* spp., *Phenacomys* spp.), American marten (*Martes americana*), ermine (*Mustela erminea*), and red fox (*Vulpes vulpes*) are common smaller mammals. Wolves (*Canis lupus*), wolverines (*Gulo gulo*), and both black and grizzly bears (*Ursus americanus* and *U. arctos*.) are present at low densities. Moose (*Alces alces*) inhabit the region year-round. The RSA overlaps a small portion of the winter range of the Porcupine caribou herd (PCH), a subpopulation of the barren-ground caribou (*Rangifer tarandus granti*). The PCH is an iconic species in north Yukon, with high cultural, social, economic, and ecological values. The PCH's population has been increasing over the last several decades and is currently estimated to consist of 202,106 to 234,808 caribou (Caikoski 2017, Porcupine Caribou Technical Committee 2018). The PCH is known to occupy portions of the Eagle Plains Ecoregion in fall and winter when they tend to occur in smaller groups over a larger area than during other seasons.

1.3.2 REGIONAL LAND USE PLANNING

The RSA overlaps four First Nation Traditional Territories. Most of the RSA is within the Traditional Territory of the Vuntut Gwitchin First Nation. The southeastern portion is in an area of overlapping Traditional Territories of Vuntut Gwitchin First Nation, the Tetlit Gwich'in Council, the First Nation of Na-cho Nyäk Dun, and Tr'ondëk Hwëchin. Although the RSA is located outside of any First Nation Settlement Lands, it does abut Vuntut Gwitchin First Nations Settlement Lands on parts of its east and southwest borders. Each First Nations government has provided input to, and approved of, the Regional Land Use Plan(s) on their Traditional Territory under the respective First Nation Final Agreements.

1.3.2.1 North Yukon Regional Land Use Plan

The RSA lies mainly within the North Yukon Planning Region and is subject to the North Yukon Regional Land Use Plan (NYRLUP) (Map 1-1). The NYRLUP was created to protect the natural and cultural resources of the region while allowing sustainable economic development opportunities (Vuntut Gwitchin Government and Yukon Government 2009). It provides management direction for using public and settlement lands based on four principles: sustainable development, precautionary principle, conservation, and adaptive management. The NYRLUP divides the Planning Region into 23 land management units classified into three categories: protected area, integrated management area (IMA), and community area. IMAs are further classified into four zones: Zone 1 (lowest development), Zone II (low development), Zone III (moderate development), and Zone IV (highest development). IMA zones are classified based on the area's sensitivity to landscape disturbance, ecological and cultural values, risk of significant impacts, and level of acceptable change. The RSA is a Zone IV IMA with lower ecological and cultural values in a moderately sensitive biophysical setting. Subsequently, Zone IV IMAs allows for the highest development level to occur.

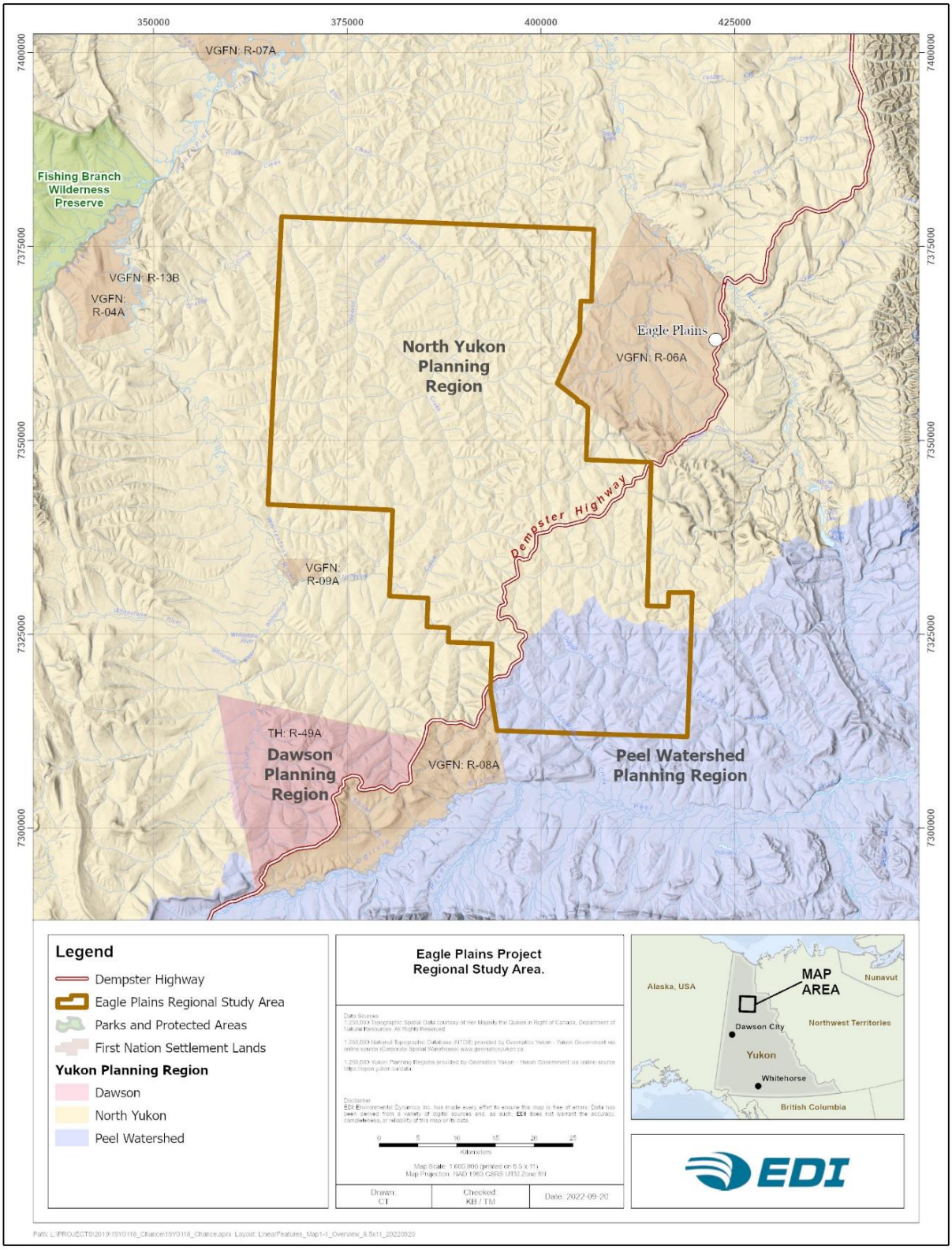
The NYRLUP encourages results-based management and uses cumulative effects indicators to determine if goals and objectives are met. Results-based management allows for innovation and creativity in land-use strategies and approaches. The two cumulative effects indicators included in the NYRLUP are direct surface disturbance and linear density. The NYRLUP guidelines for Zone IV IMAs are 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density (Vuntut Gwitchin Government and Yukon Government 2009).

However, as surface disturbances and linear features reach a level of functional recovery and become part of the continuous landscape, they can be subtracted from the total amount of disturbed area (Vuntut Gwitchin Government and Yukon Government 2009). The NYRLUP suggests using a height of 1.5 m for woody vegetation in forested areas, as vegetation above this height would likely no longer allow for travel or access by humans or wildlife and is, therefore, considered functionally recovered. Activities considered exempt from functional disturbance restrictions are (1) new linear features less than 1.5 m wide; (2) land-use activities that occur on frozen water bodies; (3) winter work with no required clearing of trees; and (4) winter work that uses existing disturbances and linear features.

1.3.2.2 Peel Watershed Regional Land Use Plan

The southeastern corner of the RSA lies within the Peel Watershed Planning Region (PWPR) and is subject to the Peel Watershed Regional Land Use Plan (PWRLUP) (Peel Watershed Planning Commission 2019) (Map 1-1). Like the NYRLUP, the PWRLUP was established to provide management direction and ensure long-term sustainable development in the Planning Region. The PWRLUP was founded on three main themes: environmental protection, social considerations, and economic development. It follows a similar framework as the NYRLUP. The PWPR is divided into 16 Landscape Management Units (LMU), which each share similar ecological characteristics, planning issues, and management intent. Each LMU is categorized by a land-use designation system. Conservation Areas are managed to protect ecological and cultural resources, while IMAs are 'working' landscapes where new development and surface disturbance may be allowed. IMAs are further classified into Zones, which correspond to the level of allowable development with comparable justification as the NYRLUP. The RSA is part of LMU 7 (Dalglish Creek), classified as an IMA Zone IV, allowing for the highest level of development.

Like the NYRLUP, the PWRLUP encourages results-based management and uses the same cumulative effects indicators, surface disturbance and linear density to inform decisions. The PWRLUP cautionary and critical indicators are identical to those of the NYRLUP: 0.75–1.0% surface disturbance and 0.75–1.0 km/km² linear density. As surface disturbances reach a level of functional recovery and no longer enable travel or access by wildlife and people, they can be subtracted from the total amount of disturbed area. The PWRLUP suggests using a 1.5 m woody vegetation height as a threshold for functional recovery in forested or shrubland areas. In areas dominated by low-growing vegetation, a feature could be considered functionally recovered when covered by native species roughly the same height and composition as the surrounding vegetation. To be considered as "functionally recovered," features must have similar sediment and run-off compared to background levels, roughly match original contours, and have no human-brought materials on the site. Exceptions to the linear density calculation are identical to those outlined in the NYRLUP.



Map 1-1. Eagle Plains Project Regional Study Area.

2 BACKGROUND

The term "linear feature" refers to any narrow, linear clearings of vegetation on the landscape. They include roads, seismic lines, power lines, and pipelines. Seismic lines are the dominant linear feature class in northern Canada, accounting for approximately 46% of all linear features in the Canadian boreal region (Pasher et al. 2013). Seismic exploration detects underground oil and natural gas reservoirs by analyzing sound waves reflected from the underlying geology (Yukon Energy Mines and Resources 2006). Sound waves are emitted by detonating small charges in a series of drilled shot holes (up to 20 m deep) or by vibrating a heavy metal plate on the ground's surface using a truck-mounted vibrator (Yukon Energy Mines and Resources 2006). Both methods require cleared travel corridors for equipment transportation, which results in a network of seismic lines across the landscape where seismic exploration has occurred.

Until the late 1990s, conventional 2D was the primary form of seismic exploration used in North America. 2D seismic lines were created using bulldozers to clear all vegetation in straight swaths, approximately 5–10 m wide in their earliest form. These wide, straight lines were necessary to enable large, heavy equipment movement. This process resulted in significant physical disturbance, often removing most surface vegetation and roots and the top layer of soil (Bliss and Wein 1972). Progressive improvements in 2D seismic exploration methods reduced the environmental impact, such as clearing in winter instead of summer and raising and adding mushroom shoes to the bulldozer blade to reduce soil disturbance. Despite these improvements, many of the 2D seismic lines created in the 1960s and 1970s in northern Canada remain disturbed, with little evidence of ecological recovery (Lee and Boutin 2006, van Rensen et al. 2015).

3D seismic exploration provides more accurate subsurface geological structure data than 2D technology. 3D seismic exploration techniques were developed in the mid-1990s, and their use became widespread in the early 2000s (Dabros et al. 2018). At the same time as the transition to 3D, the seismic industry was transitioning to smaller and more specialized equipment that reduces cost, improves efficiency and reduces environmental impacts. Modern seismic equipment and methods typically use what is referred to as Low Impact Seismic (LIS) methods that minimize line widths and site disturbance and compaction. Typical 3D seismic lines are 2–3 m wide, constructed in 100–500 m spaced grids, and follow meandering rather than straight routes. There have been substantial improvements in the equipment used for 3D seismic line creation: low ground pressure mulchers, lighter equipment, ATV-mounted equipment, mushroom shoes and smear blades, and 'envirodrills' greatly reduce physical and vegetation disturbance (Dabros et al. 2018). These methods often leave the ground vegetation intact and only remove trees and tall shrubs, reducing overall disturbance and facilitating faster regeneration. The location of the seismic line can be adjusted on the fly in the field to minimize impacts, such as avoiding the cutting of large trees.

Continuous advancements in seismic exploration technology have improved geophysical accuracy while simultaneously reducing environmental impact. Numerous studies have examined the effects of linear disturbances on soil, hydrology, vegetation, regeneration, and wildlife responses (see Dabros et al. 2018 for a comprehensive review). Although the bulk of literature focuses on 2D seismic lines, as they have been part of the landscape for over 60 years, there have been several recent studies investigating the effects of LIS and 3D seismic lines (e.g., Kemper and Macdonald 2009a, Kansas et al. 2015, Golder Associates 2016).

Linear features have been associated with various environmental effects, including permafrost thaw, soil compaction and rutting, increased soil moisture and pooling, altered snow cover, temperature and wind patterns, and varied vegetation and wildlife responses (Dabros et al. 2018). In addition to the immediate loss of vegetation, linear features can create extensive edge effects, facilitate non-native or disturbance-induced species establishment, alter species composition, and positively and negatively affect wildlife (Dabros et al. 2018).

One of the most extensively studied effects of linear features in the southern boreal forest is the indirect effects that linear features can have on mortality risk to woodland caribou (*R. tarandus caribou*). Linear features can result in complex effects on populations dynamics that include (i) increases in secondary prey (moose and deer), which elevate wolf populations (apparent competition) and (ii) more efficient hunting by predators along linear features (facilitated predation) (Wittmer et al. 2007, Latham et al. 2011, Dickie et al. 2017a, Keim et al. 2019b, 2021). Research has also documented the responses of birds to linear features (Bayne et al. 2005, Machtans 2006, Lankau et al. 2013), bears (Tigner et al. 2014, Finnegan et al. 2018), and furbearers (Tigner et al. 2015).

Most studies investigating impacts and recovery of seismic lines and other linear features were conducted in southern boreal forest ecosystems (i.e., Boreal Plains Ecozone; e.g., Lee and Boutin 2006, Kansas et al. 2015, van Rensen et al. 2015, Dickie et al. 2017a). There are fundamental differences in the climate, vegetation communities, wildlife communities, and ecological processes in taiga ecosystems that may result in different patterns and responses to linear features. For example, regeneration patterns of linear features in taiga ecosystems over permafrost can follow different successional trajectories than those of southern boreal regions (Simpson 2008). The few studies that have examined linear features in taiga regions have found similarities and differences to southern studies revegetation (Kemper and Macdonald 2009, Dabros et al. 2018). One of the key objectives of this study was to collect local information from Eagle Plains that can be used to better contextualize or adapt the findings from other studies to the Eagle Plains Project.

3 METHODS

A GIS analyses and field surveys were conducted to characterize linear features within the RSA. The inventory of linear features in the RSA was developed in a GIS by compiling available spatial data and then verifying and updating that against satellite imagery. Field studies quantified the width, vegetation characteristics, ecological function (line-of-sight, large mammal ease of movement assessment), and visibility of lines from the Dempster Highway.

3.1 LINEAR FEATURES INVENTORY

The inventory of existing linear features in the RSA was developed in a GIS by compiling available spatial data and then verifying and updating that against satellite imagery. A preliminary linear feature database was first developed that was used to support field surveys (described below in this section). A second step linked the field data to the linear feature database and conducted a more thorough review and verification process using satellite imagery to produce a final linear feature dataset for the RSA (see details in section 3.5.1).

Linear feature spatial data were obtained from the following sources:

- Yukon Government Energy, Mines and Resources "Oil and Gas Seismic Lines" dataset (a combination of less detailed National Energy Board data pre-1999 and the more detailed company-submitted data post-1999) (Yukon Government 2019)
- Natural Resources Canada CanVec "Roads," "Trails," and "Cut Lines" 1:50,000 scale datasets (Natural Resources Canada 2019)

The two datasets were merged into one dataset of all linear features documented in Yukon and clipped to the RSA. Key attribute data included (if available) the linear feature type (i.e., 2D and 3D seismic lines, winter roads, trails, Dempster Highway), width, year of establishment, and data source. This preliminary linear feature dataset was compared against satellite imagery at a (minimum) 1:10,000 scale to verify its accuracy. Any linear features that did not correspond with features visible in satellite imagery were either corrected or deleted based on satellite imagery interpretation. In the case of duplicate features across datasets, the 'best' data were attributed to a single feature by considering the spatial accuracy and the amount and accuracy of attribute data, as assessed against satellite imagery. Where duplicate widths occurred in the two source datasets, the wider width was retained.

3.2 LINEAR FEATURE CHARACTERISTICS SURVEY

Field studies quantified the width, vegetation characteristics, line-of-sight, and large mammal ease of travel assessment across the linear feature types identified from the GIS inventory. One aspect of the field study was to compare vegetation, line-of-sight, and ease of movement on the linear features to undisturbed areas adjacent to the cleared lines. Three types of surveys collected data for the linear feature study: ground surveys

(finest level of detail), air surveys (medium level of detail), and air calls (coarsest level of detail). EDI crews collected field data between July 28 and August 8, 2019.

3.2.1 SITE SELECTION

All ground surveys and aerial surveys occurred at predetermined, random sites. Sample sites were selected using a clustered, random sampling approach. This approach balanced obtaining a random, representative sample across linear feature types with survey efficiency (i.e., without clustering sites, the travel time between points would have been substantially greater and resulted in smaller sample size). Survey sites were drawn from 5,000 points distributed randomly across the set of mapped linear features (minimum spacing of 200 m between points). Each point was randomly assigned a unique number.

Each survey cluster included options for both ground and air surveys. For ground surveys, the cluster used a 2 km radius designed to accommodate approximately four ground survey sites, intended to be surveyed within a half-day of work (and close enough so crews could walk between sites). The objective was that two ground clusters could be surveyed by a crew each day. For air surveys, a 4 km radius was used that generally provided at least ten random survey site options. The objective for air survey clusters was that they could be surveyed while transiting between ground survey clusters.

Survey sites were selected via a two-stage process. The first stage was randomly drawing 100 points from the 5,000-point dataset. These points defined the survey clusters and served as actual survey sites. In this first stage, site selection was stratified to obtain an approximately equal sample across 2D, 3D and winter roads. This overweighted sampling of 2D and winter roads, relative to their extents in the RSA, but those features had the highest uncertainty in terms of their widths, vegetation characteristics, and functional characteristics. Stratification was necessary to obtain sufficient sample sizes across these less-common features. The second site-selection stage selected additional random points from the 5,000-point dataset in proximity to the first point, using the 2 km radius for ground surveys and the 4 km radius for aerial surveys.

The RSA was divided into 10 work areas to implement the sample design, each corresponding to a day of surveys. Each day the survey crew selected clusters to survey using the ascending order of the random identification number of the first point used to define each cluster. Similarly, points within each cluster were prioritized in ascending order of the random identification number. Normally, at least two ground clusters and two air clusters were sampled each day. However, that varied somewhat depending on the number of sample sites available in each cluster and the availability of the helicopter.

3.2.2 LINEAR FEATURE CHARACTERISTICS AND SURVEY METHODS

3.2.2.1 Linear Feature Characteristics

A range of structural, vegetation, human use, and functional characteristics was assessed in the field. A list of the various characteristics examined, with a description of each, is provided in Table 3-1. Successional classes and structural stages of vegetation are defined in Table 3-2 and Table 3-3, respectively.

Table 3-1. Description of physical, ecological and function characteristics assessed in the Eagle Plains linear feature study.

Parameter	Description	Survey Measured [1]
Plot location	Latitude and longitude using WGS 1984, measured by Garmin GPS units to ~4 m accuracy.	G, AS, AC
Linear feature type	Dempster Highway, winter road, 2D, 3Dc (conductor lines), 3Dr (receiver lines), and 3D5 (3D lines used both for seismic and local equipment/vehicle travel.	G, AS, AC
Linear feature width	During ground surveys, measured to the nearest 0.05 m and replicated four times. During aerial surveys, they were visually estimated to the nearest 1 m.	G, AS
Percent mulch	Percent cover of mulch (wood chips) on the seismic line, estimated to the nearest 1% using visual estimates. In areas with dense trees or large shrubs, the thick mulch layer produced during line clearing can hinder vegetation regeneration.	G, AS
Successional class	Refers to the successional trajectory of vegetation regeneration on the linear feature. Includes normal, magnified, stagnated, retrogressive, no succession, or recent disturbance class following Simpson (2008)[1].	G, AS, AC
Burn status	Burnt or not burnt; based on visual assessment (i.e., burned trees, charred ground vegetation).	G, AS, AC
Structural stage	Categorical descriptor of the dominant vegetation life form in the plot following the *Field Manual for Describing Yukon Ecosystems* criteria (Environment Yukon 2017). Structural stage categories are defined in Table 3-3.	G, AS
Height and species of tallest vegetation	Measured to the nearest 0.1 m for the tallest vegetation layer, approximated by the 90th percentile height to exclude extreme heights of individual plants.	G
Cover and species of dominant trees	Percent cover was recorded to the nearest 1% if less than 10%, and to the nearest 5% if over 10%. One or two dominant tree species were recorded.	G, AS
Cover and species of dominant shrubs	Percent cover was recorded to the nearest 1% if less than 10%, and to the nearest 5% if over 10%. Up to five co-dominant shrub species were recorded. Ground shrubs were excluded.	G, AS
Ecosite	Ecosite was recorded using Predictive Ecosystem Mapping (PEM) Units, available at the time of the survey. However, separate vegetation surveys indicated that the accuracy of the PEM mapping was poor, and ecosites were not used in subsequent analyses.	G
Permafrost activity/degradation	Present or absent. Additional comments (i.e., type of activity, percent cover) were recorded if applicable.	G
Wildlife trails	Present or absent. If present, rated as poorly, moderately, or well defined.	G
Potential for Off-Highway Vehicle (OHV) passage	Present or absent. Based on professional judgment, a 4x4 side-by-side is summer, considering obstructing vegetation, ground conditions (e.g., wetlands, peatlands), and graminoid tussocks.	G, AS
Signs of human activity	Present or absent. If present, applicable comments were recorded.	G
Ground disturbance	Percent cover of visibly disturbed ground. If present, type and additional descriptive comments were recorded.	G

[1] G=Ground Survey, AS=Aerial Survey, AC=Air Call.

[2] Between 2006 and 2008, Yukon Government, Department of Energy, Mines, and Resources investigated the recovery status of linear features in the Eagle Plains, British Mountains, and Peel River Plateau Ecoregions (Simpson 2008). They found that linear features typically regenerated into one of six categories: normal succession, magnified succession, retrogressive succession, successional stagnation, no succession, and recent disturbance (Table 3-2).

Table 3-2. Descriptions of successional classes on linear features in the Eagle Plains area (following Simpson 2008).

Successional Class	Description
Normal succession	Vegetation is similar to the adjacent undisturbed area but often in an earlier seral stage. E.g., often young trees surrounded by early successional shrubs and forbs. The disturbance was likely limited to removing trees and shrubs, with little to no disturbance to soil or permafrost.
Magnified succession	Vegetation on the feature is taller than the adjacent undisturbed area. Deciduous species often dominate tree and shrub layers, but a similar pattern was also observed for coniferous trees on some sites. The response is likely due to increased site productivity (including increased soil moisture, nutrients, and temperature) due to soil disturbance or increased depth to permafrost. Most frequently, but not exclusively, observed in burns.
Retrogressive succession	Sites are typically moss or sedge-dominated (rarely forb or low shrub), with high moisture content, often including standing water (i.e., micro wetlands), that contrast to upland conditions in adjacent undisturbed areas. The condition appears to result from permafrost melting and water pooling associated with vegetation removal and removal/compaction of the peat layer and mostly associated with winter roads.
Successional stagnation	Vegetation is typically dominated by graminoids or shrubs and not progressing to more advanced successional stages. Disturbance to soil or permafrost is likely. The ground may have been compacted. Almost exclusively associated with winter roads.
No succession	No ecological differences between the linear feature and adjacent undisturbed areas except that there is no or very little tree or shrub regeneration on the line, other than what was left after creation of the feature. Disturbance appears to be limited to the removal of trees and shrubs, with little to no disturbance to ground vegetation, soil, or permafrost.
Recent disturbance	Newer seismic line where successional patterns could not be determined. Features in this class were most likely trending to 'normal succession' or 'no succession', but the degree of regeneration was too limited to classify confidently.

Table 3-3. Structural stage categories used in ground and air surveys for the Eagle Plains linear feature study.

Structural Stage Code	Structural Stage Name	Description
1	Non-vegetated	Very recent disturbance (e.g., fire or flood) and no vegetation or less than 5% vegetation.
2	Sparse/Cryptogram	Either the initial stages of primary succession or a cryptogram community maintained by environmental conditions (e.g., bedrock, talus). Sparse tree, shrub and herb cover. Either sparsely vegetated overall (low cover of vascular plants and cryptograms, if present) or dominated by cryptograms.
2a	Sparse	5–10% vegetation cover.
2b	Bryoid	Bryophyte-dominated.
2c	Lichen	Lichen-dominated.
3	Herb	Early successional stage (e.g., post-fire forest succession) or a herb community maintained by environmental conditions or disturbance. Vegetation is dominated by herbs, although if the site overall is sparsely vegetated, herb cover can be low as long as herbs characterize the vegetation. Trees and shrubs are usually sparse or absent; however, shrub cover and stature (compared to herb cover and stature) determine whether the site is considered herbaceous.
3a	Forb-dominated	Includes non-graminoid herbs and ferns.

Structural Stage Code	Structural Stage Name	Description
3b	Graminoid-dominated	Includes grasses, sedges, reeds, and rushes.
3c	Aquatic	Floating or submerged plants dominate.
3d	Ground shrub-dominated	Dominated by dwarf woody species such as kinnikinnick (*Arctostaphylos uva-ursi*) or dwarf willows.
4	Shrub	Early successional stage of a forest or a shrub community maintained by environmental conditions or disturbance. Dominated either by shrubby vegetation, including tree seedlings or saplings; or, if sparsely vegetated overall, dominated by shrubs, which characterize the community as a shrubland.
4a	Tall Shrub	Dominated by woody plants >2 m tall with diameter at breast height (dbh) ≤7 cm.
4b	Low Shrub	Dominated by woody plants <2 m tall.
5	Treed: Pole/Sapling	Trees >2 m tall and with dbh >7 cm, typically densely stocked. Self-thinning and vertical structure are not yet evident in the canopy. Younger stands are vigorous (usually >15 to 20 years old); older stagnated stands (up to 100 years old) are also included; time since disturbance usually <40 years; up to 100+ years for dense (5,000–15,000+ stems per ha) stagnant stands.
6	Treed: Young Forest	Self-thinning has become evident and the forest canopy has begun to differentiate into distinct layers. A more open stand than at the pole/sapling stage.
7	Treed: Mature Forest	Trees established after the last stand-replacing disturbance have matured; a second cycle of shade-tolerant trees may have become established; shrub and herb understoreys become well developed as the canopy opens up.
8	Treed: Old Forest	Stands of old age with complex structure; patchy shrub and herb understoreys are typical; regeneration is usually of shade-tolerant species with a composition similar to the overstorey. Fire-maintained stands may have a single-storey appearance.
9	Treed: Very Old Forest	Very old stands with complex structures, abundant large trees, snags and coarse woody debris (CWD); snags and CWD occurring in all stages of decomposition; stands are comprised entirely of shade-tolerant overstorey species, with well-established canopy gaps.

3.2.2.2 Survey Methods

Three types of surveys assessed linear feature characteristics: ground surveys (finest level of detail), air surveys (medium level of detail), and air calls (coarsest level of detail). The reason for using different survey types was to maximize the sample size obtained, recognizing that the ability to collect certain types of data, or the level of measurement precision, decreased from ground surveys to aerial surveys to air calls. The characteristics that were measured during each survey type are noted in Table 3-1. Surveys were conducted between July 28 and August 8, 2019.

Ground surveys collected the most information and had the highest measurement precision of the three survey methods. All parameters listed in Table 3-1 were recorded. Field measurements generally followed methods in *Field Manual for Describing Terrestrial Ecosystems* (BC MFLNRORD and BC MOE 2010) with parameter specific details noted in Table 3-1. Photographs were taken of representative on-line and off-line plots.

Air surveys collected moderate resolution data on linear features. Air surveys efficiently collected a larger quantity of more generalized data than ground surveys. The subset of parameters recorded for aerial surveys is noted in Table 3-1. The survey methods generally followed procedures outlined for helicopter-based 'visual checks' in *Standard for Terrestrial Ecosystem Mapping in British Columbia* (Resources Inventory Committee 1998). Data were collected by hovering in a helicopter approximately 30 m over the sample sites for approximately three minutes while field crews recorded data for the reduced set of variables. Like ground surveys, relevant data were collected for both on-line and off-line plots. Photographs were taken at representative air survey plots (Attachment A).

Air calls collected data at the coarsest resolution of the three survey types, and no off-line data were collected. The data collected during air calls were limited to linear feature type, successional class, and burn status. Air calls were opportunistically conducted when EDI crews were flying through the RSA and linear features were encountered.

A fundamental aspect of the field study was to compare linear feature characteristics to adjacent undisturbed areas. Hence, field surveys included paired on-line and off-line plots at each sample site (excluding sites assessed via air calls). Off-line plots were located 50 m off the linear feature, with the direction off the feature selected randomly at each site using a coin toss. Data collected for each sample site were recorded on tailored survey forms (Attachment B).

3.2.2.3 Line-of-Sight and Ease of Travel

In addition to the structural and vegetation measures noted above, line-of-site and ease-of-movement were assessed as functional characteristics of the linear features at each ground plot. The sightline, measured to the nearest metre, was calculated as the farthest line that could be sighted using a range finder at the height of 1.5 m off the ground. Two measurements were recorded, one in each direction along the linear feature. Sightline measurements were repeated using the same bearings in the off-line plot.

Ease of travel was assessed using a 'walk test,' as Keim et al. (2019a) described in a study assessing the functional recovery of linear features. They found that ease of travel, as measured by a walk test conducted by human researchers, positively correlated with the intensity of use by several wildlife species. One EDI crew member timed themselves to the nearest second for the walk test while walking an approximately 75 m transect, measured to the nearest metre using a hip chain. This walk test was repeated in both the on-line and off-line plots, the paired transects spaced in parallel, approximately 50 m apart. The same observer conducted both walk tests to minimize observer bias at each site.

3.3 VISIBILITY OF LINEAR FEATURES FROM THE DEMPSTER HIGHWAY

One of the management concerns associated with seismic exploration is that seismic lines create travel routes that humans use. The probability of human use of seismic lines to access the surrounding landscape likely increases if the seismic line is visible and accessible from roads. The intersections of seismic lines and winter roads with the Dempster Highway are the primary locations where this could originate. Driving surveys were conducted along the 47 km section of the Dempster Highway within the RSA to determine the number and

type of linear features that could be located and accessed by the public from the Dempster Highway. Two types of surveys were conducted: a blind search where the location of the linear features was unknown and a 'map search,' where the observers had a map of the linear features that showed where they occurred. Both surveys were conducted on August 8, 2019.

The blind search approximated the proportion and type of linear features that the public could locate and access without prior knowledge of their locations. An EDI field crew drove along Dempster Highway at 35 km/h and attempted to identify linear features by visual inspection alone, unaware of where they intersected the highway. When a linear feature was identified, the crew stopped to record the following parameters:

- linear feature type;
- sight line distance;
- evidence of human use;
- evidence of wildlife use; and
- potential for OHV passage.

Photographs were taken, and relevant comments were recorded for each linear feature intersection where applicable.

The map search was a targeted search designed to approximate the proportion and type of linear features the public could spot from the Dempster Highway with prior knowledge of their locations. Using a map of linear features present in the RSA, an EDI field crew drove along the Dempster Highway, slowing to 10 km/h and attempting to identify the linear features when passing a point where the map showed they intersected the highway. When a linear feature intersection was reached, the crew recorded whether the line was visible or not and the parameters listed above for the blind search where a line was detected.

3.4 WINTER TRACK SURVEY

An aerial survey was conducted to assess the relative frequency of use of different liner feature types by ungulates and humans in late winter (March 2020). The survey consisted of 11 transects spanning the width of the RSA. Three of the transects were established parallel to the Dempster Highway at 50 m, 1 km and 5 km off the highway. The remaining transects were spaced approximately 5 km apart across the remainder of the RSA.

Before the field survey, each transect was established in a GIS. Each intersection with a linear feature was given a unique identification point and used to generate a field form (i.e., with a row for each linear feature intersection). The field survey involved flying along each transect and recording the presence of ungulate tracks or human tracks (e.g., snowmobile tracks) at each linear feature that was traversed. Surveys were conducted via helicopter at approximately 70 km/h, 50 m above the ground, with one navigator/data recorder and one primary observer. The surveyors classified tracks to species and counted the number of unique tracks. However, overlapping tracks and dustings of new snow made track identification and counts uncertain in over

half the detections. Therefore, analyses defaulted to the simple presence/absence of ungulate tracks. The primary metric examined was the proportion of linear features with ungulate tracks.

The original survey plan was also to count tracks in undisturbed areas between linear features. However, tracks were so numerous that surveying the entire area between linear features would have required substantially reducing the aircraft speed. This would have reduced the number of transects that could have been surveyed. As a compromise, field crews subsampled the area between lines by surveying an approximate 200 m band of an undisturbed area adjacent to each linear feature.

In conjunction with winter fish habitat assessments, the transects were surveyed over six days (March 7–13, 2020). Each day, one or two transects were surveyed while transiting to/from the study area. No track-erasing snowfalls occurred during the survey period. Snow depths ranged from 65 to 80 cm.

3.5 DATA PREPARATION AND ANALYSIS

3.5.1 SPATIAL DATA

The project generated two primary spatial datasets — a point database corresponding to all field survey sites and the linear feature database. The Linear Feature Survey Point Database (ArcGIS point feature class) contains all location-specific (point coordinate) field data collected at sample sites in summer 2019. Several fields were added to this database based on calculations and spatial joins (e.g., year of linear feature establishment and most recent fire). Paired on-line and off-line plot data were recorded as part of the same sample site coordinate.

The Linear Feature Inventory (ArcGIS polyline feature class) is a compilation of all documented linear features within the RSA, verified by comparing the preliminary linear feature inventory to aerial and satellite imagery and ground-truthing results.

Several modifications were made to improve the accuracy and detail of the Linear Feature Inventory:

- Linear features were classified into the following categories:
  - 2D (historical seismic lines, typically >3m wide),
  - 3D5 (including 4–5 m wide 3D lines that were used for both seismic and local vehicle/equipment travel);
  - 3Dc (3 m wide 3D seismic conductor lines);
  - 3Dr (2 m wide 3D seismic receiver lines);
  - winter roads (any trails or limited use roads used by vehicle or equipment, generally wider than 5 m and often with an obviously curving path); and,
  - Dempster Highway.
- Overlapping features (within a 3 m tolerance) were addressed according to the following rules:

- If two linear features of the same or unknown age overlapped, the wider feature was saved and the narrower feature deleted.
- If two linear features of the same or unknown width overlapped, the more recent feature was saved and the older feature deleted.
- If a 3D line overlapped with a 2D line, both lines were saved. This is because the older 2D lines were often still evident on the landscape in some state of regeneration, as were the 3D lines. However, both were saved since it was unknown at what state each line was in (i.e., if the 2D line was still evident, or only the 3D line, or both in varying states of regeneration). This occurred for 33 km of linear features within the RSA.

The preliminary linear feature inventory within the RSA was compared against a recent high-resolution satellite or aerial imagery (generally, 0.5–1 m resolution) at a 1:10,000 (or finer) scale to verify the accuracy of the source data. Any features that were visibly offset from georeferenced imagery were corrected to match the imagery.

Some older (1960s and 1970s) 2D seismic lines included in the source databases did not appear in satellite imagery. These 2D lines were compared against the imagery along the length of the feature to search for any sign of linear disturbance and then cross-referenced with field surveys conducted along the line, if present. These unverified linear features were classified as 'not applicable' and excluded from analysis if there was no evidence of linear disturbance along the feature's length in the imagery, which could often be verified with associated surveys noting that the feature was 'not present,' 'not visible,' or 'completely regenerated.' Unverified linear features were retained if there was evidence of linear disturbance along any feature's length in the imagery or if associated surveys had noted that the feature was present and in some state of regeneration, even if the feature was not visible in the imagery. A total of 199,473 m of erroneous or regenerated linear features were deleted from the linear feature inventory within the RSA.

Some linear features were visible on the imagery that had not been included in any of the source databases. In these cases, the linear features were manually digitized and classified into linear feature types based on visual assessment and attributes of adjacent connecting features, if present. Digitized linear features were assigned a year if they were obviously a continuation of a documented feature or if they were surrounded by features of the same type and year. Otherwise, the year was not included. High-resolution imagery was not available for the southernmost portion of the RSA (approximately 25 km by 15 km). This area was compared against lower quality Google Earth imagery, but this was not detailed enough to detect undocumented linear features if any existed (Google Earth 2019). However, existing linear features were verified using this method. A total of 202,945 m of linear features were digitized within the RSA.

After the Linear Feature Inventory was verified and corrected to be consistent with imagery and field observations, it was spatially joined to the Linear Feature Survey Point Database. In cases where the survey point did not correspond with any nearby linear feature, or if a linear feature was deleted (following the methods described above), the data were retained in the survey point database, but the linear feature type was updated to 'not applicable' and excluded from data analysis. Ten survey plots were identified as 'not applicable' and excluded from analyses; thus, the corrected sample size for survey plots is n = 210.

3.5.2 FIELD DATA

After completing field sampling, data forms and field notes were reviewed for completeness and accuracy during an internal data quality-assurance process. All associated digital photographs and GPS coordinates were reviewed to correspond to the appropriate field plots. A summary of field plots by linear feature type and survey type is provided in Table 3-4. All recorded data were entered into MS Excel databases (Microsoft 2019). Spatial data were uploaded to the ArcGIS platform (ESRI 2019).

Field-collected data were summarized primarily using Excel spreadsheets (Microsoft 2019). More detailed statistical analyses were performed on select data using R Statistical Software (R Development Core Team 2020). For example, the variation in ease of travel and vegetation cover as a function of linear feature types, burn history, successional stage, or ecosite were explored. During formal analyses, standard assumptions of normality and homogeneity of variance were assessed, and variance-covariance structures were applied to model heterogeneity (of residuals) if required. For instance, the sightline distance (m) was fourth-root transformed to meet normality. In certain models, random effects were included to account for variance among different subjects. For example, observers were included as a random variable to account for observer bias (i.e., a random intercept model; package "nlme", Pinheiro et al. 2016). Corrected Akaike's Information Criteria (AICc) scores were used to compare sets of candidate models. Models with the lowest AICc score were selected because they yielded the best balance (parsimony) between explained variance and level of complexity.

Table 3-4. The number of sites surveyed using ground surveys, air surveys, and air calls for each linear feature type in the Eagle Plains RSA.

Linear Feature Type	Survey Type			
	Ground Survey	Air Survey	Air Call	Total
2D	31	32	44	107
3D-5m wide	5	0	0	5
3D-Conductor	26	3	0	29
3D-Receiver	23	1	0	24
Winter Road	18	17	8	43
Dempster Highway	2	0	0	2
Not Applicable	3	2	5	10
Total	108	55	57	220

3.5.3 LINEAR FEATURE DENSITY CALCULATION

Linear feature densities were calculated in two ways: (1) using the total linear feature extents, and (2) adjusting the extents to account for (a) lines through 'open' habitats, such as wetlands and recent burns, where the vegetation on the line did not differ from vegetation off the line, and (b) functionally recovered linear features such as 2D lines from the 1960s and 1970s that had advanced regenerated at least to the Tall Shrub structural stage. Adjustments were determined by intersecting the Linear Feature Inventory with a recently developed

Ecological Landscape Classification (ELC) map of the RSA (a companion Eagle Plains Project baseline report). The ELC map documented the type and structural stage of vegetation communities across the RSA. The extent of linear features in open habitats was determined by the lengths of linear features overlapping Low Shrub, Herb and Bryoid structural stages in the ELC maps. This includes seral habitats regenerating from burns and ecosystems that are maintained in those stages over time, such as wetlands and shrub-carrs. The extent of regenerated linear features was determined by integrating the proportion of regenerated lines observed from the field surveys (e.g., 61% for 2D lines) with the length of lines through non-open vegetation types in the ELC map. Adjustments were applied to generate functional linear feature densities for each linear feature type individually (i.e., to compare the relative extents of different feature types) and combined to provide an overall density for all linear feature types. For example, the linear feature density for 2D lines was calculated by starting with the total length of 2D lines in the RSA, reducing that by the length of lines through open vegetation types, then reducing the remaining extent by the average proportion of 2D lines that were observed to be regenerated, and then dividing the remaining total length of lines by the extent of the RSA.

4 RESULTS

4.1 LINEAR FEATURE INVENTORY AND DENSITIES

A total of 4,269 km of linear features were mapped and verified in the RSA (Map 4-1, Table 4-1). Winter roads and 2D seismic occur in varying densities across much of the RSA. The extent of 3D seismic is limited to the one area straddling the Dempster Highway in the centre of the RSA.

The total linear feature density in the RSA was 1.79 km/km², based on a total length of 4,269 km and the RSA area of 2,386 km². 3D seismic lines accounted for approximately half of the total length of linear features in the RSA, 2D seismic lines accounted for about one-third, followed by winter roads and the Dempster Highway (Table 4-1). Adjusting for open habitats (i.e., areas in structural stages Low Shrub, Herb, and Bryoid) and vegetation regeneration[1] resulted in substantially lower densities of 0.52 km/km² (Table 4-2). Relatively large extents of recent wildfires were the greatest factor reducing linear feature densities. The relative proportions of the different linear feature types were similar after adjustments, though the proportion of 3D increased and 2D decreased. This was mainly due to the greater degree of vegetation regeneration on 2D lines, consistent with their age since disturbance.

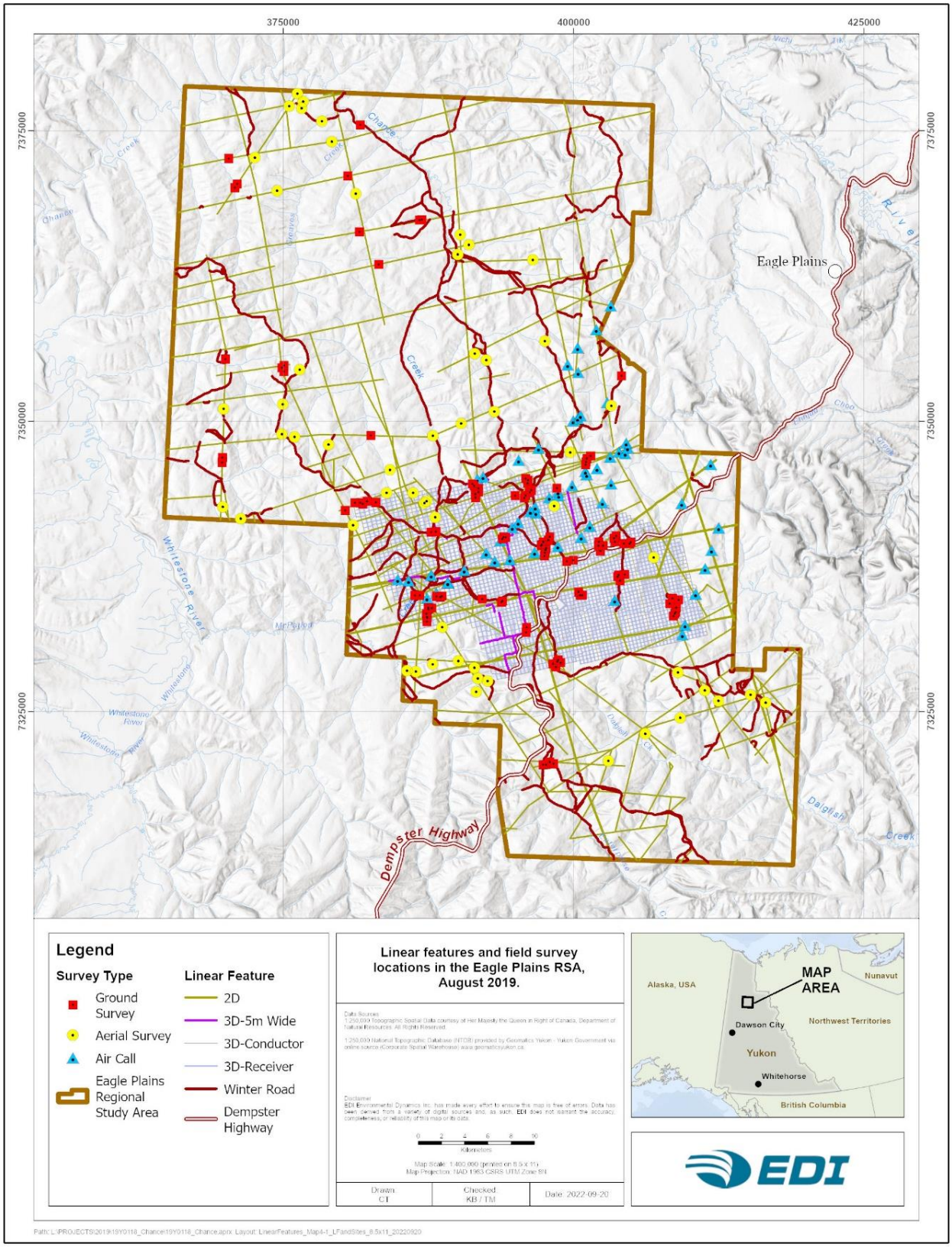
Table 4-1. Summary of total length and density of linear features documented in the Eagle Plains RSA.

Linear Feature Type	Total Length (km)	The Proportion of Total Length	Linear Feature Density (km/km²)
2D	1,452	34%	0.608
3D (combined)	2,165	51%	0.907
3D-5m wide	48	1%	0.020
3D-Conductor	1,189	28%	0.498
3D-Receiver	928	22%	0.389
Winter Road	596	14%	0.250
Dempster Highway	47	1%	0.020
Unknown	8	<1%	0.003
Total	**4,269**	**100%**	**1.788**

[1] See Section 5.5 Functional Recovery of Linear Features for details about vegetation regeneration criteria.

Table 4-2. Summary of total effective length and density of linear features in the Eagle Plains RSA adjusted for open habitat and vegetation regeneration.

Linear Feature Type	Total Length (km)	Proportion of Total Length	Linear Feature Density (km/km²)
2D	289	23%	0.121
3D (combined)	750	60%	0.314
3D-5m wide	21	<1%	0.009
3D-Conductor	401	32%	0.168
3D-Receiver	328	26%	0.138
Winter Road	171	14%	0.072
Dempster Highway	26	<1%	0.011
Unknown	8	<1%	0.003
Total	1,243	100%	0.521



Map 4-1. Linear features and field survey locations in the Eagle Plains RSA, August 2019.

4.2 LINEAR FEATURE CHARACTERISTICS

4.2.1 LINE WIDTHS

Line width varied by linear feature type. Mean line widths ranged from 1.96 m for the narrowest line type (3D receiver lines) to 33.75 m for the Dempster Highway (Table 4-3). Standard error around mean estimates were smallest for 3D seismic lines, which were cleared in the same season using the same equipment and methods, and greatest (by a large margin) for winter roads. The average difference in widths between 3D conductor (wider) and 3D receiver lines was 1.2 m.

Table 4-3. Widths of different linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Minimum mean width (m)	Maximum mean width (m)	Overall mean width (m)	Standard Error (m)
2D	107	3.97	8.5	5.42	0.11
3D-5m wide	5	5.30	6.40	5.68	0.22
3D-Conductor	29	2.50	4.80	3.17	0.13
3D-Receiver	24	1.63	2.53	1.96	0.04
Winter Road	43	2.53	17.97	7.42	0.66
Dempster Highway	2	33.00	34.50	33.75	0.75

4.2.2 MULCH COVER

Mulching of woody vegetation is common during seismic line clearing activities and was used in the 2013/14 3D program. In areas with thick tree or shrub cover, mulching can create a thick blanket of wood chips that inhibits vegetation regeneration (Golder Associates 2016). There was no evidence that this was an issue with any of the seismic lines within the RSA. On average, the percent cover of mulch was <1% on all line types.

4.2.3 HUMAN USE

No sign of human use was detected along linear features during the summer ground surveys (e.g., OHV tracks, ruts, water crossings, vegetation trampling/scarring, tree blazes, trap sets, garbage, and campsites), except for the two sites on the Dempster Highway.

On average, 42% of on-line sites were deemed passable to an OHV (a 4x4 side-by-side) during summer, considering obstructing vegetation, ground conditions (e.g., wetlands or peatlands), and the presence of graminoid tussocks (Table 4-4).

Table 4-4. Proportion of survey sites deemed passable to OHV in summer across different linear feature types in the Eagle Plains RSA.

Linear Feature Type	No. Survey Sites	% Passable
2D	55	9%
3D-5m wide	5	80%
3D-Conductor	29	59%
3D-Receiver	24	75%
Winter Road	29	55%
Dempster Highway	2	100%
Total	144	42%

4.2.4 SUCCESSIONAL CLASSES

Linear features surveys in the Eagle Plains RSA observed five of the six of the successional classes documented by Simpson (2008): normal succession, magnified succession, stagnated succession, no succession, and recent disturbance (Figure 4-1) (Attachment A). No retrogressive succession sites were observed at official survey sites. However, a small number of retrogressive sites were incidentally observed on winter roads while travelling through the RSA.

Most sites surveyed (79%) were undergoing normal succession. The next most common successional class was magnified succession, occurring in 11% of sites, followed by stagnated succession, occurring in 5% of sites. All 3D seismic lines surveyed followed a normal successional trajectory, except for one site that was classed as recently disturbed. Magnified succession was most common in 2D seismic lines (21%), while stagnated succession was most common in winter roads (19%). Successional classes were defined as 'not present' if the linear feature was not present in the field or had regenerated to a stage that was not discernable from the adjacent areas. The Dempster Highway was classified as recently disturbed due to the regular maintenance of the road.

Fire history appeared to influence some successional classes. Magnified succession was more common at burnt sites (19 burnt versus 5 unburnt). In contrast, stagnated succession was more common at unburnt sites (3 burnt versus 7 unburnt). Sites on a normal successional trajectory did not appear to have any relationship to burnt status. The remaining successional classes were too uncommon to draw any conclusions.

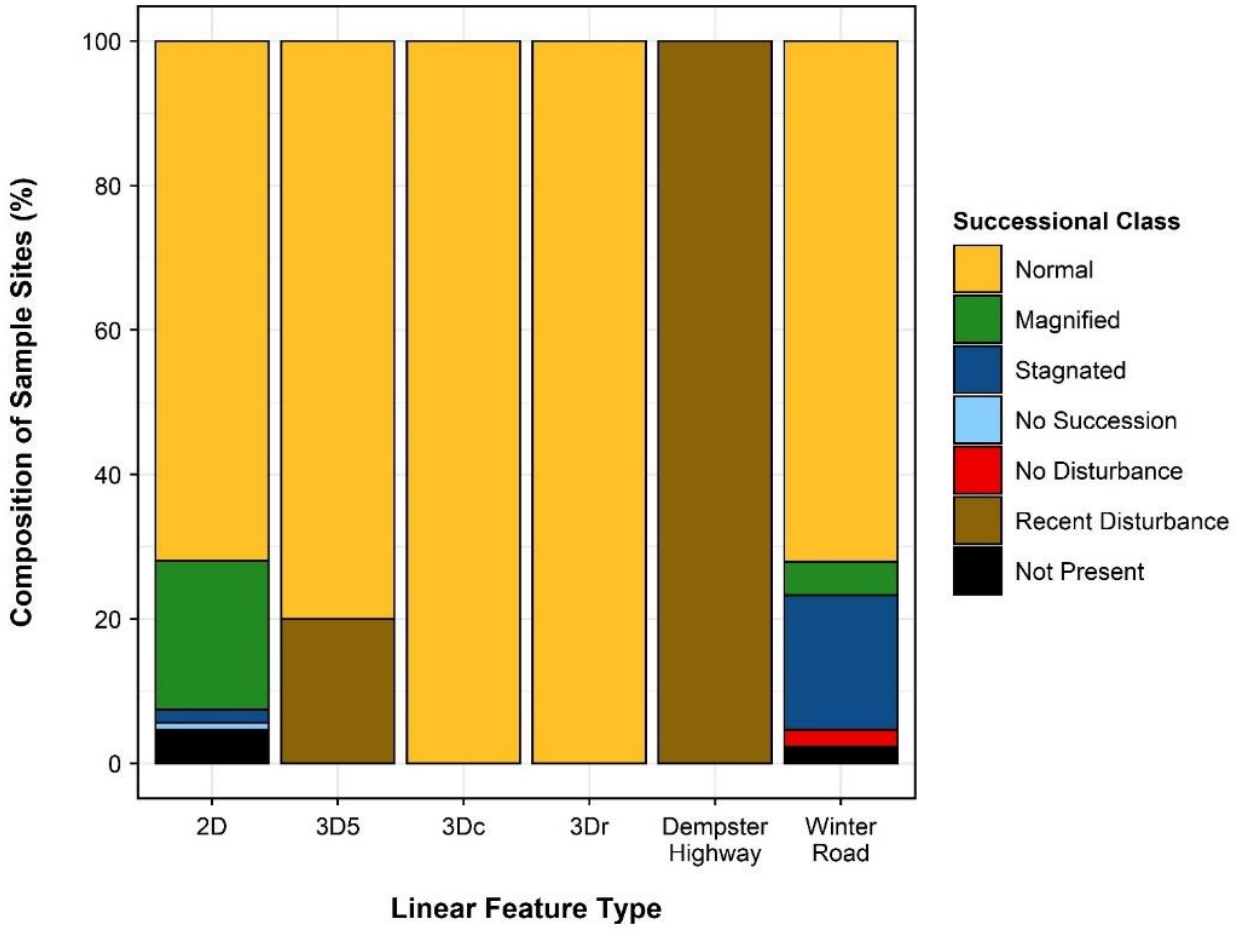


Figure 4-1. Summary of successional classes observed across different linear feature types in the Eagle Plains RSA.

4.2.5 STRUCTURAL STAGE

Most linear features were in a Low Shrub (56.1%) or Tall Shrub (29.0%) structural stage. However, the distribution of structural stages varied substantially across linear feature types (Table 4-5). Although herbaceous and forested stages occurred at some on-line plots, they were not common (less than 5%each). Nearly all forested structural stages were observed on 2D seismic lines and winter roads, reflecting the long time since they were created. Tall Shrub stages were almost twice as frequent in 2D seismic lines than any other linear feature type. Conversely, 83% of 3D linear features were in the Low Shrub structural stage, with most of the remaining in the Tall Shrub stage. The differences in structural stages between 2D and 3D lines appear to be primarily due to the time since disturbance. Winter roads were less consistent in their structural stages; herbaceous, shrubland and forested stages were all observed with moderate frequency. The two Dempster Highway plots were the only non-vegetated stages recorded.

Off-line plots were also mostly in Low Shrub and Tall Shrub stage, but they also included a higher proportion of Young Forest and Mature Forest compared to on-line plots (Table 4-5; Photos A-15 to A-20 in

Attachment A). For off-line plots, the Low Shrub sites were mostly burned areas, and the Tall Shrub sites were mostly stunted, open-canopy, black spruce forest 2–8 m tall.

Fire had a strong effect when comparing structural stages between paired on-line and off-line plots (Figure 4-2). The top two charts in Figure 4-2 show that the pattern of structural stages for burnt areas was very similar between on-line and offline plots. The bottom two charts show that the pattern of structural stages differs substantially between on-line and offline plots in unburnt areas. In unburnt areas, off-line plots had much lower numbers of sites in Low Shrub and much higher numbers of sites in Young Forest and Mature Forest than on-line plots. For burnt areas, the on-line and off-line plots at the same site were the same structural stage in 72% of cases, and within one structural stage of each other 91% of the time (e.g., Tall Shrub vs Pole Sapling). For areas that were not burnt, the on-line and off-line plots at the same site were the same structural stage in only 29% of cases. These results demonstrate that in the absence of fire, pronounced differences between linear disturbances and the surrounding community are evident in both recent (3D) and legacy (2D and winter road) linear feature types. But following a fire, the vegetation structure on-line and off-line are likely to be similar (Photos A-22 to A-24 in Attachment A).

Table 4-5. Vegetation structural stages observed on different linear feature types as a proportion of all plots sampled (n = 156) in the Eagle Plains RSA.

Linear Feature Type	No. Sites	Structural Stage[1]								
		Non-vegetated	Bryoid	Herb	Low Shrub	Tall Shrub	Pole-Sapling	Young forest	Mature forest	Old Forest
2D	62	0%	0%	2%	37%	47%	2%	8%	3%	2%
3D-5m wide	5	0%	0%	20%	80%	0%	0%	0%	0%	0%
3D-Conductor	29	0%	0%	0%	83%	14%	0%	3%	0%	0%
3D-Reciever	24	0%	4%	0%	83%	13%	0%	0%	0%	0%
Dempster Highway	2	100%	0%	0%	0%	0%	0%	0%	0%	0%
Winter Road	33	0%	0%	12%	48%	27%	3%	3%	6%	0%
Off-line	155	0%	1%	1%	33%	29%	1%	18%	17%	1%

[1] See Table 3-3 for structural stage codes and descriptions.

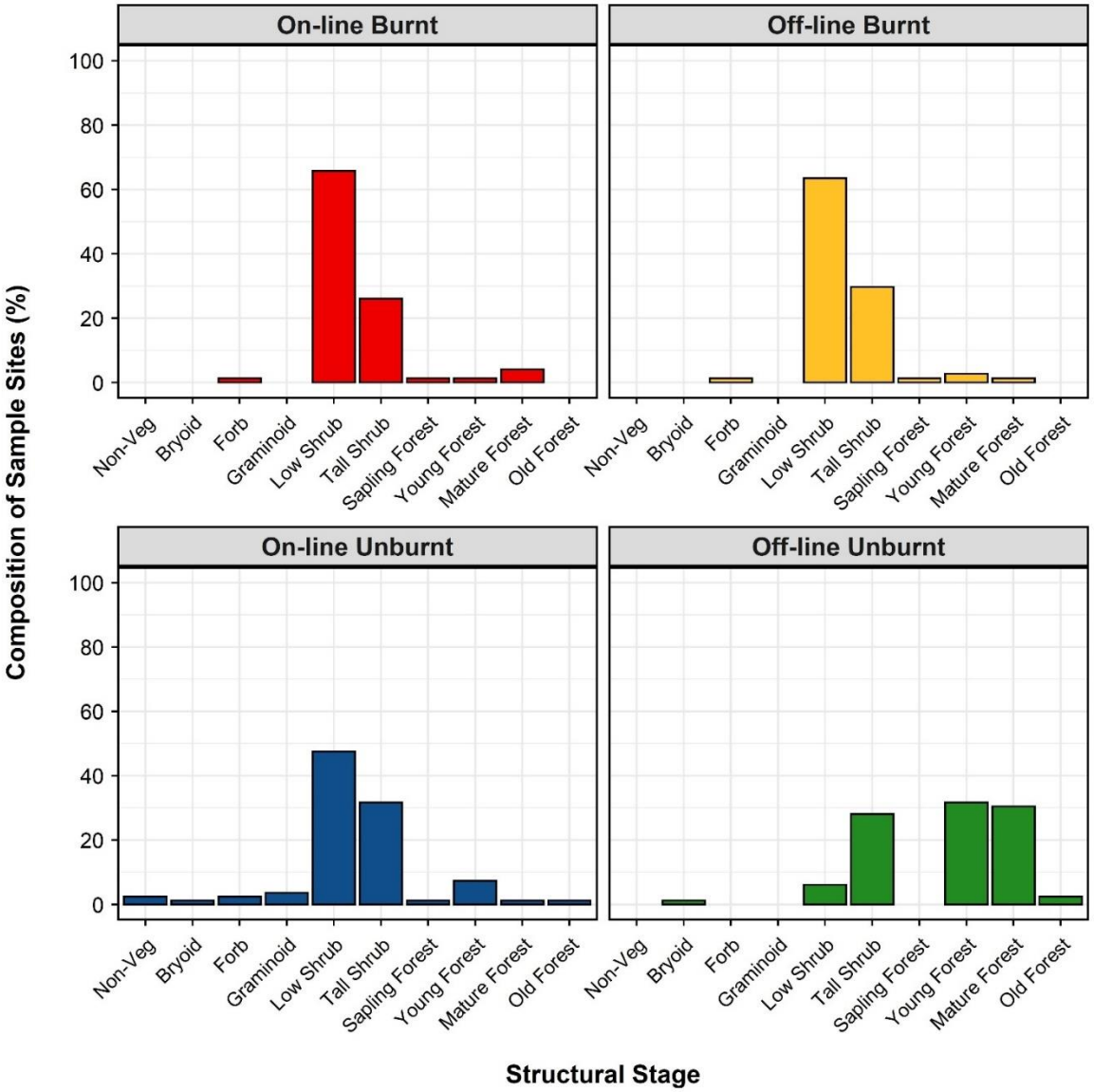


Figure 4-2. Comparison of structural stages on linear features to off-line plots in burnt and unburnt areas, in the Eagle Plains RSA.

4.2.6 VEGETATION HEIGHT

Based on the similarity of patterns in vegetation composition and structure, linear feature types were combined into two groups for assessment of patterns in height: (i) 2D and winter roads and (ii) 3D. A wide range of vegetation heights was recorded at both on-line and off-line plots in the RSA, from 0.3 m to 16 m. Collectively, off-line plots had a normal distribution of vegetation heights between 0 m and 4 m, and then a scattered distribution across heights up to 16 m (Figure 4-3). Plots with ≥4 m tall vegetation accounted for approximately 40% of all off-line reference plots.

In comparison, recovering 2D seismic lines and winter roads shared a relatively uniform distribution between 0 m and 4 m but with a peak occurring at vegetation heights measuring 1.5–2 m tall (Figure 4-4). Only 21% of 2D and winter roads contained dominant vegetation ≥4 m, and only 5% were ≥8 m tall. 3D seismic lines were rarely composed of vegetation ≥2 m, and most of the vegetation (67%) recovering on 3D lines was less than 1 m (Figure 4-5). This is very different from the off-line undisturbed height distribution. However, 3D lines were all only five years old at sampling, and shorter vegetation was expected.

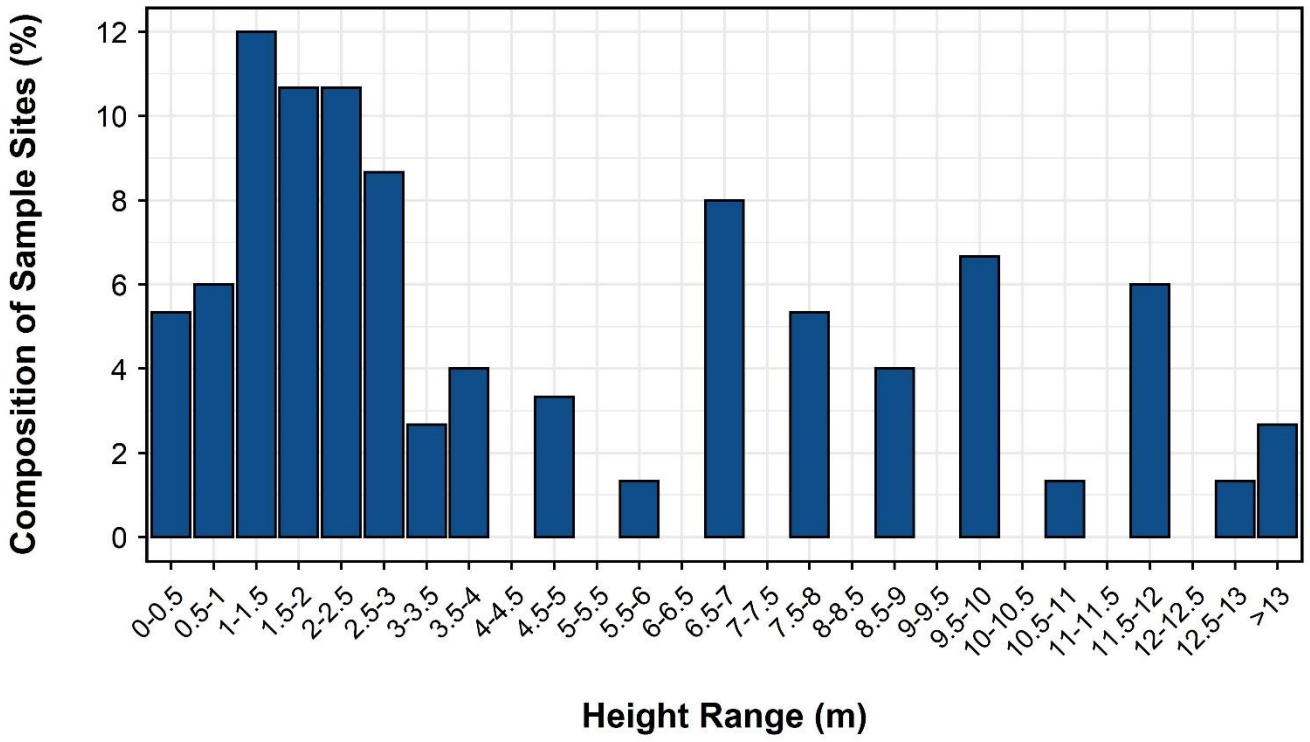


Figure 4-3. Vegetation height distribution of off-line reference plots in the Eagle Plains RSA.

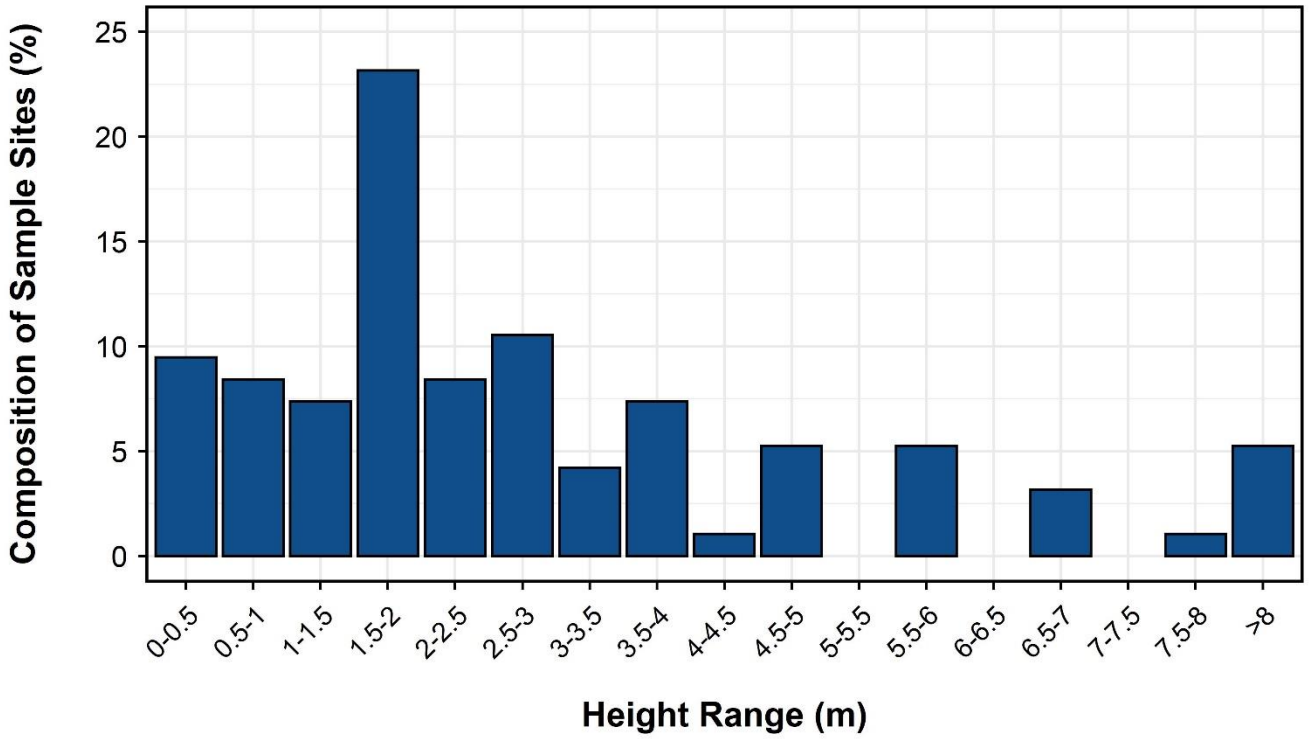


Figure 4-4. Vegetation height distribution of on-line 2D and winter road plots in the Eagle Plains RSA.

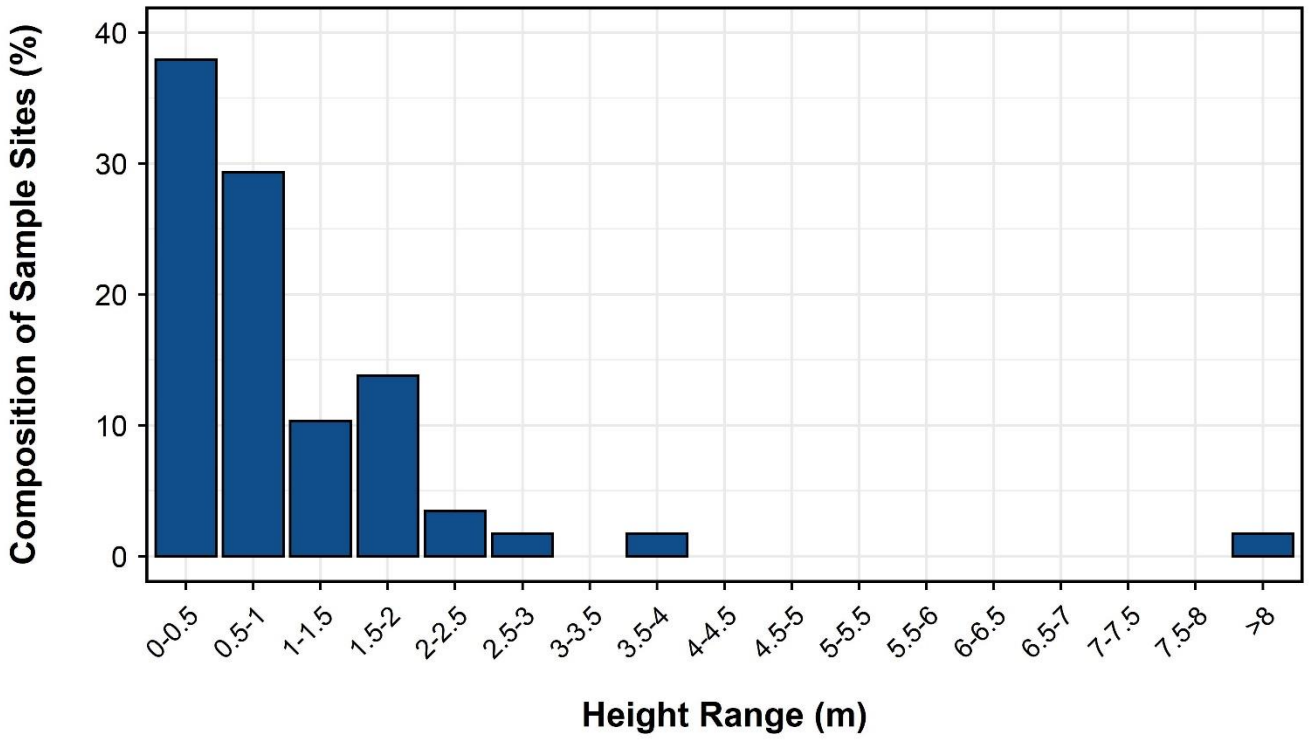


Figure 4-5. Vegetation height distribution of on-line 3D plots in the Eagle Plains RSA.

4.2.7 VEGETATION COVER

Tree and shrub cover varied between linear feature types and burn status (Table 4-6). Generally, tree cover was low on undisturbed reference plots (mean tree cover of 8% on unburnt and 2% on burnt sites). This is typical of the taiga cordillera landscape — forests are generally stunted and sparse due to poor nutrient regime and continuous permafrost conditions (Smith et al. 2004). Of the on-line plots, tree cover was greatest on 2D seismic lines and burnt winter roads (5% to 8%) and lowest on 3D seismic lines and the Dempster Highway (0%), regardless of burn status. This is likely due to the recently disturbed 3D seismic lines that are too young for trees to have re-established. Burnt 2D seismic lines and winter roads had greater tree cover than unburnt lines.

Shrub cover was much greater than tree cover overall. Shrub cover was typically 30–40% on unburnt off-line plots and 40–50% on burnt off-line plots. Shrub cover was highest on 2D seismic lines (~54%), regardless of burn status. Shrub cover was moderate on winter roads (38–45%) and lowest on unburnt 3D seismic lines (8–22%). Burnt 3D seismic lines had approximately twice as much shrub cover as unburnt 3D lines.

Table 4-6. Summary of the mean tree and shrub cover (%) between on-line and off-line, and burnt and unburnt plots surveyed in the Eagle Plains RSA.

Linear Feature Type	Burn Status	Mean Tree Cover (%)		Mean Shrub Cover (%)	
		On-line	Off-line	On-line	Off-line
2D	Burnt	7.0	3.5	54.0	36.0
	Unburnt	5.5	13.4	53.2	32.8
3D5	Burnt	0.0	0.3	41.7	60.0
	Unburnt	0.0	0.5	7.5	42.5
3Dc	Burnt	0.0	0.2	40.4	46.1
	Unburnt	0.4	6.0	21.5	34.3
3Dr	Burnt	0.0	0.7	35.0	51.9
	Unburnt	0.0	5.5	20.6	32.5
Winter Road	Burnt	7.7	1.0	45.0	43.8
	Unburnt	1.3	4.0	37.5	32.3
Dempster Highway	Unburnt	0.0	1.0	0.0	37.5

4.2.8 LINE-OF-SIGHT AND EASE OF TRAVEL

Line-of-sight (sightline) distance was examined primarily as a function of line type; however, vegetation height (the primary factor affecting sightlines) was also examined for on-line and off-line plots for each linear feature type using multiple linear regression. Mean sightlines varied significantly by linear feature type (Table 4-7, $F_{4,187} = 3.3$, $P = 0.01$). For reference, the average sightline distance for offline controls was 46.7 m. This relatively far distance reflects the open stand structure on most sites in the region. Burn status had little influence on sightlines (e.g., burnt off-line=50.2 m, unburnt offline=43.6 m). 2D lines had the shortest average sightline distances at 41.2 m. This was mainly due to the advanced stage of regenerating vegetation on the lines. Where regenerating vegetation was limited, sightline distances on 2D lines frequently exceeded 150 m.

On 3D lines, the time since clearing was too recent for regenerating vegetation to obscure sightlines. Instead, sightline distances on 3D lines were generally controlled by bends in the lines, which were specifically designed as mitigation measures to reduce sightlines. For 3D lines, sightline distances decreased from 3D5 to 3Dc to 3Dr lines. The reduction in sightline distances resulted from differences in line width and the average distance between bends across the feature types.

The regression analysis also found a significant interaction between on-line versus off-line occurrence and vegetation height ($F_{1,187}$ = 13.0, P = 0.0004), whereby on-line plots had, on average, more negative slopes than off-line plots. In other words, sightlines at on-line plots decreased more drastically than off-line plots with each incremental increase in vegetation height. This is consistent with the qualitative observations of field crews that the regenerating vegetation on lines was thicker than the vegetation off lines.

Similar to sightline distances, determining differences in ease of travel among line type the primary factor of interest for the walking speed tests. However, burn status, and the percent cover of trees and shrubs were expected to be the most important explanatory variables related to walk speeds, so they were included as secondary variables using a mixed-effects linear regression. Walking speeds across linear feature types and the differences between on- and off-line plots within linear feature types varied significantly (Table 4-8, $F_{5,170}$ = 3.4, P = 0.006). However, the magnitude of the difference between on-line and off-line plots was modest. Even the Dempster Highway only conveyed a 35% increase in walking speed over off-line plots. Other researchers, in other areas, often observed walk speeds on linear features were often at least twice as fast as off-line transects (Keim et al. 2019a).

Notwithstanding the modest magnitude of faster walking speeds on-lines, there were clear patterns in walking speed differences across linear feature types. 2D lines were the one feature type where walking speeds were slower on lines than off lines. This reflected the thick, shrub stage vegetation that had regenerated on most 2D lines, which impeded travel (similar to the effect that regenerating vegetation had on sightline distances in the previous section). Walk speeds decreased across the other feature types in relation to line width and the degree to which ground cover was levelled or compacted.

Statistical analyses indicated that both burn status ($F_{1,170}$ = 17.85, P < 0.0001) and percent cover of shrubs and trees (hereafter woody vegetation; $F_{5,170}$ = 5.29, P = 0.0002) affected walking speeds, both on and off lines. On average, walk speeds in burns were approximately 10% slower than in unburnt areas. This is partly related to thicker woody cover in most burns, which hinders walking speed because of the time it takes to push through or walk around it. Walking speeds significantly decreased, on average, by 0.04 (CI = 0.02–0.06) km/h and with every 10% increase in the percent of woody cover off-line and 0. 11 (0.07–0. 15) km/h on 2D lines.

Table 4-7. Average sightline distances along different linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Average Sightline Distance (m)	Comments
2D	30	41.2	Sightlines are frequently reduced by regenerating vegetation >1.5m tall
3D-5m	5	105.6	Has fewer bends than 3Dc and 3Dr
3D-Conductor	26	75.9	Sightlines limited by bends in lines; too recent for regenerating vegetation to impede sightlines
3D-Receiver	23	60.2	Sightlines limited by bends in lines; too recent for regenerating vegetation to impede sightlines
Dempster Highway	2	814.8	
Winter Road	17	106.2	
Off-Line Controls	103	46.7	

Table 4-8. Differences in walking speeds among linear feature types in the Eagle Plains RSA.

Linear Feature Type	n	Average Walk Speeds (km/h)		Difference (%)
		On-line	Off-line	
2D	28	2.5	2.8	-10%
3D5	5	3.8	3.0	30%
3Dc	23	3.5	3.1	13%
3Dr	23	3.2	2.9	10%
Dempster Highway	2	5.6	4.1	35%
Winter Road	16	3.6	3.1	17%
Off-Line Controls	97	n/a	2.9	

4.3 VISIBILITY OF LINEAR FEATURES FROM THE DEMPSTER HIGHWAY

Overall, the blind search identified 11 of 100 possible linear feature intersections with the Dempster Highway (Table 4-9). Five of the features were roads that were classified as winter roads in the GIS inventory, but most (four) were actually short, all-season roads leading to gravel pits or well sites. Two of the observed features were human truck/OHV trails that led to camp sites 100–200 m off the Dempster Highway, and four were 3D seismic lines. The map search detected two more 3D lines, one 2D line, and one old winter road. The 2D line and the old winter road had regenerated into Young Forest structural stages. Excluding the four short secondary roads into gravel pits and well sites, and the two human trails, only 8% of linear features that intersected the Dempster Highway were visible during the two driving surveys.

Only 6 of the 74 3D lines that crossed the Dempster were detected. The combination of construction design (i.e., creating a bend in the 3D line adjacent to the highway) and regenerating vegetation in the right-of-way made it difficult to detect the 3D lines. Evidence of human use (e.g., packed vegetation, tire tracks, rutting, garbage, campfire remnants, tree stumps, or tree blazes) was observed on four of the short, all-season roads

and the two trails. No evidence of human use was noted on any of the 2D or 3D seismic lines, or the three winter roads (including the Chance and Blackie winter roads). However, some types of human use do not leave sign during the snow-free season (e.g., snowmobile use in the winter).

Table 4-9. Summary of linear features identified and intersecting the Dempster Highway during a blind search test.

Linear Feature Type	No. Features Intersecting the Dempster	No. (%) Observed Blind Search	No. (%) Observed Map Search	Total No. (%) Observed	OHV Accessible	Sign of Human Use
2D	18	0 (0%)	1 (6%)	1 (6%)	0	0
3D	74	4 (5%)	2 (5%)	6 (8%)	4	0
Secondary Roads	8	5 (63%)	1 (13%)	6 (75%)	5	4
Trail	n/a	2 (n/a)		2	2	2
Total	100	11 (11%)	4 (4%)	15 (15%)	11	6

4.4 WINTER TRACKS

In total, 462 linear features were surveyed for winter tracks over 358 km along the 11 transects. No human sign was observed on any linear features, except the Dempster Highway. Ungulate tracks were frequently observed travelling along linear features. The proportion of linear features with tracks decreased with decreasing linear feature widths, from 29% on winter roads, 24% on 2D lines, 8% on 3D conductor lines, and 6% on 3D receiver lines (Figure 4-6).

The frequency of use in adjacent undisturbed areas, corrected to account for different survey extents between the linear features and the undisturbed areas, was 1%. As discussed in the methods, it was difficult to compare the frequency of use along linear features to use in undisturbed areas. The issue is that for the comparison to be relevant, the survey design needs to account for the size of the sample units (i.e., the extent of the undisturbed area needs to be comparable to the width of the linear features), and the two samples should be independent. These conditions were not achieved under the current survey design (i.e., the extent of the survey area in the undisturbed area was much larger than the width of the linear feature, and the location of the undisturbed area was spatially correlated to the linear feature). The estimated relative use rate of 1% in undisturbed areas adjusts the total counts within the 200 m survey area to 5 m (i.e., the average linear feature width); however, the adjustment fails to account for spatial correlation between the two samples. Therefore, the estimate of use in undisturbed areas could be biased. Notwithstanding this limitation in the estimate of travel rates in undisturbed areas, it is supported by qualitative observations of the survey crew that travel rates on even the least used linear features (i.e., 3D lines) are higher than undisturbed areas.

The relative use of linear features by ungulates also appeared to vary with distance from the Dempster Highway, with features within 1 km of the highway receiving lower use than features equal to or greater than 5 km from the highway (Figure 4-7). It is worth noting that the Highway and 1 km transects were completed on the first and second day of surveys, respectively, and the other transects were surveyed one to six days later, providing more time for tracks to accumulate. Snowfall data prior to the crew's arrival on site was not

available; however, road crews at Eagle Plains reported that there had not been a major snowfall in the area for at least a week. Based on this information, the issue of time since last snow has less potential to bias results than if a track-erasing snow event had recently occurred.

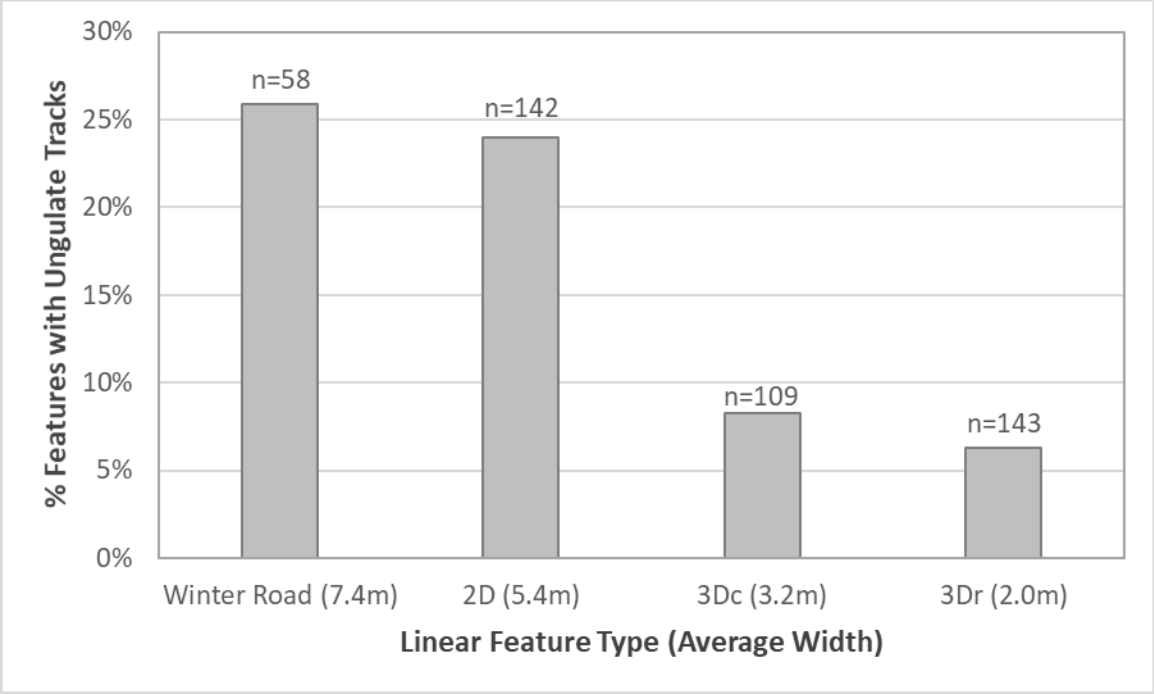


Figure 4-6. Relative use of different linear feature types by ungulates in the Eagle Plains RSA, March 2020.
The numbers above bars indicate the number of features surveyed.

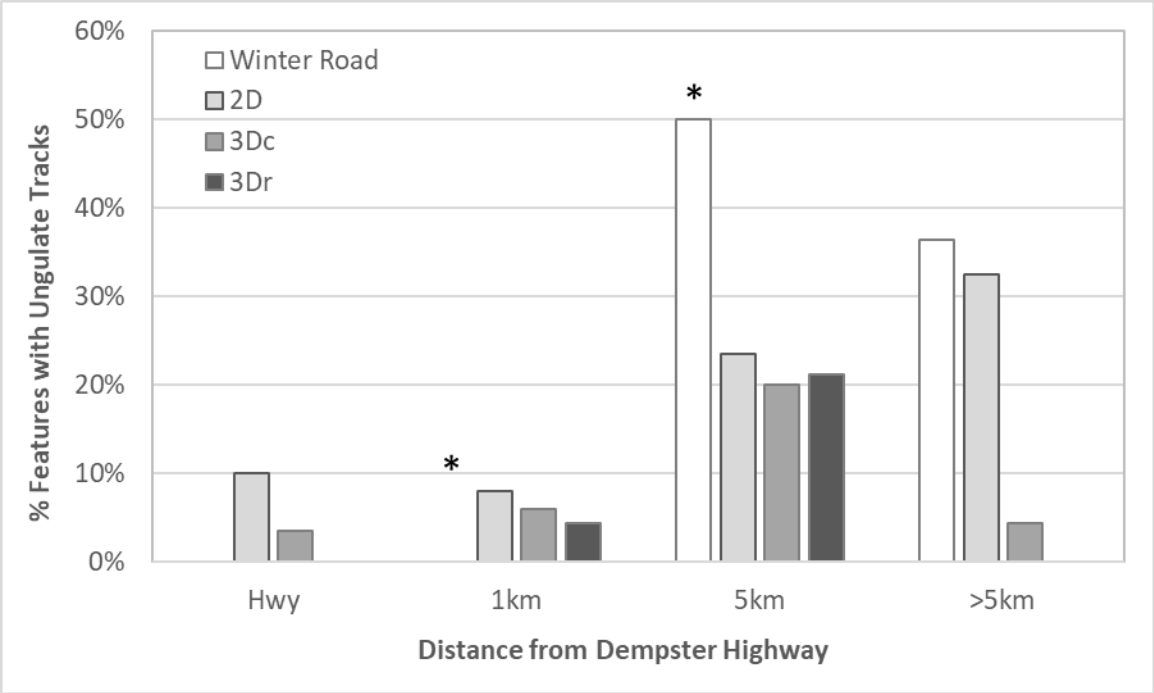


Figure 4-7. Relative use of different linear feature types by ungulates in relation to distance from the Dempster Highway in the Eagle Plains RSA, March 2020.

*The * indicates bars with small samples sizes (n=5-10); all other instances have at least 10 data points per feature type within each distance class*

5 DISCUSSION

5.1 SUMMARY OF LINEAR FEATURES IN THE EAGLE PLAINS RSA

Table 5-1 summarizes key characteristics across linear feature types in the Eagle Plains RSA.

Table 5-1. Summary of structural, ecological and functional characteristics of linear feature types in the Eagle Plains RSA.

Linear Feature Type	Mean Width (m)	Mean Sightlines (m)	Mean Movement Speed (km/h)	% Regenerated[1]	% Inhibited Regeneration[2]	Linear Feature Density (km/km²)	Adjusted Linear Feature Density (km/km²)[3]	% Ungulate Use[4]
3D seismic	2.6	71.98	3.36	14	0	0.91	0.31	7
2D seismic	5.4	41.17	2.53	61	4	0.61	0.12	24
Winter Roads	7.4	106.18	3.58	39	19	0.25	0.07	26
Dempster Highway	33.8	814.75	5.60	0	100	0.02	0.01	N/S
Off-line Controls	N/A	46.67	2.95	N/A	N/A	N/A	N/A	N/S

[1] as characterized by reaching a tall shrub stage, or greater.
[2] including stagnated and disturbed successional patterns.
[3] accounting for burns, natural openings, and regeneration.
[4] percent of lines with ungulate tracks during March 2020.

2D Seismic — 2D lines are, on average, the oldest features in the area and have had the longest time to regenerate. Most features were cleared before 1985, but some were developed in the early 2000s. Historical 2D lines were generally long and straight, with moderate widths of 4–8 m. Lines were typically constructed with bulldozers that cut into the moss layer and often included some patches of soil disturbance. The combination of site disturbance and wider widths generally resulted in a successional reset to pioneering vegetation (including early seral graminoids, forbs, and shrubs). Most sites were following a normal successional pathway (73%). However, 27% of sites exhibited atypical pathways, dominated by magnified succession (21%, mostly in burns), stagnated succession (3%) or no succession (1%). Sixty-one percent of the 2D sites had regenerated to a Tall Shrub or more advanced structural stage. 2D lines had the shortest sightlines and slowest walk test speeds of all feature types (including off-line controls), reflecting the regenerating vegetation's effect on these functional metrics. During winter, ungulates regularly used 2D lines to travel along.

3D Seismic — All 3D lines were created during the last exploration period, during the winter of 2013/14. 3D lines constitute the most extensive combined lengths of the different linear feature types, but their areal extent is limited to a relatively small portion of the RSA along the Dempster Highway. Due to their basic design, as well as specific mitigations, 3D lines minimize environmental effects compared to other linear feature types. They are narrow (averaging 3.2 m and 2.0 m for conductor and receiver, respectively), often

narrower than average tree spacing in the region. They were constructed during winter, over snow, using low-ground pressure equipment, which avoids ground disturbance and maintains vegetation in the moss, herb and low shrub layers. The lines were constructed with a meandering path, and strategically placed sharp angle dogleg bends to reduce the visibility of the lines from roads, reduce sightlines along them, and hamper travel by OHVs. All 3D lines that were surveyed were undergoing a normal successional pathway and were dominated by the same vegetation as in adjacent undisturbed areas. Regenerating vegetation was mostly in a Low Shrub structural stage, consistent with the relatively short six-year period since they were cleared. Sightlines and movement speeds were intermediate compared to other linear feature types, with sightlines primarily controlled by dogleg bends purposely designed to reduce sightline distances. Ungulates occasionally used 3D lines to travel on in winter, but at less than a third of the rate as 2D lines and winter roads.

Winter Roads — A network of winter roads across much of the RSA results from the historical exploration programs that have occurred. Although many of the winter roads were initially developed during the earliest exploration programs, vegetation has not had the same opportunity to regenerate as on 2D lines because the vegetation was re-cleared on several roads during subsequent exploration programs. The average width of winter roads was 7.4 m, but major roads, like the Chance road, were often 10–12 m wide. Historical winter roads were typically cleared with a bulldozer, and then snow was packed and graded to create a road surface. Similar to historical 2D seismic, the combination of site disturbance and wider widths (i.e., that increases solar exposure) generally resulted in a successional reset to pioneering vegetation (including early seral graminoids, forbs, and shrubs). Most sites were following a normal successional pathway (72%), but 26% of sites exhibited atypical pathways, dominated by stagnated succession (19%), magnified succession (6%) and no succession (1%); 2% of the sites were classified as no disturbance (indistinguishable from vegetation community off the road). Thirty-nine percent of the winter road sites had regenerated to a Tall Shrub or older structural stages. Winter roads had the longest sightlines and fastest walk test speeds of all feature types, other than the Dempster Highway, reflecting the variable levels of regenerating vegetation that occurred on winter roads. During winter, ungulates regularly used 2D lines for travel.

Dempster Highway — The Dempster Highway is the only all-season road in the RSA (except for short spurs off the Dempster to well sites and gravel pits). It is fundamentally different from all other linear features in the area in terms of wide width, surface material and maintenance, long sightlines, regular traffic, and base of access for human land use activities such as hunting, camping, and trapping.

5.2 LINEAR FEATURE CHARACTERISTICS

5.2.1 FIRE

The presence or absence of recent forest fires affected several linear feature characteristics, including linear feature width, successional class, structural stage, and vegetation height and cover. Mean measured linear features widths were 0.2–0.6 m wider at burnt sites than at unburnt sites. This may be due to the already shorter vegetation at burnt sites, which would reduce overgrowth occurring from forest edges and decrease the measured width between driplines (branches extending into the linear feature from either side of the line).

Magnified succession was nearly four times more common in burnt plots than unburnt plots, and stagnated succession was half as common. Fire likely facilitates magnified succession by increasing soil temperatures, accelerating decomposition, and releasing stored water and nutrients to promote vegetation growth (Seccombe-Hett and Walker-Larsen 2004, Simpson 2008). Stagnated succession is likely less common at burnt sites because the associated nutrient and water increase allows woody plant species to colonize more easily and advance through successional stages.

Overall structural stage distribution was very similar between burnt on-line and off-line plots, but was markedly different between unburnt on-line and off-line plots. Furthermore, when the structural stages were compared between paired on-line and off-line plots, they matched two to four times more frequently at burnt sites than at unburnt sites and were mismatched two to six more frequently at unburnt sites than at burnt sites. Nearly all burnt plots were in a low shrub, or tall shrub structural stage, which is expected as fires tend to remove overstory trees, and shrubs generally colonize rapidly post-fire (Seccombe-Hett and Walker-Larsen 2004).

Vegetation height was 4.4 m shorter in burnt than unburnt reference plots, and tree cover was approximately 6% less. These modest differences reflect the stunted and open nature of the taiga forest. There was little change in vegetation height between burnt and unburnt linear features, likely because there were very few linear disturbances in a forested structural stage; most of them, even in unburnt conditions, were already in a shrub-dominated stage due to the clearing of trees. For shrub cover, except for 2D seismic lines, the mean was approximately 10% to 20% greater at burnt plots than at unburnt plots. The increase in shrub cover at burnt sites was most prominent in 3D seismic lines due to their comparatively lower pre-fire shrub cover.

Post-burn vegetation was, on average, shorter and shrubbier than unburnt off-line plots, but taller and shrubbier than unburnt on-line plots. Furthermore, burnt paired plots were more similar in vegetation characteristics than unburnt paired plots. This evidence supports the theory that forest fires in taiga ecosystems resets the landscape to some extent and effectively erase signs of anthropogenic disturbance (Seccombe-Hett and Walker-Larsen 2004, Simpson 2008). Forest fire in the taiga returns ecosystems to an early successional stage (i.e., low shrub) and synchronizes baseline biophysical conditions on a landscape scale, allowing previously disturbed and undisturbed areas to recover at equal rates, as has been documented by Seccombe-Hett and Walker-Larsen (2004). Thus, most linear features that have experienced forest fires no longer create different ecological conditions or functional disturbances than the surrounding landscape.

5.2.2 SUCCESSIONAL CLASS

The idea that vegetation regeneration on linear features could follow different successional trajectories came out of work by the Yukon Government in the early 2000s (Simpson 2008). That work described six successional trajectory classes observed in the Eagle Plains area. However, that study did not quantify the relative extents of linear features that followed the different trajectories. This study used the classes that the Yukon Government work developed and quantified the proportion of linear features in each successional class across a random sample of linear features.

Successional classes in the Eagle Plains RSA varied according to linear feature type and burn status. However, one of the key findings was that normal succession was the dominant trajectory observed for all linear features except the Dempster Highway. All 3D seismic lines followed a normal successional trajectory, except for one recently disturbed site. This was likely attributable to the low impact methods used in 3D line creation that minimize ground and vegetation disturbance, creating conditions more likely to result in a normal successional trajectory (Yukon Energy Mines and Resources 2006, Golder Associates 2016). Magnified and stagnated succession were only observed in 2D seismic lines and winter roads. These linear features were generally wider and were created using methods that cause greater disturbance to soils, hydrology, and vegetation, leading to these alternative successional trajectories (Simpson 2008, Jorgenson et al. 2010, Dabros et al. 2018). Magnified succession is unique among the classes in that it results in accelerated vegetation regeneration. Magnified succession was most common on burned 2D seismic lines where the combination of site disturbance associated with the 2D lines and fire is suspected of causing accelerated soil warming, moisture availability, and nutrient flush, which increase on-line vegetation growth (Simpson 2008). Successional stagnation was most common on unburnt winter roads. Stagnation tends to occur on features that have experienced ground disturbance or have been seeded to agronomic species, which may have happened on winter roads in the RSA (Simpson 2008). Repeated disturbance associated with multiple exploration programs over time may also limit successional advancement and contribute to successional stagnation (Lee and Boutin 2006, Jorgenson et al. 2010).

Although some alternative successional pathways were observed in this study, most linear features in the Eagle Plains RSA are following a normal successional trajectory. This implies that most of these disturbances will recover to an ecological condition like that of the surrounding community with adequate time.

5.2.3 STRUCTURAL STAGE

The taiga forest in Eagle Plains presents a unique situation where the Tall Shrub stage is applied to two very different stand conditions. One condition, the more traditional, is of regenerating stands following a natural or anthropogenic disturbance. In this setting, the vegetation consists of deciduous shrubs and 2–8 m tall, 10–30 years old trees. The stage is transitional, with the vegetation expected to advance to the Pole-Sapling stage over time. The second condition where the Tall Shrub stage is applied is to stunted, old, black spruce stands in a disclimax state. In this setting, the vegetation consists of open, stunted, black spruce stands that are typically ≥50 years old and 2–8 m tall. Stands in this condition are expected to remain in the same condition over time(i.e., a disclimax state). Structurally, the stunted black spruce trees function more like shrubs than trees. Both Tall Shrub conditions (referred to as disturbance and disclimax forms hereafter) are widespread across the RSA in off-line sites. Only the disturbance form was observed on linear features.

The structural stage on linear features was predominantly Low Shrub or Tall Shrub, determined mainly by the time since line clearing and burn status. Less than 4% of surveyed features were in forested stages (Pole-Sapling or greater). Off-line plots had a higher proportion of forested structural stages (37%). However, they were still predominantly Low Shrub and Tall Shrub, resulting from extensive burns across the RSA and large extents in the disclimax form for Tall Shrub in un-burned areas.

The structural stage of on-line plots was also influenced by successional class. The small number of forested structural stages observed on features only occurred on sites undergoing normal succession. Stagnated succession was associated with only the Herb structural stage, which was expected as stagnation is defined by its high herbaceous species cover (among other factors) that limits the establishment of other structural groups. Magnified succession was the one atypical successional class with accelerated vegetation growth. Most structural stages on sites with magnified succession were in Tall Shrub and, occasionally, Pole/Sapling. Often the structural stage on magnified succession sites was one stage greater than the off-line plot.

5.2.4 VEGETATION HEIGHT

This study observed a range of vegetation heights across different feature types. Except for the 3D lines, the linear features' age was unknown, so it was impossible to estimate growth rates. Although some regenerating vegetation on 2D seismic lines and winter roads reached 8 m high, most were between 1.5 m and 2 m. Though the ages of specific features were mostly unknown, the minimum age for most was at least 35 years. Having most vegetation heights at only 1.5–2.0 m after this long period suggests regeneration growth rates on linear features may be quite slow. This pattern of slow vegetation growth on linear features may partly reflect the generally poor growing conditions in the taiga region. Still, it is also a pattern that has been observed on linear features in other studies in the southern boreal forest.

Interestingly, the vegetation heights on linear features in Eagle Plains are greater than reported in several other studies. For example, approximately 65% of sites on linear features in northeast Alberta had not advanced beyond a cover low forbs after 35 years (Lee and Boutin 2006). Key factors that have been linked to slow vegetation regeneration on linear features were continued human disturbance (e.g., OHV travel), ecosystem type (bogs and fens regenerated much slower than upland sites), competition from early seral and invasive graminoids and forbs, and soil or site degradation associated with feature construction (Lee and Boutin 2006, van Rensen et al. 2015, Finnegan et al. 2018).

There is limited data on vegetation regeneration in the taiga. A study from NWT found that vegetation regeneration on conventional seismic lines was affected by both a time lag for seedling establishment (as long as 17 years for black spruce) and slow growth rates (83 years to reach 5 m) (Seccombe-Hett and Walker-Larsen 2004). In burned areas, the seedling establishment delay was reduced to five years.

Although the 3D lines in Eagle Plains were only six years old when they were surveyed, a combination of field survey results and information from other studies suggests that vegetation recovery on 3D lines could be much faster than the previous examples for conventional 2D lines. This is because the undisturbed ground conditions and maintenance of the vegetation community in the moss, forb and low shrub layer provide both plants and growing conditions that support faster shrub and tree growth compared to sites beginning primary succession. In northeast British Columbia, Golder Associates (2016) found that in the first year following 3D seismic line creation, there were already black spruce seedlings exceeding 0.5 m in height. These seedlings were plants that were initially present on the site and that had survived line clearing. This is consistent with the results of this study, where nearly all of the 3D plots contained black spruce seedlings. Despite their relatively young age, most 3D seismic lines in Eagle Plains included shrubs and trees between 0.5 m and 1 m

tall. Although growth rates in Eagle Plains are not known, similar species that occur in Eagle Plains were observed to grow 5–10 cm per year on 3D lines in the boreal forest in northeastern British Columbia (Golder Associates 2016). If similar growth rates occur in Eagle Plains, regeneration on the 3D lines can be 2 m over the next 5–20 years.

5.3 HUMAN USE AND ACCESS ALONG LINEAR FEATURES

The NYRLUP and the PWRLUP indicate that one of the primary concerns about linear features is that they can increase human access into remote areas. This has been demonstrated in southern regions, and that access can have secondary effects of inhibiting vegetation regeneration (Lee and Boutin 2006) and, in winter, packing snow that can affect predator-prey dynamics (Latham et al. 2011, McKenzie et al. 2012, Keim et al. 2019a). In the boreal forest in northern Alberta, OHV travel was common on most conventional 2D seismic lines. After 35 years, approximately 20% of the lines were considered to have been converted to tracked access routes (Lee and Boutin 2006). In the same study, about 65% of the lines remained cleared after 35 years, and OHV use along the lines was identified as one factor contributing to the lack of vegetation regeneration. In contrast, there is little evidence of human use along linear features in the Eagle Plains RSA. No sign of human use was detected along linear features during the summer ground surveys (e.g., OHV tracks, ruts, water crossings, vegetation trampling/scarring, tree blazes, trap sets, garbage, campsites, etc.) or the winter track survey (e.g., snowmobile tracks). Although these surveys provided limited snapshots in time, and that some types of human activity leave little sign (e.g., evidence of snowmobile tracks have limited persistence during winter and leave no sign behind after snow melt), the results suggest that human use of the area is very limited outside of the Dempster Highway corridor. This is consistent with general comments from highway workers, staff at the Eagle Plains Hotel, pilots, and some First Nation residents that most areas beyond the Dempster Highway corridor receive very little human use. Specific instances of use of the area outside the Dempster Highway corridor include intermittent activity on the community trapline that occurs in Eagle Plains and occasional forays by hunters (First Nation and non-First Nation), mostly in winter.

People's limited use of the Eagle Plains area is likely due to its far distance from any human settlements and the difficulty of travel off the Dempster Highway. The network of winter roads in the area does provide access via specific types of OHVs in summer and snowmobiles in winter. However, there was no evidence observed that this occurs regularly. Travel along seismic lines, though possible in specific locations, would be hampered over any substantial distance by vegetation regeneration along the historical 2D lines, the narrow widths of and frequent dogleg bends in 3D lines and, during summer, difficult terrain (extensive peatlands and graminoid tussocks).

5.3.1 EFFECTIVENESS OF MITIGATION MEASURES FOR 3D SEISMIC LINES

In addition to the narrow widths of 3D lines, which hampers OHV travel, the 3D lines included regular bends in the lines, which were designed to limit the visibility of the lines at intersections with roads and other seismic lines, and to hamper OHV along the lines further. The driving survey along the Dempster found that this mitigation was very effective in reducing the visibility of the 3D lines from the road (i.e., only 6 of the 74 3D

lines intersecting the Dempster Highway were visible). Incidental observations during ground surveys observed similarly reduced visibility of 3D lines crossing winter roads. Regular bends in the 3D lines away from roads were also designed to limit human access by reducing sightlines and making travel more difficult along the line (i.e., needing to reduce speed to navigate the tight turns of a dogleg bend approximately every 70 m).

5.4 FUNCTIONAL CHARACTERISTICS OF LINEAR FEATURES

In addition to human travel, linear features can also affect how wildlife move within a landscape. Several studies in western Canada have documented the effects of linear features on the movements and population dynamics of large mammals, such as caribou, moose, deer, wolves and bears (Latham et al. 2011, McKenzie et al. 2012, Dickie et al. 2017b, Keim et al. 2019a). EDI focused on two established indicators of human and wildlife access and travel on linear features: sightline distance and ease of travel. These measurements act as a proxy for the functional recovery of disturbed areas. They are mainly dependent on vegetation height, cover, and terrain.

5.4.1 LINE-OF-SIGHT

Line-of-sight or sightline distance is how far one can see under normal conditions and was compared between linear features and paired reference plots. It has been proposed that humans and predators select linear disturbances because it is easier to travel and detect prey using those features (Finnegan et al. 2018). As vegetation grows taller and denser, sightlines diminish, and the use of linear features decreases (e.g., for wolves, Dickie et al. 2017a). This study found that average sightlines were farther on-line versus off-line for most linear feature types, but that sightlines varied substantially across line types. Sightlines were shorter on seismic lines than on roads, especially 2D lines which had more advanced vegetation regeneration than other feature types. On 3D lines, sightlines averaged approximately 30 m farther on lines than off lines. However, this difference probably provides little advantage to predators or human hunters because the increase is still within the olfactory and auditory detection zone for most large prey species. Average sightlines were 60 m farther on winter roads than surrounding forest, which may begin to confer more advantage to predators and hunters.

The range of sightlines observed on most linear features probably do not provide an advantage to detect prey species visually. For 2D lines and winter roads, sightline distances were primarily driven by the height and density of regenerating vegetation. The recovery period for 2D seismic lines appears to be sufficient to support vegetation that reduces visibility to a similar level as the surrounding habitats. The reason for longer sightlines on winter roads is that they are subject to intermittent re-activation, where the vegetation is cleared once again, which resets vegetation recovery and maintains longer sightlines. In contrast to 2D lines and winter roads, where sightlines were largely determined by vegetation regeneration, the sightlines on 3D lines were presently limited by the bends purposely constructed into the lines. Sightlines along all feature types will continue to diminish over time as vegetation regeneration continues.

5.4.2 EASE OF TRAVEL

Ease of travel is a fundamental indicator of functional recovery of linear features. Wolves, bears, and humans have been documented to select linear features with greater ease of travel, which is generally associated with lower and more sparse vegetation and stable, even terrain (Dickie et al. 2017b, Keim et al. 2019a). Access and travel resistance are the main determinants of predator and human use of linear features and the key concern of linear disturbances in the RSA (Vuntut Gwitchin Government and Yukon Government 2009, Peel Watershed Planning Commission 2019).

The walk test used in this study, as an index of ease of travel, found differences among linear feature types and between linear features and controls. However, the magnitude of the differences for both comparisons was modest. Even the Dempster Highway only conveyed a 35% increase in walking speed over off-line plots. Other researchers, in other areas, often observed walk speeds on linear features were often at least twice as fast as off-line transects (Keim et al. 2019a). Two conditions associated with the Eagle Plains area appear to limit the advantage of travelling on linear features. One is that the vegetation in most ecosites and structural stages is relatively open and has a limited effect on impeding movement. The second factor is that ground conditions limiting movement, including soft, thick peat and graminoid tussocks, were similar on both on-line and off-line plots for most linear feature types.

Notwithstanding the modest magnitude of faster walking speeds on-lines, there were clear patterns in walking speed differences across linear feature types. 2D lines were the one feature type where walking speeds were slower on lines than off lines. This reflected the thick, shrub stage vegetation that had regenerated on most 2D lines, which impeded travel (similar to the effect that regenerating vegetation had on sightline distances in the previous section). Walk speeds decreased across the other feature types in relation to line width and the degree to which ground cover was levelled or compacted. 3D seismic lines allowed slightly easier travel than paired off-line plots. They usually had lower vegetation cover and clearer route selection. As linear feature width decreased in 3D lines, walking speed also decreased. This implies that width may be related to functional recovery, with narrower lines having smaller impacts than wider lines, even within an already narrow linear feature type. Although ease of travel was greater in 3D seismic lines than surrounding community, it is expected that this will decrease in future years as vegetation increases in height and density.

5.5 FUNCTIONAL RECOVERY OF LINEAR FEATURES

Functional disturbance is defined in the NYRLUP and PWRLUP as "*physical land use disturbance that results in disruption of soil or hydrology, or that requires the cutting of trees*." One of the main concerns with linear disturbances under these land use plans is that such features can technically allow increased access to previously remote areas, potentially leading to a greater harvest of wildlife and fish, higher predation rates, and a change in how people and wildlife use the land (Vuntut Gwitchin Government and Yukon Government 2009). A disturbance can be considered functionally recovered and subtracted from the overall linear density when it no longer facilitates access or travel by humans or wildlife (Vuntut Gwitchin Government and Yukon Government 2009), or otherwise no longer functions as a surface disturbance (Peel Watershed Planning Commission 2019). Both plans use 1.5 m vegetation height as a threshold for functional recovery in forested communities. The

PWRLUP includes the following additional criterion for recovery "*in non-forested areas (dominated by vegetation under 1.5 m), when the disturbed area is covered by native species roughly the same height and composition as the surrounding dominant vegetation*" (Peel Watershed Planning Commission 2019):

One limitation of using height alone as a functional recovery criterion is that it does not consider vegetation density. Although regeneration may meet the recommended height criteria, if it is very sparse (as is often the case in the Eagle Plains Ecoregion), it may still facilitate access and travel by humans and wildlife. Attachment Photo A-25 provides an example in the Eagle Plains RSA where tall but sparse regeneration meets the 1.5 m criteria but does not inhibit access or travel.

The combined results of this study indicate that using regeneration to the Tall Shrub structural stage may be a more appropriate criterion for functional recovery. Attachment Photo A-3 and Attachment Photo A-10 provide examples of linear features that have regenerated to a tall shrub structural stage. Using the Tall Shrub criterion, 38% of all linear features in the RSA would be considered functionally recovered compared to 53% using the 1.5 m height criterion. For this study, the more conservative criterion of reaching the Tall Shrub structural stage was used to adjust (reduce) linear feature densities.

5.6 LINEAR FEATURE INVENTORY AND DENSITY

This study was successful in mapping all linear features within the RSA. The combined results of the mapping exercise and the field studies found that the extent of open habitats (burns and naturally open habitats like wetlands and shrublands), and the degree of vegetation regeneration, played a significant role in the effective density of linear features across the RSA. Before accounting for open areas and regeneration, the total linear feature density was 1.79 km/km². After accounting for open areas and vegetation regeneration (to the Tall Shrub structural stage), the effective linear feature density was 0.52 km/km². The NYRLUP and PWRLUP suggest cautionary levels for linear density of 0.75 km/km² and critical levels of 1.0 km/km² (Vuntut Gwitchin Government and Yukon Government 2009, Peel Watershed Planning Commission 2019).

The Yukon Land Use Planning Council (YLUPC) was conducting a pilot study of surface disturbance across the broader Eagle Plains Ecoregion (Skinner 2021) at the same time as this study. The methods they used consisted of mapping and attributing human-caused disturbances solely using high-resolution satellite imagery. The YLUPC classified vegetation into eight broad classes based on whether the surrounding area was forested or non-forested, the similarity of vegetation on-line to off-line, and the presence or absence of woody cover (i.e., shrubs or trees). The features were then classified as recovered or not-recovered based on the presence of woody cover (recovered) or, if woody cover was not present, the similarity to surrounding vegetation (i.e., if similar then recovered, if not similar, then not-recovered). Historical field data and photographs from the area (Simpson 2008) were used to verify interpretations.

The spatial data from the YLUPC work was not available to compare in detail to the linear feature inventory compiled in this study. However, the mapping linework is expected to be very similar because satellite imagery was used to verify and supplement the linear feature geospatial data compiled in this study (presumably the same satellite imagery that YLUPC used because the imagery was obtained from Yukon Geomatics). One

difference between the two products is that the YLUPC completed the inventory for the entire Eagle Plains Ecoregion, while this study was restricted to the RSA. Another difference is that the attribute data in this study is expected to be more detailed and more precise than the YLUPC data because (i) the original geospatial data includes some information, like date of creation, that would be impossible to estimate from imagery, and (ii) because this study linked field surveys to the mapping exercise to determine line widths and other characteristics more precisely.

Although it is impossible to directly compare the linear feature density estimates between the two studies, due to the different study extents, the general pattern of results is similar. The YLUPC estimated the linear density (accounting for recovery) to be 0.38 km/km² across the entire Eagle Plains Ecoregion. This is consistent with the estimate from this study for the RSA of 0.52 km/km² because the portion of the Ecoregion outside the RSA has lower linear feature density than the RSA.

6 CONCLUSION

This study successfully mapped all linear features within the RSA and measured a suite of structural, vegetation, and functional characteristics across different feature types. Generally, the effects associated with linear features (i.e., differences between conditions on-line and adjacent off-line areas) correlated to feature width and the degree of ground disturbance. In terms of combined effects across the range of feature types that occur in the Eagle Plains RSA, the ranks were:

Dempster Highway >>> Winter Roads > 2D Seismic > 3D-5m >> 3D Conductor > 3D Receiver[2]

The effects of 3D lines (both conductor and receiver lines) appear to be substantially lower than other feature types. This reduced magnitude of effects is important because 3D lines have the longest combined length of exiting linear features. They are also the predominant feature planned for the next exploration program. Important findings for 3D lines include:

- Relatively narrow line widths of 2–3 m are often smaller than natural tree spacing and minimize the potential for changes to microsite conditions (e.g., solar radiation, air and ground moisture) reported in other studies.
- Minimal ground disturbance and maintenance of the moss, herb, and low shrub layers, which retains the natural vegetation community and accelerates vegetation regeneration.
- Successful application of mitigations, notably dogleg bends that minimize sightlines, ease of human travel, and visibility of lines from roads.
- Ungulate use of 3D lines in winter was less than a third of the rate observed on 2D lines and winter roads.

The adverse effects of linear features in other areas are often caused or exacerbated by human use after the lines are initially constructed, including effects on vegetation regeneration and predator-prey dynamics. Human use does not appear to be a significant factor in Eagle Plains. No sign of human use was observed outside the Dempster Highway corridor.

Substantial vegetation regeneration has occurred on existing features in the Eagle Plains RSA. Previous work by the Yukon Government identified the potential for atypical successional trajectories to occur on linear features in the region. Although atypical succession occurred to a limited extent, this study determined that 81% of the sites exhibited a normal succession (100% on 3D lines). Only 5% exhibited inhibited regeneration trajectories (mostly stagnated succession on winter roads). Regarding functional recovery, 53% of sites met the NYRLUP and PWRLUP criterion of vegetation reaching 1.5 m, and 38% of sites met the criterion of attaining a Tall Shrub structural stage. Using the Tall Shrub structural stage as a criterion of functional recovery may be a more ecologically appropriate criterion to meet LUP objectives.

The extent of open habitats (e.g., burns, wetlands and shrublands) and the degree of regeneration on existing linear features (mostly the older 2D lines and winter roads) play an important role in calculating effective linear

[2] Relative magnitudes of effects: >>> large effect, >> moderate effect, > small effect.

feature density in the RSA. Before accounting for open areas and regeneration, the total linear feature density was 1.79 km/km². After accounting for open areas and vegetation regeneration (to the Tall Shrub structural stage), the effective linear feature density was 0.52 km/km².

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ATTACHMENTS

ATTACHMENT A EAGLE PLAINS PROJECT LINEAR FEATURES SURVEY PHOTOGRAPHS



Attachment Photo A-1. Air survey plot SL237, an unburnt 2D seismic line undergoing normal succession at a young forest structural stage when surveyed.



Attachment Photo A-2. Air survey plot SL269, an unburnt 2D seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-3. Ground survey plot SL310, an unburnt 2D seismic line undergoing normal succession at a tall shrub structural stage when surveyed.



Attachment Photo A-4. Aerial view of 3D seismic lines undergoing normal succession – meandering routes were used to mitigate some functional disturbance impacts.



Attachment Photo A-5. Ground survey plot SL357, a burnt 3D5 seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-6. Ground survey plot SL277, an unburnt 3Dc seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-7. Ground survey plot SL255, an unburnt 3Dr seismic line undergoing normal succession at a low shrub structural stage when surveyed.



Attachment Photo A-8. Aerial view of a burnt 2D seismic line undergoing magnified succession at a tall shrub structural stage when observed.



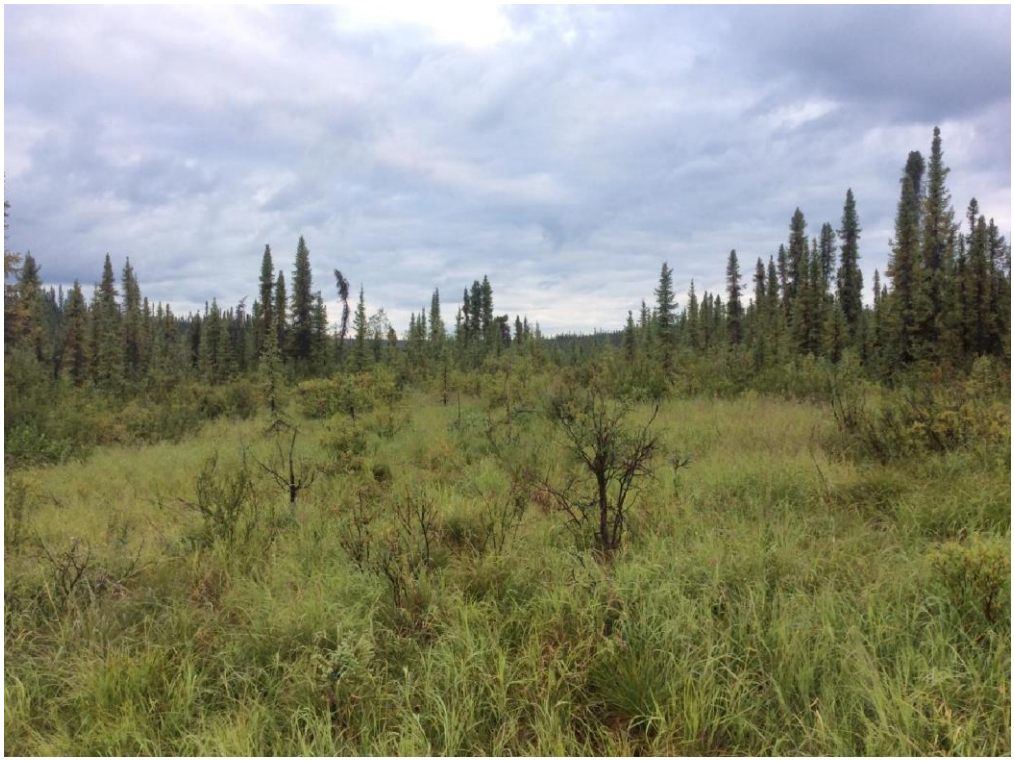
Attachment Photo A-9. Air survey plot SL234, an unburnt winter road undergoing magnified succession at a sapling forest structural stage when surveyed.



Attachment Photo A-10. Ground survey plot SL317, a burnt 2D seismic line undergoing magnified succession at a tall shrub structural stage when surveyed.



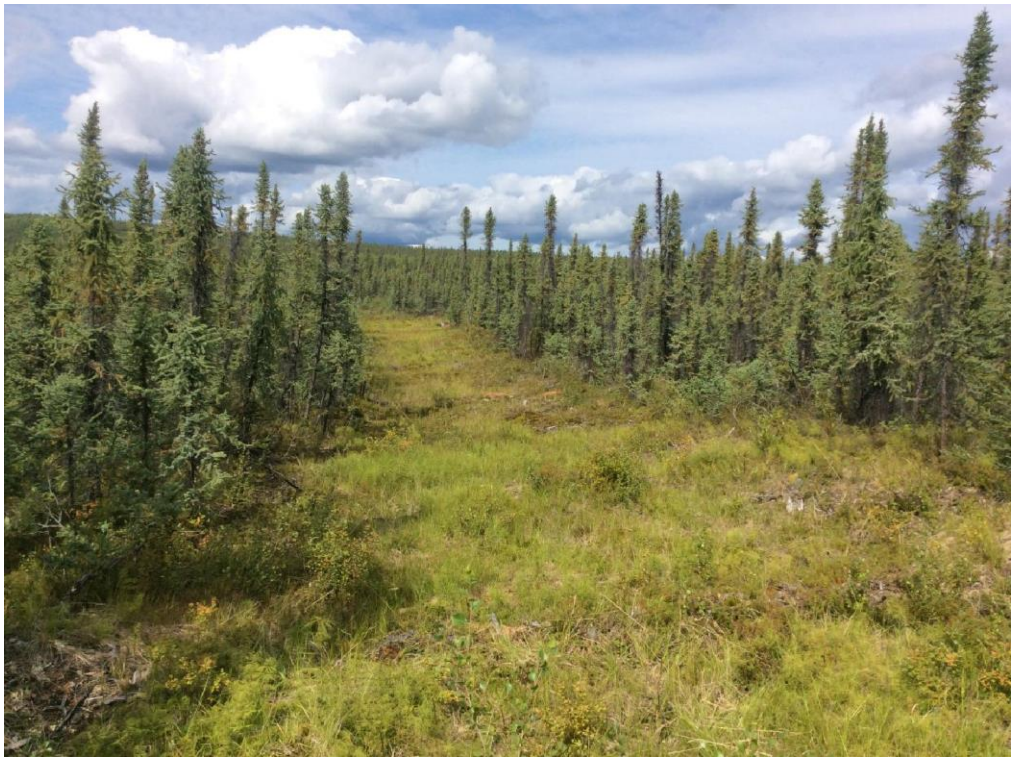
Attachment Photo A-11. Air survey plot SL238, an unburnt winter road undergoing stagnated succession at a forb-dominated herb structural stage when surveyed.



Attachment Photo A-12. Ground survey plot SL264, an unburnt winter road undergoing stagnated succession at a graminoid-dominated herb structural stage when surveyed.



Attachment Photo A-13. Ground survey plot SL226, a burnt 2D seismic line undergoing normal succession at a forb-dominated herb structural stage when surveyed.



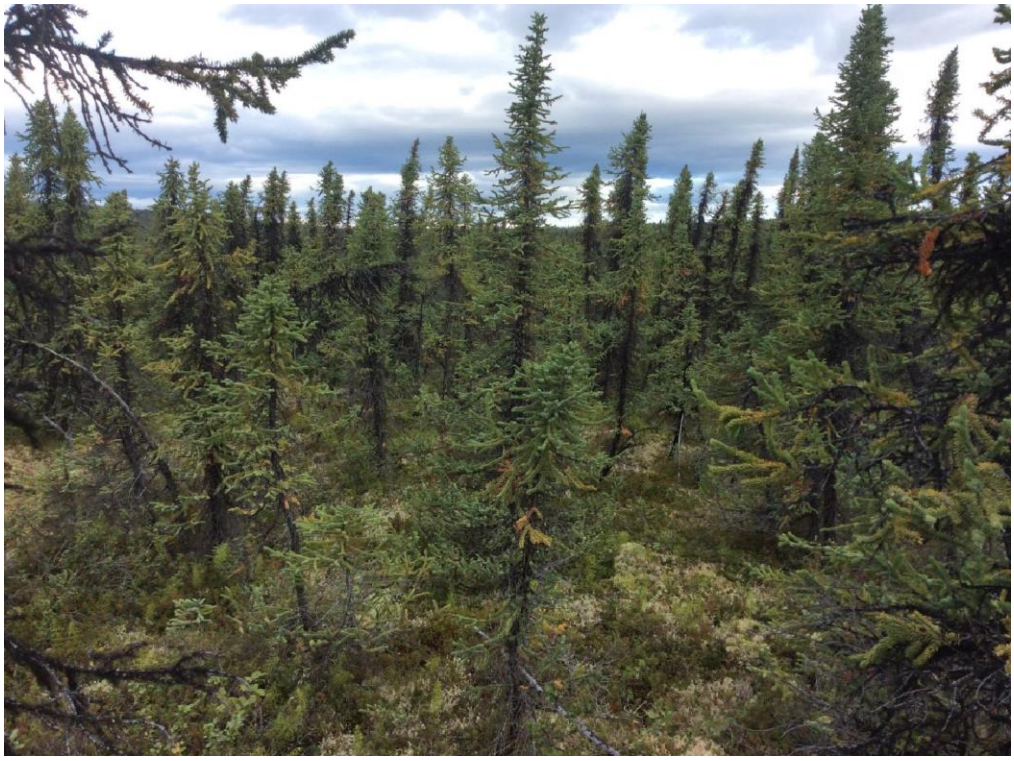
Attachment Photo A-14. Ground survey plot SL329, an unburnt 3D5 seismic line classified as recent disturbance at a forb-dominated herb structural stage when surveyed.



Attachment Photo A-15. Ground survey plot SL338, an unburnt, undisturbed reference plot at a low shrub structural stage when surveyed.



Attachment Photo A-16. Ground survey plot SL350, a burnt undisturbed reference plot at a low shrub structural stage when surveyed.



Attachment Photo A-17. Ground survey plot SL304, an unburnt undisturbed reference plot at a tall shrub structural stage when surveyed.



Attachment Photo A-18. Ground survey plot SL346, a burnt undisturbed reference plot at a tall shrub structural stage when surveyed.



Attachment Photo A-19. Ground survey plot SL3260, an unburnt undisturbed reference plot at a mature forest structural stage when surveyed.



Attachment Photo A-20. Ground survey plot SL264, an unburnt undisturbed reference plot at an old forest structural stage when surveyed.



Attachment Photo A-21. Ground survey plot SL243, a burnt winter road with melt pockets present, indicating permafrost degradation.



Attachment Photo A-22. Air survey plot SL228, a burnt 2D seismic line recovering at the same rate and stage as the surrounding community.



Attachment Photo A-23. Air survey plot SL326, a burnt winter road recovering at the same rate and stage as the surrounding community.



Attachment Photo A-24. Ground survey plot SL287, a burnt 3Dr seismic line recovering at the same rate and stage as the surrounding community.



Attachment Photo A-25. Ground survey plot SL216, a feature with regenerating trees over 1.5 m tall but very sparse, illustrating one of the limitations of the NYLUP and PWRLUP functional recovery threshold.

ATTACHMENT B DATA FORMS

Eagle Plains Linear Features Study

Surveyors: _____ **Date**: _____ **Type**: Air / Ground

Waypoint: _____ **Map Info**: _____

Line Widths: ____/____/____/____ **% Mulch**:_____

Succ. Class: Normal / No Succ / Magn / Stagn / Regress / Rcnt Dist

	On Line	Off Line
Struct. Stage		
Veg Ht / Spp	/	/
% Tree		
Tree Spp		
% Shrub		
Shrub Spp		
Ecosite		
Photos		
Sight Line (m)	/	/
Walk Test*	Dist: Time: Surveyor:	Dist: Time: Surveyor:

*Use same Surveyor for both walk tests.

Comments: _____

Eagle Plains Linear Features Study

Surveyors: _____ **Date**: _____ **Type**: Air / Ground

Waypoint: _____ **Map Info**: _____

Line Widths: ____/____/____/____ **% Mulch**:_____

Succ. Class: Normal / No Succ / Magn / Stagn / Regress / Rcnt Dist

	On Line	Off Line
Struct. Stage		
Veg Ht / Spp	/	/
% Tree		
Tree Spp		
% Shrub		
Shrub Spp		
Ecosite		
Photos		
Sight Line (m)	/	/
Walk Test*	Dist: Time: Surveyor:	Dist: Time: Surveyor:

*Use same Surveyor for both walk tests.

Comments: _____

Appendix C. Literature Summary

1 SUMMARY OF ZOI STUDIES ON CARIBOU

This document was prepared by K. Bajina, and reviewed by Todd Mahon (January 2023) and Mike Setterington (April 2023). It was prepared as background materisl or the Chance Oil and Gas Project caribou effects assessment.

Key notes on the summary of studies presented in Table 1 are presented below.

- There is a weight of evidence that ZOIs often do occur for caribou, but some studies found no effect or even selection for proximity to disturbances.
- Estimates of ZOI distances vary widely from several hundred metres to tens of kilometres. Estimates of a zone of influence distances vary with disturbance type, location, habitat, season, year, weather, herd, sex/age classes, study design, sample size, and analytical method used.
- Estimates for the same herd vary substantially from year to year.
- In all studies, the observed effect was reduced use within a ZOI, not complete avoidance. The response is graded, with maximum reduction occurring at the disturbance and then use increasing out to the ZOI distance. Most studies report the maximum reduction, so the overall magnitude of the effect across the ZOI is approximately half the magnitude of the effects reported (but a few studies indicate non-linear responses or provide estimates at varying distances).
    - The effects on the CAH and the Bathurst herds, which have been studied intensively, have been mostly linked to habitat use, movement, and local distribution. No effects have been linked to changes in abundance, demographics, or seasonal movement patterns.
    - The magnitude of the effect of ZOI relative to environmental covariates is variable. Often the magnitude of the effect of the ZOI is weaker than environmental variables, contributing to the variability of ZOI distances reported.
- Both the distance and magnitude of effects for ZOIs typically relate to the intensity of human disturbance. A general pattern across studies is that effects are greatest for Settlements and Mines, followed by high-use roads, then oil and gas development, and forestry.
    - The relationship between effects and intensity of disturbance also applies within a sector. For example, effects are greater for high-use roads than low-use roads. For O&G wells, ZOI distances relate to activity level – drilling > production > inactive.
- Several researchers suggest that the primary mechanism behind caribou ZOIs is that caribou perceive anthropogenic features and/or sensory disturbances as a threat, real or not, and avoid those areas (Frid and Dill 2002, Boulanger et al. 2021). Where hunting or facilitated predation occurs, ZOIs are likely to be larger, have a higher magnitude of effects, and persist longer.

- Some studies suggest that habituation to predictable disturbances over time (e.g., CAH) has resulted in reduced effects. Areas with variable disturbances, especially where hunting occurs, have greater effects that do not diminish over time.

Table 1. Summary zones of influence and management buffers for caribou

#	ZOI/Management Buffer	Source	Literature Type	Subspecies/ Ecotype	Location/ Herd	Mechanism	Type of Assessment	Context/Comments
1	No ZOI detected; same data as Boulanger et al. (2012)	(Golder Associates Ltd. 2020)	Report	Barren-ground	Bathurst caribou herd	Change in distribution (sensory disturbance)	Quantitative	RSF analysis of caribou abundance from aerial survey data during July-Nov (1998-2012) ZOI is calculated by controlling for area effect when evaluating caribou habitat and numbers (i.e., as the availability of area around a footprint increases (buffer size considered), so too does the potential for preferred caribou habitat Tested interaction between distance to development and area of preferred habitat; no significant interaction was found, meaning preferred habitat area increased at farther distances (as expected) Animal relative abundance increased with the amount of preferred habitat (and distance to development)
2	1–5 km for linear features 1–15 km for polygonal (largest are active mine site [14 km] and settlement [15 km], all else ≤ 5 km)	(GNWT Environment 2018)	Report	Barren-ground	Bathurst caribou herd	Effective habitat loss	Qualitative	Bathurst range plan (draft, supporting report); prescribed ZOIs around human developments for barren-ground caribou Different ZOIs prescribed to feature type (e.g., linear vs polygonal) and class (e.g., all-season vs winter road) based on a compilation of literature and project examples
3	<u>Aerial surveys:</u> 20.5 km ZOI based on caribou presence/absence (but odds ratio no different from 1, thus no true ZOI) 37.5 km based on caribou counts <u>Camera traps:</u> 5 km from the project	(TMAC Resources 2017)	Report	Barren-ground	Dolphin and Union, and Beverly herds	Change in distribution (sensory disturbance)	Quantitative	ZOI analysis from 1996-2005 (aerial surveys) and 2012+ (camera traps) for the Final Environmental Impact Statement for the Madrid-Boston Project (based on effects of the Doris Project) RSF (presence/counts) using PCA compositive variables describing habitat and NDVI for the post-calving season, and segmented regression as per Boulanger et al. (2012)
4	Graded ZOI at 4km from mine; reduced habitat effectiveness within ZOI (<1 km, 2 km, and 4 km) 2km from road; reduced habitat effectiveness within ZOI	(EDI Environmental Dynamics Inc. 2017)	Report	Barren-ground	Fortymile caribou herd	Effective habitat loss	Qualitative	YESAB project proposal for the Coffee Gold Mine in Yukon RSF habitat model was created, and multipliers were applied to mapped RSF pixels at intervals within ZOIs ZOIs based on literature review Calculated reduction in habitat effectiveness
5	Graded ZOI at 14 km; disturbance coefficients within ZOI based on distance and feature type	(Agnico Eagle Mines Ltd. and Golder Associates Ltd. 2014)	Report	Barren-ground	Qamanirjuaq caribou herd	Effective habitat loss	Qualitative	Final Environmental Impact Statement for Agnico's Meliadine Gold Project in Nunavut Implemented a ZOI framework based on the results of the study completed by Boulanger et al. (2012)

#	ZOI/Management Buffer	Source	Literature Type	Subspecies/ Ecotype	Location/ Herd	Mechanism	Type of Assessment	Context/Comments
	50–70% of (limited) collar data during winter fell within ZOI							Applied disturbance coefficients within ZOI based on feature and distance, and calculated use of the area within the ZOI by the herd
6	Graded ZOI at 4 km; no effect beyond 4 km and intensifying effect at intervals towards the PDA	(Casino Mining Corporation 2014)	Report	Woodland (Northern mountain)	Klaza caribou herd	Effective habitat loss	Qualitative	Applied ZOI/disturbance buffers for the Casino Project in west-central Yukon, Canada ZOI chosen based on a literature review Reduced habitat effectiveness within the ZOI, ranging from 40-80% reduction to calculate the effect (reduced use) on herd
7	14 km from mine; reduced ratings within ZOI (<7 km and 7–14 km) 4km from roads; reduced ratings within ZOI (<1 km and 1–4km)	(Areva Resources Canada 2014)	Report	Barren-ground	Ahiak and Qamanirjuaq caribou herds	Effective habitat loss	Qualitative	Developed a habitat unit index model for habitat availability (winter [Oct 1-May 31] and growing [June 1-September 30] seasons) and decreased ratings based on the distance to mine and road for the Kiggavik project ZOIs based on literature review Habitat ratings (nil, low, moderate, and high) were reduced two classes for the closest distance interval and 1 class for the furthest distance interval within the ZOI
8	15 km from mine 5 km from road But little to no effect on demography	(Russell 2014)	Report	Barren-ground	Qamanirjuaq caribou herd	Change in population demography (pregnancy rate and mortality) and effective habitat loss	Qualitative ZOIs Quantitative energy model	Implemented qualitative ZOIs (based on literature) to develop energy-protein and population modelling of the herd for the Kiggavik project Final Environmental Impact Statement Assumed 6% decreased foraging and 3% increased walking/ running within the ZOI Determined a potential 1% decline in pregnancy rate and a 0.93% increase in overwinter calf mortality Final population model estimates from Project effects were indistinguishable from baseline conditions
9	Graded ZOI at 14km; no effect beyond 14 km and intensifying effect at intervals towards the PDA	(Baffinland Iron Mines Corporation 2012)	Report	Barren-ground	North Baffin caribou	Effective habitat loss	Qualitative	Final Environmental Impact Statement for Baffinland's Mary River Project Implemented a ZOI framework based on the results of the study completed by Boulanger et al. (2012) RSPF habitat model was created, and multipliers were applied to mapped RSPF pixels at intervals within ZOIs; ZOIs were the same, but intervals were different among features
10	40 km ZOI in 3 years (2001, 2005 and 2009) and 15 km in 2006, but the influence of Lac de Gras was greater than the level of mine activity	(Rio Tinto 2012)	Report	Barren-ground	Bathurst caribou herd	Change in distribution and behaviour (sensory disturbance)	Quantitative	Quantified ZOIs based on aerial survey data for several years at the Diavik mine Distribution was assessed, and behavioural scans were conducted at distance intervals from the mine

#	ZOI/Management Buffer	Source	Literature Type	Subspecies/ Ecotype	Location/ Herd	Mechanism	Type of Assessment	Context/Comments
	10% reduction in feeding/rest within 5km							
11	500 m (10 distances from 50 to 4,000 m were examined)	(Environment Canada 2011)	Report	Woodland (Boreal)	A meta-analysis from herds across Canada	Change in population demography (recruitment)	Quantitative	A meta-analysis examining the effect of anthropogenic disturbance and fire on herd growth rates based on the recruitment-disturbance relationship Found that herds with >35% disturbed (500 m) +fire were consistently declining This finding has been carried forward as a criterion for critical habitat in all woodland caribou recovery strategies, including Mountain Caribou
12	Graded ZOI up to 15 km; disturbance coefficients within ZOI based on distance and feature type	(De Beers Canada Inc. 2010)	Report	Barren-ground	Bathurst, Ahiak, and Beverly caribou herds	Effective habitat loss	Qualitative	Environmental Impact Statement for De Beer's Gahcho Kue Project in Northwest Territories Applied disturbance coefficients to mapped RSF outputs (spring, post-calving, and fall migration) from Johnson et al. (2005) within ZOI based on feature and distance Used results to calculate relative changes in the availability of different quality habitats and residency within ZOI
13	Low-level human influence (500 m) up to high-level human influence (1km); used lower, middle, and upper level ZOIs for different feature types, which also differed in their range of ZOIs	(Applied Ecosystem Management Ltd. 2004)	Report	Woodland (Northern mountain)	Carcross caribou herd	Effective habitat loss	Qualitative	Calculated cumulative effects (i.e., loss of effective habitat) of development on the herd using pre-specified ZOI/disturbance buffers ZOIs were chosen from literature and based on professional judgement
14	−12.8–12.76 km (Negative to positive ZOIs; negative implies attraction to mine areas). OR ranged from 1.7-7.4 for avoided years; −0.4 to −1.3 selected years (but ns)	(Boulanger et al. 2021)	Published	Barren-ground	Bathurst caribou herd	Change in distribution (sensory disturbance)	Quantitative	RSF analysis of GPS telemetry data during the growing season (July 15 to Nov 30) 2009–2017 Quantified ZOIs for each year using segmented regression; 4/9 years had negative ZOIs or no different than zero, and 5/9 years had positive ZOIs Differences in ZOIs possibly linked to drought conditions
15	1 km from oil wells during winter (Fig 2)	(MacNearney et al. 2021)	Published	Woodland (Central mountain)	Narraway and Redrock-Prairie Creek subpopulations	Change in distribution (sensory disturbance)	Quantitative	RSF analysis of GPS telemetry data during early/late winter from 2007-2013 Avoidance was greatest during active drilling and less during inactive/production phases
16	1.5–3 km for cutblocks and linear features	(Palm 2021)	MSc Thesis	Woodland and Barren-ground	31 populations in western	Change in population demography and	Quantitative	Assessed resource selection (step-selection functions) of 31 populations of caribou to determine the effects of human/natural disturbance on behaviour, then evaluated whether those behavioural responses influenced demographic

#	ZOI/Management Buffer	Source	Literature Type	Subspecies/ Ecotype	Location/ Herd	Mechanism	Type of Assessment	Context/Comments
	3–4 km for polygonal disturbances (mines and oil/gas wells)				Canada and Alaska	distribution (sensory disturbance)		processes (calf recruitment [22 populations] and adult female survival [25 populations]) Two seasons were considered: summer (May 25-Oct 5) and winter (Oct 6-May 24) Exp1onential decay functions to identify ZOIs Also found that increased avoidance of roads was the best predictor of adult female survival and a significant predictor of recruitment
17	5 km (calving) 2 km (post-calving) 1 km (mosquito period)	(Johnson et al. 2020)	Published	Barren-ground	Central Arctic caribou herd	Change in distribution (sensory disturbance)	Quantitative	RSF analysis of GPS-collared females for several seasons (2015-2017) in the North Slope of Alaska (oil development area) Iterative predicted-vs-observed utilization at 1km intervals around the development to identify ZOI
18	1–2 km (mosquito season) to 10–11 km (post-calving)	(Prichard et al. 2020)	Published	Barren-ground	Central Arctic caribou herd	Change in distribution and relative density (sensory disturbance)	Quantitative	Assessed relative densities and distribution using GPS telemetry data to calculate the overlap of Brownian bridge models and integrated step-selection functions Relative density in proximity to roads varied by season, e.g., greatest avoidance during post-calving but close to roads during peak mosquito season The relative selection was greater closer to roads in 4/9 seasons/periods
19	40 km from roads during spring 100 km from roads during calving 20 km from roads during insect season 40 km from roads during late-summer No association with roads during the fall 38 km from roads during winter	(Baltensperger and Joly 2019)	Published	Barren-ground	Western Arctic caribou herd	Change in distribution (sensory disturbance)	Quantitative	Machine-learning algorithm (TreeNet) to analyze telemetry data of caribou in northwestern Alaska during several seasons from 2009-2017 ZOIs ranged greatly depending on season and type of disturbances The pooled seasonal model found a ZOI of 40km
20	<u>Summer:</u> 19–23 km from Raglan mine 2–4 km from mining exploration 2–4 km from human settlement 0–8 km from road <u>Winter:</u> 3–21 km from mining exploration	(Plante et al. 2018)	Published	Woodland (Boreal)	Riviere-aux-Feuilles and Riviere-George herds in northern Quebec and Labrador	Change in distribution (sensory disturbance)	Quantitative	RSF analysis of GPS telemetry data during summer and winter from 2009-2015 Iterative predicted-vs-observed utilization at 1km intervals around development to identify ZOI (Raglan mine and road) ZOIs were highly variable for disturbance types, years, and seasons

#	ZOI/Management Buffer	Source	Literature Type	Subspecies/ Ecotype	Location/ Herd	Mechanism	Type of Assessment	Context/Comments
	2–18 km from human settlement 5 km from power lines in 1 year <u>All:</u> 0–15km for other roads							
21	<u>Seismic and pipelines:</u> Attracted in 2/5 subpopulations during winter; 0.5-2km in others Attracted in 3/5 subpopulations during summer; 2.5–13.5km for others <u>Roads</u>: 1–1.75 km during winter Attracted in 2/5 subpopulations during summer; 1.5–1.75 km in others <u>Non-linear oil and gas</u> Attracted in 4/5 subpopulations during winter; 2km in other Attracted in 1/5 subpopulation during summer; 4–12.5 km in others	(Johnson et al. 2015)	Published	Woodland (Central and Northern mountain)	5 subpopulations in the South Peace region, British Columbia, Canada	Change in distribution (sensory disturbance)	Quantitative	RSF analysis of collar data for 5 subpopulations during summer and winter from 2000-2011 ZOIs were determined using log-likelihood asymptotes of models with iterative inclusion of collared/random locations Note: 12.5km and 13.5km in estimates (to left) were uncertain due to more than 1 asymptote in the log-likelihood curve
22	30 km down to 18.5 km (roads) 11 km down to 6 km (wells trails, winter roads, and seismic lines)	(Johnson and Russell 2014)	Published	Barren-ground	Porcupine caribou herd	Change in distribution (sensory disturbance)	Quantitative	RSF analysis of collar data for two periods (1985-1998 and 1999-2012) ZOIs were determined using log-likelihood asymptotes of models with iterative inclusion of collared/random locations Reduced 'avoidance' distance between periods, approximately 50% difference in magnitude
23	5 km from roads	(Leblond et al. 2013)	Published	Woodland (Boreal)	Laurentides Wildlife Reserve, Quebec, Canada	Change in distribution (sensory disturbance)	Quantitative	RSF analysis (all seasons) of GPS telemetry data from April 2004 and March 2010 Reduced use within 5km during and after road construction Avoided habitat types within that zone which were otherwise selected at the home range scale
24	11–14 km	(Boulanger et al. 2012)	Published	Barren-ground	Bathurst caribou herd	Change in distribution (sensory disturbance)	Quantitative	RSF analysis of aerial surveys and satellite-collared cows during growing seasons (summer range; mid-July to mid-Oct) 1998-2008 Segmented regression approach to estimate ZOI (log-likelihood curves), which were potentially linked to dustfall extent

#	ZOI/Management Buffer	Source	Literature Type	Subspecies/ Ecotype	Location/ Herd	Mechanism	Type of Assessment	Context/Comments
25	1 km (low-use roads) 2 km (high-use roads) 9 km in summer and 3km in winter (towns) 2 km in summer and 250 m in winter (mines) 1.5 km in summer (camps)	(Polfus et al. 2011)	Published	Woodland (Northern mountain)	Atlin caribou herd	Change in distribution (sensory disturbance)	Quantitative	RSF analysis of GPS telemetry data during winter and summer from 2000-2002 Avoidance differed depending on activity level and season
26	4 km (most seasons) during mine construction 6 km for decrease in group size and number	(Weir et al. 2007)	Published	Woodland (Boreal)	La Poile caribou herd (Hope Brook mine, Newfoundland)	Change in distribution (sensory disturbance)	Quantitative	Assessed caribou distribution and abundance based on aerial surveys from 1985-1991 during different phases of mine activity (pre-disturbance, construction and open-pit mining, and underground mining and mill operation) Caribou distribution, abundance, and group size decreased in proximity to the mine
27	4–6 km in post-road development phase	(Joly et al. 2006)	Published	Barren-ground	Central Arctic caribou herd	Change in abundance (sensory disturbance)	Quantitative	Re-analyzed Noel et al. (2004) data and found a change in the number of caribou between pre- and post-road construction phases >300% change in the number of caribou at distances 4-6km from the road
28	4 km (fall migration) for mineral exploration to ~130 km (post-calving) for major disturbance	(Johnson et al. 2005)	Published	Barren-ground	Bathurst caribou herd	Change in distribution (sensory disturbance)	Quantitative	RSFs from caribou telemetry data during different seasons (spring migration and calving, post-calving, and fall migration) from 1996-2000 Quadratic terms for distance to disturbance types (i.e., major disturbance, mineral exploration, outfitter) identified potential ZOIs that varied greatly
29	4 km	(Cameron et al. 2005)	Published	Barren-ground	Central Arctic caribou herd	Change in distribution (sensory disturbance)	Quantitative	Assessed abundance of calving caribou in Kuparuk Development Area (KPA) west of Prudhoe Bay Less than expected abundance within 4km of roads and declined exponentially with road density
30	<1 km (no ZOI) (Tested 6 1-km intervals from road) Effect size difficult to interpret because annual diff in N not taken into account	(Noel et al. 2004)	Published	Barren-ground	Central Arctic caribou herd	Change in abundance/ Density (sensory disturbance)	Quantitative	Assessed caribou numbers and densities at the Milne Point oilfield in northern Alaska during 3 periods: pre-road construction, early post-road construction, and recent post-road construction Calf density was higher within 1 km of road than >1 km from road during recent post-road construction period
31	1 km (oil wells) 250 m (roads and seismic lines)	(Dyer et al. 2001)	Published	Woodland (Northern mountain)	Northern Alberta, Canada	Change in distribution (sensory disturbance)	Quantitative	Assessed the proportion/selection of GPS collared caribou within concentric distance buffers from developments during 5 periods (late winter, calving, summer, rut, and early winter), 1998-1999

#	ZOI/Management Buffer	Source	Literature Type	Subspecies/ Ecotype	Location/ Herd	Mechanism	Type of Assessment	Context/Comments
								Use within different buffer distances were compared to identify maximum avoidance distances
32	106 m – distribution 316 m – mortality	(James and Stuart-Smith 2000)	Published	Woodland (Northern mountain)	Northeastern Alberta, Canada	Change in distribution (sensory disturbance)/ mortality risk	Quantitative	Assessed distribution and mortality of caribou near linear corridors using telemetry data from 1991-1997 Caribou were farther from lines than random locations and died closer to lines than distances kept while alive
33	<1 km (Tested 10 1-km intervals surrounding infrastructure)	(Cronin et al. 1998)	Published	Barren-ground	Central Arctic caribou herd	Change in abundance (sensory disturbance)	Quantitative	Assessed caribou numbers at distances from infrastructure at the Prudhoe Bay oil field in northern Alaska using utilization-availability and log-linear analyses Caribou tended to be more abundant than expected at intervals close to infrastructure, especially bulls or all sexes/ages combined No avoidance detected
34	4 km from roads and production-related facilities; displacement of maternal females from rugged terrain	(Nellemann and Cameron 1996)	Published	Barren-ground	Central Arctic caribou herd	Change in distribution (sensory disturbance)	Quantitative	Assessed the density of calving caribou in relation to rugged terrain at three zones of distance from structures (<4km, 4-10km, and >10km) based on aerial survey data (1987–1992); Prudhoe Bay, Alaska Caribou selected rugged terrain more than expected from availability, but this declined by 52% in areas <4km from structures
35	4 km from road	(Cameron et al. 1992)	Published	Barren-ground	Central Arctic caribou herd	Change in abundance (sensory disturbance)	Quantitative	Assessed the abundance/distribution of calving caribou relative to petroleum-related development based on aerial survey data (1978–1987); Prudhoe Bay, Alaska Relative abundance decreased by 2/3 <2 km and tripled at distances >4km
36	500 m (10 distances from 50 to 4,000 m were examined)	(Environment Canada 2011)	Report	Woodland (Boreal)	Meta analysis from herds across Canada	Change in population demography (recruitment)	Quantitative	Meta-analysis examining the effect of anthropogenic disturbance and fire on herd growth rates based on the recruitment-disturbance relationship Found that herds with >35% disturbed(500 m)+fire were consistently declining This finding has been carried forward as a criterion for critical habitat in all woodland caribou recovery strategies, including Mountain Caribou
37	1 km loss of functional habitat along logging road in Manitoba	(Schindler et al. 2007)	Published	Woodlnd (boreal)	SE Manitoba	Change is distribution/habitat use	Quantitative	Loss of functional habitat is suggested to occur within 1 kilometre of the road
38	1.5 km	(Eftestøl et al. 2019)	Published	Reindeer	Northern Norway	Change in distribution due to sensory disturbance	Quantitative	We found that reindeer significantly reduced habitat use at closer distances to the mine, indicating an influence zone up to 1.5 km. Reductions in use were strongest closest to the mine in high-activity periods. No avoidance effect of the mine was found beyond approximately 0.9 km for the 3-week holidays,

#	ZOI/Management Buffer	Source	Literature Type	Subspecies/ Ecotype	Location/ Herd	Mechanism	Type of Assessment	Context/Comments
								1.0 km for weekends, and 1.5 km for workdays with or without rock blasting. Compared to holidays and weekends, probability of use was reduced by 30–34% within 1.3 km from the mine for workday blasting periods, and up to 35% within 1.4 km for other workdays. Since averted areas can be partly utilized again within days or weeks following intensive mining activity periods, reduced mining activity in crucial periods for reindeer, such as during calving and migration, can be an effective mitigation measure.
39	300 m of a pipeline and 600 m of pipe+road combo (examined 100 m bands out to 1,000 m)	(Murphy and Curatolo 1987)	Published	Barren-ground	Central Arctic	Behaviours and movement rates	Quantitative	When insects were absent, caribou within 600 m of an elevated pipeline and road with traffic, and within 300 m of a pipeline and road without traffic, had significantly different activity budgets than undisturbed caribou; disturbance effects were significantly greater in the site with traffic. Time spent lying and running and movement rates were the best indicators of oilfield disturbance, whereas time spent feeding was not affected. Cow-calf-dominated groups and groups larger than 10 animals reacted to lower levels of disturbance than other group types, but all group types reacted similarly to high levels of disturbance. Separation of elevated pipelines from heavily traveled roads is recommended as a means of minimizing disruption of caribou behavior and movements. Energetic stress resulting from disturbance-induced changes in behavior should be minimal in a properly designed oilfield.

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APPENDIX A. Heritage Resource Overview Assessment: Eagle Plains Basin Exploration Project

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Heritage Resource Overview Assessment: Eagle Plains Basin Exploration Project

(MAY BE INCLUDED IN YESAB MATERIALS
SITE SENSITIVE DATA HAS BEEN REMOVED)

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January 20, 2022

EXECUTIVE SUMMARY

On behalf of Chance Oil and Gas Ltd., Ecofor Consulting Ltd. has conducted a Heritage Resource Overview Assessment (HROA) for the Eagle Plains Basin Exploration Project. This study builds on a previous phase of heritage resource assessment conducted under permit 13-16ASR (Buchanan 2014). The proposed project includes oil and gas exploration work including, but not limited to, drilling, seismic exploration, and access development (e.g. roads and cutlines). The study area covers approximately 238,604 ha on NTS mapsheets 116H/14, 116H/15, 116I/02, 116I/03, 116I/04, 116I/05, 116I/06, 116I/12, 116J/01, 116J/08, and 116J/09, and is located within the traditional territory of the First Nation of Na-Cho Nyak Dun, Tetlit Gwich'in First Nation, Vuntut Gwitchin First Nation. **Note: All specific geographic references to heritage site locations, photographs, and some site details have been removed from this YESAB ready version of this report so that it can be issued publicly while protecting sensitive site data.**

The objectives of this HROA are to assess the heritage resource potential and sensitivity within the study area. To accomplish these objectives, Ecofor has completed a desktop review of the physical/environmental and cultural/historical setting of the study area, and used the data to generate a GIS based Topographic Position Index Based Landform Classification (TPI) heritage resource potential model. Elevated potential for encountering heritage resources is determined through review of multiple factors, including, but not limited to, landform, viewshed, proximity to natural resources (e.g. water, food gathering areas, lithic quarries), and proximity to previously recorded heritage resource sites. No traditional knowledge/traditional land use information was collected or reviewed as part of this study.

This review identified multiple areas of elevated heritage potential for surface/subsurface heritage resource sites. Most areas of elevated potential for undocumented surface/subsurface heritage resource sites are associated with knolls and terraces in the valley bottoms and higher elevation terraces and ridgelines. Moreover, seven archaeological sites have been previously recorded within the study area, with 26 more within a 50 km site search buffer around the exploration area. One Yukon Historic Sites Inventory site has been recorded within the study area, with 13 more having been recorded within 50 km of the study area. Culturally modified tree (CMT) potential was not specifically assessed in this HROA due to a lack of available vegetation inventory data.

Based on the results of this HROA, **Heritage Resources Impact Assessments (HRIAs) are recommended for multiple areas of elevated potential for surface/subsurface heritage resource sites. Moreover, avoidance is recommended for all previously recorded heritage resource sites within the study area. If avoidance is not feasible, then further assessment work**

(e.g. systematic data recovery excavations) should be conducted before the commencement of any ground disturbing activities within known site boundaries. It is recommended that this report be provided to the First Nation of Na-Cho Nyak Dun, Tetlit Gwich'in First Nation, Vuntut Gwitchin First Nation, and should further fieldwork be conducted (e.g. HRIA), it is recommended, where possible, to include First Nation of Na-Cho Nyak Dun, Tetlit Gwich'in First Nation, Vuntut Gwitchin First Nation representatives in that fieldwork.

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1.0 INTRODUCTION

On behalf of Chance Oil and Gas Ltd., Ecofor Consulting Ltd. has conducted a Heritage Resource Overview Assessment (HROA) for the Eagle Plains Basin Exploration Project (Figure 1). This study builds on a previous phase of heritage resource assessment conducted under permit 13-16ASR (Buchanan 2014). The proposed project includes oil and gas exploration work including, but not limited to, drilling, seismic exploration, and access development (e.g. roads and cutlines). The study area covers approximately 238,604 ha on NTS mapsheets 116H/14, 116H/15, 116I/02, 116I/03, 116I/04, 116I/05, 116I/06, 116I/12, 116J/01, 116J/08, and 116J/09, and is located within the traditional territory of the First Nation of Na-Cho Nyak Dun, Tetlit Gwich'in First Nation, Vuntut Gwitchin First Nation. **Note: All specific geographic references to heritage site locations, photographs, and some site details have been removed from this YESAB ready version of this report so that it can be issued publicly while protecting sensitive site data.**

1.1 HROA Objectives

The objectives of this HROA are to assess the heritage resource potential and sensitivity within the study area. To accomplish these objectives, Ecofor has completed a desktop review of the physical/environmental and cultural/historical setting of the study area, and used the data to generate a GIS based Topographic Position Index Based Landform Classification (TPI) heritage resource potential model. Elevated potential for encountering heritage resources is determined through the review of multiple factors, including, but not limited to, landform, viewshed, proximity to natural resources (e.g. water, food gathering areas, lithic quarries), and proximity to previously recorded heritage resource sites. No traditional knowledge/traditional land use information was collected or reviewed as part of this study.

1.2 Report Format

The report begins with a basic outline of the project and the objectives of the work undertaken. The proposed activities and their impacts are then discussed in Section 2.0. Section 3.0 describes the methods employed in assessing the archaeological potential. Section 4.0 provides a description of the physical/environmental and cultural/historical setting of the study area. Section 5.0 presents an evaluation of the heritage resource potential within the various localities being considered within the study area, Section 6.0 provides a summary of this analysis and a series of heritage resource management recommendations for the study area, and Section 7.0 lists the references cited. Three appendices are included at the end of the report[1]. Appendix A

[1] Note: These appendices A and B have been removed from this YESAB ready version of this report so that it can be issued publicly while protecting sensitive site data.

Figure 1 Overview Map

Eagle Plains

Chance Oil and Gas Limited

ECOFOR

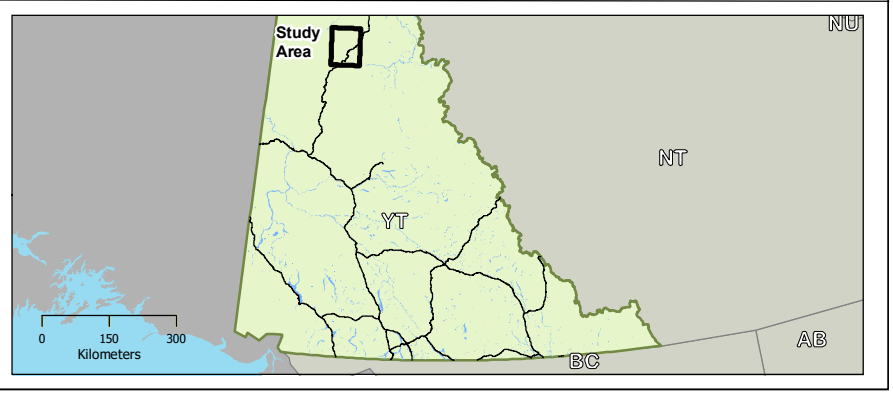
Ecofor Consulting Ltd. December 2, 2021 (JM)

Road
Trail
Contour
Watercourse
Waterbody
Wetland
Town
Highway
Study Area
Surveyed Land Parcel
First Nation Settlement Land

1:250,000

0 5 10 km

NAD 1983 UTM Zone 8N



Disclaimer: This product is for informational purposes only and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. The base data layers have been obtained from the National Topographic Database (NTDB), and GeoYukon.Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

and B present maps illustrating and supporting the recommendations, and Appendix C presents Guidelines Respecting the Discovery of Human Remains and First Nation Burial Sites in the Yukon.

2.0 PROPOSED ACTIVITIES WITHIN STUDY AREA[2]

The Proponent intends to conduct exploration drilling and flow testing of any discoveries over an area of approximately 2,400 km² in the Eagle Plains area, located between the Ogilvie and Richardson mountain ranges along the Dempster Highway. The purpose of this exploration drilling and flow testing program is to confirm the quality, quantity, and areal extent of any accumulations of hydrocarbons. The Proponent will drill up to 30 wells sequentially over a period of up to 10 years. If a well is successful (i.e. if there is a discovery of crude oil or natural gas in sufficient quantities), the Proponent will conduct an extended flow test (EFT) for a period of up to two years on that particular well. There is considerable uncertainty in terms of the outcome from exploration drilling, so it is only possible at this stage to speculate on the number of discoveries that will be made. For the purposes of this assessment, the Proponent estimates that crews may conduct EFTs on up to 20 wells, depending on the drilling success. Due to the exploratory nature of the work, it is impossible to predict the timing of any discovery, and therefore, the timing of any EFTs.

The Proponent will drill one well at a time and up to five wells per year. For a predominantly natural gas well, EFT may require up to a month to complete, and for a predominantly crude oil well, up to 2 years. The Proponent anticipates that up to eight wells may undergoing EFT at the same time (based on the planned drilling schedule), and that EFT will be undertaken on a maximum of 20 wells during the Project.

If several wells reach successful outcomes and are identified for extended flow testing, the wells will have completion equipment installed within their wellbores, the casing will be perforated, and the wells will be flowed. This would require a completion or service rig to install the completion equipment and the tubing used to conduct produced well fluid to ground surface, at which point surface equipment would then be installed, which may include artificial lift equipment to help the fluid continue to flow.

Fluids produced during EFT will need to be measured, processed, and dealt with in an environmentally responsible manner. Depending on the nature of a discovery, the Proponent anticipates that some combination of natural gas, crude oil, and possibly formation water will be extracted during the EFTs. These fluids are separated and measured in facilities on the surface. Natural gas could be flared for short periods of time, but the Proponent prefers to conserve it to provide fuel for process heating, fuel for engines providing mechanical power, and possibly onsite power generation. If natural gas quantities are significant, the Proponent would consider re-

[2] Information presented in this section has been adapted from Hemmera 2021.

injecting surplus natural gas into a compatible reservoir in the Eagle Plains basin using an existing suspended well. The Proponent currently has eight suspended wells that were drilled in the past, which could be used for re-injection. Alternatively, some of the new wells, drilled as part of this 30 well Project, may be used.

Fluid transportation vehicles will be required to travel from site to site and transport the produced fluid back to the Central Process Facility for storage, further treatment, and transfer to trucks for transport to market or disposal. Crude oil produced during the EFTs will be conserved instead of flared to the greatest extent possible. This will require some processing to stabilize the crude oil for truck transport to a suitable, approved crude oil marketing point, such as terminals in the vicinity of Fort Nelson or Fort St. John, British Columbia, or Grand Prairie, Alberta. All these locations are ready to receive and utilize crude oil produced from Yukon sources without such destinations existing within the Yukon. The Proponent may also consider trucking crude oil produced during the EFT to ports in Alaska such as Skagway, Haines, or Valdez for onward shipping to suitable markets elsewhere in North America.

Formation water produced in conjunction with crude oil or natural gas will be separated from the hydrocarbon streams and disposed of underground into a compatible and approved geological formation at Eagle Plain using one of the suspended wells or one of the wells drilled as part of this Project. These procedures to process, transport, and dispose of various fluids produced are common practice using proven technologies and equipment in every oil and gas province in Canada.

The Proponent also intends to conduct a seismic exploration program consisting of up to 1,500 km² of three-dimensional (3D) seismic and up to 2,000 km of two-dimensional (2D) seismic to identify and map oil and gas geological structures in the area.

Additional activities are required to support the drilling and seismic exploration, including:

- Mix Bury Cover (MBC) sump area to dispose of drill cuttings
- Construct winter and all-season access roads
- Construct airstrip
- Advance borrow source developments
- Transport equipment and supplies to the site and within the Project area

- Use existing camp at km 325 of the Dempster Highway and periodic use of the Eagle Plains Hotel.

The Proponent is planning to begin exploration activities in 2023/2024, and continue for a period of 10 years to cover the various stages of drilling and extended flow testing of the proposed wells. The execution of the EFTs will likely be phased, depending on the nature of the discovery (e.g., natural gas versus crude oil), and the capacity of the 75-person base camp and the Eagle Plains Hotel to accommodate the necessary crews. Until there is more information about the resources discovered, it is difficult to accurately predict the full duration the complete flow testing program.

3.0 METHODOLOGY

This report presents the results of a desktop study designed to predict the potential for encountering heritage resources within the unassessed claims within the study area. The methodology used in this desktop HROA to develop these predictions is described below.

The desktop review relies on two primary lines of evidence, the physical/environmental and cultural/historical setting of the study area:

1. The first line of evidence is predicated upon attributes of the physical/ environmental setting. These attributes are derived from an analysis of the biogeoclimatic zones, physiography, hydrology, bedrock and surficial geology, and vegetation and wildlife distributions. Aerial/satellite photographs, LiDAR-based hillshade imagery including client provided imagery and ArcticDEM hillshade imagery [Porter et al. 2018]), and slope model imagery were also reviewed. This approach relies on the assumption that specific geographic features, such as elevated landforms (e.g. ridges, knolls, terraces, etc.), water features (e.g. lakes, rivers, creeks, wetlands, and their associated banks/margins), and resource patches (e.g. hunting and foraging locales, quarry sources), can be linked to specific settlement and resource exploitation patterns. Close proximity to these types of landforms is considered to be an indicator of high potential for heritage resources regardless of whether previous heritage resources studies have identified sites of interest in the vicinity.

2. The second approach is built upon a review of previous heritage resource management research conducted within the study area and adjacent lands aimed at understanding the area's cultural/historical setting. The review includes a general overview of the culture historical context of the study area and a detailed review of previous archaeological studies, and historical records. No traditional knowledge/traditional land use (TK/TLU) information was reviewed as part of this study. In this stage of the analysis, closer proximity to previously recorded heritage resource sites is considered to be evidence for human use of the area, and it is therefore interpreted as an indicator of elevated potential for heritage resources.

The data obtained through these reviews is used to assess the potential for development related impacts to both known heritage resource sites and possible undocumented sites that may be located within the study area. In terms of the physical/environmental setting, the analysis will be based upon the criteria described in Section 3.1 of this report. A list of potential site types

expected for the study area, and the physical/environmental attributes they are expected to be correlated with, are presented below in Section 3.2. The cultural/historical assessment will be based on a general review of the documented Precontact (Section 4.2.1), Protohistoric (Section 4.2.2), and Historic (Section 4.2.3) Periods in the broader region, and modern First Nations whose traditional territory overlaps with the proposed project area (Section 4.2.4), as well as specific reviews of previous heritage resource studies, documented archaeological site inventory, and Historic sites on file with the Yukon Government Heritage Resource Unit (Section 4.2.5).

Although the sample size of previously recorded sites within the study area is too small to allow for strong conclusions to be made (n=7; 0.003 sites per km^2), trends seen in site distributions from the broader surrounding area suggest that most sites within the study area will likely be located on knolls, terraces, and ridgelines that offer good access to water and/or a commanding view of the surrounding landscape. A slight skew towards east- and south-facing landforms is evident, but sites have also been recorded on landforms with other aspects. A secondary correlation was observed between sites and documented transportation corridors such as trails and waterways.

With these general criteria for elevated heritage resource potential identified, a GIS based Topographic Position Index Based Landform Classification (TPI) was created using the QGIS software package SAGA-GIS (SAGA 2021). TPI identifies landforms by using a DEM to analyze the mean elevation of a specified area surrounding a given pixel (Weiss 2000). The landform categories identified by the TPI classification were then compared to aerial/satellite photographs, hillshade imagery, and slope model imagery to determine which landform categories correlate with the types of landforms identified in the general criteria for elevated heritage resource potential. While the majority of the modeled area was modeled using a proponent provided DEM, that data did not cover four areas within the study area. To fill these data gaps, DEM data from the ArcticDEM project (Porter et al. 2018) was incorporated into the model. These areas are shown in Figure 2. While this did allow for complete coverage of the study area, the results produced show some differences in the nature of the areas of potential (AOPs) generated by the model. These differences stem from three main factors:

- The ArcticDEM data is full feature whereas the proponent provided DEM is bare earth
- The ArcticDEM data has 2 m resolution whereas the proponent provided data has 1 m resolution
- There is an inherent discrepancy between the elevation reported in the two data sets

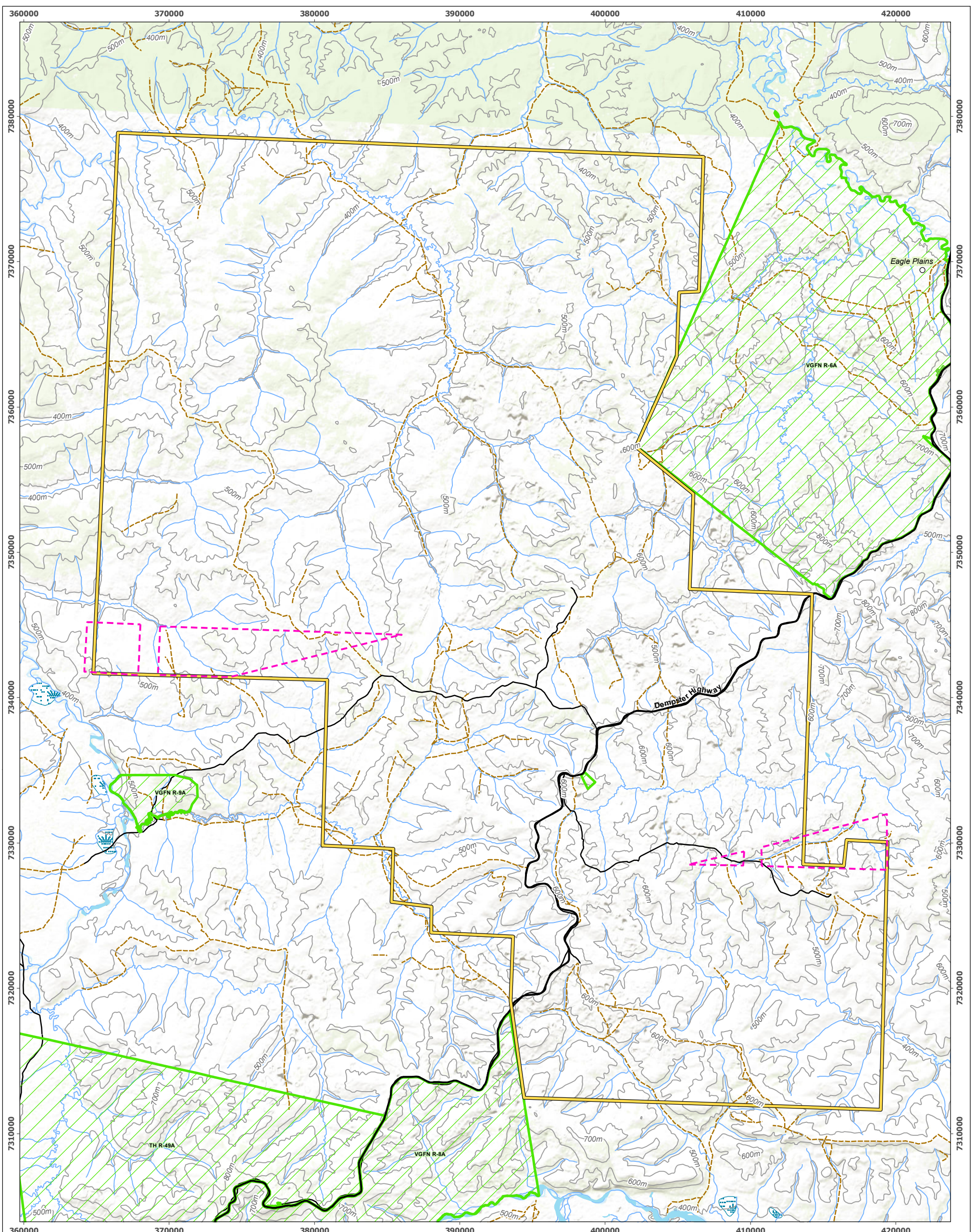


Figure 2 Overview Map

Eagle Plains ArcticDEM Coverage

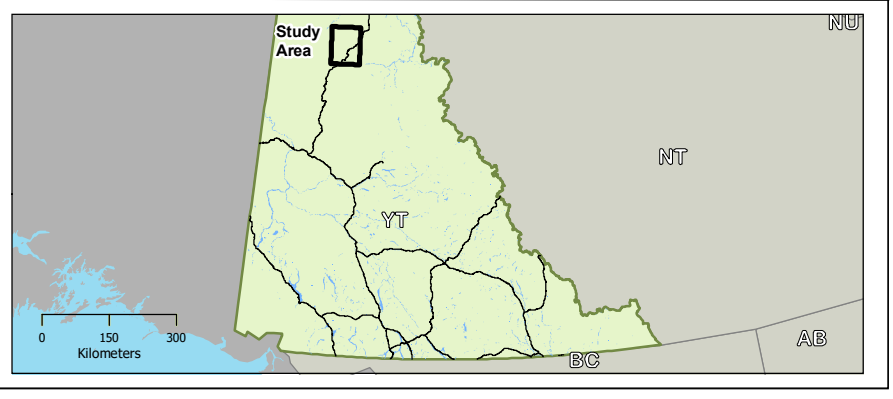
Ecofor Consulting Ltd. December 2, 2021 (JM)

- Road
- Trail
- Contour
- Watercourse
- Waterbody
- Wetland
- Town
- Highway
- Study Area
- ArcticDEM Coverage Area
- Surveyed Land Parcel
- First Nation Settlement Land

1:250,000

0 5 10 km

NAD 1983 UTM Zone 8N



Disclaimer: This product is for informational purposes only and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. The base data layers have been obtained from the National Topographic Database (NTDB), and GeoYukon.Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

Despite these differences between the data sets, the AOPs predicted by each are generally consistent. The results of this analysis were then scrutinized by experienced archaeologists who reviewed the predictions in relation to the hypothesized results. The predictions produced by the TPI analysis agreed with the hypothesized results. No significant modifications were made to the areas of potential identified by the TPI analysis.

Low potential is assigned to all areas not identified by the final GIS/desktop analyses. Areas considered to have low potential for heritage resources are typically characterized by nondescript landforms with no significant topographic relief, limited access to fresh water, poorly-drained sediments (as indicated by vegetation cover), and/or significant levels of previous disturbance. This is not to say that there is no chance for encountering heritage resources in these areas, only that the probability of such a find is low enough that it should be considered a chance find that does not fit with the established settlement and land use pattern within the study area.

The results of the TPI analysis and the resulting archaeological potential model are discussed in Section 5.0.

3.1 Landforms and Geographic Features with High Heritage Resource Potential

In addition to the areas around known sites, a number of landforms and landscape features can be used to help identify areas of heightened heritage resource potential. They include:

1. Elevated landforms such as valley edges, terraces, ridges, mid-slope benches, and knolls. These landforms are considered areas of potential for heritage resources because they often offer better drained soils, relative proximity to water and game, and larger viewsheds. Elevated landforms with south-facing margins are considered especially high potential because of their warmer temperatures and better airflow, which helps reduce insects. These types of landforms are associated with a wide variety of site types including campsites, lookout sites, cache sites, etc.

2. Areas within close proximity to water are also considered to be areas of potential for heritage resources. The potential of these areas is bolstered both by human water needs, but also those of large game animals, fish, and bird species. The easy access to water makes these areas ideal for habitation and hunting sites.

3. Areas near lithic raw material sources are considered to have potential for heritage resources due to their value as quarry sites.

4. Caves, rockshelters, and tors, are listed as possessing increased potential for heritage resources due to possible use as temporary shelters from poor weather, as possible quarries for lithic raw materials, and as special places on the landscape that may be associated with spiritualism, ritual practices, and rock art in traditional cultures.

5. Sedimentary rock beds with the potential to contain palaeontological remains.

6. A final component of assessing the physical environment is determining the level of previous disturbance in the area. If areas have been severely disturbed in the past it reduces the potential of finding intact archaeological remains. Disturbance can include previous activities such as mining, oil and gas exploration, winter road or airport construction, etc. Disturbance is determined through analysis of the maps and historical information, which indicate locations of previous known industrial activities. Professional judgment is used to determine the level of impact resulting from a given disturbance.

3.2 Potential Site Types Expected in Study Area

Eleven broad site types are considered in this heritage resource assessment for their likelihood to be present within the study areas. Definitions of these site types, and the physical/ environmental attributes they are expected to be correlated with, are presented below. These general assumptions are extrapolated from previous archaeological studies and known sites in the larger area. Please note these broad site types overlap and are not mutually exclusive (e.g. a habitation site may also have been used as a hunting or fishing site).

3.2.1 Permanent/Long-Term Habitation Sites

Permanent/long-term habitation sites would indicate prolonged or repeated occupation of a locality. In this area, permanent/long-term habitation sites could be considered those sites which are returned to seasonally year after year, such as a summer campsite. Based on previous archaeological and ethnographic research, these sites are considered most likely to be associated with high, well-drained, south-facing landforms with grassy margins and/or open, pine dominated forests, and good access to water. Essentially, permanent/long-term habitation sites are only expected in optimal locations.

3.2.2 Temporary Habitation/Subsistence Sites

Temporary habitation sites tend to be associated with resource gathering activities such as hunting and foraging, but can sometimes be related to ceremonial activities. Subsistence-related sites are typically represented by lithic tools, evidence of tool production/maintenance, hearths, hunting blinds, and possibly faunal remains. Ceremonial sites related to puberty and shamanistic

rituals are often represented by cairns, isolated hearths, and lithics. The locations of hunting related temporary habitation sites are heavily influenced by landforms that also attract animals (e.g. water features) or that offer a commanding view of areas where animals are likely to congregate (e.g. elevated lookouts). Foraging related temporary habitation sites will be focused on areas that support commonly foraged resources such as berries. The exact criteria for these sites will vary depending on the resource being foraged. Ceremonial sites will not necessarily be connected to any specific type of resource, but are often found in difficult to reach places such as high elevation ridges and plateaus. One final area of potential for temporary habitation sites is along travel corridors such as trails. Typically, if found along a travel corridor, these sites will also be associated with some other noteworthy geographic feature such as a lookout or clearing (anything to make the area stand out relative to its surroundings).

3.2.3 Quarry Sites

These sites are found in areas where natural stone was quarried for the fabrication of stone tools. Desirable qualities in raw material types for stone tool manufacture include conchoidal fracture properties and low occurrences of internal flaws and inclusions. Such materials are typically found in a number of contexts including natural veins in bedrock, volcanic formations, or in secondary deposits (e.g. riverbeds).

3.2.4 Rock Art Sites

Rock art is man-made markings or etchings/peckings on natural stone surfaces. Rock art tends to be located along major watercourses, trails, or at boundaries of traditional territories.

3.2.5 Fishing Sites

Fishing sites typically include fish weirs or natural narrowing of major rivers and streams where fish could be caught more easily. Potential also exists in lakes.

3.2.6 Human Remains

Unexpected human remains are rarely encountered during heritage resource studies, however the potential for their presence always exists, especially in areas where higher densities of people are known to have congregated in the past. Prior to the influence of Christian missionaries, First Nations people would often place graves and spirit houses on prominent points or terraces near village/camp sites, or on low, level ground near trails. Once Christian practices became commonplace, graveyard burials became the norm for most people.

3.2.7 Culturally Modified Trees

Culturally modified trees (CMTs) are trees that have been altered by humans for a variety of purposes including cambium, sap, kindling, and/or bark collection, marking trails (blazes), and communicating messages. Most documented CMTs in the Yukon are pine trees.

3.2.8 Trails

Trails are pedestrian travel routes that may be marked by a well-worn trail bed, blazed trees and/or other CMT types, and/or cairns. Trails are often associated with natural corridors such as rivers and elevated ridges.

3.2.9 Historic Sites

It is likely that Europeans stuck closer to their trading routes (rivers and trails), relying on First Nations to procure items from further away. As such, Historic Period sites are expected to be most frequently encountered along documented travel corridors and settlement sites. However, this does not preclude the possibility of encountering isolated Historic Period materials associated with early European exploration, trapping, and prospecting activities. Moreover, artifacts of European origin could have been traded to First Nations persons then transported to locations generally considered to be more indicative of Precontact sites.

3.2.10 Isolated Finds

Isolated finds are small scale archaeological sites, typically of a single artifact. Due to the scale of these sites, they offer little behavioural insight into the people who created them, but they do document human use of the land in the past.

3.2.11 Palaeontological Sites

Palaeontological sites are defined by the fossilized remains of ancient animals. These may include loose fossils in sedimentary contexts, or fossils consolidated within hardrock formations.

4.0 ANALYSIS OF STUDY AREA

The study area is located west of Eagle Plans, YT. It includes portions of the North Yukon and Peel Watershed Planning Regions, and is located within the traditional territories of the Vuntut Gwitchin and the First Nation of Na-Cho Nyak Dun, as well as the Tetlit Gwich'in Primary and Secondary Use Areas of the Gwich'in Settlement Region. The Dempster Highway transects the project area and provides all-season access to the Blackie winter road, the Chance winter road, and the suspended wells at McParlon A-25 and Ehnjuu Choo B-73. Named watercourses include Chance Creek, Dalglish Creek, Enterprise Creek, Greaves Creek, and McParlon Creek.

Further information regarding the broader physical/environmental and cultural/historical setting of the study area are presented below.

4.1 Physical/Environmental Setting

The study area is located within the Eagle Plains Ecoregion of the Taiga Cordillera Ecozone. The following Section provides a summary of this ecoregion to provide environmental context to the results of this HROA (see Smith et al. 2004 for full ecozone and ecoregion discussion).

4.1.1 Eagle Plains Ecoregion

The Eagle Plains Ecoregion is characterized as is an intermontane basin of modest relief between the Richardson Mountains to the east and the North Ogilvie Mountains to the west (Smith et al. 2004). It includes the Eagle Lowland as defined by Matthews (1986), or part of the Porcupine Plateau and Porcupine Plain as defined by Bostock (1948) and Hughes (1987). The majority of the rolling low-relief terrain falls between 300 m a.s.l. and 600 m a.s.l. (Oswald and Senyk 1977), although some mountainous areas reach as high as 1,000 m a.s.l. and some river valleys as low as 250 m a.s.l. (Smith et al. 2004). The majority of the ecoregion drains to the north through the Whitestone, Porcupine, and Eagle River systems to eventually end up in the Yukon River watershed with the exception of the southeast corner that drains east via the Ogilvie, Peel, and Wind rivers to the Mackenzie River (Smith et al. 2004). Lakes are relatively rare in the Eagle Plains Ecoregion, but some oxbow and thermokarstic lakes are located within the floodplains of the Whitestone, Porcupine, and Eagle Rivers Smith et al. 2004).

Due to its latitude, the Eagle Plains Ecoregion does experience periods of continuous daylight and darkness, however these periods are brief. Mean annual temperatures are near -7.5°C, but the area exhibits strong seasonal temperature variation (Smith et al. 2004). In January, average temperatures typically range from -31°C in lower valleys to -25°C at higher elevations (Smith et al. 2004). Summer temperatures are less affected by elevation, and average 13°C (Smith et al.

2004). Recorded extreme temperatures range from -60°C during winter to 30°C in summer (Smith et al. 2004). Precipitation is relatively moderate, with an annual average of 400 mm annually (Smith et al. 2004). The majority of this precipitation falls as rain during the summer months, primarily in showers, with the period between September and April being the driest part of the year (Smith et al. 2004).

The ecoregion's bedrock geology is characterized by Devonian through Cretaceous sedimentary rocks, including sandstones, siltstones, limestones, and shales, representing an intermontane basin sandwiched between the uplifted Richardson, North Ogilvie, and Dave Lord Mountain ranges (Smith et al. 2004). Lands within this ecoregion are not known for metallic minerals or significant coal deposits, but it does contain proven hydrocarbon reserves. Three of 11 test wells drilled before an exploration moratorium in 1968 intersected porous Carboniferous and Permian sandstone in the Chance and Dagleish anticlines in the southern and southeastern part of the ecoregion are estimated to contain 2.8 x 10^9 m^3 of gas and 3.1 x 10^6 m^3 of oil (T. Bird, in Hamblin 1990).

Surficial geology is characterized by colluvial deposits throughout most of the ecoregion, with the remainder consisting of alluvial sediments along river systems and a few glaciofluvial and glaciolacustrine deposits associated with meltwater generated by glacial activity outside the ecoregion (Smith et al. 2004). Modern processes affecting surficial geology include thermokarst subsidence and soil creep, cryoturbation, solifluction, and active layer detachment slides on shale (Smith et al. 2004). Permafrost is discontinuous, but can be up to 200 m thick in places, with taliks focused on major river valleys (Thomas and Rampton 1982).

The majority of the Eagle Plains Ecoregion is composed of unglaciated terrain with some exceptions to this trend in parts of the Nahoni Range where there is scattered evidence of a past local glaciation of undetermined age (Smith et al. 2004). However, glacial processes in neighbouring ecoregions have influenced the major rivers in Eagle Plains, with up to three levels of glacially controlled terraces present along some drainages (Thomas and Rampton 1982). Major meltwater outlets exited the eastern slopes of the North Ogilvie Mountains and the northern slopes of the South Ogilvie Mountains via Ogilvie, Miner, Whitestone, Blackstone, and Hart Rivers channels (Smith et al. 2004). Moreover, during the Late Wisconsinan glacial maximum (ca. 30 ka; Hughes et al. 1981; Schweger and Matthews 1991) the Laurentide Ice Sheet blocked drainage of the Peel River and its southern tributaries forming Glacial Lake Hughes, which diverted the drainage northward through the Eagle River discharge channel (Duk-Rodkin and Hughes 1995). Glacial Lake Hughes received all the water exiting the Mackenzie and Wernecke mountains and the Ogilvie, Blackstone, and Hart River basins. Consequently, the Eagle and

Porcupine rivers were the two major contributors to the inundation of the Old Crow, Bluefish, and Bell basins (Smith et al. 2004).

In terms of vegetation, black spruce-tussock/shrub tundra with understories including shrub birch, Cottongrass tussocks, bog cranberry, cloudberry, Labrador tea, crowberry, lingonberry, spirea, lichen, and moss is typical on the lower slopes (Zoltai and Pettapiece 1973). Upland areas are dominated by black and white spruce woodlands with understories of Labrador tea, shrub birch, willows, alder, blueberry, rose, lowbush cranberry, spirea, moss, and lichen (Smith et al. 2004). Here white spruce is most common in better drained areas (Russell et al. 1992; Murray 1997). Forest fires are a significant factor in these wooded areas. Pioneer species important in recolonizing burn areas include paper birch, aspen, and balsam poplar (Zoltai and Pettapiece 1973). The highest elevation in the Eagle Plains Ecoregion, above approximately 800 m a.s.l., are typified by shrub tundra dominated by scrub birch, willow, and prostrate shrubs with some Cottongrass tussocks (Smith et al. 2004).

Mammalian biodiversity is relatively low in the Eagle Plains Ecoregion compared to other Taiga Cordillera ecoregions due to a lack of suitable habitats for many of the rodent and ungulate species found elsewhere (Smith et al. 2004). However, representative species present do include several predators including wolf, wolverine, grizzly and black bear, marten, ermine, and red fox (Smith et al. 2004). Barren-ground caribou of the Porcupine herd also utilize this area primarily in the fall and winter, and several species of vole can be found (Smith et al. 2004).

Bird populations are more diverse, with riverine areas providing habitats for Common Merganser, Spotted Sandpiper, Herring and Mew Gulls, Bald Eagle, Belted Kingfisher, and Bank and Cliff Swallow colonies, as well as key nesting habitat for Peregrine Falcon along the Porcupine and Eagle rivers (Hayes and Mossop 1978; Frisch 1987; Peepre and Associates 1993). Wetland areas are inhabited by small numbers of Pacific and Red-throated Loons, Tundra Swan, Greater White-fronted Goose, Canada Goose, American Widgeon, Green-winged Teal, Bufflehead, Lesser Yellowlegs, Solitary Sandpiper, and Common Snipe (McKelvey 1977; Frisch 1987). Swift mountain streams support breeding populations of Harlequin Duck and American Dipper, while riparian thickets provide breeding habitat for Willow Ptarmigan, Alder Flycatcher, Yellow Warbler, Wilson's Warbler, American Tree Sparrow, and Lincoln's Sparrow (Frisch 1987). Upland forests provide year-round homes for Northern Goshawk, Spruce Grouse, Northern Hawk Owl, Three-toed Woodpecker, Gray Jay, Common Raven, Boreal Chickadee, Pine Grosbeak, Whitewinged Crossbill, and Common Redpoll (Frisch 1987). Other species, such as Gyrfalcon and Willow Ptarmigan, migrate to these forests to winter, while other, including Swainson's, Gray-cheeked, and Varied Thrushes, Bohemian Waxwing, Yellow-rumped and Blackpoll Warblers, and Dark-eyed

Junco migrate north each spring to breed in these forests (Frisch 1987). High elevation alpine tundra areas support low numbers of Golden Eagle and Rock Ptarmigan, and may be used in summer by small numbers of Horned Lark, American Pipit, and Gray-crowned Rosy Finch (Frisch 1987). Upland Sandpiper and Townsend's Solitaire breed in the subalpine zone (Frisch 1987).

4.2 Cultural/Historical Setting

The following is an overview of the culture history for the broader region surrounding the study area including south-central and southwestern Yukon, and northern British Columbia. Many researchers have reviewed the cultural history of this broader area and have presented the information using a variety of terms and temporal ranges (Clark 1981; West 1996; Workman 1978; J. V. Wright 1995, 1999).

4.2.1 Precontact Period (ca. 15,000 BP to ca. AD 1700s)

Portions of the Yukon, NWT, and Alaska were unglaciated during the Last Glacial Maximum (18,000 Before Present or BP). The area is commonly referred to as Eastern Beringia. Several of the earliest well-documented Precontact archaeological sites in Eastern Beringia are found in the northwestern Yukon and have been dated to the Late Pleistocene from approximately 15,000 BP to 13,000 BP (de Guzman et al. 2014; Easton 2015; Easton et al. 2007, 2011; Easton and MacKay 2008), as well as one outlier site dated to 24,000 BP (Bourgeon et al. 2017)[3]. Artifacts recovered from these sites include technological suites shared by other Eastern Beringian sites such as the Nenana/Chindadn (non-microblade) and Denali (microblade) Complexes, and date between 15,000 and 8,000 BP (Dixon 2011; Heffner 2002: Holmes 2001, 2011; Potter 2011). The material culture recovered from these sites, primarily defined through lithic technology that includes both non-microblade and microblade technology, is known as the Eastern Beringian Tradition (Holmes 2001). The Northern Cordilleran Tradition (11,000 BP to 7,000 BP) is defined from sites in the interior Yukon that notably lack microblade technology. The Northern Cordilleran Tradition is characterized by large straight and round-based lanceolate point forms, large blades and flakes, and transverse notched burins (Clark 1983; Hare 1995).

The Northern Cordilleran Tradition was followed by the Little Arm Phase, which dates from 7,000

[3] Of note regarding early archaeological sites in the Eastern Beringia area is the very early site at Bluefish Caves, which has been recently dated to approximately 24,000 BP (Bourgeon et al. 2017). However, due to the nature of the archaeological assemblage recovered and paucity of known archaeological sites bridging the temporal gap between Bluefish Caves and other early sites, such as the Little John site (Easton 2015; Easton et al. 2007, 2011; Easton and MacKay 2008) and the Britannia Yukon Hill site (de Guzman et al. 2014) which date to approximately 15,000 BP, questions remain for many archaeologist regarding the relationship of the occupation documented at Bluefish Caves to the more recent archaeological record and modern First Nations peoples.

BP to 4,500 BP (Clark and Gotthardt 1999; Workman 1978) and can be defined by the use of microlithic technologies. After about 4,500 BP, there is less evidence of microblade use in the Yukon, and an increase in the use of notched projectile points and a variety of scraping and carving tools. This new tool industry is known as the Taye Lake Phase in southwest Yukon, or more broadly in Yukon and Alaska as the Northern Archaic Tradition (Hare 1995; Workman 1978).

The most recent precontact archaeological component found in the Yukon is that of the late Northern Archaic Tradition, or the Late Precontact period. This period is most clearly represented by the Aishihik Phase found in the Southern Yukon (Hare 1995; Workman 1978). This phase is thought to be a cultural development from the earlier Taye Lake culture, although there are some significant differences in technology. The most notable is the introduction of the bow and arrow, replacing a type of throwing spear known as an atlatl (Hare et al. 2004). The Aishihik Phase sites are found above the White River Volcanic Ash layer (also known as White River Tephra) that is dated to approximately 1,250 BP (Clague et al. 1995).

The Aishihik Phase has been evaluated as ranging from approximately 1,200 BP to 200 BP, and also includes the use of native copper tools, stemmed projectile points, and gorges. Also indicative of the Aishihik Phase are small stemmed Kavik points, end and side scrapers, and ground adzes (Hare 1995). The poor preservation of organic materials makes the task of diet reconstruction more difficult than at the coastal sites, but there is evidence of continued use of a variety of large and small mammals, fish, and birds. In the high elevations of the southern Yukon ice patches, examples of the transition from the older atlatl technology to the bow and arrow use has been clearly documented by recent finds (Hare at al. 2004). The shift to the new technology was a rather abrupt one at roughly 1,200 BP based on a good sample of preserved and dated atlatl dart shafts and bow and arrow remains.

4.2.2 Protohistoric Period (ca. AD 1700s to ca AD 1840s)

The Protohistoric Period, as presented here, also overlaps with late Precontact/Athabaskan Period. It is defined by the appearance of non-indigenous goods, other early trade items, and foreign (western or eastern) influences, but not the documented accounts of contact between indigenous North American peoples and European/Russian/Asian peoples themselves. Other indicators of the Protohistoric Period are the arrival of the first non-indigenous diseases and information concerning non-natives. This period spans the time between the first introduction of non-indigenous influences or artifacts, and the recording of firsthand or primary written accounts. Unlike other cultural periods with more specific temporal ranges it is difficult and

perhaps impossible to determine when the first 'outside' influences of European, Russian, Asian, or other cultures began to impact First Nations people in the Yukon interior.

Some of these far-reaching effects may have been passed along from Russian exploration in the early and mid-1700s (Veniaminov 1984) and other Asian and European (Andreev 1944, Quimby 1985) exploration and contact with coastal communities. The Chilkat Tlingit from the Northwest Coast travelled and traded with many interior First Nation peoples throughout this Protohistoric Period including the Kaska and the Northern Tutchone from the Dawson and Mayo areas, and occasionally the Mountain Dene people from as far away as Fort Norman on the Mackenzie River. The Tlingit protected and controlled the trading routes into the interior and fiercely defended those routes when they were threatened. News of early non-indigenous explorers and traders would have travelled inland along with foreign items such as metals, cloths, glass beads, and later tobacco and other goods.

In some of the earliest cases, the impacts of these foreign cultures could have had significant impacts even without the presence of the foreigners themselves. Such is the case for what is called 'drift-iron' whereby metals and other materials from Asian or European shipwreck wash ashore. Historical accounts of shipwrecks have been reported in the mid-1700s, but much earlier wrecks were possible. Metals and other foreign trade items have been derived from shipwrecks off what is now British Columbia, Southeast Alaska, and perhaps the Northwest Alaska as well.

4.2.3 Historic Period (post ca. AD 1840s)

During the early years of this period the Russians were expanding their exploration and trade network along the Pacific coast and up the major rivers of the Alaskan interior, while the British were exploring eastward into what would become Canada's Northwest and Yukon Territories, as well as Alaska. The North American based explorers and traders entered the Yukon through two main routes: from the north via Fort McPherson and from the south via Fort Liard. In the 1840s, representatives of the Hudson Bay Company established trading posts near portions of the study area, including those at Lapierre House (1846) and Fort Yukon (1847). The next year Robert Campbell established Fort Selkirk southeast of the project area on the upper Yukon River and then relocated to an improved location in 1851. This upset the Chilkat indigenous trading population from the coastal area, who had controlled trade to the interior for many generations, and by 1852 increasing supply-line pressures, trade competition from the Chilkat traders, and flooding forced the Anglo traders to flee.

In 1867, US Secretary of State William Seward was able to focus increasing American interests, and he convinced the United States Senate to purchase Alaska from Russia. Soon after the

purchase, the US Army sent Captain Raymond up the Yukon River on the first stern-wheel steamer to reach Fort Yukon (Grauman 1977). Raymond surveyed the location of Fort Yukon and proved that it was within U.S. territory. The British sold the Fort to the U.S. Government and relocated east across the 141st Meridian.

The inland fur industry continued to drive exploration and settlement into the late 1800s, but mining would shift the focus to the placer gold found in streams and alluvial deposits. Mining in the second half of the nineteenth century was a risky, but often very lucrative enterprise. The impacts of mining spread quickly and drastically changed the project area.

Mineral prospecting and mining efforts in the second half of the nineteenth century were, in some ways, dependent on the existing infrastructure of the fur trading and missionary efforts. As the competition for the inland fur trade grew, so would the number of stern-wheelers on the Yukon River. These steamers could better supply the small number of trading posts along the Yukon and its tributaries and reduce the risk of prospectors running short of supplies. Therefore, more of the fur traders and other explorers turned their attention to search for gold and other minerals. Three key prospectors to the north were L. S. (Jack) McQuesten, Al Mayo, and Arthur Harper. They wrote to miners in the United States to encourage them to come north. They also established outposts along the Yukon River, including Fort Reliance, established in 1874 near the confluence of the Klondike River (what would become Dawson City; A. A. Wright 1976).

Harper and another man may have been the first to travel up the Fortymile River in search of gold in 1881 (Buzzell 2003). They collected a very rich sample, but were unable to relocate the exact location. In 1886, McQuesten, Harper, and Mayo built a post on the confluence of the Stewart and Yukon Rivers which provided supplies for additional prospectors. Also in 1886, Howard Franklin made a richer find on the Fortymile River. Others rushed in and these claims along the Fortymile River attracted miners from across Central, Eastern Alaska, and Southeast Alaska. Fortymile was the first town to grow to over a thousand people by the mid-1890s (Buzzell 2003), and in 1887 the Stewart River post was deserted. Some prospectors that did not find easy success in Fortymile returned to the Stewart and continued work in the area. In 1890, Harper re-established a trading post at the site of the old HBC post at Selkirk as interest in the area grew. This was followed by Jack Dalton who developed a series of existing First Nation trails from tide water at Haines, Alaska, into Fort Selkirk. Then, on August 16, 1896, George Carmack, Skookum Jim, and Tagish Charlie discovered a very rich claim on Bonanza Creek, a tributary to the Klondike River near Dawson. This discovery sparked one of the largest gold rushes in history.

It would take almost a year for the news of the Klondike gold fields to spread south, even to

places relatively close by in southeast Alaska. Most of the prospectors and traders in the Alaskan and Yukon interior had already converged on the Dawson area during the winter and spring, and supplies ran dangerously low. That would quickly change in the summer of 1897 and spring of 1898 as new towns and supply posts sprang up along the Gold Rush routes to cash in on the increased demand.

The population of Dawson City grew very fast and in 1898 reached a peak of over 30,000. However, the boom period did not last long, and the vast majority of population moved on very quickly with the news of other discoveries and hopes of other bonanzas. The Gold Rush period saw greatly increased steamer traffic on the entire Yukon River drainage basin and across the interior. Just prior to the Gold Rush there were only a few steamers, while at its peak there would be hundreds of vessels working the rivers. These shallow draft steamers were supported by a network of wood camps, shipyards, and a large workforce which kept the river traffic moving. This network provided the infrastructure backbone for trading posts, fish camps, missionaries, and mail routes, while meeting the needs of the growing number of prospectors and traders.

Since Dawson City is located on a flood plain at the confluence of the Klondike and Yukon Rivers it has had a long history of fighting with rising water levels. Flooding here is the result of either open water flooding at peak river flows, or the more dangerous spring ice jam events. Dawson City has been the victim of over twenty floods since 1898 (McCreath et al. 1988, Whitehorse Star 1979). The most significant of these were in 1925, 1944, 1966, 1969 and 1979. After flooding in the 1940s and 1950s Front Street was raised in an attempt to keep the waters out, but this did little to stop the flooding. A protective dyke was built around Dawson City in 1959 and was later increased in 1968. The last major flood of Dawson City occurred in 1979 when ice jams on the Indian, Klondike, and the Yukon Rivers caused the spring waters to back up across Dawson City. This prompted the construction of the improved dyke (to the 200 year flood level) in 1987 (McCreath et al. 1988). Dawson City served as the capital of the Yukon government from 1898 until 1952, when the seat was moved to Whitehorse.

The Yukon has also been hosting to oil and gas exploration efforts since the 1950s. The first well was drilled in the Eagle Plains Basin in 1957, but was declared dry in 1958 (Yukon Government Oil and Gas Resources Branch, n.d.). Exploration activity picked up again in the 1960s and 1970s, which played an important role in motivating the construction of the Dempster Highway (see Section 3.4). Interest in exploration has continued intermittently ever since, with 76 wells having been drilled to date in five of eight Yukon sedimentary basins (Eagle Plain, Beaufort Mackenzie, Peel Plateau and Plain, Kandik, and Liard Basins) between 1957 and 2013 (Yukon Government Oil and Gas Resources Branch, n.d.). Over 10,000 line-km of 2D and 3D seismic surveys have been

conducted as part of these exploration efforts (Yukon Government Oil and Gas Resources Branch, n.d.). Six oil and gas pipelines have also been constructed in the Yukon, including four built during World War II as part of the Canol project, one built in the 1950s to supply American Air Force bases in Alaska during the Korean War, and the 2012 Spectra Energy pipeline built in 1972 to move natural gas from the Kotaneelee gas field in southeast Yukon to southern markets (Yukon Government Oil and Gas Resources Branch, n.d.).

4.2.4 Modern First Nations

The study area lies within the traditional territory of the First Nation of Na-Cho Nyak Dun, Tetlit Gwich'in First Nation, Vuntut Gwitchin First Nation. Further information about each First Nation is presented in the following sections.

4.2.4.1 First Nation of Na-Cho Nyak Dun

The study area is located within the traditional territory of the First Nation of Na-Cho Nyak Dun (NND). NND is part of the Northern Tutchone language and culture group. In the past, the Tutchone peoples were highly mobile, travelling in small groups in order to exploit the greatest number of resources. They would modify their movements depending on the patterns of large game animals and fish, or in later years to trade their furs with Westerners. In the summer, small domestic units gathered together to catch fish so that they could dry and store it for the winter months. By mid-summer, several family groups moved upland together to kill large game mammals that they would dry and store in caches scattered in various areas. From there some units moved away independently during the coldest months to trap and live off of the cached foods. The leanest months were March and April. In spring, several units often came together at this point to catch spawning whitefish or trap muskrat and beaver. May was the most plentiful month, with migrating waterfowl, fat ground squirrels, larger and more abundant fish, as well as the arrival of the Coastal Tlingit traders (McClellan 1981).

The principal ethnographic descriptions of the Tutchone are available in Cruikshank (1974, 1975), Johnson and Raup (1964), McClellan (1950, 1964, 1970a, 1970b, 1975), and Tanner (1966). Additional information on camp and village locations can be found in Schwatka (1885). Although villages were not inhabited year-round, people would return to good fishing and/or hunting spots year after year. This would eventually change with the influence of Westerners. Watercraft were constructed for use, however during the summer months Tutchone people preferred to walk overland, rather than brave the sudden winds on the large lakes or the treacherous river rapids. Boats were not the preferred method of transport.

The NND First Nation remained somewhat isolated until the discovery of gold in the area in 1883 (Mayo Historical Society 1999). The NND are known to have used many traditional camps, lookout sites, hunting areas, berry patches, and trails in the larger project area with extensive use of rivers. McClellan (1981) summarized the common seasonal activities beginning in the spring with grayling fishing following spring break up. The NND people remained almost completely isolated from non-First Nation people, except for a few explorers passing through, until miners set up a supply post along the McQuesten River in 1886. The supply post soon turned into a village and from then on permanent camps and villages have existed in the larger area surrounding Mayo Lake. During the Duncan Creek gold rush, a trading post called Gordon Landing was established near the confluence of Janet Creek and the Stewart River. From there a trail allowed people to travel north partially along Davidson Creek to the confluence of Duncan Creek on the Mayo River. The Town of Mayo was established in 1903 and the people of McQuesten and a few other small encampments moved there or to the "Old Village" just outside of town (Mayo Historical Society 1999). This village made it possible for people to receive a western education, live close to Mayo, and continue their preferred way of life and cultural celebrations. Eventually the "Old Village" was abandoned when in 1958 the local health officials determined the drinking water was polluted and the NND were requested to move to the Town of Mayo. The First Nations people in the Mayo area officially chose the name "Na-Cho Nyak Dun" in 1987, which means "Big River People" in reference to the now named Stewart River.

4.2.4.2 Gwich'in Nation

The Gwich'in Nation is an Athapaskan speaking group that includes First Nations/Native American peoples in the Yukon, Northwest Territory, and Alaska (VGFN 2009). Members of the greater Gwich'in Nation include the Vuntut Gwitchin and Tetlit Gwich'in in the Yukon, the Teetl'it Zheh Gwich'in, Gwichya Gwich'in, Ehdiitat Gwich'in, and Nihtat Gwich'in in the NWT, and the Dendu Gwich'in, Draan'jik Gwich'in, Danzhit Hanlaih Gwich'in, Gwich'yaa Gwich'in, and Neets'ąjį Gwich'in in Alaska (McFadyen Clark 2019). Of particular significance to this project are the Teetl'it Zheh Gwich'in (TGC) and Vuntut Gwitchin (VGFN), whose traditional territories/modern community centers are crossed by the proposed project. Oral traditions and ethnographies of Gwich'in people have been documented by Krech (1976), Osgood (1933, 1934, 1936), Petitot (1876, 1889), Savishinsky and Hara (1981), VGFN and Smith (2009), Heine et al. (2007), and McCartney and GTC (2020), among others.

Collectively, the traditional lifeways of the Gwich'in people depended on hunting and fishing. Moose and caribou were of vital economic importance providing both food and hides for clothing and shelter, but salmon, white fish, hare, and plant foods such as berries and rhubarb were also

significant sources of subsistence (McFadyen Clark 2019). Their traditional toolkit was similar to other subarctic Athapaskan groups, and included the bow and arrow, traps, snares, deadfalls, and nets for fishing. People also utilized caribou drift fences and pounds to improve hunting yields. Snowshoes, sleds, and canoes were all employed for greater mobility. Hide covered tents provided the primary source of shelter.

Many Gwich'in communities continue to rely on subsistence harvesting from the land. The Vuntut Gwitchin (which translates to "people of the lakes") are based in Old Crow; the only community in the Yukon without road access (VGFN 2009). The Teetl'it Zheh Gwich'in (which translates to "people of the head waters") are based in Fort McPherson, NWT, which was established in 1852 when Old Fort, a Gwich'in village, was moved from six kilometers upriver to the present town site (Gwich'in Council International 2009). Fort McPherson represents the largest Gwich'in settlement in the NWT with over 80% of its population being of Gwich'in descent (Gwich'in Council International 2009). Gwichya Gwich'in (which translates to "people of the flats") are centered in Tsiigehtchic, NWT, and the Nihtat Gwich'in, meaning "mixed nations", is a group comprised of Gwich'in from various Gwich'in communities that reside in Inuvik (Gwich'in Council International 2009).

4.2.5 Previous Heritage Investigations

The study area has not been extensively explored from a heritage resource perspective, but Consultation with the Yukon Government Heritage Resource Unit did identify a few studies that have assessed portions of the current footprint. These studies include three permitted HRIAs related to previous oil and gas exploration (01-07ASR [Hammer 2001], 07-04ASR [Heffner and Ross 2008], and Commisso and Heffner [2008]), and one HRIA related to a fibre optic cable project along the Dempster Highway ROW (16-16ASR [Bennett 2016a]). Two non-permitted studies, including a historic resource overview assessment (HROA; Bennett 2016b), a traditional knowledge/traditional land use study (Bennett 2017), and an update to the original HROA (Bennett 2019), have also been completed in association with the fibre optic project along the Dempster Highway.

In total, these studies have identified seven archaeological sites and one Yukon Historic Sites Inventory (YHSI) site within the current study area. Further detail about these sites is presented in Sections 5.2 and 5.3 of this report.

5.0 RESULTS

This section presents the results of the HROA analysis. These results are divided into four categories: areas of elevated potential for previously undocumented heritage resource sites (Section 5.1), previously recorded archaeological sites (Section 5.2), previously recorded Yukon Historic Sites Inventory (YHSI) sites (Section 5.3), areas with potential for culturally modified trees (CMTs; Section 5.4).

It should be noted that although all efforts were made during the production of this report to make its assessment of heritage resource potential as comprehensive and accurate as possible, the methods employed provide relatively coarse resolution. As such, small undocumented areas of heritage resource potential may be present within the study area that were not captured by this overview. Moreover, there is always a possibility that chance finds of heritage resources will be made in areas of low perceived potential. If such areas or finds are encountered at any point during development, all work in the find area should cease and staff at the Yukon Government Heritage Resources Unit should be contacted immediately.

5.1 Areas of Elevated Potential for Previously Undocumented Heritage Resource Sites

Areas of elevated heritage potential for surface/subsurface heritage resource sites were identified through the development of a TPI-based heritage resource potential model. The TPI classification identified 10 landform categories, three of which were found to correlate with landforms that are commonly associated with heritage resource sites. Upon review of the results, one of the landform categories did well at identifying areas of high potential along watercourses, but it also identified many areas on the slopes leading down to the drainages that do not fit with the general criteria for elevated heritage resource potential. To eliminate these low potential areas from the heritage potential model, this layer was clipped to only include identified areas within 100 m of a watercourse.

In total, the heritage resource potential model predicted high potential for 13.71% of the modeled area. Of the seven sites known within the study area, the model successfully predicted the locations of all of them. It should also be noted that the locations of some of the sites are not accurate. However, after consultation with Christian Thomas at the Yukon Government Heritage Resource Unit, the likely true locations of the sites have been determined, and it is these revised locations that are used in this analysis. Based on these results, the model efficiency was evaluated using Kvamme's gain statistic (Kvamme 1988), which returned a value of 0.8629. This value shows the model to function with moderate efficiency based on the criteria published in the British Columbia Archaeological Overview Assessment Standards and Guidelines (BC 2009).

With further refinement of the model parameters, the model could likely be brought into the high efficiency range (Kvamme's gain statistic of ≥0.9; BC 2009). However, given the very low known site density within the study area (n=7; 0.003 sites per km^2), it is maintained that the model should be designed to err on the side of caution and capture a larger percentage of the landscape at this point in time. Once more data is available from future field studies becomes available, the model parameters can be adjusted to bring the model up to the high efficiency level.

Maps showing all identified areas of elevated heritage resource potential are presented in Appendix A – Figure 3 and Appendix B – Figure 4. An assessment of the potential for encountering each of the eleven site types outlined in Section 3.2 of this report is presented in Table 1.

5.2 Previously Recorded Archaeological Sites

Seven archaeological sites have been documented within the study area, with 26 more documented within 50 km of the study area (Table 2). Precontact sites dominate the list of known sites (n=25), with lithic scatters being the most common site type (n=21). However, Indigenous Historic, Historic, and palaeontological sites are also represented. This low number of archaeological sites (0.003 sites per km^2) is likely a reflection of the limited amount of archaeological survey that has been done within the study area. The locations of these sites are illustrated in Appendix A.

5.3 Previously Recorded Yukon Historic Sites Inventory Sites

One YHSI site, 116I/03/001 – Tth'an Dhidlii Njik Dalgish Creek Resource Area, has been recorded within the study area. Thirteen additional YHSI sites have been recorded within 50 km of the study area. These sites are summarized in Table 3. Due to the low level of heritage resource survey work within the study area, it is considered likely that additional historic sites remain to be recorded within the exploration area boundary.

5.4 Areas of Culturally Modified Tree Potential

Potential for CMTs was not specifically assessed in this HROA due to a lack of available vegetation inventory data. CMT potential is primarily identified through the presence or absence of old growth pine-leading stands, with the presence of such stands being interpreted as a potential elevating factor. Should old growth pine-leading stands of forest be encountered during any future field assessments, crews should be vigilant for CMTs. If pine-leading stands are not encountered, minor potential for certain types of CMT, such as blazes, trap trees, and Historic claim markers, may still exist in stands of spruce and/or aspen.

Site Type	Potential	Comments
Permanent/ Long-Term Habitation	Low	Permanent/long-term habitation tend to be located near significant landscape features that provide optimal places for campsites such as major rivers and lakes. Such landforms are not present within the study area.
Temporary Habitation/ Subsistence	High	The most likely temporary habitation sites to be encountered are those related to subsistence activities. They are most likely to be located on well-drained terraces above watercourses and prominent knolls/ridgelines.
Quarry Sites	Low	Review of geological bedrock mapping shows that sedimentary rocks characterize the areas lithology. The descriptions of the bedrock formations mention few rock types that are commonly exploited used in stone tool production, although there is some potential for mudstone and siltstone. However, minor potential for knappable rocks, such as chert, may exist in the creekbeds.
Rock Art Sites	Low	The potential for rock art is considered to be low.
Fishing Sites	Low	Although many creeks flow across the study area, no major rivers or lakes are present.
Human Remains	Low	Organic preservation conditions in the study area is not considered to be favorable for the preservation of undocumented human remains.
Culturally Modified Trees	Unknown	Potential for CMTs was not specifically assessed in this HROA due to a lack of available vegetation inventory data.
Trails	Moderate	No historic trails have been documented within the study area. However, the Dempster highway follows a natural travel corridor, and the sheer size of the study area bolsters the chance of encountering previously undocumented trails.
Historic	Moderate	No YHSI sites have been recorded within the study area. However, it should be noted that this absence of recorded sites may be a consequence of the lack of historic site survey within the study area rather than a true indication of the absence of historic sites given the fact that 14 YHSI sites have been recorded within 50 km of the study area.
Isolated Finds	High	The potential for isolated finds exists throughout the study area. If other site types are present, the probability of identifying additional associated isolated finds in their vicinity will be elevated.
Palaeonto-logical Sites	Moderate-High	The study area is located within an area of predominately sedimentary bedrock. As such, there is potential for pre-Pleistocene palaeontological remains. Potential also exists for Pleistocene/early Holocene fossils within placer deposits in the lower valleys.

Table 1: Assessment of the probability of encountering predicted site types.

Borden #	Site Class	Site Type	Permits	Notes
Sites Located Within the Study Area				
LlVc-1	Precontact	Isolated find	00-21ASR	Located on a west-facing knoll 15 m above the valley bottom on Dalglish Creek. Six shovel tests were excavated with one chert flake recovered.
LlVd-1	Precontact	Subsurface lithic scatter	00-21ASR	Located on a southeast facing bedrock knoll with exposures to the southeast and northeast overlooking Enterprise Creek. Four tests were excavated and several chert flakes resulting from the production of stone tools were recovered from two of the tests. The site is considered to be a small lithic scatter likely representing temporary camp of game lookout.
MaVc-3	Precontact	Subsurface lithic scatter	01-07ASR 13-16ASR	Located on a north-south running terrace with an east view overlooking a pond and a sedge tussock meadow. Nine test pits excavated, with one being positive. Collection consists of two chert flakes.
MaVc-4	Precontact	Surface lithic scatter	08-06ASR 13-16ASR	Located on the west branch of a small tributary of the Upper Eagle River on the southeast edge of a terrace. Two flakes were found in surface exposures on the front edge of terrace.
MaVc-5	Precontact	Subsurface lithic scatter	13-16ASR	Located on outer SE nose of a large, squared terrace bench point along small tributary of upper Eagle River. Finds include a small assemblage of chert and siltstone lithics.
MaVc-6	Precontact	Subsurface lithic scatter	13-16ASR	Located on the outer edge of a large terrace bench formation along a small tributary of upper Eagle River. Finds include a small assemblage of chert and rhyolite/tuff lithics recovered from a tree throw.
MaVe-1	Precontact	Subsurface lithic scatter	13-16ASR	Located on a small terrace knoll overlooking a large expanse of tussock meadows framed between two small tributaries feeding in from the north. Finds include a small assemblage of chert lithics.
Sites Located Within 50 km of the Study Area				
MaVc-2	Precontact	Subsurface lithic scatter	01-07ASR	Located on a bedrock knob overlooking an old creek bed, south of the Dempster Highway, southeast of Eagle Plains. Eight test pits excavated, with two being positive. Collections include chert core fragment and chert flakes.

Table 2: Known archaeological sites within/near the study area.

Borden #	Site Class	Site Type	Permits	Notes
Sites Located Within 50 km of the Study Area				
MbTx-1	Precontact	Lithic scatter	94-15ASR	Located on a medium elevation bedrock rubble ridge, in the upper Canyon Creek Valley. A small collection of flakes and one scraper was made over an area of about 50 m in diameter near the highest point in the valley.
MbTx-2	Precontact	Isolated find	94-15ASR	Located on the right bank of a small tributary that drains west into the upper part of Canyon Creek. A single flake was found and collected.
MbTx-3	Precontact	Lithic scatter	94-15ASR	Located on a series of terrace beaches on the north side of an east-west running tributary of the upper Canyon Creek. A single flake was found on the upper bench. A large scraper made of welded tuff (?) was found on the lower bench.
MbVa-1	Precontact	Isolated find	94-15ASR	Located on a ridge complex in the foothills of the Richardson Mountains, near the headwaters of a tributary of the Eagle River. A single, broken biface was collected.
MbVa-2	Precontact	Lithic scatter	94-15ASR	Located on a knoll complex, three clusters of artifacts were found within an area of about 30 m. in diameter. Artifacts include substantial quantities of debitage and 2 bifaces, one of which is made on a large (15 cm long) macroblade. Site also known as the Ziehe Site.
MbVa-3	Precontact	Lithic scatter	94-15ASR	Located on a medium elevation complex of bedrock rubble ridges. Site consists of two clusters of large argillite (?) flakes/core fragments.
MbVa-4	Indigenous historic	Pole structure	94-15ASR	Located on a heavily wooded terrace, on the right bank of a mountain stream at the foot of a bedrock rubble ridge in the foothills of the Richardson Mountains. Consists of two collapsed pole/log structures. The poles are steel axe cut. Noted one wire nail and a piece of string.
MbVa-5	Precontact	Surface lithic scatter	94-15ASR	Two flakes were collected from the surface.
McVa-1	Precontact	Isolated find	00-14ASR	Located on the south end of a ridge complex, on the east side of Canyon Creek, near the headwaters of the creek. Collection consists of one chert flake.
McVh-1	Historic	Historic scatter	69-00ASR	Located on the west bank of Whitestone River at on a long prominent bend. Metal, shell, glass bottles, and beads collected.

Table 3: Known archaeological sites within/near the study area (continued).

Borden #	Site Class	Site Type	Permits	Notes
Sites Located Within 50 km of the Study Area				
McVh-2	Precontact	Lithic scatter	69-00ASR	Located on northwest bank of Miner River, just downstream from island below confluence of Miner River and Fishing Branch. Lithic debitage collected.
McVh-3	Historic	Precontact/ historic scatter	69-00ASR	Located on north bank of fishing branch, where channel narrows to a line on the Porcupine River. Some flakes, bone, wood, glass objects collected.
McVh-4	Palaeontological	Isolated find	67-01ASR	Located on left bank of Whitestone River on the outside of a bend below the mouth of Chance Creek. A mammoth or mastodon tusk was collected from the surface of a river bar deposit in 1976.
MdVa-1	Precontact	Lithic scatter	74-01ASR	Located along the Dempster Highway ROW where the road crosses the headwaters of a major tributary of the Eagle River. Lithic artifacts and debitage collected.
MdVa-2	Precontact	Lithic scatter	78-11ASR	Located on low bench on the south side of a tributary of the Eagle River. Isolated tool and flake finds.
MdVh-1	Undetermined	Faunal materials	69-00ASR	Located on right bank of Whitestone River, just above its confluence with the Porcupine River. Faunal samples (bone) collected.
MeVb-1	Precontact	Lithic scatter	74-01ASR	Lithic artifacts and debitage collected.
MeVb-2	Precontact	Lithic scatter	74-01ASR 96-07ASR	Located on the Dempster Highway right of way where the road crosses the headwaters of Rock River. Flakes collected.
MeVb-3	Precontact	Lithic scatter	74-01ASR	Located just east of the Dempster Highway right of way where the road crosses the headwaters of the Rock River. Lithic artifacts and debitage collected.
MeVb-4	Precontact	Lithic scatter	74-01ASR	Located just west of Dempster Highway near the headwaters of Rock River. Lithics collected.
MeVb-5	Precontact	Lithic scatter	81-02ASR 96-07ASR	Located on an old terrace of the middle Rock River. Twenty artifacts were collected.
MeVd-1	Precontact	Isolated find	n/a	One possible flake collected.
MeVf-1	Undetermined	Isolated find	69-00ASR	Located on west bank of Porcupine River, on second major bend above Johnson Creek. Two specimens of modified bone collected.

Table 3: Known archaeological sites within/near the study area (continued).

Borden #	Site Class	Site Type	Permits	Notes
Sites Located Within 50 km of the Study Area				
MeVf-2	Undetermined	Isolated find	69-00ASR	Located on bank of Porcupine River, north of small stream flowing from west into large meander, below mouth of Ellen Creek. One wood specimen collected.
MfVf-1	Undetermined	Isolated find	69-00ASR	Located on east bank of Porcupine River. A single bone artifact collected. Site also referred to as Johnson Village.

Table 3: Known archaeological sites within/near the study area (continued).

YHSI #	Site Name	Category	Past Use	Current Use	Status
Sites Located Within the Study Area					
116I/03/001	Tth'an Dhidlii Njik Dalgish Creek Resource Area	Landscape, First Nation	n/a	n/a	Standing
Sites Located Within 50 km of the Study Area					
116I/09/002	Vyah K'it Gwinjik Vyah Kit Creek	Landscape, First Nation	n/a	n/a	Standing
116I/09/007	Vadzaih Kan Njik Vadzaih Kan Creek	Landscape, First Nation	n/a	n/a	Standing
116H/09/001	Featherstone Trading Post	Landscape	Trading Post	Abandoned	Standing
116J/08/001	Whitestone Village	First Nation	n/a	n/a	Standing
116I/07/002	Charlie/Tetlichi Camp	Landscape, First Nation	n/a	n/a	Standing
116I/16/001	Itsh'yah KhahViinjik Upper Rock River	Landscape, First Nation	n/a	n/a	Standing
116H/12/001	Joe Henry Cabin	Architecture, First Nation	n/a	n/a	Standing
116H/14/001	Louis Dumas Main Cabin	Architecture	Trapping cabin	Unknown	Standing
116I/07/003	Ezhin Njik Eagle River	Landscape, First Nation	n/a	n/a	Standing
116I/10/001	Vadzaih Kan Mount Joyal	Landscape, First Nation	n/a	n/a	Standing
116I/07/001	Bill Anderson Cabin	Architecture	n/a	n/a	Standing
116H/13/001	Charlie Able Cabin	Architecture, First Nation	n/a	n/a	Standing
116I/09/003	Vichi' T'ik Ts'iivii Njik Vichi Tik Tsiivii Creek	Landscape, First Nation	n/a	n/a	Standing

Table 3: YHSI sites within 50 km of the study area.

6.0 SUMMARY AND RECOMMENDATIONS

The goal of this study was to identify areas of archaeological potential within the Eagle Plains Basin Exploration Project permitted area. This was accomplished through a detailed review of the physical/environmental setting, cultural/historical setting, previous heritage studies/ identified sites within the study area, topographic maps, geological maps, aerial/satellite photographs, LiDAR-based hillshade imagery, and the creation of a GIS-based archaeological potential model.

This review identified multiple areas of elevated heritage potential for surface/subsurface heritage resource sites. Most areas of elevated potential for undocumented surface/subsurface heritage resource sites are associated with knolls and terraces in the valley bottoms and higher elevation terraces and ridgelines. Moreover, seven archaeological sites have been previously recorded within the study area, with 26 more within a 50 km site search buffer around the exploration area. One Yukon Historic Sites Inventory site has been recorded within the study area, with 13 more having been recorded within 50 km of the study area. Lastly, culturally modified tree (CMT) potential was not specifically assessed in this HROA due to a lack of available vegetation inventory data.

Heritage resource management recommendations for the Eagle Plains Basin Exploration Project directly follow the assessment of heritage resource potential discussed in Section 5.0. These recommendations include:

1. Heritage Resource Impact Assessments (HRIAs) are recommended for all lands with elevated heritage resource potential, as illustrated in Appendix A, before any ground disturbing activities are allowed to proceed within them. Should additional areas of potential be identified within a proposed development area during HRIA work, they should be assessed following the same standards recommended for the areas of potential identified in this report. HRIA work should be conducted under a Class 2 archaeological research permit issued by the Heritage Resources Unit of Yukon Tourism and Culture. HRIAs should, at minimum, include provisions for surficial survey and subsurface testing within the boundaries of the HRIA area identified in this document and any associated areas of potential that are identified in the field which are at risk of being impacted by proposed ground disturbing activities. Additional recommendations may be made following an HRIA depending on the results obtained.

2. Avoidance of areas within 30 m of any known heritage resource sites is recommended. If avoidance is not feasible, then further assessment work (e.g. systematic data recovery

excavations) should be conducted before the commencement of any ground disturbing activities within known site boundaries. This further assessment work should be conducted under a Class 2 archaeological research permit issued by the Heritage Resources Unit of Yukon Tourism and Culture.

3. No specific recommendations are made in regard to CMTs due to a lack of available vegetation inventory data. However, field crews should be vigilant for CMTs in all forested areas.

4. No Further Work (NFW) is recommended in areas identified as having low heritage resource potential prior to allowing ground disturbing activities. However, development should only be allowed to proceed on the condition that all chance finds of heritage resource materials be reported immediately to the Heritage Resources Unit of Yukon Tourism and Culture, and that all work at the location of a chance find cease until the Heritage Resources Unit is able to assess the finds and issue a response (clearance to proceed or requirements for avoidance/further mitigative work). If human remains are encountered, the guidelines provided in Appendix C should be followed.

5. It is recommended that this HROA report be submitted to the First Nation of Na-Cho Nyak Dun, Tetlit Gwich'in First Nation, Vuntut Gwitchin First Nation for review.

6. Where possible, it is recommended that representatives from the First Nation of Na-Cho Nyak Dun, Tetlit Gwich'in First Nation, Vuntut Gwitchin First Nation be given the opportunity to participate in any field investigations (e.g. HRIA).

Should future HRIA work be conducted, all heritage resource sites identified, whether new or revisited, should be recorded as per the requirements outlined in the Yukon Archaeological Sites Regulation (O.I.C. 2003/73). Once recorded/revisited, specific heritage resource management recommendations should be made for each site that reflect the potential impacts associated with the proposed development that spurred the HRIA.

Lastly, although all efforts were made during the production of this report to make its assessment of heritage resource potential as comprehensive and accurate as possible, the methods employed provide relatively coarse resolution. As such, small undocumented areas of heritage resource potential may be present within the study area. Moreover, there is always a possibility that chance finds of heritage resources will be made in areas of low perceived potential. The recommendations contained herein are intended to be used for planning purposes. Should intensive development be proposed for areas within the Eagle Plains Basin Exploration Project

permitted area in the future, further assessment, focused on the specific footprint of the proposed development is recommended.

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APPENDIX A: HROA Area of Potential and CMT Potential Mapping – Orthophoto Basemap – NOT INCLUDED IN YESAB READY/PUBLIC VERSION OF REPORT

APPENDIX B: HROA Area of Potential and CMT Potential Mapping – Hillshade Basemap – NOT INCLUDED IN YESAB READY/PUBLIC VERSION OF REPORT

APPENDIX C: Guidelines Respecting the Discovery of Human Remains and First Nation Burial Sites in the Yukon

Guidelines Respecting the Discovery of Human Remains and First Nation Burial Sites in the Yukon

With approvals as of August 1999

This document was prepared pursuant to provisions of
Yukon First Nation Final Agreements
and the Yukon Transboundary Agreement with the Gwich'in Tribal Council

Yukon
Tourism
Heritage Branch

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Introduction and Background

The treatment of every burial site requires respect. Legislation of various types protects burial sites and cemeteries from being disturbed. Government agencies and First Nations keep and consult records of known sites so that land use plans or proposals can avoid such sites.

There are many historic and First Nation graves in the Yukon however which are no longer marked and which may be disturbed accidentally through land use or development. Other sites may be disturbed by natural forces, such as erosion, leading to the exposure of human remains.

As more people travel in backcountry areas, for work or pleasure, it is expected that the number of such discoveries may increase. It is important therefore to have guidelines for reporting, investigating and managing such sites in a coordinated and effective manner, to give them proper respect.

Yukon First Nation (YFN) Final Agreements (Section 13.9.0) and the transboundary agreement with the Gwich'in Tribal Council (Tetlit Gwich'in) (Section 9.5) require the development of procedures to protect and manage YFN or TG burial sites, and specify certain actions when such sites are discovered.

Consistent with these obligations, these guidelines were developed at two workshops held jointly in March and October l998, involving First Nation Elders, heritage and implementation staff, the RCMP, Coroner and other Yukon and federal government officials.

Purpose

To provide direction on the reporting, identification, treatment and disposition of human remains found outside of recognized cemeteries in the Yukon, to ensure these remains are respected and protected consistent with legislation and Yukon land claims agreements.

Scope and Application

These guidelines apply to anyone who discovers human remains or grave goods outside of recognized cemeteries in the Yukon, and to the Yukon, Federal and First Nation government officials involved in protecting and caring for such sites.

The guidelines reflect existing practices in many ways. They do not replace legislation or regulations protecting burial sites, but are intended to integrate obligations contained in Yukon land claim agreements with land use permitting regimes and the Development Assessment Process . These guidelines may apply on Settlement Lands at the discretion of each First Nation. Government approval is required for management plans for sites on non-Settlement Land.

Existing known burial sites that are marked or otherwise recorded are protected by existing legislation. Management plans for these sites may be developed on a case by case basis.

Burial sites discovered within the boundaries of a designated heritage site may be subject to the management plan for that site.

The guidelines do not apply within National Historic Sites or National Parks. Parks Canada has its own guidelines respecting burial sites and human remains.

Evaluation and Revision of Guidelines

The implementation of these guidelines will be evaluated as necessary to ensure that they are fulfilling their purpose.

GUIDING PRINCIPLES

All human remains, and items found at graves (grave offerings, markers etc.) shall be treated with respect and dignity regardless of their cultural affiliation.

Actions taken following the discovery of sites will be consistent with Yukon and transboundary land claim agreement provisions respecting Yukon First Nation and Tetlit Gwich'in Burial Sites.

Each discovery will be handled on a case by case basis in consultation with the affected parties, in a coordinated and timely manner.

Definitions - see Appendix 1
References - see Appendix 2
Land claims provisions - see Appendix 3

Guidelines Respecting the Discovery of Human Remains and First Nation Burial Sites

See also Figure 1.

These guidelines cover five steps: discovery and notification; site protection and investigation; investigation and reporting; and site disposition or management agreements. A final step, arbitration, is provided for where no disposition agreement is reached.

1. Discovery and Notification

If human burial remains are accidentally discovered the following guidelines apply:

a) The finder will immediately cease any further activity at the site and report the site to the RCMP.

b) *If the finder is operating under a land use licence or permit*, the site must also be reported immediately to the land manager/permitting authority, as set out on the permit. The land manager/permitting authority shall confirm that the site is reported to the RCMP.

c) Based on the information it receives, the RCMP will notify: 1) the Coroner's office if the site is of a forensic or criminal nature; or 2) both the First Nation(s) in whose Traditional Territory the Site is located and the Heritage Branch, if the site is a suspected historic or First Nation burial site.

2. Site Protection and Identification

a) the land manager/permitting authority shall take reasonable measures to protect the site from environmental factors and any form of unauthorized interference or disturbance.

b) based on the evidence reported at the scene, the RCMP/Coroner will investigate the site and make a preliminary determination as to the nature of the remains.

c) *if the site is of a criminal or forensic nature* (potential crime scene or missing person), then the Coroner's office and police will assume authority over the site/remains.

d) Heritage Branch may recommend that an archaeologist assist police or coroner in the preliminary assessment of the site.

e) *If the site is **not** of police/coroner interest* then the Director, Heritage Branch, the affected First Nation(s) and the land manager will assume interim responsibility for protection and investigation of the site. If it's a suspected First Nation site, the Heritage Branch and First Nation would assume this responsibility.

f) the Director, Heritage Branch, the affected First Nation(s) and land manager shall take reasonable measures to restrict access and ensure that the human remains and any grave offerings are not further disturbed pending the investigation and identification of the remains. The RCMP may be consulted about protecting the site.

Figure 1

Guidelines respecting the Discovery of Human Remains and First Nation* Burial Sites

2. Site Protection and Investigation
-protection/no disturbance or access

If not a criminal matter, Heritage Branch takes lead with affected FN or transboundary group. RCMP may assist if requested.

- *First Nation, Minister*
- *permitting authority - person may continue activity*

with FN consent. If consent is not provided, proceed according to terms and conditions of arbitrator(UFA 26.7.0 TG Ch.18)

or

- *rebury, relocate or remove remains*
- *restrict/specify access if necessary and possible*
- *may designate existing or new site as burial site/cemetery or heritage site*
- *management plan (jointly prepared/approved by FN and Government on Non-Settlement Lands)*

Maps, inventories, reports, plans, agreements.

**the Tetlit Gwich'in will be involved in steps to protect and manage Tetlit Gwich'in burial sites discovered within their Primary Use Area (Fort McPherson Group Trapping area within the Peel River Basin).*

g) Where human remains are at risk of being destroyed or damaged, the Minister of Tourism for Heritage may issue a stop work order prohibiting any further activities and may make an agreement with the First Nation or the Tetlit Gwich'in or land owner or user for any investigation, excavation, examination and preservation and removal of the remains, consistent with land claim provisions. (s.*72, Historic Resources Act- This would address concerns about unknown remains.)*

Existing site inventories, land use records, affected First Nations and community elders, and military authorities, should be consulted as soon as possible about possible identification of the remains.

Some examination of the site/remains may be required to determine its cultural affiliation and age, and whether or not the site is modern or historic.

3. Investigation and Reporting

a) The Heritage Branch/land manager will direct an archaeologist or qualified examiner to carry out an investigation under any required permits, in consultation with the affected First Nation and other affected parties, to make an initial report citing, if possible*, the cultural affiliation of the human remains.

b) Within a reasonable time to be specified by the Minister, and the affected First Nation(s), the archaeologist or qualified examiner shall deliver a written report and any notification not yet made, to:

- the Minister, and the affected First Nation(s) if appropriate;
- the Director of the Heritage Branch;
- the land manager/permitting authority;
- any other representative of the interred, if known.

c) The written report shall attempt *to identify:

- the representative group of the interred;
- the geographic boundaries of the site;
- the grave offerings or other heritage resources that may be associated with the remains or the site.

d) The archaeologist or examiner may, with the agreement of the proper authority and the representative of the interred, if known, remove all or part of the human remains for further analysis or for temporary custody where the remains may otherwise be at risk.

e) Any exhumation, examination and reburial of human remains from a YFN/TG burial site shall be at the discretion of the affected YFN/TG; and if ordered by an arbitrator pursuant to land claim provisions, will be done or supervised by the YFN or Tetlit Gwich'in.

*it is often difficult to determine the cultural ancestry or affiliation of fragmentary human remains

3.1 Reporting

a) If the site is determined to be a Yukon First Nation Burial Site, or Tetlit Gwich'in burial site, the appropriate representative will be contacted in writing to provide further direction on the disposition of the remains. *

b) A person carrying out Government or First Nation authorized activity where a First Nation site is discovered can continue that activity with the consent of the First Nation in whose Traditional Territory the Yukon site is located. The consent of the Tetlit Gwich'in is required if the site is in the Tetlit Gwich'in primary use area. If consent is denied, the person can seek terms and conditions from an arbitrator about continuing the activity (see Section 5).

c) If after the final report, the human remains are found to be those of a different aboriginal people than those mentioned previously, the proper authority of that group shall be notified in order that they may assume the role of the representative.

d) Where a site is **not** found to be a Yukon First Nation or Tetlit Gwich'in burial site, or a military or mariner's burial site, the Director, Heritage Branch may publish notice of the discovery in a newspaper or other public notice seeking information on the remains.

4. Site Disposition Agreement (Management Plan)

4.1 When the site or remains are identified

a) The site shall not be disturbed and the Director, Heritage Branch or First Nation if on Settlement Land, shall initiate discussions towards entering into a site disposition agreement with the representative of the interred.

b) If the site is a Yukon First Nation Burial Site or a Tetlit Gwich'in burial site on non-settlement land, there must be joint approval of the site management plan by the Yukon First Nation in whose Traditional Territory the site is located and the Government. If the site is a Tetlit Gwich'in burial site located off Tetlit Gwich'in land but in the primary use area, the management plan must be jointly approved by the Tetlit Gwich'in and the Government.

c) Decisions regarding reburial, relocation or other disposition should be determined on a case by case basis in consultation with those concerned and in a timely manner.

Site disposition agreements shall determine such things as:
1. the interim care of the human remains*;*

2. the scope and extent of analysis to be performed on the human remains, if any;
3. the exact location of the place where the human remains are to remain or to be interred;
4. the style and manner of disinterment, if applicable;
5. the style and manner of reinterment, if applicable;
6. the time period in which disinterment and reinterment is to take place;
7. the procedures relating to, and the final disposition of any grave offerings discovered with the human remains and any additional analysis of them;
8. the provision for future maintenance of the cemetery or site where the human remains are to be located;
9. access to the site and ways to prevent disturbance;
10. any other issue agreed upon.

*it is often difficult to determine the cultural ancestry or affiliation of fragmentary human remains

4.2 When no representative is identified or no disposition is specified:

If disposition is not specified by a representative, or the remains are not claimed or no affiliation is established within a reasonable time, the Minister, or First Nation if on Settlement Land, shall with the necessary permits and approvals provide for the following disposition:

a) cover and leave the remains where they were found and have the site recorded as a burial site/ heritage site, if on land suitable for a burial site; or
b) have the remains disinterred and reinterred in the nearest appropriate cemetery; or
c) remove the remains from the site for analysis and may have them reinterred in a recognized cemetery or;
d) may act as the temporary repository of the remains.

(Where the remains were found on Settlement Land but are not considered First Nations remains, the Government may remove the remains in consultation with the First Nation.)

5. Arbitration

a) If no disposition agreement or management plan is reached within a reasonable time the matter may be referred to arbitration for settlement. If this matter concerns a Yukon First Nation Burial Site, this shall be done pursuant to 26.7.0 of the UFA; or Chapter 18, if the matter concerns a Tetlit Gwich'in site in the primary use area.

6. Records

a) A record of the site and a report of the discovery and disposition plan shall by kept by the Government and the affected First Nation(s)/representative for future reference to protect the site.

b) Access to information about discovered sites will be addressed in any site management plan developed under these guidelines, and will be protected under the *Access to Information and Protection of Privacy Act*, and the *Historic Resources Act* or *any similar First Nations legislation.*

Appendix 1

Definitions

burial site

the location of any human grave or remains that have been interred, cremated or otherwise placed, and include ossuaries, single burials, multiple burials; rock cairns; cave or cache burials etc. not situated within a cemetery

First Nation Burial Site

This refers to a Yukon First Nation Burial Site or a Tetlit Gwich'in burial site, which is defined as: a place outside a recognized cemetery where the remains of a cultural ancestor of a Yukon Indian Person (or the Tetlit Gwich'in) have been interred, cremated or otherwise placed."

[from the Definitions section of the *Umbrella Final Agreement for the Council for Yukon Indians (now Council of Yukon First Nations) and the Transboundary Agreement between Canada and the Gwich'in Tribal Council*]

human remains

mean the remains of a dead human body and include partial skeletons, bones, cremated remains and complete human bodies that are found outside a recognized cemetery" *(adapted from Historic Resources Act)*

grave offering

any object or objects associated with the human remains which may reflect the religious practices, customs or belief system of the interred.

historic

under the Historic Resources Act this generally means something older than 45 years.

land manager

Agency responsible for the administration of the land on which the site is located. For example, currently territorial parks are managed by Yukon Parks and Outdoor Recreation; gravel pits and rural airports are administered by Community and Transportation Services. Settlement Land is administered by the First Nation. Private land is administered by the land owner. (Burial sites may not be disturbed on any land without proper authorization.)

Recognized cemetery

a defined area of land that is set aside for the burial of human bodies.

representative

means a descendant of the interred or of the person whose remains are found, or where no descendant survives or is identified, an official representative of the appropriate First Nation in whose Traditional Territory the burial site is located or the closest culturally affiliated group, religious denomination, military or marine authority as evidenced by the location or mode of burial.

Where no representative can be determined the Minister shall act as the representative on Non-Settlement Lands and on Settlement Lands at the discretion and with the consent of the First Nation

representative group

means the appropriate Yukon First Nation or the closest culturally affiliated group, religious denomination, military or marine authority as evidenced by mode and style of burial which is willing to act as a representative.

Site disposition agreement

means a written agreement to be reached between the Director of the Heritage Branch and the representative of the interred regarding the disposition of the remains, including any disinterment and reinterment, and management plan

Management plan

means a plan to identify the roles of the representative, Government and land owner or manager respecting the care and protection of the site, including a consideration of site records, site access, and ways to protect a site from disturbance.

Appendix 2

References

The following include requirements to protect burial sites and were considered in the development of these Guidelines.

Umbrella and Yukon First Nation Final Agreements, Sections 13.9.0 and 26.7.0, and Implementation Plans
Yukon Transboundary Agreement (Gwich'in Tribal Council), Sections 9 and 18, and Implementation Plan
Yukon Historic Resources Act, Part 6
Criminal Code
Cemeteries and Burial Sites Act
Coroner's Act
Territorial Land Use Regulations
Yukon Archaeological Sites Regulations
Yukon Quartz Mining Act, and Regulations
Yukon Placer Mining Act, and Regulations
Yukon Surface Rights Act
Vital Statistics Act

Appendix 3

Land Claims Provisions Relating to Burial Sites

13.9.0 Yukon First Nation Burial Sites*

13.9.1 Government and Yukon First Nations shall each establish procedures to manage and protect Yukon First Nation Burial Sites which shall:

13.9.1.1 restrict access to Yukon First Nation Burial Sites to preserve the dignity of the Yukon First Nation Burial Sites;

13.9.1.2 where the Yukon First Nation Burial Site is on Non-Settlement Land, require the joint approval of Government and the Yukon First Nation in whose Traditional Territory the Yukon First Nation Burial Site is located for any management plans for the Yukon First Nation Burial Site; and

13.9.1.3 provide that, subject to 13.9.2, where a Yukon First Nation Burial Site is discovered, the Yukon First Nation in whose Traditional Territory the Yukon First Nation Burial Site is located shall be informed, and the Yukon First Nation Burial Site shall not be further disturbed.

13.9.2 Where a Person discovers a Yukon First Nation Burial Site in the course of carrying on an activity authorized by Government or a Yukon First Nation, as the case may be, that Person may carry on the activity with the agreement of the Yukon First Nation in whose Traditional Territory the Yukon First Nation Burial Site is located.

13.9.3 In the absence of agreement under 13.9.2, the Person may refer the dispute to arbitration under 26.7.0 for a determination of the terms and conditions upon which the Yukon First Nation Burial Site may be further disturbed.

13.9.4 Any exhumation, examination, and reburial of human remains from a Yukon First Nation Burial Site ordered by an arbitrator under 13.9.3 shall be done by, or under the supervision of, that Yukon First Nation.

13.9.5 Except as provided in 13.9.2 to 13.9.4, any exhumation, scientific examination and reburial of remains from Yukon First Nation Burial Sites shall be at the discretion of the affected Yukon First Nation.

13.9.6 The management of burial sites of a transboundary claimant group in the Yukon shall be addressed in that Transboundary Agreement.

*This is an excerpt from the Umbrella Final Agreement between Canada, the Council for Yukon Indians and the Government of the Yukon (l993),Ch. 13, pp. 128-129, and subsequent Yukon First Nation Final Agreements.

9.5. Tetlit Gwich'in Burial Sites*

9.5.1 Government and Tetlit Gwich'in shall each establish procedures to manage and protect Tetlit Gwich'in burial sites which shall:

(a) restrict access to Tetlit Gwich'in burial sites to preserve the dignity of Tetlit Gwich'in burial sites;

(b) where the Tetlit Gwich'in burial site is outside the primary use area *(Fort McPherson Group Trapping Area)*, require the joint approval of government and the Yukon First Nation in whose traditional territory the Tetlit Gwich'in burial site is located for any management plans for the Tetlit Gwich'in burial site;

(c) where the Tetlit Gwich'in burial site is on land in the primary use area which is not Tetlit Gwich'in Yukon land, require the joint approval of government and the Tetlit Gwich'in for any management plans for the Tetlit Gwich'in burial site; and

(d) provide that, subject to 9.5.2, where a Tetlit Gwich'in burial site is discovered, the Yukon First Nation in whose traditional territory the Tetlit Gwich'in burial site is located or the Tetlit Gwich'in, if the Tetlit Gwich'in burial site is in the primary use area, shall be informed and the Tetlit Gwich'in burial site shall not be further disturbed.

9.5.2 Where a person discovers a Tetlit Gwich'in burial site in the course of carrying on an activity authorized by government, a Yukon First Nation or the Tetlit Gwich'in, as the case may be, that person may carry on the activity with the agreement of the Yukon First Nation in whose traditional territory the Tetlit Gwich'in burial site is located or the Tetlit Gwich'in if the Tetlit Gwich'in burial site is in the primary use area.

9.5.3 In the absence of agreement under 9.5.2, the person may refer the dispute to arbitration under chapter 18 of this appendix for a determination of the terms and conditions upon which the Tetlit Gwich'in burial site may be further disturbed.

9.5.4 Any exhumation, examination and reburial of human remains from a Tetlit Gwich'in burial site ordered by an arbitrator under 9.5.3 shall be done by, or under the supervision of, the Tetlit Gwich'in.

9.5.5. Except as provided in 9.5.2 to 9.5.4, any exhumation, scientific examination and reburial of remains from Tetlit Gwich'in burial sites shall be at the discretion of the Tetlit Gwich'in**.**

*This is an excerpt from Appendix C - Yukon Transboundary Agreement between Canada and the Gwich'in Tribal Council, (l992), p. 32.

APPENDIX B. Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2023 Interim Report (23-03ASR)

ECOFOR
natural and cultural resource consultants

Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2023 Interim Report (23-03ASR)

(MAY BE INCLUDED IN YESAB MATERIALS
SITE SENSITIVE DATA HAS BEEN REMOVED)

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Tetlit Gwich'in First Nation
Vuntut Gwitchin First Nation
Yukon Government Heritage Resource Unit

January 19, 2024

YUKON HERITAGE RESOURCES UNIT

HERITAGE RESOURCES IMPACT ASSESSMENT – INTERIM REPORT

EAGLE PLAINS EXPLORATION PROJECT 2023 (23-03ASR)

ADMINISTRATION			
Permit Number	23-03ASR	**Report Author**	Tim Bennett
Ecofor EPN	23-1352-002	**Report Editor**	Joshua Sears
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PROJECT INFORMATION			
Type	Oil and Gas Exploration	**Name**	Eagle Plains Exploration Project 2023
Proponent	Chance Oil and Gas Ltd.	**Contact**	Richard Wyman 202-208 Main Street Whitehorse, Yukon, Y1A 2A9 Phone: 403-617-1166 Email: rwyman@chanceyukon.ca

ASSESSMENT DESCRIPTION	
Survey Type:	Heritage Resource Impact Assessment
Assessment Dates:	July 26-31, 2023

TRADITIONAL TERRITORY			
First Nation	Vuntut Gwitchin	**Contact**	Megan Williams Heritage Coordinator Phone: 867-966-3261 Email: mwilliams@vgfn.net
First Nation	Tetlit Gwich'in	**Contact**	Sharon Snowshoe Gwich'in Social and Cultural Institute Executive Director Phone: 867-952-2593 Email: ssnowshoe@Gwichin.nt.ca
First Nation	Na-Cho Nyak Dün	**Contact**	Teresa Samson Heritage Manager Phone: 867-996-2265; ext. 133 Email: heritagemgr@nndfn.com

GEOGRAPHIC REFERENCE			
Ecoregion	Eagle Plains	**Map(s) Attached**	Yes
NTS Mapsheet	116I/04, 116I/05, 116I/06	**Area (ha)**	~62521.7
UTM (NAD 83)	8 W 379050 7360580 (approximate study area center point)	**Elevation (m a.s.l.)**	~380-550

LOCATION

The proposed project includes oil and gas exploration work including, but not limited to, drilling, seismic exploration, and access development (e.g. roads and cutlines). The full study area covers approximately 238,604 ha on NTS mapsheets 116H/14, 116H/15, 116I/02, 116I/03, 116I/04, 116I/05, 116I/06, 116I/12, 116J/01, 116J/08, and 116J/09, and is located within the traditional territory of the First Nation of Na-Cho Nyak Dun, Tetlit Gwich'in First Nation, Vuntut Gwitchin First Nation (Figure 1).

MANAGEMENT SUMMARY

On behalf of Chance Oil and Gas Ltd., Ecofor Consulting Ltd. has conducted a Heritage Resource Impact Assessment (HRIA) for Eagle Plains Exploration Project 2023 study area (Figure 1). This study focused primarily on areas of predicted heritage resource potential (AOPs) in the northeastern part of the exploration area that were identified in a preceding Heritage Resource Overview Assessment (HROA; see Bennett 2022). One other area in the southern portion of the exploration area, related to an existing winter road leading to an existing well site, was also assessed from a helicopter to look for any potential areas of heritage resource concern. **Note: All specific geographic references to heritage site locations, photographs, and some site details have been removed from this YESAB ready version of this report so that it can be issued publicly while protecting sensitive site data.**

HRIA work included helicopter survey throughout the study area, with pedestrian survey and shovel testing within five AOPs/shovel test locations (STLs). In total, 232 shovel tests were excavated, with 20 in STL 20091-1 being positive for heritage resources, and leading to the recording of archaeological site McVd-1. All other STLs were negative for heritage resources. Moreover, no heritage resource concerns were observed during the aerial survey of the southern winter road area.

Further information about the newly recorded archaeological site and tested areas is presented below in the Evaluation section of this report.

POTENTIAL IMPACTS

Potential impacts include activities related to oil and gas exploration, including seismic programs, winter road creation, well pad building, and drilling.

ARCHAEOLOGICAL ASSESSMENT METHODOLOGY

This study builds on previous phases of heritage resource assessment, including Heritage Resource Impact Assessments (HRIAs) conducted under permits 01-07ASR (Hammer 2001), 07-04ASR (Heffner and Ross 2008), 08-06ASR (Commisso and Heffner 2008), and 13-16ASR (Buchanan 2014) and a 2022 Heritage Resource Overview Assessment (HROA; Bennett 2022). AOPs were first identified using a GIS model in the 2021 HROA, then manually reviewed by the applicant to eliminate false AOPs picked up by the GIS model. Given the size of the study area, it was not feasible to fully assess all AOPs within the study area footprint. As such, the assessment began with aerial reconnaissance from a helicopter to further refine the AOPs and identify those

with the best potential within the study area. HRIA field efforts focused on assessing a representative sample consisting of five of these AOPs.

Fieldwork in the assessed AOPs was conducted by a crew of three Ecofor archaeologists, including Tim Bennett (permit holder), Jacob Risk, and Mia Kelly, with assistance from Bruce Charlie (Vuntut Gwitchin First Nation). Assessment work began with pedestrian survey throughout the selected AOPs to search for any surficial heritage resources and areas with substantiated subsurface heritage resource potential. Areas with substantiated elevated subsurface potential were further investigated through shovel testing. In STLs, shovel tests were excavated every 5-15 m. Shovel tests measured at least 35 cm by 35 cm and were excavated with shovel and trowel as needed into sterile subsoils. All excavated sediments were screened through ¼ inch mesh. Artifacts identified were collected and bagged according to the shovel test unit and stratum, or arbitrary 5-10 cm vertical interval. The profile of representative shovel tests in each tested area was recorded by depth below surface and natural and cultural soil strata. All shovel tests were backfilled and returned to as close to natural conditions as possible. Where cultural materials were identified, additional shovel testing was conducted to assess the vertical and horizontal limits of the site, and to recover a sample of the material culture to assist in the assessment of the site use and cultural affiliation. All survey tracks and shovel tests were documented via hand-held GPS.

The newly recorded heritage resource site was recorded, mapped, photographed, and its location was recorded using a hand-held GPS unit. Moreover, it was flagged with a 30 m avoidance buffer (marked with “no work zone” flagging tape) in the field. It was given a temporary site number and comprehensive site data, including site setting, access, vegetation, hydrology, elevation, sedimentary and cultural stratigraphy, artifacts recovered, features present, etc. was collected. This information has been submitted to the Yukon Government Heritage Resource Unit for site inventory and return of Borden number.

All artifacts recovered will be cleaned, analyzed, and cataloged as per the requirements of the Yukon Archaeological Sites Regulations (YG 2020) at Ecofor’s Whitehorse lab, and detailed results will be included with the project final report. Lithic artifacts will be recorded by provenience and macroscopically analyzed. Flakes will be assigned to a reduction stage, tool categorized by type, raw material will be identified, and metric data will be recorded.

Final reporting, site forms, and artifact curation preparations will meet the Yukon Archaeological Sites Regulations Guidelines for Permit Holders (YG 2020).

EVALUATION

HRIA work included helicopter survey throughout the study area, with pedestrian survey and shovel testing within five AOPs/ STLs. In total, 232 shovel tests were excavated, with 20 in STL 20091-1 being positive for heritage resources, and leading to the recording of archaeological site McVd-1. All other STLs were negative for heritage resources. One other area in the southern portion of the exploration area, related to an existing winter road leading to an existing well site, was also assessed from a helicopter to look for any potential areas of heritage resource concern.

Further information about the tested areas is presented below.

Newly Recorded Archaeological Site

McVd-1 (AOP 20091/STL 20091-1)

Newly recorded archaeological site McVd-1 is located on a knoll overlooking an unnamed creek to the southwest (Figure 2 and Figure 3 – Map 3 of 6; Photo 1). Vegetation in the site area is characterized by open spruce with dwarf birch, young aspen, crowberry, lichen, and various small plants. In total, 74 shovel tests were excavated, 20 of which were positive for heritage resources, leading to the recording of new archaeological site McVd-1. Artifacts recovered are summarized in Table 1. Sediments encountered in these shovel tests consisted of organics from 0-1 cm, followed by fine grey brown sand from 1-6 cm, fine tan grey sand from 6-12 cm, light brown sand with pebbles from 12-18 cm, then grey sand with tabular pebbles from 18-23 cm below surface (Photo 2). A thick, charcoal rich lens was observed in two shovel tests located approximately 1 m from each other (Photo 3). As such, it is interpreted as being over 1 m in width. No artifacts were associated with the charcoal lens. Given the large size of the lens, and the fact that no artifacts were associated with it, it is considered likely that it is likely a product of a natural burn rather than a hearth. Based on these results, McVd-1 is interpreted as a subsurface lithic scatter. A 30 m site avoidance buffer around the positive test is recommended and was flagged in the field.

Negative Shovel Test Locations

STL 9071-1 (AOP 9071)

STL 9071-1 is located on a high, undulating, north facing terrace with sandstone bedrock exposures overlooking a small unnamed creek (Figure 2 and Figure 3 – Map 2 of 6; Photo 4). The terrace top is largely burned by past forest fires. Vegetation is characterized by open spruce forest

Artifact Type	Material	Colour	Quantity
Core Fragment	Chert	Grey	1
Flake Fragment	Chert	Black	11
		Brown	1
		Dark Grey	2
		Grey	7
		Light grey	2
	Dacite	Black	8
		Dark Grey	3
	Siltstone	Brown	1
		Grey	2
		Grey and brown	1
Scraper	Chert	Black	1
		Grey	1

Table 1: Artifact Summary from McVd-1.

with cranberry, crowberry, and lichen. In total, 40 shovel tests were excavated at STL 9071-1. Sediment profiles encountered in these shovel tests consisted of organics from 0-4 cm, followed by orange brown silty sand from 4-25 cm, then grey sand with sandstone cobbles and pebbles from 25-36 cm below surface (Photo 5). All shovel tests were negative for heritage resources.

STL 26381-1 (AOP 26381)

STL 26381-1 is located on a high northeast and east facing terrace overlooking an unnamed creek (Figure 2 and Figure 3 – Map 3 of 6; Photo 6). Vegetation is characterized by mixed aspen and spruce forest with an understory of Labrador tea, crowberry, lichen, and various small plants. In total, 42 shovel tests were excavated at STL 26381-1. Sediment profiles encountered in these shovel tests consisted of organics from 0-3 cm, followed by coarse light brown silt from 3-22 cm, fine grey brown sand from 22-40 cm, then grey sand with cobbles and pebbles from 40-50 cm below surface (Photo 7). All shovel tests were negative for heritage resources.

STL 28669-1 (AOP 28669)

STL 28669-1 is located on a high east and southeast facing terrace overlooking an unnamed creek (Figure 2 and Figure 3 – Map 3 of 6; Photo 8). Vegetation is characterized by spruce forest with occasional birch and an understory of cranberry, crowberry, blueberry, rose, and various small plants. In total, 42 shovel tests were excavated at STL 28669-1. Sediment profiles encountered in these shovel tests consisted of organics from 0-2 cm, followed by brown silt from 2-40 cm, then grey sand with cobbles and pebbles from 40-45 cm below surface (Photo 9). All shovel tests were negative for heritage resources.

STL 38131-1 (AOP 38131)

STL 38131-1 is located on a high southeast facing terrace overlooking an unnamed creek (Figure 2 and Figure 3 – Map 4 of 6; Photo 10). Vegetation is characterized by spruce forest with an understory of dwarf birch, Labrador tea, cranberry, blueberry, moss, and lichen. In total, 35 shovel tests were excavated at STL 38131-1. Sediment profiles encountered in these shovel tests consisted of moss from 0-12 cm, followed by organics from 12-17 cm, moist grey brown silty clay with pebbles from 17-35 cm, then moist grey brown silty clay with over 50% cobbles and pebbles from 35-40 cm below surface (Photo 11). All shovel tests were negative for heritage resources.

Winter Road Helicopter Survey

One other area in the southern portion of the exploration area, related to an existing winter road leading to an existing well site, was also assessed from a helicopter to look for any potential areas of heritage resource concern (Figure 2 and Figure 3 – Map 6 of 6). The area was found to be characterized by rolling hills with no well defined landforms that would indicate elevated heritage resource potential (Photo 12). No heritage resource concerns were identified along the winter road corridor.

Future Assessment Directions

In general, terrain within the study area was found to be gently rolling with very few well defined landforms. As such, the majority of AOPs identified in the preceding HROA (see Bennett 2022) were found to possess overall low potential for heritage resources based on their nature as broad, poorly defined, undulating ridges and hills. Review of the nine archaeological sites that are known

within the study area suggests that the highest potential landforms for finding sites are relatively low well defined terraces and large well defined knolls that clearly stand out against the surrounding terrain.

Based on these observations, the AOPs as predicted in the preceding HROA should be reviewed and revised on a footprint specific basis as new developments are planned for the Eagle Plains Exploration project or any other projects that are proposed in this area. These revisions should be aimed at refining the potential model to eliminate specific types of landforms that should now be considered to be low potential for heritage resources after the in field observations made during this study.

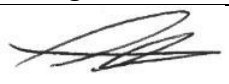
RECOMMENDATIONS

HRIA work included helicopter survey throughout the study area, with pedestrian survey and shovel testing within five AOPs/shovel test locations (STLs). In total, 232 shovel tests were excavated, with 20 in STL 20091-1 being positive for heritage resources, and leading to the recording of archaeological site McVd-1. All other STLs were negative for heritage resources. Moreover, no heritage resource concerns were observed during the aerial survey of the southern winter road area.

Based on these results, **avoidance is recommended for newly recorded archaeological site McVd-1 and previously recorded archaeological sites LlVc-1, LiVd-1, MaVc-3, MaVc-4, MaVc-5, MaVc-6, MaVe-1, and MbVf-1. If avoidance is deemed to be infeasible, then further assessment (e.g. additional shovel testing and systematic data recovery excavations) should be conducted before the commencement of ground disturbing activities. The specific mitigative plan should be developed through consultation with the Yukon Government Heritage Resource Unit and First Nations. No further work is recommended for any of the negative STLs. Untested AOPs should be reviewed and revised on a footprint specific basis as new developments are planned for the Eagle Plains Exploration project or any other projects that are proposed in this area.**

If crews encounter any undocumented heritage resources during any exploration activities, all work in the area should cease and the finds should be reported to the Yukon Government Heritage Resource Unit and First Nations immediately for guidance in managing impacts to unrecorded heritage resource sites.

Moreover, if any additional development areas are added to the project, then those new areas should also be reviewed for possible impacts to heritage resources. This follow-up heritage review may be conducted through desktop overview and/or field study. Final project reporting, to meet Yukon Heritage Permit requirements is pending, and will be completed prior to March 31, 2024.

Signed:  Date: January 19, 2024

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Appendix A: HRIA Mapping – NOT INCLUDED IN YESAB READY/PUBLIC VERSION OF REPORT

Appendix B: HRIA Photographs – NOT INCLUDED IN YESAB READY/PUBLIC VERSION OF REPORT

APPENDIX C. Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2022 Final Report (22-22ASR)

ECOFOR
natural and cultural resource consultants

Heritage Resource Impact Assessment: Eagle Plains Exploration Project 2022 Final Report (22-22ASR)

(MAY BE INCLUDED IN YESAB MATERIALS SITE SENSITIVE DATA HAS BEEN REMOVED)

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March 15, 2023

EXECUTIVE SUMMARY

On behalf of Chance Oil and Gas Ltd., Ecofor Consulting Ltd. has conducted a Heritage Resource Impact Assessment (HRIA) for Eagle Plains Exploration Project 2022 study area. HRIA efforts focused on areas of predicted elevated heritage resource potential (AOPs) identified in a preceding Heritage Resource Overview Assessment (HROA; see Bennett 2022). The proposed project includes oil and gas exploration work including, but not limited to, drilling, seismic exploration, and access development (e.g. roads and cutlines). The full permitted exploration area covers approximately 238,604 ha on NTS mapsheets 116H/14, 116H/15, 116I/02, 116I/03, 116I/04, 116I/05, 116I/06, 116I/12, 116J/01, 116J/08, and 116J/09, and is located within the traditional territories of the First Nation of Na-Cho Nyak Dun, Tetlit Gwich'in First Nation, and Vuntut Gwitchin First Nation. **Note: All specific geographic references to heritage site locations, photographs, and some site details have been removed from this YESAB ready version of this report so that it can be issued publicly while protecting sensitive site data.**

This study focuses on a subsection of the full exploration area where an oil and gas exploration program is proposed. The exploration area is located in the northern part of the greater exploration area, and covers 62,521.7 ha. The exploration work will be conducted under winter conditions, with frozen ground and limited vegetation clearing, and will have very little associated ground disturbance.

HRIA work included helicopter survey throughout the study area, with pedestrian survey and shovel testing within 12 AOPs/shovel test locations (STLs). In total, 228 shovel tests were excavated, with four in STL E10 being positive for heritage resources, and leading to the recording of archaeological site MbVf-1. All other STLs were negative for heritage resources.

Based on these results, **avoidance is recommended for newly recorded archaeological site MbVf-1. If avoidance is deemed to be infeasible, then further assessment (e.g. additional shovel testing and systematic data recovery excavations) should be conducted before the commencement of ground disturbing activities. The specific mitigative plan should be developed through consultation with the Yukon Government Heritage Resource Unit and First Nations. No further work is recommended for any of the negative STLs. Untested AOPs should be reviewed and revised on a footprint specific basis as new developments are planned for the Eagle Plains Exploration project or any other projects that are proposed in this area. No further heritage resource assessment is recommended prior to the proposed exploration program due to the low impact nature of the work as long as new archaeological site MbVf-1 is avoided.** However, if crews encounter any undocumented heritage resources during any exploration

activities, all work in the area should cease and the finds should be reported to the Yukon Government Heritage Resource Unit and First Nations immediately for guidance in managing impacts to unrecorded heritage resource sites.

CREDITS

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1.0 INTRODUCTION

On behalf of Chance Oil and Gas Ltd., Ecofor Consulting Ltd. has conducted a Heritage Resource Impact Assessment (HRIA) for Eagle Plains Exploration Project 2022 study area (Figure 1). HRIA efforts focused on areas of predicted elevated heritage resource potential (AOPs) identified in a preceding Heritage Resource Overview Assessment (HROA; see Bennett 2022). The proposed project includes oil and gas exploration work including, but not limited to, drilling, seismic exploration, and access development (e.g. roads and cutlines). The full study area covers approximately 238,604 ha on NTS mapsheets 116H/14, 116H/15, 116I/02, 116I/03, 116I/04, 116I/05, 116I/06, 116I/12, 116J/01, 116J/08, and 116J/09, but this study focuses on a 62,521.7 ha subsection of the full exploration area where an exploration program is proposed. The study area is located within the traditional territory of the First Nation of Na-Cho Nyak Dun, Tetlit Gwich'in First Nation, Vuntut Gwitchin First Nation. **Note: All specific geographic references to heritage site locations, photographs, and some site details have been removed from this YESAB ready version of this report so that it can be issued publicly while protecting sensitive site data.**

1.1 Project Overview

This study focuses on a subsection of the full exploration area where an oil and gas exploration program is proposed. The exploration area is located in the northern part of the greater exploration area, and covers 62,521.7 ha (Figure 1). The exploration work will be conducted under winter conditions, with frozen ground and limited vegetation clearing, and will have very little associated ground disturbance. Additional exploration work (e.g. well pad construction, drilling, winter road construction, etc.) may occur within this area in the future, and similar programs may be completed in other parts of the greater exploration area as the overall project develops.

This work sought to identify and record any heritage resource sites within that study area that may be affected by development and make management recommendations to minimize development related impacts to heritage resources within the development area. This work builds on a previous phases of desktop overview study that assessed the baseline heritage resource potential within the exploration area (see Bennett 2022).

1.2 Personnel

Fieldwork was completed between July 26-Aug 2, 2022 by a crew of three Ecofor archaeologists, including Tim Bennett (permit holder), Alexa Lauer, and Jacob Risk, with assistance from Vuntut Gwitchin First Nation.

Figure 1 Overview Map

Eagle Plains

Chance OIL AND GAS LIMITED

ECOFOR

Ecofor Consulting Ltd. May 17, 2022 (NM)

Road
Trail
Contour
Watercourse
Waterbody
Wetland
Town
Highway
Surveyed Land Parcel
First Nations Heritage Route
First Nation Settlement Land
Study Area
Exploration Area

1:500,000

0 5 10 15 20 km

NAD 1983 UTM Zone 8N

N



Disclaimer: This product is for informational purposes only and may not have been prepared for or be suitable for legal, engineering, or surveying purposes. The base data layers have been obtained from the National Topographic Database (NTDB), and GeoYukon.Service Layer Credits: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

1.3 Report Format

Following this introduction in Section 1.0, Section 2.0 provides a discussion of the environmental setting that the proposed project is located within, Section 3.0 discusses the culture history of the area in which the proposed project is located, Section 4.0 details the methodologies employed in completing this work, Section 5.0 presents the results of this HRIA, Section 6.0 provides a summary and recommendations for the ongoing management of heritage resources within the assessed project area, and Section 7.0 closes the report with a listing of references cited. Four appendices are included at the end of this report[1]. Appendix A shows project results mapping, Appendix B provides project photographs, Appendix C presents details about newly recorded archaeological site MbVf-1, and Appendix D provides the project field notes.

[1] Note: These appendices have been removed from this YESAB ready version of this report so that it can be issued publicly while protecting sensitive site data.

2.0 ENVIRONMENTAL SETTING

The Eagle Plains Exploration Project is located west and south of Eagle Plains, YT on public land. It includes portions of the North Yukon and Peel Watershed Planning Regions, and is located within the traditional territories of the Vuntut Gwitchin and the First Nation of Na-Cho Nyak Dun, as well as the Tetlit Gwich'in Primary and Secondary Use Areas of the Gwich'in Settlement Region. The Dempster Highway transects the project area and provides all-season access to the Blackie winter road, the Chance winter road, and the suspended wells at McParlon A-25 and Ehnjuu Choo B-73. Named watercourses include Chance Creek, Dalglish Creek, Enterprise Creek, Greaves Creek, and McParlon Creek. Further information regarding the broader physical/environmental setting of the study area is presented below.

2.1 Physical/Environmental Setting

The study area is located within the Eagle Plains Ecoregion. This ecoregion is characterized as is an intermontane sedimentary basin of modest relief between the Richardson Mountains to the east and the North Ogilvie Mountains to the west (Smith et al. 2004). It includes the Eagle Lowland as defined by Mathews (1986), or part of the Porcupine Plateau and Porcupine Plain as defined by Bostock (1948) and Hughes (1987). The majority of the rolling low-relief terrain falls between 300 m a.s.l. and 600 m a.s.l. (Oswald and Senyk 1977), although some mountainous areas reach as high as 1,000 m a.s.l. and some river valleys as low as 250 m a.s.l. (Smith et al. 2004). The majority of the ecoregion drains to the north through the Whitestone, Porcupine, and Eagle River systems to eventually end up in the Yukon River watershed with the exception of the southeast corner which drains east via the Ogilvie and Peel Rivers to the Mackenzie River (Smith et al. 2004). Lakes are relatively rare in the Eagle Plains Ecoregion, but some oxbow and thermokarstic lakes are located within the floodplains of the Whitestone, Porcupine, and Eagle Rivers (Smith et al. 2004).

Due to its latitude, the Eagle Plains Ecoregion does experience periods of continuous daylight and darkness, however these periods are brief. Mean annual temperatures are near -7.5°C, but the area exhibits strong seasonal temperature variation (Smith et al. 2004). In January, average temperatures typically range from -31°C in lower valleys to -25°C at higher elevations (Smith et al. 2004). Summer temperatures are less affected by elevation, and average 13°C (Smith et al. 2004). Recorded extreme temperatures range from -60°C during winter to 30°C in summer (Smith et al. 2004). Precipitation is relatively moderate, with an annual average of 400 mm annually (Smith et al. 2004). The majority of this precipitation falls as rain during the summer months, primarily in showers, with the period between September and April being the driest part of the year (Smith et al. 2004).

The bedrock geology of the ecoregion is characterized by Devonian through Cretaceous sedimentary rocks, including sandstones, siltstones, limestones, and shales, representing an intermontane basin sandwiched between the uplifted Richardson, North Ogilvie, and Dave Lord Mountain ranges (Smith et al. 2004). Lands within this ecoregion are not known for metallic minerals or significant coal deposits, but it does contain hydrocarbon resources. Three of 11 test wells drilled before an exploration moratorium in 1968 intersected porous Carboniferous, Permian, and Cretaceous sandstones in the Chance and Dagleish anticlines in the southern and southeastern part of the ecoregion are estimated to contain 2.8×10^9 m^3 of gas and 3.1×10^6 m^3 of oil (T. Bird, in Hamblin 1990).

Surficial geology is characterized by colluvial deposits throughout most of the ecoregion, with the remainder consisting of alluvial sediments along river systems and a few glaciofluvial and glaciolacustrine deposits associated with meltwater generated by glacial activity outside the ecoregion (Smith et al. 2004). Modern processes affecting the surficial geology include thermokarst subsidence and soil creep, cryoturbation, solifluction, and active layer detachment slides (Smith et al. 2004). Permafrost is discontinuous in the ecoregion, but is continuous within the exploration area, and can be up to 200 m thick in places with taliks focused in major river valleys (Thomas and Rampton 1982).

The majority of the Eagle Plains Ecoregion in composed of unglaciated terrain with some exceptions to this trend in parts of the Nahoni Range where there is scattered evidence of a past local glaciation of undetermined age (Smith et al. 2004). However, glacial processes in neighbouring ecoregions have influenced the major rivers in Eagle Plains, with up to three levels of glacially controlled terraces present along some drainages (Thomas and Rampton 1982). Major meltwater outlets exited the eastern slopes of the North Ogilvie Mountains and the northern slopes of the South Ogilvie Mountains via Ogilvie, Miner, Whitestone, Blackstone, and Hart Rivers channels (Smith et al. 2004). Moreover, during the Late Wisconsinan glacial maximum (ca. 30 ka; Hughes et al. 1981; Schweger and Matthews 1991) the Laurentide Ice Sheet blocked drainage of the Peel River and its southern tributaries forming Glacial Lake Hughes, which diverted the drainage northward through the Eagle River discharge channel (Duk-Rodkin and Hughes 1995). Glacial Lake Hughes received all the water exiting the Mackenzie and Wernecke mountains and the Ogilvie, Blackstone, and Hart river basins. Consequently, the Eagle and Porcupine rivers were the two major contributors to the inundation of the Old Crow, Bluefish, and Bell basins (Smith et al. 2004).

In terms of vegetation, black spruce-tussock/shrub tundra with understories including shrub birch, Cottongrass tussocks, bog cranberry, cloudberry, Labrador tea, crowberry, lingonberry,

spirea, lichen, and moss is typical on the lower slopes (Zoltai and Pettapiece 1973). Upland areas are dominated by black and white spruce woodlands with understories of Labrador tea, shrub birch, willows, alder, blueberry, rose, lowbush cranberry, spirea, moss, and lichen (Smith et al. 2004). Here white spruce is most common in better drained areas (Russell et al. 1992; Murray 1997). Forest fires are a significant factor in these wooded areas. Pioneer species important in recolonizing burn areas include paper birch, aspen, and balsam poplar (Zoltai and Pettapiece 1973). The highest elevation in the Eagle Plains Ecoregion, above approximately 800 m a.s.l., are typified by shrub tundra dominated by scrub birch, willow, and prostrate shrubs with some Cottongrass tussocks (Smith et al. 2004).

Mammalian biodiversity is relatively low in the Eagle Plains Ecoregion compared to other Taiga Cordillera ecoregions due to a lack of suitable habitats for many of the rodent and ungulate species found elsewhere (Smith et al. 2004). However, representative species present do include several predators including wolf, wolverine, grizzly and black bear, marten, ermine, and red fox (Smith et al. 2004). Barren-ground caribou of the Porcupine herd also utilize this area primarily in the fall and winter, and several species of vole can be found (Smith et al. 2004). The Eagle Plains Ecoregion also supports a large and greatly diverse avian population, including both permanent and migratory birds (Smith et al. 2004).

3.0 CULTURAL HISTORY

The following is an overview of the culture history for the broader region surrounding the study area including south-central and southwestern Yukon, and northern British Columbia. Many researchers have reviewed the cultural history of this broader area and have presented the information using a variety of terms and temporal ranges (Clark 1981; West 1996; Workman 1978; Wright 1995, 1999).

3.1 Precontact Period (ca. 15,000 BP to ca. AD 1700s)

Portions of the Yukon, NWT, and Alaska were unglaciated during the Last Glacial Maximum (18,000 BP). The area is commonly referred to as Eastern Beringia. Several of the earliest well-documented Precontact archaeological sites in Eastern Beringia are found in the northwestern Yukon and have been dated to the Late Pleistocene from approximately 15,000 BP to 13,000 BP (de Guzman et al. 2014; Easton 2015; Easton et al. 2007, 2011; Easton and MacKay 2008), as well as one outlier site dated to 24,000 BP (Bourgeon et al. 2017)[2]. Artifacts recovered from these sites include technological suites shared by other Eastern Beringian sites such as the Nenana/Chindadn (non-microblade) and Denali (microblade) Complexes, and date between 15,000 and 8,000 BP (Dixon 2011; Heffner 2002; Holmes 2001, 2011; Potter 2011). The material culture recovered from these sites, primarily defined through lithic technology that includes both non-microblade and microblade technology, is known as the Eastern Beringian Tradition (Holmes 2001). The Northern Cordilleran Tradition (11,000 BP to 7,000 BP) is defined from sites in the interior Yukon that notably lack microblade technology. The Northern Cordilleran Tradition is characterized by large straight and round-based lanceolate point forms, large blades and flakes, and transverse notched burins (Clark 1983; Hare 1995).

The Northern Cordilleran Tradition was followed by the Little Arm Phase, which dates from 7,000 BP to 4,500 BP (Clark and Gotthardt 1999; Workman 1978) and can be defined by the use of microlithic technologies. After about 4,500 BP, there is less evidence of microblade use in the Yukon, and an increase in the use of notched projectile points and a variety of scraping and carving tools. This new tool industry is known as the Taye Lake Phase in southwest Yukon, or

[2] Of note regarding early archaeological sites in the Eastern Beringia area is the very early site at Bluefish Caves, which has been recently dated to approximately 24,000 BP (Bourgeon et al. 2017). However, due to the nature of the archaeological assemblage recovered and paucity of known archaeological sites bridging the temporal gap between Bluefish Caves and other early sites, such as the Little John site (Easton 2015; Easton et al. 2007, 2011; Easton and MacKay 2008) and the Britannia Yukon Hill site (de Guzman et al. 2014) which date to approximately 15,000 BP, questions remain for many archaeologist regarding the relationship of the occupation documented at Bluefish Caves to the more recent archaeological record and modern First Nations peoples.

more broadly in the Yukon and Alaska as the Northern Archaic Tradition (Hare 1995; Workman 1978).

The most recent precontact archaeological component found in the Yukon is that of the late Northern Archaic Tradition, or the Late Precontact period. This period is most clearly represented by the Aishihik Phase found in the Southern Yukon (Hare 1995; Workman 1978). This phase is thought to be a cultural development from the earlier Taye Lake culture, although there are some significant differences in technology. The most notable is the introduction of the bow and arrow, replacing a type of throwing spear known as an atlatl (Hare et al. 2004). The Aishihik Phase sites are found above the White River Volcanic Ash layer (also known as White River Tephra) that is dated to approximately 1,250 BP (Clague et al. 1995).

The Aishihik Phase has been evaluated as ranging from approximately 1,200 BP to 200 BP, and also includes the use of native copper tools, stemmed projectile points, and gorges. Also indicative of the Aishihik Phase are small stemmed Kavik points, end and side scrapers, and ground adzes (Hare 1995). The poor preservation of organic materials makes the task of diet reconstruction more difficult than at the coastal sites, but there is evidence of continued use of a variety of large and small mammals, fish, and birds. In the high elevations of the southern Yukon ice patches, examples of the transition from the older atlatl technology to the bow and arrow use has been clearly documented by recent finds (Hare et al. 2004). The shift to the new technology was a rather abrupt one at roughly 1,200 BP based on a good sample of preserved and dated atlatl dart shafts and bow and arrow remains.

3.2 Protohistoric Period (A.D. 1700s to ca. AD 1840s)

The Protohistoric Period, as presented here, also overlaps with late Prehistoric/Athabaskan Period. It is defined by the appearance of non-indigenous goods, other early trade items, and foreign (western or eastern) influences, but not the documented accounts of contact between indigenous North American peoples and European/Russian/Asian peoples themselves. Other indicators of the Protohistoric Period are the arrival of the first non-indigenous diseases and information concerning non-indigenous peoples. Unlike other cultural periods with more specific temporal ranges it is difficult and perhaps impossible to determine when the first 'outside' influences of European, Russian, Asian, or other cultures began to impact First Nations people in the Yukon interior.

Some of these far-reaching effects may have been passed along from Russian exploration in the early and mid-1700s (Veniaminov 1984) and other Asian and European (Andreev 1944; Quimby 1985) exploration and contact with coastal communities. The Chilkat Tlingit from the Northwest

Coast travelled and traded with many interior First Nation peoples throughout this Protohistoric Period including the Kaska and the Northern Tutchone from the Dawson and Mayo areas, and occasionally the Mountain Dene people from as far away as Fort Norman on the Mackenzie River. The Tlingit protected and controlled the trading routes into the interior and fiercely defended those routes when they were threatened. News of early non-indigenous explorers and traders would have travelled inland along with foreign items such as metals, cloths, glass beads, and later tobacco and other goods.

In some of the earliest cases, the impacts of these foreign cultures could have had significant impacts even without the presence of the foreigners themselves. Such is the case for what is called 'drift-iron' whereby metals and other materials from Asian or European shipwreck wash ashore. Historical accounts of shipwrecks have been reported in the mid-1700s, but much earlier wrecks were possible. Metals and other foreign trade items have been derived from shipwrecks off what is now British Columbia, Southeast Alaska, and perhaps the Northwest Alaska as well.

3.3 Historic Period (post-A.D. 1840s)

During the early years of this period the Russians were exploring along the Pacific coast and up the major rivers of the Alaskan interior, while the British were exploring eastward into what would become Canada's Northwest and Yukon Territories, and Alaska. In the 1840s, representatives of the Hudson Bay Company (HBC) established trading posts throughout much of the northern territories. The closest trading post to the study area would have been the HBC Fort Francis post, located on the north side of Frances Lake, at the junction of the East and West Arms. In 1840 Robert Campbell of the HBC built "Glenlyon House" and began trading there in 1842. When trading began Campbell changed the name from Glenlyon House to Fort Francis, after Lady Francis Simpson the wife of the governor of the HBC. It was the first trading post in the Yukon Territory and was successful for the first few years, however when Fort Selkirk and Fort Pelly Banks were established it deteriorated and eventually shut down in 1852 (Coutts 1980). The location of Fort Selkirk was known to upset the Chilkat Tlingit who controlled the trade routes from the coast to the central Yukon. In 1852, a Chilkat Tlingit raiding party travelled inland and forced Robert Campbell and his crew to leave the trading post, which was consequently burned by the Northern Tutchone (Castillo 2012).

In 1867, US Secretary of State William Seward was able to focus increasing American interests, and he convinced the United States Senate to purchase Alaska from Russia. Soon after the purchase, the US Army sent Captain Raymond up the Yukon River on the first stern-wheel steamer to reach Fort Yukon (Grauman 1977). Raymond surveyed the location of Fort Yukon and

proved that it was within U.S. territory. The British sold the Fort to the U.S. Government and relocated east across the 141st Meridian.

The inland fur industry continued to drive exploration and settlement into the late 1800s, but mining would shift the focus to the placer gold found in streams and alluvial deposits. Mining in the second half of the nineteenth century was a risky, but often very lucrative enterprise. The impacts of mining spread quickly and drastically changed the project area.

Mineral prospecting and mining efforts in the second half of the nineteenth century were, in some ways, dependent on the existing infrastructure of the fur trading and missionary efforts. As the competition for the inland fur trade grew, so would the number of stern-wheelers on the Yukon River. These steamers could better supply the small number of trading posts along the Yukon and its tributaries and reduce the risk of prospectors running short of supplies. Therefore, more of the fur traders and other explorers turned their attention to search for gold and other minerals. Three key prospectors to the north were L. S. (Jack) McQuesten, Al Mayo, and Arthur Harper. They wrote to miners in the United States to encourage them to come north. They also established outposts along the Yukon River, including Fort Reliance, established in 1874 near the confluence of the Klondike River (what would become Dawson City; Wright 1976).

Harper and another man may have been the first to travel up the Fortymile River in search of gold in 1881 (Buzzell 2003). They collected a very rich sample, but were unable to relocate the exact location. In 1886, McQuesten, Harper, and Mayo built a post on the confluence of the Stewart and Yukon Rivers which provided supplies for additional prospectors. Also in 1886, Howard Franklin made a richer find on the Fortymile River. Others rushed in and these claims along the Fortymile River attracted miners from across Central, Eastern Alaska, and Southeast Alaska. Fortymile was the first town to grow to over a thousand people by the mid-1890s (Buzzell 2003), and in 1887 the Stewart River post was deserted. Some prospectors that did not find easy success in Fortymile returned to the Stewart and continued work in the area. In 1890, Harper re-established a trading post at the site of the old HBC post at Selkirk as interest in the area grew. This was followed by Jack Dalton who developed a series of existing First Nation trails from tide water at Haines Alaska, into Fort Selkirk. Then, on August 16, 1896, George Carmack, Skookum Jim, and Tagish Charlie discovered a very rich claim on Bonanza Creek, a tributary to the Klondike River near Dawson. This discovery sparked one of the largest gold rushes in history.

It would take almost a year for the news of the Klondike gold fields to spread south, even to places relatively close by in southeast Alaska. Most of the prospectors and traders in the Alaskan and Yukon interior had already converged on the Dawson area during the winter and spring, and

supplies ran dangerously low. That would quickly change in the summer of 1897 and spring of 1898 as new towns and supply posts sprang up along the Gold Rush routes to cash in on the increased demand.

The population of Dawson City grew very fast and in 1898 reached a peak of over 30,000. However, the boom period did not last long, and the vast majority of population moved on very quickly with the news of other discoveries and hopes of other bonanzas. The Gold Rush period saw greatly increased steamer traffic on the entire Yukon River drainage basin and across the interior. Just prior to the Gold Rush there were only a few steamers, while at its peak there would be hundreds of vessels working the rivers. These shallow draft steamers were supported by a network of wood camps, shipyards, and a large workforce which kept the river traffic moving. This network provided the infrastructure backbone for trading posts, fish camps, missionaries, and mail routes, while meeting the needs of the growing number of prospectors and traders.

Since Dawson City is located on a flood plain at the confluence of the Klondike and Yukon Rivers it has had a long history of fighting with rising water levels. Flooding here is the result of either open water flooding at peak river flows, or the more dangerous spring ice jam events. Dawson City has been the victim of over twenty floods since 1898 (McCreath et al. 1988; Whitehorse Star 1979). The most significant of these were in 1925, 1944, 1966, 1969 and 1979. After flooding in the 1940s and 1950s Front Street was raised in an attempt to keep the waters out, but this did little to stop the flooding. A protective dyke was built around the City in 1959 and was later increased in 1968. The last major flood of Dawson City occurred in 1979 when ice jams on the Indian, Klondike, and the Yukon Rivers caused the spring waters to back up across the City. This prompted the construction of the improved dyke (to the 200 year flood level) in 1987 (McCreath et al. 1988). Dawson City served as the capital of the Yukon government from 1898 until 1952, when the seat was moved to Whitehorse.

The Yukon has also hosted oil and gas exploration efforts since the 1950s. The first well was drilled in the Eagle Plains Basin in 1957, but was declared dry in 1958 (Yukon Government Oil and Gas Resources Branch, n.d.). Exploration activity picked up again in the 1960s and 1970s, which played an important role in motivating the construction of the Dempster Highway. Interest in exploration has continued intermittently ever since, with 76 wells having been drilled to date in five of eight Yukon sedimentary basins (Eagle Plain, Beaufort Mackenzie, Peel Plateau and Plain, Kandik, and Liard Basins) between 1957 and 2013 (Yukon Government Oil and Gas Resources Branch, n.d.). Over 10,000 line-km of 2D and 3D seismic surveys have been conducted as part of these exploration efforts (Yukon Government Oil and Gas Resources Branch, n.d.). Six oil and gas pipelines have also been constructed in the Yukon, including four built during World War II as

part of the Canol project, one built in the 1950s to supply American Air Force bases in Alaska during the Korean War, and the 2012 Spectra Energy pipeline built in 1972 to move natural gas from the Kotaneelee gas field in southeast Yukon to southern markets (Yukon Government Oil and Gas Resources Branch, n.d.).

3.4 Modern First Nations

3.4.1 Gwich'in Nation

The Gwich'in Nation is an Athapaskan speaking group that includes First Nations/Native American peoples in the Yukon, Northwest Territory, and Alaska (VGFN 2009). Members of the greater Gwich'in Nation include the Vuntut Gwitchin and Tetlit Gwich'in in the Yukon, the Teetl'it Zheh Gwich'in, Gwichya Gwich'in, Ehdiitat Gwich'in, and Nihtat Gwich'in in the NWT, and the Dendu Gwich'in, Draan'jik Gwich'in, Danzhit Hanlaih Gwich'in, Gwich'yaa Gwich'in, and Neets'ąjį Gwich'in in Alaska (McFadyen Clark 2020). Of particular significance to this project are the Teetl'it Zheh Gwich'in (TGC) and Vuntut Gwitchin (VGFN), whose traditional territories/modern community centers are crossed by the proposed project. Oral traditions and ethnographies of Gwich'in people have been documented by Krech (1976), Osgood (1933, 1934, 1936), Petitot (1876, 1889), Savishinsky and Hara (1981), VGFN and Smith (2009), Heine et al. (2007), and McCartney and Gwich'in Tribal Council (2020), among others.

Collectively, the traditional lifeways of the Gwich'in people depended on hunting and fishing. Moose and caribou were of vital economic importance providing both food and hides for clothing and shelter, but salmon, white fish, hare, and plant foods such as berries and rhubarb were also significant sources of subsistence (McFadyen Clark 2020). Their traditional toolkit was similar to other subarctic Athapaskan groups, and included the bow and arrow, traps, snares, deadfalls, and nets for fishing. People also utilized caribou drift fences and pounds to improve hunting yields. Snowshoes, sleds, and canoes were all employed for greater mobility. Hide covered tents provided the primary source of shelter.

Many Gwich'in communities continue to rely on subsistence harvesting from the land. The Vuntut Gwitchin (which translates to "people of the lakes") are based in Old Crow; the only community in the Yukon without road access (VGFN 2009). The Teetl'it Zheh Gwich'in (which translates to "people of the head waters") are based in Fort McPherson, NWT, which was established in 1852 when Old Fort, a Gwich'in village, was moved from six kilometers upriver to the present town site (Gwich'in Council International 2009). Fort McPherson represents the largest Gwich'in settlement in the NWT with over 80% of its population being of Gwich'in descent (Gwich'in Council International 2009). Gwichya Gwich'in (which translates to "people of the flats") are centered in Tsiigehtchic, NWT, and the Nihtat Gwich'in, meaning "mixed nations", is a

group comprised of Gwich'in from various Gwich'in communities that reside in Inuvik (Gwich'in Council International 2009).

3.4.2 First Nation of Na-Cho Nyak Dun

The First Nation of Na-Cho Nyak Dun (NND) is part of the Northern Tutchone language and culture group. In the past, the Tutchone peoples were highly mobile, travelling in small groups in order to exploit the greatest number of resources. They would modify their movements depending on the patterns of large game animals and fish, or in later years to trade their furs with non-indigenous peoples. In the summer, small domestic units gathered together to catch fish so that they could dry and store it for the winter months. By mid-summer, several family groups moved upland together in order to kill large game mammals that they would dry and store in caches scattered in a variety of areas. From there some units moved away independently during the coldest months to trap and live off of the cached foods. The leanest months were March and April. In spring, several units often came together at this point to catch spawning whitefish or trap muskrat and beaver. May was the most plentiful month, with migrating waterfowl, fat ground squirrels, larger and more abundant fish, as well as the arrival of the Coastal Tlingit traders (McClellan 1981).

The principal ethnographic descriptions of the Tutchone are available in Cruikshank (1974, 1975), Johnson and Raup (1964), McClellan (1950, 1964, 1970a, 1970b, 1975), and Tanner (1966). Additional information on camp and village locations can be found in Schwatka (1885). Although villages were not inhabited year-round, people would return to good fishing and/or hunting spots year after year. This would eventually change with the influence of Westerners. Watercraft were constructed for use, however during the summer months Tutchone people preferred to walk overland, rather than brave the sudden winds on the large lakes or the treacherous river rapids. Boats were not the preferred method of transport.

NND remained somewhat isolated until the discovery of gold in the area in 1883 (Mayo Historical Society 1999). The NND are known to have used many traditional camps, lookout sites, hunting areas, berry patches, and trails in the larger project area with extensive use of rivers. McClellan (1981) summarized the common seasonal activities beginning in the spring with grayling fishing following spring break up. The NND people remained almost completely isolated from non-First Nation people, except for a few explorers passing through, until miners set up a supply post along the McQuesten River in 1886. The supply post soon turned into a village and from then on permanent camps and villages have existed in the larger area surrounding Mayo Lake. During the Duncan Creek gold rush, a trading post called Gordon Landing was established near the confluence of Janet Creek and the Stewart River. From there a trail allowed people to travel

north partially along Davidson Creek to the confluence of Duncan Creek on the Mayo River. The Town of Mayo was established in 1903 and the people of McQuesten and a few other small encampments moved there or to the "Old Village" just outside of town (Mayo Historical Society 1999). This village made it possible for people to receive a western education, live close to Mayo, and continue their preferred way of life and cultural celebrations. Eventually the "Old Village" was abandoned when in 1958 the local health officials determined the drinking water was polluted and the NND were requested to move to the Town of Mayo. The First Nations people in the Mayo area officially chose the name "Na-Cho Nyak Dun" in 1987 which means "Big River People" in reference to the now named Stewart River.

3.5 Previous Heritage Investigations

The study area has not been extensively explored from a heritage resource perspective, but consultation with the Yukon Government Heritage Resource Unit did identify a few studies that have assessed portions of the current footprint. These studies include three permitted HRIAs related to previous oil and gas exploration (01-07ASR [Hammer 2001], 07-04ASR [Heffner and Ross 2008], and Commisso and Heffner [2008]), and one HRIA related to a fibre optic cable project along the Dempster Highway ROW (16-16ASR [Bennett 2016a]). Three non-permitted studies, including a historic resource overview assessment (HROA; Bennett 2016b), a traditional knowledge/traditional land use study (Bennett 2017), and an update to the original HROA (Bennett 2019), have also been completed in association with the fibre optic project along the Dempster Highway, and an HROA was completed in 2022 for the Eagle Plains Exploration Project (Bennett 2022). Known sites within the 50 km of the study area are summarized below in Table 1 and Table 2.

Borden #	Site Class	Site Type	Permits	Notes
LlVc-1	Precontact	Isolated find	00-21ASR	Located on a west-facing knoll 15 m above the valley bottom on Dalglish Creek. Six shovel tests were excavated with one chert flake recovered.
LlVd-1	Precontact	Subsurface lithic scatter	00-21ASR	Located on a southeast facing bedrock knoll with exposures to the southeast and northeast overlooking Enterprise Creek. Four tests were excavated and several chert flakes resulting from the production of stone tools were recovered from two of the tests. The site is considered to be a small lithic scatter likely representing temporary camp of game lookout.
MaVc-3	Precontact	Subsurface lithic scatter	01-07ASR 13-16ASR	Located on a north-south running terrace with an east view overlooking a pond and a sedge tussock meadow. Nine test pits excavated, with one being positive. Collection consists of two chert flakes.
MaVc-4	Precontact	Surface lithic scatter	08-06ASR 13-16ASR	Located on the west branch of a small tributary of the Upper Eagle River on the southeast edge of a terrace. Two flakes were found in surface exposures on the front edge of terrace.
MaVc-5	Precontact	Subsurface lithic scatter	13-16ASR	Located on outer SE nose of a large, squared terrace bench point along small tributary of upper Eagle River. Finds include a small assemblage of chert and siltstone lithics.
MaVc-6	Precontact	Subsurface lithic scatter	13-16ASR	Located on the outer edge of a large terrace bench formation along a small tributary of upper Eagle River. Finds include a small assemblage of chert and rhyolite/tuff lithics recovered from a tree throw.
MaVe-1	Precontact	Subsurface lithic scatter	13-16ASR	Located on a small terrace knoll overlooking a large expanse of tussock meadows framed between two small tributaries feeding in from the north. Finds include a small assemblage of chert lithics.
MaVc-2	Precontact	Subsurface lithic scatter	01-07ASR	Located on a bedrock knob overlooking an old creek bed, south of the Dempster Highway, southeast of Eagle Plains. Eight test pits excavated, with two being positive. Collections include chert core fragment and chert flakes.

Table 1: Known archaeological sites within/near the study area.

Borden #	Site Class	Site Type	Permits	Notes
MbTx-1	Precontact	Lithic scatter	94-15ASR	Located on a medium elevation bedrock rubble ridge, in the upper Canyon Creek Valley. A small collection of flakes and one scraper was made over an area of about 50 m in diameter near the highest point in the valley.
MbTx-2	Precontact	Isolated find	94-15ASR	Located on the right bank of a small tributary that drains west into the upper part of Canyon Creek. A single flake was found and collected.
MbTx-3	Precontact	Lithic scatter	94-15ASR	Located on a series of terrace beaches on the north side of an east-west running tributary of the upper Canyon Creek. A single flake was found on the upper bench. A large scraper made of welded tuff (?) was found on the lower bench.
MbVa-1	Precontact	Isolated find	94-15ASR	Located on a ridge complex in the foothills of the Richardson Mountains, near the headwaters of a tributary of the Eagle River. A single, broken biface was collected.
MbVa-2	Precontact	Lithic scatter	94-15ASR	Located on a knoll complex, three clusters of artifacts were found within an area of about 30 m. in diameter. Artifacts include substantial quantities of debitage and 2 bifaces, one of which is made on a large (15 cm long) macroblade. Site also known as the Ziehe Site.
MbVa-3	Precontact	Lithic scatter	94-15ASR	Located on a medium elevation complex of bedrock rubble ridges. Site consists of two clusters of large argillite (?) flakes/core fragments.
MbVa-4	Indigenous historic	Pole structure	94-15ASR	Located on a heavily wooded terrace, on the right bank of a mountain stream at the foot of a bedrock rubble ridge in the foothills of the Richardson Mountains. Consists of two collapsed pole/log structures. The poles are steel axe cut. Noted one wire nail and a piece of string.
MbVa-5	Precontact	Surface lithic scatter	94-15ASR	Two flakes were collected from the surface.
McVa-1	Precontact	Isolated find	00-14ASR	Located on the south end of a ridge complex, on the east side of Canyon Creek, near the headwaters of the creek. Collection consists of one chert flake.

Table 1: Known archaeological sites within/near the study area (continued).

Borden #	Site Class	Site Type	Permits	Notes
McVh-1	Historic	Historic scatter	69-00ASR	Located on the west bank of Whitestone River at on a long prominent bend. Metal, shell, glass bottles, and beads collected.
McVh-2	Precontact	Lithic scatter	69-00ASR	Located on northwest bank of Miner River, just downstream from island below confluence of Miner River and Fishing Branch. Lithic debitage collected.
McVh-3	Historic	Precontact/ historic scatter	69-00ASR	Located on north bank of fishing branch, where channel narrows to a line on the Porcupine River. Some flakes, bone, wood, glass objects collected.
McVh-4	Palaeontological	Isolated find	67-01ASR	Located on left bank of Whitestone River on the outside of a bend below the mouth of Chance Creek. A mammoth or mastodon tusk was collected from the surface of a river bar deposit in 1976.
MdVa-1	Precontact	Lithic scatter	74-01ASR	Located along the Dempster Highway ROW where the road crosses the headwaters of a major tributary of the Eagle River. Lithic artifacts and debitage collected.
MdVa-2	Precontact	Lithic scatter	78-11ASR	Located on low bench on the south side of a tributary of the Eagle River. Isolated tool and flake finds.
MdVh-1	Undetermined	Faunal materials	69-00ASR	Located on right bank of Whitestone River, just above its confluence with the Porcupine River. Faunal samples (bone) collected.
MeVb-1	Precontact	Lithic scatter	74-01ASR	Lithic artifacts and debitage collected.
MeVb-2	Precontact	Lithic scatter	74-01ASR 96-07ASR	Located on the Dempster Highway right of way where the road crosses the headwaters of Rock River. Flakes collected.
MeVb-3	Precontact	Lithic scatter	74-01ASR	Located just east of the Dempster Highway right of way where the road crosses the headwaters of the Rock River. Lithic artifacts and debitage collected.
MeVb-4	Precontact	Lithic scatter	74-01ASR	Located west of Dempster Highway near the headwaters of Rock River. Lithics collected.
MeVb-5	Precontact	Lithic scatter	81-02ASR 96-07ASR	Located on an old terrace of the middle Rock River. Twenty artifacts were collected.
MeVd-1	Precontact	Isolated find	n/a	One possible flake collected.
MeVf-1	Undetermined	Isolated find	69-00ASR	Located on west bank of Porcupine River, on second major bend above Johnson Creek. Two specimens of modified bone collected.
MeVf-2	Undetermined	Isolated find	69-00ASR	Located on bank of Porcupine River, north of small stream flowing from west into large meander, below mouth of Ellen Creek. One wood specimen collected.

Table 1: Known archaeological sites within/near the study area (continued).

Borden #	Site Class	Site Type	Permits	Notes
MfVf-1	Undetermined	Isolated find	69-00ASR	Located on east bank of Porcupine River. A single bone artifact collected. Site also referred to as Johnson Village.
MeVf-2	Undetermined	Isolated find	69-00ASR	Located on bank of Porcupine River, north of small stream flowing from west into large meander, below mouth of Ellen Creek. One wood specimen collected.
MfVf-1	Undetermined	Isolated find	69-00ASR	Located on east bank of Porcupine River. A single bone artifact collected. Site also referred to as Johnson Village.

Table 1: Known archaeological sites within/near the study area (continued).

YHSI #	Site Name	Category	Past Use	Current Use	Status
116I/03/001	Tth'an Dhidlii Njik Dalgish Creek Resource Area	Landscape, First Nation	n/a	n/a	Standing
116I/09/002	Vyah K'it Gwinjik Vyah Kit Creek	Landscape, First Nation	n/a	n/a	Standing
116I/09/007	Vadzaih Kan Njik Vadzaih Kan Creek	Landscape, First Nation	n/a	n/a	Standing
116H/09/001	Featherstone Trading Post	Landscape	Trading Post	Abandoned	Standing
116J/08/001	Whitestone Village	First Nation	n/a	n/a	Standing
116I/07/002	Charlie/Tetlichi Camp	Landscape, First Nation	n/a	n/a	Standing
116I/16/001	Itsh'yah Khah Viinjik Upper Rock River	Landscape, First Nation	n/a	n/a	Standing
116H/12/001	Joe Henry Cabin	Architecture, First Nation	n/a	n/a	Standing
116H/14/001	Louis Dumas Main Cabin	Architecture	Trapping cabin	Unknown	Standing
116I/07/003	Ezhin Njik Eagle River	Landscape, First Nation	n/a	n/a	Standing
116I/10/001	Vadzaih Kan Mount Joyal	Landscape, First Nation	n/a	n/a	Standing
116I/07/001	Bill Anderson Cabin	Architecture	n/a	n/a	Standing
116H/13/001	Charlie Able Cabin	Architecture, First Nation	n/a	n/a	Standing
116I/09/003	Vichi' T'ik Ts'iivii Njik Vichi Tik Tsiivii Creek	Landscape, First Nation	n/a	n/a	Standing

Table 2: YHSI sites within 50 km of the study area.

4.0 METHODOLOGY

This study builds on previous phases of heritage resource assessment, including Heritage Resource Impact Assessments (HRIAs) conducted under permits 01-07ASR (Hammer 2001), 07-04ASR (Heffner and Ross 2008), 08-06ASR (Commisso and Heffner 2008), and 13-16ASR (Buchanan 2014) and a 2022 Heritage Resource Overview Assessment (HROA; Bennett 2022). Areas of potential (AOPs) were first identified using a GIS model in the 2021 HROA, then manually reviewed by the applicant to eliminate false AOPs picked up by the GIS model. Given the size of the study area, it was not feasible to fully assess all AOPs within the exploration area footprint. As such, the assessment began with aerial reconnaissance from a helicopter to further refine the AOPs and identify those with the best potential within the study area. HRIA field efforts focused on assessing a representative sample consisting of twelve of these AOPs.

Assessment work began with pedestrian survey throughout the selected AOPs to search for any surficial heritage resources and areas with substantiated subsurface heritage resource potential. Areas with substantiated elevated subsurface potential were further investigated through shovel testing. In shovel test locations (STLs), shovel tests were excavated every 5-15 m. Shovel tests measured at least 35 cm by 35 cm and were excavated with shovel and trowel as needed into sterile subsoils. All excavated sediments were screened through ¼ inch mesh. Artifacts identified were collected and bagged according to the shovel test unit and stratum, or arbitrary 5-10 cm vertical interval. The profile of representative shovel tests in each tested area was recorded by depth below surface and natural and cultural soil strata. All shovel tests were backfilled and returned to as close to natural conditions as possible. Where cultural materials were identified, additional shovel testing was conducted to assess the vertical and horizontal limits of the site, and to recover a sample of the material culture to assist in the assessment of the site use and cultural affiliation. All survey tracks and shovel tests were documented via hand-held GPS.

The newly recorded heritage resource site was recorded, mapped, photographed, and its location was recorded using a hand-held GPS unit. Moreover, it was flagged with a 30 m avoidance buffer (marked with “no work zone” flagging tape) in the field. It was given a temporary site number and comprehensive site data, including site setting, access, vegetation, hydrology, elevation, sedimentary and cultural stratigraphy, artifacts recovered, features present, etc. was collected. This information has been submitted to the Yukon Government Heritage Resource Unit for site inventory and return of Borden number.

All artifacts recovered have been cleaned, analyzed, and cataloged as per the requirements of the Yukon Archaeological Sites Regulations (YG 2020) at Ecofor’s Whitehorse lab. Lithic artifacts were recorded by provenience and macroscopically analyzed. Flakes will be assigned to a

reduction stage, tool categorized by type, raw material will be identified, and metric data will be recorded.

5.0 RESULTS

HRIA work included helicopter survey throughout the study area, with pedestrian survey and shovel testing within 12 AOPs/shovel test locations (STLs). In total, 228 shovel tests were excavated, with four in STL E10 being positive for heritage resources, and leading to the recording of archaeological site MbVf-1. All other STLs were negative for heritage resources. Further information about the tested areas is presented below.

5.1 Newly Recorded Archaeological Site

5.1.1 MbVf-1 – STL E10 (AOP 56587)

Newly recorded archaeological site MbVf-1 is located in STL E10 (AOP 56587) on a V-shaped point terrace overlooking the confluence of three drainage channels to the west (Figure 2 – Mapsheet 12 of 13; Photo 1). The site is located approximately 56 km west southwest of Eagle Plains. Vegetation in the site area is characterized by recently burnt spruce forest. Regenerating vegetation currently present at the site includes dwarf birch, rose, fireweed, Labrador tea, and various small plants with standing and fallen burnt spruce. In total, 47 shovel tests were excavated. Four were positive for heritage resources, leading to the recording of new archaeological site MbVf-1. Finds include eight chert flakes/flake fragments and one siltstone flake fragment. Sediments encountered in the positive test consisted of organics from 0-9 cm, followed by brown sandy silt from 9-25 cm, then greyish brown sandy silt from 25-32 cm below surface (Photo 2). Based on these results, MbVf-1 is interpreted as a subsurface lithic scatter that likely represents an ephemeral occupation of the area. A 30 m site avoidance buffer around the positive test is recommended and was flagged in the field.

5.2 Negative Shovel Test Locations

5.2.1 STL E1 (AOP 22214)

STL E1 (AOP 22214) is located on a high terrace overlooking a small unnamed drainage to the south (Figure 2 – Mapsheet 2 of 13; Photo 3). The terrace top is largely burned by past forest fires. Vegetation is characterized by standing and fallen burnt spruce, live birch, fireweed, rose, and various small plants. The surrounding unburnt areas is characterized by mature spruce forest. In total, eight shovel tests were excavated at STL E1. Sediment profiles encountered in these shovel tests consisted of organics from 0-7 cm, followed by brown clayey silt from 7-29 cm, dark brown sand from 29-57 cm, then dark brown sand with tabular cobbles from 57-60 cm below surface (Photo 4). All shovel tests were negative for heritage resources.

5.2.2 STL E2 (AOP 22214)

STL E2 (AOP 22214) is located on the same terrace as STL E1 with the same vegetation cover

(Figure 2 – Mapsheet 2 of 13; Photo 5). In total, seven shovel tests were excavated at STL E2. Sediment profiles encountered in these shovel tests consisted of organics from 0-7 cm, followed by tan silt from 7-25 cm, then light brown clayey silt (clay content increasing with depth) from 25-54 cm below surface (Photo 6). All shovel tests were negative for heritage resources.

5.2.3 STL E3 and STL E4 (AOP 22214)

STL E3 and STL E4 (AOP 22214) are located on the same terrace as STL E1 and STL E2 (Figure 2 – Mapsheet 2 of 13; Photo 7 and Photo 8). By the time they were completed, they had grown together to effectively become a single STL. Vegetation is characterized by partially burnt open spruce and aspen forest. In total, 10 shovel tests were excavated at STL E3 with an additional 16 tests in the STL E4 section. Sediment profiles encountered in STL E3 shovel tests consisted of organics from 0-4 cm, followed by brown clayey silt from 4-28 cm, olive brown silty clay from 28-49 cm, then brown sand with pebbles from 49-61 cm below surface (Photo 9). STL E4 sediment profiles were characterized by organics from 0-2 cm, followed by reddish brown silt from 2-24 cm, brown silty sand from 24-34 cm, then light brown sand from 34-42 cm below surface (Photo 10). All shovel tests were negative for heritage resources.

5.2.4 STL E5 (AOP 148087)

STL E5 (AOP 148087) is located on a high U-shaped terrace offering views to the south and west (Figure 2 – Mapsheet 2 of 13; Photo 11). The terrace becomes poorly defined in the more northerly part of AOP 148087, and no testing was conducted in that area as it was interpreted as possessing low potential for heritage resources. Forest fires have burnt this area, and vegetation is characterized by fire killed spruce and birch with living alder, rose, fireweed, Labrador tea, kinnikinnick, blueberry, cloud berry, and grass tussocks. In total, 30 shovel tests were excavated. Sediment profiles encountered in these shovel tests range from organics from 0-5 cm, followed by light brown clayey silt from 5-16 cm, brown clayey sand that grades to grey with depth from 16-40 cm, then grey moist sand from 40-45 cm below surface in shovel test E5-7 (Photo 12) to organics/root mat from 0-5 cm then grey/brown compact clay from 5-29 cm below surface in shovel test E5-19 (Photo 13). All shovel tests were negative for heritage resources.

5.2.5 STL E6 (AOP 17886)

STL E6 (AOP 17886) is located on a moderately defined terrace overlooking Chance Creek and a pond to the east (Figure 2 – Mapsheet 3 of 13; Photo 14). The area had moderate potential at best, but was identified by Vuntut Gwitchin participant Bruce Charlie as a typical winter use area, so the decision was made to excavate some shovel tests. Vegetation is characterized by young spruce (fire regeneration) with an understory of moss, lichen, dwarf birch, willow, and various

small plants. In total, 15 shovel tests were excavated. Sediment profiles encountered in these shovel tests consisted of organics from 0-9 cm, followed by brown clayey silt from 9-19 cm, then grey/brown sticky compact clay from 19-35 cm below surface (Photo 15). All shovel tests were negative for heritage resources.

5.2.6 STL E7 (AOP 18907)

STL E7 (AOP 18907) is located on a variably well-defined terrace overlooking Chance Creek to the east (Figure 2 – Mapsheet 3 of 13; Photo 16). Vegetation is characterized by spruce forest with an understory of moss, lichen, rose, Labrador tea, kinnikinnick, and various small plants. In total, 11 shovel tests were excavated. Sediment profiles encountered in these shovel tests consisted of organics from 0-6 cm, followed by brown clayey silt with small pebbles from 6-28 cm, then dark brown sand with pebbles from 28-43 cm below surface (Photo 17). All shovel tests were negative for heritage resources.

5.2.7 STL E8 (AOP 38363)

STL E8 (AOP 38363) is located on a long terrace with views to the south and southwest (Figure 2 – Mapsheet 8 of 13; Photo 18). Vegetation is characterized by medium sized spruce with birch at the terrace edge and an understory of moss, lichen, rose, kinnikinnick, and grass tussocks. In total, 27 shovel tests were excavated. Sediment profiles encountered in these tests were variable. In the eastern portion of the STL profiles consisted of moss from 0-8 cm, organics from 8-15 cm, then compact grey clay from 15-30 cm below surface (Photo 19). In the central part of the STL profiles were characterized by moss from 0-9 cm, followed by organics from 9-14 cm, brown silty clay from 14-16 cm, grey clay with veins of ice from 16-29 cm, then permafrost below 29 cm below surface (Photo 20). It the western part of the STL permafrost was much more pronounced appearing immediately below 19 cm of moss (Photo 21). All shovel tests were negative for heritage resources.

5.2.8 STL E9 (AOP 38753)

STL E9 (AOP 38753) is located on a south facing midslope terrace downslope from STL E8 (Figure 2 – Mapsheet 8 of 13; Photo 22). The primary view is to the south to a small unnamed drainage, but Chance Creek would also be visible to the west if not for the trees. Vegetation is open spruce forest with kinnikinnick, Labrador tea, rose, moss, lichen, and various small plants. In total, 10 shovel tests. Sediment profiles encountered in these shovel tests consisted of organics from 0-6 cm, followed by tan silt from 6-10 cm, brown clayey silt from 10-32 cm, then grey sand with 50% cobbles and pebbles from 32-50 cm below surface (Photo 23). All shovel tests were negative for heritage resources.

5.2.9 STL E11 (AOP 56058)

STL E11 (AOP 56058) is located on a U-shaped terrace with views over drainages to the south, southeast, and southwest (Figure 2 – Mapsheet 12 of 13; Photo 24). The area has been burnt by forest fires, with current vegetation represented by dwarf birch, rose, fireweed, Labrador tea, and various small plants with standing and fallen burnt spruce. In total, 22 shovel tests were excavated. Sediment profiles encountered in these shovel tests consisted of organics from 0-2 cm, followed by pinkish tan silt from 2-7 cm, orangish brown silt from 7-16 cm, then coarse brown sand with 50% pebbles from 16-30 cm below surface (Photo 25). All shovel tests were negative for heritage resources.

5.2.10 STL E12 (AOP 148076)

STL E12 (AOP 148076) is located on a high point terrace overlooking a valley to the south (Figure 2 – Mapsheet 12 of 13; Photo 26). The terrace edge has been burnt by forest fires, and current vegetation is characterized by dead spruce and birch with living fireweed, rose, grasses, and various small plants. In total, 25 shovel tests were excavated. Sediment profiles encountered in these shovel tests consisted of organics from 0-9 cm, followed by brown clayey silt from 9-29 cm, then greyish brown silty clay with cobbles and pebbles from 29-37 cm below surface (Photo 27). All shovel tests were negative for heritage resources.

5.3 Helicopter Survey Observations and Future Assessment Directions

Helicopter based survey was conducted throughout the study area while searching for AOPs with substantiated potential for shovel testing. The locations of previously recorded archaeological sites (LlVc-1, LiVd-1, MaVc-3, MaVc-4, MaVc-5, MaVc-6, and MaVe-1) were also flown over to observe the landforms on which they were identified. In general, terrain within the study area was found to be gently rolling with very few well defined landforms. As such, the majority of AOPs identified in the preceding HROA (see Bennett 2022) were found to possess overall low potential for heritage resources based on their nature as broad, poorly defined, undulating ridges and hills. Review of the eight archaeological sites that are known within the study area suggests that the highest potential landforms for finding sites are relatively low well defined terraces and large well defined knolls that clearly stand out against the surrounding terrain.

Based on these observations, the AOPs as predicted in the preceding HROA should be reviewed and revised on a footprint specific basis as new developments are planned for the Eagle Plains Exploration project or any other projects that are proposed in this area. These revisions should be aimed at refining the potential model to eliminate specific types of landforms that should now

be considered to be low potential for heritage resources after the in field observations made during this study.

6.0 SUMMARY AND RECOMMENDATIONS

HRIA work included helicopter survey throughout the study area, with pedestrian survey and shovel testing within 12 AOPs/shovel test locations (STLs). In total, 228 shovel tests were excavated, with four in STL E10 being positive for heritage resources, and leading to the recording of archaeological site MbVf-1. All other STLs were negative for heritage resources.

Based on these results, **avoidance is recommended for newly recorded archaeological site MbVf-1. If avoidance is deemed to be infeasible, then further assessment (e.g. additional shovel testing and systematic data recovery excavations) should be conducted before the commencement of ground disturbing activities. The specific mitigative plan should be developed through consultation with the Yukon Government Heritage Resource Unit and First Nations. No further work is recommended for any of the negative STLs. Untested AOPs should be reviewed and revised on a footprint specific basis as new developments are planned for the Eagle Plains Exploration project or any other projects that are proposed in this area. No further heritage resource assessment is recommended prior to the proposed exploration program due to the low impact nature of the work as long as new archaeological site MbVf-1 is avoided.** However, if crews encounter any undocumented heritage resources during any exploration activities, all work in the area should cease and the finds should be reported to the Yukon Government Heritage Resource Unit and First Nations immediately for guidance in managing impacts to unrecorded heritage resource sites.

If any additional development areas are added to the project, then those new areas should also be reviewed for possible impacts to heritage resources. This follow-up heritage review may be conducted through desktop overview and/or field study.

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APPENDIX A: HRIA Results Mapping – NOT INCLUDED IN YESAB READY/PUBLIC VERSION OF REPORT

APPENDIX B: Photographs – NOT INCLUDED IN YESAB READY/PUBLIC VERSION OF REPORT

APPENDIX C: MbVf-1 Site Data – NOT INCLUDED IN YESAB READY/PUBLIC VERSION OF REPORT

APPENDIX D: Project Field Notes – NOT INCLUDED IN YESAB READY/PUBLIC VERSION OF REPORT

APPENDIX A. Eagle Plains Exploration Project Socio-Economic Baseline Technical Data Report (TDR)

Non-Confidential Summary

Chance is submitting **Appendix 11-A Eagle Plains Exploration Project Socio-Economic Baseline Technical Data Report (TDR)** as CONFIDENTIAL in **Section 11** of the Project Proposal. Documents requested to be designated confidential are being shared with the Yukon Environmental and Socio-economic Assessment Board (YESAB) Executive Committee to support their assessment of the Project.

The Socio-economic Technical Data Report has been requested to be designated confidential to meet the criteria below per this *Yukon Environmental Socio-economic Assessment Act,* S.C. 2003, c. 7 *(YESAA*) requirement:

- "traditional knowledge that is determined to be confidential under the applicable rules and that is provided in confidence to them for the purposes of this Act" (Yukon Environmental and Socio-economic Assessment Board 2024).

Appendix 11-A describes the existing socio-economic conditions for the human environment in the Yukon that may be potentially affected by the Project-related activities described in **Section 1 Details of the Proposed Project**. The existing conditions characterization includes:

- Regional Context
  - description of the regional context of the Yukon and NWT and potentially affected First Nations and communities.
- Community Profiles
  - description of geographic, historical, and governance information for potentially affected First Nations and communities in the Yukon and NWT.
- Demographic Information
  - description of population and demographic information for potentially affected First Nations and communities in the Yukon and NWT.
- Employment and Economic Conditions
  - description of information on the labour force, income, businesses, and infrastructure developments for potentially affected First Nations and communities in the Yukon and NWT, including a description of traditional economies.
- Community Infrastructure and Services
  - description of existing community infrastructure and services, including housing; healthcare; educational and cultural facilities; police, fire, and emergency services; waste management systems; water supply and sewage; transportation; and other public utilities.
- Land and Resource Use
  - description of First Nations cultural land and resource use, commercial and recreational land and resource use, and relevant land and resource plans or strategies and designated lands that are applicable to the Project and surrounding lands.

- Community Health and Wellbeing
    - description of existing conditions for community health and wellbeing according to environmental quality and the social determinants of health.

This information is summarized in the relevant sections of **Section 11** and will be used to inform the baseline socio-economic conditions to support the assessment of potential Project effects as part of Chance's Eagle Plains Project Proposal to YESAB.

References

Yukon Environmental and Socio-economic Assessment Board. 2024. "Application to Designate Information Confidential."